Oracle9*i*

Supplied PL/SQL Packages and Types Reference

Release 1 (9.0.1)

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Supplied PL/SQL Packages and Types Reference, Release 1 (9.0.1)

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Preface

This reference manual describes the Oracle PL/SQL packages shipped with the Oracle database server. This information applies to versions of the Oracle database server that run on all platforms unless otherwise specified.

This preface discusses the following:

- Audience
- Related Documentation
- Conventions
- Documentation Accessibility

> **See Also:** For information about Java packages, please refer to *Oracle9i Supplied Java Packages Reference.*

Audience

This manual is intended for programmers, systems analysts, project managers, and others interested in the development and tuning of database applications.

This manual assumes you have a working knowledge of application programming and that you are familiar with the use of structured query language (SQL) to access information in relational database systems.

Certain sections of this manual also assume a knowledge of the basic concepts of object-oriented programming.

Related Documentation

For more information, see the following manuals in the Oracle9*i* documentation set:

- *Oracle9i Application Developer's Guide - Fundamentals*
- *PL/SQL User's Guide and Reference*

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`http://technet.oracle.com/membership/index.htm`

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`http://technet.oracle.com/docs/index.htm`

Conventions

This section describes the conventions used in the text and code examples of this documentation set. It describes:

- Conventions in Text
- Conventions in Code Examples

Conventions in Text

We use various conventions in text to help you more quickly identify special terms. The following table describes those conventions and provides examples of their use.

Convention	Meaning	Example
Bold	Bold typeface indicates terms that are defined in the text or terms that appear in a glossary, or both.	When you specify this clause, you create an **index-organized table**.
Italics	Italic typeface indicates book titles, emphasis, syntax clauses, or placeholders.	*Oracle9i Database Concepts* Ensure that the recovery catalog and target database do *not* reside on the same disk.
UPPERCASE monospace (fixed-width font)	Uppercase monospace typeface indicates elements supplied by the system. Such elements include parameters, privileges, datatypes, RMAN keywords, SQL keywords, SQL*Plus or utility commands, packages and methods, as well as system-supplied column names, database objects and structures, user names, and roles.	You can specify this clause only for a `NUMBER` column. You can back up the database by using the `BACKUP` command. Query the `TABLE_NAME` column in the `USER_TABLES` data dictionary view. Use the `DBMS_STATS.GENERATE_STATS` procedure.
lowercase monospace (fixed-width font)	Lowercase monospace typeface indicates executables and sample user-supplied elements. Such elements include computer and database names, net service names, and connect identifiers, as well as user-supplied database objects and structures, column names, packages and classes, user names and roles, program units, and parameter values.	Enter `sqlplus` to open SQL*Plus. The password is specified in the `orapwd` file. Back up the datafiles and control files in the `/disk1/oracle/dbs` directory. The `department_id`, `department_name`, and `location_id` columns are in the `hr.departments` table. The `JRepUtil` class implements these methods.

Conventions in Code Examples

Code examples illustrate SQL, PL/SQL, SQL*Plus, or other command-line statements. They are displayed in a monospace (fixed-width) font and separated from normal text as shown in this example:

```
SELECT username FROM dba_users WHERE username = 'MIGRATE';
```

The following table describes typographic conventions used in code examples and provides examples of their use.

Convention	Meaning	Example
[ ]	Brackets enclose one or more optional items. Do not enter the brackets.	`DECIMAL (`*`digits`*` [ , `*`precision`*` ])`
{ }	Braces enclose two or more items, one of which is required. Do not enter the braces.	`{ENABLE | DISABLE}`
|	A vertical bar represents a choice of two or more options within brackets or braces. Enter one of the options. Do not enter the vertical bar.	`{ENABLE | DISABLE}` `[COMPRESS | NOCOMPRESS]`
...	Horizontal ellipsis points indicate either:	
	▪ That we have omitted parts of the code that are not directly related to the example	`CREATE TABLE ... AS `*`subquery`*`;`
	▪ That you can repeat a portion of the code	`SELECT `*`col1`*`, `*`col2`*`, ... , `*`coln`*` FROM employees;`
. . .	Vertical ellipsis points indicate that we have omitted several lines of code not directly related to the example.	
Other notation	You must enter symbols other than brackets, braces, vertical bars, and ellipsis points as shown.	`acctbal NUMBER(11,2);` `acct CONSTANT NUMBER(4) := 3;`
Italics	Italicized text indicates placeholders or variables for which you must supply particular values.	`CONNECT SYSTEM/`*`system_password`* `DB_NAME = `*`database_name`*

Convention	Meaning	Example

UPPERCASE	Uppercase typeface indicates elements supplied by the system. We show these terms in uppercase in order to distinguish them from terms you define. Unless terms appear in brackets, enter them in the order and with the spelling shown. However, because these terms are not case sensitive, you can enter them in lowercase.	`SELECT last_name, employee_id FROM employees;`
		`SELECT * FROM USER_TABLES;`
		`DROP TABLE hr.employees;`

lowercase	Lowercase typeface indicates programmatic elements that you supply. For example, lowercase indicates names of tables, columns, or files.
	Note: Some programmatic elements use a mixture of UPPERCASE and lowercase. Enter these elements as shown.
		`SELECT last_name, employee_id FROM employees;`
		`sqlplus hr/hr`
		`CREATE USER mjones IDENTIFIED BY ty3MU9;`

Documentation Accessibility

Oracle's goal is to make our products, services, and supporting documentation accessible to the disabled community with good usability. To that end, our documentation includes features that make information available to users of assistive technology. This documentation is available in HTML format, and contains markup to facilitate access by the disabled community. Standards will continue to evolve over time, and Oracle is actively engaged with other market-leading technology vendors to address technical obstacles so that our documentation can be accessible to all of our customers. For additional information, visit the Oracle Accessibility Program Web site at

`http://www.oracle.com/accessibility/`

JAWS, a Windows screen reader, may not always correctly read the code examples in this document. The conventions for writing code require that closing braces should appear on an otherwise empty line; however, JAWS may not always read a line of text that consists solely of a bracket or brace.

What's New in Supplied PL/SQL Packages and Types?

The following sections describe the new features in Oracle Supplied PL/SQL Packages and Types:

- Oracle9i Release 1 (9.0.1) New Features in Supplied PL/SQL Packages and Types
- Oracle8i Release 2 (8.1.6) New Features in Supplied PL/SQL Packages
- Oracle8i Release 1 (8.1.5) New Features in Supplied PL/SQL Packages

Oracle9*i* Release 1 (9.0.1) New Features in Supplied PL/SQL Packages and Types

This release includes the following new packages:

- DBMS_AQELM
- DBMS_ENCODE
- DBMS_FGA
- DBMS_FLASHBACK
- DBMS_LDAP
- DBMS_LibCache
- DBMS_LOGMNR_CDC_PUBLISH
- DBMS_LOGMNR_CDC_SUBSCRIBE
- DBMS_METADATA
- DBMS_ODCI
- DBMS_OUTLN_EDIT
- DBMS_REDEFINITION
- DBMS_TRANSFORM
- DBMS_URL
- DBMS_WM
- DBMS_XMLGEN
- DBMS_XMLQuery
- DMBS_XMLSave
- UTL_ENCODE

This release includes new information about types:

- DBMS_TYPES
- ANYDATA_TYPE
- ANYDATASET_TYPE
- ANYTYPE_TYPE

This release includes enhancements to the following packages:

- UTL_FILE
- UTL_HTTP
- UTL_RAW

Oracle8*i* Release 2 (8.1.6) New Features in Supplied PL/SQL Packages

This release included the following new packages

- DBMS_BACKUP_RESTORE
- DBMS_OBFUSCATION_TOOLKIT
- UTL_INADDR
- UTL_SMTP
- UTL_TCP

This release included enhancements to the following packages:

- DBMS_DEBUG
- DBMS_DISTRIBUTED_TRUST_ADMIN
- DBMS_LOGMINER
- DBMS_LOGMINER_D
- DBMS_PCLXUTIL
- DMBS_PROFILER
- DBMS_REPAIR
- DBMS_RESOURCE_MANAGER
- DBMS_ROWID
- DBMS_SQL
- DBMS_UTILITY
- UTL_HTTP

Oracle8*i* Release 1 (8.1.5) New Features in Supplied PL/SQL Packages

This book was new for release 8.1.5.

1

Introduction

Oracle supplies many PL/SQL packages with the Oracle server to extend database functionality and provide PL/SQL access to SQL features. You can use the supplied packages when creating your applications or for ideas in creating your own stored procedures.

> **Note:** This manual covers the packages provided with the Oracle database server. Packages supplied with other products, such as Oracle Developer or the Oracle Application Server, are not covered.

This chapter contains the following topics:

> **See Also:** For information on how to create your own packages, see the *Oracle9i Application Developer's Guide - Fundamentals*.

Package Overview

A *package* is an encapsulated collection of related program objects stored together in the database. Program objects are procedures, functions, variables, constants, cursors, and exceptions.

Packages have many advantages over standalone procedures and functions. For example, they:

- Let you organize your application development more efficiently.
- Let you grant privileges more efficiently.
- Let you modify package objects without recompiling dependent schema objects.
- Enable Oracle to read multiple package objects into memory at once.
- Let you *overload* procedures or functions. Overloading means creating multiple procedures with the same name in the same package, each taking arguments of different number or datatype.
- Can contain global variables and cursors that are available to all procedures and functions in the package.

Package Components

PL/SQL packages have two parts: the specification and the body, although sometimes the body is unnecessary. The specification is the interface to your application; it declares the types, variables, constants, exceptions, cursors, and subprograms available for use. The body fully defines cursors and subprograms, and so implements the specification.

Unlike subprograms, packages cannot be called, parameterized, or nested. However, the formats of a package and a subprogram are similar:

```
CREATE PACKAGE name AS  -- specification (visible part)
   -- public type and item declarations
   -- subprogram specifications
END [name];

CREATE PACKAGE BODY name AS  -- body (hidden part)
   -- private type and item declarations
   -- subprogram bodies
[BEGIN
   -- initialization statements]
END [name];
```

The specification holds public declarations that are visible to your application. The body holds implementation details and private declarations that are hidden from your application. You can debug, enhance, or replace a package body without changing the specification. You can change a package body without recompiling calling programs because the implementation details in the body are hidden from your application.

Using Oracle Supplied Packages

Most Oracle supplied packages are automatically installed when the database is created and the CATPROC.SQL script is run. For example, to create the DBMS_ALERT package, the DBMSALRT.SQL and PRVTALRT.PLB scripts must be run when connected as the user SYS. These scripts are run automatically by the CATPROC.SQL script.

Certain packages are not installed automatically. Special installation instructions for these packages are documented in the individual chapters.

To call a PL/SQL function from SQL, you must either own the function or have EXECUTE privileges on the function. To select from a view defined with a PL/SQL function, you must have SELECT privileges on the view. No separate EXECUTE privileges are needed to select from the view. Instructions on special requirements for packages are documented in the individual chapters.

Creating New Packages

To create packages and store them permanently in an Oracle database, use the CREATE PACKAGE and CREATE PACKAGE BODY statements. You can execute these statements interactively from SQL*Plus or Enterprise Manager.

To create a new package, do the following:

1. Create the package specification with the CREATE PACKAGE statement.

   You can declare program objects in the package specification. Such objects are called *public* objects. Public objects can be referenced outside the package, as well as by other objects in the package.

   Note: It is often more convenient to add the OR REPLACE clause in the CREATE PACKAGE statement.

2. Create the package body with the CREATE PACKAGE BODY statement.

You can declare and define program objects in the package body.

- You must define public objects declared in the package specification.
- You can declare and define additional package objects, called *private* objects. Private objects are declared in the package body rather than in the package specification, so they can be referenced only by other objects in the package. They cannot be referenced outside the package.

  See Also: For more information on creating new packages, see *PL/SQL User's Guide and Reference* and *Oracle9i Application Developer's Guide - Fundamentals*. For more information on storing and executing packages, see *Oracle9i Database Concepts*.

Separating the Specification and Body

The specification of a package declares the public types, variables, constants, and subprograms that are visible outside the immediate scope of the package. The body of a package defines the objects declared in the specification, as well as private objects that are not visible to applications outside the package.

Oracle stores the specification and body of a package separately in the database. Other schema objects that call or reference public program objects depend only on the package specification, not on the package body. This distinction allows you to change the definition of a program object in the package body without causing Oracle to invalidate other schema objects that call or reference the program object. Oracle invalidates dependent schema objects only if you change the declaration of the program object in the package specification.

Example The following example shows a package specification for a package named EMPLOYEE_MANAGEMENT. The package contains one stored function and two stored procedures.

```
CREATE PACKAGE employee_management AS
   FUNCTION hire_emp (name VARCHAR2, job VARCHAR2,
      mgr NUMBER, hiredate DATE, sal NUMBER, comm NUMBER,
      deptno NUMBER) RETURN NUMBER;
   PROCEDURE fire_emp (emp_id NUMBER);
   PROCEDURE sal_raise (emp_id NUMBER, sal_incr NUMBER);
END employee_management;
```

The body for this package defines the function and the procedures:

```
CREATE PACKAGE BODY employee_management AS
   FUNCTION hire_emp (name VARCHAR2, job VARCHAR2,
```

```
      mgr NUMBER, hiredate DATE, sal NUMBER, comm NUMBER,
      deptno NUMBER) RETURN NUMBER IS
```

The function accepts all arguments for the fields in the employee table except for the employee number. A value for this field is supplied by a sequence. The function returns the sequence number generated by the call to this function.

```
       new_empno    NUMBER(10);

   BEGIN
      SELECT emp_sequence.NEXTVAL INTO new_empno FROM dual;
      INSERT INTO emp VALUES (new_empno, name, job, mgr,
         hiredate, sal, comm, deptno);
      RETURN (new_empno);
   END hire_emp;

   PROCEDURE fire_emp(emp_id IN NUMBER) AS
```

The procedure deletes the employee with an employee number that corresponds to the argument `emp_id`. If no employee is found, then an exception is raised.

```
   BEGIN
      DELETE FROM emp WHERE empno = emp_id;
      IF SQL%NOTFOUND THEN
      raise_application_error(-20011, 'Invalid Employee
         Number: ' || TO_CHAR(emp_id));
   END IF;
END fire_emp;

PROCEDURE sal_raise (emp_id IN NUMBER, sal_incr IN NUMBER) AS
```

The procedure accepts two arguments. `Emp_id` is a number that corresponds to an employee number. `Sal_incr` is the amount by which to increase the employee's salary.

```
   BEGIN

   -- If employee exists, then update salary with increase.

      UPDATE emp
         SET sal = sal + sal_incr
         WHERE empno = emp_id;
      IF SQL%NOTFOUND THEN
         raise_application_error(-20011, 'Invalid Employee
            Number: ' || TO_CHAR(emp_id));
```

```
      END IF;
   END sal_raise;
END employee_management;
```

Note: If you want to try this example, then first create the sequence number `emp_sequence`. You can do this using the following SQL*Plus statement:

```
SQL> CREATE SEQUENCE emp_sequence
   > START WITH 8000 INCREMENT BY 10;
```

Referencing Package Contents

To reference the types, items, and subprograms declared in a package specification, use the dot notation. For example:

```
package_name.type_name
package_name.item_name
package_name.subprogram_name
```

Abbreviations for Datetime and Interval Datatypes

Many of the datetime and interval datatypes have names that are too long to be used with the procedures and functions in the replication management API. Therefore, you must use abbreviations for these datatypes instead of the full names. The following table lists each datatype and its abbreviation. No abbreviation is necessary for the DATE and TIMESTAMP datatypes.

Datatype	Abbreviation
TIMESTAMP WITH TIME ZONE	TSTZ
TIMESTAMP LOCAL TIME ZONE	TSLTZ
INTERVAL YEAR TO MONTH	IYM
INTERVAL DAY TO SECOND	IDS

For example, if you want to use the DBMS_DEFER_QUERY.GET_*datatype*_ARG function to determine the value of a TIMESTAMP LOCAL TIME ZONE argument in a deferred call, then you substitute TSLTZ for *datatype*. Therefore, you run the DBMS_DEFER_QUERY.GET_TSLTZ_ARG function.

Summary of Oracle Supplied PL/SQL Packages

Table 1–1 lists the supplied PL/SQL server packages. These packages run as the invoking user, rather than the package owner. Unless otherwise noted, the packages are callable through public synonyms of the same name.

Caution:

- The procedures and functions provided in these packages and their external interfaces are reserved by Oracle and are subject to change.
- Modifying Oracle supplied packages can cause internal errors and database security violations. Do not modify supplied packages.

Table 1–1 Summary of Oracle Supplied PL/SQL Packages

Package Name	Description	Documentation
DBMS_ALERT	Provides support for the asynchronous notification of database events.	Chapter 2
DBMS_APPLICATION_INFO	Lets you register an application name with the database for auditing or performance tracking purposes.	Chapter 3
DBMS_AQ	Lets you add a message (of a predefined object type) onto a queue or to dequeue a message.	Chapter 4
DBMS_AQADM	Lets you perform administrative functions on a queue or queue table for messages of a predefined object type.	Chapter 5
DBMS_AQELM	Provides procedures to manage the configuration of Advanced Queuing asynchronous notification by e-mail and HTTP.	Chapter 6
DBMS_BACKUP_RESTORE	Normalizes filenames on Windows NT platforms.	Chapter 7
DBMS_DDL	Provides access to some SQL DDL statements from stored procedures, and provides special administration operations not available as DDLs.	Chapter 8
DBMS_DEBUG	Implements server-side debuggers and provides a way to debug server-side PL/SQL program units.	Chapter 9
DBMS_DEFER	Provides the user interface to a replicated transactional deferred remote procedure call facility. Requires the Distributed Option.	Chapter 10
DBMS_DEFER_QUERY	Permits querying the deferred remote procedure calls (RPC) queue data that is not exposed through views. Requires the Distributed Option.	Chapter 11
DMBS_DEFER_SYS	Provides the system administrator interface to a replicated transactional deferred remote procedure call facility. Requires the Distributed Option.	Chapter 12
DBMS_DESCRIBE	Describes the arguments of a stored procedure with full name translation and security checking.	Chapter 13
DBMS_DISTRIBUTED_TRUST_ADMIN	Maintains the Trusted Database List, which is used to determine if a privileged database link from a particular server can be accepted.	Chapter 14
DBMS_FGA	Provides fine-grained security functions.	Chapter 15

Table 1–1 Summary of Oracle Supplied PL/SQL Packages (Cont.)

Package Name	Description	Documentation
DMBS_FLASHBACK	Lets you flash back to a version of the database at a specified wall-clock time or a specified system change number (SCN).	Chapter 16
DBMS_HS_PASSTHROUGH	Lets you use Heterogeneous Services to send pass-through SQL statements to non-Oracle systems.	Chapter 17
DBMS_IOT	Creates a table into which references to the chained rows for an Index Organized Table can be placed using the ANALYZE command.	Chapter 18
DBMS_JOB	Lets you schedule administrative procedures that you want performed at periodic intervals; it is also the interface for the job queue.	Chapter 19
DBMS_LDAP	Provides functions and procedures to access data from LDAP servers.	Chapter 20
DBMS_LIBCACHE	Prepares the library cache on an Oracle instance by extracting SQL and PL/SQL from a remote instance and compiling this SQL locally without execution.	Chapter 21
DBMS_LOB	Provides general purpose routines for operations on Oracle Large Object (LOBs) datatypes - BLOB, CLOB (read-write), and BFILEs (read-only).	Chapter 22
DBMS_LOCK	Lets you request, convert and release locks through Oracle Lock Management services.	Chapter 23
DBMS_LOGMNR	Provides functions to initialize and run the log reader.	Chapter 24
DBMS_LOGMNR_CDC_PUBLISH	Identifies new data that has been added to, modified, or removed from, relational tables and publishes the changed data in a form that is usable by an application.	Chapter 25
DBMS_LOGMNR_CDC_SUBSCRIBE	Lets you view and query the change data that was captured and published with the DBMS_LOGMNR_CDC_PUBLISH package.	Chapter 26
DBMS_LOGMNR_D	Queries the dictionary tables of the current database, and creates a text based file containing their contents.	Chapter 27
DBMS_METADATA	Lets callers easily retrieve complete database object definitions (metadata) from the dictionary.	Chapter 28

Table 1–1 Summary of Oracle Supplied PL/SQL Packages (Cont.)

Package Name	Description	Documentation
DBMS_MVIEW	Lets you refresh snapshots that are not part of the same refresh group and purge logs. DBMS_SNAPSHOT is a synonym.	Chapter 29
DBMS_OBFUSCATION_TOOLKIT	Provides procedures for Data Encryption Standards.	Chapter 30
DBMS_ODCI	Returns the CPU cost of a user function based on the elapsed time of the function.	Chapter 31
DBMS_OFFLINE_OG	Provides public APIs for offline instantiation of master groups.	Chapter 32
DBMS_OFFLINE_SNAPSHOT	Provides public APIs for offline instantiation of snapshots.	Chapter 33
DBMS_OLAP	Provides procedures for summaries, dimensions, and query rewrites.	Chapter 34
DBMS_ORACLE_TRACE_AGENT	Provides client callable interfaces to the Oracle TRACE instrumentation within the Oracle7 Server.	Chapter 35
DBMS_ORACLE_TRACE_USER	Provides public access to the Oracle release 7 Server Oracle TRACE instrumentation for the calling user.	Chapter 36
DBMS_OUTLN	Provides the interface for procedures and functions associated with management of stored outlines. Synonymous with OUTLN_PKG	Chapter 37
DBMS_OUTLN_EDIT	Lets you edit an invoker's rights package.	Chapter 38
DBMS_OUTPUT	Accumulates information in a buffer so that it can be retrieved out later.	Chapter 39
DBMS_PCLXUTIL	Provides intra-partition parallelism for creating partition-wise local indexes.	Chapter 40
DBMS_PIPE	Provides a DBMS pipe service which enables messages to be sent between sessions.	Chapter 41
DBMS_PROFILER	Provides a Probe Profiler API to profile existing PL/SQL applications and identify performance bottlenecks.	Chapter 42
DBMS_RANDOM	Provides a built-in random number generator.	Chapter 43
DBMS_RECTIFIER_DIFF	Provides APIs used to detect and resolve data inconsistencies between two replicated sites.	Chapter 44

Table 1–1 Summary of Oracle Supplied PL/SQL Packages (Cont.)

Package Name	Description	Documentation
DBMS_REDEFINITION	Lets you perform an online reorganization of tables.	Chapter 45
DBMS_REFRESH	Lets you create groups of snapshots that can be refreshed together to a transactionally consistent point in time. Requires the Distributed Option.	Chapter 46
DBMS_REPAIR	Provides data corruption repair procedures.	Chapter 47
DBMS_REPCAT	Provides routines to administer and update the replication catalog and environment. Requires the Replication Option.	Chapter 48
DBMS_REPCAT_ADMIN	Lets you create users with the privileges needed by the symmetric replication facility. Requires the Replication Option.	Chapter 49
DBMS_REPCAT_INSTATIATE	Instantiates deployment templates. Requires the Replication Option.	Chapter 50
DBMS_REPCAT_RGT	Controls the maintenance and definition of refresh group templates. Requires the Replication Option.	Chapter 51
DBMS_REPUTIL	Provides routines to generate shadow tables, triggers, and packages for table replication.	Chapter 52
DBMS_RESOURCE_MANAGER	Maintains plans, consumer groups, and plan directives; it also provides semantics so that you may group together changes to the plan schema.	Chapter 53
DBMS_RESOURCE_MANAGER_PRIVS	Maintains privileges associated with resource consumer groups.	Chapter 54
DBMS_RESUMABLE	Lets you suspend large operations that run out of space or reach space limits after executing for a long time, fix the problem, and make the statement resume execution.	Chapter 55
DBMS_RLS	Provides row level security administrative interface.	Chapter 56
DBMS_ROWID	Provides procedures to create rowids and to interpret their contents.	Chapter 57
DBMS_SESSION	Provides access to SQL ALTER SESSION statements, and other session information, from stored procedures.	Chapter 58

Table 1–1 Summary of Oracle Supplied PL/SQL Packages (Cont.)

Package Name	Description	Documentation
DBMS_SHARED_POOL	Lets you keep objects in shared memory, so that they will not be aged out with the normal LRU mechanism.	Chapter 59
DBMS_SNAPSHOT	Synonym for DBMS_MVIEW	Chapter 29
DBMS_SPACE	Provides segment space information not available through standard SQL.	Chapter 60
DBMS_SPACE_ADMIN	Provides tablespace and segment space administration not available through the standard SQL.	Chapter 61
DBMS_SQL	Lets you use dynamic SQL to access the database.	Chapter 62
DBMS_STANDARD	Provides language facilities that help your application interact with Oracle.	Refer to Note #1
DBMS_STATS	Provides a mechanism for users to view and modify optimizer statistics gathered for database objects.	Chapter 63
DBMS_TRACE	Provides routines to start and stop PL/SQL tracing.	Chapter 64
DBMS_TRANSACTION	Provides access to SQL transaction statements from stored procedures and monitors transaction activities.	Chapter 65
DBMS_TRANSFORM	Provides an interface to the message format transformation features of Oracle Advanced Queuing.	Chapter 66
DBMS_TTS	Checks if the transportable set is self-contained.	Chapter 67
DBMS_TYPES	Consists of constants, which represent the built-in and user-defined types.	Chapter 68
DBMS_UTILITY	Provides various utility routines.	Chapter 69
DBMS_WM	Describes how to use the the programming interface to Oracle Database Workspace Manager to work with long transactions.	Chapter 70
DBMS_XMLGEN	Converts the results of a SQL query to a canonical XML format.	Chapter 71
DMBS_XMLQUERY	Provides database-to-XMLType functionality.	Chapter 72
DBMS_XMLSAVE	Provides XML-to-database-type functionality.	Chapter 73

Table 1–1 Summary of Oracle Supplied PL/SQL Packages (Cont.)

Package Name	Description	Documentation
DEBUG_EXTPROC	Lets you debug external procedures on platforms with debuggers that can attach to a running process.	Chapter 74
OUTLN_PKG	Synonym of DBMS_OUTLN.	Chapter 37
PLITBLM	Handles index-table operations.	Refer to Note #1
SDO_CS (refer to Note #2)	Provides functions for coordinate system transformation.	*Oracle Spatial User's Guide and Reference*
SDO_GEOM (refer to Note #2)	Provides functions implementing geometric operations on spatial objects.	*Oracle Spatial User's Guide and Reference*
SDO_LRS (refer to Note #2)	Provides functions for linear referencing system support.	*Oracle Spatial User's Guide and Reference*
SDO_MIGRATE (refer to Note #2)	Provides functions for migrating spatial data from previous releases.	*Oracle Spatial User's Guide and Reference*
SDO_TUNE (refer to Note #2)	Provides functions for selecting parameters that determine the behavior of the spatial indexing scheme used in Oracle Spatial.	*Oracle Spatial User's Guide and Reference*
STANDARD	Declares types, exceptions, and subprograms which are available automatically to every PL/SQL program.	Refer to Note #1
UTL_COLL	Enables PL/SQL programs to use collection locators to query and update.	Chapter 75
UTL_ENCODE	Provides functions that encode RAW data into a standard encoded format so that the data can be transported between hosts.	Chapter 76
UTL_FILE	Enables your PL/SQL programs to read and write operating system text files and provides a restricted version of standard operating system stream file I/O.	Chapter 77
UTL_HTTP	Enables HTTP callouts from PL/SQL and SQL to access data on the Internet or to call Oracle Web Server Cartridges.	Chapter 78
UTL_INADDR	Provides a procedure to support internet addressing.	Chapter 79

Table 1–1 Summary of Oracle Supplied PL/SQL Packages (Cont.)

Package Name	Description	Documentation
UTL_PG	Provides functions for converting COBOL numeric data into Oracle numbers and Oracle numbers into COBOL numeric data.	*Oracle Procedural Gateway for APPC User's Guide*
UTL_RAW	Provides SQL functions for RAW datatypes that concat, substr, etc. to and from RAWS.	Chapter 80
UTL_REF	Enables a PL/SQL program to access an object by providing a reference to the object.	Chapter 81
UTL_SMTP	Provides PL/SQL functionality to send emails.	Chapter 82
UTL_TCP	Provides PL/SQL functionality to support simple TCP/IP-based communications between servers and the outside world.	Chapter 83
UTL_URL	Provides escape and unescape mechanisms for URL characters.	Chapter 84
ANYDATA TYPE	A self-describing data instance type containing an instance of the type plus a description	Chapter 85
ANYDATASET TYPE	Contains a description of a given type plus a set of data instances of that type	Chapter 86
ANYTYPE TYPE	Contains a type description of any persistent SQL type, named or unnamed, including object types and collection types; or, it can be used to construct new transient type descriptions	Chapter 87

Note #1

The DBMS_STANDARD, STANDARD, and PLITBLM packages contain subprograms to help implement basic language features. Oracle does not recommend that the subprograms be directly called. For this reason, these three supplied packages are not documented in this book.

Note #2

Spatial packages are installed in user MDSYS with public synonyms.

Summary of Subprograms in Supplemental Packages

The packages listed in this section are documented in other Oracle books. See Table 1–1 for the documentation reference for each package. See Table 1–2 through Table 1–7 for the subprograms provided with these packages.

SDO_CS Package

Table 1–2 SDO_CS Package Subprograms

Subprogram	Description
SDO_CS.TRANSFORM	Transforms a geometry representation using a coordinate system (specified by SRID or name).
SDO_CS.TRANSFORM_LAYER	Transforms an entire layer of geometries (that is, all geometries in a specified column in a table).
VIEWPORT_TRANSFORM	Transforms an optimized rectangle into a valid geodetic polygon for use with Spatial operators and functions.

SDO_GEOM Package

Table 1–3 SDO_GEOM Package Subprograms

Subprogram	Description
RELATE	Determines how two objects interact.
SDO_ARC_DENSIFY	Changes each circular arc into an approximation consisting of straight lines, and each circle into a polygon consisting of a series of straight lines that approximate the circle.
SDO_AREA	Computes the area of a two-dimensional polygon.
SDO_BUFFER	Generates a buffer polygon around a geometry.
SDO_CENTROID	Returns the centroid of a polygon.
SDO_CONVEXHULL	Returns a polygon-type object that represents the convex hull of a geometry object.
SDO_DIFFERENCE	Returns a geometry object that is the topological difference (MINUS operation) of two geometry objects.
SDO_DISTANCE	Computes the distance between two geometry objects.
SDO_INTERSECTION	Returns a geometry object that is the topological intersection (AND operation) of two geometry objects.
SDO_LENGTH	Computes the length or perimeter of a geometry.
SDO_MAX_MBR_ORDINATE	Returns the maximum value for the specified ordinate of the minimum bounding rectangle of a geometry object.
SDO_MBR	Returns the minimum bounding rectangle of a geometry.

Table 1–3 SDO_GEOM Package Subprograms (Cont.)

Subprogram	Description
SDO_MIN_MBR_ORDINATE	Returns the minimum value for the specified ordinate of the minimum bounding rectangle of a geometry object.
SDO_POINTONSURFACE	Returns a point that is guaranteed to be on the surface of a polygon.
SDO_UNION	Returns a geometry object that is the topological union (OR operation) of two geometry objects.
SDO_XOR	Returns a geometry object that is the topological symmetric difference (XOR operation) of two geometry objects.
VALIDATE_GEOMETRY	Determines if a geometry is valid.
VALIDATE_LAYER	Determines if all the geometries stored in a column are valid.
WITHIN_DISTANCE	Determines if two geometries are within a specified Euclidean distance from one another.

SDO_LRS Package

Table 1–4 SDO_LRS Package Subprograms

Subprogram	Description
CLIP_GEOM_SEGMENT	Clips a geometric segment (synonym of DYNAMIC_SEGMENT).
CONCATENATE_GEOM_SEGMENTS	Concatenates two geometric segments into one segment.
CONNECTED_GEOM_SEGMENTS	Checks if two geometric segments are connected.
CONVERT_TO_LRS_DIM_ARRAY	Converts a standard dimensional array to a Linear Referencing System dimensional array by creating a measure dimension.
CONVERT_TO_LRS_GEOM	Converts a standard SDO_GEOMETRY line string to a Linear Referencing System geometric segment by adding measure information.
CONVERT_TO_LRS_LAYER	Converts all geometry objects in a column of type SDO_GEOMETRY from standard line string geometries without measure information to Linear Referencing System geometric segments with measure information, and updates the metadata.

Table 1–4 SDO_LRS Package Subprograms (Cont.)

Subprogram	Description
CONVERT_TO_STD_DIM_ARRAY	Converts a Linear Referencing System dimensional array to a standard dimensional array by removing the measure dimension.
CONVERT_TO_STD_GEOM	Converts a Linear Referencing System geometric segment to a standard SDO_GEOMETRY line string by removing measure information.
CONVERT_TO_STD_LAYER	Converts all geometry objects in a column of type SDO_GEOMETRY from Linear Referencing System geometric segments with measure information to standard line string geometries without measure information, and updates the metadata.
DEFINE_GEOM_SEGMENT	Defines a geometric segment.
DYNAMIC_SEGMENT	Clips a geometric segment (synonym of CLIP_GEOM_SEGMENT).
FIND_LRS_DIM_POS	Returns the position of the measure dimension within the SDO_DIM_ARRAY structure for a specified SDO_GEOMETRY column.
FIND_MEASURE	Returns the measure of the closest point on a segment to a specified projection point.
GEOM_SEGMENT_END_MEASURE	Returns the end measure of a geometric segment.
GEOM_SEGMENT_END_PT	Returns the end point of a geometric segment.
GEOM_SEGMENT_LENGTH	Returns the length of a geometric segment.
GEOM_SEGMENT_START_MEASURE	Returns the start measure of a geometric segment.
GEOM_SEGMENT_START_PT	Returns the start point of a geometric segment.
GET_MEASURE	Returns the measure of an LRS point.
IS_GEOM_SEGMENT_DEFINED	Checks if an LRS segment is defined correctly.
IS_MEASURE_DECREASING	Checks if the measure values along an LRS segment are decreasing (that is, descending in numerical value).

Table 1–4 SDO_LRS Package Subprograms (Cont.)

Subprogram	Description
IS_MEASURE_INCREASING	Checks if the measure values along an LRS segment are increasing (that is, ascending in numerical value).
LOCATE_PT	Returns the point located at a specified distance from the start of a geometric segment.
MEASURE_RANGE	Returns the measure range of a geometric segment, that is, the difference between the start measure and end measure.
MEASURE_TO_PERCENTAGE	Returns the percentage (0 to 100) that a specified measure is of the measure range of a geometric segment.
OFFSET_GEOM_SEGMENT	Returns the geometric segment at a specified offset from a geometric segment.
PERCENTAGE_TO_MEASURE	Returns the measure value of a specified percentage (0 to 100) of the measure range of a geometric segment.
PROJECT_PT	Returns the projection point of a point on a geometric segment.
REDEFINE_GEOM_SEGMENT	Populates the measures of all shape points of a geometric segment based on the start and end measures, overriding any previously assigned measures between the start point and end point.
RESET_MEASURE	Sets all measures of a geometric segment, including the start and end measures, to null values, overriding any previously assigned measures.
REVERSE_MEASURE	Returns a new geometric segment by reversing the original geometric segment.
REVERSE_GEOMETRY	Returns a new geometric segment by reversing the measure values and the direction of the original geometric segment.
SCALE_GEOM_SEGMENT	Scales a geometric segment.
SET_PT_MEASURE	Sets the measure value of a specified point.
SPLIT_GEOM_SEGMENT	Splits a geometric segment into two segments.

Table 1–4 SDO_LRS Package Subprograms (Cont.)

Subprogram	Description
TRANSLATE_MEASURE	Returns a new geometric segment by translating the original geometric segment (that is, shifting the start and end measures by a specified value).
VALID_GEOM_SEGMENT	Checks if a geometric segment is valid.
VALID_LRS_PT	Checks if an LRS point is valid.
VALID_MEASURE	Checks if a measure falls within the measure range of a geometric segment.
VALIDATE_LRS_GEOMETRY	Checks if an LRS geometry is valid.

SDO_MIGRATE Package

Table 1–5 SDO_MIGRATE Package Subprograms

Procedure	Description
FROM_815_TO_81X	Migrates data from Spatial release 8.1.5 to the current release.
OGIS_METADATA_FROM	Generates a temporary table used when migrating OGIS (OpenGIS) metadata tables.
OGIS_METADATA_TO	Reads a temporary table used when migrating OGIS metadata tables.
TO_734	Migrates data from a previous release of Spatial Data Option to release 7.3.4.
TO_81X	Migrates tables from Spatial Data Option 7.3.4 or Spatial Cartridge 8.0.4 to Oracle Spatial.
TO_CURRENT	Migrates data from a previous Spatial release to the current release.

SDO_TUNE Package

Table 1–6 SDO_TUNE Package Subprograms

Subprogram	Description
ANALYZE_RTREE	Analyzes an R-tree index; generates statistics about the index use, and recommends a rebuild of the index if a rebuild would improve query performance significantly.
AVERAGE_MBR	Calculates the average minimum bounding rectangle for geometries in a layer.
ESTIMATE_INDEX_ PERFORMANCE	Estimates the spatial index selectivity.
ESTIMATE_TILING_LEVEL	Determines an appropriate tiling level for creating fixed-size index tiles.
ESTIMATE_TILING_TIME	Estimates the tiling time for a layer, in seconds.
ESTIMATE_TOTAL_NUMTILES	Estimates the total number of spatial tiles for a layer.
EXTENT_OF	Determines the minimum bounding rectangle of the data in a layer.
HISTOGRAM_ANALYSIS	Calculates statistical histograms for a spatial layer.
MIX_INFO	Calculates geometry type information for a spatial layer, such as the percentage of each geometry type.
QUALITY_DEGRADATION	Returns the quality degradation for an R-tree index or the average quality degradation for all index tables for an R-tree index.
RTREE_QUALITY	Returns the quality score for an R-tree index or the average quality score for all index tables for an R-tree index.

UTL_PG Package

Table 1–7 UTL_PG Package Subprograms

Subprogram	Description
MAKE_NUMBER_TO_RAW_ FORMAT	Makes a `number_to_raw` format conversion specification used to convert an Oracle number of declared precision and scale to a `RAW` byte-string in the remote host internal format.

Table 1–7 UTL_PG Package Subprograms (Cont.)

Subprogram	Description
MAKE_RAW_TO_NUMBER_FORMAT	Makes a raw_to_number format conversion specification used to convert a RAW byte-string from the remote host internal format into an Oracle number of comparable precision and scale.
NUMBER_TO_RAW	Converts an Oracle number of declared precision and scale to a RAW byte-string in the remote host internal format.
NUMBER_TO_RAW_FORMAT	Converts, according to the number_to_raw conversion format n2rfmt, an Oracle number numval of declared precision and scale to a RAW byte-string in the remote host internal format.
RAW_TO_NUMBER	Converts a RAW byte-string from the remote host internal format into an Oracle number.
RAW_TO_NUMBER_FORMAT	Converts, according to the raw_to_number conversion format r2nfmt, a RAW byte-string rawval in the remote host internal format to an Oracle number.
WMSG	Extracts a warning message specified by wmsgitem from wmsgblk.
WMSGCNT	Tests a wmsgblk to determine how many warnings, if any, are present.

2

DBMS_ALERT

DBMS_ALERT supports asynchronous notification of database events (alerts). By appropriate use of this package and database triggers, an application can cause itself to be notified whenever values of interest in the database are changed.

For example, suppose a graphics tool is displaying a graph of some data from a database table. The graphics tool can, after reading and graphing the data, wait on a database alert (WAITONE) covering the data just read. The tool automatically wakes up when the data is changed by any other user. All that is required is that a trigger be placed on the database table, which performs a signal (SIGNAL) whenever the trigger is fired.

Alerts are transaction-based. This means that the waiting session does not get alerted until the transaction signalling the alert commits.There can be any number of concurrent signallers of a given alert, and there can be any number of concurrent waiters on a given alert.

A waiting application is blocked in the database and cannot do any other work.

> **Note:** Because database alerters issue commits, they cannot be used with Oracle Forms. For more information on restrictions on calling stored procedures while Oracle Forms is active, refer to your Oracle Forms documentation.

This chapter discusses the following topics:

- Security, Constants, and Errors for DBMS_ALERT
- Using Alerts
- Summary of DBMS_ALERT Subprograms

Security, Constants, and Errors for DBMS_ALERT

Security

Security on this package can be controlled by granting EXECUTE on this package to selected users or roles. You might want to write a cover package on top of this one that restricts the alert names used. EXECUTE privilege on this cover package can then be granted rather than on this package.

Constants

```
maxwait constant integer :=  86400000; -- 1000 days
```

The maximum time to wait for an alert (this is essentially forever).

Errors

DBMS_ALERT raises the application error -20000 on error conditions. This table shows the messages and the procedures that can raise them.

Table 2–1 DBMS_ALERT Error Messages

Error Message	Procedure
ORU-10001 lock request error, status: N	SIGNAL
ORU-10015 error: N waiting for pipe status	WAITANY
ORU-10016 error: N sending on pipe 'X'	SIGNAL
ORU-10017 error: N receiving on pipe 'X'	SIGNAL
ORU-10019 error: N on lock request	WAIT
ORU-10020 error: N on lock request	WAITANY
ORU-10021 lock request error; status: N	REGISTER
ORU-10022 lock request error, status: N	SIGNAL
ORU-10023 lock request error; status N	WAITONE
ORU-10024 there are no alerts registered	WAITANY
ORU-10025 lock request error; status N	REGISTER
ORU-10037 attempting to wait on uncommitted signal from same session	WAITONE

Using Alerts

The application can register for multiple events and can then wait for any of them to occur using the WAITANY procedure.

An application can also supply an optional timeout parameter to the WAITONE or WAITANY procedures. A timeout of 0 returns immediately if there is no pending alert.

The signalling session can optionally pass a message that is received by the waiting session.

Alerts can be signalled more often than the corresponding application wait calls. In such cases, the older alerts are discarded. The application always gets the latest alert (based on transaction commit times).

If the application does not require transaction-based alerts, the DBMS_PIPE package may provide a useful alternative.

See Also: Chapter 41, "DBMS_PIPE"

If the transaction is rolled back after the call to SIGNAL, no alert occurs.

It is possible to receive an alert, read the data, and find that no data has changed. This is because the data changed after the *prior* alert, but before the data was read for that *prior* alert.

Checking for Alerts

Usually, Oracle is event-driven; this means that there are no polling loops. There are two cases where polling loops can occur:

- Shared mode. If your database is running in shared mode, a polling loop is required to check for alerts from another instance. The polling loop defaults to one second and can be set by the SET_DEFAULTS procedure.
- WAITANY procedure. If you use the WAITANY procedure, and if a signalling session does a signal but does not commit within one second of the signal, a polling loop is required so that this uncommitted alert does not camouflage other alerts. The polling loop begins at a one second interval and exponentially backs off to 30-second intervals.

Summary of DBMS_ALERT Subprograms

Table 2–2 DBMS_ALERT Package Subprograms

Subprogram	Description
"REGISTER Procedure" on page 2-4	Receives messages from an alert.
"REMOVE Procedure" on page 2-5	Disables notification from an alert.
"REMOVEALL Procedure" on page 2-5	Removes all alerts for this session from the registration list.
"SET_DEFAULTS Procedure" on page 2-6	Sets the polling interval.
"SIGNAL Procedure" on page 2-6	Signals an alert (send message to registered sessions).
"WAITANY Procedure" on page 2-7	Waits `timeout` seconds to receive alert message from an alert registered for session.
"WAITONE Procedure" on page 2-8	Waits `timeout` seconds to receive message from named alert.

REGISTER Procedure

This procedure lets a session register interest in an alert. The name of the alert is the `IN` parameter. A session can register interest in an unlimited number of alerts. Alerts should be deregistered when the session no longer has any interest, by calling `REMOVE`.

Syntax

```
DBMS_ALERT.REGISTER (
   name  IN  VARCHAR2);
```

Parameters

Table 2–3 REGISTER Procedure Parameters

Parameter	Description
name	Name of the alert in which this session is interested.

Caution: Alert names beginning with 'ORA$' are reserved for use for products provided by Oracle Corporation. Names must be 30 bytes or less. The name is case insensitive.

REMOVE Procedure

This procedure enables a session that is no longer interested in an alert to remove that alert from its registration list. Removing an alert reduces the amount of work done by signalers of the alert.

Removing alerts is important because it reduces the amount of work done by signalers of the alert. If a session dies without removing the alert, that alert is eventually (but not immediately) cleaned up.

Syntax

```
DBMS_ALERT.REMOVE (
   name  IN  VARCHAR2);
```

Parameters

Table 2–4 REMOVE Procedure Parameters

Parameter	Description
name	Name of the alert (case-insensitive) to be removed from registration list.

REMOVEALL Procedure

This procedure removes all alerts for this session from the registration list. You should do this when the session is no longer interested in any alerts.

This procedure is called automatically upon first reference to this package during a session. Therefore, no alerts from prior sessions which may have terminated abnormally can affect this session.

This procedure always performs a commit.

Syntax

```
DBMS_ALERT.REMOVEALL;
```

SET_DEFAULTS Procedure

In case a polling loop is required, use the SET_DEFAULTS procedure to set the polling interval.

Syntax

```
DBMS_ALERT.SET_DEFAULTS (
   sensitivity  IN  NUMBER);
```

Parameters

Table 2–5 SET_DEFAULTS Procedure Parameters

Parameter	Description
sensitivity	Polling interval, in seconds, to sleep between polls. The default interval is five seconds.

SIGNAL Procedure

This procedure signals an alert. The effect of the SIGNAL call only occurs when the transaction in which it is made commits. If the transaction rolls back, SIGNAL has no effect.

All sessions that have registered interest in this alert are notified. If the interested sessions are currently waiting, they are awakened. If the interested sessions are not currently waiting, they are notified the next time they do a wait call.

Multiple sessions can concurrently perform signals on the same alert. Each session, as it signals the alert, blocks all other concurrent sessions until it commits. This has the effect of serializing the transactions.

Syntax

```
DBMS_ALERT.SIGNAL (
   name     IN  VARCHAR2,
   message  IN  VARCHAR2);
```

Parameters

Table 2–6 SIGNAL Procedure Parameters

Parameter	Description
name	Name of the alert to signal.
message	Message, of 1800 bytes or less, to associate with this alert. This message is passed to the waiting session. The waiting session might be able to avoid reading the database after the alert occurs by using the information in the message.

WAITANY Procedure

Call WAITANY to wait for an alert to occur for any of the alerts for which the current session is registered. An implicit COMMIT is issued before this procedure is executed. The same session that waits for the alert may also first signal the alert. In this case remember to commit after the signal and before the wait; otherwise, DBMS_LOCK.REQUEST (which is called by DBMS_ALERT) returns status 4.

Syntax

```
DBMS_ALERT.WAITANY (
   name      OUT  VARCHAR2,
   message   OUT  VARCHAR2,
   status    OUT  INTEGER,
   timeout   IN   NUMBER DEFAULT MAXWAIT);
```

Parameters

Table 2–7 WAITANY Procedure Parameters

Parameter	Description
name	Returns the name of the alert that occurred.
message	Returns the message associated with the alert. This is the message provided by the SIGNAL call. If multiple signals on this alert occurred before WAITANY, the message corresponds to the most recent SIGNAL call. Messages from prior SIGNAL calls are discarded.
status	Values returned: 0 - alert occurred 1 - time-out occurred
timeout	Maximum time to wait for an alert. If no alert occurs before timeout seconds, this returns a status of 1.

Errors

```
-20000, ORU-10024: there are no alerts registered.
```

Cause: You must register an alert before waiting.

WAITONE Procedure

This procedure waits for a specific alert to occur. An implicit COMMIT is issued before this procedure is executed. A session that is the first to signal an alert can also wait for the alert in a subsequent transaction. In this case, remember to commit after the signal and before the wait; otherwise, DBMS_LOCK.REQUEST (which is called by DBMS_ALERT) returns status 4.

Syntax

```
DBMS_ALERT.WAITONE (
   name      IN   VARCHAR2,
   message   OUT  VARCHAR2,
   status    OUT  INTEGER,
   timeout   IN   NUMBER DEFAULT MAXWAIT);
```

Parameters

Table 2–8 WAITONE Procedure Parameters

Parameter	Description
name	Name of the alert to wait for.
message	Returns the message associated with the alert. This is the message provided by the SIGNAL call. If multiple signals on this alert occurred before WAITONE, the message corresponds to the most recent SIGNAL call. Messages from prior SIGNAL calls are discarded.
status	Values returned: 0 - alert occurred 1 - time-out occurred
timeout	Maximum time to wait for an alert. If the named alert does not occurs before timeout seconds, this returns a status of 1.

Example

Suppose you want to graph average salaries by department, for all employees. Your application needs to know whenever EMP is changed. Your application would look similar to this code:

```
DBMS_ALERT.REGISTER('emp_table_alert');
    <<readagain>>:
   /* ... read the emp table and graph it */
      DBMS_ALERT.WAITONE('emp_table_alert', :message, :status);
      if status = 0 then goto <<readagain>>; else
      /* ... error condition */
```

The EMP table would have a trigger similar to this:

```
CREATE TRIGGER emptrig AFTER INSERT OR UPDATE OR DELETE ON emp
    BEGIN
      DBMS_ALERT.SIGNAL('emp_table_alert', 'message_text');
   END;
```

When the application is no longer interested in the alert, it makes this request:

```
DBMS_ALERT.REMOVE('emp_table_alert');
```

This reduces the amount of work required by the alert signaller. If a session exits (or dies) while registered alerts exist, the alerts are eventually cleaned up by future users of this package.

The above example guarantees that the application always sees the latest data, although it may not see every intermediate value.

3

DBMS_APPLICATION_INFO

Application developers can use the DBMS_APPLICATION_INFO package with Oracle Trace and the SQL trace facility to record names of executing modules or transactions in the database for later use when tracking the performance of various modules and debugging.

Registering the application allows system administrators and performance tuning specialists to track performance by module. System administrators can also use this information to track resource use by module. When an application registers with the database, its name and actions are recorded in the V$SESSION and V$SQLAREA views.

Your applications should set the name of the module and name of the action automatically each time a user enters that module. The module name could be the name of a form in an Oracle Forms application, or the name of the code segment in an Oracle Precompilers application. The action name should usually be the name or description of the current transaction within a module.

If you want to gather your own statistics based on module, then you can implement a wrapper around this package by writing a version of this package in another schema that first gathers statistics and then calls the SYS version of the package. The public synonym for DBMS_APPLICATION_INFO can then be changed to point to the DBA's version of the package.

This chapter discusses the following topics:

Note: The public synonym for DBMS_APPLICATION_INFO is not dropped before creation, in order to allow users to redirect the public synonym to point to their own package.

Privileges

No further privileges are required. The DBMSUTIL.SQL script is already run by catproc.

Summary of DBMS_APPLICATION_INFO Subprograms

Table 3–1 DBMS_APPLICATION_INFO Package Subprograms

Subprogram	Description
"SET_MODULE Procedure" on page 3-2	Sets the name of the module that is currently running to a new module.
"SET_ACTION Procedure" on page 3-3	Sets the name of the current action within the current module.
"READ_MODULE Procedure" on page 3-4	Reads the values of the module and action fields of the current session.
"SET_CLIENT_INFO Procedure" on page 3-5	Sets the client info field of the session.
"READ_CLIENT_INFO Procedure" on page 3-6	Reads the value of the client_info field of the current session.
"SET_SESSION_ LONGOPS Procedure" on page 3-6	Sets a row in the V$SESSION_LONGOP table.

SET_MODULE Procedure

This procedure sets the name of the current application or module. The module name should be the name of the procedure (if using stored procedures), or the name of the application. The action name should describe the action performed.

Syntax

```
DBMS_APPLICATION_INFO.SET_MODULE (
   module_name IN VARCHAR2,
   action_name IN VARCHAR2);
```

Parameters

Table 3–2 SET_MODULE Procedure Parameters

Parameter	Description
module_name	Name of module that is currently running. When the current module terminates, call this procedure with the name of the new module if there is one, or NULL if there is not. Names longer than 48 bytes are truncated.
action_name	Name of current action within the current module. If you do not want to specify an action, this value should be NULL. Names longer than 32 bytes are truncated.

Example

```
CREATE or replace PROCEDURE add_employee(
  name VARCHAR2,
  salary NUMBER,
  manager NUMBER,
  title VARCHAR2,
  commission NUMBER,
  department NUMBER) AS
BEGIN
  DBMS_APPLICATION_INFO.SET_MODULE(
    module_name => 'add_employee',
    action_name => 'insert into emp');
  INSERT INTO emp
    (ename, empno, sal, mgr, job, hiredate, comm, deptno)
    VALUES (name, emp_seq.nextval, salary, manager, title, SYSDATE,
            commission, department);
  DBMS_APPLICATION_INFO.SET_MODULE(null,null);
END;
```

SET_ACTION Procedure

This procedure sets the name of the current action within the current module. The action name should be descriptive text about the current action being performed. You should probably set the action name before the start of every transaction.

Syntax

```
DBMS_APPLICATION_INFO.SET_ACTION (
   action_name IN VARCHAR2);
```

Parameters

Table 3–3 SET_ACTION Procedure Parameters

Parameter	Description
action_name	The name of the current action within the current module. When the current action terminates, call this procedure with the name of the next action if there is one, or NULL if there is not. Names longer than 32 bytes are truncated.

Usage Notes

Set the transaction name to NULL after the transaction completes, so that subsequent transactions are logged correctly. If you do not set the transaction name to NULL, then subsequent transactions may be logged with the previous transaction's name.

Example

The following is an example of a transaction that uses the registration procedure:

```
CREATE OR REPLACE PROCEDURE bal_tran (amt IN NUMBER(7,2)) AS
BEGIN

-- balance transfer transaction

   DBMS_APPLICATION_INFO.SET_ACTION(
      action_name => 'transfer from chk to sav');
   UPDATE chk SET bal = bal + :amt
      WHERE acct# = :acct;
   UPDATE sav SET bal = bal - :amt
      WHERE acct# = :acct;
   COMMIT;
   DBMS_APPLICATION_INFO.SET_ACTION(null);

END;
```

READ_MODULE Procedure

This procedure reads the values of the module and action fields of the current session.

Syntax

```
DBMS_APPLICATION_INFO.READ_MODULE (
   module_name OUT VARCHAR2,
```

```
   action_name OUT VARCHAR2);
```

Parameters

Table 3–4 READ_MODULE Procedure Parameters

Parameter	Description
module_name	Last value that the module name was set to by calling SET_MODULE.
action_name	Last value that the action name was set to by calling SET_ACTION or SET_MODULE.

Usage Notes

Module and action names for a registered application can be retrieved by querying V$SQLAREA or by calling the READ_MODULE procedure. Client information can be retrieved by querying the V$SESSION view, or by calling the READ_CLIENT_INFO procedure.

Example

The following sample query illustrates the use of the MODULE and ACTION column of the V$SQLAREA.

```
SELECT sql_text, disk_reads, module, action
FROM v$sqlarea
WHERE module = 'add_employee';

SQL_TEXT DISK_READS MODULE ACTION
------------------ ---------- ----------------- ---------------
INSERT INTO emp 1 add_employee insert into emp
(ename, empno, sal, mgr, job, hiredate, comm, deptno)
VALUES
(name, next.emp_seq, manager, title, SYSDATE, commission, department)

1 row selected.
```

SET_CLIENT_INFO Procedure

This procedure supplies additional information about the client application.

Syntax

```
DBMS_APPLICATION_INFO.SET_CLIENT_INFO (
```

```
   client_info IN VARCHAR2);
```

Parameters

Table 3–5 SET_CLIENT_INFO Procedure Parameters

Parameter	Description
client_info	Supplies any additional information about the client application. This information is stored in the V$SESSIONS view. Information exceeding 64 bytes is truncated.

Note: CLIENT_INFO is readable and writable by any user. For storing secured application attributes, you can use the application context feature.

READ_CLIENT_INFO Procedure

This procedure reads the value of the client_info field of the current session.

Syntax

```
DBMS_APPLICATION_INFO.READ_CLIENT_INFO (
   client_info OUT VARCHAR2);
```

Parameters

Table 3–6 READ_CLIENT_INFO Procedure Parameters

Parameter	Description
client_info	Last client information value supplied to the SET_CLIENT_INFO procedure.

SET_SESSION_LONGOPS Procedure

This procedure sets a row in the V$SESSION_LONGOPS view. This is a view that is used to indicate the on-going progress of a long running operation. Some Oracle functions, such as parallel execution and Server Managed Recovery, use rows in this view to indicate the status of, for example, a database backup.

Applications may use the set_session_longops procedure to advertise information on the progress of application specific long running tasks so that the progress can be monitored by way of the V$SESSION_LONGOPS view.

Syntax

```
DBMS_APPLICATION_INFO.SET_SESSION_LONGOPS (
   rindex      IN OUT BINARY_INTEGER,
   slno        IN OUT BINARY_INTEGER,
   op_name     IN     VARCHAR2       DEFAULT NULL,
   target      IN     BINARY_INTEGER DEFAULT 0,
   context     IN     BINARY_INTEGER DEFAULT 0,
   sofar       IN     NUMBER         DEFAULT 0,
   totalwork   IN     NUMBER         DEFAULT 0,
   target_desc IN     VARCHAR2       DEFAULT 'unknown target',
   units       IN     VARCHAR2       DEFAULT NULL)

set_session_longops_nohint constant BINARY_INTEGER := -1;
```

Pragmas

```
pragma TIMESTAMP('1998-03-12:12:00:00');
```

Parameters

Table 3–7 SET_SESSION_LONGOPS Procedure Parameters

Parameter	Description
rindex	A token which represents the v$session_longops row to update. Set this to set_session_longops_nohint to start a new row. Use the returned value from the prior call to reuse a row.
slno	Saves information across calls to set_session_longops: It is for internal use and should not be modified by the caller.
op_name	Specifies the name of the long running task. It appears as the OPNAME column of v$session_longops. The maximum length is 64 bytes.
target	Specifies the object that is being worked on during the long running operation. For example, it could be a table ID that is being sorted. It appears as the TARGET column of v$session_longops.
context	Any number the client wants to store. It appears in the CONTEXT column of v$session_longops.
sofar	Any number the client wants to store. It appears in the SOFAR column of v$session_longops. This is typically the amount of work which has been done so far.
totalwork	Any number the client wants to store. It appears in the TOTALWORK column of v$session_longops. This is typically an estimate of the total amount of work needed to be done in this long running operation.
target_desc	Specifies the description of the object being manipulated in this long operation. This provides a caption for the target parameter. This value appears in the TARGET_DESC field of v$session_longops. The maximum length is 32 bytes.
units	Specifies the units in which sofar and totalwork are being represented. It appears as the UNITS field of v$session_longops. The maximum length is 32 bytes.

Example

This example performs a task on ten objects in a loop. As the example completes each object, Oracle updates V$SESSION_LONGOPS on the procedure's progress.

```
DECLARE
        rindex    BINARY_INTEGER;
        slno      BINARY_INTEGER;
        totalwork number;
        sofar     number;
        obj       BINARY_INTEGER;

      BEGIN
        rindex := dbms_application_info.set_session_longops_nohint;
        sofar := 0;
        totalwork := 10;

        WHILE sofar < 10 LOOP
          -- update obj based on sofar
          -- perform task on object target

          sofar := sofar + 1;
          dbms_application_info.set_session_longops(rindex, slno,
            "Operation X", obj, 0, sofar, totalwork, "table", "tables");
        END LOOP;
      END;
```

4

DBMS_AQ

The DBMS_AQ package provides an interface to Oracle's Advanced Queuing.

See Also: *Oracle9i Application Developer's Guide - Advanced Queuing* contains information about using DBMS_AQ.

Java Classes

Java interfaces are available for DBMS_AQ and DBMS_AQADM. The Java interfaces are provided in the $ORACLE_HOME/rdbms/jlib/aqapi.jar. Users are required to have EXECUTE privileges on the DBMS_AQIN package to use these interfaces.

Enumerated Constants

When using enumerated constants such as BROWSE, LOCKED, or REMOVE, the PL/SQL constants must be specified with the scope of the packages defining it. All types associated with the operational interfaces have to be prepended with DBMS_AQ. For example: DBMS_AQ.BROWSE.

Table 4–1 Enumerated Constants

Parameter	Options
visibility	IMMEDIATE, ON_COMMIT
dequeue mode	BROWSE, LOCKED, REMOVE, REMOVE_NODATA
navigation	FIRST_MESSAGE, NEXT_MESSAGE, NEXT_TRANSACTION
state	WAITING, READY, PROCESSED, EXPIRED
sequence_deviation	BEFORE, TOP
wait	FOREVER, NO_WAIT
delay	NO_DELAY
expiration	NEVER
namespace	NAMESPACE_AQ, NAMESPACE_ANONYMOUS

Data Structures for DBMS_AQ

Table 4–2 lists the data structures used in both DBMS_AQ and DBMS_AQADM.

Table 4–2 Data structures in DBMS_AQ and DBMS_AQDM

Data Structures
"Object Name" on page 4-3
"Type Name" on page 4-3
"Agent" on page 4-4
"Enqueue Options Type" on page 4-5

Table 4–2 Data structures in DBMS_AQ and DBMS_AQDM (Cont.)

Data Structures
"Dequeue Options Type" on page 4-6
"Message Properties Type" on page 4-9
"AQ Recipient List Type" on page 4-11
"AQ Agent List Type" on page 4-11
"AQ Subscriber List Type" on page 4-11
"AQ Registration Info Type" on page 4-12
"AQ Registration Info List Type" on page 4-14
"AQ Notification Descriptor Type" on page 4-14
"AQ Post Info Type" on page 4-14
"AQ Post Info List Type" on page 4-15
"AQ PL/SQL Callback" on page 4-15

Object Name

The `object_name` data structure names database objects It applies to queues, queue tables, agent names, and object types.

Syntax

```
object_name := VARCHAR2;
object_name := [<schema_name>.]<name>;
```

Usage Notes

Names for objects are specified by an optional schema name and a name. If the schema name is not specified, then the current schema is assumed. The name must follow object name guidelines in the *Oracle9i SQL Reference* with regard to reserved characters. Schema names, agent names, and object type names can be up to 30 bytes long. Queue names and queue table names can be up to 24 bytes long.

Type Name

The `type_name` data structure defines queue types.

Syntax

```
type_name := VARCHAR2;
type_name := <object_type> | "RAW";
```

Attributes

Table 4–3 Type Name Attributes

Attribute	Description
<object_types>	Maximum number of attributes in the object type is limited to 900. See Also: *Oracle9i Database Concepts*
"RAW"	To store payload of type RAW, AQ creates a queue table with a LOB column as the payload repository. The theoretical maximum size of the message payload is the maximum amount of data that can be stored in a LOB column. However, the maximum size of the payload is determined by which programmatic environment you use to access AQ. For PL/SQL, Java and precompilers the limit is 32K; for the OCI the limit is 4G. Because the PL/SQL enqueue and dequeue interfaces accept RAW buffers as the payload parameters you will be limited to 32K bytes. In OCI, the maximum size of your RAW data will be limited to the maximum amount of contiguous memory (as an OCIRaw is simply an array of bytes) that the OCI Object Cache can allocate. Typically, this will be at least 32K bytes and much larger in many cases. Because LOB columns are used for storing RAW payload, the AQ administrator can choose the LOB tablespace and configure the LOB storage by constructing a LOB storage string in the storage_clause parameter during queue table creation time.

Agent

The aq$_agent data structure identifies a producer or a consumer of a message.

Syntax

```
TYPE sys.aq$_agent IS OBJECT (
   name      VARCHAR2(30),
   address   VARCHAR2(1024),
   protocol  NUMBER);
```

Attributes

Table 4–4 Agent Attributes

Attribute	Description
name	Name of a producer or consumer of a message. The name must follow object name guidelines in the *Oracle9i SQL Reference* with regard to reserved characters.
address	Protocol-specific address of the recipient. If the protocol is 0 (default), then the address is of the form `[schema.]queue[@dblink]`.
protocol	Protocol to interpret the address and propagate the message. The default is 0.

Enqueue Options Type

The `enqueue_options_t` data structure specifies the options available for the enqueue operation.

Syntax

```
TYPE enqueue_options_t IS RECORD (
   visibility            BINARY_INTEGER DEFAULT ON_COMMIT,
   relative_msgid        RAW(16)        DEFAULT NULL,
   sequence_deviation    BINARY_INTEGER DEFAULT NULL,
   transformation        VARCHAR2(60)   DEFAULT NULL );
```

Attributes

Table 4–5 Enqueue Options Type Attributes

Attribute	Description
visibility	Specifies the transactional behavior of the enqueue request. `ON_COMMIT`: The enqueue is part of the current transaction. The operation is complete when the transaction commits. This is the default case. `IMMEDIATE`: The enqueue is not part of the current transaction. The operation constitutes a transaction on its own. This is the only value allowed when enqueuing to a non-persistent queue.

Table 4–5 Enqueue Options Type Attributes

Attribute	Description
relative_msgid	Specifies the message identifier of the message which is referenced in the sequence deviation operation. This field is valid if, and only if, BEFORE is specified in sequence_deviation. This parameter is ignored if sequence deviation is not specified.
sequence_deviation	Specifies whether the message being enqueued should be dequeued before other message(s) already in the queue. BEFORE: The message is enqueued ahead of the message specified by relative_msgid. TOP: The message is enqueued ahead of any other messages. NULL: Default
transformation	Specifies a transformation that will be applied before enqueuing the message. The return type of the transformation function must match the type of the queue.

Dequeue Options Type

The dequeue_options_t data structure specifies the options available for the dequeue operation.

Syntax

```
TYPE dequeue_options_t IS RECORD (
   consumer_name    VARCHAR2(30)   DEFAULT NULL,
   dequeue_mode     BINARY_INTEGER DEFAULT REMOVE,
   navigation       BINARY_INTEGER DEFAULT NEXT_MESSAGE,
   visibility       BINARY_INTEGER DEFAULT ON_COMMIT,
   wait             BINARY_INTEGER DEFAULT FOREVER,
   msgid            RAW(16)        DEFAULT NULL,
   correlation      VARCHAR2(128)  DEFAULT NULL,
   deq_condition    VARCHAR2(4000) DEFAULT NULL,
   transformation   VARCHAR2(60)   DEFAULT NULL );
```

Attributes

Table 4–6 Dequeue Options Type Attributes

Attribute	Description
consumer_name	Name of the consumer. Only those messages matching the consumer name are accessed. If a queue is not set up for multiple consumers, then this field should be set to NULL.
dequeue_mode	Specifies the locking behavior associated with the dequeue. BROWSE: Read the message without acquiring any lock on the message. This is equivalent to a select statement. LOCKED: Read and obtain a write lock on the message. The lock lasts for the duration of the transaction. This is equivalent to a select for update statement. REMOVE: Read the message and update or delete it. This is the default. The message can be retained in the queue table based on the retention properties. REMOVE_NODATA: Mark the message as updated or deleted. The message can be retained in the queue table based on the retention properties.
navigation	Specifies the position of the message that will be retrieved. First, the position is determined. Second, the search criterion is applied. Finally, the message is retrieved. NEXT_MESSAGE: Retrieve the next message which is available and matches the search criteria. If the previous message belongs to a message group, then AQ retrieves the next available message which matches the search criteria and belongs to the message group. This is the default. NEXT_TRANSACTION: Skip the remainder of the current transaction group (if any) and retrieve the first message of the next transaction group. This option can only be used if message grouping is enabled for the current queue. FIRST_MESSAGE: Retrieves the first message which is available and matches the search criteria. This resets the position to the beginning of the queue.

Table 4–6 Dequeue Options Type Attributes

Attribute	Description
visibility	Specifies whether the new message is dequeued as part of the current transaction.The visibility parameter is ignored when using the BROWSE mode. ON_COMMIT: The dequeue will be part of the current transaction. This is the default case. IMMEDIATE: The dequeued message is not part of the current transaction. It constitutes a transaction on its own.
wait	Specifies the wait time if there is currently no message available which matches the search criteria. FOREVER: wait forever. This is the default. NO_WAIT: do not wait number: wait time in seconds
msgid	Specifies the message identifier of the message to be dequeued.
correlation	Specifies the correlation identifier of the message to be dequeued. Special pattern matching characters, such as the percent sign (%) and the underscore (_) can be used. If more than one message satisfies the pattern, then the order of dequeuing is undetermined.
deq_condition	A conditional expression based on the message properties, the message data properties and PL/SQL functions. A deq_condition is specified as a Boolean expression using syntax similar to the WHERE clause of a SQL query. This Boolean expression can include conditions on message properties, user data properties (object payloads only), and PL/SQL or SQL functions (as specified in the where clause of a SQL query). Message properties include priority, corrid and other columns in the queue table To specify dequeue conditions on a message payload (object payload), use attributes of the object type in clauses. You must prefix each attribute with tab.user_data as a qualifier to indicate the specific column of the queue table that stores the payload. The deq_condition parameter cannot exceed 4000 characters.
transformation	Specifies a transformation that will be applied after dequeuing the message. The source type of the transformation must match the type of the queue.

Message Properties Type

The message_properties_t data structure describes the information that is used by AQ to manage individual messages. These are set at enqueue time, and their values are returned at dequeue time.

Syntax

```
TYPE message_properties_t IS RECORD (
   priority               BINARY_INTEGER DEFAULT 1,
   delay                  BINARY_INTEGER DEFAULT NO_DELAY,
   expiration             BINARY_INTEGER DEFAULT NEVER,
   correlation            VARCHAR2(128)  DEFAULT NULL,
   attempts               BINARY_INTEGER,
   recipient_list         aq$_recipient_list_t,
   exception_queue        VARCHAR2(51)   DEFAULT NULL,
   enqueue_time           DATE,
   state                  BINARY_INTEGER,
   sender_id              aq$_agent      DEFAULT NULL,
   original_msgid         RAW(16)        DEFAULT NULL);

TYPE aq$_recipient_list_t IS TABLE OF sys.aq$_agent
   INDEX BY BINARY_INTEGER;
```

Attributes

Table 4–7 Message Properties Type Attributes

Attribute	Description
priority	Specifies / returns the priority of the message. A smaller number indicates higher priority. The priority can be any number, including negative numbers.
delay	Specifies / returns the delay of the enqueued message. The delay represents the number of seconds after which a message is available for dequeuing. Dequeuing by msgid overrides the delay specification. A message enqueued with delay set will be in the WAITING state, when the delay expires the messages goes to the READY state. DELAY processing requires the queue monitor to be started. Note that delay is set by the producer who enqueues the message. NO_DELAY: the message is available for immediate dequeuing. number: the number of seconds to delay the message.

Table 4–7 Message Properties Type Attributes

Attribute	Description
`expiration`	Specifies / returns the expiration of the message. It determines, in seconds, the duration the message is available for dequeuing. This parameter is an offset from the delay. Expiration processing requires the queue monitor to be running. `NEVER`: message does not expire. number: number of seconds message remains in `READY` state. If the message is not dequeued before it expires, then it is moved to the exception queue in the `EXPIRED` state.
`correlation`	Returns the identification supplied by the producer for a message at enqueuing.
`attempts`	Returns the number of attempts that have been made to dequeue this message. This parameter cannot be set at enqueue time.
`recipient_list`	For type definition, see the "Agent" on page 4-4. This parameter is only valid for queues which allow multiple consumers. The default recipients are the queue subscribers. This parameter is not returned to a consumer at dequeue time.
`exception_queue`	Specifies / returns the name of the queue to which the message is moved if it cannot be processed successfully. Messages are moved in two cases: The number of unsuccessful dequeue attempts has exceeded *max_retries* or the message has expired. All messages in the exception queue are in the `EXPIRED` state. The default is the exception queue associated with the queue table. If the exception queue specified does not exist at the time of the move, then the message is moved to the default exception queue associated with the queue table, and a warning is logged in the alert file. If the default exception queue is used, then the parameter returns a `NULL` value at dequeue time.
`enqueue_time`	Returns the time the message was enqueued. This value is determined by the system and cannot be set by the user. This parameter can not be set at enqueue time.

Table 4–7 Message Properties Type Attributes

Attribute	Description
state	Returns the state of the message at the time of the dequeue. This parameter can not be set at enqueue time. 0: The message is ready to be processed. 1: The message delay has not yet been reached. 2: The message has been processed and is retained. 3: The message has been moved to the exception queue.
sender_id	Specifies / returns the application-specified sender identification. DEFAULT: NULL
original_msgid	This parameter is used by Oracle AQ for propagating messages. DEFAULT: NULL

AQ Recipient List Type

The aq$_recipeint_list_t data structure identifies the list of agents that will receive the message. It is used only when the queue is enabled for multiple dequeues.

Syntax

```
TYPE aq$_recipient_list_t IS TABLE OF sys.aq$_agent
   INDEX BY BINARY_INTEGER;
```

AQ Agent List Type

The aq$_agent_list_t data structure identifies the list of agents for DBMS_AQ.LISTEN to listen for.

Syntax

```
TYPE aq$_agent_list_t IS TABLE of sys.aq$_agent
   INDEX BY BINARY INTEGER;
```

AQ Subscriber List Type

The aq$_subscriber_list_t data structure identifies the list of subscribers that subscribe to this queue.

Syntax

```
TYPE aq$_subscriber_list_t IS TABLE OF sys.aq$_agent
   INDEX BY BINARY_INTEGER;
```

AQ Registration Info Type

The `aq$_reg_info` data structure identifies a producer or a consumer of a message.

Syntax

```
TYPE sys.aq$_reg_info IS OBJECT (
   name      VARCHAR2(128),
   namespace NUMBER,
   callback  VARCHAR2(4000),
   context   RAW(2000));
```

Attributes

Table 4–8 AQ Registration Info Type Attributes

Attribute	Description
name	Specifies the name of the subscription. The subscription name is of the form <schema>.<queue> if the registration is for a single consumer queue and <schema>.<queue>:<consumer_name> if the registration is for a multiconsumer queues.
namespace	Specifies the namespace of the subscription. To receive notifications from AQ queues the namespace must be DBMS_AQ.NAMESPACE_AQ. To receive notifications from other applications via DBMS_AQ.POST or OCISubscriptionPost(), the namespace must be DBMS_AQ.NAMESPACE_ANONYMOUS.
callback	For HTTP notifications, the form is `http://www.company.com:8080`

Table 4–8 AQ Registration Info Type Attributes

Attribute	Description
callback	Specifies the action to be performed on message notification. For email notifications, the form is mailto://xyz@company.com For AQ PL/SQL Callback, use plsql://<schema>.<procedure>?PR=0 for raw message payload OR plsql://<schema>.<procedure>?PR=1 for ADT message payload converted to XML
context	Specifies the context that is to be passed to the callback function. Default: NULL

Table 4–9 shows the actions performed when different notification mechanisms/presentations are specified for nonpersistent queues.

Table 4–9 Nonpersistent Queues

Queue Payload Type	Presentation Specified					
	RAW			XML		
	Notification Mechanism			Notification Mechanism		
	OCI	Email	PL/SQL Callback	OCI	Email	PL/SQL Callback
RAW	The callback receives the RAW data in the payload.	Not supported	The PL/SQL callback receives the RAW data in the payload.	The callback receives the XML data in the payload.	The XML data is formatted as an IDAP message and emailed to the registered email address.	The PL/SQL callback receives the XML data in the payload.
ADT	Not supported.	Not supported.	Not supported.	The callback receives the XML data in the payload.	The XML data is formatted as an IDAP message and emailed to the registered email address.	The PL/SQL callback receives the XML data in the payload.

AQ Registration Info List Type

The aq$_reg_info_list data structure identifies the list of registrations to a queue.

Syntax

```
TYPE aq$_reg_info_list AS VARRAY(1024) OF sys.aq$_reg_info
```

AQ Notification Descriptor Type

The aq$_descriptor data structure specifies the AQ Descriptor received by the AQ PL/SQL callbacks upon notification. See "AQ PL/SQL Callback" on page 4-15.

Syntax

```
TYPE sys.aq$_descriptor IS OBJECT (
  queue_name    VARCHAR2(30),
  consumer_name VARCHAR2(30),
  msg_id        RAW(16),
  msg_prop      msg_prop_t);
```

Attributes

Table 4–10 AQ Notification Descriptor Type

Attribute	Description
queue_name	Name of the queue in which the message was enqueued which resulted in the notification.
consumer_name	Name of the consumer for the multiconsumer queue
msg_id	Id of the message.
msg_prop	Message properties. See "Message Properties Type" on page 4-9.

AQ Post Info Type

The aq$_post_info data structure specifies anonymous subscriptions to which you want to post messages.

Syntax

```
TYPE sys.aq$_post_info IS OBJECT (
  name       VARCHAR2(128),
```

```
  namespace  NUMBER,
  payload    RAW(2000));
```

Attributes

Table 4–11 AQ Post Info Type Attributes

Attribute	Description
name	name of the anonymous subscription to which you want to post to.
namespace	To receive notifications from other applications via DBMS_AQ.POST or OCISubscriptionPost(), the namespace must be DBMS_AQ.NAMESPACE_ANONYMOUS.
payload	The payload to be posted to the anonymous subscription Default: NULL

AQ Post Info List Type

The `aq$_post_info_list` data structure identifies the list of anonymous subscriptions to which you want to post messages.

Syntax

```
TYPE aq$_post_info_list AS VARRAY(1024) OF sys.aq$_post_info
```

AQ PL/SQL Callback

The `plsqlcallback` data structure specifies the user-defined PL/SQL procedure, defined in the database to be invoked on message notification.

Syntax

If a notification message is expected for an raw payload enqueue then this PL/SQL callback must have the following signature:

```
procedure plsqlcallback(
  context  OUT RAW,
  reginfo  OUT SYS.AQ$_REG_INFO,
  descr    OUT SYS.AQ$_DESCRIPTOR,
  payload  OUT RAW,
  payloadl OUT NUMBER);
```

Attributes

Table 4–12 AQ PL/SQL Callback Attributes

Attribute	Description
context	Specifies the context for the callback function that was passed by dbms_aq.register. See "AQ Registration Info Type" on page 4-12.
reginfo	See "AQ Registration Info Type" on page 4-12.
descr	See "AQ Notification Descriptor Type" on page 4-14.
payload	If a notification message is expected for a raw payload enqueue then this contains the raw payload that was enqueued into a non persistent queue. In case of a persistent queue with raw payload this parameter will be null.
payloadl	Specifies the length of payload. If payload is null, payload1 = 0.

If the notification message is expected for a ADT payload enqueue, the PL/SQL callback must have the following signature:

```
procedure plsqlcallback(
  context  OUT RAW,
  reginfo  OUT SYS.AQ$_REG_INFO,
  descr    OUT SYS.AQ$_DESCRIPTOR,
  payload  OUT VARCHAR2,
  payloadl OUT NUMBER);
```

Summary of Subprograms

Table 4–13 DBMS_AQ Package Subprograms

Subprograms	Description
ENQUEUE Procedure on page 4-17	Adds a message to the specified queue.
DEQUEUE Procedure on page 4-19	Dequeues a message from the specified queue.
LISTEN Procedure on page 4-21	Listen to one or more queues on behalf of a list of agents.

Table 4–13 DBMS_AQ Package Subprograms

Subprograms	Description
REGISTER Procedure on page 4-22	Register for message notifications
UNREGISTER Procedure on page 4-23	Unregister a subscription which turns off notification
POST Procedure on page 4-24	Posts to a anonymous subscription which allows all clients who are registered for the subscription to get notifications.
BIND_AGENT Procedure on page 4-25	Creates an entry for an AQ agent in the LDAP directory
UNBIND_AGENT Procedure on page 4-25	Removes an entry for an AQ agent from the LDAP directory

Note: The DBMS_AQ package does not have a purity level defined; therefore, you cannot call any procedure in this package from other procedures that have RNDS, WNDS, RNPS or WNPS constraints defined.

ENQUEUE Procedure

This procedure adds a message to the specified queue.

Syntax

```
DBMS_AQ.ENQUEUE (
   queue_name           IN      VARCHAR2,
   enqueue_options      IN      enqueue_options_t,
   message_properties   IN      message_properties_t,
   payload              IN      "<type_name>",
   msgid                OUT     RAW);
```

Parameters

Table 4–14 ENQUEUE Procedure Parameters

Parameter	Description
queue_name	Specifies the name of the queue to which this message should be enqueued. The queue cannot be an exception queue.
enqueue_options	See "Enqueue Options Type" on page 4-5.
message_properties	See "Message Properties Type" on page 4-9.
payload	Not interpreted by Oracle AQ. The payload must be specified according to the specification in the associated queue table. NULL is an acceptable parameter. For the definition of <type_name> please refer to "Type Name" on page 4-3.
msgid	System generated identification of the message. This is a globally unique identifier that can be used to identify the message at dequeue time.

Usage Notes

The sequence_deviation parameter in enqueue_options can be used to change the order of processing between two messages. The identity of the other message, if any, is specified by the enqueue_options parameter relative_msgid. The relationship is identified by the sequence_deviation parameter.

Specifying sequence_deviation for a message introduces some restrictions for the delay and priority values that can be specified for this message. The delay of this message must be less than or equal to the delay of the message before which this message is to be enqueued. The priority of this message must be greater than or equal to the priority of the message before which this message is to be enqueued.

If a message is enqueued to a multiconsumer queue with no recipient, and if the queue has no subscribers (or rule-based subscribers that match this message), then the Oracle error ORA_24033 is raised. This is a warning that the message will be discarded because there are no recipients or subscribers to whom it can be delivered.

DEQUEUE Procedure

This procedure dequeues a message from the specified queue.

Syntax

```
DBMS_AQ.DEQUEUE (
   queue_name           IN      VARCHAR2,
   dequeue_options      IN      dequeue_options_t,
   message_properties   OUT     message_properties_t,
   payload              OUT     "<type_name>",
   msgid                OUT     RAW);
```

Parameters

Table 4–15 DEQUEUE Procedure Parameters

Parameter	Description
queue_name	Specifies the name of the queue.
dequeue_options	See "Dequeue Options Type" on page 4-6.
message_properties	See "Message Properties Type" on page 4-9.
payload	Not interpreted by Oracle AQ. The payload must be specified according to the specification in the associated queue table. For the definition of <type_name> please refer to "Type Name" on page 4-3.
msgid	System generated identification of the message.

Usage Notes

The search criteria for messages to be dequeued is determined by the consumer_name, msgid, correlation and deq_condition parameters in dequeue_options.

- Msgid uniquely identifies the message to be dequeued.
- Correlation identifiers are application-defined identifiers that are not interpreted by AQ.
- Dequeue condition is an expression based on the message properties, the message data properties and PL/SQL functions. A deq_condition is specified as a Boolean expression using syntax similar to the WHERE clause of a SQL query. This Boolean expression can include conditions on message properties, user

data properties (object payloads only), and PL/SQL or SQL functions (as specified in the where clause of a SQL query). Message properties include `priority, corrid` and other columns in the queue table.

To specify dequeue conditions on a message payload (object payload), use attributes of the object type in clauses. You must prefix each attribute with `tab.user_data` as a qualifier to indicate the specific column of the queue table that stores the payload.

Example: `tab.user_data.orderstatus='EXPRESS''`

Only messages in the `READY` state are dequeued unless `msgid` is specified.

The dequeue order is determined by the values specified at the time the queue table is created unless overridden by the `msgid` and correlation ID in `dequeue_options`.

The database-consistent read mechanism is applicable for queue operations. For example, a `BROWSE` call may not see a message that is enqueued after the beginning of the browsing transaction.

The default `NAVIGATION` parameter during dequeue is `NEXT_MESSAGE`. This means that subsequent dequeues will retrieve the messages from the queue based on the snapshot obtained in the first dequeue. In particular, a message that is enqueued after the first dequeue command will be processed only after processing all the remaining messages in the queue. This is usually sufficient when all the messages have already been enqueued into the queue, or when the queue does not have a priority-based ordering. However, applications must use the `FIRST_MESSAGE` navigation option when the first message in the queue needs to be processed by every dequeue command. This usually becomes necessary when a higher priority message arrives in the queue while messages already-enqueued are being processed.

Note: It may be more efficient to use the `FIRST_MESSAGE` navigation option when messages are concurrently enqueued. If the `FIRST_MESSAGE` option is not specified, AQ continually generates the snapshot as of the first dequeue command, leading to poor performance. If the `FIRST_MESSAGE` option is specified, then AQ uses a new snapshot for every dequeue command.

Messages enqueued in the same transaction into a queue that has been enabled for message grouping will form a group. If only one message is enqueued in the

transaction, then this will effectively form a group of one message. There is no upper limit to the number of messages that can be grouped in a single transaction.

In queues that have not been enabled for message grouping, a dequeue in LOCKED or REMOVE mode locks only a single message. By contrast, a dequeue operation that seeks to dequeue a message that is part of a group will lock the entire group. This is useful when all the messages in a group need to be processed as an atomic unit.

When all the messages in a group have been dequeued, the dequeue returns an error indicating that all messages in the group have been processed. The application can then use the NEXT_TRANSACTION to start dequeuing messages from the next available group. In the event that no groups are available, the dequeue will time-out after the specified WAIT period.

LISTEN Procedure

This procedure listens on one or more queues on behalf of a list of agents. The address field of the agent indicates the queue the agent wants to monitor. Only local queues are supported as addresses. Protocol is reserved for future use.

If 'agent-address' is a multiconsumer queue, then 'agent-name' is mandatory. For single-consumer queues, agent-name must not be specified.

This is a blocking call that returns when there is a message ready for consumption for an agent in the list. If no messages are found when the wait time expires, an error is raised.

Syntax

```
DBMS_AQ.LISTEN (
   agent_list IN    aq$_agent_list_t,
   wait       IN    BINARY_INTEGER DEFAULT DBMS_AQ.FOREVER,
   agent      OUT   sys.aq$_agent);

TYPE aq$_agent_list_t IS TABLE of aq$_agent INDEXED BY BINARY_INTEGER;
```

Parameters

Table 4–16 LISTEN Procedure Parameters

Parameter	Description
agent_list	List of agents to listen for.

Table 4–16 LISTEN Procedure Parameters

Parameter	Description
wait	Time-out for the listen call (in seconds). By default, the call will block forever.
agent	Agent with a message available for consumption.

Usage Notes

This procedure takes a list of agents as an argument. You specify the queue to be monitored in the address field of each agent listed. You also must specify the name of the agent when monitoring multiconsumer queues. For single-consumer queues, an agent name must not be specified. Only local queues are supported as addresses. Protocol is reserved for future use.

This is a blocking call that returns when there is a message ready for consumption for an agent in the list. If there are messages for more than one agent, then only the first agent listed is returned. If there are no messages found when the wait time expires, then an error is raised.

A successful return from the listen call is only an indication that there is a message for one of the listed agents in one the specified queues. The interested agent must still dequeue the relevant message.

Note that you cannot call listen on non-persistent queues.

REGISTER Procedure

This procedure registers an email address, user-defined PL/SQL procedure, or HTTP URL for message notification.

Syntax

```
DBMS_AQ.REGISTER (
   reg_list IN SYS.AQ$_REG_INFO_LIST,
   count    IN NUMBER);
```

Parameters

Table 4–17 REGISTER Procedure Parameters

Parameter	Description
reg_list	Specifies the list of subscriptions to which you want to register for message notifications. It is a list of AQ Registration Info Type.
count	Specifies the number of entries in the reg_list.

Usage Notes

This procedure is used to register for notifications. You can specify an email address to which message notifications are sent, register a procedure to be invoked on a notification, or register an HTTP URL to which the notification is posted. Interest in several subscriptions can be registered at one time.

If you register for email notifications, then you should set the host name and port name for the SMTP server that will be used by the database to send email notifications. If required, you should set the send-from email address, which is set by the database as the `sent from` field. See Chapter 6, "DBMS_AQELM" for more information on email notifications. You need a Java-enabled database to use this feature.

If you register for HTTP notifications, you may want to set the host name and port number for the proxy server and a list of no-proxy domains that will be used by the database to post HTTP notifications. See Chapter 6, "DBMS_AQELM" for more information on HTTP notifications.

UNREGISTER Procedure

This procedure unregisters a subscription which turns off notifications.

Syntax

```
DBMS_AQ.UNREGISTER (
   reg_list IN SYS.AQ$_REG_INFO_LIST,
   count    IN NUMBER);
```

Parameters

Table 4–18 UNREGISTER Procedure Parameters

Parameter	Description
reg_list	Specifies the list of subscriptions to which you want to register for message notifications. It is a list of AQ Registration Info Type.
count	Specifies the number of entries in the reg_list.

Usage Notes

This procedure is used to unregister a subscription which turns off notifications. Several subscriptions can be unregistered from at one time.

POST Procedure

This procedure posts to a list of anonymous subscriptions which allows all clients who are registered for the subscriptions to get notifications.

Syntax

```
DBMS_AQ.POST (
  post_list  IN  SYS.AQ$_POST_INFO_LIST,
  count      IN NUMBER);
```

Parameters

Table 4–19 POST Procedure Parameters

Parameter	Description
post_list	Specifies the list of anonymous subscriptions to which you want to post. It is a list of AQ Post Info Type.
count	Specifies the number of entries in the post_list.

Usage Notes

This procedure is used to post to anonymous subscriptions which allows all clients who are registered for the subscriptions to get notifications. Several subscriptions can be posted to at one time.

BIND_AGENT Procedure

This procedure creates an entry for an AQ agent in the LDAP server.

Syntax

```
DBMS_AQ.BIND_AGENT(
   agent        IN SYS.AQ$_AGENT,
   certificate  IN VARCHAR2 default NULL);
```

Parameters

Table 4–20 BIND_AGENT Procedure Parameters

Parameter	Description
agent	Agent that is to be registered in LDAP server
certificate	Location (LDAP distinguished name) of the "organizationalperson" entry in LDAP whose digital certificate (attribute `usercertificate`) is to be used for this agent Example: "cn=OE, cn=ACME, cn=com" is a DN for a OrganizationalPerson OE whose certificate will be used with the agent specified above

Usage Notes

In the LDAP server, digital certificates are stored as an attribute (`usercertificate`) of the "OrganizationalPerson" entity. The distinguished name for this "OrganizationalPerson" must be specified when binding the agent.

UNBIND_AGENT Procedure

This procedure removes the entry for an AQ agent from the LDAP server.

Syntax

```
DBMS_AQ.UNBIND_AGENT(
   agent        IN SYS.AQ$_AGENT);
```

Parameters

Table 4–21 BIND_AGENT Procedure Parameters

Parameter	Description
agent	Agent that is to be removed from the LDAP server

5

DBMS_AQADM

The DBMS_AQADM package provides procedures to manage Advanced Queuing configuration and administration information.

> **See Also:** *Oracle9i Application Developer's Guide - Advanced Queuing* contains information about using DBMS_AQADM.

This chapter discusses the following topics:

- Enumerated Constants
- Summary of DBMS_AQADM Subprograms

Enumerated Constants

When using enumerated constants, such as INFINITE, TRANSACTIONAL, or NORMAL_QUEUE, the symbol must be specified with the scope of the packages defining it. All types associated with the administrative interfaces must be prepended with DBMS_AQADM. For example: DBMS_AQADM.NORMAL_QUEUE.

Table 5–1 Enumerated Types in the Administrative Interface

Parameter	Options
retention	0,1,2...INFINITE
message_grouping	TRANSACTIONAL, NONE
queue_type	NORMAL_QUEUE, EXCEPTION_QUEUE, NON_PERSISTENT_QUEUE

See Also: For more information on the Java classes and data structures used in both DBMS_AQ and DBMS_AQADM, see Chapter 4, "DBMS_AQ"

Summary of DBMS_AQADM Subprograms

Table 5–2 DBMS_AQADM Package Subprograms

Subprogram	Description
"CREATE_QUEUE_TABLE Procedure" on page 5-4	Creates a queue table for messages of a predefined type.
"ALTER_QUEUE_TABLE Procedure" on page 5-8	Alters an existing queue table.
"DROP_QUEUE_TABLE Procedure" on page 5-9	Drops an existing queue table.
"CREATE_QUEUE Procedure" on page 5-9	Creates a queue in the specified queue table.
"CREATE_NP_QUEUE Procedure" on page 5-11	Creates a nonpersistent RAW queue.
"ALTER_QUEUE Procedure" on page 5-12	Alters existing properties of a queue.
"DROP_QUEUE Procedure" on page 5-14	Drops an existing queue.

Table 5–2 DBMS_AQADM Package Subprograms (Cont.)

Subprogram	Description
"START_QUEUE Procedure" on page 5-14	Enables the specified queue for enqueuing and/or dequeueing.
"STOP_QUEUE Procedure" on page 5-15	Disables enqueuing and/or dequeuing on the specified queue.
"GRANT_SYSTEM_PRIVILEGE Procedure" on page 5-16	Grants AQ system privileges to users and roles.
"REVOKE_SYSTEM_PRIVILEGE Procedure" on page 5-17	Revokes AQ system privileges from users and roles.
"GRANT_QUEUE_PRIVILEGE Procedure" on page 5-18	Grants privileges on a queue to users and roles.
"REVOKE_QUEUE_PRIVILEGE Procedure" on page 5-19	Revokes privileges on a queue from users and roles.
"ADD_SUBSCRIBER Procedure" on page 5-19	Adds a default subscriber to a queue.
"ALTER_SUBSCRIBER Procedure" on page 5-21	Alters existing properties of a subscriber to a specified queue.
"REMOVE_SUBSCRIBER Procedure" on page 5-21	Removes a default subscriber from a queue.
"SCHEDULE_PROPAGATION Procedure" on page 5-22	Schedules propagation of messages from a queue to a destination identified by a specific dblink.
"UNSCHEDULE_PROPAGATION Procedure" on page 5-23	Unschedules previously scheduled propagation of messages from a queue to a destination identified by a specific dblink.
"VERIFY_QUEUE_TYPES Procedure" on page 5-24	Verifies that the source and destination queues have identical types.
"ALTER_PROPAGATION_SCHEDULE Procedure" on page 5-25	Alters parameters for a propagation schedule.
"ENABLE_PROPAGATION_SCHEDULE Procedure" on page 5-27	Enables a previously disabled propagation schedule.
"DISABLE_PROPAGATION_SCHEDULE Procedure" on page 5-27	Disables a propagation schedule.

Table 5–2 DBMS_AQADM Package Subprograms (Cont.)

Subprogram	Description
"MIGRATE_QUEUE_TABLE Procedure" on page 5-28	Upgrades an 8.0-compatible queue table to an 8.1-compatible queue table, or downgrades an 8.1-compatible queue table to an 8.0-compatible queue table.
"CREATE_AQ_AGENT Procedure" on page 5-28	Registers a agent for AQ Internet access
"ALTER_AQ_AGENT Procedure" on page 5-29	Alters a agent registered for AQ Internet access
"DROP_AQ_AGENT Procedure" on page 5-30	Drops a agent registered for AQ Internet access
"ENABLE_DB_ACCESS Procedure" on page 5-31	Grants an AQ Internet agent the privileges of a specific database user
"DISABLE_DB_ACCESS Procedure" on page 5-31	Revokes the privileges of a database user from an AQ Internet agent
"ADD_ALIAS_TO_LDAP Procedure" on page 5-32	Creates an alias for a queue, agent, or a JMS ConnectionFactory in LDAP.
"DEL_ALIAS_FROM_LDAP Procedure" on page 5-32	Drops an alias for a queue, agent, or JMS ConnectionFactory in LDAP.

CREATE_QUEUE_TABLE Procedure

This procedure creates a queue table for messages of a predefined type. The sort keys for dequeue ordering, if any, must be defined at table creation time. The following objects are created at this time:

- A default exception queue associated with the queue table, called `aq$_<queue_table_name>_e`.
- A read-only view, which is used by AQ applications for querying queue data, called `aq$<queue_table_name>`.
- An index or an index organized table (IOT) in the case of multiple consumer queues for the queue monitor operations, called `aq$_<queue_table_name>_t`.
- An index or an index organized table in the case of multiple consumer queues for dequeue operations, called `aq$_<queue_table_name>_i`.

For Oracle8*i*-compatible queue tables, the following two index organized tables are created:

- A table called aq$_<queue_table_name>_s. This table stores information about the subscribers.
- A table called aq$_<queue_table_name>_r. This table stores information about rules on subscriptions.
- An index organized table called aq$_<queue_table_name>_h. This table stores the dequeue history data.

Syntax

```
DBMS_AQADM.CREATE_QUEUE_TABLE (
   queue_table          IN      VARCHAR2,
   queue_payload_type   IN      VARCHAR2,
   storage_clause       IN      VARCHAR2       DEFAULT NULL,
   sort_list            IN      VARCHAR2       DEFAULT NULL,
   multiple_consumers   IN      BOOLEAN        DEFAULT FALSE,
   message_grouping     IN      BINARY_INTEGER DEFAULT NONE,
   comment              IN      VARCHAR2       DEFAULT NULL,
   auto_commit          IN      BOOLEAN        DEFAULT TRUE,
   primary_instance     IN      BINARY_INTEGER DEFAULT 0,
   secondary_instance   IN      BINARY_INTEGER DEFAULT 0,
   compatible           IN      VARCHAR2       DEFAULT NULL);
```

Parameters

Table 5–3 CREATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Name of a queue table to be created.
queue_payload_type	Type of the user data stored. See "Type Name" on page 4-3 for valid values for this parameter.

Table 5–3 CREATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
storage_clause	Storage parameter. The storage parameter is included in the CREATE TABLE statement when the queue table is created. The storage parameter can be made up of any combinations of the following parameters: PCTFREE, PCTUSED, INITRANS, MAXTRANS, TABLEPSACE, LOB, and a table storage clause. If a tablespace is not specified here, then the queue table and all its related objects are created in the default user tablespace. If a tablespace is specified here, then the queue table and all its related objects are created in the tablespace specified in the storage clause. See *Oracle9i SQL Reference* for the usage of these parameters.
sort_list	The columns to be used as the sort key in ascending order. Sort_list has the following format: '<sort_column_1>,<sort_column_2>' The allowed column names are priority and enq_time. If both columns are specified, then <sort_column_1> defines the most significant order. After a queue table is created with a specific ordering mechanism, all queues in the queue table inherit the same defaults. The order of a queue table cannot be altered after the queue table has been created. If no sort list is specified, then all the queues in this queue table are sorted by the enqueue time in ascending order. This order is equivalent to FIFO order. Even with the default ordering defined, a dequeuer is allowed to choose a message to dequeue by specifying its msgid or correlation. msgid, correlation, and sequence_ deviation take precedence over the default dequeueing order, if they are specified.
multiple_consumers	FALSE: Queues created in the table can only have one consumer per message. This is the default. TRUE: Queues created in the table can have multiple consumers per message.

Table 5–3 CREATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
message_grouping	Message grouping behavior for queues created in the table. NONE: Each message is treated individually. TRANSACTIONAL: Messages enqueued as part of one transaction are considered part of the same group and can be dequeued as a group of related messages.
comment	User-specified description of the queue table. This user comment is added to the queue catalog.
auto_commit	TRUE: causes the current transaction, if any, to commit before the CREATE_QUEUE_TABLE operation is carried out. The CREATE_QUEUE_TABLE operation becomes persistent when the call returns. This is the default. FALSE: The operation is part of the current transaction and becomes persistent only when the caller enters a commit. Note: This parameter has been deprecated.
primary_instance	The primary owner of the queue table. Queue monitor scheduling and propagation for the queues in the queue table are done in this instance. The default value for primary instance is 0, which means queue monitor scheduling and propagation will be done in any available instance.
secondary_instance	The queue table fails over to the secondary instance if the primary instance is not available. The default value is 0, which means that the queue table will fail over to any available instance.
compatible	The lowest database version with which the queue is compatible. Currently the possible values are either '8.0' or '8.1'. ■ If the database is in 8.1 or higher compatible mode, the default value is '8.1' ■ If the database is in 8.0 compatible mode, the default value is '8.0'

Usage Notes

CLOB, BLOB, and BFILE are valid attributes for AQ object type payloads. However, only CLOB and BLOB can be propagated using AQ propagation in Oracle8*i* release 8.1.5 or later. See the *Oracle9i Application Developer's Guide - Advanced Queuing* for more information.

The default value of the compatible parameter depends on the database compatibility mode in the init.ora

- If the database is in 8.1 or higher compatible mode, the default value is '8.1'
- If the database is in 8.0 compatible mode, the default value is '8.0'

You can specify and modify the `primary_instance` and `secondary_instance` only in 8.1-compatible mode.

You cannot specify a secondary instance unless there is a primary instance.

ALTER_QUEUE_TABLE Procedure

This procedure alters the existing properties of a queue table.

Syntax

```
DBMS_AQADM.ALTER_QUEUE_TABLE (
   queue_table          IN   VARCHAR2,
   comment              IN   VARCHAR2       DEFAULT NULL,
   primary_instance     IN   BINARY_INTEGER DEFAULT NULL,
   secondary_instance   IN   BINARY_INTEGER DEFAULT NULL);
```

Parameters

Table 5–4 ALTER_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Name of a queue table to be created.
comment	Modifies the user-specified description of the queue table. This user comment is added to the queue catalog. The default value is NULL which means that the value will not be changed.
primary_instance	This is the primary owner of the queue table. Queue monitor scheduling and propagation for the queues in the queue table will be done in this instance. The default value is NULL, which means that the current value will not be changed.
secondary_instance	The queue table fails over to the secondary instance if the primary instance is not available. The default value is NULL, which means that the current value will not be changed.

DROP_QUEUE_TABLE Procedure

This procedure drops an existing queue table. All the queues in a queue table must be stopped and dropped before the queue table can be dropped. You must do this explicitly unless the `force` option is used, in which case this done automatically.

Syntax

```
DBMS_AQADM.DROP_QUEUE_TABLE (
   queue_table       IN    VARCHAR2,
   force             IN    BOOLEAN DEFAULT FALSE,
   auto_commit       IN    BOOLEAN DEFAULT TRUE);
```

Parameters

Table 5–5 DROP_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Name of a queue table to be dropped.
force	FALSE: The operation does not succeed if there are any queues in the table. This is the default. TRUE: All queues in the table are stopped and dropped automatically.
auto_commit	TRUE: Causes the current transaction, if any, to commit before the DROP_QUEUE_TABLE operation is carried out. The DROP_QUEUE_TABLE operation becomes persistent when the call returns. This is the default. FALSE: The operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

CREATE_QUEUE Procedure

This procedure creates a queue in the specified queue table.

Syntax

```
DBMS_AQADM.CREATE_QUEUE (
   queue_name          IN       VARCHAR2,
   queue_table         IN       VARCHAR2,
   queue_type          IN       BINARY_INTEGER DEFAULT NORMAL_QUEUE,
   max_retries         IN       NUMBER         DEFAULT NULL,
   retry_delay         IN       NUMBER         DEFAULT 0,
```

```
retention_time      IN      NUMBER          DEFAULT 0,
dependency_tracking IN      BOOLEAN         DEFAULT FALSE,
comment             IN      VARCHAR2        DEFAULT NULL,
auto_commit         IN      BOOLEAN         DEFAULT TRUE);
```

Parameters

Table 5–6 CREATE_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue that is to be created. The name must be unique within a schema and must follow object name guidelines in the *Oracle9i SQL Reference* with regard to reserved characters.
queue_table	Name of the queue table that will contain the queue.
queue_type	Specifies whether the queue being created is an exception queue or a normal queue. NORMAL_QUEUE: The queue is a normal queue. This is the default. EXCEPTION_QUEUE: It is an exception queue. Only the dequeue operation is allowed on the exception queue.
max_retries	Limits the number of times a dequeue with the REMOVE mode can be attempted on a message. The maximum value of max_retries is 2**31 -1. The count is incremented when the application issues a rollback after executing the dequeue. The message is moved to the exception queue when it is reaches its max_retries. Note that max_retries is supported for all single consumer queues and 8.1-compatible multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retry_delay	Delay time, in seconds, before this message is scheduled for processing again after an application rollback. The default is 0, which means the message can be retried as soon as possible. This parameter has no effect if max_retries is set to 0. Note that rety_delay is supported for single consumer queues and 8.1-compatible multiconsumer queues but not for 8.0-compatible multiconsumer queues.

Table 5–6 CREATE_QUEUE Procedure Parameters

Parameter	Description
retention_time	Number of seconds for which a message is retained in the queue table after being dequeued from the queue. INFINITE: Message is retained forever. NUMBER: Number of seconds for which to retain the messages. The default is 0, no retention.
dependency_ tracking	Reserved for future use. FALSE: This is the default. TRUE: Not permitted in this release.
comment	User-specified description of the queue. This user comment is added to the queue catalog.
auto_commit	TRUE: Causes the current transaction, if any, to commit before the CREATE_QUEUE operation is carried out. The CREATE_ QUEUE operation becomes persistent when the call returns. This is the default. FALSE: The operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

Usage Notes

All queue names must be unique within a schema. After a queue is created with CREATE_QUEUE, it can be enabled by calling START_QUEUE. By default, the queue is created with both enqueue and dequeue disabled.

CREATE_NP_QUEUE Procedure

Create a nonpersistent RAW queue.

Syntax

```
DBMS_AQADM.CREATE_NP_QUEUE (
   queue_name              IN       VARCHAR2,
   multiple_consumers      IN       BOOLEAN  DEFAULT FALSE,
   comment                 IN       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 5–7 CREATE_NP_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the nonpersistent queue that is to be created. The name must be unique within a schema and must follow object name guidelines in the *Oracle9i SQL Reference* with regard to reserved characters.
multiple_consumers	FALSE: Queues created in the table can only have one consumer per message. This is the default. TRUE: Queues created in the table can have multiple consumers per message. Note that this parameter is distinguished at the queue level, because a nonpersistent queue does not inherit this characteristic from any user-created queue table.
comment	User-specified description of the queue. This user comment is added to the queue catalog.

Usage Notes

The queue may be either single-consumer or multiconsumer queue. All queue names must be unique within a schema. The queues are created in a 8.1-compatible system-created queue table (AQ$_MEM_SC or AQ$_MEM_MC) in the same schema as that specified by the queue name.

If the queue name does not specify a schema name, then the queue is created in the login user's schema. After a queue is created with CREATE_NP_QUEUE, it can be enabled by calling START_QUEUE. By default, the queue is created with both enqueue and dequeue disabled.

You cannot dequeue from a nonpersistent queue. The only way to retrieve a message from a nonpersistent queue is by using the OCI notification mechanism. You cannot invoke the `listen` call on a nonpersistent queue.

ALTER_QUEUE Procedure

This procedure alters existing properties of a queue. The parameters `max_retries`, `retention_time`, and `retry_delay` are not supported for nonpersistent queues.

Syntax

```
DBMS_AQADM.ALTER_QUEUE (
```

```
   queue_name        IN    VARCHAR2,
   max_retries       IN    NUMBER   DEFAULT NULL,
   retry_delay       IN    NUMBER   DEFAULT NULL,
   retention_time    IN    NUMBER   DEFAULT NULL,
   auto_commit       IN    BOOLEAN  DEFAULT TRUE,
   comment           IN    VARCHAR2 DEFAULT NULL);
```

Parameters

Table 5–8 ALTER_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue that is to be altered.
max_retries	Limits the number of times a dequeue with REMOVE mode can be attempted on a message. The maximum value of max_retries is 2**31 -1. The count is incremented when the application issues a rollback after executing the dequeue. If the time at which one of the retries has passed the expiration time, then no further retries are attempted. Default is NULL, which means that the value will not be altered. Note that max_retries is supported for all single consumer queues and 8.1-compatible multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retry_delay	Delay time in seconds before this message is scheduled for processing again after an application rollback. The default is NULL, which means that the value will not be altered. Note that retry_delay is supported for single consumer queues and 8.1-compatible multiconsumer queues but not for 8.0-compatible multiconsumer queues.
retention_time	Retention time in seconds for which a message is retained in the queue table after being dequeued. The default is NULL, which means that the value will not be altered.
auto_commit	TRUE: Causes the current transaction, if any, to commit before the ALTER_QUEUE operation is carried out. The ALTER_QUEUE operation become persistent when the call returns. This is the default. FALSE: The operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

Table 5–8 ALTER_QUEUE Procedure Parameters

Parameter	Description
comment	User-specified description of the queue. This user comment is added to the queue catalog. The default value is NULL, which means that the value will not be changed.

DROP_QUEUE Procedure

This procedure drops an existing queue. DROP_QUEUE is not allowed unless STOP_QUEUE has been called to disable the queue for both enqueuing and dequeuing. All the queue data is deleted as part of the drop operation.

Syntax

```
DBMS_AQADM.DROP_QUEUE (
   queue_name        IN    VARCHAR2,
   auto_commit       IN    BOOLEAN DEFAULT TRUE);
```

Parameters

Table 5–9 DROP_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue that is to be dropped.
auto_commit	TRUE: Causes the current transaction, if any, to commit before the DROP_QUEUE operation is carried out. The DROP_QUEUE operation becomes persistent when the call returns. This is the default. FALSE: The operation is part of the current transaction and becomes persistent only when the caller enters a commit. Caution: This parameter has been deprecated.

START_QUEUE Procedure

This procedure enables the specified queue for enqueuing and/or dequeueing.

After creating a queue the administrator must use START_QUEUE to enable the queue. The default is to enable it for both ENQUEUE and DEQUEUE. Only dequeue operations are allowed on an exception queue. This operation takes effect when the call completes and does not have any transactional characteristics.

Syntax

```
DBMS_AQADM.START_QUEUE (
   queue_name      IN     VARCHAR2,
   enqueue         IN     BOOLEAN DEFAULT TRUE,
   dequeue         IN     BOOLEAN DEFAULT TRUE);
```

Parameters

Table 5–10 START_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue to be enabled.
enqueue	Specifies whether ENQUEUE should be enabled on this queue. TRUE: Enable ENQUEUE. This is the default. FALSE: Do not alter the current setting.
dequeue	Specifies whether DEQUEUE should be enabled on this queue. TRUE: Enable DEQUEUE. This is the default. FALSE: Do not alter the current setting.

STOP_QUEUE Procedure

This procedure disables enqueuing and/or dequeuing on the specified queue.

By default, this call disables both ENQUEUEs or DEQUEUEs. A queue cannot be stopped if there are outstanding transactions against the queue. This operation takes effect when the call completes and does not have any transactional characteristics.

Syntax

```
DBMS_AQADM.STOP_QUEUE (
   queue_name      IN   VARCHAR2,
   enqueue         IN   BOOLEAN DEFAULT TRUE,
   dequeue         IN   BOOLEAN DEFAULT TRUE,
   wait            IN   BOOLEAN DEFAULT TRUE);
```

Parameters

Table 5–11 STOP_QUEUE Procedure Parameters

Parameter	Description
queue_name	Name of the queue to be disabled.
enqueue	Specifies whether ENQUEUE should be disabled on this queue. TRUE: Disable ENQUEUE. This is the default. FALSE: Do not alter the current setting.
dequeue	Specifies whether DEQUEUE should be disabled on this queue. TRUE: Disable DEQUEUE. This is the default. FALSE: Do not alter the current setting.
wait	Specifies whether to wait for the completion of outstanding transactions. TRUE: Wait if there are any outstanding transactions. In this state no new transactions are allowed to enqueue to or dequeue from this queue. FALSE: Return immediately either with a success or an error.

GRANT_SYSTEM_PRIVILEGE Procedure

This procedure grants AQ system privileges to users and roles. The privileges are ENQUEUE_ANY, DEQUEUE_ANY, and MANAGE_ANY. Initially, only SYS and SYSTEM can use this procedure successfully.

Syntax

```
DBMS_AQADM.GRANT_SYSTEM_PRIVILEGE (
   privilege         IN    VARCHAR2,
   grantee           IN    VARCHAR2,
   admin_option      IN    BOOLEAN := FALSE);
```

Parameters

Table 5–12 GRANT_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The AQ system privilege to grant. The options are ENQUEUE_ANY, DEQUEUE_ANY, and MANAGE_ANY. The operations allowed for each system privilege are specified as follows: ENQUEUE_ANY: users granted with this privilege are allowed to enqueue messages to any queues in the database. DEQUEUE_ANY: users granted with this privilege are allowed to dequeue messages from any queues in the database. MANAGE_ANY: users granted with this privilege are allowed to run DBMS_AQADM calls on any schemas in the database.
grantee	Grantee(s). The grantee(s) can be a user, a role, or the PUBLIC role.
admin_option	Specifies if the system privilege is granted with the ADMIN option or not. If the privilege is granted with the ADMIN option, then the grantee is allowed to use this procedure to grant the system privilege to other users or roles. The default is FALSE.

REVOKE_SYSTEM_PRIVILEGE Procedure

This procedure revokes AQ system privileges from users and roles. The privileges are ENQUEUE_ANY, DEQUEUE_ANY and MANAGE_ANY. The ADMIN option for a system privilege cannot be selectively revoked.

Syntax

```
DBMS_AQADM.REVOKE_SYSTEM_PRIVILEGE (
   privilege         IN   VARCHAR2,
   grantee           IN   VARCHAR2);
```

Parameters

Table 5–13 REVOKE_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The AQ system privilege to revoke. The options are ENQUEUE_ANY, DEQUEUE_ANY, and MANAGE_ANY. The ADMIN option for a system privilege cannot be selectively revoked.
grantee	Grantee(s). The grantee(s) can be a user, a role, or the PUBLIC role.

GRANT_QUEUE_PRIVILEGE Procedure

This procedure grants privileges on a queue to users and roles. The privileges are ENQUEUE or DEQUEUE. Initially, only the queue table owner can use this procedure to grant privileges on the queues.

Syntax

```
DBMS_AQADM.GRANT_QUEUE_PRIVILEGE (
   privilege        IN    VARCHAR2,
   queue_name       IN    VARCHAR2,
   grantee          IN    VARCHAR2,
   grant_option     IN    BOOLEAN := FALSE);
```

Parameters

Table 5–14 GRANT_QUEUE_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The AQ queue privilege to grant. The options are ENQUEUE, DEQUEUE, and ALL. ALL means both ENQUEUE and DEQUEUE.
queue_name	Name of the queue.
grantee	Grantee(s). The grantee(s) can be a user, a role, or the PUBLIC role.
grant_option	Specifies if the access privilege is granted with the GRANT option or not. If the privilege is granted with the GRANT option, then the grantee is allowed to use this procedure to grant the access privilege to other users or roles, regardless of the ownership of the queue table. The default is FALSE.

REVOKE_QUEUE_PRIVILEGE Procedure

This procedure revokes privileges on a queue from users and roles. The privileges are ENQUEUE or DEQUEUE. To revoke a privilege, the revoker must be the original grantor of the privilege. The privileges propagated through the GRANT option are revoked if the grantor's privileges are revoked.

Syntax

```
DBMS_AQADM.REVOKE_QUEUE_PRIVILEGE (
   privilege         IN      VARCHAR2,
   queue_name        IN      VARCHAR2,
   grantee           IN      VARCHAR2);
```

Parameters

Table 5–15 REVOKE_QUEUE_PRIVILEGE Procedure Parameters

Parameter	Description
privilege	The AQ queue privilege to revoke. The options are ENQUEUE, DEQUEUE, and ALL. ALL means both ENQUEUE and DEQUEUE.
queue_name	Name of the queue.
grantee	Grantee(s). The grantee(s) can be a user, a role, or the PUBLIC role. If the privilege has been propagated by the grantee through the GRANT option, then the propagated privilege is also revoked.

ADD_SUBSCRIBER Procedure

This procedure adds a default subscriber to a queue.

Syntax

```
DBMS_AQADM.ADD_SUBSCRIBER (
   queue_name     IN    VARCHAR2,
   subscriber     IN    sys.aq$_agent,
   rule           IN    VARCHAR2 DEFAULT NULL,
   transformation IN    VARCHAR2);
```

Parameters

Table 5–16 ADD_SUBSCRIBER Procedure Parameters

Parameter	Description
queue_name	Name of the queue.
subscriber	Agent on whose behalf the subscription is being defined.
rule	A conditional expression based on the message properties, the message data properties and PL/SQL functions. A rule is specified as a Boolean expression using syntax similar to the WHERE clause of a SQL query. This Boolean expression can include conditions on message properties, user data properties (object payloads only), and PL/SQL or SQL functions (as specified in the where clause of a SQL query). Currently supported message properties are priority and corrid. To specify rules on a message payload (object payload), use attributes of the object type in clauses. You must prefix each attribute with tab.user_data as a qualifier to indicate the specific column of the queue table that stores the payload. The rule parameter cannot exceed 4000 characters.
transformation	Specifies a transformation that will be applied when this subscriber dequeues the message. The source type of the transformation must match the type of the queue. If the subscriber is remote, then the transformation is applied before propagation to the remote queue

Usage Notes

A program can enqueue messages to a specific list of recipients or to the default list of subscribers. This operation only succeeds on queues that allow multiple consumers. This operation takes effect immediately, and the containing transaction is committed. Enqueue requests that are executed after the completion of this call will reflect the new behavior.

Any string within the rule must be quoted as shown below;

```
rule   => 'PRIORITY <= 3 AND CORRID =  ''FROM JAPAN'''
```

Note that these are all single quotation marks.

ALTER_SUBSCRIBER Procedure

This procedure alters existing properties of a subscriber to a specified queue. Only the rule can be altered.Syntax

```
DBMS_AQADM.ALTER_SUBSCRIBER (
   queue_name     IN    VARCHAR2,
   subscriber     IN    sys.aq$_agent,
   rule           IN    VARCHAR2
   transformation IN    VARCHAR2);
```

Parameters

Table 5–17 ALTER_SUBSCRIBER Procedure Parameters

Parameter	Description
queue_name	Name of the queue.
subscriber	Agent on whose behalf the subscription is being altered. See "Agent" on page 4-4.
rule	A conditional expression based on the message properties, the message data properties and PL/SQL functions. Note: The rule parameter cannot exceed 4000 characters. To eliminate the rule, set the rule parameter to NULL.
transformation	Specifies a transformation that will be applied when this subscriber dequeues the message. The source type of the transformation must match the type of the queue. If the subscriber is remote, then the transformation is applied before propagation to the remote queue

Usage Notes

This procedure alters both the rule and the transformation for the subscriber. If you wish to retain the existing value for either of them, you must specify its old value. The current values for rule and transformation for a subscriber can be obtained from the <schema>.AQ$<queue_table>_R and <schema>.AQ$<queue_table>_S views.

REMOVE_SUBSCRIBER Procedure

This procedure removes a default subscriber from a queue. This operation takes effect immediately, and the containing transaction is committed. All references to the subscriber in existing messages are removed as part of the operation.

Syntax

```
DBMS_AQADM.REMOVE_SUBSCRIBER (
   queue_name          IN          VARCHAR2,
   subscriber          IN          sys.aq$_agent);
```

Parameters

Table 5–18 REMOVE_SUBSCRIBER Procedure Parameters

Parameter	Description
queue_name	Name of the queue.
subscriber	Agent who is being removed. See "Agent" on page 4-4.

SCHEDULE_PROPAGATION Procedure

This procedure schedules propagation of messages from a queue to a destination identified by a specific dblink.

Messages may also be propagated to other queues in the same database by specifying a NULL destination. If a message has multiple recipients at the same destination in either the same or different queues, then the message is propagated to all of them at the same time.

Syntax

```
DBMS_AQADM.SCHEDULE_PROPAGATION (
   queue_name       IN    VARCHAR2,
   destination      IN    VARCHAR2 DEFAULT NULL,
   start_time       IN    DATE     DEFAULT SYSDATE,
   duration         IN    NUMBER   DEFAULT NULL,
   next_time        IN    VARCHAR2 DEFAULT NULL,
   latency          IN    NUMBER   DEFAULT 60);
```

Parameters

Table 5–19 SCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the administrative user.

Table 5–19 SCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
destination	Destination dblink. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.
start_time	Initial start time for the propagation window for messages from the source queue to the destination.
duration	Duration of the propagation window in seconds. A NULL value means the propagation window is forever or until the propagation is unscheduled.
next_time	Date function to compute the start of the next propagation window from the end of the current window. If this value is NULL, then propagation is stopped at the end of the current window. For example, to start the window at the same time every day, next_time should be specified as 'SYSDATE + 1 - duration/86400'.
latency	Maximum wait, in seconds, in the propagation window for a message to be propagated after it is enqueued. For example: If the latency is 60 seconds, then during the propagation window; if there are no messages to be propagated, then messages from that queue for the destination are not propagated for at least 60 more seconds. It is at least 60 seconds before the queue is checked again for messages to be propagated for the specified destination. If the latency is 600, then the queue is not checked for 10 minutes, and if the latency is 0, then a job queue process will be waiting for messages to be enqueued for the destination. As soon as a message is enqueued, it is propagated.

UNSCHEDULE_PROPAGATION Procedure

This procedure unschedules previously scheduled propagation of messages from a queue to a destination identified by a specific dblink.

Syntax

```
DBMS_AQADM.UNSCHEDULE_PROPAGATION (
   queue_name      IN   VARCHAR2,
   destination     IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 5–20 UNSCHEDULE_PROPAGATION Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the administrative user.
destination	Destination dblink. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.

VERIFY_QUEUE_TYPES Procedure

This procedure verifies that the source and destination queues have identical types. The result of the verification is stored in the table sys.aq$_message_types, overwriting all previous output of this command.

Syntax

```
DBMS_AQADM.VERIFY_QUEUE_TYPES (
   src_queue_name     IN    VARCHAR2,
   dest_queue_name    IN    VARCHAR2,
   destination        IN    VARCHAR2 DEFAULT NULL,
   rc                 OUT   BINARY_INTEGER);
```

Parameters

Table 5–21 VERIFY_QUEUE_TYPES Procedure Parameters

Parameter	Description
src_queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
dest_queue_name	Name of the destination queue where messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination dblink. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.
rc	Return code for the result of the procedure. If there is no error, and if the source and destination queue types match, then the result is 1. If they do not match, then the result is 0. If an Oracle error is encountered, then it is returned in rc.

ALTER_PROPAGATION_SCHEDULE Procedure

This procedure alters parameters for a propagation schedule.

Syntax

```
DBMS_AQADM.ALTER_PROPAGATION_SCHEDULE (
   queue_name      IN     VARCHAR2,
   destination     IN     VARCHAR2 DEFAULT NULL,
   duration        IN     NUMBER   DEFAULT NULL,
   next_time       IN     VARCHAR2 DEFAULT NULL,
   latency         IN     NUMBER   DEFAULT 60);
```

Parameters

Table 5–22 ALTER_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination dblink. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.
duration	Duration of the propagation window in seconds. A NULL value means the propagation window is forever or until the propagation is unscheduled.
next_time	Date function to compute the start of the next propagation window from the end of the current window. If this value is NULL, then propagation is stopped at the end of the current window. For example, to start the window at the same time every day, next_time should be specified as 'SYSDATE + 1 - duration/86400'.
latency	Maximum wait, in seconds, in the propagation window for a message to be propagated after it is enqueued. The default value is 60. Caution: if latency is not specified for this call, then latency will over-write any existing value with the default value. For example, if the latency is 60 seconds, then during the propagation window, if there are no messages to be propagated, then messages from that queue for the destination will not be propagated for at least 60 more seconds. It will be at least 60 seconds before the queue will be checked again for messages to be propagated for the specified destination. If the latency is 600, then the queue will not be checked for 10 minutes and if the latency is 0, then a job queue process will be waiting for messages to be enqueued for the destination and as soon as a message is enqueued it will be propagated.

ENABLE_PROPAGATION_SCHEDULE Procedure

This procedure enables a previously disabled propagation schedule.

Syntax

```
DBMS_AQADM.ENABLE_PROPAGATION_SCHEDULE (
   queue_name       IN     VARCHAR2,
   destination      IN     VARCHAR2 DEFAULT NULL);
```

Parameters

Table 5–23 ENABLE_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination dblink. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.

DISABLE_PROPAGATION_SCHEDULE Procedure

This procedure disables a propagation schedule.

Syntax

```
DBMS_AQADM.DISABLE_PROPAGATION_SCHEDULE (
   queue_name       IN     VARCHAR2,
   destination      IN     VARCHAR2 DEFAULT NULL);
```

Parameters

Table 5–24 DISABLE_PROPAGATION_SCHEDULE Procedure Parameters

Parameter	Description
queue_name	Name of the source queue whose messages are to be propagated, including the schema name. If the schema name is not specified, then it defaults to the schema name of the user.
destination	Destination dblink. Messages in the source queue for recipients at this destination are propagated. If it is NULL, then the destination is the local database and messages are propagated to other queues in the local database. The length of this field is currently limited to 128 bytes, and if the name is not fully qualified, then the default domain name is used.

MIGRATE_QUEUE_TABLE Procedure

This procedure upgrades an 8.0-compatible queue table to an 8.1-compatible queue table, or downgrades an 8.1-compatible queue table to an 8.0-compatible queue table.

Syntax

```
DBMS_AQADM.MIGRATE_QUEUE_TABLE (
   queue_table    IN   VARCHAR2,
   compatible     IN   VARCHAR2);
```

Parameters

Table 5–25 MIGRATE_QUEUE_TABLE Procedure Parameters

Parameter	Description
queue_table	Specifies name of the queue table to be migrated.
compatible	Set this to '8.1' to upgrade an 8.0-compatible queue table, or set this to '8.0' to downgrade an 8.1-compatible queue table.

CREATE_AQ_AGENT Procedure

This procedure registers an agent for AQ Internet access using HTTP/SMTP protocols.

Syntax

```
DBMS_AQADM.CREATE_AQ_AGENT (
  agent_name                IN VARCHAR2,
  certificate_location      IN VARCHAR2 DEFAULT NULL,
  enable_http               IN BOOLEAN DEFAULT FALSE,
  enable_smtp               IN BOOLEAN DEFAULT FALSE,
  enable_anyp               IN BOOLEAN DEFAULT FALSE )
```

Parameters

Table 5–26 CREATE_AQ_AGENT Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the AQ Internet agent
certification_location	Agent's certificate location in LDAP (default= NULL). If the agent is allowed to access AQ via SMTP, then its certificate must be registered in LDAP. For access via HTTP, the certificate location is not required
enable_http	TRUE: the agent can access AQ via HTTP FALSE: the agent cannot access AQ via HTTP
enable_smtp	TRUE: the agent can access AQ via SMTP (email) FALSE: the agent cannot access AQ via SMTP
enable_anyp	TRUE: the agent can access AQ via any protocol (HTTP or SMTP)

Usage Notes

The SYS.AQ$INTERNET_USERS view has a list of all AQ Internet agents.

ALTER_AQ_AGENT Procedure

This procedure alters an agent registered for AQ Internet access.

Syntax

```
DBMS_AQADM.ALTER_AQ_AGENT (
  agent_name                IN VARCHAR2,
  certificate_location      IN VARCHAR2 DEFAULT NULL,
  enable_http               IN BOOLEAN DEFAULT FALSE,
  enable_smtp               IN BOOLEAN DEFAULT FALSE,
```

```
  enable_anyp                IN BOOLEAN DEFAULT FALSE )
```

Parameters

Table 5–27 ALTER_AQ_AGENT Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the AQ Internet agent
certification_location	Agent's certificate location in LDAP (default= NULL). If the agent is allowed to access AQ via SMTP, then its certificate must be registered in LDAP. For access via HTTP, the certificate location is not required
enable_http	TRUE: the agent can access AQ via HTTP FALSE: the agent cannot access AQ via HTTP
enable_smtp	TRUE: the agent can access AQ via SMTP (email) FALSE: the agent cannot access AQ via SMTP
enable_anyp	TRUE: the agent can access AQ via any protocol (HTTP or SMTP)

DROP_AQ_AGENT Procedure

This procedure drops an agent that was previously registered for AQ Internet access.

Syntax

```
DBMS_AQADM.DROP_AQ_AGENT (
  agent_name                 IN VARCHAR2)
```

Parameters

Table 5–28 DROP_AQ_AGENT Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the AQ Internet agent

ENABLE_DB_ACCESS Procedure

This procedure grants an AQ Internet agent the privileges of a specific database user. The AQ Internet agent should have been previously created using the CREATE_AQ_AGENT procedure.

Syntax

```
DBMS_AQADM.ENABLE_DB_ACCESS (
  agent_name                IN VARCHAR2,
  db_username               IN VARCHAR2)
```

Parameters

Table 5–29 ENABLE_DB_ACCESS Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the AQ Internet agent
db_username	Specified the database user whose privileges are to be granted to the AQ Internet agent

Usage Notes

The SYS.AQ$INTERNET_USERS view has a list of all AQ Internet agents and the names of the database users whose privileges are granted to them.

DISABLE_DB_ACCESS Procedure

This procedure revokes the privileges of a specific database user from an AQ Internet agent. The AQ Internet agent should have been previously granted those privileges using the ENABLE_DB_ACCESS procedure.

Syntax

```
DBMS_AQADM.DISABLE_DB_ACCESS (
  agent_name                IN VARCHAR2,
  db_username               IN VARCHAR2)
```

Parameters

Table 5–30 DISABLE_DB_ACCESS Procedure Parameters

Parameter	Description
agent_name	Specifies the username of the AQ Internet agent
db_username	Specified the database user whose privileges are to be revoked from the AQ Internet agent

ADD_ALIAS_TO_LDAP Procedure

This procedure creates an alias for a queue, agent, or a JMS ConnectionFactory in LDAP. The alias will be placed directly under the database server's distinguished name in LDAP hierarchy.

Syntax

```
DBMS_AQADM.ADD_ALIAS_TO_LDAP(
   alias          IN VARCHAR2,
   obj_location   IN VARCHAR2);
```

Parameters

Table 5–31 ADD_ALIAS_TO_LDAP Procedure Parameters

Parameter	Description
alias	the name of the alias Example:'west_shipping'
obj_location	The distinguished name of the object (queue, agent or connection factory) to which the above alias refers to

Usage Notes

This method can be used to create aliases for Queues, Agents and JMS ConnectionFactory objects. These object must exist before the alias is created. These aliases can be used for JNDI lookup in JMS and AQ Internet access.

DEL_ALIAS_FROM_LDAP Procedure

This procedure drops an alias for a queue, agent, or JMS ConnectionFactory in LDAP.

Syntax

```
DBMS_AQ.DEL_ALIAS_FROM_LDAP(
   alias IN VARCHAR2);
```

Parameters

Table 5–32 DEL_ALIAS_FROM_LDAP Procedure Parameters

Parameter	Description
alias	The alias to be removed

6

DBMS_AQELM

The DBMS_AQELM package provides procedures to manage the configuration of Advanced Queuing asynchronous notification by e-mail and HTTP.

> **See Also:** *Oracle9i Application Developer's Guide - Advanced Queuing* for detailed information about DBMS_AQELM.

This chapter discusses the following topics:

- Summary of DBMS_AQELM Subprograms

Summary of DBMS_AQELM Subprograms

Table 6–1 DBMS_AQELM Subprograms

Subprogram	Description
"SET_MAILHOST Procedure" on page 6-2	Sets the host name for SMTP server.
"GET_MAILHOST Procedure" on page 6-3	Gets the host name for SMTP server.
"SET_MAILPORT Procedure" on page 6-3	Sets the port number for SMTP server.
"GET_MAILPORT Procedure" on page 6-4	Gets the port number for SMTP server.
"SET_SENDFROM Procedure" on page 6-4	Sets the sent-from e-mail address.
"GET_SENDFROM Procedure" on page 6-5	Gets the sent-from e-mail address.
"SET_PROXY Procedure" on page 6-5	Sets the proxy server name to be used for requests of HTTP protocol, excluding requests for hosts that belong to the domain specified in `no_proxy_domains`.
"GET_PROXY Procedure" on page 6-6	Gets the proxy server name and `no_proxy_domains` set by `DBMS_AQELM.SET_PROXY` for HTTP notifications.

SET_MAILHOST Procedure

This procedure sets the host name for the SMTP server. As part of the configuration for e-mail notifications, a user with `AQ_ADMINISTRATOR_ROLE` or with `EXECUTE` permissions on the `DBMS_AQELM` package needs to set the host name before registering for e-mail notifications. The database will use this SMTP server host name to send out e-mail notifications.

Syntax

```
DBMS_AQELM.SET_MAILHOST (
    mailhost  IN  VARCHAR2);
```

Parameters

Table 6–2 shows the parameters for the `SET_MAILHOST` procedure.

Table 6–2 SET_MAILHOST Procedure Parameters

Parameter	Description
mailhost	The SMTP server host name.

GET_MAILHOST Procedure

This procedure gets the host name set by DBMS_AQELM.SET_MAILHOST for the SMTP server.

Syntax

```
DBMS_AQELM.GET_MAILHOST (
    mailhost  OUT VARCHAR2);
```

Parameters

Table 6–3 shows the parameters for the GET_MAILHOST procedure.

Table 6–3 GET_MAILHOST Procedure Parameters

Parameter	Description
mailhost	The SMTP server host name.

SET_MAILPORT Procedure

This procedure sets the port number for the SMTP server. As part of the configuration for e-mail notifications, a user with AQ_ADMINISTRATOR_ROLE or with EXECUTE permissions on DBMS_AQELM package needs to set the port number before registering for e-mail notifications. The database will use this SMTP server port number to send out e-mail notifications. If not set, the SMTP mailport defaults to 25.

Syntax

```
DBMS_AQELM.SET_MAILPORT (
    mailport  IN NUMBER);
```

Parameters

Table 6–4 shows the parameters for the SET_MAILPORT procedure.

Table 6–4 SET_MAILPORT Procedure Parameters

Parameter	Description
mailport	The SMTP server port number.

GET_MAILPORT Procedure

This procedure gets the port number for the SMTP server set by the DBMS_AQELM.SET_MAILPORT procedure or the default value, which is 25.

Syntax

```
DBMS_AQELM.GET_MAILPORT (
    mailport  OUT NUMBER);
```

Parameters

Table 6–5 shows the parameters for the GET_MAILPORT procedure.

Table 6–5 GET_MAILPORT Procedure Parameters

Parameter	Description
mailport	The SMTP server port number.

SET_SENDFROM Procedure

This procedure sets the sent-from e-mail address. As part of the configuration for e-mail notifications, a user with AQ_ADMINISTRATOR_ROLE or with EXECUTE permissions on the DBMS_AQELM package should set the sent-from address before registering for e-mail notifications This e-mail address is used in the sent-from field in all the e-mail notifications sent out by the database to the registered e-mail addresses.

Syntax

```
DBMS_AQELM.SET_SENDFROM (
    sendfrom  IN  VARCHAR2);
```

Parameters

Table 6–6 shows the parameters for the SET_SENDFROM procedure.

Table 6–6 SET_SENDFROM Procedure Parameters

Parameter	Description
sendfrom	The sent-from e-mail address.

GET_SENDFROM Procedure

This procedure gets the sent-from e-mail address set by DBMS_AQELM.SET_SENDFROM procedure.

Syntax

```
DBMS_AQELM.GET_SENDFROM (
    sendfrom  OUT  VARCHAR2);
```

Parameters

Table 6–7 shows the parameters for the GET_SENDFROM procedure.

Table 6–7 GET_SENDFROM Procedure Parameters

Parameter	Procedure
sendfrom	The sent-from e-mail address.

SET_PROXY Procedure

This procedure sets the proxy server name to be used for requests of HTTP protocol, excluding requests for hosts that belong to the domain specified in no_proxy_domains. The proxy server name can include an optional TCP/IP port number at which the proxy server listens at. If the port is not specified for the proxy server, port 80 is assumed. no_proxy_domains is a list of domains or hosts for which HTTP requests should be sent directly to the destination HTTP server instead of going through a proxy server. Optionally, a port number can be specified for each domain or host. If the port number is specified, the no-proxy restriction is only applied to the request at that port of the particular domain or host. When no_proxy_domains is NULL and the proxy server is set, all requests go through the proxy server. When the proxy server is not set, http_send sends the requests to the target Web servers directly.

As part of the configuration for HTTP notifications, a user with AQ_ADMINISTRATOR_ROLE or with EXECUTE permissions on the DBMS_AQELM package can choose to set the proxy server name and a list of no_proxy_domains,

if required, before registering for HTTP notifications. The database will use this information to post HTTP notifications.

Syntax

```
DBMS_AQELM.SET_PROXY (
   proxy           IN VARCHAR2,
   no_proxy_domains IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 6–8 shows the parameters for the SET_PROXY procedure.

Table 6–8 SET_PROXY Procedure Parameters

Parameter	Procedure
proxy	The proxy server host and port number. The syntax is "[http://]host[:port][/]". For example, "www-proxy.my-company.com:80".
no_proxy_domains	The list of no-proxy domains or hosts. The syntax is a list of host or domains, with optional port numbers separated by a comma, a semi-colon, or a space. For example, "corp.my-company.com, eng.my-company.com:80"

GET_PROXY Procedure

This procedure gets the proxy server name and no_proxy_domains set by DBMS_AQELM.SET_PROXY for HTTP notifications.

Syntax

```
DBMS_AQELM.GET_PROXY (
   proxy           OUT VARCHAR2,
   no_proxy_domains OUT VARCHAR2);
```

Parameters

Table 6–9 shows the parameters for the GET_PROXY procedure.

Table 6–9 GET_PROXY Procedure Parameters

Parameter	Procedure
proxy	The proxy server host and port number.

Table 6–9 GET_PROXY Procedure Parameters

Parameter	Procedure
no_proxy_domains	The list of no-proxy domains or hosts.

7

DBMS_BACKUP_RESTORE

The DBMS_BACKUP_RESTORE package has a PL/SQL procedure to normalize filenames on Windows NT platforms.

> **Note:** Do not use this procedure on Oracle releases prior to 8.1.6 or on UNIX-based Oracle installations.

This chapter discusses the following topics:

- Filename Normalization for Oracle on Windows NT Platforms

Filename Normalization for Oracle on Windows NT Platforms

In release 8.1.6 and higher, Oracle correctly normalizes filenames. However, you must use this procedure to normalize filenames in the control file and recovery catalog from earlier releases.

In releases prior to 8.1.6, a flawed filename normalization mechanism allowed two different filenames to refer to one physical file. DBMS_BACKUP_RESTORE corrects this so that Oracle accurately identifies all physical files referenced in the control file and the recovery catalog.

For more information on this package and for detailed procedures on executing it, please refer to *Oracle9i Database Migration*.

8

DBMS_DDL

This package provides access to some SQL Data Definition Language (DDL) statements from stored procedures. It also provides special administration operations that are not available as DDLs.

The `ALTER_COMPILE` and `ANALYZE_OBJECT` procedures commit the current transaction, perform the operation, and then commit again.

This package runs with the privileges of calling user, rather than the package owner `SYS`.

This chapter discusses the following topics:

Summary of DBMS_DDL Subprograms

Table 8–1 DBMS_DDL Package Subprograms

Subprogram	Description
"ALTER_COMPILE Procedure" on page 8-2	Compiles the PL/SQL object.
"ANALYZE_OBJECT Procedure" on page 8-3	Provides statistics for the database object.

ALTER_COMPILE Procedure

This procedure is equivalent to the following SQL statement:

```
ALTER PROCEDURE|FUNCTION|PACKAGE [<schema>.] <name> COMPILE [BODY]
```

If the named object is this package, or any packages upon which it depends (currently, STANDARD or DBMS_STANDARD), then the procedure simply returns, and these packages are successfully compiled.

Syntax

```
DBMS_DDL.ALTER_COMPILE (
   type   VARCHAR2,
   schema VARCHAR2,
   name   VARCHAR2);
```

Parameters

Table 8–2 ALTER_COMPILE Procedure Parameters

Parameter	Description
type	Must be either PROCEDURE, FUNCTION, PACKAGE, PACKAGE BODY or TRIGGER.
schema	Schema name. If NULL, then use current schema (case-sensitive).
name	Name of the object (case-sensitive).

Exceptions

Table 8–3 ALTER_COMPILE Procedure Exceptions

Exception	Description
ORA-20000:	Insufficient privileges or object does not exist.
ORA-20001:	Remote object, cannot compile.
ORA-20002:	Bad value for object type Should be either PACKAGE, PACKAGE BODY, PROCEDURE, FUNCTION, or TRIGGER.

ANALYZE_OBJECT Procedure

This procedure provides statistics for the given table, index, or cluster. It is equivalent to the following SQL statement:

```
ANALYZE TABLE|CLUSTER|INDEX [<schema>.]<name> [<method>] STATISTICS [SAMPLE <n>
[ROWS|PERCENT]]
```

Syntax

```
DBMS_DDL.ANALYZE_OBJECT (
   type             VARCHAR2,
   schema           VARCHAR2,
   name             VARCHAR2,
   method           VARCHAR2,
   estimate_rows    NUMBER   DEFAULT NULL,
   estimate_percent NUMBER   DEFAULT NULL,
   method_opt       VARCHAR2 DEFAULT NULL,
   partname         VARCHAR2 DEFAULT NULL);
```

Parameters

Table 8–4 ANALYZE_OBJECT Procedure Parameters

Parameter	Description
type	One of TABLE, CLUSTER or INDEX. If none of these, an ORA-20001 error is raised.
schema	Schema of object to analyze. NULL means current schema, case-sensitive.
name	Name of object to analyze, case-sensitive.

Table 8–4 ANALYZE_OBJECT Procedure Parameters

Parameter	Description
method	One of ESTIMATE, COMPUTE or DELETE. If ESTIMATE, then either estimate_rows or estimate_percent must be non-zero.
estimate_rows	Number of rows to estimate.
estimate_percent	Percentage of rows to estimate. If estimate_rows is specified, then ignore this parameter.
method_opt	Method options of the following format. [FOR TABLE] [FOR ALL [INDEXED] COLUMNS] [SIZE n] [FOR ALL INDEXES]
partname	Specific partition to be analyzed.

Exceptions

Table 8–5 ANALYZE_OBJECT Procedure Exceptions

Exception	Description
ORA-20000:	Insufficient privileges or object does not exist.
ORA-20001:	Bad value for object type. Should be either TABLE, INDEX or CLUSTER.
ORA-20002:	METHOD must be one of COMPUTE, ESTIMATE or DELETE.

9

DBMS_DEBUG

DBMS_DEBUG is a PL/SQL API to the PL/SQL debugger layer, *Probe*, in the Oracle server.

This API is primarily intended to implement server-side debuggers and it provides a way to debug server-side PL/SQL program units.

> **Note:** The term *program unit* refers to a PL/SQL program of any type (procedure, function, package, package body, trigger, anonymous block, object type, or object type body).

This chapter discusses the following topics:

Using DBMS_DEBUG

To debug server-side code, it is necessary to have two database sessions: one session to run the code in debug-mode (the target session), and a second session to supervise the target session (the debug session).

The target session becomes available for debugging by making initializing calls with DBMS_DEBUG. This marks the session, so the PL/SQL interpreter runs in debug-mode and generates debug events. As debug events are generated, they are posted from the session. In most cases, debug events require return notification: the interpreter pauses awaiting a reply.

Meanwhile, the debug session must also initialize itself using DBMS_DEBUG: This tells it what target session to supervise. The debug session may then call entrypoints in DBMS_DEBUG to read events that were posted from the target session and to communicate with the target session.

> **See Also:** Figure 9–1 and Figure 9–2 illustrate the flow of operations in the session to be debugged and in the debugging session.

DBMS_DEBUG does not provide any interface to the PL/SQL compiler; however, it does depend on debug information optionally generated by the compiler. Without debug information, it is not possible to examine or modify the values of parameters or variables. There are two ways to ensure that debug information is generated: through a session switch, or through individual recompilation.

To set the session switch, enter the following statement:

```
ALTER SESSION SET PLSQL_DEBUG = true;
```

This instructs the compiler to generate debug information for the remainder of the session. It does not recompile any existing PL/SQL.

To generate debug information for existing PL/SQL code, use one of the following statements (the second recompiles a package or type body):

```
ALTER [PROCEDURE | FUNCTION | PACKAGE | TRIGGER | TYPE] <name> COMPILE DEBUG;
ALTER [PACKAGE | TYPE] <name> COMPILE DEBUG BODY;
```

Figure 9–1 Target Session

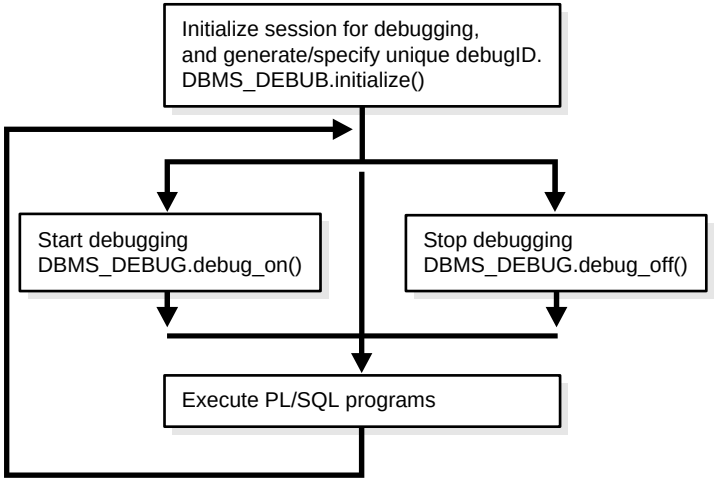


Figure 9–2 Debug Session

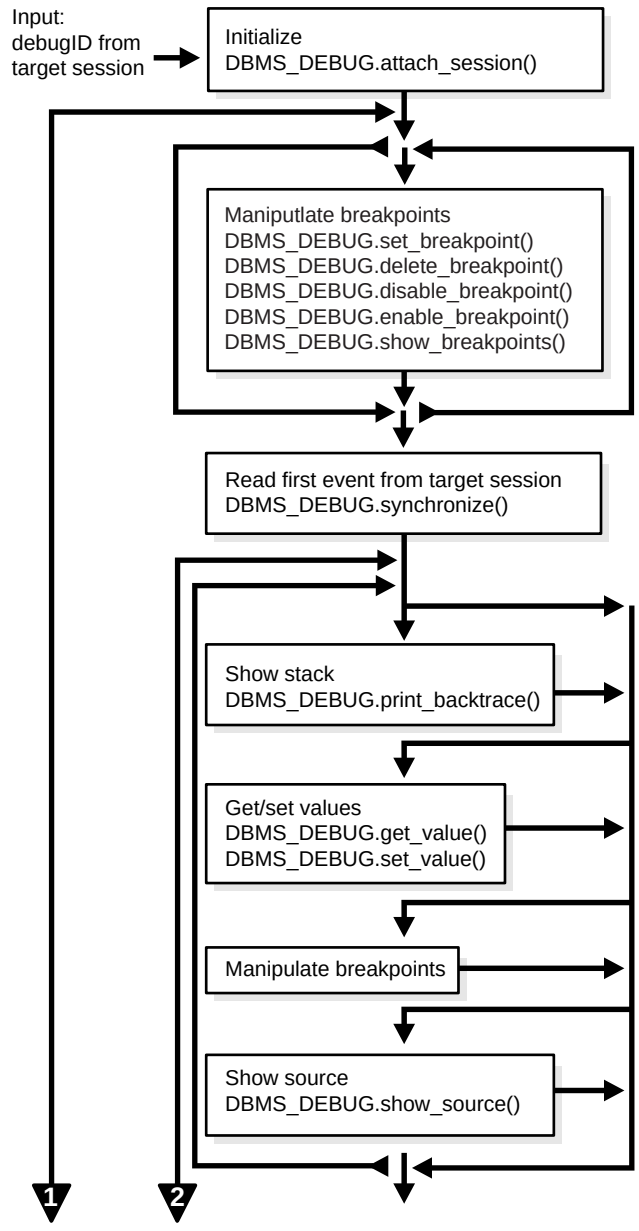
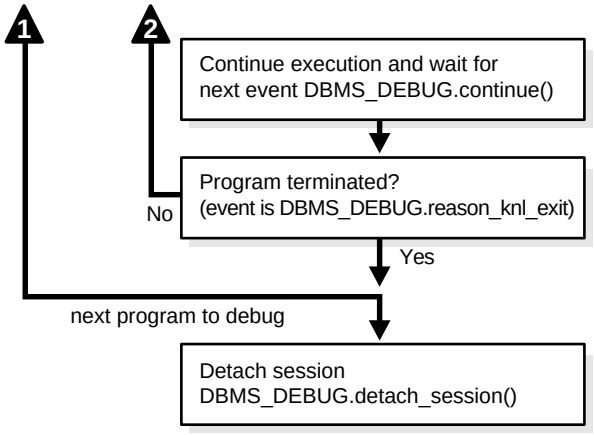


Figure 9–2 Debug Session (Cont.)



Control of the Interpreter

The interpreter pauses execution at the following times:

1. At startup of the interpreter so any deferred breakpoints may be installed prior to execution.
2. At any line containing an enabled breakpoint.
3. At any line where an *interesting* event occurs. The set of interesting events is specified by the flags passed to `DBMS_DEBUG.CONTINUE` in the `breakflags` parameter.

Usage Notes

Session Termination

There is no event for session termination. Therefore, it is the responsibility of the debug session to check and make sure that the target session has not ended. A call to `DBMS_DEBUG.SYNCHRONIZE` after the target session has ended causes the debug session to hang until it times out.

Deferred Operations

The diagram suggests that it is possible to set breakpoints prior to having a target session. This is true. In this case, Probe caches the breakpoint request and transmits it to the target session at first synchronization. However, if a breakpoint request is deferred in this fashion, then:

- `SET_BREAKPOINT` does not set the breakpoint number (it can be obtained later from `SHOW_BREAKPOINTS` if necessary).
- `SET_BREAKPOINT` does not validate the breakpoint request. If the requested source line does not exist, then an error silently occurs at synchronization, and no breakpoint is set.

Diagnostic Output

To debug Probe, there are *diagnostics* parameters to some of the calls in `DBMS_DEBUG`. These parameters specify whether to place diagnostic output in the RDBMS tracefile. If output to the RDBMS tracefile is disabled, then these parameters have no effect.

Types and Constants

Types

PROGRAM_INFO

This type specifies a program location. It is a line number in a program unit. This is used for stack backtraces and for setting and examining breakpoints. The read-only fields are currently ignored by Probe for breakpoint operations. They are set by Probe only for stack backtraces.

`EntrypointName`	Null, unless this is a nested procedure or function.
`LibunitType`	Disambiguate among objects that share the same namespace (for example, procedure and package specifications). See the Libunit Types on page 9-9 for more information.

```
TYPE program_info IS RECORD
(
    -- The following fields are used when setting a breakpoint
    Namespace        BINARY_INTEGER,  -- See 'NAMESPACES' section below.
    Name             VARCHAR2(30),    -- name of the program unit
    Owner            VARCHAR2(30),    -- owner of the program unit
    Dblink           VARCHAR2(30),    -- database link, if remote
    Line#            BINARY_INTEGER,
    -- Read-only fields (set by Probe when doing a stack backtrace)
    LibunitType      BINARY_INTEGER,
    EntrypointName   VARCHAR2(30)
);
```

RUNTIME_INFO

This type gives context information about the running program.

```
TYPE runtime_info IS RECORD
(
    Line#            BINARY_INTEGER,  -- (duplicate of program.line#)
    Terminated       BINARY_INTEGER,  -- has the program terminated?
    Breakpoint       BINARY_INTEGER,  -- breakpoint number
    StackDepth       BINARY_INTEGER,  -- number of frames on the stack
    InterpreterDepth BINARY_INTEGER,  -- <reserved field>
    Reason           BINARY_INTEGER,  -- reason for suspension
    Program          program_info     -- source location
);
```

BREAKPOINT_INFO

This type gives information about a breakpoint, such as its current status and the program unit in which it was placed.

```
TYPE breakpoint_info IS RECORD
(
   -- These fields are duplicates of 'program_info':
   Name        VARCHAR2(30),
   Owner       VARCHAR2(30),
   DbLink      VARCHAR2(30),
   Line#       BINARY_INTEGER,
   LibunitType BINARY_INTEGER,
   Status      BINARY_INTEGER   -- see breakpoint_status_* below
);
```

INDEX_TABLE

This type is used by GET_INDEXES to return the available indexes for an indexed table.

```
TYPE index_table IS table of BINARY_INTEGER INDEX BY BINARY_INTEGER;
```

BACKTRACE_TABLE

This type is used by PRINT_BACKTRACE.

```
TYPE backtrace_table IS TABLE OF program_info INDEX BY BINARY_INTEGER;
```

BREAKPOINT_TABLE

This type is used by SHOW_BREAKPOINTS.

```
TYPE breakpoint_table IS TABLE OF breakpoint_info INDEX BY BINARY_INTEGER;
```

VC2_TABLE

This type is used by SHOW_SOURCE.

```
TYPE vc2_table IS TABLE OF VARCHAR2(90) INDEX BY BINARY_INTEGER;
```

Constants

A breakpoint status may have these values:

breakpoint_status_unused	Breakpoint is not in use.

Otherwise, the status is a mask of the following values:

breakpoint_status_active	A line breakpoint.
breakpoints_status_disabled	Breakpoint is currently disabled.
breakpoint_status_remote	A 'shadow' breakpoint (a local representation of a remote breakpoint).

NAMESPACES

Program units on the server reside in different namespaces. When setting a breakpoint, specify the desired namespace.

1. Namespace_cursor contains cursors (anonymous blocks).
2. Namespace_pgkspec_or_toplevel contains:
   - Package specifications.

- Procedures and functions that are not nested inside other packages, procedures, or functions.
- Object types.

3. `Namespace_pkg_body` contains package bodies and type bodies.
4. `Namespace_trigger` contains triggers.

Libunit Types

These values are used to disambiguate among objects in a given namespace. These constants are used in `PROGRAM_INFO` when Probe is giving a stack backtrace.

`LibunitType_cursor`

`LibunitType_procedure`

`LibunitType_function`

`LibunitType_package`

`LibunitType_package_body`

`LibunitType_trigger`

`LibunitType_Unknown`

Breakflags

These are values to use for the `breakflags` parameter to `CONTINUE`, in order to tell Probe what events are of interest to the client. These flags may be combined.

`break_next_line`	Break at next source line (step over calls).
`break_any_call`	Break at next source line (step into calls).
`break_any_return`	Break after returning from current entrypoint (skip over any entrypoints called from the current routine).
`break_return`	Break the next time an entrypoint gets ready to return. (This includes entrypoints called from the current one. If interpreter is running `Proc1`, which calls `Proc2`, then `break_return` stops at the end of `Proc2`.)
`break_exception`	Break when an exception is raised.
`break_handler`	Break when an exception handler is executed.

abort_execution	Stop execution and force an 'exit' event as soon as DBMS_DEBUG.CONTINUE is called.

Information Flags

These are flags which may be passed as the info_requested parameter to SYNCHRONIZE, CONTINUE, and GET_RUNTIME_INFO.

info_getStackDepth	Get the current depth of the stack.
info_getBreakpoint	Get the breakpoint number.
info_getLineinfo	Get program unit information.

Reasons for Suspension

After CONTINUE is run, the program either runs to completion or breaks on some line.

reason_none	
reason_interpreter_starting	Interpreter is starting.
reason_breakpoint	Hit a breakpoint.
reason_enter	Procedure entry.
reason_return	Procedure is about to return.
reason_finish	Procedure is finished.
reason_line	Reached a new line.
reason_interrupt	An interrupt occurred.
reason_exception	An exception was raised.
reason_exit	Interpreter is exiting (old form).
reason_knl_exit	Kernel is exiting.
reason_handler	Start exception-handler.
reason_timeout	A timeout occurred.
reason_instantiate	Instantiation block.
reason_abort	Interpreter is aborting.

Error Codes, Exceptions, and Variables

Error Codes

These values are returned by the various functions called in the debug session (SYNCHRONIZE, CONTINUE, SET_BREAKPOINT, and so on). If PL/SQL exceptions worked across client/server and server/server boundaries, then these would all be exceptions rather than error codes.

success	Normal termination.

Statuses returned by GET_VALUE and SET_VALUE:

error_bogus_frame	No such entrypoint on the stack.
error_no_debug_info	Program was compiled without debug symbols.
error_no_such_object	No such variable or parameter.
error_unknown_type	Debug information is unreadable.
error_indexed_table	Returned by GET_VALUE if the object is a table, but no index was provided.
error_illegal_index	No such element exists in the collection.
error_nullcollection	Table is atomically null.
error_nullvalue	Value is null.

Statuses returned by SET_VALUE:

error_illegal_value	Constraint violation.
error_illegal_null	Constraint violation.
error_value_malformed	Unable to decipher the given value.
error_other	Some other error.
error_name_incomplete	Name did not resolve to a scalar.

Statuses returned by the breakpoint functions:

error_no_such_breakpt	No such breakpoint.
error_idle_breakpt	Cannot enable or disable an unused breakpoint.

error_bad_handle	Unable to set breakpoint in given program (non-existent or security violation).

General error codes (returned by many of the DBMS_DEBUG subprograms):

error_unimplemented	Functionality is not yet implemented.
error_deferred	No program running; operation deferred.
error_exception	An exception was raised in the DBMS_DEBUG or Probe packages on the server.
error_communication	Some error other than a timeout occurred.
error_timeout	Timout occurred.

Exceptions

illegal_init	DEBUG_ON was called prior to INITIALIZE.

The following exceptions are raised by procedure SELF_CHECK:

pipe_creation_failure	Could not create a pipe.
pipe_send_failure	Could not write data to the pipe.
pipe_receive_failure	Could not read data from the pipe.
pipe_datatype_mismatch	Datatype in the pipe was wrong.
pipe_data_error	Data got garbled in the pipe.

Variables

default_timeout	The timeout value (used by both sessions).The smallest possible timeout is 1 second. If this value is set to 0, then a large value (3600) is used.

Common and Debug Session Sections

Common Section

The following subprograms may be called in either the target or the debug session:

- PROBE_VERSION Procedure

- SELF_CHECK Procedure
- SET_TIMEOUT Function

Debug Session Section

The following subprograms should be run in the debug session only:

- ATTACH_SESSION Procedure
- SYNCHRONIZE Function
- SHOW_SOURCE Procedure
- PRINT_BACKTRACE Procedure
- CONTINUE Function
- SET_BREAKPOINT Function
- DELETE_BREAKPOINT Function
- DISABLE_BREAKPOINT Function
- ENABLE_BREAKPOINT Function
- SHOW_BREAKPOINTS Procedure
- GET_VALUE Function
- SET_VALUE Function
- DETACH_SESSION Procedure
- GET_RUNTIME_INFO Function
- GET_INDEXES Function
- EXECUTE Procedure

OER Breakpoints

Exceptions that are declared in PL/SQL programs are known as user-defined exceptions. In addition, there are Oracle Errors (OERs) that are returned from the Oracle kernel. To tie the two mechanisms together, PL/SQL provides the "exception_init" pragma that turns a user-defined exception into an OER, so that a PL/SQL handler may be used for it, and so that the PL/SQL engine can return OERs to the Oracle kernel. As of the current release, the only information available about an OER is its number. If two user-defined exceptions are exception_init'd to the same OER, they are indistinguishable.

Summary of DBMS_DEBUG Subprograms

Table 9–1 DBMS_DEBUG Package Subprograms

Subprogram	Description
"PROBE_VERSION Procedure" on page 9-15	Returns the version number of DBMS_DEBUG on the server.
"SELF_CHECK Procedure" on page 9-15	Performs an internal consistency check.
"SET_TIMEOUT Function" on page 9-16	Sets the timeout value.
"INITIALIZE Function" on page 9-17	Sets debugID in target session.
"DEBUG_ON Procedure" on page 9-18	Turns debug-mode on.
"DEBUG_OFF Procedure" on page 18	Turns debug-mode off.
"ATTACH_SESSION Procedure" on page 9-19	Notifies the debug session about the target debugID.
"SYNCHRONIZE Function" on page 9-19	Waits for program to start running.
"SHOW_SOURCE Procedure" on page 9-20	Fetches program source.
"PRINT_BACKTRACE Procedure" on page 9-22	Prints a stack backtrace.
"CONTINUE Function" on page 9-23	Continues execution of the target program.
"SET_BREAKPOINT Function" on page 9-24	Sets a breakpoint in a program unit.
"DELETE_BREAKPOINT Function" on page 9-25	Deletes a breakpoint.
"DISABLE_BREAKPOINT Function" on page 9-26	Disables a breakpoint.
"ENABLE_BREAKPOINT Function" on page 9-27	Activates an existing breakpoint.
"SHOW_BREAKPOINTS Procedure" on page 9-27	Returns a listing of the current breakpoints.

Table 9–1 DBMS_DEBUG Package Subprograms (Cont.)

Subprogram	Description
"GET_VALUE Function" on page 9-28	Gets a value from the currently-running program.
"SET_VALUE Function" on page 9-31	Sets a value in the currently-running program.
"DETACH_SESSION Procedure" on page 9-33	Stops debugging the target program.
"GET_RUNTIME_INFO Function" on page 9-33	Returns information about the current program.
"GET_INDEXES Function" on page 9-34	Returns the set of indexes for an indexed table.
"EXECUTE Procedure" on page 9-35	Executes SQL or PL/SQL in the target session.

PROBE_VERSION Procedure

This procedure returns the version number of DBMS_DEBUG on the server.

Syntax

```
DBMS_DEBUG.PROBE_VERSION (
   major out BINARY_INTEGER,
   minor out BINARY_INTEGER);
```

Parameters

Table 9–2 PROBE_VERSION Procedure Parameters

Parameter	Description
major	Major version number.
minor	Minor version number: increments as functionality is added.

SELF_CHECK Procedure

This procedure performs an internal consistency check. SELF_CHECK also runs a communications test to ensure that the Probe processes are able to communicate.

If SELF_CHECK does not return successfully, then an incorrect version of DBMS_DEBUG was probably installed on this server. The solution is to install the correct version (pbload.sql loads DBMS_DEBUG and the other relevant packages).

Syntax

```
DBMS_DEBUG.SELF_CHECK (
   timeout IN binary_integer := 60);
```

Parameters

Table 9–3 SELF_CHECK Procedure Parameters

Parameter	Description
timeout	The timeout to use for the communication test. Default is 60 seconds.

Exceptions

Table 9–4 SELF_CHECK Procedure Exceptions

Exception	Description
OER-6516	Probe version is inconsistent.
pipe_creation_failure	Could not create a pipe.
pipe_send_failure	Could not write data to the pipe.
pipe_receive_failure	Could not read data from the pipe.
pipe_datatype_mismatch	Datatype in the pipe was wrong.
pipe_data_error	Data got garbled in the pipe.

All of these exceptions are fatal. They indicate a serious problem with Probe that prevents it from working correctly.

SET_TIMEOUT Function

This function sets the timeout value and returns the new timeout value.

Syntax

```
DBMS_DEBUG.SET_TIMEOUT (
   timeout BINARY_INTEGER)
```

```
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–5 SET_TIMEOUT Function Parameters

Parameter	Description
timeout	The timeout to use for communication between the target and debug sessions.

TARGET SESSION Section

The following subprograms are run in the target session (the session that is to be debugged):

- INITIALIZE Function
- DEBUG_ON Procedure
- DEBUG_OFF Procedure

INITIALIZE Function

This function initializes the target session for debugging.

Syntax

```
DBMS_DEBUG.INITIALIZE (
   debug_session_id  IN VARCHAR2       := NULL,
   diagnostics       IN BINARY_INTEGER := 0)
  RETURN VARCHAR2;
```

Parameters

Table 9–6 INITIALIZE Function Parameters

Parameter	Description
debug_session_id	Name of session ID. If NULL, then a unique ID is generated.
diagnostics	Indicates whether to dump diagnostic output to the tracefile. 0 = (default) no diagnostics 1 = print diagnostics

Returns

The newly-registered debug session ID (debugID)

DEBUG_ON Procedure

This procedure marks the target session so that all PL/SQL is run in debug mode. This must be done before any debugging can take place.

Syntax

```
DBMS_DEBUG.DEBUG_ON (
   no_client_side_plsql_engine BOOLEAN := TRUE,
   immediate                   BOOLEAN := FALSE);
```

Parameters

Table 9–7 DEBUG_ON Procedure Parameters

Parameter	Description
no_client_side_plsql_engine	Should be left to its default value unless the debugging session is taking place from a client-side PL/SQL engine.
immediate	If this is TRUE, then the interpreter immediately switches itself into debug-mode, instead of continuing in regular mode for the duration of the call.

Caution: There must be a debug session waiting if immediate is TRUE.

DEBUG_OFF Procedure

This procedure notifies the target session that debugging should no longer take place in that session. It is not necessary to call this function before ending the session.

Syntax

```
DBMS_DEBUG.DEBUG_OFF;
```

Usage Notes

The server does not handle this entrypoint specially. Therefore, it attempts to debug this entrypoint.

ATTACH_SESSION Procedure

This procedure notifies the debug session about the target program.

Syntax

```
DBMS_DEBUG.ATTACH_SESSION (
   debug_session_id  IN VARCHAR2,
   diagnostics       IN BINARY_INTEGER := 0);
```

Parameters

Table 9–8 ATTACH_SESSION Procedure Parameters

Parameter	Description
debug_session_id	Debug ID from a call to INITIALIZE in target session.
diagnostics	Generate diagnostic output if non-zero.

SYNCHRONIZE Function

This function waits until the target program signals an event. If info_requested is not NULL, then it calls GET_RUNTIME_INFO.

Syntax

```
DBMS_DEBUG.SYNCHRONIZE (
   run_info       OUT  runtime_info,
   info_requested IN   BINARY_INTEGER := NULL)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–9 SYNCHRONIZE Function Parameters

Parameter	Description
run_info	Structure in which to write information about the program. By default, this includes information about what program is running and at which line execution has paused.

Table 9–9 SYNCHRONIZE Function Parameters

Parameter	Description
info_requested	Optional bit-field in which to request information other than the default (which is info_getStackDepth + info_getLineInfo). 0 means that no information is requested at all. See "Information Flags" on page 9-10.

Returns

Table 9–10 SYNCHRONIZE Function Returns

Return	Description
success	
error_timeout	Timed out before the program started execution.
error_communication	Other communication error.

SHOW_SOURCE Procedure

The best way to get the source code (for a program that is being run) is to use SQL. For example:

```
DECLARE
   info DBMS_DEBUG.runtime_info;
BEGIN
   -- call DBMS_DEBUG.SYNCHRONIZE, CONTINUE,
   -- or GET_RUNTIME_INFO to fill in 'info'
   SELECT text INTO <buffer> FROM all_source
   WHERE owner = info.Program.Owner
     AND name  = info.Program.Name
     AND line  = info.Line#;
END;
```

However, this does not work for non-persistent programs (for example, anonymous blocks and trigger invocation blocks). For non-persistent programs, call SHOW_SOURCE. There are two flavors: one returns an indexed table of source lines, and the other returns a packed (and formatted) buffer.

There are two overloaded SHOW_SOURCE procedures.

Syntax

```
DBMS_DEBUG.SHOW_SOURCE (
   first_line  IN   BINARY_INTEGER,
   last_line   IN   BINARY_INTEGER,
   source      OUT  vc2_table);
```

Parameters

Table 9–11 SHOW_SOURCE Procedure Parameters

Parameter	Description
first_line	Line number of first line to fetch. (PL/SQL programs always start at line 1 and have no holes.)
last_line	Line number of last line to fetch. No lines are fetched past the end of the program.
source	The resulting table, which may be indexed by line#.

Returns

An indexed table of source-lines. The source lines are stored starting at `first_line`. If any error occurs, then the table is empty.

Usage Notes

This second overloading of SHOW_SOURCE returns the source in a formatted buffer, complete with line-numbers. It is faster than the indexed table version, but it does not guarantee to fetch all the source.

If the source does not fit in bufferlength (`buflen`), then additional pieces can be retrieved using the GET_MORE_SOURCE procedure (`pieces` returns the number of additional pieces that need to be retrieved).

Syntax

```
DBMS_DEBUG.SHOW_SOURCE (
   first_line   IN     BINARY_INTEGER,
   last_line    IN     BINARY_INTEGER,
   window       IN     BINARY_INTEGER,
   print_arrow  IN     BINARY_INTEGER,
   buffer       IN OUT VARCHAR2,
   buflen       IN     BINARY_INTEGER,
   pieces       OUT    BINARY_INTEGER);
```

Parameters

Table 9–12 SHOW_SOURCE Procedure Parameters

Parameter	Description
first_line	Smallest line-number to print.
last_line	Largest line-number to print.
window	'Window' of lines (the number of lines around the current source line).
print_arrow	Non-zero means to print an arrow before the current line.
buffer	Buffer in which to place the source listing.
buflen	Length of buffer.
pieces	Set to non-zero if not all the source could be placed into the given buffer.

PRINT_BACKTRACE Procedure

This procedure prints a backtrace listing of the current execution stack. This should only be called if a program is currently running.

There are two overloaded PRINT_BACKTRACE procedures.

Syntax

```
DBMS_DEBUG.PRINT_BACKTRACE (
  listing IN OUT VARCHAR2);
```

Parameters

Table 9–13 PRINT_BACKTRACE Procedure Parameters

Parameter	Description
listing	A formatted character buffer with embedded newlines.

Syntax

```
DBMS_DEBUG.PRINT_BACKTRACE (
   backtrace OUT backtrace_table);
```

Parameters

Table 9–14 PRINT_BACKTRACE Procedure Parameters

Parameter	Description
backtrace	1-based indexed table of backtrace entries. The currently-running procedure is the last entry in the table (that is, the frame numbering is the same as that used by GET_VALUE). Entry 1 is the oldest procedure on the stack.

CONTINUE Function

This function passes the given breakflags (a mask of the events that are of interest) to Probe in the target process. It tells Probe to continue execution of the target process, and it waits until the target process runs to completion or signals an event.

If info_requested is not NULL, then calls GET_RUNTIME_INFO.

Syntax

```
DBMS_DEBUG.CONTINUE (
   run_info       IN OUT runtime_info,
   breakflags     IN     BINARY_INTEGER,
   info_requested IN     BINARY_INTEGER := NULL)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–15 CONTINUE Function Parameters

Parameter	Description
run_info	Information about the state of the program.
breakflags	Mask of events that are of interest. See "Breakflags" on page 9-9.
info_requested	Which information should be returned in run_info when the program stops. See "Information Flags" on page 9-10.

Returns

Table 9–16 CONTINUE Function Returns

Return	Description
success	
error_timeout	Timed out before the program started running.
error_communication	Other communication error.

SET_BREAKPOINT Function

This function sets a breakpoint in a program unit, which persists for the current session. Execution pauses if the target program reaches the breakpoint.

Syntax

```
DBMS_DEBUG.SET_BREAKPOINT (
   program     IN  program_info,
   line#       IN  BINARY_INTEGER,
   breakpoint# OUT BINARY_INTEGER,
   fuzzy       IN  BINARY_INTEGER := 0,
   iterations  IN  BINARY_INTEGER := 0)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–17 SET_BREAKPOINT Function Parameters

Parameter	Description
program	Information about the program unit in which the breakpoint is to be set. (In version 2.1 and later, the namespace, name, owner, and dblink may be set to NULL, in which case the breakpoint is placed in the currently-running program unit.)
line#	Line at which the breakpoint is to be set.
breakpoint#	On successful completion, contains the unique breakpoint number by which to refer to the breakpoint.

Table 9–17 SET_BREAKPOINT Function Parameters

Parameter	Description
fuzzy	Only applicable if there is no executable code at the specified line: 0 means return error_illegal_line. 1 means search forward for an adjacent line at which to place the breakpoint. -1 means search backwards for an adjacent line at which to place the breakpoint.
iterations	Number of times to wait before signalling this breakpoint.

Note: The fuzzy and iterations parameters are not yet implemented.

Returns

Table 9–18 SET_BREAKPOINT Function Returns

Return	Description
success	
error_illegal_line	Cannot set a breakpoint at that line.
error_bad_handle	No such program unit exists.

DELETE_BREAKPOINT Function

This function deletes a breakpoint.

Syntax

```
DBMS_DEBUG.DELETE_BREAKPOINT (
   breakpoint IN BINARY_INTEGER)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–19 DELETE_BREAKPOINT Function Parameters

Parameter	Description
breakpoint	Breakpoint number from a previous call to SET_BREAKPOINT.

Returns

Table 9–20 DELETE_BREAKPOINT Function Returns

Return	Description
success	
error_no_such_breakpt	No such breakpoint exists.
error_idle_breakpt	Cannot delete an unused breakpoint.
error_stale_breakpt	The program unit was redefined since the breakpoint was set.

DISABLE_BREAKPOINT Function

This function makes an existing breakpoint inactive, but it leaves it in place.

Syntax

```
DBMS_DEBUG.DISABLE_BREAKPOINT (
   breakpoint IN BINARY_INTEGER)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–21 DISABLE_BREAKPOINT Function Parameters

Parameter	Description
breakpoint	Breakpoint number from a previous call to SET_BREAKPOINT.

Returns

Table 9–22 DISABLE_BREAKPOINT Function Returns

Returns	Description
success	

Table 9–22 DISABLE_BREAKPOINT Function Returns

Returns	Description
error_no_such_breakpt	No such breakpoint exists.
error_idle_breakpt	Cannot disable an unused breakpoint.

ENABLE_BREAKPOINT Function

This function is the reverse of disabling. This enables a previously disabled breakpoint.

Syntax

```
DBMS_DEBUG.ENABLE_BREAKPOINT (
   breakpoint IN BINARY_INTEGER)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–23 ENABLE_BREAKPOINT Function Parameters

Parameter	Description
breakpoint	Breakpoint number from a previous call to SET_BREAKPOINT.

Returns

Table 9–24 ENABLE_BREAKPOINT Function Returns

Return	Description
success	
error_no_such_breakpt	No such breakpoint exists.
error_idle_breakpt	Cannot enable an unused breakpoint.

SHOW_BREAKPOINTS Procedure

This procedure returns a listing of the current breakpoints. There are two overloaded SHOW_BREAKPOINTS procedures.

Syntax

```
DBMS_DEBUG.SHOW_BREAKPOINTS (
```

```
   listing    IN OUT VARCHAR2);
```

Parameters

Table 9–25 SHOW_BREAKPOINTS Procedure Parameters

Parameter	Description
listing	A formatted buffer (including newlines) of the breakpoints.

Syntax

```
DBMS_DEBUG.SHOW_BREAKPOINTS (
   listing  OUT breakpoint_table);
```

Parameters

Table 9–26 SHOW_BREAKPOINTS Procedure Parameters

Parameter	Description
listing	Indexed table of breakpoint entries. The breakpoint number is indicated by the index into the table. Breakpoint numbers start at 1 and are reused when deleted.

GET_VALUE Function

This function gets a value from the currently-running program. There are two overloaded GET_VALUE functions.

Syntax

```
DBMS_DEBUG.GET_VALUE (
   variable_name  IN  VARCHAR2,
   frame#         IN  BINARY_INTEGER,
   scalar_value   OUT VARCHAR2,
   format         IN  VARCHAR2 := NULL)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–27 GET_VALUE Function Parameters

Parameter	Description
variable_name	Name of the variable or parameter.
frame#	Frame in which it lives; 0 means the current procedure.
scalar_value	Value.
format	Optional date format to use, if meaningful.

Returns

Table 9–28 GET_VALUE Function Returns

Return	Description
success	
error_bogus_frame	Frame does not exist.
error_no_debug_info	Entrypoint has no debug information.
error_no_such_object	variable_name does not exist in frame#.
error_unknown_type	The type information in the debug information is illegible.
error_nullvalue	Value is NULL.
error_indexed_table	The object is a table, but no index was provided.

This form of GET_VALUE is for fetching package variables. Instead of a frame#, it takes a handle, which describes the package containing the variable.

Syntax

```
DBMS_DEBUG.GET_VALUE (
   variable_name  IN  VARCHAR2,
   handle         IN  program_info,
   scalar_value   OUT VARCHAR2,
   format         IN  VARCHAR2 := NULL)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–29 GET_VALUE Function Parameters

Parameter	Description
variable_name	Name of the variable or parameter.
handle	Description of the package containing the variable.
scalar_value	Value.
format	Optional date format to use, if meaningful.

Returns

Table 9–30 GET_VALUE Function Returns

Return	Description
error_no_such_object	Either: - Package does not exist. - Package is not instantiated. - User does not have privileges to debug the package. - Object does not exist in the package.
error_indexed_table	The object is a table, but no index was provided.

Example

This example illustrates how to get the value with a given package PACK in schema SCOTT, containing variable VAR:

```
DECLARE
   handle     dbms_debug.program_info;
   resultbuf  VARCHAR2(500);
   retval     BINARY_INTEGER;
BEGIN
   handle.Owner     := 'SCOTT';
   handle.Name      := 'PACK';
   handle.namespace := dbms_debug.namespace_pkgspec_or_toplevel;
   retval           := dbms_debug.get_value('VAR', handle, resultbuf, NULL);
END;
```

SET_VALUE Function

This function sets a value in the currently-running program. There are two overloaded SET_VALUE functions.

Syntax

```
DBMS_DEBUG.SET_VALUE (
   frame#               IN binary_integer,
   assignment_statement IN varchar2)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–31 SET_VALUE Function Parameters

Parameter	Description
frame#	Frame in which the value is to be set; 0 means the currently executing frame.
assignment_statement	An assignment statement (which must be legal PL/SQL) to run in order to set the value. For example, 'x := 3;'.
	Only scalar values are supported in this release. The right side of the assignment statement must be a scalar.

Returns

Table 9–32 SET_VALUE Function Returns

Return	Description
success	
error_illegal_value	Not possible to set it to that value.
error_illegal_null	Cannot set to NULL because object type specifies it as 'not null'.
error_value_malformed	Value is not a scalar.
error_name_incomplete	The assignment statement does not resolve to a scalar. For example, 'x := 3;', if x is a record.

This form of SET_VALUE sets the value of a package variable.

Syntax

```
DBMS_DEBUG.SET_VALUE (
   handle               IN program_info,
   assignment_statement IN VARCHAR2)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–33 SET_VALUE Function Parameters

Parameter	Description
handle	Description of the package containing the variable.
assignment_statement	An assignment statement (which must be legal PL/SQL) to run in order to set the value. For example, 'x := 3;'.
	Only scalar values are supported in this release. The right side of the assignment statement must be a scalar.

Table 9–34 SET_VALUE Function Returns

Return	Description
error_no_such_object	Either:
	- Package does not exist.
	- Package is not instantiated.
	- User does not have privileges to debug the package.
	- Object does not exist in the package.

In some cases, the PL/SQL compiler uses temporaries to access package variables, and Probe does not guarantee to update such temporaries. It is possible, although unlikely, that modification to a package variable using SET_VALUE might not take effect for a line or two.

Example

To set the value of SCOTT.PACK.var to 6:

```
DECLARE
   handle  dbms_debug.program_info;
   retval  BINARY_INTEGER;
BEGIN
   handle.Owner     := 'SCOTT';
```

```
   handle.Name      := 'PACK';
   handle.namespace := dbms_debug.namespace_pkgspec_or_toplevel;
   retval           := dbms_debug.set_value(handle, 'var := 6;');
END;
```

DETACH_SESSION Procedure

This procedure stops debugging the target program. This procedure may be called at any time, but it does not notify the target session that the debug session is detaching itself, and it does not abort execution of the target session. Therefore, care should be taken to ensure that the target session does not hang itself.

Syntax

```
DBMS_DEBUG.DETACH_SESSION;
```

GET_RUNTIME_INFO Function

This function returns information about the current program. It is only needed if the `info_requested` parameter to `SYNCHRONIZE` or `CONTINUE` was set to `0`.

> **Note:** This is currently only used by client-side PL/SQL.

Syntax

```
DBMS_DEBUG.GET_RUNTIME_INFO (
   info_requested  IN  BINARY_INTEGER,
   run_info        OUT runtime_info)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–35 GET_RUNTIME_INFO Function Parameters

Parameter	Description
`info_requested`	Which information should be returned in `run_info` when the program stops. See "Information Flags" on page 9-10.
`run_info`	Information about the state of the program.

GET_INDEXES Function

Given a name of a variable or parameter, this function returns the set of its indexes, if it is an indexed table. An error is returned if it is not an indexed table.

Syntax

```
DBMS_DEBUG.GET_INDEXES (
   varname   IN  VARCHAR2,
   frame#    IN  BINARY_INTEGER,
   handle    IN  program_info,
   entries   OUT index_table)
  RETURN BINARY_INTEGER;
```

Parameters

Table 9–36 GET_INDEXES Function Parameters

Parameter	Description
varname	Name of the variable to get index information about.
frame#	Number of frame in which the variable or parameter resides; NULL for a package variable.
handle	Package description, if object is a package variable.
entries	1-based table of the indexes. If non-NULL, then entries(1) contains the first index of the table, entries(2) contains the second index, and so on.

Returns

Table 9–37 GET_INDEXES Function Returns

Return	Description
error_no_such_object	Either: - The package does not exist. - The package is not instantiated. - The user does not have privileges to debug the package. - The object does not exist in the package.

EXECUTE Procedure

This procedure executes SQL or PL/SQL code in the target session. The target session is assumed to be waiting at a breakpoint (or other event). The call to DBMS_DEBUG.EXECUTE occurs in the debug session, which then asks the target session to execute the code.

Syntax

```
DBMS_DEBUG.EXECUTE (
   what         IN VARCHAR2,
   frame#       IN BINARY_INTEGER,
   bind_results IN BINARY_INTEGER,
   results      IN OUT NOCOPY dbms_debug_vc2coll,
   errm         IN OUT NOCOPY VARCHAR2);
```

Parameters

Table 9–38 EXECUTE Procedure Parameters

Parameter	Description
what	SQL or PL/SQL source to execute.
frame#	The context in which to execute the code. Only -1 (global context) is supported at this time.
bind_results	Whether the source wants to bind to results in order to return values from the target session. 0 = No 1 = Yes
results	Collection in which to place results, if bind_results is not 0.
errm	Error message, if an error occurred; otherwise, NULL.

Example 1

This example executes a SQL statement. It returns no results.

```
DECLARE
   coll sys.dbms_debug_vc2coll; -- results (unused)
   errm VARCHAR2(100);
BEGIN
   dbms_debug.execute('insert into emp(ename,empno,deptno) ' ||
                      'values(''LJE'', 1, 1)',
                      -1, 0, coll, errm);
```

```
END;
```

Example 2

This example executes a PL/SQL block, and it returns no results. The block is an autonomous transaction, which means that the value inserted into the table becomes visible in the debug session.

```
DECLARE
   coll sys.dbms_debug_vc2coll;
   errm VARCHAR2(100);
BEGIN
   dbms_debug.execute(
       'DECLARE PRAGMA autonomous_transaction; ' ||
       'BEGIN ' ||
       '   insert into emp(ename, empno, deptno) ' ||
       '   values(''LJE'', 1, 1); ' ||
       ' COMMIT; ' ||
       'END;',
       -1, 0, coll, errm);
END;
```

Example 3

This example executes a PL/SQL block, and it returns some results.

```
DECLARE
   coll sys.dbms_debug_vc2coll;
   errm VARCHAR2(100);
BEGIN
   dbms_debug.execute(
      'DECLARE ' ||
      '   pp SYS.dbms_debug_vc2coll := SYS.dbms_debug_vc2coll(); ' ||
      '   x  PLS_INTEGER; ' ||
      '   i  PLS_INTEGER := 1; ' ||
      'BEGIN ' ||
      '   SELECT COUNT(*) INTO x FROM emp; ' ||
      '   pp.EXTEND(x * 6); ' ||
      '   FOR c IN (SELECT * FROM emp) LOOP ' ||
      '      pp(i) := ''Ename: '' || c.ename; i := i+1; ' ||
      '      pp(i) := ''Empno: '' || c.empno; i := i+1; ' ||
      '      pp(i) := ''Job:   '' || c.job;   i := i+1; ' ||
      '      pp(i) := ''Mgr:   '' || c.mgr;   i := i+1; ' ||
      '      pp(i) := ''Sal:   '' || c.sal;   i := i+1; ' ||
      '      pp(i) := null;                   i := i+1; ' ||
      '   END LOOP; ' ||
```

```
      '   :1 := pp;' ||
      'END;',
       -1, 1, coll, errm);
   each := coll.FIRST;
   WHILE (each IS NOT NULL) LOOP
      dosomething(coll(each));
      each := coll.NEXT(each);
   END LOOP;
END;
```

PRINT_INSTANTIATIONS Procedure

This procedure returns a list of the packages that have been instantiated in the current session.

Parameters

- pkgs the instantiated packages (OUT)
- flags - bitmask of options:
  - 1 - show specs
  - 2 - show bodies
  - 4 - show local instantiations
  - 8 - show remote instantiations (NYI)
  - 16 - do a fast job. The routine does not test whether debug information exists or whether the libunit is shrink-wrapped.

Exceptions

no_target_program - target session is not currently executing

Usage Notes

On return, "pkgs" contains a program_info for each instantiation. The valid fields are: Namespace, Name, Owner, and LibunitType.

In addition, Line# contains a bitmask of:

- 1 - the libunit contains debug info
- 2 - the libunit is shrink-wrapped

```
PROCEDURE print_instantiations (pkgs IN OUT NOCOPY backtrace_table, flags
IN BINARY_INTEGER);
```

TARGET_PROGRAM_RUNNING Procedure

Return TRUE if the target session is currently executing a stored procedure, or FALSE if it is not.

```
FUNCTION target_program_running RETURN BOOLEAN;
```

PING Procedure

Ping the target session, to prevent it from timing out. Use this procedure when execution is suspended in the target session, for example at a breakpoint.

If the timeout_behavior is set to retry_on_timeout then this procedure is not necessary.

Exceptions

Oracle will display the no_target_program exception if there is no target program or if the target session is not currently waiting for input from the debug session.

```
PROCEDURE ping;
```

Timeout Options

Timeout options for the target session are registered with the target session by calling set_timeout_behavior.

- retry_on_timeout - Retry. Timeout has no effect. This is like setting the timeout to an infinitely large value.
- continue_on_timeout - Continue execution, using same event flags.
- nodebug_on_timeout - Turn debug-mode OFF (in other words, call debug_off) and then continue execution. No more events will be generated by this target session unless it is re-initialized by calling debug_on.
- abort_on_timeout - Continue execution, using the abort_execution flag, which should cause the program to abort immediately. The session remains in debug-mode.

```
retry_on_timeout CONSTANT BINARY_INTEGER:= 0;

continue_on_timeout CONSTANT BINARY_INTEGER:= 1;
```

```
nodebug_on_timeout CONSTANT BINARY_INTEGER:= 2;
abort_on_timeout     CONSTANT BINARY_INTEGER:= 3;
```

SET_TIMEOUT_BEHAVIOUR Procedure

This procedure tells Probe what to do with the target session when a timeout occurs. [This call is made in the target session.]

Parameters

- behavior - one of the following (see descriptions above):
- retry_on_timeout
- continue_on_timeout
- nodebug_on_timeout
- abort_on_timeout

Exceptions

unimplemented - the requested behavior is not recognized

Usage Notes

The default behavior (if this procedure is not called) is continue_on_timeout, since it allows a debugger client to re-establish control (at the next event) but does not cause the target session to hang indefinitely.

```
PROCEDURE set_timeout_behavior (behavior IN PLS_INTEGER);
```

GET_TIMEOUT_BEHAVIOUR - Returns the current timeout behavior. [This call is made in the target session.]

```
FUNCTION get_timeout_behavior RETURN BINARY_INTEGER;
```

Information Flags

```
info_getOerInfo      CONSTANT PLS_INTEGER:= 32;
```

Reasons

```
reason_oer_breakpoint   CONSTANT BINARY_INTEGER:= 26;
```

RUNTIME_INFO

Runtime_info gives context information about the running program.

Probe v2.4:

Added OER. It gets set if info_getOerInfo is set. The OER is a positive number. It can be translated into SQLCODE by translating 1403 to 100, 6510 to 1, and negating any other value.

```
TYPE runtime_info IS RECORD
   (
       Line#            BINARY_INTEGER,   (duplicate of program.line#)
       Terminated       BINARY_INTEGER,   has the program terminated?
       Breakpoint       BINARY_INTEGER,   breakpoint number
       StackDepth       BINARY_INTEGER,   number of frames on the stack
       InterpreterDepth BINARY_INTEGER,   <reserved field>
       Reason           BINARY_INTEGER,   reason for suspension
       Program          program_info,     source location
Following fields were added in Probe v2.4 oer             PLS_INTEGER       OER
(exception), if any
   );
```

oer_table

Used by show_breakpoints

TYPE oer_table IS TABLE OF BINARY_INTEGER INDEX BY BINARY_INTEGER;

- SET_OER_BREAKPOINT

Set a breakpoint on an OER. The breakpoint persists for the session (or until deleted), as with code breakpoints.

Parameters

oer - the OER (a 4-byte positive number)

Returns

success

Usage Notes

Less functionality is supported on OER breakpoints than on code breakpoints. In particular, note that:

- No "breakpoint number" is returned - the number of the OER is used instead. Thus it is impossible to set duplicate breakpoints on a given OER (it is a no-op).
- It is not possible to disable an OER breakpoint (although clients are free to simulate this by deleting it).
- OER breakpoints are deleted via delete_oer_breakpoint.

FUNCTION set_oer_breakpoint(oer IN PLS_INTEGER) RETURN PLS_INTEGER;

DELETE_OER_BREAKPOINT

Delete an OER breakpoint.

Parameters

oer - the OER (positive 4-byte number) to delete

Returns

success

error_no_such_breakpt - no such OER breakpoint exists

FUNCTION delete_oer_breakpoint(oer IN PLS_INTEGER) RETURN PLS_INTEGER;

SHOW_BREAKPOINTS

Parameters

- code_breakpoints - indexed table of breakpoint entries, indexed by breakpoint number.
- oer_breakpoints - indexed table of OER breakpoints, indexed by OER.
- PROCEDURE show_breakpoints (code_breakpoints OUT breakpoint_table, oer_breakpoints OUT oer_table);

10

DBMS_DEFER

DBMS_DEFER is the user interface to a replicated transactional deferred remote procedure call facility. Replicated applications use the calls in this interface to queue procedure calls for later transactional execution at remote nodes.

These procedures are typically called from either after row triggers or application specified update procedures.

This chapter discusses the following topics:

- Summary of DBMS_DEFER Subprograms

Summary of DBMS_DEFER Subprograms

Table 10–1 DBMS_DEFER Package Subprograms

Subprogram	Description
"CALL Procedure" on page 10-3	Builds a deferred call to a remote procedure.
"COMMIT_WORK Procedure" on page 10-4	Performs a transaction commit after checking for well-formed deferred remote procedure calls.
"datatype_ARG Procedure" on page 10-5	Provides the data that is to be passed to a deferred remote procedure call.
"TRANSACTION Procedure" on page 10-8	Indicates the start of a new deferred transaction.

CALL Procedure

This procedure builds a deferred call to a remote procedure.

Syntax

```
DBMS_DEFER.CALL (
   schema_name       IN   VARCHAR2,
   package_name      IN   VARCHAR2,
   proc_name         IN   VARCHAR2,
   arg_count         IN   NATURAL,
   { nodes           IN   node_list_t
   | group_name      IN   VARCHAR2 :=''});
```

> **Note:** This procedure is overloaded. The nodes and group_name parameters are mutually exclusive.

Parameters

Table 10–2 CALL Procedure Parameters

Parameter	Description
schema_name	Name of the schema in which the stored procedure is located.
package_name	Name of the package containing the stored procedure. The stored procedure must be part of a package. Deferred calls to standalone procedures are not supported.
proc_name	Name of the remote procedure to which you want to defer a call.
arg_count	Number of parameters for the procedure. You must have one call to DBMS_DEFER.*datatype*_ARG for each of these parameters. **Note:** You must include all of the parameters for the procedure, even if some of the parameters have defaults.
nodes	A PL/SQL index-by table of fully qualified database names to which you want to propagate the deferred call. The table is indexed starting at position 1 and continuing until a NULL entry is found, or the no_data_found exception is raised. The data in the table is case insensitive. This parameter is optional.
group_name	Reserved for internal use.

Exceptions

Table 10–3 CALL Procedure Exceptions

Exception	Description
ORA-23304 (malformedcall)	Previous call was not correctly formed.
ORA-23319	Parameter value is not appropriate.
ORA-23352	Destination list (specified by nodes or by a previous DBMS_DEFER.TRANSACTION call) contains duplicates.

COMMIT_WORK Procedure

This procedure performs a transaction commit after checking for well-formed deferred remote procedure calls.

Syntax

```
DBMS_DEFER.COMMIT_WORK (
   commit_work_comment IN VARCHAR2);
```

Parameters

Table 10–4 COMMIT_WORK Procedure Parameters

Parameter	Description
commit_work_comment	Equivalent to the COMMIT COMMENT statement in SQL.

Exceptions

Table 10–5 COMMIT_WORK Procedure Exceptions

Exception	Description
ORA-23304 (malformedcall)	Transaction was not correctly formed or terminated.

*datatype*_ARG Procedure

This procedure provides the data that is to be passed to a deferred remote procedure call. Depending upon the type of the data that you need to pass to a procedure, you must call one of the following procedures for each argument to the procedure.

You must specify each parameter in your procedure using the *datatype*_ARG procedure after you execute DBMS_DEFER.CALL. That is, you cannot use the default parameters for the deferred remote procedure call. For example, suppose you have the following procedure:

```
CREATE OR REPLACE PACKAGE my_pack AS
   PROCEDURE my_proc(a VARCHAR2, b VARCHAR2 DEFAULT 'SALES');
END;
/
```

When you run the DBMS_DEFER.CALL procedure, you must include a separate procedure call for each parameter in the my_proc procedure:

```
CREATE OR REPLACE PROCEDURE load_def_tx IS
   node DBMS_DEFER.NODE_LIST_T;
BEGIN
   node(1) := 'MYCOMPUTER.WORLD';
   node(2) := NULL;
   DBMS_DEFER.TRANSACTION(node);
   DBMS_DEFER.CALL('PR', 'MY_PACK', 'MY_PROC', 2);
   DBMS_DEFER.VARCHAR2_ARG('TEST');
   DBMS_DEFER.VARCHAR2_ARG('SALES'); -- required, cannot omit to use default
END;
/
```

Note:

- The AnyData_ARG procedure supports the following user-defined types: object types, collections, and REFs. See *Oracle9i SQL Reference* and *Oracle9i Application Developer's Guide - Object-Relational Features* for more information about the AnyData datatype.
- This procedure uses abbreviations for some datetime and interval datatypes. For example, TSTZ is used for the TIMESTAMP WITH TIME ZONE datatype. For information about these abbreviations, see "Abbreviations for Datetime and Interval Datatypes" on page 1-7.

Syntax

```
DBMS_DEFER.AnyData_ARG      (arg  IN SYS.AnyData);
DBMS_DEFER.NUMBER_ARG       (arg  IN NUMBER);
DBMS_DEFER.DATE_ARG         (arg  IN DATE);
DBMS_DEFER.VARCHAR2_ARG     (arg  IN VARCHAR2);
DBMS_DEFER.CHAR_ARG         (arg  IN CHAR);
DBMS_DEFER.ROWID_ARG        (arg  IN ROWID);
DBMS_DEFER.RAW_ARG          (arg  IN RAW);
DBMS_DEFER.BLOB_ARG         (arg  IN BLOB);
DBMS_DEFER.CLOB_ARG         (arg  IN CLOB);
DBMS_DEFER.NCLOB_ARG        (arg  IN NCLOB);
DBMS_DEFER.NCHAR_ARG        (arg  IN NCHAR);
DBMS_DEFER.NVARCHAR2_ARG    (arg  IN NVARCHAR2);
DBMS_DEFER.ANY_CLOB_ARG     (arg  IN CLOB);
DBMS_DEFER.ANY_VARCHAR2_ARG (arg  IN VARCHAR2);
DBMS_DEFER.ANY_CHAR_ARG     (arg  IN CHAR);
DBMS_DEFER.IDS_ARG          (arg  IN DSINTERVAL_UNCONSTRAINED);
DBMS_DEFER.IYM_ARG          (arg  IN YMINTERVAL_UNCONSTRAINED);
DBMS_DEFER.TIMESTAMP_ARG    (arg  IN TIMESTAMP_UNCONSTRAINED);
DBMS_DEFER.TSLTZ_ARG        (arg  IN TIMESTAMP_LTZ_UNCONSTRAINED);
DBMS_DEFER.TSTZ_ARG         (arg  IN TIMESTAMP_TZ_UNCONSTRAINED);
```

Parameters

Table 10–6 datatype_ARG Procedure Parameters

Parameter	Description
arg	Value of the parameter that you want to pass to the remote procedure to which you previously deferred a call.

Exceptions

Table 10–7 datatype_ARG Procedure Exceptions

Exception	Description
ORA-23323	Argument value is too long.

TRANSACTION Procedure

This procedure indicates the start of a new deferred transaction. If you omit this call, then Oracle considers your first call to DBMS_DEFER.CALL to be the start of a new transaction.

Syntax

```
DBMS_DEFER.TRANSACTION (
   nodes  IN   node_list_t);
```

Note: This procedure is overloaded. The behavior of the version without an input parameter is similar to that of the version with an input parameter, except that the former uses the nodes in the DEFDEFAULTDEST view instead of using the nodes in the nodes parameter.

Parameters

Table 10–8 TRANSACTION Procedure Parameters

Parameter	Description
nodes	A PL/SQL index-by table of fully qualified database names to which you want to propagate the deferred calls of the transaction. The table is indexed starting at position 1 and continuing until a NULL entry is found, or the no_data_found exception is raised. The data in the table is case insensitive.

Exceptions

Table 10–9 TRANSACTION Procedure Exceptions

Exception	Description
ORA-23304 (malformedcall)	Previous transaction was not correctly formed or terminated.
ORA-23319	Parameter value is not appropriate.
ORA-23352	Raised by DBMS_DEFER.CALL if the node list contains duplicates.

11

DBMS_DEFER_QUERY

DBMS_DEFER_QUERY enables querying the deferred transactions queue data that is not exposed through views.

This chapter discusses the following topics:

Summary of DBMS_DEFER_QUERY Subprograms

Table 11–1 DBMS_DEFER_QUERY Package Subprograms

Subprogram	Description
"GET_ARG_FORM Function" on page 11-3	Determines the form of an argument in a deferred call.
"GET_ARG_TYPE Function" on page 11-5	Determines the type of an argument in a deferred call.
"GET_CALL_ARGS Procedure" on page 11-7	Returns the text version of the various arguments for the specified call.
"GET_datatype_ARG Function" on page 11-9	Determines the value of an argument in a deferred call.
"GET_OBJECT_NULL_ VECTOR_ARG Function" on page 11-12	Returns the type information for a column object.

GET_ARG_FORM Function

This function returns the character set form of a deferred call parameter.

> **See Also:** The Replication Management tool's online help for information about displaying deferred transactions and error transactions in the Replication Management tool

Syntax

```
DBMS_DEFER_QUERY.GET_ARG_FORM (
   callno                IN   NUMBER,
   arg_no                IN   NUMBER,
   deferred_tran_id      IN   VARCHAR2)
  RETURN NUMBER;
```

Parameters

Table 11–2 GET_ARG_FORM Function Parameters

Parameter	Description
callno	Call identifier from the DEFCALL view.
arg_no	Position of desired parameter in calls argument list. Parameter positions are 1...*number* of parameters in call.
deferred_tran_id	Deferred transaction identification.

Exceptions

Table 11–3 GET_ARG_FORM Function Exceptions

Exception	Description
NO_DATA_FOUND	Input parameters do not correspond to a parameter of a deferred call.

Returns

Table 11–4 GET_ARG_FORM Function Returns

Constant Return Value	Return Value	Possible Datatype
DBMS_DEFER_QUERY.ARG_FORM_NONE	0	DATE NUMBER ROWID RAW BLOB User-defined types
DBMS_DEFER_QUERY.ARG_FORM_IMPLICIT	1	CHAR VARCHAR2 CLOB
DBMS_DEFER_QUERY.ARG_FORM_NCHAR	2	NCHAR NVARCHAR2 NCLOB

GET_ARG_TYPE Function

This function determines the type of an argument in a deferred call. The type of the deferred remote procedure call (RPC) parameter is returned.

> **See Also:** The Replication Management tool's online help for information about displaying deferred transactions and error transactions in the Replication Management tool

Syntax

```
DBMS_DEFER_QUERY.GET_ARG_TYPE (
   callno            IN   NUMBER,
   arg_no            IN   NUMBER,
   deferred_tran_id  IN   VARCHAR2)
  RETURN NUMBER;
```

Parameters

Table 11–5 GET_ARG_TYPE Function Parameters

Parameter	Description
callno	Identification number from the DEFCALL view of the deferred remote procedure call.
arg_no	Numerical position of the argument to the call whose type you want to determine. The first argument to a procedure is in position 1.
deferred_tran_id	Identifier of the deferred transaction.

Exceptions

Table 11–6 GET_ARG_TYPE Function Exceptions

Exception	Description
NO_DATA_FOUND	Input parameters do not correspond to a parameter of a deferred call.

Returns

Table 11–7 GET_ARG_TYPE Function Returns

Constant Return Value	Return Value	Corresponding Datatype
DBMS_DEFER_QUERY.ARG_TYPE_VARCHAR2	1	VARCHAR2
DBMS_DEFER_QUERY.ARG_TYPE_NUM	2	NUMBER
DBMS_DEFER_QUERY.ARG_TYPE_ROWID	11	ROWID
DBMS_DEFER_QUERY.ARG_TYPE_DATE	12	DATE
DBMS_DEFER_QUERY.ARG_TYPE_RAW	23	RAW
DBMS_DEFER_QUERY.ARG_TYPE_CHAR	96	CHAR
DBMS_DEFER_QUERY.ARG_TYPE_AnyData	109	AnyData
DBMS_DEFER_QUERY.ARG_TYPE_CLOB	112	CLOB
DBMS_DEFER_QUERY.ARG_TYPE_BLOB	113	BLOB
DBMS_DEFER_QUERY.ARG_TYPE_BFIL	114	BFILE
DBMS_DEFER_QUERY.ARG_TYPE_OBJECT_NULL_VECTOR	121	OBJECT_NULL_VECTOR
DBMS_DEFER_QUERY.ARG_TYPE_TIMESTAMP	180	TIMESTAMP
DBMS_DEFER_QUERY.ARG_TYPE_TSTZ	181	TSTZ
DBMS_DEFER_QUERY.ARG_TYPE_IYM	182	IYM
DBMS_DEFER_QUERY.ARG_TYPE_IDS	183	IDS
DBMS_DEFER_QUERY.ARG_TYPE_TSLTZ	231	TSLTZ

Note:

- The AnyData datatype supports the following user-defined types: object types, collections, and REFs. See *Oracle9i SQL Reference* and *Oracle9i Application Developer's Guide - Object-Relational Features* for more information about the AnyData datatype.
- This function uses abbreviations for some datetime and interval datatypes. For example, TSTZ is used for the TIMESTAMP WITH TIME ZONE datatype. For information about these abbreviations, see "Abbreviations for Datetime and Interval Datatypes" on page 1-7.

GET_CALL_ARGS Procedure

This procedure returns the text version of the various arguments for the specified call. The text version is limited to the first 2000 bytes.

See Also:

- "GET_datatype_ARG Function" on page 11-9
- *Oracle9i SQL Reference* and *Oracle9i Application Developer's Guide - Object-Relational Features* for more information about the AnyData datatype

Syntax

```
DBMS_DEFER_QUERY.GET_CALL_ARGS (
   callno    IN  NUMBER,
   startarg  IN  NUMBER := 1,
   argcnt    IN  NUMBER,
   argsize   IN  NUMBER,
   tran_id   IN  VARCHAR2,
   date_fmt  IN  VARCHAR2,
   types     OUT TYPE_ARY,
   forms     OUT TYPE_ARY,
   vals      OUT VAL_ARY);
```

Parameters

Table 11–8 GET_CALL_ARGS Procedure Parameters

Parameter	Description
callno	Identification number from the DEFCALL view of the deferred remote procedure call (RPC).
startarg	Numerical position of the first argument you want described.
argcnt	Number of arguments in the call.
argsize	Maximum size of returned argument.
tran_id	Identifier of the deferred transaction.
date_fmt	Format in which the date is returned.
types	Array containing the types of arguments.
forms	Array containing the character set forms of arguments.
vals	Array containing the values of the arguments in a textual form.

Exceptions

Table 11–9 GET_CALL_ARGS Procedure Exceptions

Exception	Description
NO_DATA_FOUND	Input parameters do not correspond to a parameter of a deferred call.

GET_*datatype*_ARG Function

This function determines the value of an argument in a deferred call.

The AnyData type supports the following user-defined types: object types, collections and REFs. Not all types supported by this function can be enqueued by the AnyData_ARG procedure in the DBMS_DEFER package.

The returned text for type arguments includes the following values: type owner, type name, type version, length, precision, scale, character set identifier, character set form, and number of elements for collections or number of attributes for object types. These values are separated by a colon (:).

See Also:

- "datatype_ARG Procedure" on page 10-5
- The Replication Management tool's online help for information about displaying deferred transactions and error transactions in the Replication Management tool
- *Oracle9i SQL Reference* and *Oracle9i Application Developer's Guide - Object-Relational Features* for more information about the AnyData datatype
- This function uses abbreviations for some datetime and interval datatypes. For example, TSTZ is used for the TIMESTAMP WITH TIME ZONE datatype. For information about these abbreviations, see "Abbreviations for Datetime and Interval Datatypes" on page 1-7.

Syntax

Depending upon the type of the argument value that you want to retrieve, the syntax for the appropriate function is as follows. Each of these functions returns the value of the specified argument.

```
DBMS_DEFER_QUERY.GET_datatype_ARG (
   callno             IN   NUMBER,
   arg_no             IN   NUMBER,
   deferred_tran_id   IN   VARCHAR2 DEFAULT NULL)
  RETURN datatype;
```

where *datatype* is:

```
{ AnyData
| NUMBER
| VARCHAR2
| CHAR
| DATE
| RAW
| ROWID
| BLOB
| CLOB
| NCLOB
| NCHAR
| NVARCHAR2
| IDS
| IYM
| TIMESTAMP
| TSLTZ
| TSTZ }
```

Parameters

Table 11–10 GET_datatype_ARG Function Parameters

Parameter	Description
callno	Identification number from the DEFCALL view of the deferred remote procedure call.
arg_no	Numerical position of the argument to the call whose value you want to determine. The first argument to a procedure is in position 1.
deferred_tran_id	Identifier of the deferred transaction. Defaults to the last transaction identifier passed to the GET_ARG_TYPE function. The default is NULL.

Exceptions

Table 11–11 GET_datatype_ARG Function Exceptions

Exception	Description
NO_DATA_FOUND	Input parameters do not correspond to a parameter of a deferred call.
ORA-26564	Argument in this position is not of the specified type or is not one of the types supported by the AnyData type.

GET_OBJECT_NULL_VECTOR_ARG Function

This function returns the type information for a column object, including the type owner, name, and hashcode.

Syntax

```
DBMS_DEFER_QUERY.GET_OBJECT-NULL_VECTOR_ARG (
   callno                IN   NUMBER,
   arg_no                IN   NUMBER,
   deferred_tran_id      IN   VARCHAR2)
  RETURN SYSTEM.REPCAT$_OBJECT_NULL_VECTOR;
```

Parameters

Table 11–12 GET_OBJECT_NULL_VECTOR_ARG Function Parameters

Parameter	Description
callno	Call identifier from the DEFCALL view.
arg_no	Position of desired parameter in calls argument list. Parameter positions are 1...*number* of parameters in call.
deferred_tran_id	Deferred transaction identification.

Exceptions

Table 11–13 GET_OBJECT_NULL_VECTOR_ARG Function Exceptions

Exception	Description
NO_DATA_FOUND	Input parameters do not correspond to a parameter of a deferred call.
ORA-26564	Parameter is not an object_null_vector type.

Returns

Table 11–14 GET_OBJECT_NULL_VECTOR_ARG Function Returns

Return Value	Type Definition

SYSTEM.REPCAT$_OBJECT_NULL_VECTOR type	CREATE TYPE
	SYSTEM.REPCAT$_OBJECT_NULL_VECTOR
	AS OBJECT (
	  type_owner VARCHAR2(30),
	  type_name VARCHAR2(30),
	  type_hashcode RAW(17),
	  null_vector RAW(2000));

12

DBMS_DEFER_SYS

DBMS_DEFER_SYS procedures manage default replication node lists. This package is the system administrator interface to a replicated transactional deferred remote procedure call facility. Administrators and replication daemons can execute transactions queued for remote nodes using this facility, and administrators can control the nodes to which remote calls are destined.

This chapter discusses the following topics:

Summary of DBMS_DEFER_SYS Subprograms

Table 12–1 DBMS_DEFER_SYS Package Subprograms **(Page 1 of 2)**

Subprogram	Description
"ADD_DEFAULT_DEST Procedure" on page 12-4	Adds a destination database to the DEFDEFAULTDEST view.
"CLEAR_PROP_ STATISTICS Procedure" on page 12-5	Clears the propagation statistics in the DEFSCHEDULE data dictionary view.
"DELETE_DEFAULT_ DEST Procedure" on page 12-6	Removes a destination database from the DEFDEFAULTDEST view.
"DELETE_DEF_ DESTINATION Procedure" on page 12-6	Removes a destination database from the DEFSCHEDULE view.
"DELETE_ERROR Procedure" on page 12-7	Deletes a transaction from the DEFERROR view.
"DELETE_TRAN Procedure" on page 12-8	Deletes a transaction from the DEFTRANDEST view.
"DISABLED Function" on page 12-9	Determines whether propagation of the deferred transaction queue from the current site to a specified site is enabled.
"EXCLUDE_PUSH Function" on page 12-10	Acquires an exclusive lock that prevents deferred transaction PUSH.
"EXECUTE_ERROR Procedure" on page 12-11	Reexecutes a deferred transaction that did not initially complete successfully in the security context of the original receiver of the transaction.
"EXECUTE_ERROR_AS_ USER Procedure" on page 12-12	Reexecutes a deferred transaction that did not initially complete successfully in the security context of the user who executes this procedure.
"PURGE Function" on page 12-13	Purges pushed transactions from the deferred transaction queue at your current master site or materialized view site.
"PUSH Function" on page 12-16	Forces a deferred remote procedure call queue at your current master site or materialized view site to be pushed to a remote site.

Table 12–1 DBMS_DEFER_SYS Package Subprograms **(Page 2 of 2)**

Subprogram	Description
"REGISTER_ PROPAGATOR Procedure" on page 12-19	Registers the specified user as the propagator for the local database.
"SCHEDULE_PURGE Procedure" on page 12-20	Schedules a job to purge pushed transactions from the deferred transaction queue at your current master site or materialized view site.
"SCHEDULE_PUSH Procedure" on page 12-22	Schedules a job to push the deferred transaction queue to a remote site.
"SET_DISABLED Procedure" on page 12-24	Disables or enables propagation of the deferred transaction queue from the current site to a specified destination site.
"UNREGISTER_ PROPAGATOR Procedure" on page 12-26	Unregisters a user as the propagator from the local database.
"UNSCHEDULE_PURGE Procedure" on page 12-27	Stops automatic purges of pushed transactions from the deferred transaction queue at a master site or materialized view site.
"UNSCHEDULE_PUSH Procedure" on page 12-27	Stops automatic pushes of the deferred transaction queue from a master site or materialized view site to a remote site.

ADD_DEFAULT_DEST Procedure

This procedure adds a destination database to the DEFDEFAULTDEST data dictionary view.

Syntax

```
DBMS_DEFER_SYS.ADD_DEFAULT_DEST (
   dblink   IN   VARCHAR2);
```

Parameters

Table 12–2 ADD_DEFAULT_DEST Procedure Parameters

Parameter	Description
dblink	The fully qualified database name of the node that you want to add to the DEFDEFAULTDEST view.

Exceptions

Table 12–3 ADD_DEFAULT_DEST Procedure Exceptions

Exception	Description
ORA-23352	The dblink that you specified is already in the default list.

CLEAR_PROP_STATISTICS Procedure

This procedure clears the propagation statistics in the DEFSCHEDULE data dictionary view. When this procedure is executed successfully, all statistics in this view are returned to zero and statistic gathering starts fresh.

Specifically, this procedure clears statistics from the following columns in the DEFSCHEDULE data dictionary view:

- TOTAL_TXN_COUNT
- AVG_THROUGHPUT
- AVG_LATENCY
- TOTAL_BYTES_SENT
- TOTAL_BYTES_RECEIVED
- TOTAL_ROUND_TRIPS
- TOTAL_ADMIN_COUNT
- TOTAL_ERROR_COUNT
- TOTAL_SLEEP_TIME

Syntax

```
DBMS_DEFER_SYS.CLEAR_PROP_STATISTICS (
   dblink   IN   VARCHAR2);
```

Parameters

Table 12–4 CLEAR_PROP_STATISTICS Procedure Parameters

Parameter	Description
dblink	The fully qualified database name of the node whose statistics you want to clear. The statistics to be cleared are the statistics for propagation of deferred transactions from the current node to the node you specify for dblink.

DELETE_DEFAULT_DEST Procedure

This procedure removes a destination database from the DEFDEFAULTDEST view.

Syntax

```
DBMS_DEFER_SYS.DELETE_DEFAULT_DEST (
   dblink   IN   VARCHAR2);
```

Parameters

Table 12–5 DELETE_DEFAULT_DEST Procedure Parameters

Parameter	Description
dblink	The fully qualified database name of the node that you want to delete from the DEFDEFAULTDEST view. If Oracle does not find this dblink in the view, then no action is taken.

DELETE_DEF_DESTINATION Procedure

This procedure removes a destination database from the DEFSCHEDULE view.

Syntax

```
DBMS_DEFER_SYS.DELETE_DEF_DESTINATION (
   destination   IN   VARCHAR2,
   force         IN   BOOLEAN := false);
```

Parameters

Table 12–6 DELETE_DEF_DESTINATION Procedure Parameters

Parameter	Description
destination	The fully qualified database name of the destination that you want to delete from the DEFSCHEDULE view. If Oracle does not find this destination in the view, then no action is taken.
force	When set to true, Oracle ignores all safety checks and deletes the destination.

DELETE_ERROR Procedure

This procedure deletes a transaction from the DEFERROR view.

Syntax

```
DBMS_DEFER_SYS.DELETE_ERROR(
   deferred_tran_id     IN   VARCHAR2,
   destination          IN   VARCHAR2);
```

Parameters

Table 12–7 DELETE_ERROR Procedure Parameters

Parameter	Description
deferred_tran_id	Identification number from the DEFERROR view of the deferred transaction that you want to remove from the DEFERROR view. If this parameter is NULL, then all transactions meeting the requirements of the other parameter are removed.
destination	The fully qualified database name from the DEFERROR view of the database to which the transaction was originally queued. If this parameter is NULL, then all transactions meeting the requirements of the other parameter are removed from the DEFERROR view.

DELETE_TRAN Procedure

This procedure deletes a transaction from the DEFTRANDEST view. If there are no other DEFTRANDEST or DEFERROR entries for the transaction, then the transaction is deleted from the DEFTRAN and DEFCALL views as well.

Syntax

```
DBMS_DEFER_SYS.DELETE_TRAN (
   deferred_tran_id     IN   VARCHAR2,
   destination          IN   VARCHAR2);
```

Parameters

Table 12–8 DELETE_TRAN Procedure Parameters

Parameter	Description
deferred_tran_id	Identification number from the DEFTRAN view of the deferred transaction that you want to delete. If this is NULL, then all transactions meeting the requirements of the other parameter are deleted.
destination	The fully qualified database name from the DEFTRANDEST view of the database to which the transaction was originally queued. If this is NULL, then all transactions meeting the requirements of the other parameter are deleted.

DISABLED Function

This function determines whether propagation of the deferred transaction queue from the current site to a specified site is enabled. The DISABLED function returns true if the deferred remote procedure call (RPC) queue is disabled for the specified destination.

Syntax

```
DBMS_DEFER_SYS.DISABLED (
   destination  IN   VARCHAR2)
  RETURN BOOLEAN;
```

Parameters

Table 12–9 DISABLED Function Parameters

Parameter	Description
destination	The fully qualified database name of the node whose propagation status you want to check.

Returns

Table 12–10 DISABLED Function Return Values

Value	Description
true	Propagation to this site from the current site is disabled.
false	Propagation to this site from the current site is enabled.

Exceptions

Table 12–11 DISABLED Function Exceptions

Exception	Description
NO_DATA_FOUND	Specified destination does not appear in the DEFSCHEDULE view.

EXCLUDE_PUSH Function

This function acquires an exclusive lock that prevents deferred transaction PUSH (either serial or parallel). This function performs a commit when acquiring the lock. The lock is acquired with RELEASE_ON_COMMIT => true, so that pushing of the deferred transaction queue can resume after the next commit.

Syntax

```
DBMS_DEFER_SYS.EXCLUDE_PUSH (
   timeout   IN   INTEGER)
  RETURN INTEGER;
```

Parameters

Table 12–12 EXCLUDE_PUSH Function Parameters

Parameter	Description
timeout	Timeout in seconds. If the lock cannot be acquired within this time period (either because of an error or because a PUSH is currently under way), then the call returns a value of 1. A timeout value of DBMS_LOCK.MAXWAIT waits indefinitely.

Returns

Table 12–13 EXCLUDE_PUSH Function Return Values

Value	Description
0	Success, lock acquired.
1	Timeout, no lock acquired.
2	Deadlock, no lock acquired.
4	Already own lock.

EXECUTE_ERROR Procedure

This procedure reexecutes a deferred transaction that did not initially complete successfully in the security context of the original receiver of the transaction.

Syntax

```
DBMS_DEFER_SYS.EXECUTE_ERROR (
   deferred_tran_id IN   VARCHAR2,
   destination      IN   VARCHAR2);
```

Parameters

Table 12–14 EXECUTE_ERROR Procedure Parameters

Parameter	Description
deferred_tran_id	Identification number from the DEFERROR view of the deferred transaction that you want to reexecute. If this is NULL, then all transactions queued for destination are reexecuted.
destination	The fully qualified database name from the DEFERROR view of the database to which the transaction was originally queued. This must not be NULL. If the provided database name is not fully qualified or is invalid, no error will be raised.

Exceptions

Table 12–15 EXECUTE_ERROR Procedure Exceptions

Exception	Description
ORA-24275 error	Illegal combinations of NULL and non-NULL parameters were used.
badparam	Parameter value missing or invalid (for example, if destination is NULL).
missinguser	Invalid user.

EXECUTE_ERROR_AS_USER Procedure

This procedure reexecutes a deferred transaction that did not initially complete successfully. Each transaction is executed in the security context of the connected user.

Syntax

```
DBMS_DEFER_SYS.EXECUTE_ERROR_AS_USER (
   deferred_tran_id IN   VARCHAR2,
   destination      IN   VARCHAR2);
```

Parameters

Table 12–16 EXECUTE_ERROR_AS_USER Procedure Parameters

Parameter	Description
deferred_tran_id	Identification number from the DEFERROR view of the deferred transaction that you want to reexecute. If this is NULL, then all transactions queued for destination are reexecuted.
destination	The fully qualified database name from the DEFERROR view of the database to which the transaction was originally queued. This must not be NULL.

Exceptions

Table 12–17 EXECUTE_ERROR_AS_USER Procedure Exceptions

Exception	Description
ORA-24275 error	Illegal combinations of NULL and non-NULL parameters were used.
badparam	Parameter value missing or invalid (for example, if destination is NULL).
missinguser	Invalid user.

PURGE Function

This function purges pushed transactions from the deferred transaction queue at your current master site or materialized view site.

Syntax

```
DBMS_DEFER_SYS.PURGE (
   purge_method          IN  BINARY_INTEGER := purge_method_quick,
   rollback_segment      IN  VARCHAR2       := NULL,
   startup_seconds       IN  BINARY_INTEGER := 0,
   execution_seconds     IN  BINARY_INTEGER := seconds_infinity,
   delay_seconds         IN  BINARY_INTEGER := 0,
   transaction_count     IN  BINARY_INTEGER := transactions_infinity,
   write_trace           IN  BOOLEAN        := NULL);
  RETURN BINARY_INTEGER;
```

Parameters

Table 12–18 PURGE Function Parameters **(Page 1 of 2)**

Parameter	Description
purge_method	Controls how to purge the deferred transaction queue: purge_method_quick costs less, while purge_method_precise offers better precision. Specify the following for this parameter to use purge_method_quick: dbms_defer_sys.purge_method_quick Specify the following for this parameter to user purge_method_precise: dbms_defer_sys.purge_method_precise If you use purge_method_quick, deferred transactions and deferred procedure calls that have been successfully pushed may remain in the DEFTRAN and DEFCALL data dictionary views for longer than expected before they are purged. See "Usage Notes" on page 12-15 for more information.
rollback_segment	Name of rollback segment to use for the purge, or NULL for default.
startup_seconds	Maximum number of seconds to wait for a previous purge of the same deferred transaction queue.

Table 12–18 PURGE Function Parameters **(Page 2 of 2)**

Parameter	Description
execution_seconds	If > 0, then stop purge cleanly after the specified number of seconds of real time.
delay_seconds	Stop purge cleanly after the deferred transaction queue has no transactions to purge for `delay_seconds`.
transaction_count	If > 0, then shut down cleanly after purging `transaction_count` number of transactions.
write_trace	When set to `true`, Oracle records the result value returned by the `PURGE` function in the server's trace file. When set to `false`, Oracle does not record the result value.

Returns

Table 12–19 Purge Function Returns

Value	Description
result_ok	OK, terminated after `delay_seconds` expired.
result_startup_seconds	Terminated by lock timeout while starting.
result_execution_seconds	Terminated by exceeding `execution_seconds`.
result_transaction_count	Terminated by exceeding `transaction_count`.
result_errors	Terminated after errors.
result_split_del_order_limit	Terminated after failing to acquire the enqueue in exclusive mode. If you receive this return code, then retry the purge. If the problem persists, then contact Oracle Support Services.
result_purge_disabled	Queue purging is disabled internally for synchronization when adding new master sites without quiesce.

Exceptions

Table 12–20 PURGE Function Exceptions

Exception	Description
argoutofrange	Parameter value is out of a valid range.
executiondisabled	Execution of purging is disabled.
defererror	Internal error.

Usage Notes

When you use the purge_method_quick for the purge_method parameter in the DBMS_DEFER_SYS.PURGE function, deferred transactions and deferred procedure calls may remain in the DEFCALL and DEFTRAN data dictionary views after they have been successfully pushed. This behavior occurs in replication environments that have more than one database link and the push is executed to only one database link.

To purge the deferred transactions and deferred procedure calls, perform one of the following actions:

- Use purge_method_precise for the purge_method parameter instead of the purge_method_quick. Using purge_method_precise is more expensive, but it ensures that the deferred transactions and procedure calls are purged after they have been successfully pushed.
- Using purge_method_quick for the purge_method parameter, push the deferred transactions to all database links. The deferred transactions and deferred procedure calls are purged efficiently when the push to the last database link is successful.

PUSH Function

This function forces a deferred remote procedure call (RPC) queue at your current master site or materialized view site to be pushed (propagated) to a remote site using either serial or parallel propagation.

Syntax

```
DBMS_DEFER_SYS.PUSH (
   destination          IN  VARCHAR2,
   parallelism          IN  BINARY_INTEGER := 0,
   heap_size            IN  BINARY_INTEGER := 0,
   stop_on_error        IN  BOOLEAN        := false,
   write_trace          IN  BOOLEAN        := false,
   startup_seconds      IN  BINARY_INTEGER := 0,
   execution_seconds    IN  BINARY_INTEGER := seconds_infinity,
   delay_seconds        IN  BINARY_INTEGER := 0,
   transaction_count    IN  BINARY_INTEGER := transactions_infinity,
   delivery_order_limit IN  NUMBER         := delivery_order_infinity)
  RETURN BINARY_INTEGER;
```

Parameters

Table 12–21 PUSH Function Parameters **(Page 1 of 2)**

Parameter	Description
destination	The fully qualified database name of the master site or master materialized view site to which you are forwarding changes.
parallelism	0 specifies serial propagation. *n* > 1 specifies parallel propagation with *n* parallel processes. 1 specifies parallel propagation using only one parallel process.
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance. **Note:** Do not set the parameter unless so directed by Oracle Support Services.
stop_on_error	The default, `false`, indicates that the executor should continue even if errors, such as conflicts, are encountered. If `true`, then stops propagation at the first indication that a transaction encountered an error at the destination site.

Table 12–21 PUSH Function Parameters **(Page 2 of 2)**

Parameter	Description
write_trace	When set to `true`, Oracle records the result value returned by the function in the server's trace file. When set to `false`, Oracle does not record the result value.
startup_seconds	Maximum number of seconds to wait for a previous push to the same destination.
execution_seconds	If > 0, then stop push cleanly after the specified number of seconds of real time. If `transaction_count` and `execution_seconds` are zero (the default), then transactions are executed until there are no more in the queue. The `execution_seconds` parameter only controls the duration of time that operations can be started. It does not include the amount of time that the transactions require at remote sites. Therefore, the `execution_seconds` parameter is not intended to be used as a precise control to stop the propagation of transactions to a remote site. If a precise control is required, use the `transaction_count` or `delivery_order` parameters.
delay_seconds	Do not return before the specified number of seconds have elapsed, even if the queue is empty. Useful for reducing execution overhead if PUSH is called from a tight loop.
transaction_count	If > 0, then the maximum number of transactions to be pushed before stopping. If `transaction_count` and `execution_seconds` are zero (the default), then transactions are executed until there are no more in the queue that need to be pushed.
delivery_order_limit	Stop execution cleanly before pushing a transaction where `delivery_order` >= `delivery_order_limit`

Returns

Table 12–22 PUSH Function Returns

Value	Description
result_ok	OK, terminated after delay_seconds expired.
result_startup_seconds	Terminated by lock timeout while starting.
result_execution_seconds	Terminated by exceeding execution_seconds.
result_transaction_count	Terminated by exceeding transaction_count.
result_delivery_order_limit	Terminated by exceeding delivery_order_limit.
result_errors	Terminated after errors.
result_push_disabled	Push was disabled internally. Typically, this return value means that propagation to the destination was set to disabled internally by Oracle for propagation synchronization when adding a new master site to a master group without quiescing the master group. Oracle will enable propagation automatically at a later time
result_split_del_order_limit	Terminated after failing to acquire the enqueue in exclusive mode. If you receive this return code, then retry the push. If the problem persists, then contact Oracle Support Services.

Exceptions

Table 12–23 PUSH Function Exceptions

Exception	Description
incompleteparallelpush	Serial propagation requires that parallel propagation shuts down cleanly.
executiondisabled	Execution of deferred remote procedure calls (RPCs) is disabled at the destination.
crt_err_err	Error while creating entry in DEFERROR.
deferred_rpc_quiesce	Replication activity for replication group is suspended.
commfailure	Communication failure during deferred remote procedure call (RPC).
missingpropagator	A propagator does not exist.

REGISTER_PROPAGATOR Procedure

This procedure registers the specified user as the propagator for the local database. It also grants the following privileges to the specified user (so that the user can create wrappers):

- CREATE SESSION
- CREATE PROCEDURE
- CREATE DATABASE LINK
- EXECUTE ANY PROCEDURE

Syntax

```
DBMS_DEFER_SYS.REGISTER_PROPAGATOR (
   username  IN  VARCHAR2);
```

Parameters

Table 12–24 REGISTER_PROPAGATOR Procedure Parameters

Parameter	Description
username	Name of the user.

Exceptions

Table 12–25 REGISTER_PROPAGATOR Procedure Exceptions

Exception	Description
missinguser	Specified user does not exist.
alreadypropagator	Specified user is already the propagator.
duplicatepropagator	There is already a different propagator.

SCHEDULE_PURGE Procedure

This procedure schedules a job to purge pushed transactions from the deferred transaction queue at your current master site or materialized view site. You should schedule one purge job.

> **See Also:** *Oracle9i Replication* for information about using this procedure to schedule continuous or periodic purge of your deferred transaction queue

Syntax

```
DBMS_DEFER_SYS.SCHEDULE_PURGE (
   interval             IN  VARCHAR2,
   next_date            IN  DATE,
   reset                IN  BOOLEAN        := NULL,
   purge_method         IN  BINARY_INTEGER := NULL,
   rollback_segment     IN  VARCHAR2       := NULL,
   startup_seconds      IN  BINARY_INTEGER := NULL,
   execution_seconds    IN  BINARY_INTEGER := NULL,
   delay_seconds        IN  BINARY_INTEGER := NULL,
   transaction_count    IN  BINARY_INTEGER := NULL,
   write_trace          IN  BOOLEAN        := NULL);
```

Parameters

Table 12–26 SCHEDULE_PURGE Procedure Parameters **(Page 1 of 2)**

Parameter	Description
interval	Allows you to provide a function to calculate the next time to purge. This value is stored in the `interval` field of the `DEFSCHEDULE` view and calculates the `next_date` field of this view. If you use the default value for this parameter, `NULL`, then the value of this field remains unchanged. If the field had no previous value, it is created with a value of `NULL`. If you do not supply a value for this field, you must supply a value for `next_date`.

Table 12–26 SCHEDULE_PURGE Procedure Parameters **(Page 2 of 2)**

Parameter	Description
next_date	Allows you to specify a time to purge pushed transactions from the site's queue. This value is stored in the next_date field of the DEFSCHEDULE view. If you use the default value for this parameter, NULL, then the value of this field remains unchanged. If this field had no previous value, it is created with a value of NULL. If you do not supply a value for this field, then you must supply a value for interval.
reset	Set to true to reset LAST_TXN_COUNT, LAST_ERROR, and LAST_MSG to NULL.
purge_method	Controls how to purge the deferred transaction queue: purge_method_quick costs less, while purge_method_precise offers better precision. Specify the following for this parameter to use purge_method_quick: dbms_defer_sys.purge_method_quick Specify the following for this parameter to user purge_method_precise: dbms_defer_sys.purge_method_precise If you use purge_method_quick, deferred transactions and deferred procedure calls that have been successfully pushed may remain in the DEFTRAN and DEFCALL data dictionary views for longer than expected before they are purged. For more information, see "Usage Notes" on page 12-15. These usage notes are for the DBMS_DEFER_SYS.PURGE function, but they also apply to the DBMS_DEFER_SYS.SCHEDULE_PURGE procedure.
rollback_segment	Name of rollback segment to use for the purge, or NULL for default.
startup_seconds	Maximum number of seconds to wait for a previous purge of the same deferred transaction queue.
execution_seconds	If >0, then stop purge cleanly after the specified number of seconds of real time.
delay_seconds	Stop purge cleanly after the deferred transaction queue has no transactions to purge for delay_seconds.
transaction_count	If > 0, then shut down cleanly after purging transaction_count number of transactions.
write_trace	When set to true, Oracle records the result value returned by the PURGE function in the server's trace file.

SCHEDULE_PUSH Procedure

This procedure schedules a job to push the deferred transaction queue to a remote site. This procedure performs a COMMIT.

> **See Also:** *Oracle9i Replication* for information about using this procedure to schedule continuous or periodic push of your deferred transaction queue

Syntax

```
DBMS_DEFER_SYS.SCHEDULE_PUSH (
   destination          IN  VARCHAR2,
   interval             IN  VARCHAR2,
   next_date            IN  DATE,
   reset                IN  BOOLEAN        := false,
   parallelism          IN  BINARY_INTEGER := NULL,
   heap_size            IN  BINARY_INTEGER := NULL,
   stop_on_error        IN  BOOLEAN        := NULL,
   write_trace          IN  BOOLEAN        := NULL,
   startup_seconds      IN  BINARY_INTEGER := NULL,
   execution_seconds    IN  BINARY_INTEGER := NULL,
   delay_seconds        IN  BINARY_INTEGER := NULL,
   transaction_count    IN  BINARY_INTEGER := NULL);
```

Parameters

Table 12–27 SCHEDULE_PUSH Procedure Parameters **(Page 1 of 2)**

Parameter	Description
destination	The fully qualified database name of the master site or master materialized view site to which you are forwarding changes.
interval	Allows you to provide a function to calculate the next time to push. This value is stored in the interval field of the DEFSCHEDULE view and calculates the next_date field of this view. If you use the default value for this parameter, NULL, then the value of this field remains unchanged. If the field had no previous value, it is created with a value of NULL. If you do not supply a value for this field, then you must supply a value for next_date.

Table 12–27 SCHEDULE_PUSH Procedure Parameters **(Page 2 of 2)**

Parameter	Description
next_date	Allows you to specify a time to push deferred transactions to the remote site. This value is stored in the next_date field of the DEFSCHEDULE view. If you use the default value for this parameter, NULL, then the value of this field remains unchanged. If this field had no previous value, then it is created with a value of NULL. If you do not supply a value for this field, then you must supply a value for interval.
reset	Set to true to reset LAST_TXN_COUNT, LST_ERROR, and LAST_MSG to NULL.
parallelism	0 specifies serial propagation. *n* > 1 specifies parallel propagation with *n* parallel processes. 1 specifies parallel propagation using only one parallel process.
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance. **Note:** Do not set the parameter unless so directed by Oracle Support Services.
stop_on_error	The default, false, indicates that the executor should continue even if errors, such as conflicts, are encountered. If true, then stops propagation at the first indication that a transaction encountered an error at the destination site.
write_trace	When set to true, Oracle records the result value returned by the function in the server's trace file.
startup_seconds	Maximum number of seconds to wait for a previous push to the same destination.
execution_seconds	If >0, then stop execution cleanly after the specified number of seconds of real time. If transaction_count and execution_seconds are zero (the default), then transactions are executed until there are no more in the queue.
delay_seconds	Do not return before the specified number of seconds have elapsed, even if the queue is empty. Useful for reducing execution overhead if PUSH is called from a tight loop.
transaction_count	If > 0, then the maximum number of transactions to be pushed before stopping. If transaction_count and execution_seconds are zero (the default), then transactions are executed until there are no more in the queue that need to be pushed.

SET_DISABLED Procedure

To disable or enable propagation of the deferred transaction queue from the current site to a specified destination site. If the disabled parameter is `true`, then the procedure disables propagation to the specified destination and future invocations of `PUSH` do not push the deferred remote procedure call (RPC) queue. `SET_DISABLED` eventually affects a session already pushing the queue to the specified destination, but does not affect sessions appending to the queue with `DBMS_DEFER`.

If the disabled parameter is `false`, then the procedure enables propagation to the specified destination and, although this does not push the queue, it permits future invocations of `PUSH` to push the queue to the specified destination. Whether the disabled parameter is `true` or `false`, a `COMMIT` is required for the setting to take effect in other sessions.

Syntax

```
DBMS_DEFER_SYS.SET_DISABLED (
   destination   IN   VARCHAR2,
   disabled      IN   BOOLEAN := true,
   catchup       IN   RAW := '00',
   override      IN   BOOLEAN := false);
```

Parameters

Table 12–28 SET_DISABLED Procedure Parameters

Parameter	Description
destination	The fully qualified database name of the node whose propagation status you want to change.
disabled	By default, this parameter disables propagation of the deferred transaction queue from your current site to the specified destination. Set this to `false` to enable propagation.
catchup	The extension identifier for adding new master sites to a master group without quiescing the master group. The new master site is the destination. Query the DEFSCHEDULE data dictionary view for the existing extension identifiers.
override	A `false` setting, the default, specifies that Oracle raises the `cantsetdisabled` exception if the `disabled` parameter is set to `false` and propagation was disabled internally by Oracle. A `true` setting specifies that Oracle ignores whether the disabled state was set internally for synchronization and always tries to set the state as specified by the `disabled` parameter. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 12–29 SET_DISABLED Procedure Exceptions

Exception	Description
NO_DATA_FOUND	No entry was found in the DEFSCHEDULE view for the specified `destination`.
cantsetdisabled	The disabled status for this site is set internally by Oracle for synchronization during adding a new master site to a master group without quiescing the master group. Ensure that adding a new master site without quiescing finished before invoking this procedure.

UNREGISTER_PROPAGATOR Procedure

To unregister a user as the propagator from the local database. This procedure:

- Deletes the specified propagator from DEFPROPAGATOR.
- Revokes privileges granted by REGISTER_PROPAGATOR from the specified user (including identical privileges granted independently).
- Drops any generated wrappers in the schema of the specified propagator, and marks them as dropped in the replication catalog.

Syntax

```
DBMS_DEFER_SYS.UNREGISTER_PROPAGATOR (
   username  IN  VARCHAR2
   timeout   IN  INTEGER DEFAULT DBMS_LOCK.MAXWAIT);
```

Parameters

Table 12–30 UNREGISTER_PROPAGATOR Procedure Parameters

Parameter	Description
username	Name of the propagator user.
timeout	Timeout in seconds. If the propagator is in use, then the procedure waits until timeout. The default is DBMS_LOCK.MAXWAIT.

Exceptions

Table 12–31 UNREGISTER_PROPAGATOR Procedure Exceptions

Parameter	Description
missingpropagator	Specified user is not a propagator.
propagator_inuse	Propagator is in use, and thus cannot be unregistered. Try later.

UNSCHEDULE_PURGE Procedure

This procedure stops automatic purges of pushed transactions from the deferred transaction queue at a master site or materialized view site.

Syntax

```
DBMS_DEFER_SYS.UNSCHEDULE_PURGE();
```

Parameters

None

UNSCHEDULE_PUSH Procedure

This procedure stops automatic pushes of the deferred transaction queue from a master site or materialized view site to a remote site.

Syntax

```
DBMS_DEFER_SYS.UNSCHEDULE_PUSH (
   dblink   IN   VARCHAR2);
```

Parameters

Table 12–32 UNSCHEDULE_PUSH Procedure Parameters

Parameter	Description
dblink	Fully qualified path name for the database at which you want to unschedule periodic execution of deferred remote procedure calls.

Table 12–33 UNSCHEDULE_PUSH Procedure Exceptions

Exception	Description
NO_DATA_FOUND	No entry was found in the DEFSCHEDULE view for the specified dblink.

13

DBMS_DESCRIBE

You can use the DBMS_DESCRIBE package to get information about a PL/SQL object. When you specify an object name, DBMS_DESCRIBE returns a set of indexed tables with the results. Full name translation is performed and security checking is also checked on the final object.

This package provides the same functionality as the Oracle Call Interface OCIDescribeAny call.

See Also: *Oracle Call Interface Programmer's Guide*

This chapter discusses the following topics:

Security, Types, and Errors for DBMS_DESCRIBE

Security

This package is available to PUBLIC and performs its own security checking based on the schema object being described.

Types

The DBMS_DESCRIBE package declares two PL/SQL table types, which are used to hold data returned by DESCRIBE_PROCEDURE in its OUT parameters. The types are:

```
TYPE VARCHAR2_TABLE IS TABLE OF VARCHAR2(30)
    INDEX BY BINARY_INTEGER;

TYPE NUMBER_TABLE IS TABLE OF NUMBER
    INDEX BY BINARY_INTEGER;
```

Errors

DBMS_DESCRIBE can raise application errors in the range -20000 to -20004.

Table 13–1 DBMS_DESCRIBE Errors

Error	Description
ORA-20000	ORU 10035: cannot describe a package ('X') only a procedure within a package.
ORA-20001	ORU-10032: procedure 'X' within package 'Y' does not exist.
ORA-20002	ORU-10033: object 'X' is remote, cannot describe; expanded name 'Y'.
ORA-20003	ORU-10036: object 'X' is invalid and cannot be described.
ORA-20004	Syntax error attempting to parse 'X'.

Summary of DBMS_DESCRIBE Subprograms

DBMS_DESCRIBE contains only one procedure: DESCRIBE_PROCEDURE.

DESCRIBE_PROCEDURE Procedure

The procedure DESCRIBE_PROCEDURE accepts the name of a stored procedure, a description of the procedure, and each of its parameters.

Syntax

```
DBMS_DESCRIBE.DESCRIBE_PROCEDURE(
   object_name    IN  VARCHAR2,
   reserved1      IN  VARCHAR2,
   reserved2      IN  VARCHAR2,
   overload       OUT NUMBER_TABLE,
   position       OUT NUMBER_TABLE,
   level          OUT NUMBER_TABLE,
   argument_name  OUT VARCHAR2_TABLE,
   datatype       OUT NUMBER_TABLE,
   default_value  OUT NUMBER_TABLE,
   in_out         OUT NUMBER_TABLE,
   length         OUT NUMBER_TABLE,
   precision      OUT NUMBER_TABLE,
   scale          OUT NUMBER_TABLE,
   radix          OUT NUMBER_TABLE,
   spare          OUT NUMBER_TABLE);
```

Parameters

Table 13–2 DBMS_DESCRIBE.DESCRIBE_PROCEDURE Parameters

Parameter	Description
object_name	Name of the procedure being described. The syntax for this parameter follows the rules used for identifiers in SQL. The name can be a synonym. This parameter is required and may not be null. The total length of the name cannot exceed 197 bytes. An incorrectly specified OBJECT_NAME can result in one of the following exceptions: ORA-20000 - A package was specified. You can only specify a stored procedure, stored function, packaged procedure, or packaged function. ORA-20001 - The procedure or function that you specified does not exist within the given package. ORA-20002 - The object that you specified is a remote object. This procedure cannot currently describe remote objects. ORA-20003 - The object that you specified is invalid and cannot be described. ORA-20004 - The object was specified with a syntax error.
reserved1 reserved2	Reserved for future use -- must be set to NULL or the empty string.

Table 13–2 DBMS_DESCRIBE.DESCRIBE_PROCEDURE Parameters

Parameter	Description
overload	A unique number assigned to the procedure's signature. If a procedure is overloaded, then this field holds a different value for each version of the procedure.
position	Position of the argument in the parameter list. Position 0 returns the values for the return type of a function.
level	If the argument is a composite type, such as record, then this parameter returns the level of the datatype. See the *Oracle Call Interface Programmer's Guide* for a description of the ODESSP call for an example.
argument_name	Name of the argument associated with the procedure that you are describing.
datatype	Oracle datatype of the argument being described. The datatypes and their numeric type codes are: 0 placeholder for procedures with no arguments 1 VARCHAR, VARCHAR, STRING 2 NUMBER, INTEGER, SMALLINT, REAL, FLOAT, DECIMAL 3 BINARY_INTEGER, PLS_INTEGER, POSITIVE, NATURAL 8 LONG 11 ROWID 12 DATE 23 RAW 24 LONG RAW 96 CHAR (ANSI FIXED CHAR), CHARACTER 106 MLSLABEL 250 PL/SQL RECORD 251 PL/SQL TABLE 252 PL/SQL BOOLEAN
default_value	1 if the argument being described has a default value; otherwise, the value is 0.
in_out	Describes the mode of the parameter: 0 IN 1 OUT 2 IN OUT
length	Data length, in bytes, of the argument being described.
precision	If the argument being described is of datatype 2 (NUMBER), then this parameter is the precision of that number.

Table 13–2 DBMS_DESCRIBE.DESCRIBE_PROCEDURE Parameters

Parameter	Description
scale	If the argument being described is of datatype 2 (NUMBER, etc.), then this parameter is the scale of that number.
radix	If the argument being described is of datatype 2 (NUMBER, etc.), then this parameter is the radix of that number.
spare	Reserved for future functionality.

Return Values

All values from DESCRIBE_PROCEDURE are returned in its OUT parameters. The datatypes for these are PL/SQL tables, in order to accommodate a variable number of parameters.

Examples

One use of the DESCRIBE_PROCEDURE procedure would be as an external service interface.

For example, consider a client that provides an OBJECT_NAME of SCOTT.ACCOUNT_UPDATE where ACCOUNT_UPDATE is an overloaded function with specification:

```
table account (account_no number, person_id number,
               balance number(7,2))
table person  (person_id number(4), person_nm varchar2(10))

function ACCOUNT_UPDATE (account_no   number,
                         person       person%rowtype,
                         amounts      dbms_describe.number_table,
                         trans_date   date)
                         return       accounts.balance%type;

function ACCOUNT_UPDATE (account_no   number,
                         person       person%rowtype,
                         amounts      dbms_describe.number_table,
                         trans_no     number)
                         return       accounts.balance%type;
```

The describe of this procedure might look similar to the output shown below.

```
overload position  argument level  datatype length prec scale rad
-------- --------- -------- ------ -------- ------ ---- ----- ---
       1         0              0         2     22    7     2  10
```

```
1        1   ACCOUNT     0        2     0    0     0   0
1        2   PERSON      0      250     0    0     0   0
1        1   PERSON_ID   1        2    22    4     0  10
1        2   PERSON_NM   1        1    10    0     0   0
1        3   AMOUNTS     0      251     0    0     0   0
1        1               1        2    22    0     0   0
1        4   TRANS_DATE  0       12     0    0     0   0
2        0               0        2    22    7     2  10
2        1   ACCOUNT_NO  0        2    22    0     0   0
2        2   PERSON      0        2    22    4     0  10
2        3   AMOUNTS     0      251    22    4     0  10
2        1               1        2     0    0     0   0
2        4   TRANS_NO    0        2     0    0     0   0
```

The following PL/SQL procedure has as its parameters all of the PL/SQL datatypes:

```
CREATE OR REPLACE PROCEDURE p1 (
        pvc2    IN     VARCHAR2,
        pvc     OUT    VARCHAR,
        pstr    IN OUT STRING,
        plong   IN     LONG,
        prowid  IN     ROWID,
        pchara  IN     CHARACTER,
        pchar   IN     CHAR,
        praw    IN     RAW,
        plraw   IN     LONG RAW,
        pbinint IN     BINARY_INTEGER,
        pplsint IN     PLS_INTEGER,
        pbool   IN     BOOLEAN,
        pnat    IN     NATURAL,
        ppos    IN     POSITIVE,
        pposn   IN     POSITIVEN,
        pnatn   IN     NATURALN,
        pnum    IN     NUMBER,
        pintgr  IN     INTEGER,
        pint    IN     INT,
        psmall  IN     SMALLINT,
        pdec    IN     DECIMAL,
        preal   IN     REAL,
        pfloat  IN     FLOAT,
        pnumer  IN     NUMERIC,
        pdp     IN     DOUBLE PRECISION,
        pdate   IN     DATE,
        pmls    IN     MLSLABEL) AS
```

```
BEGIN
    NULL;
END;
```

If you describe this procedure using the package below:

```
CREATE OR REPLACE PACKAGE describe_it AS

    PROCEDURE desc_proc (name VARCHAR2);

END describe_it;

CREATE OR REPLACE PACKAGE BODY describe_it AS

  PROCEDURE prt_value(val VARCHAR2, isize INTEGER) IS
    n INTEGER;
  BEGIN
    n := isize - LENGTHB(val);
    IF n < 0 THEN
      n := 0;
    END IF;
    DBMS_OUTPUT.PUT(val);
    FOR i in 1..n LOOP
      DBMS_OUTPUT.PUT(' ');
    END LOOP;
  END prt_value;

  PROCEDURE desc_proc (name VARCHAR2) IS

      overload     DBMS_DESCRIBE.NUMBER_TABLE;
      position     DBMS_DESCRIBE.NUMBER_TABLE;
      c_level      DBMS_DESCRIBE.NUMBER_TABLE;
      arg_name     DBMS_DESCRIBE.VARCHAR2_TABLE;
      dty          DBMS_DESCRIBE.NUMBER_TABLE;
      def_val      DBMS_DESCRIBE.NUMBER_TABLE;
      p_mode       DBMS_DESCRIBE.NUMBER_TABLE;
      length       DBMS_DESCRIBE.NUMBER_TABLE;
      precision    DBMS_DESCRIBE.NUMBER_TABLE;
      scale        DBMS_DESCRIBE.NUMBER_TABLE;
      radix        DBMS_DESCRIBE.NUMBER_TABLE;
      spare        DBMS_DESCRIBE.NUMBER_TABLE;
      idx          INTEGER := 0;

  BEGIN
```

```
      DBMS_DESCRIBE.DESCRIBE_PROCEDURE(
              name,
              null,
              null,
              overload,
              position,
              c_level,
              arg_name,
              dty,
              def_val,
              p_mode,
              length,
              precision,
              scale,
              radix,
              spare);

      DBMS_OUTPUT.PUT_LINE('Position    Name        DTY  Mode');
      LOOP
          idx := idx + 1;
          prt_value(TO_CHAR(position(idx)), 12);
          prt_value(arg_name(idx), 12);
          prt_value(TO_CHAR(dty(idx)), 5);
          prt_value(TO_CHAR(p_mode(idx)), 5);
          DBMS_OUTPUT.NEW_LINE;
      END LOOP;
  EXCEPTION
     WHEN NO_DATA_FOUND THEN
        DBMS_OUTPUT.NEW_LINE;
        DBMS_OUTPUT.NEW_LINE;

  END desc_proc;
END describe_it;
```

Then, the results, as shown below, list all the numeric codes for the PL/SQL datatypes:

```
Position  Name    Datatype_Code  Mode
1         PVC2      1              0
2         PVC       1              1
3         PSTR      1              2
4         PLONG     8              0
5         PROWID    11             0
6         PCHARA    96             0
7         PCHAR     96             0
```

```
8          PRAW      23             0
9          PLRAW     24             0
10         PBININT   3              0
11         PPLSINT   3              0
12         PBOOL     252            0
13         PNAT      3              0
14         PPOS      3              0
15         PPOSN     3              0
16         PNATN     3              0
17         PNUM      2              0
18         PINTGR    2              0
19         PINT      2              0
20         PSMALL    2              0
21         PDEC      2              0
22         PREAL     2              0
23         PFLOAT    2              0
24         PNUMER    2              0
25         PDP       2              0
26         PDATE     12             0
27         PMLS      106            0
```

Usage Notes

There is currently no way from a third generation language to directly bind to an argument of type `record` or `boolean`. For Booleans, there are the following work-arounds:

- Assume function `F` returns a Boolean. `G` is a procedure with one `IN` Boolean argument, and `H` is a procedure which has one `OUT` Boolean argument. Then, you can execute these functions, binding in `DTYINTs` (native integer) as follows, where `0=>FALSE` and `1=>TRUE`:

```
begin :dtyint_bind_var := to_number(f); end;

begin g(to_boolean(:dtyint_bind_var)); end;

declare b boolean; begin h(b); if b then :dtyint_bind_var := 1;
else :dtyint_bind_var := 0; end if; end;
```

- Access to procedures with arguments of type `record` require writting a wrapper similar to that in the last example above (see funciton `H`).

14

DBMS_DISTRIBUTED_TRUST_ADMIN

DBMS_DISTRIBUTED_TRUST_ADMIN procedures maintain the Trusted Servers List. Use these procedures to define whether a server is trusted. If a database is not trusted, Oracle refuses current user database links from the database.

Oracle uses local Trusted Servers Lists, along with enterprise domain membership lists stored in the enterprise LDAP directory service, to determine if another database is trusted. The LDAP directory service entries are managed with the Enterprise Security Manager Tool in OEM.

Oracle considers another database to be "trusted" if it meets the following criteria:

1) It is in the same enterprise domain in the directory service as the local database.

2) The enterprise domain is marked as trusted in the directory service.

3) It is not listed as untrusted in the local Trusted Servers List. Current user database links will only be accepted from another database if both databases involved trust each other.

You can list a database server locally in the Trusted Servers List regardless of what is listed in the directory service. However, if you list a database that is not in the same domain as the local database, or if that domain is untrusted, the entry will have no effect.

This functionality is part of the Enterprise User Security feature of the Oracle Advanced Security Option.

This chapter discusses the following topics:

Requirements

To execute DBMS_DISTRIBUTED_TRUST_ADMIN, the EXECUTE_CATALOG_ROLE role must be granted to the DBA. To select from the view TRUSTED_SERVERS, the SELECT_CATALOG_ROLE role must be granted to the DBA.

It is important to know whether all servers are trusted or not trusted. Trusting a particular server with the ALLOW_SERVER procedure does not have any effect if the database already trusts all databases, or if that database is already trusted. Similarly, denying a particular server with the DENY_SERVER procedure does not have any effect if the database already does not trust any database or if that database is already untrusted.

The procedures DENY_ALL and ALLOW_ALL delete all entries (in other words, server names) that are explicitly allowed or denied using the ALLOW_SERVER procedure or DENY_SERVER procedure respectively.

Summary of DBMS_DISTRIBUTED_TRUST_ADMIN Subprograms

Table 14–1 DBMS_DISTRIBUTED_TRUST_ADMIN Package Subprograms

Subprogram	Description
"ALLOW_ALL Procedure" on page 14-2	Empties the list and inserts a row indicating that all servers should be trusted.
"ALLOW_SERVER Procedure" on page 14-3	Enables a specific server to be allowed access even though deny all is indicated in the list.
"DENY_ALL Procedure" on page 14-3	Empties the list and inserts a row indicating that all servers should be untrusted.
"DENY_SERVER Procedure" on page 14-4	Enables a specific server to be denied access even though allow all is indicated in the list.

ALLOW_ALL Procedure

This procedure empties the Trusted Servers List and specifies that all servers that are members of a trusted domain in an enterprise directory service and that are in the same domain are allowed access.

The view TRUSTED_SERVERS will show "TRUSTED ALL" indicating that the database trusts all servers that are currently trusted by the enterprise directory service.

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.ALLOW_ALL;
```

Usage Notes

ALLOW_ALL only applies to servers listed as trusted in the enterprise directory service and in the same enterprise domain.

ALLOW_SERVER Procedure

This procedure ensures that the specified server is considered trusted (even if you have previously specified "deny all").

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.ALLOW_SERVER (
   server IN VARCHAR2);
```

Parameters

Table 14–2 ALLOW_SERVER Procedure Parameters

Parameter	Description
server	Unique, fully-qualified name of the server to be trusted.

Usage Notes

If the Trusted Servers List contains the entry "deny all", then this procedure adds a specification indicating that a specific database (for example, DBx) is to be trusted.

If the Trusted Servers List contains the entry "allow all", and if there is no "deny DBx" entry in the list, then executing this procedure causes no change.

If the Trusted Servers List contains the entry "allow all", and if there is a "deny DBx" entry in the list, then that entry is deleted.

DENY_ALL Procedure

This procedure empties the Trusted Servers List and specifies that all servers are denied access.

The view TRUSTED_SERVERS will show "UNTRUSTED ALL" indicating that no servers are currently trusted.

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_ALL;
```

DENY_SERVER Procedure

This procedure ensures that the specified server is considered untrusted (even if you have previously specified "allow all").

Syntax

```
DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_SERVER (
   server IN VARCHAR2);
```

Parameters

Table 14–3 DENY_SERVER Procedure Parameters

Parameter	Description
server	Unique, fully-qualified name of the server to be untrusted.

Usage Notes

If the Trusted Servers List contains the entry "`allow all`", then this procedure adds an entry indicating that the specified database (for example, `DBx`) is not to be trusted.

If the Trusted Servers List contains the entry "`deny all`", and if there is no "`allow DBx`" entry in the list, then this procedure causes no change.

If the Trusted Servers List contains the entry "`deny all`", and if there is an "`allow DBx`" entry, then this procedure causes that entry to be deleted.

Example

If you have not yet used the package `DBMS_DISTRIBUTED_TRUST_ADMIN` to change the trust listing, by default you trust all databases in the same enterprise domain if that domain it listed as trusted in the directory service:

```
SELECT * FROM TRUSTED_SERVERS;
TRUST     NAME
--------- --------------------
Trusted   All

1 row selected.
```

Because all servers are currently trusted, you can execute the DENY_SERVER procedure and specify that a particular server is not trusted:

```
EXECUTE DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_SERVER
                          ('SALES.US.AMERICAS.ACME_AUTO.COM');

Statement processed.

SELECT * FROM TRUSTED_SERVERS;

TRUST      NAME
---------- ------------------------------------------------
Untrusted SALES.US.AMERICAS.ACME_AUTO.COM

1 row selected
```

By executing the DENY_ALL procedure, you can choose to not trust any database server:

```
EXECUTE DBMS_DISTRIBUTED_TRUST_ADMIN.DENY_ALL;

Statement processed.

SELECT * FROM TRUSTED_SERVERS;

TRUST      NAME
---------- ------------------------------------------------
Untrusted All

1 row selected.
```

The ALLOW_SERVER procedure can be used to specify that one particular database is to be trusted:

```
EXECUTE
DBMS_DISTRIBUTED_TRUST_ADMIN.ALLOW_SERVER
                          ('SALES.US.AMERICAS.ACME_AUTO.COM');

Statement processed.

SELECT * FROM TRUSTED_SERVERS;

TRUST      NAME
---------- ------------------------------------------------
```

```
Trusted    SALES.US.AMERICAS.ACME_AUTO.COM

1 row selected.
```

15

DBMS_FGA

The DBMS_FGA package provides fine-grained security functions. Execute privilege on DBMS_FGA is needed for administering audit policies. Because the audit function can potentially capture all user environment and application context values, policy administration should be executable by privileged users only.

> **See Also:** *Oracle9i Application Developer's Guide - Fundamentals* for a fuller discussion and more usage information on DBMS_FGA.

This feature is available for only cost-based optimization. The rule-based optimizer may generate unnecessary audit records since audit monitoring can occur before row filtering. For both the rule-based optimizer and the cost-based optimizer, you can refer to DBA_FGA_AUDIT_TRAIL to analyze the SQL text and corresponding bind variables that are issued.

Note: DBMS_RLS is only available with the Enterprise Edition.

This chapter discusses the following topics:

Summary of DBMS_FGA Subprogram

Table 15–1 Summary of DBMS_FGA Subprograms

Subprogram	Description
"ADD_POLICY Procedure" on page 15-2	Creates an audit policy using the supplied predicate as the audit condition
"DROP_POLICY Procedure" on page 15-3	Drops an audit policy
"ENABLE_POLICY Procedure" on page 15-4	Enables an audit policy
"DISABLE_POLICY Procedure" on page 15-4	Disables an audit policy

ADD_POLICY Procedure

This procedure creates an audit policy using the supplied predicate as the audit condition.

Syntax

```
DBMS_FGA.ADD_POLICY(
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   policy_name     VARCHAR2,
   audit_condition VARCHAR2,
   audit_column    VARCHAR2,
   handler_schema  VARCHAR2,
   /handler_module  VARCHAR2,
   enable          BOOLEAN  );
```

Parameters

Table 15–2 ADD_POLICY Parameters

Parameter	Description
object_schema	The schema of the object to be audited
object_name	The name of the object to be audited
policy_name	The unique name of the policy
audit_condition	A condition in a row that indicates a monitoring condition

Table 15–2 ADD_POLICY Parameters

Parameter	Description
audit_column	The column to be checked for access. The default is all columns.
handler_schema	The schema that contains the event handler. The default is the current schema.
handler_module	The function name of the event handler; includes the package name if necessary. This is fired only after the first row that matches the audit condition is processed in the query. If the procedure fails with exception, the user SQL statement will fail as well. The default is NULL.
enable	Enables the policy if TRUE, which is the default.

Usage Notes

- An event record will always be inserted into `fga_log$` when the monitored condition becomes TRUE.
- The audit function must have the following interface:
  `PROCEDURE <fname> ( object_schema VARCHAR2, object_name VARCHAR2, policy_name VARCHAR2 ) AS ...`
  `where fname` is the name of the procedure, `schema` is the schema of the table audited, `table` is the table audited, and `policy` is the policy being enforced.
- The audit function is executed as an autonomous transaction.
- Each audit policy is applied to the query individually. That is, as long as the rows being returned fit into any of the audit condition defined on the table, an audit record will be generated, and there will be at most one record generated for each policy.

DROP_POLICY Procedure

This procedure drops an audit policy.

Syntax

```
DBMS_FGA.DROP_POLICY(
   object_schema  VARCHAR2,
   object_name    VARCHAR2,
   policy_name    VARCHAR2 );
```

Parameters

Table 15–3 DROP_POLICY Parameters

Parameter	Description
object_schema	The schema of the object to be audited
object_name	The name of the object to be audited
policy_name	The unique name of the policy

Usage Notes

The DBMS_FGA procedures cause current DML transactions, if any, to commit before the operation. However, the procedures do not cause a commit first if they are inside a DDL event trigger. With DDL transactions, the DBMS_FGA procedures are part of the DDL transaction.

ENABLE_POLICY Procedure

This procedure enables an audit policy.

Syntax

```
DBMS_FGA.ENABLE_POLICY(
   object_schema  VARCHAR2,
   object_name    VARCHAR2,
   policy_name    VARCHAR2 );
```

Parameters

Table 15–4

Parameter	Description
object_schema	The schema of the object to be audited
object_name	The name of the object to be audited
policy_name	The unique name of the policy

DISABLE_POLICY Procedure

This procedure disables an audit policy.

Syntax

```
DBMS_FGA.DISABLE_POLICY(
   object_schema  VARCHAR2,
   object_name    VARCHAR2,
   policy_name    VARCHAR2 );
```

Parameters

Table 15–5 DISABLE_POLICY Procedure

Parameter	Description
object_schema	The schema of the object to be audited
object_name	The name of the object to be audited
policy_name	The unique name of the policy

16

DBMS_FLASHBACK

Using DBMS_FLASHBACK, you can flash back to a version of the database at a specified wall-clock time or a specified system change number (SCN). When DBMS_FLASHBACK is enabled, the user session uses the Flashback version of the database, and applications can execute against the Flashback version of the database. DBMS_FLASHBACK is automatically turned off when the session ends, either by disconnection or by starting another connection.

PL/SQL cursors opened in Flashback mode return rows as of the flashback time or SCN. Different concurrent sessions (connections) in the database can perform Flashback to different wall-clock times or SCNs. DML and DDL operations and distributed operations are not allowed while a session is running in Flashback mode. You can use PL/SQL cursors opened before disabling Flashback to perform DML.

Under Automatic Undo Management (AUM) mode, you can use retention control to control how far back in time to go for the version of the database you need. If you need to perform a Flashback over a 24-hour period, the DBA should set the undo_retention parameter to 24 hours. This way, the system retains enough undo information to regenerate the older versions of the data.

When enabling Flashback using a wall-clock time, the database chooses an SCN that was generated within five minutes of the time specified. For finer grain control of Flashback, you can enable an SCN. An SCN identifies the exact version of the database. In a Flashback-enabled session, SYSDATE will not be affected; it will continue to provide the current time.

DBMS_FLASHBACK can be used within logon triggers to enable Flashback without changing the application code.

You may want to use DBMS_FLASHBACK for the following reasons:

- Self-service repair. If you accidentally delete rows from a table, you can recover the deleted rows.
- Packaged applications such as e-mail and voicemail. You can use Flashback to restore deleted e-mail by re-inserting the deleted message into the current message box.
- Decision support system (DSS) and online analytical processing (OLAP) applications. You can perform data analysis or data modeling to track seasonal demand, for example.

To use this package, a database administrator must grant `EXECUTE` privileges for `DBMS_FLASHBACK`.

> **See Also:** *Oracle9i Application Developer's Guide - Fundamentals* for detailed information about `DBMS_FLASHBACK`.

This chapter discusses the following topics:

DBMS_FLASHBACK Error Messages

Table 16–1 DBMS_FLASHBACK Error Messages

Error	Description
8182	In Flashback mode, user cannot perform DML or DDL operations.
8184	User cannot enable Flashback within another Flashback session.
8183	User cannot enable Flashback within an uncommitted transaction.
8185	SYS cannot enable Flashback mode. User cannot begin read only or serializable transactions in Flashback mode.
8180	Time specified is too old.
8181	Invalid system change number specified.

DBMS_FLASHBACK Example

The following example illustrates how Flashback can be used when the deletion of a senior employee triggers the deletion of all the personnel reporting to him. Using the Flashback feature, you can recover and re-insert the missing employees.

```
/* keep_scn is a temporary table to store scns that we are interested in. */
create table keep_scn (scn number);
execute dbms_flashback.disable;
set echo on
create table employee (
    employee_no   number(5) primary key,
    employee_name varchar2(20),
    employee_mgr  number(5)
        constraint mgr_fkey references employee on delete cascade,
    salary        number,
    hiredate      date
);

/* Populate the company with employees */
insert into employee values (1, 'John Doe', null, 1000000, '5-jul-81');
insert into employee values (10, 'Joe Johnson', 1, 500000, '12-aug-84');
insert into employee values (20, 'Susie Tiger', 10, 250000, '13-dec-90');
insert into employee values (100, 'Scott Tiger', 20, 200000, '3-feb-86');
```

```
insert into employee values (200, 'Charles Smith', 100, 150000, '22-mar-88');
insert into employee values (210, 'Jane Johnson', 100, 100000, '11-apr-87');
insert into employee values (220, 'Nancy Doe', 100, 100000, '18-sep-93');
insert into employee values (300, 'Gary Smith', 210, 75000, '4-nov-96');
insert into employee values (310, 'Bob Smith', 210, 65000, '3-may-95');
commit;

/* Show the entire org */
select lpad(' ', 2*(level-1)) || employee_name Name
from employee
connect by prior employee_no = employee_mgr
start with employee_no = 1
order by level;

execute dbms_flashback.disable;
/* Store this snapshot for later access through Flashback */
declare
I number;
begin
I := dbms_flashback.get_system_change_number;
insert into keep_scn values (I);
commit;

/* Scott decides to retire but the transaction is done incorrectly */

delete from employee where employee_name = 'Scott Tiger';
commit;

/* notice that all of scott's employees are gone */
select lpad(' ', 2*(level-1)) || employee_name Name
from employee
connect by prior employee_no = employee_mgr
start with employee_no = 1
order by level;

/* Put back scott's organization */
declare
    restore_scn date;
begin
    select  scn into restore_scn from keep_scn;
    dbms_flashback.enable_at_system_change_number (restore_scn);
end;
/

/* Show Scott's org */
```

```
select lpad(' ', 2*(level-1)) || employee_name Name
from employee
connect by prior employee_no = employee_mgr
start with employee_no =
    (select employee_no from employee where employee_name = 'Scott Tiger')
order by level;

declare
    scotts_emp number;
    scotts_mgr number;
    cursor c1 is
        select employee_no, employee_name, employee_mgr, salary, hiredate
        from employee
        connect by prior employee_no = employee_mgr
        start with employee_no =
            (select employee_no from employee where employee_name = 'Scott
            Tiger');
c1_rec is c1 % ROWTYPE;
begin
    select employee_no, employee_mgr into scotts_emp, scotts_mgr from employee
    where employee_name = 'Scott Tiger';
/* Open c1 with Flashback enabled. */
 open c1;
/* Disable Flashback. */
dbms_flashback.disable;
 loop
 /* Note that all the DML operations inside the loop are performed with
Flashback disabled. */
    fetch c1 into c1_rec;
exit when c1%NOTFOUND;
    for c1_rec in c1 loop
    if (c1_rec.employee_mgr = scotts_emp) then
        insert into employee values (c1_rec.employee_no,
            c1_rec.employee_name,
            scotts_mgr,
            c1_rec.salary,
            c1_rec.hiredate);
else
    if (c1_rec.employee_no != scotts_emp) then
    insert into employee values (c1_rec.employee_no,
            c1_rec.employee_name,
            c1_rec.employee_mgr,
            c1_rec.salary,
            c1_rec.hiredate);
      end if;
```

```
    end if;
end loop;
end;
/

execute dbms_flashback. disable;
```

Summary of DBMS_FLASHBACK Subprograms

Table 16–2 DBMS_FLASHBACK Subprograms

Subprogram	Description
"ENABLE_AT_TIME Procedure" on page 16-6	This procedure enables Flashback for the entire session. The snapshot time is set to the SCN that most closely matches the time specified in `query_time`.
"ENABLE_AT_SYSTEM_CHANGE_NUMBER Procedure" on page 16-7	This procedure takes an SCN as an Oracle number and sets the session snapshot to the specified number. Inside the Flashback mode, all queries will return data consistent as of the specified wall-clock time or SCN.
"GET_SYSTEM_CHANGE_NUMBER Function" on page 16-8	This function returns the current SCN as an Oracle number. You can use the SCN to store specific snapshots.
"DISABLE Procedure" on page 16-8	This procedure disables the Flashback mode for the entire session.

ENABLE_AT_TIME Procedure

This procedure enables Flashback for the entire session. The snapshot time is set to the SCN that most closely matches the time specified in `query_time`.

Syntax

```
DBMS_FLASHBACK.ENABLE_AT_TIME (
    query_time   IN TIMESTAMP);
```

Parameters

Table 16–3 shows the parameters for the `ENABLE_AT_TIME` procedure.

Table 16–3 ENABLE_AT_TIME Procedure Parameters

Parameter	Description
query_time	This is an input parameter of type TIMESTAMP. A time stamp can be specified in the following ways: Using the TIMESTAMP constructor: Example: execute dbms_flashback.enable_at_time(TIMESTAMP '2001-01-09 12:31:00'). Use the NLS format and supply a string. The format depends on the NLS settings. Using the TO_TIMESTAMP function: Example: execute dbms_flashback.enable_at_time(TO_TIMESTAMP('12-02-2001 14:35:00', 'DD-MM-YYYY HH24:MI:SS')). You provide the format you want to use. This example shows the TO_TIMESTAMP function for February 12, 2001, 2:35 PM. If the time is omitted from query time, it defaults to the beginning of the day, that is, 12:00 A.M. Note that if the query time contains a time zone, the time zone information is truncated.

ENABLE_AT_SYSTEM_CHANGE_NUMBER Procedure

This procedure takes an SCN as an input parameter and sets the session snapshot to the specified number.

In the Flashback mode, all queries return data consistent as of the specified wall-clock time or SCN.

Syntax

```
DBMS_FLASHBACK.ENABLE_AT_SYSTEM_CHANGE (
    query_scn IN NUMBER);
```

Parameters

Table 16–4 shows the parameters for the ENABLE_AT_SYSTEM_CHANGE_NUMBER procedure.

Table 16–4 ENABLE_AT_SYSTEM_CHANGE_NUMBER Procedure Parameters

Parameter	Description
query_scn	The system change number (SCN), a version number for the database that is incremented on every transaction commit.

GET_SYSTEM_CHANGE_NUMBER Function

This function returns the current SCN as an Oracle number datatype. You can obtain the current change number and stash it away for later use. This helps you store specific snapshots.

Syntax

```
DBMS_FLASHBACK.GET_SYSTEM_CHANGE_NUMBER (
RETURN NUMBER);
```

DISABLE Procedure

This procedure disables the Flashback mode for the entire session.

Syntax

```
DBMS_FLASHBACK.DISABLE;
```

Example

The following example queries the salary of an employee, Joe, on August 30, 2000:

```
EXECUTE dbms_flashback.enable_at_time('30-AUG-2000');
SELECT salary from emp where name = 'Joe'
EXECUTE dbms_flashback.disable;
```

17

DBMS_HS_PASSTHROUGH

The pass-through SQL feature allows an application developer to send a statement directly to a non-Oracle system without being interpreted by the Oracle server. This can be useful if the non-Oracle system allows for operations in statements for which there is no equivalent in Oracle.

You can run these statements directly at the non-Oracle system using the PL/SQL package `DBMS_HS_PASSTHROUGH`. Any statement executed with this package is run in the same transaction as regular "transparent" SQL statements.

> **See Also:** For detailed information on Heterogeneous Services and on binding variables, see *Oracle9i Distributed Database Systems.*

This chapter discusses the following topics:

- Security
- Summary of DBMS_HS_PASSTHROUGH Subprograms

Security

The DBMS_HS_PASSTHROUGH package conceptually resides at the non-Oracle system. Procedures and functions in the package must be called by using the appropriate database link to the non-Oracle system.

Summary of DBMS_HS_PASSTHROUGH Subprograms

Table 17–1 DBMS_HS_PASSTHROUGH Package Subprograms

Subprogram	Description
"BIND_VARIABLE Procedure" on page 17-3	Binds an IN variable positionally with a PL/SQL program variable.
"BIND_VARIABLE_RAW Procedure" on page 17-4	Binds IN variables of type RAW.
"BIND_OUT_VARIABLE Procedure" on page 17-5	Binds an OUT variable with a PL/SQL program variable.
"BIND_OUT_VARIABLE_RAW Procedure" on page 17-7	Binds an OUT variable of datatype RAW with a PL/SQL program variable.
"BIND_INOUT_VARIABLE Procedure" on page 17-8	Binds IN OUT bind variables.
"BIND_INOUT_VARIABLE_ RAW Procedure" on page 17-9	Binds IN OUT bind variables of datatype RAW.
"CLOSE_CURSOR Procedure" on page 17-10	Closes the cursor and releases associated memory after the SQL statement has been run at the non-Oracle system.
"EXECUTE_IMMEDIATE Procedure" on page 17-11	Runs a (non-SELECT) SQL statement immediately, without bind variables.
"EXECUTE_NON_QUERY Function" on page 17-12	Runs a (non-SELECT) SQL statement.
"FETCH_ROW Function" on page 17-13	Fetches rows from a query.
"GET_VALUE Procedure" on page 17-14	Retrieves column value from SELECT statement, or retrieves OUT bind parameters.
"GET_VALUE_RAW Procedure" on page 17-15	Similar to GET_VALUE, but for datatype RAW.
"OPEN_CURSOR Function" on page 17-16	Opens a cursor for running a passthrough SQL statement at the non-Oracle system.

Table 17–1 DBMS_HS_PASSTHROUGH Package Subprograms (Cont.)

Subprogram	Description
"PARSE Procedure" on page 17-17	Parses SQL statement at non-Oracle system.

BIND_VARIABLE Procedure

This procedure binds an IN variable positionally with a PL/SQL program variable.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_VARIABLE (
   c      IN BINARY_INTEGER NOT NULL,
   pos    IN BINARY_INTEGER NOT NULL,
   val    IN <dty>,
   name   IN VARCHAR2);
```

Where <dty> is either DATE, NUMBER, or VARCHAR2

> **See Also:** To bind RAW variables use BIND_VARIABLE_RAW Procedure on page 17-4.

Parameters

Table 17–2 BIND_VARIABLE Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable in the SQL statement: Starts at 1.
val	Value that must be passed to the bind variable name.
name	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 17–3 BIND_VARIABLE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

Purity level defined: WNDS, RNDS

BIND_VARIABLE_RAW Procedure

This procedure binds IN variables of type RAW.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_VARIABLE_RAW (
   c      IN BINARY_INTEGER NOT NULL,
   pos    IN BINARY_INTEGER NOT NULL,
   val    IN RAW,
   name   IN VARCHAR2);
```

Parameters

Table 17–4 BIND_VARIABLE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable in the SQL statement: Starts at 1.
val	Value that must be passed to the bind variable.

Table 17–4 BIND_VARIABLE_RAW Procedure Parameters

Parameter	Description
name	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 17–5 BIND_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

Purity level defined : WNDS, RNDS

BIND_OUT_VARIABLE Procedure

This procedure binds an OUT variable with a PL/SQL program variable.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_OUT_VARIABLE (
   c        IN  BINARY_INTEGER NOT NULL,
   pos      IN  BINARY_INTEGER NOT NULL,
   val      OUT <dty>,
   name     IN  VARCHAR2);
```

Where <dty> is either DATE, NUMBER, or VARCHAR2

See Also: For binding OUT variables of datatype RAW, see BIND_OUT_VARIABLE_RAW Procedure on page 17-7.

Parameters

Table 17–6 BIND_OUT_VARIABLE Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable in the SQL statement: Starts at 1.
val	Variable in which the OUT bind variable stores its value. The package remembers only the "size" of the variable. After the SQL statement is run, you can use GET_VALUE to retrieve the value of the OUT parameter. The size of the retrieved value should not exceed the size of the parameter that was passed using BIND_OUT_VARIABLE.
name	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 17–7 BIND_OUT_VARIABLE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

```
Purity level defined : WNDS, RNDS
```

BIND_OUT_VARIABLE_RAW Procedure

This procedure binds an OUT variable of datatype RAW with a PL/SQL program variable.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_OUT_VARIABLE (
   c       IN  BINARY_INTEGER NOT NULL,
   pos     IN  BINARY_INTEGER NOT NULL,
   val     OUT RAW,
   name    IN  VARCHAR2);
```

Parameters

Table 17–8 BIND_OUT_VARIABLE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable in the SQL statement: Starts at 1.
val	Variable in which the OUT bind variable stores its value. The package remembers only the "size" of the variable. After the SQL statement is run, you can use GET_VALUE to retrieve the value of the OUT parameter. The size of the retrieved value should not exceed the size of the parameter that was passed using BIND_OUT_VARIABLE_RAW.
name	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 17–9 BIND_OUT_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.

Table 17–9 BIND_OUT_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

```
Purity level defined : WNDS, RNDS
```

BIND_INOUT_VARIABLE Procedure

This procedure binds IN OUT bind variables.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_INOUT_VARIABLE (
   c       IN     BINARY_INTEGER NOT NULL,
   pos     IN     BINARY_INTEGER NOT NULL,
   val     IN OUT <dty>,
   name    IN     VARCHAR2);
```

Where <dty> is either DATE, NUMBER, or VARCHAR2

> **See Also:** For binding IN OUT variables of datatype RAW see BIND_INOUT_VARIABLE_RAW Procedure on page 17-9.

Parameters

Table 17–10 BIND_INOUT_VARIABLE Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable in the SQL statement: Starts at 1.
val	This value is used for two purposes: - To provide the IN value before the SQL statement is run. - To determine the size of the out value.

Table 17–10 BIND_INOUT_VARIABLE Procedure Parameters

Parameter	Description
name	(Optional) Name of the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 17–11 BIND_INOUT_VARIABLE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

Purity level defined : WNDS, RNDS

BIND_INOUT_VARIABLE_RAW Procedure

This procedure binds IN OUT bind variables of datatype RAW.

Syntax

```
DBMS_HS_PASSTHROUGH.BIND_INOUT_VARIABLE (
   c        IN     BINARY_INTEGER NOT NULL,
   pos      IN     BINARY_INTEGER NOT NULL,
   val      IN OUT RAW,
   name     IN     VARCHAR2);
```

Parameters

Table 17–12 BIND_INOUT_VARIABLE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed' using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable in the SQL statement: Starts at 1.
val	This value is used for two purposes: - To provide the IN value before the SQL statement is run. - To determine the size of the out value.
name	(Optional) Name the bind variable. For example, in SELECT * FROM emp WHERE ename=:ename, the position of the bind variable :ename is 1, the name is :ename. This parameter can be used if the non-Oracle system supports "named binds" instead of positional binds. Passing the position is still required.

Exceptions

Table 17–13 BIND_INOUT_VARIABLE_RAW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

```
Purity level defined : WNDS, RNDS
```

CLOSE_CURSOR Procedure

This function closes the cursor and releases associated memory after the SQL statement has been run at the non-Oracle system. If the cursor was not open, then the operation is a "no operation".

Syntax

```
DBMS_HS_PASSTHROUGH.CLOSE_CURSOR (
   c IN BINARY_INTEGER NOT NULL);
```

Parameters

Table 17–14 CLOSE_CURSOR Procedure Parameters

Parameter	Description
c	Cursor to be released.

Exceptions

Table 17–15 CLOSE_CURSOR Procedure Exceptions

Exception	Description
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

Purity level defined : WNDS, RNDS

EXECUTE_IMMEDIATE Procedure

This function runs a SQL statement immediately. Any valid SQL command except SELECT can be run immediately. The statement must not contain any bind variables. The statement is passed in as a VARCHAR2 in the argument. Internally the SQL statement is run using the PASSTHROUGH SQL protocol sequence of OPEN_CURSOR, PARSE, EXECUTE_NON_QUERY, CLOSE_CURSOR.

Syntax

```
DBMS_HS_PASSTHROUGH.EXECUTE_IMMEDIATE (
   S IN VARCHAR2 NOT NULL)
RETURN BINARY_INTEGER;
```

Parameters

Table 17–16 EXECUTE_IMMEDIATE Procedure Parameters

Parameter	Description
s	VARCHAR2 variable with the statement to be executed immediately.

Returns

The number of rows affected by the execution of the SQL statement.

Exceptions

Table 17–17 EXECUTE_IMMEDIATE Procedure Exceptions

Exception	Description
ORA-28551	SQL statement is invalid.
ORA-28544	Max open cursors.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

EXECUTE_NON_QUERY Function

This function runs a SQL statement. The SQL statement cannot be a SELECT statement. A cursor has to be open and the SQL statement has to be parsed before the SQL statement can be run.

Syntax

```
DBMS_HS_PASSTHROUGH.EXECUTE_NON_QUERY (
   c IN BINARY_INTEGER NOT NULL)
  RETURN BINARY_INTEGER;
```

Parameters

Table 17–18 EXECUTE_NON_QUERY Function Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.

Returns

The number of rows affected by the SQL statement in the non-Oracle system

Exceptions

Table 17–19 EXECUTE_NON_QUERY Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	BIND_VARIABLE procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28555	A NULL value was passed for a NOT NULL parameter.

FETCH_ROW Function

This function fetches rows from a result set. The result set is defined with a SQL SELECT statement. When there are no more rows to be fetched, the exception NO_DATA_FOUND is raised. Before the rows can be fetched, a cursor has to be opened, and the SQL statement has to be parsed.

Syntax

```
DBMS_HS_PASSTHROUGH.FETCH_ROW (
   c       IN BINARY_INTEGER NOT NULL,
   first   IN BOOLEAN)
  RETURN BINARY_INTEGER;
```

Parameters

Table 17–20 FETCH_ROW Function Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
first	(Optional) Reexecutes SELECT statement. Possible values: - TRUE: reexecute SELECT statement. - FALSE: fetch the next row, or if run for the first time, then execute and fetch rows (default).

Returns

The returns the number of rows fetched. The function returns "0" if the last row was already fetched.

Exceptions

Table 17–21 FETCH_ROW Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

```
Purity level defined : WNDS
```

GET_VALUE Procedure

This procedure has two purposes:

- It retrieves the select list items of SELECT statements, after a row has been fetched.
- It retrieves the OUT bind values, after the SQL statement has been run.

Syntax

```
DBMS_HS_PASSTHROUGH.GET_VALUE (
   c      IN  BINARY_INTEGER NOT NULL,
   pos    IN  BINARY_INTEGER NOT NULL,
   val    OUT <dty>);
```

Where <dty> is either DATE, NUMBER, or VARCHAR2

> **See Also:** For retrieving values of datatype RAW, see GET_VALUE_RAW Procedure on page 17-15.

Parameters

Table 17–22 GET_VALUE Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable or select list item in the SQL statement: Starts at 1.
val	Variable in which the OUT bind variable or select list item stores its value.

Exceptions

Table 17–23 GET_VALUE Procedure Exceptions

Exception	Description
ORA-1403	Returns NO_DATA_FOUND exception when running the GET_VALUE after the last row was fetched (i.e., FETCH_ROW returned "0").
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

Purity level defined : WNDS

GET_VALUE_RAW Procedure

This procedure is similar to GET_VALUE, but for datatype RAW.

Syntax

```
DBMS_HS_PASSTHROUGH.GET_VALUE_RAW (
   c      IN  BINARY_INTEGER NOT NULL,
   pos    IN  BINARY_INTEGER NOT NULL,
   val    OUT RAW);
```

Parameters

Table 17–24 GET_VALUE_RAW Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened and parsed, using the routines OPEN_CURSOR and PARSE respectively.
pos	Position of the bind variable or select list item in the SQL statement: Starts at 1.
val	Variable in which the OUT bind variable or select list item stores its value.

Exceptions

Table 17–25 GET_VALUE_RAW Procedure Exceptions

Exception	Description
ORA-1403	Returns NO_DATA_FOUND exception when running the GET_VALUE after the last row was fetched (i.e., FETCH_ROW returned "0").
ORA-28550	The cursor passed is invalid.
ORA-28552	Procedure is not run in right order. (Did you first open the cursor and parse the SQL statement?)
ORA-28553	The position of the bind variable is out of range.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

```
Purity level defined : WNDS
```

OPEN_CURSOR Function

This function opens a cursor for running a pass-through SQL statement at the non-Oracle system. This function must be called for any type of SQL statement

The function returns a cursor, which must be used in subsequent calls. This call allocates memory. To deallocate the associated memory, call the procedure CLOSE_CURSOR.

Syntax

```
DBMS_HS_PASSTHROUGH.OPEN_CURSOR
  RETURN BINARY_INTEGER;
```

Returns

The cursor to be used on subsequent procedure and function calls.

Exceptions

Table 17–26 OPEN_CURSOR Function Exceptions

Exception	Description
ORA-28554	Maximum number of open cursor has been exceeded. Increase Heterogeneous Services' OPEN_CURSORS initialization parameter.

Pragmas

```
Purity level defined : WNDS, RNDS
```

PARSE Procedure

This procedure parses SQL statement at non-Oracle system.

Syntax

```
DBMS_HS_PASSTHROUGH.GET_VALUE_RAW (
   c       IN  BINARY_INTEGER NOT NULL,
   stmt    IN  VARCHAR2       NOT NULL);
```

Parameters

Table 17–27 PARSE Procedure Parameters

Parameter	Description
c	Cursor associated with the pass-through SQL statement. Cursor must be opened using function OPEN_CURSOR.
stmt	Statement to be parsed.

Exceptions

Table 17–28 GET_VALUE Procedure Exceptions

Exception	Description
ORA-28550	The cursor passed is invalid.
ORA-28551	SQL statement is illegal.
ORA-28555	A NULL value was passed for a NOT NULL parameter.

Pragmas

```
Purity level defined : WNDS, RNDS
```

18

DBMS_IOT

The DBMS_IOT package creates a table into which references to the chained rows for an index organized table can be placed using the ANALYZE command. It can also create an exception table into which rows of an index-organized table that violate a constraint can be placed during the enable_constraint operation.

This chapter discusses the following topics:

Summary of DBMS_IOT Subprograms

Table 18–1 DBMS_IOT Package Subprograms

Subprogram	Description
"BUILD_CHAIN_ROWS_TABLE Procedure" on page 18-2	Creates a table into which references to the chained rows for an index-organized table can be placed using the ANALYZE command.
"BUILD_EXCEPTIONS_TABLE Procedure" on page 18-3	Creates an exception table into which rows of an index-organized table that violate a constraint can be placed during the enable_constraint operation.

BUILD_CHAIN_ROWS_TABLE Procedure

The BUILD_CHAIN_ROWS_TABLE procedure creates a table into which references to the chained rows for an index-organized table can be placed using the ANALYZE command.

Syntax

```
DBMS_IOT.BUILD_CHAIN_ROWS_TABLE (
   owner               IN VARCHAR2,
   iot_name            IN VARCHAR2,
   chainrow_table_name IN VARCHAR2 default 'IOT_CHAINED_ROWS');
```

Parameters

Table 18–2 BUILD_CHAIN_ROWS_TABLE Procedure Parameters

Parameter	Description
owner	Owner of the index-organized table.
iot_name	Index-organized table name.
chainrow_table_name	Intended name for the chained-rows table.

Example

```
CREATE TABLE l(a char(16),b char(16), c char(16), d char(240),
PRIMARY KEY(a,b,c)) ORGANIZATION INDEX pctthreshold 10 overflow;
EXECUTE DBMS_IOT.BUILD_CHAIN_ROWS_TABLE('SYS','L','LC');
```

A chained-row table is created with the following columns:

```
Column Name                    Null?    Type
------------------------------ -------- ----
OWNER_NAME                              VARCHAR2(30)
TABLE_NAME                              VARCHAR2(30)
CLUSTER_NAME                            VARCHAR2(30)
PARTITION_NAME                          VARCHAR2(30)
SUBPARTITION_NAME                       VARCHAR2(30)
HEAD_ROWID                              ROWID
TIMESTAMP                               DATE
A                                       CHAR(16)
B                                       CHAR(16)
C                                       CHAR(16)
```

BUILD_EXCEPTIONS_TABLE Procedure

The BUILD_EXCEPTIONS_TABLE procedure creates an exception table into which rows of an index-organized table that violate a constraint can be placed during the enable_constraint operation.

A separate chained-rows table and an exception table should be created for each index-organized table to accommodate its primary key.

> **Note:** This form of chained-rows table and exception table are required only for servers running with Oracle8, Release 8.0 compatibility.

Syntax

```
DBMS_IOT.BUILD_EXCEPTIONS_TABLE (
   owner                 IN VARCHAR2,
   iot_name              IN VARCHAR2,
   exceptions_table_name IN VARCHAR2 default 'IOT_EXCEPTIONS');
```

Parameters

Table 18–3 BUILD_EXCEPTIONS_TABLE Procedure Parameters

Parameter	Description
owner	Owner of the index-organized table.
iot_name	Index-organized table name.
exceptions_table_name	Intended name for exception-table.

Example

```
EXECUTE DBMS_IOT.BUILD_EXCEPTIONS_TABLE('SYS','L','LE');
```

An exception table for the above index-organized table with the following columns:

```
Column Name                    Null?    Type
------------------------------ -------- ----
ROW_ID                                  VARCHAR2(30)
OWNER                                   VARCHAR2(30)
TABLE_NAME                              VARCHAR2(30)
CONSTRAINT                              VARCHAR2(30)
A                                       CHAR(16)
B                                       CHAR(16)
C                                       CHAR(16)
```

19

DBMS_JOB

DBMS_JOB subprograms schedule and manage jobs in the job queue.

> **See Also:** For more information on the DBMS_JOB package and the job queue, see *Oracle9i Database Administrator's Guide*.

This chapter discusses the following topics:

- Requirements
- Using the DBMS_JOB Package with Oracle Real Application Clusters
- Summary of DBMS_JOB Subprograms

Requirements

There are no database privileges associated with jobs. DBMS_JOB does not allow a user to touch any jobs except their own.

Using the DBMS_JOB Package with Oracle Real Application Clusters

For this example, a constant in DBMS_JOB indicates "no mapping" among jobs and instances, that is, jobs can be executed by any instance.

DBMS_JOB.SUBMIT

To submit a job to the job queue, use the following syntax:

```
DBMS_JOB.SUBMIT( JOB OUT BINARY_INTEGER,
WHAT IN VARCHAR2, NEXT_DATE IN DATE DEFAULTSYSDATE,
INTERVAL IN VARCHAR2 DEFAULT 'NULL',
NO_PARSE IN BOOLEAN DEFAULT FALSE,
INSTANCE IN BINARY_INTEGER DEFAULT ANY_INSTANCE,
FORCE IN BOOLEAN DEFAULT FALSE)
```

Use the parameters INSTANCE and FORCE to control job and instance affinity. The default value of INSTANCE is 0 (zero) to indicate that any instance can execute the job. To run the job on a certain instance, specify the INSTANCE value. Oracle displays error ORA-23319 if the INSTANCE value is a negative number or NULL.

The FORCE parameter defaults to FALSE. If force is TRUE, any positive integer is acceptable as the job instance. If FORCE is FALSE, the specified instance must be running, or Oracle displays error number ORA-23428.

DBMS_JOB.INSTANCE

To assign a particular instance to execute a job, use the following syntax:

```
DBMS_JOB.INSTANCE(  JOB IN BINARY_INTEGER,
INSTANCE IN BINARY_INTEGER,
FORCE IN BOOLEAN DEFAULT FALSE)
```

The FORCE parameter in this example defaults to FALSE. If the instance value is 0 (zero), job affinity is altered and any available instance can execute the job despite the value of force. If the INSTANCE value is positive and the FORCE parameter is FALSE, job affinity is altered only if the specified instance is running, or Oracle displays error ORA-23428.

If the FORCE parameter is TRUE, any positive integer is acceptable as the job instance and the job affinity is altered. Oracle displays error ORA-23319 if the INSTANCE value is negative or NULL.

DBMS_JOB.CHANGE

To alter user-definable parameters associated with a job, use the following syntax:

```
DBMS_JOB.CHANGE(  JOB IN BINARY_INTEGER,
WHAT IN VARCHAR2 DEFAULT NULL,
NEXT_DATE IN DATE DEFAULT NULL,
INTERVAL IN VARCHAR2 DEFAULT NULL,
INSTANCE IN BINARY_INTEGER DEFAULT NULL,
 FORCE IN BOOLEAN DEFAULT FALSE )
```

Two parameters, INSTANCE and FORCE, appear in this example. The default value of INSTANCE is NULL indicating that job affinity will not change.

The default value of FORCE is FALSE. Oracle displays error ORA-23428 if the specified instance is not running and error ORA-23319 if the INSTANCE number is negative.

DBMS_JOB.RUN

The FORCE parameter for DBMS_JOB.RUN defaults to FALSE. If force is TRUE, instance affinity is irrelevant for running jobs in the foreground process. If force is FALSE, the job can run in the foreground only in the specified instance. Oracle displays error ORA-23428 if force is FALSE and the connected instance is the incorrect instance.

```
DBMS_JOB.RUN( JOB IN BINARY_INTEGER,
FORCE IN BOOLEAN DEFAULT FALSE)
```

> **See Also:** For more information about Oracle Real Application Clusters, please refer to *Oracle9i Real Application Clusters Concepts.*

Summary of DBMS_JOB Subprograms

Table 19–1 DBMS_JOB Package Subprograms

Subprogram	Description
"SUBMIT Procedure" on page 19-4	Submits a new job to the job queue.

Table 19–1 DBMS_JOB Package Subprograms (Cont.)

Subprogram	Description
"REMOVE Procedure" on page 19-6	Removes specified job from the job queue.
"CHANGE Procedure" on page 19-6	Alters any of the user-definable parameters associated with a job.
"WHAT Procedure" on page 19-7	Alters the job description for a specified job.
"NEXT_DATE Procedure" on page 19-8	Alters the next execution time for a specified job.
"INSTANCE Procedure" on page 19-8	Assigns a job to be run by a instance.
"INTERVAL Procedure" on page 19-9	Alters the interval between executions for a specified job.
"BROKEN Procedure" on page 19-10	Disables job execution.
"RUN Procedure" on page 19-11	Forces a specified job to run.
"USER_EXPORT Procedure" on page 19-11	Recreates a given job for export.
"USER_EXPORT Procedure" on page 19-12	Recreates a given job for export with instance affinity.

SUBMIT Procedure

This procedure submits a new job. It chooses the job from the sequence `sys.jobseq`.

Syntax

```
DBMS_JOB.SUBMIT (
   job       OUT BINARY_INTEGER,
   what      IN  VARCHAR2,
   next_date IN  DATE DEFAULT sysdate,
   interval  IN  VARCHAR2 DEFAULT 'null',
   no_parse  IN  BOOLEAN DEFAULT FALSE,
   instance  IN  BINARY_INTEGER DEFAULT any_instance,
   force     IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 19–2 SUBMIT Procedure Parameters

Parameter	Description
job	Number of the job being run.
what	PL/SQL procedure to run.
next_date	Next date when the job will be run.
interval	Date function that calculates the next time to run the job. The default is NULL. This must evaluate to a either a future point in time or NULL.
no_parse	A flag. The default is FALSE. If this is set to FALSE, then Oracle parses the procedure associated with the job. If this is set to TRUE, then Oracle parses the procedure associated with the job the first time that the job is run. For example, if you want to submit a job before you have created the tables associated with the job, then set this to TRUE.
instance	When a job is submitted, specifies which instance can run the job.
force	If this is TRUE, then any positive integer is acceptable as the job instance. If this is FALSE (the default), then the specified instance must be running; otherwise the routine raises an exception.

Usage Notes

The parameters `instance` and `force` are added for job queue affinity. Job queue affinity gives users the ability to indicate whether a particular instance or any instance can run a submitted job.

Example

This submits a new job to the job queue. The job calls the procedure DBMS_DDL.ANALYZE_OBJECT to generate optimizer statistics for the table DQUON.ACCOUNTS. The statistics are based on a sample of half the rows of the ACCOUNTS table. The job is run every 24 hours:

```
VARIABLE jobno number;
BEGIN
   DBMS_JOB.SUBMIT(:jobno,
      'dbms_ddl.analyze_object(''TABLE'',
      ''DQUON'', ''ACCOUNTS'',
```

```
      ''ESTIMATE'', NULL, 50);'
      SYSDATE, 'SYSDATE + 1');
   commit;
END;
/
Statement processed.
print jobno
JOBNO
----------
14144
```

REMOVE Procedure

This procedure removes an existing job from the job queue. This currently does not stop a running job.

Syntax

```
DBMS_JOB.REMOVE (
   job       IN  BINARY_INTEGER );
```

Parameters

Table 19–3 REMOVE Procedure Parameters

Parameter	Description
job	Number of the job being run.

Example

```
EXECUTE DBMS_JOB.REMOVE(14144);
```

CHANGE Procedure

This procedure changes any of the user-settable fields in a job.

Syntax

```
DBMS_JOB.CHANGE (
   job       IN  BINARY_INTEGER,
   what      IN  VARCHAR2,
   next_date IN  DATE,
   interval  IN  VARCHAR2,
   instance  IN  BINARY_INTEGER DEFAULT NULL,
```

```
   force     IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 19–4 CHANGE Procedure Parameters

Parameter	Description
job	Number of the job being run.
what	PL/SQL procedure to run.
next_date	Date of the next refresh.
interval	Date function; evaluated immediately before the job starts running.
instance	When a job is submitted, specifies which instance can run the job. This defaults to NULL, which indicates that instance affinity is not changed.
force	If this is FALSE, then the specified instance (to which the instance number change) must be running. Otherwise, the routine raises an exception. If this is TRUE, then any positive integer is acceptable as the job instance.

Usage Notes

The parameters `instance` and `force` are added for job queue affinity. Job queue affinity gives users the ability to indicate whether a particular instance or any instance can run a submitted job.

If the parameters `what`, `next_date`, or `interval` are `NULL`, then leave that value as it is.

Example

```
EXECUTE DBMS_JOB.CHANGE(14144, null, null, 'sysdate+3');
```

WHAT Procedure

This procedure changes what an existing job does, and replaces its environment.

Syntax

```
DBMS_JOB.WHAT (
   job       IN  BINARY_INTEGER,
```

```
   what      IN  VARCHAR2);
```

Parameters

Table 19–5 WHAT Procedure Parameters

Parameter	Description
job	Number of the job being run.
what	PL/SQL procedure to run.

Some legal values of what (assuming the routines exist) are:

- `'myproc( ''10-JAN-82'', next_date, broken);'`
- `'scott.emppackage.give_raise( ''JENKINS'', 30000.00);'`
- `'dbms_job.remove(job);'`

NEXT_DATE Procedure

This procedure changes when an existing job next runs.

Syntax

```
DBMS_JOB.NEXT_DATE (
   job       IN  BINARY_INTEGER,
   next_date IN  DATE);
```

Parameters

Table 19–6 NEXT_DATE Procedure Parameters

Parameter	Description
job	Number of the job being run.
next_date	Date of the next refresh: it is when the job will be automatically run, assuming there are background processes attempting to run it.

INSTANCE Procedure

This procedure changes job instance affinity.

Syntax

```
DBMS_JOB.INSTANCE (
   job        IN BINARY_INTEGER,
   instance   IN BINARY_INTEGER,
   force      IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 19–7 INSTANCE Procedure Parameters

Parameter	Description
job	Number of the job being run.
instance	When a job is submitted, a user can specify which instance can run the job.
force	If this is TRUE, then any positive integer is acceptable as the job instance. If this is FALSE (the default), then the specified instance must be running; otherwise the routine raises an exception.

INTERVAL Procedure

This procedure changes how often a job runs.

Syntax

```
DBMS_JOB.INTERVAL (
   job       IN  BINARY_INTEGER,
   interval  IN  VARCHAR2);
```

Parameters

Table 19–8 INTERVAL Procedure Parameters

Parameter	Description
job	Number of the job being run.
interval	Date function, evaluated immediately before the job starts running.

Usage Notes

If the job completes successfully, then this new date is placed in `next_date`. `interval` is evaluated by plugging it into the statement select `interval` into `next_date` from dual;

The `interval` parameter must evaluate to a time in the future. Legal intervals include:

`'sysdate + 7'`	Run once a week.
`'next_day(sysdate,''TUESDAY'')'`	Run once every Tuesday.
`'null'`	Run only once.

If `interval` evaluates to `NULL` and if a job completes successfully, then the job is automatically deleted from the queue.

BROKEN Procedure

This procedure sets the broken flag. Broken jobs are never run.

Syntax

```
DBMS_JOB.BROKEN (
   job       IN  BINARY_INTEGER,
   broken    IN  BOOLEAN,
   next_date IN  DATE DEFAULT SYSDATE);
```

Parameters

Table 19–9 Broken Procedure Parameters

Parameter	Description
job	Number of the job being run.
broken	Job broken: `IN` value is `FALSE`.
next_data	Date of the next refresh.

> **Note:** If you set job as broken while it is running, Oracle resets the job's status to normal after the job completes. Therefore, only execute this procedure for jobs that are not running.

RUN Procedure

This procedure runs job JOB now. It runs it even if it is broken.

Running the job recomputes next_date. See view user_jobs.

Syntax

```
DBMS_JOB.RUN (
   job       IN  BINARY_INTEGER,
   force     IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 19–10 Run Procedure Parameters

Parameter	Description
job	Number of the job being run.
force	If this is TRUE, then instance affinity is irrelevant for running jobs in the foreground process. If this is FALSE, then the job can be run in the foreground only in the specified instance.

Example

```
EXECUTE DBMS_JOB.RUN(14144);
```

Caution: This reinitializes the current session's packages.

Exceptions

An exception is raised if force is FALSE, and if the connected instance is the wrong one.

USER_EXPORT Procedure

This procedure produces the text of a call to recreate the given job.

Syntax

```
DBMS_JOB.USER_EXPORT (
   job    IN     BINARY_INTEGER,
   mycall IN OUT VARCHAR2);
```

Parameters

Table 19–11 USER_EXPORT Procedure Parameter

Parameter	Description
job	Number of the job being run.
mycall	Text of a call to recreate the given job.

USER_EXPORT Procedure

This procedure alters instance affinity (8*i* and above) and preserves the compatibility.

Syntax

```
DBMS_JOB.USER_EXPORT (
   job      IN     BINARY_INTEGER,
   mycall   IN OUT VARCHAR2,
   myinst   IN OUT VARCHAR2);
```

Parameters

Table 19–12 USER_EXPORT Procedure Parameters

Parameter	Description
job	Number of the job being run.
mycall	Text of a call to recreate a given job.
myinst	Text of a call to alter instance affinity.

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DBMS_LDAP

DBMS_LDAP provides functions and procedures to access data from LDAP servers. To use DBMS_LDAP, you must first load it into the database. Use the catldap.sql script located in the $ORACLE_HOME/rdbms/admin directory.

> **See Also:** *Oracle Internet Directory Application Developer's Guide* for more information on using DBMS_LDAP.

This chapter discusses the following topics:

Exception Summary

Table 20–1 lists the exceptions generated by DBMS_LDAP.

Table 20–1 DBMS_LDAP Exception Summary

Exception Name	Oracle Error	Cause of Exception
general_error	31202	Raised anytime an error is encountered that does not have a specific PL/SQL exception associated with it. The error string contains the description of the problem in the local language of the user.
init_failed	31203	Raised by DBMS_LDAP.init if there are some problems.
invalid_session	31204	Raised by all functions and procedures in the DBMS_LDAP package if they are passed an invalid session handle.
invalid_auth_method	31205	Raised by DBMS_LDAP.bind_s if the authentication method requested is not supported.
invalid_search_scope	31206	Raised by all of the search functions if the scope of the search is invalid.
invalid_search_time_val	31207	Raised by time based search function: DBMS_LDAP.search_st if it is given an invalid value for the time limit.
invalid_message	31208	Raised by all functions that iterate through a result-set for getting entries from a search operation if the message handle given to them is invalid.
count_entry_error	31209	Raised by DBMS_LDAP.count_entries if it cannot count the entries in a given result set.
get_dn_error	31210	Raised by DBMS_LDAP.get_dn if the DN of the entry it is retrieving is NULL.
invalid_entry_dn	31211	Raised by all the functions that modify/add/rename an entry if they are presented with an invalid entry DN.
invalid_mod_array	31212	Raised by all functions that take a modification array as an argument if they are given an invalid modification array.
invalid_mod_option	31213	Raised by DBMS_LDAP.populate_mod_array if the modification option given is anything other than MOD_ADD, MOD_DELETE or MOD_REPLACE.
invalid_mod_type	31214	Raised by DBMS_LDAP.populate_mod_array if the attribute type that is being modified is NULL.
invalid_mod_value	31215	Raised by DBMS_LDAP.populate_mod_array if the modification value parameter for a given attribute is NULL.
invalid_rdn	31216	Raised by all functions and procedures that expect a valid RDN if the value of the RDN is NULL.

Table 20–1 DBMS_LDAP Exception Summary

Exception Name	Oracle Error	Cause of Exception
invalid_ newparent	31217	Raised by DBMS_LDAP.rename_s if the new parent of an entry being renamed is NULL.
invalid_ deleteoldrdn	31218	Raised by DBMS_LDAP.rename_s if the deleteoldrdn parameter is invalid.
invalid_ notypes	31219	Raised by DBMS_LDAP.explode_dn if the notypes parameter is invalid.
invalid_ssl_ wallet_loc	31220	Raised by DBMS_LDAP.open_ssl if the wallet location is NULL but the SSL authentication mode requires a valid wallet.
invalid_ssl_ wallet_ password	31221	Raised by DBMS_LDAP.open_ssl if the wallet password given is NULL.
invalid_ssl_ auth_mode	31222	Raised by DBMS_LDAP.open_ssl if the SSL authentication mode is not one of 1, 2, or 3.
mts_mode_not_ supported	31398	Raised by the functions init, bind_s or simple_bind_s if they are ever invoked in MTS mode.

Summary of Data Types

The DBMS_LDAP package uses the data types shown in Table 20–2.

Table 20–2 DBMS_LDAP Summary of Data Types

Data-Type	Purpose
SESSION	Holds the handle of the LDAP session. Nearly all of the functions in the API require a valid LDAP session to work.
MESSAGE	Holds a handle to the message retrieved from the result set. This is used by all functions that work with entries, attributes, and values.
MOD_ARRAY	Holds a handle into the array of modifications being passed into either modify_s or add_s.
TIMEVAL	Passes time limit information to the LDAP API functions that require a time limit.
BER_ELEMENT	Holds a handle to a BER structure used for decoding incoming messages.

Table 20–2 DBMS_LDAP Summary of Data Types

Data-Type	Purpose
STRING_COLLECTION	Holds a list of VARCHAR2 strings which can be passed on to the LDAP server.
BINVAL_COLLECTION	Holds a list of RAW data which represent binary data.
BERVAL_COLLECTION	Holds a list of BERVAL values that are used for populating a modification array.

Summary of DBMS_LDAP Subprograms

Table 20–3 DBMS_LDAP Subprograms

Function or Procedure	Description
"init Function" on page 20-6	Initializes a session with an LDAP server. This actually establishes a connection with the LDAP server.
"simple_bind_s Function" on page 20-8	Performs simple username / password based authentication to the directory server.
"bind_s Function" on page 20-9	Performs complex authentication to the directory server.
"unbind_s Function" on page 20-12	Closes an active LDAP session.
"compare_s Function" on page 20-13	Tests if a particular attribute in a particular entry has a particular value.
"search_s Function" on page 20-15	Performs a synchronous search in the LDAP server. It returns control to the PL / SQL environment only after all of the search results have been sent by the server or if the search request is timed out by the server.
"search_st Function" on page 20-17	Performs a synchonous search in the LDAP server with a client side timeout. It returns control to the PL / SQL environment only after all of the search results have been sent by the server or if the search request is timed out by the client or the server.
"first_entry Function" on page 20-20	Retrieves the first entry in the result set returned by either search_s or search_st.
"next_entry Function" on page 20-21	Iterates to the next entry in the result set of a search operation.

Table 20–3 DBMS_LDAP Subprograms (Cont.)

Function or Procedure	Description
"count_entries Function" on page 20-23	Counts the number of entries in the result set. It can also be used to count the number of entries remaining during a traversal of the result set using a combination of the functions `first_entry` and `next_entry`.
"first_attribute Function" on page 20-25	Fetches the first attribute of a given entry in the result set.
"next_attribute Function" on page 20-27	Fetches the next attribute of a given entry in the result set.
"get_dn Function" on page 20-29	Retrieves the X.500 distinguished name of given entry in the result set.
"get_values Function" on page 20-30	Retrieves all of the values associated for a given attribute in a given entry.
"get_values_len Function" on page 20-32	Retrieves values of attributes that have a Binary syntax.
"delete_s Function" on page 20-34	Removes a leaf entry in the LDAP Directory Information Tree.
"modrdn2_s Function" on page 20-35	Renames the relative distinguished name of an entry.
"err2string Function" on page 20-37	Converta an LDAP error code to string in the local language in which the API is operating.
"create_mod_array Function" on page 20-38	Allocates memory for array modification entries that are applied to an entry using the `modify_s` functions.
"populate_mod_array (String Version) Procedure" on page 20-39	Populates one set of attribute information for add or modify operations.
"populate_mod_array (Binary Version) Procedure" on page 20-41	Populates one set of attribute information for add or modify operations. This procedure call has to happen after `DBMS_LDAP.create_mod_array` is called.
"modify_s Function" on page 20-43	Performs a sychronous modification of an existing LDAP directory entry.
"add_s Function" on page 20-45	Adds a new entry to the LDAP directory synchronously. Before calling `add_s`, we have to call `DBMS_LDAP.creat_mod_array` and `DBMS_LDAP.populate_mod_array` first.
"free_mod_array Procedure" on page 20-47	Frees the memory allocated by `DBMS_LDAP.create_mod_array`.

Table 20–3 DBMS_LDAP Subprograms (Cont.)

Function or Procedure	Description
"count_values Function" on page 20-48	Counts the number of values returned by DBMS_LDAP.get_values.
"count_values_len Function" on page 20-49	Counts the number of values returned by DBMS_LDAP.get_values_len.
"rename_s Function" on page 20-50	Renames an LDAP entry synchronously.
"explode_dn Function" on page 20-52	Breaks a DN up into its components.
"open_ssl Function" on page 20-52	Establishes an SSL (Secure Sockets Layer) connection over an existing LDAP connection.

init Function

This function initializes a session with an LDAP server. This actually establishes a connection with the LDAP server.

Syntax

```
DBMS_LDAP.init (
    hostname  IN VARCHAR2,
    portnum   IN PLS_INTEGER )
RETURN SESSION;
```

Parameters

Table 20–4 init Function Parameters

Parameter	Description
hostname (IN)	Contains a space-separated list of host names or dotted strings representing the IP address of hosts running an LDAP server. Each host name in the list may include a port number, which is separated from the host with a colon (:). The hosts are tried in the order listed, stopping with the first one to which a successful connection is made.
portnum (IN)	Contains the TCP port number to connect to. If a host includes a port number, this parameter is ignored. If this parameter is not specified and the host name does not contain the port number, the default port number 389 is assumed.

Return Values

Table 20–5 init Function Return Values

Value	Description
SESSION	A handle to an LDAP session that can be used for further calls into the API.

Exceptions

Table 20–6 init Function Exceptions

Exception	Description
init_failed	Raised when there is a problem contacting the LDAP server.
ts_mode_not_ supported	Raised if DBMS_LDAP.init is invoked from a user session that is logged onto the database using an MTS service.
general_error	For all other errors. The error string associated with the exception describes the error in detail.

Usage Notes

DBMS_LDAP.init is the first function that should be called in order to establish a session to the LDAP server. DBMS_LDAP.init returns a session handle, a pointer to an opaque structure that must be passed to subsequent calls pertaining to the session. This routine returns NULL and raises the INIT_FAILED exception if the session cannot be initialized. Subsequent to the call to init, the connection must be authenticated using DBMS_LDAP.bind_s or DBMS_LDAP.simple_bind_s.

See Also:

- "simple_bind_s Function" on page 20-8
- "bind_s Function" on page 20-9

simple_bind_s Function

This function can be used to perform simple username/password based authentication to the directory server.

Syntax

```
DBMS_LDAP.simple_bind_s (
    ld  IN SESSION,
    dn  IN VARCHAR2,
    passwd  IN VARCHAR2)
RETURN PLS_INTEGER;
```

Parameters

Table 20–7 simple_bind_s Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
dn (IN)	The distinguished name of the user under which you are trying to login.
passwd (IN)	A text string containing the password.

Return Values

Table 20–8 simple_bind_s Function Return Values

Value	Description
PLS_INTEGER	DBMS_LDAP SUCCESS on a successful completion. If there was a problem, one of the exceptions in Table 20–9 is raised.

Exceptions

Table 20–9 simple_bind_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
mts_mode_not_ supported	Raised if DBMS_LDAP.init is invoked from a user session that is logged onto as an MTS service.
general_error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

DBMS_LDAP.simple_bind_s can be used to authenticate a user whose directory distinguished name and directory password are known. It can be called only after a valid LDAP session handle is obtained from a call to DBMS_LDAP.init.

bind_s Function

This function performs complex authentication to the directory server.

Syntax

```
DBMS_LDAP.bind_s (
```

```
    ld  IN SESSION,
    dn  IN VARCHAR2,
    passwd  IN VARCHAR2,
    meth  IN PLS_INTEGER )
RETURN PLS_INTEGER;
```

Parameters

Table 20–10 bind_s Function Parameters

Parameter	Description
ld	A valid LDAP session handle.
dn	The distinguished name of the user under which you are trying to login.
cred	A text string containing the credentials used for authentication.
meth	The authentication method.

Return Values

Table 20–11 bind_s Function Return Values

Value	Description
PLS_INTEGER	DBMS_LDAP.SUCCESS on a successful completion. One of the exceptions in Table 20–12 is raised if there is a problem.

Exceptions

Table 20–12 bind_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_auth_method	Raised if the authentication method requested is not supported.
mts_mode_not_ supported	Raised if invoked from a user session that is logged onto an MTS service.
general_error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

DBMS_LDAP.bind_s can be used to authenticate a user. It can be called only after a valid LDAP session handle is obtained from a call to DBMS_LDAP.init.

See Also:

- "init Function" on page 20-6
- "simple_bind_s Function" on page 20-8

unbind_s Function

This function closes an active LDAP session.

Syntax

```
DBMS_LDAP.unbind_s (
    ld  IN SESSION )
RETURN PLS_INTEGER;
```

Parameters

Table 20–13 unbind_s Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.

Return Values

Table 20–14 unbind_s Function Return Values

Value	Description
PLS_INTEGER	SUCCESS on proper completion. One of the exceptions listed in Table 20–15 is raised otherwise.

Exceptions

Table 20–15 unbind_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
general error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

The unbind_s function sends an unbind request to the server, closes all open connections associated with the LDAP session, and disposes of all resources

associated with the session handle before returning. After a call to this function, the session handle ld is invalid and it is illegal to make any further LDAP API calls using ld.

See Also:

- "simple_bind_s Function" on page 20-8
- "bind_s Function" on page 20-9

compare_s Function

This function tests whether a particular attribute in a particular entry has a particular value.

Syntax

```
DBMS_LDAP.compare_s (
    ld  IN SESSION,
    dn  IN VARCHAR2,
    attr  IN VARCHAR2,
    value  IN VARCHAR2)
RETURN PLS_INTEGER;
```

Parameters

Table 20–16 compare_s Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle
dn (IN)	The name of the entry to compare against
attr (IN)	The attribute to compare against.
value (IN)	A string attribute value to compare against

Return Values

Table 20–17 compare_s Function Return Values

Value	Description
PLS_INTEGER	COMPARE_TRUE is the given attribute that has a matching value. COMPARE_FALSE if the value of the attribute does not match the value given.

Exceptions

Table 20–18 compare_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
general_error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

The function compare_s can be used to assert if the value of a given attribute stored in the directory server matches a certain value.This operation can only be performed on attributes whose syntax definition allows them to be compared. The compare_s function can only be called after a valid LDAP session handle has been obtained from the init function and authenticated using the bind_s or simple_bind_s functions.

See Also: "bind_s Function" on page 20-9.

search_s Function

This function performs a synchronous search in the LDAP server. It returns control to the PL/SQL environment only after all of the search results have been sent by the server or if the search request is timed out by the server.

Syntax

```
FUNCTION search_s  (
    ld  IN SESSION,
    base  IN VARCHAR2,
    scope  IN PLS_INTEGER,
    filter  IN VARCHAR2,
    attrs  IN STRING_COLLECTION,
    attronly  IN PLS_INTEGER,
    res  OUT MESSAGE)
RETURN PLS_INTEGER;
```

Parameters

Table 20–19 search_s Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
base (IN)	The dn of the entry at which to start the search.
scope (IN)	One of SCOPE_BASE (0x00), SCOPE_ONELEVEL (0x01), or SCOPE_SUBTREE (0x02), indicating the scope of the search.
filter (IN)	A character string representing the search filter. The value NULL can be passed to indicate that the filter (objectclass=*) which matches all entries is to be used.
attrs (IN)	A collection of strings indicating which attributes to return for each matching entry. Passing NULL for this parameter causes all available user attributes to be retrieved. The special constant string NO_ATTRS (1.1) can be used as the only string in the array to indicate that no attribute types are returned by the server. The special constant string ALL_USER_ATTRS (*) can be used in the attrs array along with the names of some operational attributes to indicate that all user attributes plus the listed operational attributes are returned.
attrsonly (IN)	A boolean value that must be zero if both attribute types and values are returned, and non-zero if only types are wanted.
res (OUT)	This is a result parameter which will contain the results of the search upon completion of the call. If no results are returned, *res is set to NULL.

Return Values

Table 20–20 search_s Function Return Value

Value	Description
PLS_INTEGER	DBMS_LDAP.SUCCESS if the search operation succeeded. An exception is raised in all other cases.
res (OUT parameter)	If the search succeeded and there are entries, this parameter is set to a NON-NULL value that can be used to iterate through the result set.

Exceptions

Table 20–21 search_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_search_scope	Raised if the search scope is not one of SCOPE_BASE, SCOPE_ONELEVEL, or SCOPE_SUBTREE.
general_error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

This function issues a search operation, and does not return control to the user environment until all of the results have been returned from the server. Entries returned from the search, if any, are contained in the res parameter. This parameter is opaque to the caller. Entries, attributes, values, and so on can be extracted by calling the parsing routines described below.

See Also:

- "search_st Function" on page 20-17
- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21

search_st Function

This function performs a synchronous search in the LDAP server with a client-side timeout. It returns control to the PL/SQL environment only after all of the search results have been sent by the server or if the search request is timed out by the client or the server.

Syntax

```
DBMS_LDAP.search_st (
    ld  IN  SESSION,
    base  IN  VARCHAR2,
    scope  IN  PLS_INTEGER,
    filter  IN  VARCHAR2,
    attrs  IN  STRING_COLLECTION,
    attronly  IN  PLS_INTEGER,
    tv  IN  TIMEVAL,
    res OUT MESSAGE)
```

```
    RETURN PLS_INTEGER;
```

Parameters

Table 20–22 search_st Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
base (IN)	The dn of the entry at which to start the search.
scope (IN)	One of SCOPE_BASE (0x00), SCOPE_ONELEVEL (0x01), or SCOPE_SUBTREE (0x02), indicating the scope of the search.
filter (IN)	A character string representing the search filter. The value NULL can be passed to indicate that the filter (objectclass=*) which matches all entries is to be used.
attrs (IN)	A collection of strings indicating which attributes to return for each matching entry. Passing NULL for this parameter causes all available user attributes to be retrieved. The special constant string NO_ATTRS (1.1) can be used as the only string in the array to indicate that no attribute types are returned by the server. The special constant string ALL_USER_ATTRS (*) can be used in the attrs array along with the names of some operational attributes to indicate that all user attributes plus the listed operational attributes are returned.
attrsonly (IN)	A boolean value that must be zero if both attribute types and values are returned, and non-zero if only types are wanted.
tv (IN)	The timeout value expressed in seconds and microseconds that should be used for this search.
res (OUT)	This is a result parameter that will contain the results of the search upon completion of the call. If no results are returned, *res is set to NULL.

Return Values

Table 20–23 search_st Function Return Values

Value	Description
PLS_INTEGER	DBMS_LDAP.SUCCESS if the search operation succeeded. An exception is raised in all other cases.
res (OUT parameter)	If the search succeeded and there are entries, this parameter is set to a NON_NULL value that can be used to iterate through the result set.

Exceptions

Table 20–24 search_st Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_search_scope	Raised if the search scope is not one of SCOPE_BASE, SCOPE_ONELEVEL or SCOPE_SUBTREE.
invalid_search_time_value	Raised if the time value specified for the timeout is invalid.
general_error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

This function is very similar to DBMS_LDAP.search_s, except that it requires a timeout value.

See Also:

- "search_s Function" on page 20-15
- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21

first_entry Function

This function retrieves the first entry in the result set returned by either search_s or search_st

Syntax

```
DBMS_LDAP.first_entry (
    ld  IN SESSION,
    msg  IN MESSAGE )
RETURN MESSAGE;
```

Parameters

Table 20–25 first_entry Function Parameters

Parameter	Description
`ld (IN)`	A valid LDAP session handle.
`msg (IN)`	The search result obtained by a call to one of the synchronous search routines.

Return Values

Table 20–26 first_entry Return Values

Value	Description
MESSAGE	A handle to the first entry in the list of entries returned from the LDAP server. It is set to `NULL` if there was an error and an exception is raised.

Exceptions

Table 20–27 first_entry Exceptions

Exception	Description
`invalid_session`	Raised if the session handle ld is invalid.
`invalid_message`	Raised if the incoming msg handle is invalid.

Usage Notes

The function `first_entry` should always be the first function used to retrieve the results from a search operation.

See Also:

- "next_entry Function" on page 20-21
- "search_s Function" on page 20-15
- "search_st Function" on page 20-17

next_entry Function

This function iterates to the next entry in the result set of a search operation.

Syntax

```
DBMS_LDAP.next_entry (
    ld  IN SESSION,
    msg  IN MESSAGE )
RETURN MESSAGE;
```

Parameters

Table 20–28 next_entry Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
msg (IN)	The search result, as obtained by a call to one of the synchronous search routines.

Return Values

Table 20–29 next_entry Function Return Values

Value	Description
MESSAGE	A handle to the next entry in the list of entries returned from the LDAP server. It is set to NULL if there was an error and an exception is raised.

Exceptions

Table 20–30 next_entry Function Exceptions

Exception	Description
invalid_session	Raised if the session handle, ld is invalid.
invalid_message	Raised if the incoming msg handle is invalid.

Usage Notes

The function next_entry should always be called after a call to first_entry. Also, the return value of a successful call to next_entry should be used as msg argument used in a subsequent call to next_entry to fetch the next entry in the list.

See Also:

- "search_s Function" on page 20-15
- "search_st Function" on page 20-17
- "first_entry Function" on page 20-20

count_entries Function

This function counts the number of entries in the result set. It can also count the number of entries remaining during a traversal of the result set using a combination of the functions `first_entry` and `next_entry`.

Syntax

```
DBMS_LDAP.count_entries (
    ld  IN SESSION,
    msg  IN MESSAGE )
RETURN PLS_INTEGER;
```

Parameters

Table 20–31 count_entry Function Parameters

Parameter	Description
`ld (IN)`	A valid LDAP session handle
`msg (IN)`	The search result, as obtained by a call to one of the synchronous search routines

Return Values

Table 20–32 count_entry Function Return Values

Value	Description
PLS INTEGER	Non-zero if there are entries in the result set -1 if there was a problem.

Exceptions

Table 20–33 count_entry Function Exceptions

Exception	Description
`invalid_session`	Raised if the session handle ld is invalid.
`invalid_message`	Raised if the incoming msg handle is invalid.
`count_entry_error`	Raised if there was a problem in counting the entries.

Usage Notes

The `count_entries` function returns the number of entries contained in a chain of entries. If an error occurs, such as the `res` parameter being invalid, `-1` is returned. The `count_entries` call can also be used to count the number of entries that remain in a chain if called with a message, entry, or reference returned by `first_message`, `next_message`, `first_entry`, `next_entry`, `first_reference`, and `next_reference`.

See Also:

- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21

first_attribute Function

This function fetches the first attribute of a given entry in the result set.

Syntax

```
DBMS_LDAP.first_attribute (
    ld  IN  SESSION,
    msg  IN  MESSAGE,
    ber_elem  OUT BER_ELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 20–34 first_attribute Function Parameter

Parameter	Description
ld (IN)	A valid LDAP session handle
msg (IN)	The entry whose attributes are to be stepped through, as returned by first_entry or next_entry
ber_elem (OUT)	A handle to a BER ELEMENT that is used to keep track of which attribute in the entry has been read

Return Values

Table 20–35 first_attribute Function Return Values

Value	Description
VARCHAR2	The name of the attribute if it exists. NULL if no attribute exists or if an error occurred.
ber_elem	A handle used by DBMS_LDAP.next_attribute to iterate over all of the attributes

Exceptions

Table 20–36 first_attribute Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_message	Raised if the incoming msg handle is invalid.

Usage Notes

The handle to the BER_ELEMENT returned as a function parameter to first_attribute should be used in the next call to next_attribute to iterate through the various attributes of an entry. The name of the attribute returned from a call to first_attribute can in turn be used in calls to the functions get_values or get_values_len to get the values of that particular attribute.

See Also:
- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21
- "next_attribute Function" on page 20-27
- "get_values Function" on page 20-30
- "get_values_len Function" on page 20-32

next_attribute Function

This function fetches the next attribute of a given entry in the result set.

Syntax

```
DBMS_LDAP.next_attribute (
    ld  IN SESSION,
    msg  IN MESSAGE,
    ber_elem  IN BER_ELEMENT)
RETURN VARCHAR2;
```

Parameters

Table 20–37 next_attribute Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
msg (IN)	The entry whose attributes are to be stepped through, as returned by first_entry or next_entry.
ber_elem (IN)	A handle to a BER ELEMENT that is used to keep track of which attribute in the entry has been read.

Return Values

Table 20–38 next_attribute Function Return Values

Value	Description
VARCHAR2	The name of the attribute, if it exists.

Exceptions

Table 20–39 next_attribute Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_message	Raised if the incoming msg handle is invalid.

Usage Notes

The handle to the BER_ELEMENT returned as a function parameter to first_attribute should be used in the next call to next_attribute to iterate through the various attributes of an entry. The name of the attribute returned from a call to next_attribute can in turn be used in calls to get_values or get_values_len to get the values of that particular attribute.

See Also:

- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21
- "first_attribute Function" on page 20-25
- "get_values Function" on page 20-30
- "get_values_len Function" on page 20-32

get_dn Function

This function retrieves the X.500 distinguished name of a given entry in the result set.

The function `first_attribute` fetches the first attribute of a given entry in the result set

Syntax

```
DBMS_LDAP.get_dn (
    ld  IN SESSION,
    msg  IN MESSAGE)
RETURN VARCHAR2;
```

Parameters

Table 20–40 get_dn Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
msg (IN)	The entry whose DN is to be returned.

Return Values

Table 20–41 get_dn Function Return Values

Value	Description
VARCHAR2	The X.500 distinguished name of the entry as a PL/SQL string. NULL if there was a problem.

Exceptions

Table 20–42 get_dn Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_message	Raised if the incoming msg handle is invalid.
get_dn_error	Raised if there was a problem in determining the DN.

Usage Notes

The function get_dn can be used to retrieve the DN of an entry as the program logic is iterating through the result set. This be used as an input to explode_dn to retrieve the individual components of the DN.

See Also: "explode_dn Function" on page 20-52.

get_values Function

This function retrieves all of the values associated for a given attribute in a given entry.

Syntax

```
DBMS_LDAP.get_values (
    ld  IN SESSION,
```

```
    ldapentry  IN MESSAGE,
    attr  IN VARCHAR2)
RETURN STRING_COLLECTION;
```

Parameters

Table 20–43 get_values Function Parameters

Parameter	Description
`ld (IN)`	A valid LDAP session handle.
`ldapentry (IN)`	A valid handle to an entry returned from a search result.
`attr (IN)`	The name of the attribute for which values are being sought.

Return Values

Table 20–44 get_values Function Return Values

Value	Description
`STRING_COLLECTION`	A PL/SQL string collection containing all of the values of the given attribute. `NULL` if there are no values associated with the given attribute.

Exceptions

Table 20–45 get_values Function Exceptions

Exception	Description
`invalid session`	Raised if the session handle ld is invalid.
`invalid message`	Raised if the incoming entry handle is invalid.

Usage Notes

The function `get_values` can only be called after the handle to entry has been first retrieved by a call to either `first_entry` or `next_entry`. The name of the attribute can be known beforehand, and it can also be determined by a call to `first_attribute` or `next_attribute`. The function `get_values` always assumes that the datatype of the attribute it is retrieving is String. For retrieving binary datatypes, use `get_values_len`.

See Also:

- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21
- "get_values_len Function" on page 20-32
- "count_values Function" on page 20-48

get_values_len Function

This function retrieves values of attributes that have a Binary syntax.

Syntax

```
DBMS_LDAP.get_values_len (
    ld  IN SESSION,
    ldapentry  IN MESSAGE,
    attr  IN VARCHAR2)
RETURN BINVAL_COLLECTION;
```

Parameters

Table 20–46 get_values_len Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
ldapentrymsg (IN)	A valid handle to an entry returned from a search result.
attr (IN)	The string name of the attribute for which values are being sought.

Return Values

Table 20–47 get_values_len Function Return Values

Value	Description
BINVAL_COLLECTION	A PL/SQL Raw collection containing all the values of the given attribute. NULL if there are no values associated with the given attribute.

Exceptions

Table 20–48 get_values_len Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_message	Raised if the incoming entry handle is invalid

Usage Notes

The function get_values_len can only be called after the handle to entry has been retrieved by a call to either first_entry or next_entry. The name of the attribute can be known beforehand, and it can also be determined by a call to first_attribute or next_attribute. This function can be used to retrieve both binary and non-binary attribute values.

See Also:

- "first_entry Function" on page 20-20
- "next_entry Function" on page 20-21
- "get_values Function" on page 20-30
- "count_values_len Function" on page 20-49

delete_s Function

This function removes a leaf entry in the LDAP Directory Information Tree.

Syntax

```
DBMS_LDAP.delete_s (
    ld  IN SESSION,
    entrydn  IN VARCHAR2)
RETURN PLS_INTEGER;
```

Table 20–49 delete_s Function Parameters

Parameter Name	Description
`ld (IN)`	A valid LDAP session
`entrydn (IN)`	The X.500 distinguished name of the entry to delete.

Return Values

Table 20–50 delete_s Function Return Values

Value	Description
PLS_INTEGER	DBMS_LDAP.SUCCESS if the delete operation wa successful. An exception is raised otherwise.

Exceptions

Table 20–51 delete_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_entry_dn	Raised if the distinguished name of the entry is invalid
general_error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

The function delete_s can be used to remove only leaf level entries in the LDAP DIT. A leaf level entry is an entry that does not have any children / LDAP entries under it. It cannot be used to delete non-leaf entries.

See Also: "modrdn2_s Function" on page 20-35.

modrdn2_s Function

This function modrdn2_s can be used to rename the relative distinguished name of an entry.

Syntax

```
DBMS_LDAP.modrdn2_s (
    ld  IN SESSION,
    entrydn  IN VARCHAR2
    newrdn  IN VARCHAR2
    deleteoldrdn  IN PLS_INTEGER)
RETURN PLS_INTEGER;
```

Parameters

Table 20–52 modrdn2_s Function Parameters

Parameter	Description
ld (IN)	A valid LDAP session handle.
entrydn (IN)	The distinguished name of the entry. (This entry must be a leaf node in the DIT.).
newrdn (IN)	The new relative distinguished name of the entry.
deleteoldrdn (IN)	A boolean value that if non-zero, indicates that the attribute values from the old name should be removed from the entry.

Return Values

Table 20–53 modrdn2_s Function Return Values

Value	Description
PLS_INTEGER	DBMS_LDAP.SUCCESS if the operation was successful. An exception is raised otherwise.

Exceptions

Table 20–54 modrdn2_s Function Exceptions

Exception	Description
invalid_session	Raised if the session handle ld is invalid.
invalid_entry_dn	Raised if the distinguished name of the entry is invalid.
invalid_rdn	Invalid LDAP RDN.
invalid_deleteoldrdn	Invalid LDAP deleteoldrdn.
general error	For all other errors. The error string associated with this exception explains the error in detail.

Usage Notes

This function can be used to rename the leaf nodes of a DIT. It simply changes the relative distinguished name by which they are known. The use of this function is being deprecated in the LDAP v3 standard. Please use rename_s, which can achieve the same foundation.

See Also: "rename_s Function" on page 20-50.

err2string Function

This function converts an LDAP error code to string in the local language in which the API is operating

Syntax

```
DBMS_LDAP.err2string (
    ldap_err  IN PLS_INTEGER )
RETURN VARCHAR2;
```

Parameters

Table 20–55 err2string Function Parameters

Parameter	Description
`ldap_err (IN)`	An error number returned from one the API calls.

Return Values

Table 20–56 err2string Function Return Values

Value	Description
VARCHAR2	A character string appropriately translated to the local language which describes the error in detail.

Exceptions

Table 20–57 err2string Function Exceptions

Exception	Description
N/A	None.

Usage Notes

In this release, the exception handling mechanism automatically invokes this if any of the API calls encounter an error.

create_mod_array Function

This function allocates memory for array modification entries that are applied to an entry using the `modify_s` or `add_s` functions.

Syntax

```
DBMS_LDAP.create_mod_array (
    num  IN PLS_INTEGER)
RETURN MOD_ARRAY;
```

Parameters

Table 20–58 create_mod_array Function Parameters

Parameter	Description
`num (IN)`	The number of the attributes that you want to add or modify.

Return Values

Table 20–59 create_mod_array Function Return Values

Value	Description
`MOD_ARRAY`	The data structure holds a pointer to an LDAP mod array. `NULL` if there was a problem.

Exceptions

Table 20–60 create_mod_array Function Exceptions

Exception	Description
N/A	No LDAP specific exception is raised

Usage Notes

This function is one of the preparation steps for `DBMS_LDAP.add_s` and `DBMS_LDAP.modify_s`. It is required to call `DBMS_LDAP.free_mod_array` to free memory after the calls to `add_s` or `modify_s` have completed.

See Also:

- "populate_mod_array (String Version) Procedure" on page 20-39
- "modify_s Function" on page 20-43
- "add_s Function" on page 20-45
- "free_mod_array Procedure" on page 20-47

populate_mod_array (String Version) Procedure

This procedure populates one set of attribute information for add or modify operations.

Syntax

```
DBMS_LDAP.populate_mod_array (
    modptr  IN DBMS_LDAP.MOD_ARRAY,
    mod_op  IN PLS_INTEGER,
    mod_type  IN VARCHAR2,
    modval  IN DBMS_LDAP.STRING_COLLECTION);
```

Parameters

Table 20–61 populate_mod_array (String Version) Procedure Parameters

Parameter	Description
`modptr (IN)`	The data structure holds a pointer to an LDAP mod array.
`Mod_op (IN)`	This field specifies the type of modification to perform.
`Mod_type (IN)`	This field indicates the name of the attribute type to which the modification applies.
`Modval (IN)`	This field specifies the attribute values to add, delete, or replace. It is for the string values only.

Return Values

Table 20–62 populate_mod_array (String Version) Procedure Return Values

Value	Description
N/A	

Exceptions

Table 20–63 populate_mod_array (String Version) Procedure Exceptions

Exception	Description
`invalid_mod_array`	Invalid LDAP mod array.
`invalid_mod_option`	Invalid LDAP mod option.
`invalid_mod_type`	Invalid LDAP mod type.
`invalid_mod_value`	Invalid LDAP mod value.

Usage Notes

This function is one of the preparation steps for `DBMS_LDAP.add_s` and `DBMS_LDAP.modify_s`. It has to happen after `DBMS_LDAP.create_mod_array` is called.

See Also:

- "create_mod_array Function" on page 20-38
- "modify_s Function" on page 20-43
- "add_s Function" on page 20-45
- "free_mod_array Procedure" on page 20-47

populate_mod_array (Binary Version) Procedure

This procedure populates one set of attribute information for add or modify operations. This procedure call has to happen after `DBMS_LDAP.create_mod_array` is called.

Syntax

```
PROCEDURE populate_mod_array
    (modptr   IN DBMS_LDAP.MOD_ARRAY,
     mod_op   IN PLS_INTEGER,
     mod_type IN VARCHAR2,
     modval   IN DBMS_LDAP.BERVAL_COLLECTION);
```

Parameters

Table 20–64 populate_mod_array (Binary Version) Procedure Parameters

Parameter	Description
`modptr (IN)`	The data structure holds a pointer to an LDAP mod array.
`Mod_op (IN)`	This field specifies the type of modification to perform.
`Mod_typ (IN)`	This field indicates the name of the attribute type to which the modification applies.
`Modval (IN)`	This field specifies the attribute values to add, delete, or replace. It is for the binary values.

Return Values

Table 20–65 populate_mod_array (Binary Version) Procedure Return Values

Value	Description
N/A	

Exceptions

Table 20–66 populate_mod_array (Binary Version) Procedure Exceptions

Exception	Description
`invalid_mod_array`	Invalid LDAP mod array.
`invalid_mod_option`	Invalid LDAP mod option.
`invalid_mod_type`	Invalid LDAP mod type.
`invalid_mod_value`	Invalid LDAP mod value.

Usage Notes

This function is one of the preparation steps for `DBMS_LDAP.add_s` and `DBMS_LDAP.modify_s`. It has to happen after `DBMS_LDAP.create_mod_array` is called.

See Also:

- "create_mod_array Function" on page 20-38
- "modify_s Function" on page 20-43
- "add_s Function" on page 20-45
- "free_mod_array Procedure" on page 20-47

modify_s Function

This function performs a synchronous modification of an existing LDAP directory entry.

Syntax

```
DBMS_LDAP.modify_s (
    ld  IN DBMS_LDAP.SESSION,
    entrydn  IN VARCHAR2,
    modptr  IN DBMS_LDAP.MOD_ARRAY)
RETURN PLS_INTEGER;
```

Parameters

Table 20–67 modify_s Function Parameters

Parameter	Description
ld (IN)	A handle to an LDAP session, as returned by a successful call to DBMS_LDAP.init.
entrydn (IN)	Specifies the name of the directory entry whose contents are to be modified.
modptr (IN)	The handle to an LDAP mod structure, as returned by a successful call to DBMS_LDAP.create_mod_array.

Return Values

Table 20–68 modify_s Function Return Values

Value	Description
PLS_INTEGER	The indication of the success or failure of the modification operation

Exceptions

Table 20–69 modify_s Function Exceptions

Exception	Description
invalid_session	Invalid LDAP session.
invalid_entry_dn	Invalid LDAP entry dn.
invalid_mod_array	Invalid LDAP mod array.

Usage Notes

This function call has to follow successful calls of DBMS_LDAP.create_mod_array and DBMS_LDAP.populate_mod_array.

See Also:

- "create_mod_array Function" on page 20-38
- "populate_mod_array (String Version) Procedure" on page 20-39
- "add_s Function" on page 20-45
- "free_mod_array Procedure" on page 20-47

add_s Function

This function adds a new entry to the LDAP directory sychronously. Before calling `add_s`, you must call `DBMS_LDAP.create_mod_array` and `DBMS_LDAP.populate_mod_array`.

Syntax

```
DBMS_LDAP.add_s (
    ld  IN DBMS_LDAP.SESSION,
    entrydn  IN VARCHAR2,
    modptr  IN DBMS_LDAP.MOD_ARRAY)
RETURN PLS_INTEGER;
```

Parameters

Table 20–70 add_s Function Parameters

Parameter	Description
ld (IN)	A handle to an LDAP session, as returned by a successful call to DBMS_LDAP.init.
Entrydn (IN)	Specifies the name of the directory entry to be created.
Modptr (IN)	The handle to an LDAP mod structure, as returned by successful call to DBMS_LDAP.create_mod_array.

Return Values

Table 20–71 add_s Function Return Values

Value	Description
PLS_INTEGER	The indication of the success or failure of the modification operation.

Exceptions

Table 20–72 add_s Function Exceptions

Exception	Description
invalid_session	Invalid LDAP session.
invalid_entry_dn	Invalid LDAP entry dn.
invalid_mod_array	Invalid LDAP mod array.

Usage Notes

The parent entry of the entry to be added must already exist in the directory. This function call has to follow successful calls of DBMS_LDAP.create_mod_array and DBMS_LDAP.populate_mod_array.

See Also:

- "create_mod_array Function" on page 20-38
- "populate_mod_array (String Version) Procedure" on page 20-39
- "modify_s Function" on page 20-43
- "free_mod_array Procedure" on page 20-47

free_mod_array Procedure

This procedure frees the memory allocated by `DBMS_LDAP.create_mod_array`.

Syntax

```
DBMS_LDAP.free_mod_array (
    modptr  IN DBMS_LDAP.MOD_ARRAY);
```

Parameters

Table 20–73 free_mod_array Procedure Parameters

Parameter	Description
`modptr (in)`	The handle to an LDAP mod structure, as returned by successful call to `DBMS_LDAP.create_mod_array`.

Return Values

Table 20–74 free_mod_array Procedure Return Value

Value	Description
N / A	

Exceptions

Table 20–75 free_mod_array Procedure Exceptions

Exception	Description
N / A	No LDAP specific exception is raised.

See Also:

- "create_mod_array Function" on page 20-38
- "populate_mod_array (String Version) Procedure" on page 20-39
- "modify_s Function" on page 20-43
- "add_s Function" on page 20-45

count_values Function

This function counts the number of values returned by `DBMS_LDAP.get_values`.

Syntax

```
DBMS_LDAP.count_values (
    values  IN DBMS_LDAP.STRING_COLLECTION)
RETURN PLS_INTEGER;
```

Parameters

Table 20–76 count_values Function Parameters

Parameter	Description
values (IN)	The collection of string values.

Return Values

Table 20–77 count_values Function Return Values

Value	Description
PLS_INTEGER	The indication of the success or failure of the operation.

Exceptions

Table 20–78 count_values Function Exceptions

Exception	Description
N/A	No LDAP specific exception is raised.

See Also:

- "get_values Function" on page 20-30
- "count_values_len Function" on page 20-49

count_values_len Function

This function counts the number of values returned by DBMS_LDAP.get_values_len.

Syntax

```
DBMS_LDAP.count_values_len (
    values  IN DBMS_LDAP.BINVAL_COLLECTION)
RETURN PLS_INTEGER;
```

Parameters

Table 20–79 count_values_len Function Parameters

Parameter	Description
`values (IN)`	The collection of binary values.

Return Values

Table 20–80 count_values_len Function Return Values

Value	Description
`PLS_INTEGER`	The indication of the success or failure of the operation.

Exceptions

Table 20–81 count_values_len Function Exceptions

Exception	Description
N/A	No LDAP specific exception is raised.

See Also:

- "get_values_len Function" on page 20-32
- "count_values Function" on page 20-48

rename_s Function

This function renames an LDAP entry synchronously.

Syntax

```
DBMS_LDAP.rename_s (
    ld  IN SESSION,
    dn  IN VARCHAR2,
    newrdn  IN VARCHAR2,
    newparent  IN VARCHAR2,
    deleteoldrdn  IN PLS_INTEGER,
    serverctrls  IN LDAPCONTROL,
    clientctrls  IN LDAPCONTROL)
RETURN PLS_INTEGER;
```

Parameters

Table 20–82 rename_s Function Parameters

Parameter	Description
ld (IN)	A handle to an LDAP session, as returned by a successful call to DBMS_LDAP.init.
Dn (IN)	Specifies the name of the directory entry to be renamed or moved.
newrdn (IN)	Specifies the new RDN.
Newparent (IN)	Specifies the DN of the new parent.
Deleteoldrdn (IN)	Specifies if the old RDN should be retained. If this value is 1, then the old RDN is removed.
Serverctrls (IN)	Currently not supported.
Clientctrls (IN)	Currently not supported.

Return Values

Table 20–83 rename_s Function Return Values

Value	Description
PLS_INTEGER	The indication of the success or failure of the operation.

Exceptions

Table 20–84 rename_s Function Exceptions

Exception	Description
invalid_session	Invalid LDAP Session.
invalid_entry_dn	Invalid LDAP DN.
invalid_rdn	Invalid LDAP RDN.
invalid_newparent	Invalid LDAP newparent.
invalid_deleteoldrdn	Invalid LDAP deleteoldrdn.

See Also: "modrdn2_s Function" on page 20-35.

explode_dn Function

This function breaks a DN up into its components.

Syntax

```
DBMS_LDAP.explode_dn (
    dn  IN VARCHAR2,
    notypes  IN PLS_INTEGER)
RETURN STRING_COLLECTION;
```

Parameters

Table 20–85 explode_dn Function Parameters

Parameter	Description
dn (IN)	Specifies the name of the directory entry to be broken up.
Notypes (IN)	Specifies if the attribute tags will be returned. If this value is not 0, no attribute tags are returned.

Return Values

Table 20–86 explode_dn Function Return Values

Value	Description
STRING_COLLECTION	An array of strings. If the DN cannot be broken up, NULL is returned.

Exceptions

Table 20–87 explode_dn Function Exceptions

Exception	Description
invalid_entry_dn	Invalid LDAP DN.
invalid_notypes	Invalid LDAP notypes value.

See Also: "get_dn Function" on page 20-29.

open_ssl Function

This function establishes an SSL (Secure Sockets Layer) connection over an existing LDAP connection.

Syntax

```
DBMS_LDAP.open_ssl (
    ld  IN SESSION,
    sslwrl  IN VARCHAR2,
    sslwalletpasswd  IN VARCHAR2,
    sslauth  IN PLS_INTEGER)
RETURN PLS_INTEGER;
```

Parameters

Table 20–88 open_ssl Function Parameters

Parameter	Description
ld (IN)	A handle to an LDAP session, as returned by a successful call to DBMS_LDAP.init.
Sslwrl (IN)	Specifies the wallet location (Required for one-way or two-way SSL connection.)
sslwalletpasswd (IN)	Specifies the wallet password (Required for one-way or two-way SSL connection.)
sslauth (IN)	Specifies the SSL Authentication Mode (1 for no authentication required, 2 for one way authentication required, 3 for two way authentication required.

Return Values

Table 20–89 open_ssl Function Return Values

Value	Description
PLS_INTEGER	The indication of the success or failure of the operation.

Exceptions

Table 20–90 open_ssl Function Exceptions

Exception	Description
invalid_session	Invalid LDAP Session.
invalid_ssl_ wallet_loc	Invalid LDAP SSL wallet location.
invalid_ssl_ wallet_passwd	Invalid LDAP SSL wallet passwd.
invalid_ssl_auth_ mode	Invalid LDAP SSL authentication mode.

Usage Notes

Call DBMS_LDAP.init first to acquire a valid LDAP session.

See Also: "init Function" on page 20-6.

21

DBMS_LIBCACHE

The PL/SQL package DBMS_LIBCACHE prepares the library cache on an Oracle instance by extracting SQL and PL/SQL from a remote instance and compiling this SQL locally without execution. The value of compiling the cache of an instance is to prepare the information the application requires to execute in advance of failover or switchover.

Compiling a shared cursor consists of open, parse, and bind operations, plus the type-checking and execution plan functions performed at the first execution. All of these steps are executed in advance by the package DBMS_LIBCACHE for SELECT statements. The open and parse functions are executed in advance for PL/SQL and DML. For PL/SQL, executing the parse phase has the effect of loading all library cache heaps other than the MCODE.

This chapter discusses the following topics:

Requirements

To execute DBMS_LIBCACHE you must directly access the same objects as do SQL statements. You can best accomplish this by utilizing the same user id as the original system on the remote system. When there are multiple schema users, DBMS_LIBCACHE should be called for each. Alternately, DBMS_LIBCACHE may be called with the generic user PARSER. However, this user cannot parse the SQL that uses objects with access granted though roles. This is a standard PL/SQL security limitation.

Summary of DBMS_LIBCACHE Subprograms

Table 21–1 DBMS_SESSION Subprograms

Subprogram	Description
"COMPILE_CURSORS_FROM_ REMOTE Procedure" on page 21-2	Extracts SQL in batch from the source instance and compiles the SQL at the target instance.

COMPILE_CURSORS_FROM_REMOTE Procedure

This procedure extracts SQL in batch from the source instance and compiles the SQL at the target instance.

Syntax

```
DBMS_LIBCACHE.COMPILE_CURSORS_FROM_REMOTE('LIBC_LINK', {MY_USER}, 1,
1024000);
```

Parameters

Table 21–2 COMPILE_CURSORS_FROM_REMOTE Procedure Parameters

Parameter	Description
Database Link Name	The database link pointing to the instance used for extracting the SQL statements.
Source username	Parsing username for the SQL statements extracted.
Execution threshold	Lower bound on the number of executions. Below this value cursors will not be selected for compiling.

Table 21–2 COMPILE_CURSORS_FROM_REMOTE Procedure Parameters

Parameter	Description
`Sharable memory threshold`	The lower bound for the size of the shared memory consumed by the context area on the source instance. Below this value cursors will not be selected for compiling.

Usage Notes

Note the following:

- You must provide a `Database link name` and a Source user name as these are mandatory parameters. The syntax demonstrates the addition of the two optional parameters for preparsing all SQL larger than 1MB.
- `Database link name` - The connection may use either a password file or an LDAP authorization. A default database link, `libc_link`, is created when the catalog program, `catlibc.sql`, is executed. There is no actual default value as this parameter is mandatory for releases with `dbms_libcache$def.ACCESS_METHOD = DB_LINK_METHOD.`
- `Source user name` - This parameter allows the package to be executed in the matching local parsing user id. When using this parameter it is usual to be connected to the same username locally. If the username is supplied it must be a valid value. The name is not case sensitive.
- `Execution threshold` - The execution count on a cursor value is reset whenever the cursor is reloaded. This parameter allows the application to extract and compile statements with executions for example, greater than 3. The default value is 1. This means SQL statements that have never executed, including invalid SQL statements, will not be extracted.
- `Sharable memory threshold` - This parameter allows the application to extract and compile statements with shared memory for example, greater than 1024000 bytes. The default value (1000) allows you to skip cursors that are invalid and so never executed.

22

DBMS_LOB

The DBMS_LOB package provides subprograms to operate on BLOBs, CLOBs, NCLOBs, BFILEs, and temporary LOBs. You can use DBMS_LOB to access and manipulation specific parts of a LOB or complete LOBs.

This package must be created under SYS (connect internal). Operations provided by this package are performed under the current calling user, not under the package owner SYS.

DBMS_LOB can read and modify BLOBs, CLOBs, and NCLOBs; it provides read-only operations for BFILEs. The bulk of the LOB operations are provided by this package.

> **See Also:** *Oracle9i Application Developer's Guide - Large Objects (LOBs).*

This chapter discusses the following topics:

LOB Locators for DBMS_LOB

All DBMS_LOB subprograms work based on LOB locators. For the successful completion of DBMS_LOB subprograms, you must provide an input locator that represents a LOB that already exists in the database tablespaces or external filesystem. See also Chapter 1 of *Oracle9i Application Developer's Guide - Large Objects (LOBs)*.

Internal LOBs

For internal LOBs, you must first use SQL data definition language (DDL) to define tables that contain LOB columns and then use SQL data manipulation language (DML) to initialize or populate the locators in these LOB columns.

External LOBs

For external LOBs, you must ensure that a DIRECTORY object representing a valid, existing physical directory has been defined, and that physical files exist with read permission for Oracle. If your operating system uses case-sensitive pathnames, then be sure you specify the directory in the correct format.

After the LOBs are defined and created, you may then SELECT a LOB locator into a local PL/SQL LOB variable and use this variable as an input parameter to DBMS_LOB for access to the LOB value.

Temporary LOBs

For temporary LOBs, you must use the OCI, PL/SQL, or another programmatic interface to create or manipulate them. Temporary LOBs can be either BLOBs, CLOBs, or NCLOBs.

Datatypes, Constants, and Exceptions for DBMS_LOB

Datatypes

Parameters for the DBMS_LOB subprograms use these datatypes:

Table 22–1 DBMS_LOB datatypes

BLOB	A source or destination binary LOB.
RAW	A source or destination RAW buffer (used with BLOB).
CLOB	A source or destination character LOB (including NCLOB).

Table 22–1 DBMS_LOB datatypes

VARCHAR2	A source or destination character buffer (used with CLOB and NCLOB).
INTEGER	Specifies the size of a buffer or LOB, the offset into a LOB, or the amount to access.
BFILE	A large, binary object stored outside the database.

The DBMS_LOB package defines no special types. NCLOB is a special case of CLOBs for fixed-width and varying-width, multi-byte national character sets. The clause ANY_CS in the specification of DBMS_LOB subprograms for CLOBs enables them to accept a CLOB or NCLOB locator variable as input.

Constants

DBMS_LOB defines the following constants:

```
file_readonly CONSTANT BINARY_INTEGER := 0;
lob_readonly  CONSTANT BINARY_INTEGER := 0;
lob_readwrite CONSTANT BINARY_INTEGER := 1;
lobmaxsize    CONSTANT INTEGER        := 4294967295;
call          CONSTANT PLS_INTEGER    := 12;
session       CONSTANT PLS_INTEGER    := 10;
```

Oracle supports a maximum LOB size of 4 gigabytes (2^{32}). However, the amount and offset parameters of the package can have values between 1 and 4294967295 (2^{32}-1).

The PL/SQL 3.0 language specifies that the maximum size of a RAW or VARCHAR2 variable is 32767 *bytes*.

> **Note:** The value 32767 bytes is represented by maxbufsize in the following sections.

Exceptions

Table 22–2 DBMS_LOB Exceptions

Exception	Code	Description
invalid_argval	21560	The argument is expecting a non-NULL, valid value but the argument value passed in is NULL, invalid, or out of range.

Table 22–2 DBMS_LOB Exceptions

Exception	Code	Description
access_error	22925	You are trying to write too much data to the LOB: LOB size is limited to 4 gigabytes.
noexist_directory	22285	The directory leading to the file does not exist.
nopriv_directory	22286	The user does not have the necessary access privileges on the directory alias and / or the file for the operation.
invalid_directory	22287	The directory alias used for the current operation is not valid if being accessed for the first time, or if it has been modified by the DBA since the last access.
operation_failed	22288	The operation attempted on the file failed.
unopened_file	22289	The file is not open for the required operation to be performed.
open_toomany	22290	The number of open files has reached the maximum limit.

Security for DBMS_LOB

Any DBMS_LOB subprogram called from an anonymous PL / SQL block is executed using the privileges of the current user. Any DBMS_LOB subprogram called from a stored procedure is executed using the privileges of the owner of the stored procedure.

With Oracle8*i*, when creating the procedure, users can set the AUTHID to indicate whether they want definer's rights or invoker's rights. For example:

```
CREATE PROCEDURE proc1 authid definer ...
```

or

```
CREATE PROCEDURE proc1 authid current_user ....
```

> **See Also:** For more information on AUTHID and privileges, see *PL/SQL User's Guide and Reference.*

You can provide secure access to BFILEs using the DIRECTORY feature discussed in BFILENAME function in the *Oracle9i Application Developer's Guide - Large Objects (LOBs)* and the *Oracle9i SQL Reference*.

Rules and Limitations for DBMS_LOB

- The following rules apply in the specification of subprograms in this package:
  - `length` and `offset` parameters for subprograms operating on `BLOB`s and `BFILE`s must be specified in terms of *bytes*.
  - `length` and `offset` parameters for subprograms operating on `CLOB`s must be specified in terms of *characters*.
  - `offset` and `amount` parameters are always in *characters* for `CLOB`s / `NCLOB`s and in *bytes* for `BLOB`s / `BFILE`s.
- A subprogram raises an `INVALID_ARGVAL` exception if the following restrictions are not followed in specifying values for parameters (unless otherwise specified):
  1. Only positive, absolute offsets from the beginning of `LOB` data are permitted: Negative offsets from the tail of the `LOB` are not permitted.
  2. Only positive, non-zero values are permitted for the parameters that represent size and positional quantities, such as `amount`, `offset`, `newlen`, `nth`, etc. Negative offsets and ranges observed in Oracle SQL string functions and operators are not permitted.
  3. The value of `offset`, `amount`, `newlen`, `nth` must not exceed the value `lobmaxsize` (4GB-1) in any `DBMS_LOB` subprogram.
  4. For `CLOB`s consisting of fixed-width multi-byte characters, the maximum value for these parameters must not exceed (`lobmaxsize` / `character_width_in_bytes`) characters.

     For example, if the `CLOB` consists of 2-byte characters, such as:

     ```
     JA16SJISFIXED
     ```

     Then, the maximum `amount` value should not exceed:

     ```
     4294967295/2 = 2147483647 characters.
     ```

- PL / SQL language specifications stipulate an upper limit of 32767 bytes (not characters) for `RAW` and `VARCHAR2` parameters used in `DBMS_LOB` subprograms. For example, if you declare a variable to be:

  ```
  charbuf VARCHAR2(3000)
  ```

Then, charbuf can hold 3000 single byte characters or 1500 2-byte fixed width characters. This has an important consequence for DBMS_LOB subprograms for CLOBs and NCLOBs.

- The %CHARSET clause indicates that the form of the parameter with %CHARSET must match the form of the ANY_CS parameter to which it refers.

  For example, in DBMS_LOB subprograms that take a VARCHAR2 buffer parameter, the form of the VARCHAR2 buffer must match the form of the CLOB parameter. If the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

  For DBMS_LOB subprograms that take two CLOB parameters, both CLOB parameters must have the same form; i.e., they must both be NCLOBs, or they must both be CLOBs.

- If the value of amount plus the offset exceeds 4 GB (i.e., lobmaxsize+1) for BLOBs and BFILEs, and (lobmaxsize/character_width_in_bytes)+1 for CLOBs in calls to update subprograms (i.e., APPEND, COPY, TRIM, WRITE and WRITEAPPEND subprograms), then access exceptions are raised.

  Under these input conditions, read subprograms, such as READ, COMPARE, INSTR, and SUBSTR, read until End of Lob/File is reached. For example, for a READ operation on a BLOB or BFILE, if the user specifies offset value of 3 GB and an amount value of 2 GB, then READ reads only ((4GB-1)-3GB) bytes.

- Functions with NULL or invalid input values for parameters return a NULL. Procedures with NULL values for destination LOB parameters raise exceptions.

- Operations involving patterns as parameters, such as COMPARE, INSTR, and SUBSTR do not support regular expressions or special matching characters (such as % in the LIKE operator in SQL) in the pattern parameter or substrings.

- The End Of LOB condition is indicated by the READ procedure using a NO_DATA_FOUND exception. This exception is raised only upon an attempt by the user to read beyond the end of the LOB/FILE. The READ buffer for the last read contains 0 bytes.

- For consistent LOB updates, you must lock the row containing the destination LOB before making a call to any of the procedures (mutators) that modify LOB data.

- Unless otherwise stated, the default value for an offset parameter is 1, which indicates the first byte in the BLOB or BFILE data, and the first character in the

CLOB or NCLOB value. No default values are specified for the amount parameter — you must input the values explicitly.

- You must lock the row containing the destination internal LOB before calling any subprograms that modify the LOB, such as APPEND, COPY, ERASE, TRIM, or WRITE. These subprograms do not implicitly lock the row containing the LOB.

BFILE-Specific Rules and Limitations

- The subprograms COMPARE, INSTR, READ, SUBSTR, FILECLOSE, FILECLOSEALL and LOADFROMFILE operate only on an *opened* BFILE locator; that is, a successful FILEOPEN call must precede a call to any of these subprograms.
- For the functions FILEEXISTS, FILEGETNAME and GETLENGTH, a file's open/close status is unimportant; however, the file must exist physically, and you must have adequate privileges on the DIRECTORY object and the file.
- DBMS_LOB does not support any concurrency control mechanism for BFILE operations.
- In the event of several open files in the session whose closure has not been handled properly, you can use the FILECLOSEALL subprogram to close all files opened in the session and resume file operations from the beginning.
- If you are the creator of a DIRECTORY, or if you have system privileges, then use the CREATE OR REPLACE, DROP, and REVOKE statements in SQL with extreme caution.

  If you, or other grantees of a particular directory object, have several open files in a session, then any of the above commands can adversely affect file operations. In the event of such abnormal termination, your only choice is to invoke a program or anonymous block that calls FILECLOSEALL, reopen your files, and restart your file operations.
- All files opened during a user session are implicitly closed at the end of the session. However, Oracle strongly recommends that you close the files after *both* normal and abnormal termination of operations on the BFILE.

  In the event of normal program termination, proper file closure ensures that the number of files that are open simultaneously in the session remains less than SESSION_MAX_OPEN_FILES.

  In the event of abnormal program termination from a PL/SQL program, it is imperative that you provide an exception handler that ensures closure of all files opened in that PL/SQL program. This is necessary because after an

exception occurs, only the exception handler has access to the BFILE variable in its most current state.

After the exception transfers program control outside the PL/SQL program block, all references to the open BFILEs are lost. The result is a larger open file count which may or may not exceed the SESSION_MAX_OPEN_FILES value.

For example, consider a READ operation past the end of the BFILE value, which generates a NO_DATA_FOUND exception:

```
DECLARE
       fil BFILE;
       pos INTEGER;
       amt BINARY_INTEGER;
       buf RAW(40);
BEGIN
       SELECT f_lob INTO fil FROM lob_table WHERE key_value = 21;
       dbms_lob.open(fil, dbms_lob.lob_readonly);
       amt := 40; pos := 1 + dbms_lob.getlength(fil); buf := '';
       dbms_lob.read(fil, amt, pos, buf);
       dbms_output.put_line('Read F1 past EOF: '||
           utl_raw.cast_to_varchar2(buf));
       dbms_lob.close(fil);
END;

ORA-01403: no data found
ORA-06512: at "SYS.DBMS_LOB", line 373
ORA-06512: at line 10
```

After the exception has occurred, the BFILE locator variable file goes out of scope, and no further operations on the file can be done using that variable. Therefore, the solution is to use an exception handler:

```
DECLARE
     fil BFILE;
     pos INTEGER;
     amt BINARY_INTEGER;
     buf RAW(40);
BEGIN
     SELECT f_lob INTO fil FROM lob_table WHERE key_value = 21;
     dbms_lob.open(fil, dbms_lob.lob_readonly);
     amt := 40; pos := 1 + dbms_lob.getlength(fil); buf := '';
     dbms_lob.read(fil, amt, pos, buf);
     dbms_output.put_line('Read F1 past EOF: '||
          utl_raw.cast_to_varchar2(buf));
     dbms_lob.close(fil);
```

```
      exception
      WHEN no_data_found
      THEN
        BEGIN
          dbms_output.put_line('End of File reached. Closing file');
          dbms_lob.fileclose(fil);
          -- or dbms_lob.filecloseall if appropriate
        END;
END;
      /

Statement processed.
End of File reached. Closing file
```

In general, you should ensure that files opened in a PL/SQL block using DBMS_LOB are closed before normal or abnormal termination of the block.

Temporary LOBs

Oracle8*i* supports the definition, creation, deletion, access, and update of temporary LOBs. Your temporary tablespace stores the temporary LOB data. Temporary LOBs are not permanently stored in the database. Their purpose is mainly to perform transformations on LOB data.

A temporary LOB is empty when it is created. By default, all temporary LOBs are deleted at the end of the session in which they were created. If a process dies unexpectedly or if the database crashes, then temporary LOBs are deleted, and the space for temporary LOBs is freed.

In Oracle8*i*, there is also an interface to let you group temporary LOBs together into a logical bucket. The duration represents this logical store for temporary LOBs. Each temporary LOB can have separate storage characteristics, such as CACHE/ NOCACHE. There is a default store for every session into which temporary LOBs are placed if you don't specify a specific duration. Additionally, you are able to perform a free operation on durations, which causes all contents in a duration to be freed.

There is no support for consistent read (CR), undo, backup, parallel processing, or transaction management for temporary LOBs. Because CR and rollbacks are not supported for temporary LOBs, you must free the temporary LOB and start over again if you encounter an error.

Because CR, undo, and versions are not generated for temporary LOBs, there is potentially a performance impact if you assign multiple locators to the same

temporary LOB. Semantically, each locator should have its own copy of the temporary LOB.

A copy of a temporary LOB is created if the user modifies the temporary LOB while another locator is also pointing to it. The locator on which a modification was performed now points to a new copy of the temporary LOB. Other locators no longer see the same data as the locator through which the modification was made. A deep copy was not incurred by permanent LOBs in these types of situations, because CR snapshots and version pages enable users to see their own versions of the LOB cheaply.

You can gain pseudo-REF semantics by using pointers to locators in OCI and by having multiple pointers to locators point to the same temporary LOB locator, if necessary. In PL/SQL, you must avoid using more than one locator per temporary LOB. The temporary LOB locator can be passed "by ref" to other procedures.

Because temporary LOBs are not associated with any table schema, there are no meanings to the terms in-row and out-of-row temporary LOBs. Creation of a temporary LOB instance by a user causes the engine to create and return a locator to the LOB data. The PL/SQL DBMS_LOB package, PRO*C, OCI, and other programmatic interfaces operate on temporary LOBs through these locators just as they do for permanent LOBs.

There is no support for client side temporary LOBs. All temporary LOBs reside in the server.

Temporary LOBs do not support the EMPTY_BLOB or EMPTY_CLOB functions that are supported for permanent LOBs. The EMPTY_BLOB function specifies the fact that the LOB is initialized, but not populated with any data.

A temporary LOB instance can only be destroyed by using OCI or the DBMS_LOB package by using the appropriate FREETEMPORARY or OCIDurationEnd statement.

A temporary LOB instance can be accessed and modified using appropriate OCI and DBMS_LOB statements, just as for regular permanent internal LOBs. To make a temporary LOB permanent, you must explicitly use the OCI or DBMS_LOB COPY command, and copy the temporary LOB into a permanent one.

Security is provided through the LOB locator. Only the user who created the temporary LOB is able to see it. Locators are not expected to be able to pass from one user's session to another. Even if someone did pass a locator from one session to another, they would not access the temporary LOBs from the original session. Temporary LOB lookup is localized to each user's own session. Someone using a locator from somewhere else is only able to access LOBs within his own session that

have the same LOB ID. Users should not try to do this, but if they do, they are not able to affect anyone else's data.

Oracle keeps track of temporary LOBs per session in a v$ view called V$TEMPORARY_LOBS, which contains information about how many temporary LOBs exist per session. V$ views are for DBA use. From the session, Oracle can determine which user owns the temporary LOBs. By using V$TEMPORARY_LOBS in conjunction with DBA_SEGMENTS, a DBA can see how much space is being used by a session for temporary LOBs. These tables can be used by DBAs to monitor and guide any emergency cleanup of temporary space used by temporary LOBs.

Temporary LOBs Usage Notes

1. All functions in DBMS_LOB return NULL if any of the input parameters are NULL. All procedures in DBMS_LOB raise an exception if the LOB locator is input as NULL.

2. Operations based on CLOBs do not verify if the character set IDs of the parameters (CLOB parameters, VARCHAR2 buffers and patterns, etc.) match. It is the user's responsibility to ensure this.

3. Data storage resources are controlled by the DBA by creating different temporary tablespaces. DBAs can define separate temporary tablespaces for different users, if necessary.

4. Temporary LOBs still adhere to value semantics in order to be consistent with permanent LOBs and to try to conform to the ANSI standard for LOBs. As a result, each time a user does an OCILobLocatatorAssign, or the equivalent assignment in PL/SQL, the database makes a copy of the temporary LOB.

   Each locator points to its own LOB value. If one locator is used to create a temporary LOB, and then is assigned to another LOB locator using OCILobLOcatorAssign in OCI or through an assignment operation in PL/SQL, then the database copies the original temporary LOB and causes the second locator to point to the copy.

   In order for users to modify the same LOB, they must go through the same locator. In OCI, this can be accomplished fairly easily by using pointers to locators and assigning the pointers to point to the same locator. In PL/SQL, the same LOB variable must be used to update the LOB to get this effect.

   The following example shows a place where a user incurs a copy, or at least an extra roundtrip to the server.

```
DECLARE
  a blob;
```

```
  b blob;
BEGIN
  dbms_lob.createtemporary(b, TRUE);
  -- the following assignment results in a deep copy
  a := b;
END;
```

The PL/SQL compiler makes temporary copies of actual arguments bound to `OUT` or `IN OUT` parameters. If the actual parameter is a temporary `LOB`, then the temporary copy is a deep (value) copy.

The following PL/SQL block illustrates the case where the user incurs a deep copy by passing a temporary `LOB` as an `IN OUT` parameter.

```
DECLARE
  a blob;
  procedure foo(parm IN OUT blob) is
  BEGIN
   ...
  END;
BEGIN
  dbms_lob.createtemporary(a, TRUE);
  -- the following call results in a deep copy of the blob a
  foo(a);
END;
```

To minimize deep copies on PL/SQL parameter passing, use the `NOCOPY` compiler hint where possible.

The duration parameter passed to `dbms_lob.createtemporary()` is a hint. The duration of the new temp LOB is the same as the duration of the locator variable in PL/SQL. For example, in the program block above, the program variable `a` has the duration of the residing frame. Therefore at the end of the block, memory of `a` will be freed at the end of the function.

If a PL/SQL package variable is used to create a temp LOB, it will have the duration of the package variable, which has a duration of `SESSION`.

```
BEGIN
   y clob;
  END;
/
BEGIN
   dbms_lob.createtemporary(package.y, TRUE);
END;
```

See Also: *PL/SQL User's Guide and Reference.* for more information on NOCOPY syntax

Exceptions

Table 22–3 DBMS_LOB Exceptions

Exception	Code	Description
INVALID_ARGVAL	21560	Value for argument %s is not valid.
ACCESS_ERROR	22925	Attempt to read or write beyond maximum LOB size on %s.
NO_DATA_FOUND		EndofLob indicator for looping read operations. This is not a hard error.
VALUE_ERROR	6502	PL/SQL error for invalid values to subprogram's parameters.

Summary of DBMS_LOB Subprograms

Table 22–4 DBMS_LOB Subprograms

Subprogram	Description
"APPEND Procedure" on page 22-15	Appends the contents of the source LOB to the destination LOB.
"CLOSE Procedure" on page 22-16	Closes a previously opened internal or external LOB.
"COMPARE Function" on page 22-17	Compares two entire LOBs or parts of two LOBs.
"COPY Procedure" on page 22-20	Copies all, or part, of the source LOB to the destination LOB.
"CREATETEMPORARY Procedure" on page 22-23	Creates a temporary BLOB or CLOB and its corresponding index in the user's default temporary tablespace.
"ERASE Procedure" on page 22-24	Erases all or part of a LOB.
"FILECLOSE Procedure" on page 22-26	Closes the file.
"FILECLOSEALL Procedure" on page 22-27	Closes all previously opened files.
"FILEEXISTS Function" on page 22-28	Checks if the file exists on the server.

Table 22–4 DBMS_LOB Subprograms (Cont.)

Subprogram	Description
"FILEGETNAME Procedure" on page 22-29	Gets the directory alias and file name.
"FILEISOPEN Function" on page 22-31	Checks if the file was opened using the input `BFILE` locators.
"FILEOPEN Procedure" on page 22-32	Opens a file.
"FREETEMPORARY Procedure" on page 22-33	Frees the temporary `BLOB` or `CLOB` in the user's default temporary tablespace.
"GETCHUNKSIZE Function" on page 22-34	Returns the amount of space used in the `LOB` chunk to store the `LOB` value.
"GETLENGTH Function" on page 22-35	Gets the length of the `LOB` value.
"INSTR Function" on page 22-37	Returns the matching position of the *nth* occurrence of the pattern in the `LOB`.
"ISOPEN Function" on page 22-40	Checks to see if the `LOB` was already opened using the input locator.
"ISTEMPORARY Function" on page 22-41	Checks if the locator is pointing to a temporary `LOB`.
"LOADFROMFILE Procedure" on page 22-42	Loads `BFILE` data into an internal `LOB`.
"OPEN Procedure" on page 22-44	Opens a `LOB` (internal, external, or temporary) in the indicated mode.
"READ Procedure" on page 22-46	Reads data from the `LOB` starting at the specified offset.
"SUBSTR Function" on page 22-49	Returns part of the `LOB` value starting at the specified offset.
"TRIM Procedure" on page 22-52	Trims the `LOB` value to the specified shorter length.
"WRITE Procedure" on page 22-54	Writes data to the `LOB` from a specified offset.
"WRITEAPPEND Procedure" on page 22-56	Writes a buffer to the end of a `LOB`.

APPEND Procedure

This procedure appends the contents of a source internal LOB to a destination LOB. It appends the complete source LOB.

There are two overloaded APPEND procedures.

Syntax

```
DBMS_LOB.APPEND (
   dest_lob IN OUT  NOCOPY BLOB,
   src_lob  IN             BLOB);

DBMS_LOB.APPEND (
   dest_lob IN OUT  NOCOPY CLOB  CHARACTER SET ANY_CS,
   src_lob  IN             CLOB  CHARACTER SET dest_lob%CHARSET);
```

Parameters

Table 22–5 APPEND Procedure Parameters

Parameter	Description
dest_lob	Locator for the internal LOB to which the data is to be appended.
src_lob	Locator for the internal LOB from which the data is to be read.

Exceptions

Table 22–6 APPEND Procedure Exceptions

Exception	Description
VALUE_ERROR	Either the source or the destination LOB is NULL.

Usage Notes

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can

adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.

Examples

```
CREATE OR REPLACE PROCEDURE Example_1a IS
    dest_lob BLOB;
    src_lob  BLOB;
BEGIN
    -- get the LOB locators
    -- note that the FOR UPDATE clause locks the row
    SELECT b_lob INTO dest_lob
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    SELECT b_lob INTO src_lob
        FROM lob_table
        WHERE key_value = 21;
    DBMS_LOB.APPEND(dest_lob, src_lob);
    COMMIT;
EXCEPTION
    WHEN some_exception
    THEN handle_exception;
END;

CREATE OR REPLACE PROCEDURE Example_1b IS
    dest_lob, src_lob  BLOB;
BEGIN
    -- get the LOB locators
    -- note that the FOR UPDATE clause locks the row
    SELECT b_lob INTO dest_lob
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    SELECT b_lob INTO src_lob
        FROM lob_table
        WHERE key_value = 12;
    DBMS_LOB.APPEND(dest_lob, src_lob);
    COMMIT;
EXCEPTION
    WHEN some_exception
    THEN handle_exception;
END;
```

CLOSE Procedure

This procedure closes a previously opened internal or external LOB.

Syntax

```
DBMS_LOB.CLOSE (
   lob_loc    IN OUT NOCOPY BLOB);

DBMS_LOB.CLOSE (
   lob_loc    IN OUT NOCOPY CLOB CHARACTER SET ANY_CS);

DBMS_LOB.CLOSE (
   file_loc   IN OUT NOCOPY BFILE);
```

Errors

No error is returned if the BFILE exists but is not opened. An error is returned if the LOB is not open.

Usage Notes

CLOSE requires a round-trip to the server for both internal and external LOBs. For internal LOBs, CLOSE triggers other code that relies on the close call, and for external LOBs (BFILEs), CLOSE actually closes the server-side operating system file.

It is not mandatory that you wrap all LOB operations inside the Open/Close APIs. However, if you open a LOB, you must close it before you commit or rollback the transaction; an error is produced if you do not. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

It is an error to commit the transaction before closing all opened LOBs that were opened by the transaction. When the error is returned, the openness of the open LOBs is discarded, but the transaction is successfully committed. Hence, all the changes made to the LOB and non-LOB data in the transaction are committed, but the domain and functional indexes are not updated. If this happens, you should rebuild the functional and domain indexes on the LOB column.

COMPARE Function

This function compares two entire LOBs or parts of two LOBs. You can only compare LOBs of the same datatype (LOBs of BLOB type with other BLOBs, and CLOBs with CLOBs, and BFILEs with BFILEs). For BFILEs, the file must be already opened using a successful FILEOPEN operation for this operation to succeed.

COMPARE returns zero if the data exactly matches over the range specified by the offset and amount parameters. Otherwise, a non-zero INTEGER is returned.

For fixed-width *n*-byte CLOBs, if the input amount for COMPARE is specified to be greater than (4294967295 / *n*), then COMPARE matches characters in a range of size (4294967295 / *n*), or Max(length(clob1), length(clob2)), whichever is lesser.

Syntax

```
DBMS_LOB.COMPARE (
   lob_1            IN BLOB,
   lob_2            IN BLOB,
   amount           IN INTEGER := 4294967295,
   offset_1         IN INTEGER := 1,
   offset_2         IN INTEGER := 1)
  RETURN INTEGER;

DBMS_LOB.COMPARE (
   lob_1            IN CLOB  CHARACTER SET ANY_CS,
   lob_2            IN CLOB  CHARACTER SET lob_1%CHARSET,
   amount           IN INTEGER := 4294967295,
   offset_1         IN INTEGER := 1,
   offset_2         IN INTEGER := 1)
  RETURN INTEGER;

DBMS_LOB.COMPARE (
   lob_1            IN BFILE,
   lob_2            IN BFILE,
   amount           IN INTEGER,
   offset_1         IN INTEGER := 1,
   offset_2         IN INTEGER := 1)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(COMPARE, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 22–7 COMPARE Function Parameters

Parameter	Description
lob_1	LOB locator of first target for comparison.
lob_2	LOB locator of second target for comparison.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to compare.

Table 22–7 COMPARE Function Parameters

Parameter	Description
offset_1	Offset in bytes or characters on the first LOB (origin: 1) for the comparison.
offset_2	Offset in bytes or characters on the first LOB (origin: 1) for the comparison.

Returns

- INTEGER: Zero if the comparison succeeds, non-zero if not.
- NULL, if
  - amount < 1
  - amount > LOBMAXSIZE
  - offset_1 or offset_2 < 1
    - offset_1 or offset_2 > LOBMAXSIZE

Exceptions

Table 22–8 COMPARE Function Exceptions for BFILE operations

Exception	Description
UNOPENED_FILE	File was not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Examples

```
CREATE OR REPLACE PROCEDURE Example2a IS
    lob_1, lob_2      BLOB;
    retval            INTEGER;
BEGIN
    SELECT b_col INTO lob_1 FROM lob_table
        WHERE key_value = 45;
    SELECT b_col INTO lob_2 FROM lob_table
        WHERE key_value = 54;
```

```
    retval := dbms_lob.compare(lob_1, lob_2, 5600, 33482,
        128);
    IF retval = 0 THEN
      ;    -- process compared code
    ELSE
      ;    -- process not compared code
    END IF;
END;

CREATE OR REPLACE PROCEDURE Example_2b IS
    fil_1, fil_2       BFILE;
    retval             INTEGER;
BEGIN

    SELECT f_lob INTO fil_1 FROM lob_table WHERE key_value = 45;
    SELECT f_lob INTO fil_2 FROM lob_table WHERE key_value = 54;
    dbms_lob.fileopen(fil_1, dbms_lob.file_readonly);
    dbms_lob.fileopen(fil_2, dbms_lob.file_readonly);
    retval := dbms_lob.compare(fil_1, fil_2, 5600,
                                3348276, 2765612);
    IF (retval = 0)
    THEN
        ; -- process compared code
    ELSE
        ; -- process not compared code
    END IF;
    dbms_lob.fileclose(fil_1);
    dbms_lob.fileclose(fil_2);
END;
```

COPY Procedure

This procedure copies all, or a part of, a source internal LOB to a destination internal LOB. You can specify the offsets for both the source and destination LOBs, and the number of bytes or characters to copy.

If the offset you specify in the destination LOB is beyond the end of the data currently in this LOB, then zero-byte fillers or spaces are inserted in the destination BLOB or CLOB respectively. If the offset is less than the current length of the destination LOB, then existing data is overwritten.

It is not an error to specify an amount that exceeds the length of the data in the source LOB. Thus, you can specify a large amount to copy from the source LOB, which copies data from the `src_offset` to the end of the source LOB.

Syntax

```
DBMS_LOB.COPY (
  dest_lob    IN OUT NOCOPY BLOB,
  src_lob     IN            BLOB,
  amount      IN            INTEGER,
  dest_offset IN            INTEGER := 1,
  src_offset  IN            INTEGER := 1);

DBMS_LOB.COPY (
  dest_lob    IN OUT NOCOPY CLOB  CHARACTER SET ANY_CS,
  src_lob     IN            CLOB  CHARACTER SET dest_lob%CHARSET,
  amount      IN            INTEGER,
  dest_offset IN            INTEGER := 1,
  src_offset  IN            INTEGER := 1);
```

Parameters

Table 22–9 COPY Procedure Parameters

Parameter	Description
dest_lob	LOB locator of the copy target.
src_lob	LOB locator of source for the copy.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to copy.
dest_offset	Offset in bytes or characters in the destination LOB (origin: 1) for the start of the copy.
src_offset	Offset in bytes or characters in the source LOB (origin: 1) for the start of the copy.

Exceptions

Table 22–10 COPY Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or invalid.

Table 22–10 COPY Procedure Exceptions

Exception	Description
INVALID_ARGVAL	Either: - src_offset or dest_offset < 1 - src_offset or dest_offset > LOBMAXSIZE - amount < 1 - amount > LOBMAXSIZE

Usage Notes

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.

Examples

```
CREATE OR REPLACE PROCEDURE Example_3a IS
    lobd, lobs     BLOB;
    dest_offset    INTEGER := 1
    src_offset     INTEGER := 1
    amt            INTEGER := 3000;
BEGIN
    SELECT b_col INTO lobd
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    SELECT b_col INTO lobs
        FROM lob_table
        WHERE key_value = 21;
    DBMS_LOB.COPY(lobd, lobs, amt, dest_offset, src_offset);
    COMMIT;
   EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

```
CREATE OR REPLACE PROCEDURE Example_3b IS
    lobd, lobs     BLOB;
    dest_offset    INTEGER := 1
    src_offset     INTEGER := 1
    amt            INTEGER := 3000;
BEGIN
    SELECT b_col INTO lobd
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    SELECT b_col INTO lobs
        FROM lob_table
        WHERE key_value = 12;
    DBMS_LOB.COPY(lobd, lobs, amt, dest_offset, src_offset);
    COMMIT;
   EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

CREATETEMPORARY Procedure

This procedure creates a temporary BLOB or CLOB and its corresponding index in your default temporary tablespace.

Syntax

```
DBMS_LOB.CREATETEMPORARY (
   lob_loc IN OUT NOCOPY BLOB,
   cache   IN            BOOLEAN,
   dur     IN            PLS_INTEGER := 10);

DBMS_LOB.CREATETEMPORARY (
   lob_loc IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
   cache   IN            BOOLEAN,
   dur     IN            PLS_INTEGER := 10);
```

Parameters

Table 22–11 CREATETEMPORARY Procedure Parameters

Parameter	Description
lob_loc	LOB locator.

Table 22–11 CREATETEMPORARY Procedure Parameters

Parameter	Description
cache	Specifies if LOB should be read into buffer cache or not.
dur	1 of 2 predefined duration values (SESSION or CALL) which specifies a hint as to whether the temporary LOB is cleaned up at the end of the session or call. If dur is omitted, then the session duration is used.

Example

```
DBMS_LOB.CREATETEMPORARY(Dest_Loc, TRUE)
```

See Also: *PL/SQL User's Guide and Reference* for more information about NOCOPY and passing temporary lobs as parameters.

ERASE Procedure

This procedure erases an entire internal LOB or part of an internal LOB.

Note: The length of the LOB is not decreased when a section of the LOB is erased. To decrease the length of the LOB value, see the "TRIM Procedure" on page 22-52.

When data is erased from the middle of a LOB, zero-byte fillers or spaces are written for BLOBs or CLOBs respectively.

The actual number of bytes or characters erased can differ from the number you specified in the amount parameter if the end of the LOB value is reached before erasing the specified number. The actual number of characters or bytes erased is returned in the amount parameter.

Syntax

```
DBMS_LOB.ERASE (
   lob_loc          IN OUT   NOCOPY   BLOB,
   amount           IN OUT   NOCOPY   INTEGER,
   offset           IN                INTEGER := 1);

DBMS_LOB.ERASE (
   lob_loc          IN OUT   NOCOPY   CLOB CHARACTER SET ANY_CS,
```

```
amount          IN OUT   NOCOPY   INTEGER,
offset          IN                INTEGER := 1);
```

Parameters

Table 22–12 ERASE Procedure Parameters

Parameter	Description
lob_loc	Locator for the LOB to be erased.
amount	Number of bytes (for BLOBs or BFILES) or characters (for CLOBs or NCLOBs) to be erased.
offset	Absolute offset (origin: 1) from the beginning of the LOB in bytes (for BLOBs) or characters (CLOBs).

Exceptions

Table 22–13 ERASE Procedure Exceptions

Exception	Description
VALUE_ERROR	Any input parameter is NULL.
INVALID_ARGVAL	Either: - amount < 1 or amount > LOBMAXSIZE - offset < 1 or offset > LOBMAXSIZE

Usage Notes

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.

Example

```
CREATE OR REPLACE PROCEDURE Example_4 IS
```

```
    lobd       BLOB;
    amt        INTEGER := 3000;
BEGIN
    SELECT b_col INTO lobd
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    dbms_lob.erase(dest_lob, amt, 2000);
    COMMIT;
END;
```

See Also: "TRIM Procedure" on page 22-52

FILECLOSE Procedure

This procedure closes a BFILE that has already been opened via the input locator.

Note: Oracle has only read-only access to BFILEs. This means that BFILEs cannot be written through Oracle.

Syntax

```
DBMS_LOB.FILECLOSE (
    file_loc IN OUT NOCOPY BFILE);
```

Parameters

Table 22–14 FILECLOSE Procedure Parameter

Parameter	Description
file_loc	Locator for the BFILE to be closed.

Exceptions

Table 22–15 FILECLOSE Procedure Exceptions

Exception	Description
VALUE_ERROR	NULL input value for file_loc.
UNOPENED_FILE	File was not opened with the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.

Table 22–15 FILECLOSE Procedure Exceptions

Exception	Description
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Example

```
CREATE OR REPLACE PROCEDURE Example_5 IS
    fil BFILE;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 99;
    dbms_lob.fileopen(fil);
    -- file operations
    dbms_lob.fileclose(fil);
    EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

See Also:

- "FILEOPEN Procedure" on page 22-32
- "FILECLOSEALL Procedure" on page 22-27

FILECLOSEALL Procedure

This procedure closes all BFILEs opened in the session.

Syntax

```
DBMS_LOB.FILECLOSEALL;
```

Exceptions

Table 22–16 FILECLOSEALL Procedure Exception

Exception	Description
UNOPENED_FILE	No file has been opened in the session.

Example

```
CREATE OR REPLACE PROCEDURE Example_6 IS
```

```
    fil BFILE;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 99;
    dbms_lob.fileopen(fil);
    -- file operations
    dbms_lob.filecloseall;
    EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

See Also:

- "FILEOPEN Procedure" on page 22-32
- "FILECLOSE Procedure" on page 22-26

FILEEXISTS Function

This function finds out if a given BFILE locator points to a file that actually exists on the server's filesystem.

Syntax

```
DBMS_LOB.FILEEXISTS (
   file_loc     IN    BFILE)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(FILEEXISTS, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 22–17 FILEEXISTS Function Parameter

Parameter	Description
file_loc	Locator for the BFILE.

Returns

Table 22–18 FILEEXISTS Function Returns

Return	Description
0	Physical file does not exist.
1	Physical file exists.

Exceptions

Table 22–19 FILEEXISTS Function Exceptions

Exception	Description
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.

Example

```
CREATE OR REPLACE PROCEDURE Example_7 IS
    fil BFILE;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 12;
    IF (dbms_lob.fileexists(fil))
    THEN
        ; -- file exists code
    ELSE
        ; -- file does not exist code
    END IF;
    EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

See Also: "FILEISOPEN Function" on page 22-31.

FILEGETNAME Procedure

This procedure determines the directory alias and filename, given a BFILE locator. This function only indicates the directory alias name and filename assigned to the locator, not if the physical file or directory actually exists.

The maximum constraint values for the dir_alias buffer is 30, and for the entire pathname is 2000.

Syntax

```
DBMS_LOB.FILEGETNAME (
   file_loc   IN    BFILE,
   dir_alias  OUT   VARCHAR2,
   filename   OUT   VARCHAR2);
```

Parameters

Table 22–20 FILEGETNAME Procedure Parameters

Parameter	Description
file_loc	Locator for the BFILE.
dir_alias	Directory alias.
filename	Name of the BFILE.

Exceptions

Table 22–21 FILEGETNAME Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or INVALID.
INVALID_ARGVAL	dir_alias or filename are NULL.

Example

```
CREATE OR REPLACE PROCEDURE Example_8 IS
    fil BFILE;
    dir_alias VARCHAR2(30);
    name VARCHAR2(2000);
BEGIN
    IF (dbms_lob.fileexists(fil))
    THEN
        dbms_lob.filegetname(fil, dir_alias, name);
        dbms_output.put_line("Opening " || dir_alias || name);
        dbms_lob.fileopen(fil, dbms_lob.file_readonly);
        -- file operations
        dbms_output.fileclose(fil);
```

```
    END IF;
END;
```

FILEISOPEN Function

This function finds out whether a BFILE was opened with the given FILE locator.

If the input FILE locator was never passed to the FILEOPEN procedure, then the file is considered not to be opened by this locator. However, a different locator may have this file open. In other words, openness is associated with a specific locator.

Syntax

```
DBMS_LOB.FILEISOPEN (
   file_loc   IN    BFILE)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(FILEISOPEN, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 22–22 FILEISOPEN Function Parameter

Parameter	Description
file_loc	Locator for the BFILE.

Returns

INTEGER: 0 = file is not open, 1 = file is open

Exceptions

Table 22–23 FILEISOPEN Function Exceptions

Exception	Description
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Example

```
CREATE OR REPLACE PROCEDURE Example_9 IS
DECLARE
    fil      BFILE;
    pos      INTEGER;
    pattern  VARCHAR2(20);
BEGIN
    SELECT f_lob INTO fil FROM lob_table
        WHERE key_value = 12;
    -- open the file
    IF (dbms_lob.fileisopen(fil))
    THEN
        pos := dbms_lob.instr(fil, pattern, 1025, 6);
         -- more file operations
         dbms_lob.fileclose(fil);
   ELSE
        ; -- return error
    END IF;
END;
```

See Also: "FILEEXISTS Function" on page 22-28

FILEOPEN Procedure

This procedure opens a BFILE for read-only access. BFILEs may not be written through Oracle.

Syntax

```
DBMS_LOB.FILEOPEN (
   file_loc   IN OUT NOCOPY  BFILE,
   open_mode  IN             BINARY_INTEGER := file_readonly);
```

Parameters

Table 22–24 FILEOPEN Procedure Parameters

Parameter	Description
file_loc	Locator for the BFILE.
open_mode	File access is read-only.

Exceptions

Table 22–25 FILEOPEN Procedure Exceptions

Exception	Description
VALUE_ERROR	file_loc or open_mode is NULL.
INVALID_ARGVAL	open_mode is not equal to FILE_READONLY.
OPEN_TOOMANY	Number of open files in the session exceeds session_max_open_files.
NOEXIST_DIRECTORY	Directory associated with file_loc does not exist.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Example

```
CREATE OR REPLACE PROCEDURE Example_10 IS
    fil BFILE;
BEGIN
    -- open BFILE
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 99;
    IF (dbms_lob.fileexists(fil))
    THEN
        dbms_lob.fileopen(fil, dbms_lob.file_readonly);
        -- file operation
        dbms_lob.fileclose(fil);
    END IF;
    EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

See Also:

- "FILECLOSE Procedure" on page 22-26
- "FILECLOSEALL Procedure" on page 22-27

FREETEMPORARY Procedure

This procedure frees the temporary BLOB or CLOB in your default temporary tablespace. After the call to FREETEMPORARY, the LOB locator that was freed is marked as invalid.

If an invalid LOB locator is assigned to another LOB locator using OCILobLocatorAssign in OCI or through an assignment operation in PL/SQL, then the target of the assignment is also freed and marked as invalid.

Syntax

```
DBMS_LOB.FREETEMPORARY (
   lob_loc  IN OUT  NOCOPY BLOB);

DBMS_LOB.FREETEMPORARY (
   lob_loc  IN OUT  NOCOPY CLOB CHARACTER SET ANY_CS);
```

Parameters

Table 22–26 FREETEMPORARY Procedure Parameters

Parameter	Description
lob_loc	LOB locator.

Example

```
DECLARE
  a blob;
  b blob;
BEGIN
  dbms_lob.createtemporary(a, TRUE);
  dbms_lob.createtemporary(b, TRUE);
  ...
  -- the following call frees lob a
  dbms_lob.freetemporary(a);
  -- at this point lob locator a is marked as invalid
  -- the following assignment frees the lob b and marks it as invalid
also
  b := a;
END;
```

GETCHUNKSIZE Function

When creating the table, you can specify the chunking factor, which can be a multiple of Oracle blocks. This corresponds to the chunk size used by the LOB data layer when accessing or modifying the LOB value. Part of the chunk is used to store system-related information, and the rest stores the LOB value.

This function returns the amount of space used in the LOB chunk to store the LOB value.

Syntax

```
DBMS_LOB.GETCHUNKSIZE (
   lob_loc IN BLOB)
  RETURN INTEGER;

DBMS_LOB.GETCHUNKSIZE (
   lob_loc IN CLOB CHARACTER SET ANY_CS)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(GETCHUNKSIZE, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 22–27 GETCHUNKSIZE Function Parameters

Parameter	Description
lob_loc	LOB locator.

Returns

The value returned for BLOBs is in terms of bytes. The value returned for CLOBs is in terms of characters.

Usage Notes

Performance is improved if you enter read/write requests using a multiple of this chunk size. For writes, there is an added benefit, because LOB chunks are versioned, and if all writes are done on a chunk basis, then no extra or excess versioning is done or duplicated. You could batch up the WRITE until you have enough for a chunk, instead of issuing several WRITE calls for the same chunk.

GETLENGTH Function

This function gets the length of the specified LOB. The length in bytes or characters is returned.

The length returned for a BFILE includes the EOF, if it exists. Any 0-byte or space filler in the LOB caused by previous ERASE or WRITE operations is also included in the length count. The length of an empty internal LOB is 0.

Syntax

```
DBMS_LOB.GETLENGTH (
   lob_loc    IN  BLOB)
  RETURN INTEGER;

DBMS_LOB.GETLENGTH (
   lob_loc    IN  CLOB   CHARACTER SET ANY_CS)
  RETURN INTEGER;

DBMS_LOB.GETLENGTH (
   file_loc    IN  BFILE)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(GETLENGTH, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 22–28 GETLENGTH Function Parameter

Parameter	Description
file_loc	The file locator for the LOB whose length is to be returned.

Returns

The length of the LOB in bytes or characters as an INTEGER. NULL is returned if the input LOB is NULL or if the input lob_loc is NULL. An error is returned in the following cases for BFILEs:

- lob_loc does not have the necessary directory and OS privileges
- lob_loc cannot be read because of an OS read error

Examples

```
CREATE OR REPLACE PROCEDURE Example_11a IS
    lobd        BLOB;
    length      INTEGER;
BEGIN
```

```
    -- get the LOB locator
    SELECT b_lob INTO lobd FROM lob_table
        WHERE key_value = 42;
    length := dbms_lob.getlength(lobd);
    IF length IS NULL THEN
        dbms_output.put_line('LOB is null.');
    ELSE
        dbms_output.put_line('The length is '
            || length);
    END IF;
END;

CREATE OR REPLACE PROCEDURE Example_11b IS
DECLARE
    len INTEGER;
    fil BFILE;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 12;
    len := dbms_lob.length(fil);
END;
```

INSTR Function

This function returns the matching position of the *nth* occurrence of the pattern in the LOB, starting from the offset you specify.

The form of the VARCHAR2 buffer (the pattern parameter) must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

For BFILEs, the file must be already opened using a successful FILEOPEN operation for this operation to succeed.

Operations that accept RAW or VARCHAR2 parameters for pattern matching, such as INSTR, do not support regular expressions or special matching characters (as in the case of SQL LIKE) in the pattern parameter or substrings.

Syntax

```
DBMS_LOB.INSTR (
   lob_loc    IN   BLOB,
   pattern    IN   RAW,
   offset     IN   INTEGER := 1,
   nth        IN   INTEGER := 1)
```

```
  RETURN INTEGER;

DBMS_LOB.INSTR (
   lob_loc    IN   CLOB      CHARACTER SET ANY_CS,
   pattern    IN   VARCHAR2  CHARACTER SET lob_loc%CHARSET,
   offset     IN   INTEGER := 1,
   nth        IN   INTEGER := 1)
  RETURN INTEGER;

DBMS_LOB.INSTR (
   file_loc   IN   BFILE,
   pattern    IN   RAW,
   offset     IN   INTEGER := 1,
   nth        IN   INTEGER := 1)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(INSTR, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 22–29 INSTR Function Parameters

Parameter	Description
lob_loc	Locator for the LOB to be examined.
file_loc	The file locator for the LOB to be examined.
pattern	Pattern to be tested for. The pattern is a group of RAW bytes for BLOBs, and a character string (VARCHAR2) for CLOBs.The maximum size of the pattern is 16383 bytes.
offset	Absolute offset in bytes (BLOBs) or characters (CLOBs) at which the pattern matching is to start. (origin: 1)
nth	Occurrence number, starting at 1.

Returns

Table 22–30 INSTR Function Returns

Return	Description
INTEGER	Offset of the start of the matched pattern, in bytes or characters. It returns 0 if the pattern is not found.

Table 22–30 INSTR Function Returns

Return	Description
NULL	Either: -any one or more of the IN parameters was NULL or INVALID. -offset < 1 or offset > LOBMAXSIZE. -nth < 1. -nth > LOBMAXSIZE.

Exceptions

Table 22–31 INSTR Function Exceptions for BFILES

Exception	Description
UNOPENED_FILE	File was not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Examples

```
CREATE OR REPLACE PROCEDURE Example_12a IS
    lobd        CLOB;
    pattern     VARCHAR2 := 'abcde';
    position    INTEGER  := 10000;
BEGIN
-- get the LOB locator
    SELECT b_col INTO lobd
        FROM lob_table
        WHERE key_value = 21;
    position := DBMS_LOB.INSTR(lobd,
                        pattern, 1025, 6);
    IF position = 0 THEN
        dbms_output.put_line('Pattern not found');
    ELSE
        dbms_output.put_line('The pattern occurs at '
                || position);
    END IF;
END;
```

```
CREATE OR REPLACE PROCEDURE Example_12b IS
DECLARE
    fil BFILE;
    pattern VARCHAR2;
    pos INTEGER;
BEGIN
    -- initialize pattern
    -- check for the 6th occurrence starting from 1025th byte
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 12;
    dbms_lob.fileopen(fil, dbms_lob.file_readonly);
    pos := dbms_lob.instr(fil, pattern, 1025, 6);
    dbms_lob.fileclose(fil);
END;
```

See Also: "SUBSTR Function" on page 22-49

ISOPEN Function

This function checks to see if the LOB was already opened using the input locator. This subprogram is for internal and external LOBs.

Syntax

```
DBMS_LOB.ISOPEN (
   lob_loc IN BLOB)
  RETURN INTEGER;

DBMS_LOB.ISOPEN (
   lob_loc IN CLOB CHARACTER SET ANY_CS)
  RETURN INTEGER;

DBMS_LOB.ISOPEN (
   file_loc IN BFILE)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(ISOPEN, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 22–32 ISOPEN Function Parameters

Parameter	Description
lob_loc	LOB locator.
file_loc	File locator.

Usage Notes

For BFILES, openness is associated with the locator. If the input locator was never passed to OPEN, the BFILE is not considered to be opened by this locator. However, a different locator may have opened the BFILE. More than one OPEN can be performed on the same BFILE using different locators.

For internal LOBs, openness is associated with the LOB, not with the locator. If locator1 opened the LOB, then locator2 also sees the LOB as open. For internal LOBs, ISOPEN requires a round-trip, because it checks the state on the server to see if the LOB is indeed open.

For external LOBs (BFILEs), ISOPEN also requires a round-trip, because that's where the state is kept.

ISTEMPORARY Function

Syntax

```
DBMS_LOB.ISTEMPORARY (
   lob_loc IN BLOB)
  RETURN INTEGER;

DBMS_LOB.ISTEMPORARY (
   lob_loc IN CLOB CHARACTER SET ANY_CS)
  RETURN INTEGER;
```

Pragmas

```
PRAGMA RESTRICT_REFERENCES(istemporary, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 22–33 ISTEMPORARY Procedure Parameters

Parameter	Description
lob_loc	LOB locator.
temporary	Boolean, which indicates whether the LOB is temporary or not.

Returns

This function returns TRUE in temporary if the locator is pointing to a temporary LOB. It returns FALSE otherwise.

LOADFROMFILE Procedure

This procedure copies all, or a part of, a source external LOB (BFILE) to a destination internal LOB.

You can specify the offsets for both the source and destination LOBs, and the number of bytes to copy from the source BFILE. The amount and src_offset, because they refer to the BFILE, are in terms of bytes, and the dest_offset is either in bytes or characters for BLOBs and CLOBs respectively.

> **Note:** The input BFILE must have been opened prior to using this procedure. No character set conversions are performed implicitly when binary BFILE data is loaded into a CLOB. The BFILE data must already be in the same character set as the CLOB in the database. No error checking is performed to verify this.

If the offset you specify in the destination LOB is beyond the end of the data currently in this LOB, then zero-byte fillers or spaces are inserted in the destination BLOB or CLOB respectively. If the offset is less than the current length of the destination LOB, then existing data is overwritten.

There is an error if the input amount plus offset exceeds the length of the data in the BFILE.

Note: If the character set is varying width, UTF-8 for example, the LOB value is stored in the fixed-width UCS2 format. Therefore, if you are using DBMS_LOB.LOADFROMFILE, the data in the BFILE should be in the UCS2 character set instead of the UTF-8 character set. However, you should use sql*loader instead of LOADFROMFILE to load data into a CLOB or NCLOB because sql*loader will provide the necessary character set conversions.

Syntax

```
DBMS_LOB.LOADFROMFILE (
   dest_lob    IN OUT NOCOPY BLOB,
   src_file    IN            BFILE,
   amount      IN            INTEGER,
   dest_offset IN            INTEGER  := 1,
   src_offset  IN            INTEGER  := 1);

DBMS_LOB.LOADFROMFILE(
   dest_lob    IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
   src_file    IN            BFILE,
   amount      IN            INTEGER,
   dest_offset IN            INTEGER := 1,
   src_offset  IN            INTEGER := 1);
```

Parameters

Table 22–34 LOADFROMFILE Procedure Parameters

Parameter	Description
dest_lob	LOB locator of the target for the load.
src_file	BFILE locator of the source for the load.
amount	Number of bytes to load from the BFILE.
dest_offset	Offset in bytes or characters in the destination LOB (origin: 1) for the start of the load.
src_offset	Offset in bytes in the source BFILE (origin: 1) for the start of the load.

Usage Requirements

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and

domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open / Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.

Exceptions

Table 22–35 LOADFROMFILE Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of the input parameters are NULL or INVALID.
INVALID_ARGVAL	Either: - src_offset or dest_offset < 1. - src_offset or dest_offset > LOBMAXSIZE. - amount < 1. - amount > LOBMAXSIZE.

Example

```
CREATE OR REPLACE PROCEDURE Example_l2f IS
  lobd       BLOB;
  fils       BFILE   := BFILENAME('SOME_DIR_OBJ','some_file');
  amt        INTEGER := 4000;
BEGIN
  SELECT b_lob INTO lobd FROM lob_table WHERE key_value = 42 FOR UPDATE;
  dbms_lob.fileopen(fils, dbms_lob.file_readonly);
  dbms_lob.loadfromfile(lobd, fils, amt);
  COMMIT;
  dbms_lob.fileclose(fils);
END;
```

OPEN Procedure

This procedure opens a LOB, internal or external, in the indicated mode. Valid modes include read-only, and read-write. It is an error to open the same LOB twice.

Note: If the LOB was opened in read-only mode, and if you try to write to the LOB, then an error is returned. BFILE can only be opened with read-only mode.

In Oracle8.0, the constant file_readonly was the only valid mode in which to open a BFILE. For Oracle 8*i*, two new constants have been added to the DBMS_LOB package: lob_readonly and lob_readwrite.

Syntax

```
DBMS_LOB.OPEN (
   lob_loc   IN OUT NOCOPY BLOB,
   open_mode IN            BINARY_INTEGER);

DBMS_LOB.OPEN (
   lob_loc   IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
   open_mode IN            BINARY_INTEGER);

DBMS_LOB.OPEN (
   file_loc  IN OUT NOCOPY BFILE,
   open_mode IN            BINARY_INTEGER := file_readonly);
```

Parameters

Table 22–36 OPEN Procedure Parameters

Parameter	Description
lob_loc	LOB locator.
open_mode	Mode in which to open.

Usage Notes

OPEN requires a round-trip to the server for both internal and external LOBs. For internal LOBs, OPEN triggers other code that relies on the OPEN call. For external LOBs (BFILEs), OPEN requires a round-trip because the actual operating system file on the server side is being opened.

It is not mandatory that you wrap all LOB operations inside the Open/Close APIs. However, if you open a LOB, you must close it before you commit or rollback the transaction; an error is produced if you do not. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

It is an error to commit the transaction before closing all opened LOBs that were opened by the transaction. When the error is returned, the openness of the open LOBs is discarded, but the transaction is successfully committed. Hence, all the changes made to the LOB and nonLOB data in the transaction are committed, but the domain and functional indexes are not updated. If this happens, you should rebuild the functional and domain indexes on the LOB column.

READ Procedure

This procedure reads a piece of a LOB, and returns the specified amount into the buffer parameter, starting from an absolute offset from the beginning of the LOB.

The number of bytes or characters actually read is returned in the amount parameter. If the input offset points past the End of LOB, then amount is set to 0, and a NO_DATA_FOUND exception is raised.

Syntax

```
DBMS_LOB.READ (
   lob_loc   IN             BLOB,
   amount    IN OUT  NOCOPY BINARY_INTEGER,
   offset    IN             INTEGER,
   buffer    OUT            RAW);

DBMS_LOB.READ (
   lob_loc   IN             CLOB CHARACTER SET ANY_CS,
   amount    IN OUT  NOCOPY BINARY_INTEGER,
   offset    IN             INTEGER,
   buffer    OUT            VARCHAR2 CHARACTER SET lob_loc%CHARSET);

DBMS_LOB.READ (
   file_loc   IN              BFILE,
   amount    IN OUT   NOCOPY BINARY_INTEGER,
   offset    IN               INTEGER,
   buffer    OUT              RAW);
```

Parameters

Table 22–37 READ Procedure Parameters

Parameter	Description
lob_loc	Locator for the LOB to be read.
file_loc	The file locator for the LOB to be examined.

Table 22–37 READ Procedure Parameters

Parameter	Description
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to read, or number that were read.
offset	Offset in bytes (for BLOBs) or characters (for CLOBs) from the start of the LOB (origin: 1).
buffer	Output buffer for the read operation.

Exceptions

Table 22–38 READ Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of lob_loc, amount, or offset parameters are NULL.
INVALID_ARGVAL	Either: - amount < 1 - amount > MAXBUFSIZE - offset < 1 - offset > LOBMAXSIZE - amount is greater, in bytes or characters, than the capacity of buffer.
NO_DATA_FOUND	End of the LOB is reached, and there are no more bytes or characters to read from the LOB: amount has a value of 0.

Exceptions

Table 22–39 READ Procedure Exceptions for BFILEs

Exception	Description
UNOPENED_FILE	File is not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Usage Notes

The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

When calling DBMS_LOB.READ from the client (for example, in a BEGIN/END block from within SQL*Plus), the returned buffer contains data in the client's character set. Oracle converts the LOB value from the server's character set to the client's character set before it returns the buffer to the user.

Examples

```
CREATE OR REPLACE PROCEDURE Example_13a IS
    src_lob        BLOB;
    buffer         RAW(32767);
    amt            BINARY_INTEGER := 32767;
    pos            INTEGER := 2147483647;
BEGIN
    SELECT b_col INTO src_lob
        FROM lob_table
        WHERE key_value = 21;
    LOOP
        dbms_lob.read (src_lob, amt, pos, buffer);
        -- process the buffer
        pos := pos + amt;
    END LOOP;
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            dbms_output.put_line('End of data');
END;

CREATE OR REPLACE PROCEDURE Example_13b IS
    fil BFILE;
    buf RAW(32767);
    amt BINARY_INTEGER := 32767;
    pos INTEGER := 2147483647;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 21;
    dbms_lob.fileopen(fil, dbms_lob.file_readonly);
    LOOP
        dbms_lob.read(fil, amt, pos, buf);
        -- process contents of buf
        pos := pos + amt;
```

```
    END LOOP;
    EXCEPTION
      WHEN NO_DATA_FOUND
      THEN
      BEGIN
        dbms_output.putline ('End of LOB value reached');
        dbms_lob.fileclose(fil);
      END;
END;
```

Example for efficient I/O on OS that performs better with block I/O rather than stream I/O:

```
CREATE OR REPLACE PROCEDURE Example_13c IS
    fil BFILE;
    amt BINARY_INTEGER := 1024; -- or n x 1024 for reading n
    buf RAW(1024); -- blocks at a time
    tmpamt BINARY_INTEGER;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 99;
    dbms_lob.fileopen(fil, dbms_lob.file_readonly);
    LOOP
        dbms_lob.read(fil, amt, pos, buf);
        -- process contents of buf
        pos := pos + amt;
    END LOOP;
    EXCEPTION
        WHEN NO_DATA_FOUND
        THEN
            BEGIN
                dbms_output.putline ('End of data reached');
                dbms_lob.fileclose(fil);
            END;
END;
```

SUBSTR Function

This function returns `amount` bytes or characters of a `LOB`, starting from an absolute `offset` from the beginning of the `LOB`.

For fixed-width `n`-byte `CLOBs`, if the input amount for `SUBSTR` is specified to be greater than (32767/`n`), then `SUBSTR` returns a character buffer of length (32767/`n`), or the length of the `CLOB`, whichever is lesser. For CLOBs in a varying-width character set, `n` is 2.

Syntax

```
DBMS_LOB.SUBSTR (
   lob_loc     IN    BLOB,
   amount      IN    INTEGER := 32767,
   offset      IN    INTEGER := 1)
  RETURN RAW;

DBMS_LOB.SUBSTR (
   lob_loc     IN    CLOB   CHARACTER SET ANY_CS,
   amount      IN    INTEGER := 32767,
   offset      IN    INTEGER := 1)
  RETURN VARCHAR2 CHARACTER SET lob_loc%CHARSET;

DBMS_LOB.SUBSTR (
   file_loc     IN    BFILE,
   amount      IN    INTEGER := 32767,
   offset      IN    INTEGER := 1)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(SUBSTR, WNDS, WNPS, RNDS, RNPS);
```

Parameters

Table 22–40 SUBSTR Function Parameters

Parameter	Description
lob_loc	Locator for the LOB to be read.
file_loc	The file locator for the LOB to be examined.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to be read.
offset	Offset in bytes (for BLOBs) or characters (for CLOBs) from the start of the LOB (origin: 1).

Returns

Table 22–41 SUBSTR Function Returns

Return	Description
RAW	Function overloading that has a BLOB or BFILE in parameter.

Table 22–41 SUBSTR Function Returns

Return	Description
VARCHAR2	CLOB version.
NULL	Either: - any input parameter is NULL - amount < 1 - amount > 32767 - offset < 1 - offset > LOBMAXSIZE

Exceptions

Table 22–42 SUBSTR Function Exceptions for BFILE operations

Exception	Description
UNOPENED_FILE	File is not opened using the input locator.
NOEXIST_DIRECTORY	Directory does not exist.
NOPRIV_DIRECTORY	You do not have privileges for the directory.
INVALID_DIRECTORY	Directory has been invalidated after the file was opened.
INVALID_OPERATION	File does not exist, or you do not have access privileges on the file.

Usage Notes

The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

When calling DBMS_LOB.SUBSTR from the client (for example, in a BEGIN/END block from within SQL*Plus), the returned buffer contains data in the client's character set. Oracle converts the LOB value from the server's character set to the client's character set before it returns the buffer to the user.

Examples

```
CREATE OR REPLACE PROCEDURE Example_14a IS
    src_lob         CLOB;
    pos             INTEGER := 2147483647;
```

```
    buf            VARCHAR2(32000);
BEGIN
    SELECT c_lob INTO src_lob FROM lob_table
        WHERE key_value = 21;
    buf := DBMS_LOB.SUBSTR(src_lob, 32767, pos);
    -- process the data
END;

CREATE OR REPLACE PROCEDURE Example_14b IS
    fil BFILE;
    pos INTEGER := 2147483647;
    pattern RAW;
BEGIN
    SELECT f_lob INTO fil FROM lob_table WHERE key_value = 21;
    dbms_lob.fileopen(fil, dbms_lob.file_readonly);
    pattern := dbms_lob.substr(fil, 255, pos);
    dbms_lob.fileclose(fil);
END;
```

See Also:

- "INSTR Function" on page 22-37
- "READ Procedure" on page 22-46

TRIM Procedure

This procedure trims the value of the internal LOB to the length you specify in the newlen parameter. Specify the length in bytes for BLOBs, and specify the length in characters for CLOBs.

Note: The TRIM procedure decreases the length of the LOB to the value specified in the newlen parameter.

If you attempt to TRIM an empty LOB, then nothing occurs, and TRIM returns no error. If the new length that you specify in newlen is greater than the size of the LOB, then an exception is raised.

Syntax

```
DBMS_LOB.TRIM (
   lob_loc        IN OUT  NOCOPY BLOB,
   newlen         IN             INTEGER);
```

```
DBMS_LOB.TRIM (
   lob_loc         IN OUT  NOCOPY CLOB CHARACTER SET ANY_CS,
   newlen          IN              INTEGER);
```

Parameters

Table 22–43 TRIM Procedure Parameters

Parameter	Description
lob_loc	Locator for the internal LOB whose length is to be trimmed.
newlen	New, trimmed length of the LOB value in bytes for BLOBs or characters for CLOBs.

Exceptions

Table 22–44 TRIM Procedure Exceptions

Exception	Description
VALUE_ERROR	lob_loc is NULL.
INVALID_ARGVAL	Either: - new_len < 0 - new_len > LOBMAXSIZE

Usage Notes

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.

Example

```
CREATE OR REPLACE PROCEDURE Example_15 IS
    lob_loc        BLOB;
```

```
BEGIN
-- get the LOB locator
    SELECT b_col INTO lob_loc
        FROM lob_table
        WHERE key_value = 42 FOR UPDATE;
    dbms_lob.trim(lob_loc, 4000);
    COMMIT;
END;
```

See Also:

- "ERASE Procedure" on page 22-24
- "WRITEAPPEND Procedure" on page 22-56

WRITE Procedure

This procedure writes a specified amount of data into an internal LOB, starting from an absolute offset from the beginning of the LOB. The data is written from the `buffer` parameter.

WRITE replaces (overwrites) any data that already exists in the LOB at the offset, for the length you specify.

There is an error if the input amount is more than the data in the buffer. If the input amount is less than the data in the buffer, then only amount bytes or characters from the buffer is written to the LOB. If the offset you specify is beyond the end of the data currently in the LOB, then zero-byte fillers or spaces are inserted in the BLOB or CLOB respectively.

Syntax

```
DBMS_LOB.WRITE (
   lob_loc  IN OUT NOCOPY  BLOB,
   amount   IN             BINARY_INTEGER,
   offset   IN             INTEGER,
   buffer   IN             RAW);

DBMS_LOB.WRITE (
   lob_loc  IN OUT  NOCOPY CLOB   CHARACTER SET ANY_CS,
   amount   IN             BINARY_INTEGER,
   offset   IN             INTEGER,
   buffer   IN             VARCHAR2 CHARACTER SET lob_loc%CHARSET);
```

Parameters

Table 22–45 WRITE Procedure Parameters

Parameter	Description
lob_loc	Locator for the internal LOB to be written to.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to write, or number that were written.
offset	Offset in bytes (for BLOBs) or characters (for CLOBs) from the start of the LOB (origin: 1) for the write operation.
buffer	Input buffer for the write.

Exceptions

Table 22–46 WRITE Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of lob_loc, amount, or offset parameters are NULL, out of range, or INVALID.
INVALID_ARGVAL	Either: - amount < 1 - amount > MAXBUFSIZE - offset < 1 - offset > LOBMAXSIZE

Usage Notes

The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

When calling DBMS_LOB.WRITE from the client (for example, in a BEGIN/END block from within SQL*Plus), the buffer must contain data in the client's character set. Oracle converts the client-side buffer to the server's character set before it writes the buffer data to the LOB.

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you

opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open / Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the `OPEN` or `CLOSE` statement.

Example

```
CREATE OR REPLACE PROCEDURE Example_16 IS
    lob_loc        BLOB;
    buffer         RAW;
    amt            BINARY_INTEGER := 32767;
    pos            INTEGER := 2147483647;
    i              INTEGER;
BEGIN
    SELECT b_col INTO lob_loc
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    FOR i IN 1..3 LOOP
        dbms_lob.write (lob_loc, amt, pos, buffer);
        -- fill in more data
        pos := pos + amt;
    END LOOP;
    EXCEPTION
        WHEN some_exception
        THEN handle_exception;
END;
```

See Also:

- "APPEND Procedure" on page 22-15
- "COPY Procedure" on page 22-20

WRITEAPPEND Procedure

This procedure writes a specified amount of data to the end of an internal `LOB`. The data is written from the `buffer` parameter.

There is an error if the input amount is more than the data in the buffer. If the input amount is less than the data in the buffer, then only amount bytes or characters from the buffer are written to the end of the `LOB`.

Syntax

```
DBMS_LOB.WRITEAPPEND (
   lob_loc IN OUT NOCOPY BLOB,
   amount  IN            BINARY_INTEGER,
   buffer  IN            RAW);

DBMS_LOB.WRITEAPPEND (
   lob_loc IN OUT NOCOPY CLOB CHARACTER SET ANY_CS,
   amount  IN            BINARY_INTEGER,
   buffer  IN            VARCHAR2 CHARACTER SET lob_loc%CHARSET);
```

Parameters

Table 22–47 WRITEAPPEND Procedure Parameters

Parameter	Description
lob_loc	Locator for the internal LOB to be written to.
amount	Number of bytes (for BLOBs) or characters (for CLOBs) to write, or number that were written.
buffer	Input buffer for the write.

Exceptions

Table 22–48 WRITEAPPEND Procedure Exceptions

Exception	Description
VALUE_ERROR	Any of lob_loc, amount, or offset parameters are NULL, out of range, or INVALID.
INVALID_ARGVAL	Either: - amount < 1 - amount > MAXBUFSIZE

Usage Notes

The form of the VARCHAR2 buffer must match the form of the CLOB parameter. In other words, if the input LOB parameter is of type NCLOB, then the buffer must contain NCHAR data. Conversely, if the input LOB parameter is of type CLOB, then the buffer must contain CHAR data.

When calling DBMS_LOB.WRITEAPPEND from the client (for example, in a BEGIN/END block from within SQL*Plus), the buffer must contain data in the client's character set. Oracle converts the client-side buffer to the server's character set before it writes the buffer data to the LOB.

It is not mandatory that you wrap the LOB operation inside the Open/Close APIs. If you did not open the LOB before performing the operation, the functional and domain indexes on the LOB column are updated during the call. However, if you opened the LOB before performing the operation, you must close it before you commit or rollback the transaction. When an internal LOB is closed, it updates the functional and domain indexes on the LOB column.

If you do not wrap the LOB operation inside the Open/Close API, the functional and domain indexes are updated each time you write to the LOB. This can adversely affect performance. Therefore, it is recommended that you enclose write operations to the LOB within the OPEN or CLOSE statement.

Example

```
CREATE OR REPLACE PROCEDURE Example_17 IS
    lob_loc    BLOB;
    buffer     RAW;
    amt        BINARY_INTEGER := 32767;
    i          INTEGER;
BEGIN
    SELECT b_col INTO lob_loc
        FROM lob_table
        WHERE key_value = 12 FOR UPDATE;
    FOR i IN 1..3 LOOP
        -- fill the buffer with data to be written to the lob
        dbms_lob.writeappend (lob_loc, amt, buffer);
    END LOOP;
END;
```

See Also:

- "APPEND Procedure" on page 22-15
- "COPY Procedure" on page 22-20
- "WRITE Procedure" on page 22-54

23

DBMS_LOCK

Oracle Lock Management services for your applications are available through procedures in the DBMS_LOCK package. You can request a lock of a specific mode, give it a unique name recognizable in another procedure in the same or another instance, change the lock mode, and release it.

Because a reserved user lock is the same as an Oracle lock, it has all the functionality of an Oracle lock, such as deadlock detection. Be certain that any user locks used in distributed transactions are released upon COMMIT, or an undetected deadlock may occur.

User locks never conflict with Oracle locks because they are identified with the prefix "UL". You can view these locks using the Enterprise Manager lock monitor screen or the appropriate fixed views. User locks are automatically released when a session terminates.

The lock identifier is a number in the range of 0 to 1073741823.

Some uses of user locks:

- Providing exclusive access to a device, such as a terminal
- Providing application-level enforcement of read locks
- Detecting when a lock is released and cleanup after the application
- Synchronizing applications and enforcing sequential processing

This chapter discusses the following topics:

Requirements, Security, and Constants for DBMS_LOCK

Requirements

DBMS_LOCK is most efficient with a limit of a few hundred locks per session. Oracle strongly recommends that you develop a standard convention for using these locks in order to avoid conflicts among procedures trying to use the same locks. For example, include your company name as part of your lock names.

Security

There might be operating system-specific limits on the maximum number of total locks available. This *must* be considered when using locks or making this package available to other users. Consider granting the EXECUTE privilege only to specific users or roles.

A better alternative would be to create a cover package limiting the number of locks used and grant EXECUTE privilege to specific users. An example of a cover package is documented in the DBMSLOCK.SQL package specification file.

Constants

```
nl_mode  constant integer := 1;
ss_mode  constant integer := 2;       -- Also called 'Intended Share'
sx_mode  constant integer := 3;       -- Also called 'Intended Exclusive'
s_mode   constant integer := 4;
ssx_mode constant integer := 5;
x_mode   constant integer := 6;
```

These are the various lock modes (nl -> "NuLl", ss -> "Sub Shared", sx -> "Sub eXclusive", s -> "Shared", ssx -> "Shared Sub eXclusive", x -> "eXclusive").

A sub-share lock can be used on an aggregate object to indicate that share locks are being aquired on sub-parts of the object. Similarly, a sub-exclusive lock can be used on an aggregate object to indicate that exclusive locks are being aquired on sub-parts of the object. A share-sub-exclusive lock indicates that the entire aggregate object has a share lock, but some of the sub-parts may additionally have exclusive locks.

Lock Compatibility Rules

When another process holds "held", an attempt to get "get" does the following:

Table 23–1 Lock Compatibility

HELD MODE	GET NL	GET SS	GET SX	GET S	GET SSX	GET X
NL	Success	Success	Success	Success	Success	Success
SS	Success	Success	Success	Success	Success	Fail
SX	Success	Success	Success	Fail	Fail	Fail
S	Success	Success	Fail	Success	Fail	Fail
SSX	Success	Success	Fail	Fail	Fail	Fail
X	Success	Fail	Fail	Fail	Fail	Fail

```
maxwait  constant integer := 32767;
```

The constant `maxwait` waits forever.

Summary of DBMS_LOCK Subprograms

Table 23–2 DBMS_LOCK Package Subprograms

Subprogram	Description
"ALLOCATE_UNIQUE Procedure" on page 23-3	Allocates a unique lock ID to a named lock.
"REQUEST Function" on page 23-5	Requests a lock of a specific mode.
"CONVERT Function" on page 23-7	Converts a lock from one mode to another.
"RELEASE Function" on page 23-8	Releases a lock.
"SLEEP Procedure" on page 23-9	Puts a procedure to sleep for a specific time.

ALLOCATE_UNIQUE Procedure

This procedure allocates a unique lock identifier (in the range of 1073741824 to 1999999999) given a lock name. Lock identifiers are used to enable applications to coordinate their use of locks. This is provided because it may be easier for applications to coordinate their use of locks based on lock names rather than lock numbers.

If you choose to identify locks by name, you can use ALLOCATE_UNIQUE to generate a unique lock identification number for these named locks.

The first session to call ALLOCATE_UNIQUE with a new lock name causes a unique lock ID to be generated and stored in the dbms_lock_allocated table. Subsequent calls (usually by other sessions) return the lock ID previously generated.

A lock name is associated with the returned lock ID for at least expiration_secs (defaults to 10 days) past the last call to ALLOCATE_UNIQUE with the given lock name. After this time, the row in the dbms_lock_allocated table for this lock name may be deleted in order to recover space. ALLOCATE_UNIQUE performs a commit.

Caution: Named user locks may be less efficient, because Oracle uses SQL to determine the lock associated with a given name.

Syntax

```
DBMS_LOCK.ALLOCATE_UNIQUE (
   lockname         IN  VARCHAR2,
   lockhandle       OUT VARCHAR2,
   expiration_secs  IN  INTEGER   DEFAULT 864000);
```

Parameters

Table 23–3 ALLOCATE_UNIQUE Procedure Parameters

Parameter	Description
lockname	Name of the lock for which you want to generate a unique ID. Do not use lock names beginning with ORA$; these are reserved for products supplied by Oracle Corporation.

Table 23–3 ALLOCATE_UNIQUE Procedure Parameters

Parameter	Description
lockhandle	Returns the handle to the lock ID generated by ALLOCATE_UNIQUE. You can use this handle in subsequent calls to REQUEST, CONVERT, and RELEASE. A handle is returned instead of the actual lock ID to reduce the chance that a programming error accidentally creates an incorrect, but valid, lock ID. This provides better isolation between different applications that are using this package. LOCKHANDLE can be up to VARCHAR2 (128). All sessions using a lock handle returned by ALLOCATE_UNIQUE with the same lock name are referring to the same lock. Therefore, do not pass lock handles from one session to another.
expiration_specs	Number of seconds to wait after the last ALLOCATE_UNIQUE has been performed on a given lock, before permitting that lock to be deleted from the DBMS_LOCK_ALLOCATED table. The default waiting period is 10 days. You should not delete locks from this table. Subsequent calls to ALLOCATE_UNIQUE may delete expired locks to recover space.

Errors

ORA-20000, ORU-10003: Unable to find or insert lock <lockname> into catalog dbms_lock_allocated.

REQUEST Function

This function requests a lock with a given mode. REQUEST is an overloaded function that accepts either a user-defined lock identifier, or the lock handle returned by the ALLOCATE_UNIQUE procedure.

Syntax

```
DBMS_LOCK.REQUEST(
   id                IN  INTEGER ||
   lockhandle        IN  VARCHAR2,
   lockmode          IN  INTEGER DEFAULT X_MODE,
   timeout           IN  INTEGER DEFAULT MAXWAIT,
   release_on_commit IN  BOOLEAN DEFAULT FALSE,
  RETURN INTEGER;
```

The current default values, such as X_MODE and MAXWAIT, are defined in the DBMS_LOCK package specification.

Parameters

Table 23–4 REQUEST Function Parameters

Parameter	Description
id or lockhandle	User assigned lock identifier, from 0 to 1073741823, or the lock handle, returned by ALLOCATE_UNIQUE, of the lock mode you want to change.
lockmode	Mode that you are requesting for the lock. The available modes and their associated integer identifiers are listed below. The abbreviations for these locks, as they appear in the V$ views and Enterprise Manager monitors are in parentheses. 1 - null mode 2 - row share mode (ULRS) 3 - row exclusive mode (ULRX) 4 - share mode (ULS) 5 - share row exclusive mode (ULRSX) 6 - exclusive mode (ULX) Each of these lock modes is explained in *Oracle8 Concepts*.
timeout	Number of seconds to continue trying to grant the lock. If the lock cannot be granted within this time period, then the call returns a value of 1 (timeout).
release_on_commit	Set this parameter to TRUE to release the lock on commit or roll-back. Otherwise, the lock is held until it is explicitly released or until the end of the session.

Return Values

Table 23–5 REQUEST Function Return Values

Return Value	Description
0	Success

Table 23–5 REQUEST Function Return Values

Return Value	Description
1	Timeout
2	Deadlock
3	Parameter error
4	Already own lock specified by `id` or `lockhandle`
5	Illegal lock handle

CONVERT Function

This function converts a lock from one mode to another. `CONVERT` is an overloaded function that accepts either a user-defined lock identifier, or the lock handle returned by the `ALLOCATE_UNIQUE` procedure.

Syntax

```
DBMS_LOCK.CONVERT(
   id         IN INTEGER ||
   lockhandle IN VARCHAR2,
   lockmode   IN INTEGER,
   timeout    IN NUMBER DEFAULT MAXWAIT)
  RETURN INTEGER;
```

Parameters

Table 23–6 CONVERT Function Parameters

Parameter	Description
`id or lockhandle`	User assigned lock identifier, from 0 to 1073741823, or the lock handle, returned by `ALLOCATE_UNIQUE`, of the lock mode you want to change.

Table 23–6 CONVERT Function Parameters

Parameter	Description
lockmode	New mode that you want to assign to the given lock. The available modes and their associated integer identifiers are listed below. The abbreviations for these locks, as they appear in the V$ views and Enterprise Manager monitors are in parentheses. 1 - null mode 2 - row share mode (ULRS) 3 - row exclusive mode (ULRX) 4 - share mode (ULS) 5 - share row exclusive mode (ULRSX) 6 - exclusive mode (ULX) Each of these lock modes is explained in *Oracle8 Concepts*.
timeout	Number of seconds to continue trying to change the lock mode. If the lock cannot be converted within this time period, then the call returns a value of 1 (timeout).

Return Values

Table 23–7 CONVERT Function Return Values

Return Value	Description
0	Success
1	Timeout
2	Deadlock
3	Parameter error
4	Don't own lock specified by id or lockhandle
5	Illegal lock handle

RELEASE Function

This function explicitly releases a lock previously acquired using the REQUEST function. Locks are automatically released at the end of a session. RELEASE is an

overloaded function that accepts either a user-defined lock identifier, or the lock handle returned by the ALLOCATE_UNIQUE procedure.

Syntax

```
DBMS_LOCK.RELEASE (
   id         IN INTEGER)
  RETURN INTEGER;

DBMS_LOCK.RELEASE (
   lockhandle IN VARCHAR2)
  RETURN INTEGER;
```

Parameters

Table 23–8 RELEASE Function Parameter

Parameter	Description
id or lockhandle	User assigned lock identifier, from 0 to 1073741823, or the lock handle, returned by ALLOCATE_UNIQUE, of the lock mode you want to change.

Return Values

Table 23–9 RELEASE Function Return Values

Return Value	Description
0	Success
3	Parameter error
4	Do not own lock specified by id or lockhandle
5	Illegal lock handle

SLEEP Procedure

This procedure suspends the session for a given period of time.

Syntax

```
DBMS_LOCK.SLEEP (
   seconds  IN NUMBER);
```

Parameters

Table 23–10 SLEEP Procedure Parameters

Parameter	Description
seconds	Amount of time, in seconds, to suspend the session. The smallest increment can be entered in hundredths of a second; for example, 1.95 is a legal time value.

Example

This Pro*COBOL precompiler example shows how locks can be used to ensure that there are no conflicts when multiple people need to access a single device.

Print Check

Any cashier may issue a refund to a customer returning goods. Refunds under $50 are given in cash; anything above that is given by check. This code prints the check. The one printer is opened by all the cashiers to avoid the overhead of opening and closing it for every check. This means that lines of output from multiple cashiers could become interleaved if we don't ensure exclusive access to the printer. The DBMS_LOCK package is used to ensure exclusive access.

CHECK-PRINT

Get the lock "handle" for the printer lock:

```
MOVE "CHECKPRINT" TO LOCKNAME-ARR.
MOVE 10 TO LOCKNAME-LEN.
EXEC SQL EXECUTE
   BEGIN DBMS_LOCK.ALLOCATE_UNIQUE ( :LOCKNAME, :LOCKHANDLE );
   END; END-EXEC.
```

Lock the printer in exclusive mode (default mode):

```
EXEC SQL EXECUTE
   BEGIN DBMS_LOCK.REQUEST ( :LOCKHANDLE );
   END; END-EXEC.
```

We now have exclusive use of the printer, print the check:

```
...
```

Unlock the printer so other people can use it:

```
EXEC SQL EXECUTE
```

```
BEGIN DBMS_LOCK.RELEASE ( :LOCKHANDLE );

END; END-EXEC.
```

24

DBMS_LOGMNR

LogMiner allows you to make queries based on actual data values. For instance, you could issue a query to select all updates to the table `scott.emp` or all deletions performed by user `scott`. You could also perform a query to show all updates to `scott.emp` that increased `sal` more than a certain amount. Such data can be used to analyze system behavior and to perform auditing tasks.

The `DBMS_LOGMNR` package contains procedures used to initialize the LogMiner tool. You use these procedures to list the redo log files to be analyzed and to specify the SCN or time range of interest. After these procedures complete, the server is ready to process SQL `SELECT` statements against the `V$LOGMNR_CONTENTS` view.

The data in redo log files is especially important for recovery, because you can use it to pinpoint when a database became corrupted.You can then use this information to recover the database to the state just prior to corruption.

> **See Also:** *Oracle9i Database Administrator's Guide* and *Oracle9i User-Managed Backup and Recovery Guide*

This chapter discusses the following topics:

DBMS_LOGMNR Constants

The following sections describe the constants for the DBMS_LOGMNR package.

Constants for ADD_LOGFILE Options Flag

NEW	DBMS_LOGMNR.NEW purges the existing list of redo log files, if any. Places the specified redo log file in the list of log files to be analyzed.
ADDFILE	DBMS_LOGMNR.ADDFILE adds the specified redo log file to the list of log files to be analyzed. Any attempts to add a duplicate file raise an exception (ORA-1289).
REMOVEFILE	DBMS_LOGMNR.REMOVEFILE removes the redo log file from the list of log files to be analyzed. Any attempts to remove a file that has not been previously added, raise an exception (ORA-1290).

Constants for START_LOGMNR Options Flag

COMMITTED_DATA_ONLY	If set, only DMLs corresponding to committed transactions are returned. DMLs corresponding to a committed transaction are grouped together. Transactions are returned in their commit order. If this option is not set, all rows for all transactions (committed, rolled back and in-progress) are returned.
SKIP_CORRUPTION	Directs a SELECT operation from V$LOGMNR_CONTENTS to skip any corruptions in the redo log file being analyzed and continue processing. This option works only when a block in the redo log file (and not the header of the redo log file) has been corrupted. Caller should check the INFO column in the V$LOGMNR_CONTENTS view to determine the corrupt blocks skipped by LogMiner.
DDL_DICT_TRACKING	If the dictionary in use is a flat file or in the redo log files, LogMiner ensures that its internal dictionary is updated if a DDL event occurs. This ensures that correct SQL_REDO and SQL_UNDO information is maintained for objects that are modified after the LogMiner dictionary is built. This option cannot be used in conjunction with the DICT_FROM_ONLINE_CATALOG option.

NO_DICT_ RESET_ ONSELECT	This option is only valid if the DDL_DICT_TRACKING option is also specified. It prevents LogMiner from reloading its internal dictionary at the beginning of each select operation on V$LOGMNR_CONTENTS. This can be an advantage because it can be time consuming to refresh the dictionary if a DDL operation has updated the dictionary. If you use this option, be aware that because the dictionary has not been refreshed for subsequent select operations, you may get incompletely reconstructed SQL_REDO and SQL_UNDO information for objects that are modified in the redo log files. Such incomplete reconstructions produce SQL that cannot be executed.
DICT_FROM_ ONLINE_ CATALOG	Directs LogMiner to use the current live database dictionary rather than a dictionary snapshot contained in a flat file or in a redo log file. This option cannot be used in conjunction with the DDL_DICT_ TRACKING option.
DICT_FROM_ REDO_LOGS	If set, LogMiner expects to find a dictionary in the redo log files that were specified with the DBMS_LOGMNR.ADD_LOGFILE procedure.

Extracting Data Values From Redo Log Files

LogMiner data extraction from redo log files is performed using two mine functions: DBMS_LOGMNR.MINE_VALUE and DBMS_LOGMNR.COLUMN_PRESENT, described later in this chapter.

Example of Using DBMS_LOGMNR

The following example shows how to use the DBMS_LOGMNR procedures to add redo log files to a LogMiner session, how to start LogMiner, how to perform a select operation from V$LOGMNR_CONTENTS, and how to end a LogMiner session. For complete descriptions of the DBMS_LOGMNR procedures, see Summary of DBMS_ LOGMNR Subprograms on page 24-4.

```
EXECUTE DBMS_LOGMNR.ADD_LOGFILE(
   LogFileName => '/oracle/logs/log1.f',
   Options => dbms_logmnr.NEW);
```

```
EXECUTE DBMS_LOGMNR.ADD_LOGFILE(
   LogFileName => '/oracle/logs/log2.f',
   Options => dbms_logmnr.ADDFILE);

EXECUTE DBMS_LOGMNR.START_LOGMNR(
   DictFileName =>'/oracle/dictionary.ora');

SELECT sql_redo
FROM V$LOGMNR_CONTENTS
EXECUTE DBMS_LOGMNR.END_LOGMNR();
```

Summary of DBMS_LOGMNR Subprograms

Table 24–1 describes the procedures in the DBMS_LOGMNR supplied package.

Table 24–1 DBMS_LOGMNR Package Subprograms

Subprogram	Description
"ADD_LOGFILE Procedure" on page 24-4	Adds a file to the existing or newly created list of archive files to process.
"START_LOGMNR Procedure" on page 24-5	Initializes the LogMiner utility.
"END_LOGMNR Procedure" on page 24-8	Finishes a LogMiner session.
"MINE_VALUE Function" on page 24-8	This function may be called for any row returned from V$LOGMNR_CONTENTS to retrieve the undo or redo column value of the column specified by the column_name input parameter to this function.
"COLUMN_PRESENT Function" on page 24-9	This function may be called for any row returned from V$LOGMNR_CONTENTS to determine if undo or redo column values exist for the column specified by the column_name input parameter to this function.

ADD_LOGFILE Procedure

This procedure adds a file to the existing or newly created list of archive files to process.

In order to select information from the V$LOGMNR_CONTENTS view, the LogMiner session must be set up with information about the redo log files to be analyzed. Use the ADD_LOGFILE procedure to specify the list of redo log files to analyze.

Note: If you want to analyze five redo log files, you must call the ADD_LOGFILE procedure five times.

Syntax

```
DBMS_LOGMNR.ADD_LOGFILE(
   LogFileName         IN VARCHAR2,
   Options             IN BINARY_INTEGER default ADDFILE );
```

Parameters

Table 24–2 ADD_LOGFILE Procedure Parameters

Parameter	Description
LogFileName	Name of the redo log file that must be added to the list of log files to be analyzed by this session.
Options	Either: - Starts a new list (DBMS_LOGMNR.NEW) - Adds a file to an existing list (DBMS_LOGMNR.ADDFILE), or - Removes a redo log file (DBMS_LOGMNR.REMOVEFILE) See "Constants for ADD_LOGFILE Options Flag" on page 24-2.

Exceptions

- ORA-1284: logfile cannot be opened. Logfile or the directory may be non-existent or inaccessible.
- ORA-1286: logfile specified is not from the database that produced other logfiles added for analysis.
- ORA-1287: logfile specified is from a different database incarnation.
- ORA-1289: attempt to add duplicate logfile.
- ORA-1290: attempt to remove unlisted logfile.
- ORA-1337: logfile specified has a different compatibility version than the rest of the logfiles added.

START_LOGMNR Procedure

This procedure starts a LogMiner session.

Note: This procedure fails if you did not specify a list of redo log files to be analyzed previously through the ADD_LOGFILE procedure.

Syntax

```
DBMS_LOGMNR.START_LOGMNR(
   startScn           IN NUMBER default 0,
   endScn             IN NUMBER default 0,
   startTime          IN DATE default '01-jan-1988',
   endTime            IN DATE default '01-jan-2988',
   DictFileName       IN VARCHAR2 default '',
   Options            IN BINARY_INTEGER default 0 );
```

Parameters

The parameters for the DBMS_LOGMNR.START_LOGMNR procedure are listed in Table 24–3.

Table 24–3 START_LOGMNR Procedure Parameters

Parameter	Description
startScn	Only consider redo records with SCN greater than or equal to the startSCN specified. This fails if there is no redo log file with an SCN range (i.e, the LOW_SCN and NEXT_SCN associated with the log file as shown in V$LOGMNR_LOGS view) containing the startScn.
endScn	Only consider redo records with SCN less than or equal to the endSCN specified. This fails if there is no redo log file with an SCN range (i.e, the LOW_SCN and NEXT_SCN associated with the log file as shown in V$LOGMNR_LOGS view) containing the endScn.
startTime	Only consider redo records with timestamp greater than or equal to the startTime specified. This fails if there is no redo log file with a time range (i.e, the LOW_TIME and HIGH_TIME associated with the log file as shown in V$LOGMNR_LOGS view) containing the startTime. This parameter is ignored if startScn is specified.
endTime	Only consider redo records with timestamp less than or equal to the endTime specified. This fails if there is no redo log file with a time range (i.e, the LOW_TIME and HIGH_TIME associated with the log file as shown in V$LOGMNR_LOGS view) containing the endTime. This parameter is ignored if endScn is specified.

Table 24–3 START_LOGMNR Procedure Parameters

Parameter	Description
DictFileName	This flat file contains a snapshot of the database catalog. It is used to reconstruct SQL_REDO and SQL_UNDO columns in V$LOGMNR_CONTENTS, as well as to fully translate SEG_NAME, SEG_OWNER, SEG_TYPE_NAME and TABLE_SPACE columns. The fully qualified pathname for the dictionary file must be specified (This file must have been created previously through the DBMS_LOGMNR_D.BUILD procedure). You only need to specify this parameter if neither DICT_FROM_REDO_LOGS nor DICT_FROM_ONLINE_CATALOG is specified.
Options	See "Constants for START_LOGMNR Options Flag" on page 24-2.

After executing the START_LOGMNR procedure, you can make use of the following views:

- V$LOGMNR_DICTIONARY - contains current information about the dictionary file
- V$LOGMNR_PARAMETERS - contains information about the LogMiner session
- V$LOGMNR_LOGS - contains information about the redo log files being analyzed

Exceptions

- ORA-1280: The procedure fails with this exception if LogMiner encounters an internal error
- ORA-1281: endScn is less than startScn
- ORA-1282: endDate is earlier than startDate
- ORA-1283: Invalid options is specified
- ORA-1293: The procedure fails with this exception for the following reasons:
  1. No logfile has (LOW_SCN, NEXT_SCN) range containing the startScn specified.
  2. No logfile has (LOW_SCN, NEXT_SCN) range containing the endScn specified.
  3. No logfile has (LOW_TIME, HIGH_TIME) range containing the startTime specified.

4. No logfile has (LOW_TIME, HIGH_TIME) range containing the endTime specified.

- ORA-1294: Dictionary file specified is corrupt.
- ORA-1295: Dictionary specified does not correspond to the same database that produced the logfiles being analyzed.

END_LOGMNR Procedure

This procedure finishes a LogMiner session. Because this procedure performs cleanup operations which may not otherwise be done, you must use it to properly end a LogMiner session.

Syntax

```
DBMS_LOGMNR.END_LOGMNR;
```

Parameters

None.

Exception

- ORA-1307: No LogMiner session is active. The END_LOGMNR procedure was called without adding any logfiles.

MINE_VALUE Function

This function returns the value contained in the first parameter corresponding to the column name indicated in the second parameter.

The syntax for this function is as follows:

Syntax

```
dbms_logmnr.mine_value(
     sql_redo_undo        IN  RAW,
     column_name        IN  VARCHAR2 default '') RETURN VARCHAR2;
```

Parameters

The parameters for the MINE_VALUE function are listed in Table 24–4.

Table 24–4 MINE_VALUE Function Parameters

Parameter	Description
sql_redo_undo	Value of the REDO_VALUE or UNDO_VALUE columns selected from V$LOGMNR_CONTENTS. The value of this parameter directs LogMiner to return undo or redo column information. This parameter can be thought of as a self-describing record that contains values corresponding to several columns in a table.
column_name	Fully qualified column name (schema.table.column) which this function will return information about.

Returns

Table 24–5 Return Values for MINE_VALUE Function

Return	Description
NULL	The column is not contained within the self-describing record or the column value is NULL.
NON-NULL	The column is contained within the self-describing record; the value is returned in string format.

Exceptions

No LogMiner errors are returned.

Usage Notes

- To use the MINE_VALUE function, you must have successfully started a LogMiner session.
- The MINE_VALUE function must be invoked in the context of a select operation from the V$LOGMNR_CONTENTS view.
- The MINE_VALUE function does not support LONG, LOB, ADT, or COLLECTION datatypes.

COLUMN_PRESENT Function

This function is meant to be used in conjunction with DBMS_LOGMNR.MINE_VALUE.

The syntax for this function is as follows:

Syntax

```
dbms_logmnr.column_present(
     sql_redo_undo        IN  RAW,
     column_name         IN  VARCHAR2 default '') RETURN NUMBER;
```

Parameters

The parameters for the COLUMN_PRESENT function are listed in Table 24–6.

Table 24–6 COLUMN_PRESENT Function Parameters

Parameter	Description
sql_redo_undo	Value of the REDO_VALUE or UNDO_VALUE columns selected from V$LOGMNR_CONTENTS. The value of this parameter directs LogMiner to look for undo or redo column information.
column_name	Fully qualified column name which this function will return information about.

Returns

Table 24–7 Return Values for COLUMN_PRESENT Function

Return	Description
0	Specified column is not present in this row of V$LOGMNR_CONTENTS.
1	Column is present in this row of V$LOGMNR_CONTENTS. Returns 1 if the self-describing record (the first parameter) contains the column specified in the second parameter. This can be used to distinguish between NULL returns from the DBMS_LOGMNR.MINE_VALUE function.

Exceptions

No LogMiner errors are returned.

Usage Notes

- To use the COLUMN_PRESENT function, you must have successfully started a LogMiner session.
- The COLUMN_PRESENT function must be invoked in the context of a select operation from the V$LOGMNR_CONTENTS view.

- The COLUMN_PRESENT function does not support LONG, LOB, ADT, or COLLECTION datatypes.

25

DBMS_LOGMNR_CDC_PUBLISH

Oracle Change Data Capture identifies new data that has been added to, modified, or removed from relational tables and publishes the changed data in a form that is usable by an application.

This chapter describes how to use the `DBMS_LOGMNR_CDC_PUBLISH` supplied package to set up an Oracle Change Data Capture system to capture and publish data from one or more Oracle relational source tables. Change Data Capture captures and publishes only committed data.

Typically, a Change Data Capture system has one **publisher** that captures and publishes changes for any number of Oracle source (relational) tables. The publisher then provides subscribers, typically applications, with access to the published data.

> **See Also:** *Oracle9i Data Warehousing Guide* for more information about the Oracle Change Data Capture publish and subscribe model.

This chapter discusses the following topics:

Publishing Change Data

The publisher, typically a database administrator, is concerned primarily with the source of the data and with creating the schema objects that describe the structure of the capture system: change sources, change sets, and change tables.

Most Change Data Capture systems have one publisher and many subscribers. The publisher accomplishes the following main objectives:

1. Determine which source table changes need to be published.
2. Use the procedures in the DBMS_LOGMNR_CDC_PUBLISH package to capture change data and makes it available from the source tables by creating and administering the change source, change set, and change table objects.
3. Allow controlled access to subscribers by using the SQL GRANT and REVOKE statements to grant and revoke the SELECT privilege on change tables for users and roles.

   This is necessary to allow the subscribers, usually applications, to use the DBMS_LOGMNR_CDC_SUBSCRIBE procedure to subscribe to the change data.

Summary of DBMS_LOGMNR_CDC_PUBLISH Subprograms

Through the DBMS_LOGMNR_CDC_PUBLISH package, the publisher creates and maintains change sources, change sets, and change tables, and eventually drops them when they are no longer useful.

Note: To use the DBMS_LOGMNR_CDC_PUBLISH package, you must have the EXECUTE_CATALOG_ROLE privilege, and you must have the SELECT_CATALOG_ROLE privilege to look at all of the views.

Table 25–1 describes the procedures in the DBMS_LOGMNR_CDC_PUBLISH supplied package.

Table 25–1 DBMS_LOGMNR_CDC_PUBLISH Package Subprograms

Subprogram	Description
"CREATE_CHANGE_TABLE Procedure" on page 25-3	Creates a change table in a specified schema and creates corresponding Change Data Capture metadata.
"ALTER_CHANGE_TABLE Procedure" on page 25-8	Adds or drops columns for an existing change table, or changes the properties of an existing change table.
"DROP_SUBSCRIBER_VIEW Procedure" on page 25-13	Allows the publisher to drop a subscriber view from the subscriber's schema. The view must have been created by a prior call to the PREPARE_SUBSCRIBER_VIEW procedure.
"DROP_SUBSCRIPTION Procedure" on page 25-14	Allows a publisher to drop a subscription that was created with a prior call to the GET_SUBSCRIPTION_HANDLE procedure.
"DROP_CHANGE_TABLE Procedure" on page 25-16	Drops an existing change table when there is no more activity on the table.
"PURGE Procedure" on page 25-17	Monitors usage by all subscriptions, determines which rows are no longer needed by subscriptions, and removes the unneeded rows to prevent change tables from growing endlessly.

CREATE_CHANGE_TABLE Procedure

This procedure creates a change table in a specified schema.

Syntax

The following syntax specifies columns and datatypes using a comma-separated string.

```
DBMS_LOGMNR_CDC_PUBLISH.CREATE_CHANGE_TABLE (
    owner                IN VARCHAR2,
    change_table_name    IN VARCHAR2,
    change_set_name      IN VARCHAR2,
    source_schema        IN VARCHAR2,
    source_table         IN VARCHAR2,
    column_type_list     IN VARCHAR2,
    capture_values       IN VARCHAR2,
    rs_id                IN CHAR,
    row_id               IN CHAR,
    user_id              IN CHAR,
    timestamp            IN CHAR,
```

```
object_id          IN CHAR,
source_colmap      IN CHAR,
target_colmap      IN CHAR,
options_string     IN VARCHAR2);
```

Parameters

Table 25–2 CREATE_CHANGE_TABLE Procedure Parameters

Parameter	Description
owner	Name of the schema that owns the change table.
change_table_name	Name of the change table that is being created.
change_set_name	Name of an existing change set with which this change table is associated. Synchronous change tables must specify SYNC_SET.
source_schema	The schema where the source table is located.
source_table	The source table from which the change records are captured.
column_type_list	Comma-separated list of columns and datatypes that are being tracked.
capture_values	Set this parameter to one of the following capture values for update operations: **Value** — **Description** OLD — Captures the original values from the source table. NEW — Captures the changed values from the source table. BOTH — Captures the original and changed values from the source table.
rs_id	Adds a column to the change table that contains the row sequence number. This parameter orders the operations in a transaction in the sequence that they were committed in the database. The row sequence ID (`rs_id`) parameter is optional for synchronous mode. **Note:** For synchronous mode, the `rs_id` parameter reflects an operations capture order within a transaction, but you cannot use the `rs_id` parameter by itself to order committed operations across transactions. Set this parameter to Y or N, as follows:

Table 25–2 CREATE_CHANGE_TABLE Procedure Parameters

Parameter	Description
	Value **Description** Y Indicates that you want to add a column to the change table that will contain the row sequence of the change. N Indicates that you do not want to track the `rs_id` column.
row_id	Adds a column to the change table that contains the row ID of the changed row in the source table, as follows. **Value** **Description** Y Indicates that you want to add a column to the change table that contains the row ID of the changed row in the source table. N Indicates that you do not want to track the `row_id` column.
user_id	Adds a column to the change table that contains the user name of the user who entered a DML statement, as follows. **Value** **Description** Y Indicates that you want to add a column to the change table that contains the user name of the user who entered a DML statement. N Indicates that you do not want to track users.
timestamp	Adds a column to the change table that contains the capture timestamp of the change record, as follows: **Value** **Description** Y Indicates that you want to add a column to the change table that contains the capture timestamp of the change record. N Indicates that you do not want to track timestamps.
object_id	Adds a column to the change table that contains the object ID of this change record. This is a control column for object support. Specify Y or N, as follows: **Value** **Description** Y Indicates that you want to add a column to the change table that contains the object ID of this change record. N Indicates that you do not want to track object IDs.

Table 25–2 CREATE_CHANGE_TABLE Procedure Parameters

Parameter	Description
source_colmap	Adds a column to the change table as a change column vector that indicates which source columns actually changed. Specify Y or N, as follows: **Value** — **Description** Y — Indicates that you want to add a column to the change table to track the source columns that have changed. N — Indicates that you do not want to track which source columns changed.
target_colmap	Adds a column to the change table as a column vector indicating which change table user columns actually changed. Specify Y or N, as follows. **Value** — **Description** Y — Indicates that you want to add a column to the change table to track the change table user columns that have changed. N — Indicates that you do not want to track changes which change table user columns changed.
options_string	A string that contains syntactically correct options to be passed to a `CREATE TABLE` DDL statement. The options string is appended to the generated `CREATE TABLE` DDL statement after the closing parenthesis that defines the columns of the table. See the Usage Notes for more information.

Exceptions

Table 25–3 CREATE_CHANGE_TABLE Procedure Exceptions

Exception	Description
ORA-31409	One or more of the input parameters to the `CREATE_CHANGE_TABLE` procedure had invalid values. Identify the incorrect parameters and supply the correct values to the procedure.
ORA-31416	The value specified for the `source_colmap` parameter is invalid. For synchronous mode, specify either Y or N.
ORA-31417	A reserved column name was specified in a column list or column type parameter. Ensure that the name specified does not conflict with a reserved column name.

Table 25–3 CREATE_CHANGE_TABLE Procedure Exceptions

Exception	Description
ORA-31418	While creating a synchronous change table, the name of the source schema did not match any existing schema name in the database.
ORA-31419	When creating a synchronous change table, the underlying source table did not exist when the procedure was called.
ORA-31420	When creating the first change table, a purge job is submitted to the job queue. Submission of this purge job failed.
ORA-31421	The specified change table does not exist. Check the specified change table name to see that it matches the name of an existing change table.
ORA-31422	Owner schema does not exist.
ORA-31438	Duplicate change table. Re-create the change table with a unique name.
ORA-31450	Invalid value was specified for change_table_name.
ORA-31451	Invalid value was specified for the capture_value. Expecting either OLD, NEW, or BOTH.
ORA-31452	Invalid value was specified. Expecting either Y or N.
ORA-31459	System triggers for DBMS_LOGMRN_CDC_PUBLISH package are not installed.
ORA-31467	No column found in the source table. The OBJECT_ID flag was set to Y on the call to CREATE_CHANGE_TABLE and change table belongs to the synchronous change set. The corresponding object column was not detected in the source table.

Usage Notes

- A change table is a database object that contains the change data resulting from DML statements (INSERT, UPDATE, and DELETE) made to a source table. A given change table can capture changes from only one source table.
- A synchronous change table must belong to the SYNC_SET change set.
- A change table is a database table that maintains the change data in these two types of columns:
  - Source columns identify the columns from the source table to capture. Source columns are copies of actual source table columns that reside in the change table.
  - Control columns maintain special metadata for each change row in the container table. Information such as the DML operation performed, the

capture time (timestamp), and changed column vectors are examples of control columns.

- The publisher can control a change table's physical properties, tablespace properties, and so on by specifying the `options_string` parameter. With the `options_string` parameter, you can set any option that is valid for the `CREATE TABLE` DDL statement.
- Do not attempt to control a change table's partitioning properties. When Change Data Capture performs a purge operation to remove rows from a change set, it automatically manages the change table partitioning for you.

Note: How you define the `options_string` parameter can have an effect on the performance and operations in a Change Data Capture system. For example, if the publisher places several constraints in the options column, it can have a noticeable effect on performance. Also, if the publisher uses `NOT NULL` constraints and a particular column is not changed in an incoming change row, then the constraint can cause the entire `INSERT` operation to fail.

Example

```
execute DBMS_CDC_PUBLISH.CREATE_CHANGE_TABLE(OWNER => 'cdc1', \
    CHANGE_TABLE_NAME => 'emp_ct', \
    CHANGE_SET_NAME => 'SYNC_SET', \
    SOURCE_SCHEMA => 'scott', \
    SOURCE_TABLE => 'emp', \
    COLUMN_TYPE_LIST => 'empno number, ename varchar2(10), job varchar2(9), mgr
    number, hiredate date, deptno number', \
    CAPTURE_VALUES => 'both', \
    RS_ID => 'y', \
    ROW_ID => 'n', \
    USER_ID => 'n', \
    TIMESTAMP => 'n', \
    OBJECT_ID => 'n',\
    SOURCE_COLMAP => 'n', \
    TARGET_COLMAP => 'y', \
    OPTIONS_STRING => NULL);
```

ALTER_CHANGE_TABLE Procedure

This procedure adds columns to, or drops columns from, an existing change table.

Syntax

The following syntax specifies columns and datatypes as a comma-separated list.

```
DBMS_LOGMNR_CDC_PUBLISH.ALTER_CHANGE_TABLE (
    owner                IN VARCHAR2,
    change_table_name    IN VARCHAR2,
    operation            IN VARCHAR2,
    column_list          IN VARCHAR2,
    rs_id                IN CHAR,
    row_id               IN CHAR,
    user_id              IN CHAR,
    timestamp            IN CHAR,
    object_id            IN CHAR,
    source_colmap        IN CHAR,
    target_colmap        IN CHAR);
```

Parameters

Table 25–4 ALTER_CHANGE_TABLE Procedure Parameters

Parameter	Description
owner	Name of the schema that owns the change table.
change_table_name	Name of the change table that is being altered.
operation	Specifies either the value DROP or ADD to indicate whether to add or drop the columns in the field column_table or column_list.
column_list	A comma-separated list of column names and datatypes for each column of the source table that should be added to, or dropped from, the change table.
rs_id	Adds or drops the control column that tracks the row sequence (rs_id). Set this parameter to Y or N, as follows: **Value** **Description** Y Adds or drops a column on the change table that contains the row sequence (rs_id). N The rs_id control column is not changed in the change table.
row_id	Adds or drops a row_id column, as follows:

Table 25–4 ALTER_CHANGE_TABLE Procedure Parameters

Parameter	Description
	Value **Description** Y Adds or drops the `row_id` control column for the change table. N The row_id column is not changed in the change table.
user_id	Adds or drops the user name control column. Specify Y or N, as follows: **Value** **Description** Y Adds or drops a column on the change table that contains the user name (`user_id`). N The user_id column is not changed in the change table.
timestamp	Adds or drops the timestamp control column to the change table, as follows: **Value** **Description** Y Adds or drops a column on the change table that contains the timestamp. N The timestamp control column is not changed in the change table.
object_id	Add or drops the `object_id` column, as follows: **Value** **Description** Y Adds or drops a column on the change table that contains the `object_id`. N The object_id control column is not changed in the change table.
source_colmap	Adds or drops the source_colmap control column from the change table, as follows: **Value** **Description** Y Adds or drops a column on the change table that contains the source columns (source_colmap). N The source_colmap column is not changed in the change table.
target_colmap	Adds or drops the `target_colmap` control column from the change table, as follows:

Table 25–4 ALTER_CHANGE_TABLE Procedure Parameters

Parameter	Description	
	Value	**Description**
	Y	Adds or drops a column on the change table that contains the target columns (target_colmap).
	N	The target_colmap column is not changed in the change table.

Exceptions

Table 25–5 ALTER_CHANGE_TABLE Procedure Exceptions

Exception	Description
ORA-31403	You issued an ALTER_CHANGE_TABLE procedure with an ADD operation but a column by this name already exists in the specified table.
ORA-31409	One or more of the input parameters to the ALTER_CHANGE_SET procedure had invalid values. Identify the incorrect parameters and supply the correct values to the procedure.
ORA-31417	A reserved column name was specified in the column list parameter. Ensure that the name specified does not conflict with a reserved column name.
ORA-31421	The specified change table does not exist. Check the specified change table name to see that it matches the name of an existing change table.
ORA-31423	You issued the ALTER_CHANGE_TABLE with a drop operation and the specified column does not exist in the change table.
ORA-31454	Illegal value was specified for operation parameter; expecting ADD or DROP.
ORA-31455	Nothing to alter. The specified column list is NULL and all optional control columns are N.
ORA-31456	An internal attempt to invoke a procedure within the DBMS_CDC_UTILITY package failed. Check the trace logs for more information.
ORA-31459	One or more required system triggers are not installed.

Usage Notes

- You cannot add and drop user columns in the same call to the ALTER_CHANGE_TABLE procedure; these schema changes require separate calls.
- Do not specify the name of the control columns in the user-column lists.

- The following table describes what happens when you add a column to a change table:

If the publisher adds	And	Then . . .
A user column	A new subscription includes this column	The subscription window starts at the point the column was added.
A user column	A new subscription does not include this newly added column	The subscription window starts at the low-water mark for the change table thus enabling the subscriber to see the entire table.
A user column	Old subscriptions exist	The subscription window remains unchanged and the entire table can be seen.
A control column	There is a new subscription	The subscription window starts at the low-water mark for the change table. The subscription can see the control column immediately. All rows that existed in the change table prior to adding the control column will have the value NULL for the newly added control column field.
A control column	—	Any existing subscriptions can see the new control column when the window is extended (DBMS_LOGMNR_CDC_PUBLISH.EXTEND_WINDOW procedure) such that the low watermark for the window crosses over the point when the control column was added.

Example

```
EXECUTE DBMS_LOGMNR_CDC_PUBLISH.ALTER_CHANGE_TABLE (OWNER => 'cdc1') \
    CHANGE_TABLE_NAME => 'emp_ct' \
    OPERATION => ADD \
    ADD_COLUMN_LIST => '' \
    RS_ID => 'Y' \
    ROW_ID => 'N' \
    USER_ID => 'N' \
    TIMESTAMP => 'N' \
    OBJECT_ID => 'N' \
    SOURCE_COLMAP => 'N' \
    TARGET_COLMAP => 'N');
```

DROP_SUBSCRIBER_VIEW Procedure

This procedure allows a publisher to drop a subscriber view in the subscriber's schema.

Note: This procedure works the same way as the DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIBER_VIEW procedure.

Syntax

```
DBMS_LOGMNR_CDC_PUBLISH.DROP_SUBSCRIBER_VIEW (
    subscription_handle     IN NUMBER,
    source_schema           IN VARCHAR2,
    source_table            IN VARCHAR2)
```

Parameters

Table 25–6 DROP_SUBSCRIBER_VIEW Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the DBMS_LOGMNR_CDC_SUBSCRIBE.GET_SUBSCRIPTION_HANDLE procedure.
source_schema	Schema name where the source table resides.
source_table	Name of the published source table.

Exceptions

Table 25–7 DROP_SUBSCRIBER_VIEW Procedure Exceptions

Exception	Description
ORA-31425	Subscription handle does not exist or handle does not belong to this user. Call the function again with a valid subscription handle.
ORA-31429	The subscription has not been activated. Check the subscription handle and correct it, if necessary. Call the DBMS_LOGMNR_CDC_SUBSCRIBE.ACTIVATE_SUBSCRIPTION procedure for this subscription handle and then try the original command again.

Table 25–7 DROP_SUBSCRIBER_VIEW Procedure Exceptions

Exception	Description
ORA-31432	The schema_name.source_table does not exist or does not belong to this subscription. Check the spelling of the schema_name and source_table parameters. Verify the specified table exists in the specified schema and is subscribed to by the subscription handle.
ORA-31433	The subscriber view does not exist. Either you specified an incorrect subscriber view or the view is already dropped. Check the name and specify the name of an existing subscriber view.

Usage Notes

- This procedure provides the publisher with a way to clean up views that have not been removed by the subscriber. (Typically, subscribers drop the subscriber views using the DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIBER_VIEW procedure.)
- The subscriber view you want to drop must have been created with a prior call to the DBMS_LOGMNR_CDC_SUBSCRIBE.PREPARE_SUBSCRIBER_VIEW procedure.
- You must use this procedure to drop any subscriber views prior to dropping a subscription using the DBMS_LOGMNR_CDC_PUBLISH.DROP_SUBSCRIPTION procedure.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.DROP_SUBSCRIBER_VIEW( \
    SUBSCRIPTION_HANDLE =>:subhandle, \
    SOURCE_SCHEMA =>'scott', \
    SOURCE_TABLE => 'emp');
```

DROP_SUBSCRIPTION Procedure

This procedure allows a publisher to drop a subscription that was created with a prior call to the DBMS_LOGMNR_CDC_SUBSCRIBE.GET_SUBSCRIPTION_HANDLE procedure.

Note: This procedure works the same way as the DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIPTION procedure.

Syntax

```
DBMS_LOGMNR_CDC_PUBLISH.DROP_SUBSCRIPTION (
    subscription_handle      IN NUMBER)
```

Parameters

Table 25–8 DROP_SUBSCRIPTION Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the DBMS_LOGMNR_CDC_SUBSCRIBE.GET_SUBSCRIPTION_HANDLE procedure.

Exceptions

Table 25–9 DROP_SUBSCRIPTION Procedure Exceptions

Exception	Description
ORA-31425	Subscription handle does not exist or handle does not belong to this user. Call the function again with a valid subscription handle.
ORA-31430	The subscriber view was not dropped prior to making this call. Call the DBMS_LOGMNR_CDC_PUBLISH.DROP_SUBSCRIBER_VIEW procedure and then try the original command again.

Usage Notes

- This procedure provides the publisher with a way to drop subscriptions that have not been dropped by the subscriber. (Typically, subscribers drop subscriptions using the DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIPTION procedure.)
- Prior to dropping a subscription, you must drop the subscriber view using the DBMS_LOGMNR_CDC_PUBLISH.DROP_SUBSCRIBER_VIEW procedure.

Example

```
EXECUTE DBMS_LOGMNR_CDC_PUBLISH.DROP_SUBSCRIPTION ( \
    SUBSCRIPTION_HANDLE => :subhandle);
```

DROP_CHANGE_TABLE Procedure

This procedure drops an existing change table.

Syntax

```
DBMS_LOGMNR_CDC_PUBLISH.DROP_CHANGE_TABLE (
    owner                          IN VARCHAR2,
    change_table_name              IN VARCHAR2,
    force_flag                     IN CHAR)
```

Parameters

Table 25–10 DROP_CHANGE_TABLE Procedure Parameters

Parameter	Description
owner	Name of the schema that owns the change table.
change_table_name	Name of the change table that is being dropped.
force_flag	Drops the change table, depending on whether or not there are subscriptions making references to it, as follows: **Value** — **Description** Y — Drops the change table even if there are subscriptions making references to it. N — Drops the change table only if there are no subscribers referencing it.

Exceptions

Table 25–11 DROP_CHANGE_TABLE Procedure Exceptions

Exception	Description
ORA-31421	The specified change table does not exist. Check the specified change table name to see that it matches the name of an existing change table.
ORA-31422	Owner schema does not exist.

Table 25–11 DROP_CHANGE_TABLE Procedure Exceptions

Exception	Description
ORA-31424	The specified change table has active subscriptions, and thus it cannot be dropped. If you must drop the table, use the `force_flag` parameter to immediately drop the change table from all of the subscribers.
ORA-31441	Table is not a change table. You attempted to execute the DROP_CHANGE_TABLE procedure on a table that is not a change table.

Example

```
EXECUTE DBMS_LOGMNR_CDC_PUBLISH.DROP_CHANGE_TABLE ( \
    OWNER => 'cdc1', \
    CHANGE_TABLE_NAME => 'emp_ct' \
    FORCE_FLAG => 'N')
```

PURGE Procedure

This procedure monitors change table usage by all subscriptions, determines which rows are no longer needed by subscriptions, and removes the unneeded rows to prevent change tables from growing endlessly.

Syntax

```
DBMS_LOGMNR_CDC_PUBLISH.PURGE ( )
```

Exceptions

Only standard Oracle exceptions (for example, a privilege violation) are returned during a purge operation.

Usage Notes

- You can run this procedure manually or automatically:
  - Run this procedure manually from the command line at any time that you want to purge data from change tables.
  - Run this procedure in a script to routinely perform a purge operation and proactively control the growth of change tables. You can always remove or disable (or suspend) the purge operation if you want to prevent it from running automatically.
- Use this procedure to control the growth of change tables.

- Do not attempt to control a change table's partitioning properties. When the DBMS_LOGMNR_CDC_PUBLISH.PURGE procedure runs, Change Data Capture performs partition maintenance automatically.

Example

```
EXECUTE DBMS_LOGMNR_CDC_PUBLISH.PURGE
```

26

DBMS_LOGMNR_CDC_SUBSCRIBE

This chapter describes how to use the DBMS_LOGMNR_CDC_SUBSCRIBE package to view and query the change data that was captured and published with the DBMS_LOGMNR_CDC_PUBLISH package.

A Change Data Capture system usually has one publisher that captures and publishes changes for any number of Oracle source (relational) tables and many subscribers. The **subscribers**, typically applications, use the Oracle supplied package, DBMS_LOGMNR_CDC_SUBSCRIBE, to access the published data.

This chapter discusses the following topics:

> **See Also:** *Oracle9i Data Warehousing Guide* for more information about the Oracle Change Data Capture publish and subscribe model.

Subscribing to Change Data

Once the publisher sets up the system to capture data into change tables and grants access, subscribers can access and query the published change data for any of the source tables of interest. Using the procedures in the DBMS_LOGMNR_CDC_SUBSCRIBE package, the subscriber accomplishes the following main objectives:

1. Indicate the change data of interest by creating subscriptions to published source tables and source columns.
2. Extend the subscription window and create a new subscriber view when the subscriber is ready to receive a set of change data.
3. Use SELECT statements to retrieve change data from the subscriber views.
4. Drop the subscriber view and purge the subscription window when finished processing a block of changes.
5. Drop the subscription when the subscriber no longer needs its change data.

Summary of DBMS_LOGMNR_CDC_SUBSCRIBE Subprograms

The primary role of the subscriber is to use the change data. Through the DBMS_LOGMNR_CDC_SUBSCRIBE package, each subscriber registers interest in a set of source tables by *subscribing* to them.

Table 26–1 describes the procedures for the DBMS_LOGMNR_CDC_SUBSCRIBE package.

Table 26–1 DBMS_LOGMNR_CDC_SUBSCRIBE Package Subprograms

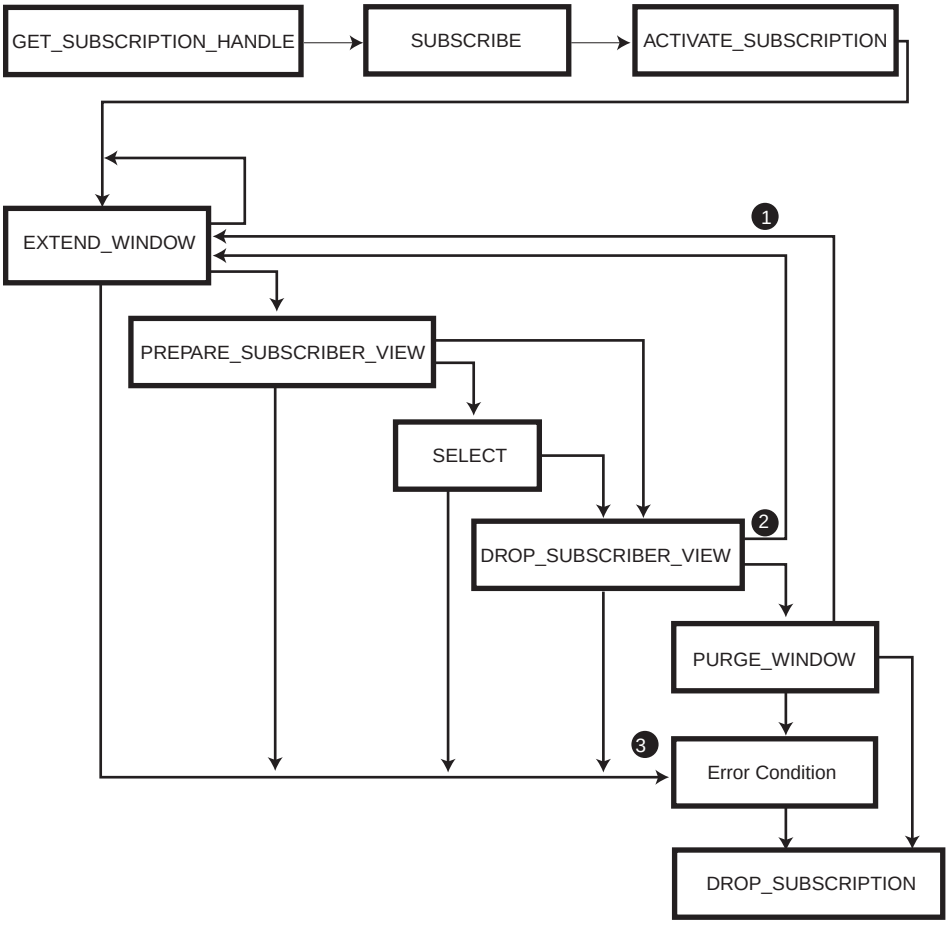
Subprogram	Description
"GET_SUBSCRIPTION_HANDLE Procedure" on page 26-5	Creates a subscription handle that associates the subscription with one change set.
"SUBSCRIBE Procedure" on page 26-6	Specifies the source tables and source columns for which the subscriber wants to access change data.
"ACTIVATE_SUBSCRIPTION Procedure" on page 26-9	Indicates that a subscription is ready to start accessing change data.
"EXTEND_WINDOW Procedure" on page 26-10	Sets the subscription window boundaries (low-water and high-water mark) so that new change data can be seen.
"PREPARE_SUBSCRIBER_VIEW Procedure" on page 26-11	Creates a subscriber view in the subscriber's schema in which the subscriber can query the change data encompassed by the current subscription window.

Table 26–1 DBMS_LOGMNR_CDC_SUBSCRIBE Package Subprograms (Cont.)

Subprogram	Description
"DROP_SUBSCRIBER_VIEW Procedure" on page 26-13	Drops a subscriber view from the subscriber's schema.
"PURGE_WINDOW Procedure" on page 26-14	Sets the low-water mark for a subscription window to notify the capture system that the subscriber is finished processing a set of change data.
"DROP_SUBSCRIPTION Procedure" on page 26-14	Drops a subscription that was created with a prior call to the `GET_SUBSCRIPTION_HANDLE` procedure.

Subscribers call the procedures in the order shown in Table 26–1 unless an error occurs, at which time the subscribers should exit. Figure 26–1 shows the most common steps for using the procedures in the `DBMS_LOGMNR_CDC_SUBSCRIBE` package.

Figure 26–1 Subscription Flow



In Figure 26–1:

1. If you use the `PURGE_WINDOW` procedure immediately after using an `EXTEND_WINDOW` procedure, then change data is lost without ever being processed.
2. If you use the `EXTEND_WINDOW` procedure immediately after using the `DROP_SUBSCRIBER_VIEW` procedure, you will see the data that you just processed again and possibly some new data.

3. If an error occurs during any step in the process, the application program calling the DBMS_LOGMNR_CDC_SUBSCRIBE procedures should detect the error and exit. For example, if the PREPARE_SUBSCRIBER_VIEW procedure fails for any reason, and the application ignores the error and continues, then the PURGE_WINDOW procedure will delete data that was never seen or selected by the subscriber.

GET_SUBSCRIPTION_HANDLE Procedure

This procedure creates a subscription handle that associates the subscription with one change set. Creating a subscription handle is the first step in obtaining a subscription.

Syntax

```
DBMS_LOGMNR_CDC_SUBSCRIBE.GET_SUBSCRIPTION_HANDLE(
    change_set          IN VARCHAR2,
    description         IN VARCHAR2 := NULL,
    subscription_handle OUT NUMBER)
```

Parameters

Table 26–2 GET_SUBSCRIPTION_HANDLE Procedure Parameters

Parameter	Description
change_set	Name of an existing change set to which the application subscribes. You must set the value to SYNC_SET.
description	Describes the subscription handle and the purpose for which it is used.
subscription_handle	Unique number of the subscription handle for this subscription.

Exception

Table 26–3 GET_SUBSCRIPTION_HANDLE Procedure Exceptions

Exception	Description
ORA-31415	Could not find an existing change set with this name.
ORA-31457	The maximum number of characters permitted in the description field was exceeded.

Table 26–3 GET_SUBSCRIPTION_HANDLE Procedure Exceptions (Cont.)

Exception	Description
ORA-31458	This is an internal error. Contact Oracle Support Services and report the error.

Usage Notes

- The GET_SUBSCRIPTION_HANDLE procedure allows a subscriber to register interest in a change set associated with source tables of interest.
- To see all of the published source tables for which the subscriber has privileges, query the ALL_PUBLICATIONS view.
- A subscriber can later use a single subscription handle to access the multiple change tables in the subscription.
- Subscription handles:
  - Never get reused and are tracked from the time of creation until they are dropped with the DROP_SUBSCRIPTION procedure.
  - Are not shared among subscribers; rather, each subscription handle is validated against the subscriber's login ID.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.GET_SUBSCRIPTION_HANDLE(\
    CHANGE_SET=>'SYNC_SET', \
    DESCRIPTION=>'Change data for emp',\
    SUBSCRIPTION_HANDLE=>:subhandle);
```

SUBSCRIBE Procedure

This procedure specifies the source tables and source columns for which the subscriber wants to access change data.

Syntax

There are two versions of syntax for the SUBSCRIBE procedure, each of which specifies the subscriber columns and datatypes. If the subscribers know which publication contains the source columns of interest, the subscribers can use the version of the procedure that contains the publication ID. If they do not know the publication ID, the Change Data Capture system will select a publication based on the supplied source schema and source table.

The following syntax identifies the source table of interest, allowing Change Data Capture to select any publication that contains all source columns of interest.

```
DBMS_LOGMNR_CDC_SUBSCRIBE.SUBSCRIBE (
    subscription_handle     IN NUMBER,
    source_schema           IN VARCHAR2,
    source_table            IN VARCHAR2,
    column_list             IN VARCHAR2)
```

The following syntax specifies the publication ID for a specific publication that contains the source columns of interest.

```
DBMS_LOGMNR_CDC_SUBSCRIBE.SUBSCRIBE (
    subscription_handle     IN NUMBER,
    publication_id          IN NUMBER,
    column_list             IN VARCHAR2)
```

Parameters

Table 26–4 SUBSCRIBE Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the `GET_SUBSCRIPTION_HANDLE` procedure.
source_schema	Schema name where the source table resides.
source_table	Name of a published source table.
column_list	A comma-separated list of columns from the published source table.
publication_id	A valid publication_id, which you can obtain from the `ALL_PUBLISHED_COLUMNS` view.

Exceptions

Table 26–5 SUBSCRIBE Procedure Exceptions

Exception	Description
`ORA-31425`	The specified subscription handle does not exist, or it does not belong to this user or application.

Table 26–5 SUBSCRIBE Procedure Exceptions (Cont.)

Exception	Description
ORA-31426	The subscription handle has been activated; additional calls to the SUBSCRIBE procedure are prohibited. You must subscribe to all of the desired tables and columns before activating the subscription. Ensure that the correct subscription handle was specified.
ORA-31427	The subscription represented by the subscription handle already contains the schema name and source table. Check the values of the subscription_handle, source_schema, and source_table parameters. Do not attempt to subscribe to the same table more than once using the same subscription handle.
ORA-31428	No publication contains all of the specified columns. One or more of the specified columns cannot be found in a single publication. Consult the ALL_PUBLISHED_COLUMNS view to see the current publications and change the subscription request to select only the columns that are in the same publication.

Usage Notes

- You can subscribe to any valid publication_id. You can find valid publications in the ALL_PUBLISHED_COLUMNS view.
- The SUBSCRIBE procedure allows an application to subscribe to one or more published source tables and to specific columns in each source table.
- To see all of the published source table columns for which the subscriber has privileges, query the ALL_PUBLISHED_COLUMNS view.
- Subscriptions must be created before the application actually needs the data. The Change Data Capture system does not guarantee that there will be any change data available at the moment the subscription is created.
- Subscribers can subscribe only to published columns from the source table. Also, all of the columns must come from the same publication. Any control columns associated with the underlying change table are added to the subscription automatically.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.SUBSCRIBE(\
    SUBSCRIPTION_HANDLE=>:subhandle, \
    SOURCE_SCHEMA=>'scott', \
    SOURCE_TABLE=>'emp', \
    COLUMN_LIST=>'empno, ename, hiredate');
```

ACTIVATE_SUBSCRIPTION Procedure

The ACTIVATE_SUBSCRIPTION procedure indicates that a subscription is ready to start accessing change data.

Syntax

```
DBMS_CDC_SUBSCRIBE.ACTIVATE_SUBSCRIPTION (
    subscription_handle          IN NUMBER)
```

Parameters

Table 26–6 ACTIVATE_SUBSCRIPTION Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the GET_SUBSCRIPTION_HANDLE procedure.

Exceptions

Table 26–7 ACTIVATE_SUBSCRIPTION Procedure Exceptions

Exception	Description
ORA-31425	The specified subscription handle does not exist, or it does not belong to this user ID or application.
ORA-31439	The subscription is already active. You can activate a subscription only once.

Usage Notes

- The ACTIVATE_SUBSCRIPTION procedure indicates that you are finished subscribing to tables, and the subscription is ready to start accessing data.
- Once the subscriber activates the subscription:
  - No additional source tables can be added to the subscription.
  - The Change Data Capture system holds the available data for the source tables and sets the subscription window to empty.
  - The subscriber must use the EXTEND_WINDOW procedure to see the initial set of change data.
  - The subscription cannot be activated again.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.ACTIVATE_SUBSCRIPTION( \
    SUBSCRIPTION_HANDLE=>:subhandle);
```

EXTEND_WINDOW Procedure

This procedure sets the subscription window boundaries (low-water and high-water mark) so that new change data can be seen.

Syntax

```
DBMS_LOGMNR_CDC_SUBSCRIBE.EXTEND_WINDOW (
    subscription_handle          IN NUMBER)
```

Parameters

Table 26–8 EXTEND_WINDOW Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the GET_SUBSCRIPTION_HANDLE procedure.

Exceptions

Table 26–9 EXTEND_WINDOW Procedure Exceptions

Exception	Description
ORA-31425	The specified subscription handle does not exist or it does not belong to this user or application.
ORA-31429	The subscription handle must be activated before you use the EXTEND_WINDOW procedure. Call the ACTIVATE_SUBSCRIPTION procedure for this subscription handle and then try the original command again.
ORA-31430	The subscriber view was not dropped prior to making this call. Call the DROP_SUBSCRIBER_VIEW procedure and then try the original command again.

Usage Notes

- Until you call the EXTEND_WINDOW procedure to begin capturing change data, the subscription window remains empty.

- The first time that you call the EXTEND_WINDOW procedure, it establishes the initial boundaries for the subscription window.
- Subsequent calls to the EXTEND_WINDOW procedure extend the high-water mark of the subscription window so that new change data can be seen.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.EXTEND_WINDOW( \
subscription_handle=>:subhandle);
```

PREPARE_SUBSCRIBER_VIEW Procedure

This procedure creates a subscriber view in the subscriber's schema in which the subscriber can query the change data encompassed by the current subscription window.

Syntax

```
DBMS_LOGMNR_CDC_SUBSCRIBE.PREPARE_SUBSCRIBER_VIEW (
    subscription_handle     IN NUMBER,
    source_schema           IN VARCHAR2,
    source_table            IN VARCHAR2,
    view_name               OUT VARCHAR2)
```

Parameters

Table 26–10 PREPARE_SUBSCRIBER_VIEW Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the GET_SUBSCRIPTION_HANDLE procedure.
source_schema	Schema name where the source table resides.
source_table	Name of the published source table that belongs to the subscription handle.
view_name	Name of the newly-created view that will return the change data for the source table.

Exceptions

Table 26–11 PREPARE_SUBSCRIBER_VIEW Procedure Exceptions

Exception	Description
ORA-31425	The specified subscription handle does not exist, or it does not belong to this user or application.
ORA-31429	The subscription has not been activated. The subscription handle must be activated before you use the PREPARE_SUBSCRIBER_VIEW procedure. Call the ACTIVATE_SUBSCRIPTION procedure for this subscription handle and then try the original command again.
ORA-31430	An earlier subscriber view was not dropped prior to making this call. Call the DROP_SUBSCRIBER_VIEW procedure and then try the original command again.
ORA-31432	The schema name or source table does not exist or does not belong to this subscription. Check the spelling of the schema_name and source_table parameters. Verify the specified table exists in the specified schema and is subscribed to by the subscription handle.

Usage Notes

- This procedure creates a subscriber view in the subscriber's schema in which to display the change data. After the subscriber view is created, the subscriber can select change data that is within the boundaries defined (by the EXTEND_WINDOW procedure) for the subscription window.
- The Change Data Capture system determines the name of the subscriber view and returns the name to the subscriber. The name of the subscriber view is constant over the life of the subscription. To access the change data, there must be a view for each source table in the subscription. Applications use a SELECT statement from these views and retrieve the change data. For the purpose of the following example, assume that sys.sub9view was the view name returned by the PREPARE_SUBSCRIBER_VIEW procedure:

```
SELECT * FROM sys.sub9view;
.
.
.
```

- If a view already exists with the same view_name (for example, if the previous view was not dropped with a DROP VIEW DDL statement), an exception occurs. The PREPARE_SUBSCRIBER_VIEW procedure checks if the underlying change table still exists.

Examples

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.PREPARE_SUBSCRIBER_VIEW( \
    SUBSCRIPTION_HANDLE =>:subhandle, \
    SOURCE_SCHEMA =>'scott', \
    SOURCE_TABLE => 'emp', \
    VIEW_NAME => :viewname);
```

DROP_SUBSCRIBER_VIEW Procedure

This procedure drops a subscriber view from the subscriber's schema.

Syntax

```
DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIBER_VIEW (
    subscription_handle     IN NUMBER,
    source_schema           IN VARCHAR2,
    source_table            IN VARCHAR2)
```

Parameters

Table 26–12 DROP_SUBSCRIBER_VIEW Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the GET_SUBSCRIPTION_HANDLE procedure.
source_schema	Schema name where the source table resides.
source_table	Name of the published source table that belongs to the subscription handle.

Exceptions

Table 26–13 DROP_SUBSCRIBER_VIEW Procedure Exceptions

Exception	Description
ORA-31425	Subscription handle does not exist or handle does not belong to this user. Call the function again with a valid subscription handle.
ORA-31429	The subscription has not been activated. Check the subscription handle and correct it, if necessary. Call the ACTIVATE_SUBSCRIPTION procedure for this subscription handle and then try the original command again.

Table 26–13 DROP_SUBSCRIBER_VIEW Procedure Exceptions (Cont.)

Exception	Description
ORA-31432	The schema_name.source_table does not exist or does not belong to this subscription. Check the spelling of the schema_name and source_table parameters. Verify the specified table exists in the specified schema and is subscribed to by the subscription handle.
ORA-31433	The subscriber view does not exist. Either you specified an incorrect source table or its view is already dropped.

Usage Notes

- The subscriber view you want to drop must have been created with a prior call to the DBMS_LOGMNR_CDC_SUBSCRIBE.PREPARE_SUBSCRIBER_VIEW procedure.
- You must use this procedure to drop the subscriber view prior to dropping a subscription using the DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIPTION procedure.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.DROP_SUBSCRIBER_VIEW( \
    SUBSCRIPTION_HANDLE =>:subhandle, \
    SOURCE_SCHEMA =>'scott', \
    SOURCE_TABLE => 'emp');
```

PURGE_WINDOW Procedure

The subscriber calls this procedure to notify the capture system it is finished processing a block of changes. The PURGE_WINDOW procedure sets the low-water mark so that the subscription no longer sees any data, effectively making the subscription window empty.

Syntax

```
DBMS_CDC_SUBSCRIBE.PURGE_WINDOW(
    subscription_handle              IN NUMBER)
```

Parameters

Table 26–14 PURGE_WINDOW Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the GET_SUBSCRIPTION_HANDLE procedure.

Exceptions

Table 26–15 PURGE_WINDOW Procedure Exceptions

Exception	Description
ORA-31425	Subscription handle does not exist or handle does not belong to this user. Call the function again with a valid subscription handle.
ORA-31429	The subscription handle must be activated before you use the EXTEND_WINDOW procedure. Call the ACTIVATE_SUBSCRIPTION procedure for this subscription handle and then try the original command again.
ORA-31430	The subscriber view was not dropped prior to making this call. Call the DROP_SUBSCRIBER_VIEW Procedure and then try the original command again.

Usage Notes

- When finished with a set of changes, the subscriber purges the subscription window with the PURGE_WINDOW procedure. By this action the subscriber performs the following functions:
  - Informs the change capture system that the subscriber is ready to receive the next batch of change data.
  - Enables the system to remove change data that is no longer needed by any subscribers.

  The Change Data Capture system manages the change data to ensure that it is available as long as there are subscribers who need it.

Example

```
EXECUTE sys.DBMS_CDC_SUBSCRIBE.PURGE_WINDOW ( \
SUBSCRIPTION_HANDLE=>:subhandle);
```

DROP_SUBSCRIPTION Procedure

This procedure drops a subscription that was created with a prior call to the GET_SUBSCRIPTION_HANDLE procedure.

Syntax

```
DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIPTION (
    subscription_handle          IN NUMBER)
```

Parameters

Table 26–16 DROP_SUBSCRIPTION Procedure Parameters

Parameter	Description
subscription_handle	Unique number of the subscription handle that was returned by a previous call to the GET_SUBSCRIPTION_HANDLE procedure.

Exceptions

Table 26–17 DROP_SUBSCRIPTION Procedure Exceptions

Exception	Description
ORA-31425	Subscription handle does not exist or handle does not belong to this user. Call the function again with a valid subscription handle.
ORA-31430	The subscriber view was not dropped prior to making this call. Call the DROP_SUBSCRIBER_VIEW procedure and then try the original command again.

Usage Notes

- Prior to dropping a subscription, you must drop the subscriber view using the DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIBER_VIEW procedure.

Example

```
EXECUTE DBMS_LOGMNR_CDC_SUBSCRIBE.DROP_SUBSCRIPTION (\
SUBSCRIPTION_HANDLE => :subhandle);
```

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DBMS_LOGMNR_D

DBMS_LOGMNR_D contains the LogMiner procedure, DBMS_LOGMNR_D.BUILD, used to create the LogMiner dictionary file. This procedure extracts the dictionary either to the redo log files or to a flat file.

This information is saved in preparation for future analysis of redo log files using the LogMiner tool.

> **See Also:** *Oracle9i Database Administrator's Guide* and *Oracle9i User-Managed Backup and Recovery Guide*

This chapter discusses the following topics:

Extracting a Dictionary to the Redo Log Files

To extract a dictionary file to the redo log files, the following conditions must be met:

- The `DBMS_LOGMNR_D.BUILD` procedure must be run on a system that is running Oracle9*i* or later
- Archiving mode must be enabled in order to generate usable redo
- Oracle9*i* compatibility must be employed
- The mining system must be Oracle9*i* or later
- The dictionary redo files must be created from the same database that generated the redo log files you want to analyze

The `DBMS_LOGMNR_D.BUILD` procedure will not run if there are any ongoing DDL operations.

Additionally, while the procedure is executing, no DDL operations are allowed.

Extracting a Dictionary to a Flat File

When extracting a dictionary to a flat file, the procedure queries the dictionary tables of the current database and creates a text-based file containing the contents of the tables.

To extract a dictionary to a flat file, the following conditions must be met:

The dictionary file must be created from the same database that generated the redo log files you want to analyze

- You must specify a directory for use by the PL/SQL procedure. To do so, set the initialization parameter `UTL_FILE_DIR` in the init.ora file. For example:

  ```
  UTL_FILE_DIR = /oracle/dictionary
  ```

  If you do not set this parameter, the procedure will fail.
- You must ensure that no DDL operations occur while the dictionary build is running. Otherwise, the dictionary file may not contain a consistent snapshot of the data dictionary.

Examples of Using DBMS_LOGMNR_D.BUILD

The DBMS_LOGMNR_D package contains one procedure, DBMS_LOGMNR_D.BUILD. For a complete description of this procedure, see DBMS_LOGMNR_D.BUILD Procedure on page 27-3.

To use the DBMS_LOGMNR_D.BUILD procedure, mount and open the database whose files you will want to analyze.

Then run the PL/SQL procedure DBMS_LOGMNR_D.BUILD, as illustrated in the following examples.

Example of Extracting to a Flat File

The following example extracts the dictionary file to a flat file named dictionary.ora in a specified path (/oracle/database).

```
SQLPLUS>EXECUTE dbms_logmnr_d.build('dictionary.ora',
SQLPLUS>'/oracle/database/',
SQLPLUS>options => dbms_logmnr_d.store_in_flat_file);
```

Example of Extracting to Redo Logs

```
SQLPLUS>EXECUTE dbms_logmnr_d.build (
SQLPLUS>options => dbms_logmnr_d.store_in_redo_logs);
```

Summary of DBMS_LOGMNR_D Subprograms

DBMS_LOGMNR_D contains one procedure, BUILD, which writes the dictionary tables of the current database (the online catalog) into the redo log files or into a flat file.

DBMS_LOGMNR_D.BUILD Procedure

The syntax for the DBMS_LOGMNR_D.BUILD procedure is as follows:

Syntax

```
DBMS_LOGMNR_D.BUILD (
dictionary_filename IN VARCHAR2,
dictionary_location IN VARCHAR2,
options IN NUMBER);
```

Parameters

Table 27–1 BUILD Procedure Parameters

Parameter	Description
dictionary_filename	Name of the dictionary file
dictionary_location	Path to file directory
options	Specifies that the dictionary is written to either a flat file (STORE_IN_FLAT_FILE) or the redo log files (STORE_IN_REDO_LOGS) destination

To extract the dictionary to a flat file, you must supply a file name and location.

To extract the dictionary to the redo log files, specify only the STORE_IN_REDO_LOGS option. The size of the dictionary may cause it to be contained in multiple redo logs.

In summary, the combinations of parameters used result in the following behavior:

- If you do not specify any parameters, an error message is returned.
- If you specify a file name and location, without any options, the dictionary is extracted to a flat file with that name.
- If you specify a file name and location, as well as the DBMS_LOGMNR_D.STORE_IN_FLAT_FILE option, the dictionary is extracted to a flat file with the specified name.
- If you do not specify a file name and location, but do specify the DBMS_LOGMNR_D.STORE_IN_REDO_LOGS option, the dictionary is extracted to the redo logs.
- If you specify a file name and location, as well as the STORE_IN_REDO_LOGS option, an error is returned.

Exceptions

- ORA-1308: initialization parameter UTL_FILE_DIR is not set.
- ORA-1336 - this error is returned under the following conditions:
  1. Dictionary_location does not exist.
  2. UTL_FILE_DIR is not set to have access to dictionary_location.
  3. Dictionary_file is read only.

Usage Notes

- Ideally, the dictionary file will be created after all dictionary changes to a database and prior to the creation of any redo log files that are to be analyzed. As of LogMiner version 9*i*, you can dump the dictionary to the redo log files, perform DDL operations, and dynamically apply the changes to the LogMiner dictionary.
- To monitor progress of the dictionary build issue the `SET SERVEROUTPUT ON` command.

28

DBMS_METADATA

With DBMS_METADATA you can retrieve complete database object definitions (metadata) from the dictionary by specifying:

- The type of object, for example, tables, indexes, or procedures
- Optional selection criteria, such as owner or name
- Optional transformations on the output. By default the output is represented in XML, but callers can specify transformations (into SQL DDL, for example), which are implemented by XSL-T stylesheets stored in the database or externally.

DBMS_METADATA provides the following retrieval interfaces:

- For programmatic use: OPEN, SET_FILTER, SET_COUNT, GET_QUERY, SET_PARSE_ITEM, ADD_TRANSFORM, SET_TRANSFORM_PARAM, FETCH_xxx and CLOSE retrieve multiple objects.
- For browsing: GET_XML and GET_DDL return metadata for a single object and are used in SQL queries and for browsing.

This chapter discusses the following topics:

Summary of DBMS_METADATA Subprograms

Table 28–1 DBMS_METADATA Package Subprograms

Subprogram	Description
"OPEN Procedure" on page 28-2	Specifies the type of object to be retrieved, the version of its metadata, and the object model.
"SET_FILTER Procedure" on page 28-5	Specifies restrictions on the objects to be retrieved, for example, the object name or schema.
"SET_COUNT Procedure" on page 28-9	Specifies the maximum number of objects to be retrieved in a single FETCH_xxx call.
"GET_QUERY Procedure" on page 28-10	Returns the text of the queries that are used by FETCH_xxx.
"SET_PARSE_ITEM Procedure" on page 28-11	Enables output parsing by specifying an object attribute to be parsed and returned.
"ADD_TRANSFORM Procedure" on page 28-13	Specifies a transform that FETCH_xxx applies to the XML representation of the retrieved objects.
"SET_TRANSFORM_PARAM Procedure" on page 28-15	Specifies parameters to the XSL-T stylesheet identified by transform_handle.
"FETCH_xxx Procedure" on page 28-18	Returns metadata for objects meeting the criteria established by OPEN, SET_FILTER, SET_COUNT, ADD_TRANSFORM, and so on.
"CLOSE Procedure" on page 28-21	Invalidates the handle returned by OPEN and cleans up the associated state.
"GET_XML and GET_DDL Functions" on page 28-25	Returns the metadata for the specified object as XML or DDL.

OPEN Procedure

OPEN specifies the type of object to be retrieved, the version of its metadata, and the object model. The return value is an opaque context handle for the set of objects to be used in subsequent calls.

Syntax

```
FUNCTION open
( object_type  IN VARCHAR2,
    version IN VARCHAR2 DEFAULT 'COMPATIBLE',
    model IN VARCHAR2 DEFAULT 'ORACLE',
) RETURN NUMBER;
```

Parameters

Table 28–2 Open() Parameters

Parameter	Description
object_type	The type of object to be retrieved. Table 28–3 lists the valid type names and their meanings. These object types will be supported for the ORACLE model of metadata (see model in this table) in Oracle9*i*. Future models may support a different set of object types. Most objects have names, belong to schemas, and are uniquely identified within their namespace by their schema and name. Some objects (for example, outlines) are not schema objects; these are marked with an "N" in Table 28–3. Some objects (for example, system privilege grants) do not have names; see the "Notes" column in Table 28–3. These differences are relevant when choosing object selection criteria. See "SET_FILTER Procedure" on page 28-5 for more information.
version	The version of metadata to be extracted. Database objects or attributes that are incompatible with the version will not be extracted. Legal values for this parameter are: COMPATIBLE (default)—the version of the metadata corresponds to the database compatibility level. Note that database compatibility must be set to 9.0.0 or higher. LATEST—the version of the metadata corresponds to the database version. A specific database version, for example, 9.0.0.
model	Specifies which view to use, since the API can support multiple views on the metadata. Only the ORACLE model is supported in Oracle9*i*.

Table 28–3 DBMS_METADATA: Object Types

Type Name	Meaning	Schema Object	Notes
FUNCTION	stored functions		
INDEX	indexes		
INDEXTYPE	indextypes		
OBJECT_GRANT	object grants		Not a named object.

Table 28–3 DBMS_METADATA: Object Types

Type Name	Meaning	Schema Object	Notes
OPERATOR	operators		
OUTLINE	stored outlines	N	
PACKAGE	stored packages		By default, both package specification and package body are retrieved. See "SET_FILTER Procedure" on page 28-5.
PROCEDURE	stored procedures		
SYNONYM	synonyms	See notes.	Private synonyms are schema objects. Public synonyms are not, but for the purposes of this API, their schema name is PUBLIC. The name of a synonym is considered to be the synonym itself. For example, in CREATE PUBLIC SYNONYM FOO FOR BAR, the resultant object is considered to have name FOO and schema PUBLIC.
SYSTEM_GRANT	system privilege grants	N	Not a named object.
TABLE	tables		
TRIGGER	triggers		
TYPE	user-defined types		By default, both type and type body are retrieved. See "SET_FILTER Procedure" on page 28-5.
VIEW	views		

Returns

An opaque handle to the class of objects. This handle is used as input to SET_FILTER, SET_COUNT, ADD_TRANSFORM, GET_QUERY, SET_PARSE_ITEM, FETCH_xxx, and CLOSE.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.

- INVALID_OBJECT_PARAM. The version or model parameter was not valid for the object_type.

SET_FILTER Procedure

SET_FILTER specifies restrictions on the objects to be retrieved, for example, the object name or schema.

Syntax

```
PROCEDURE set_filter
  (handle IN NUMBER,
   name IN VARCHAR2,
   value IN VARCHAR2);
PROCEDURE set_filter
  (handle IN NUMBER,
   name IN VARCHAR2,
   value IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 28–4 SET_FILTER Parameters

Parameter	Description
handle	The handle returned from OPEN.
name	The name of the filter. For each filter, Table 28–5 lists the object_type it applies to, its name, its datatype (text or Boolean) and its meaning or effect (including its default value, if any).
value	The value of the filter.

Table 28–5 SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
Named objects	NAME	text	Objects with this exact name are selected.
	NAME_EXPR	text	The filter value is the right-hand side of a SQL comparison, i.e., a SQL comparison operator (=,!=, etc.) and the value compared against. The value must contain parentheses and quotation marks where appropriate. In particular, two single quotes (not a double quote) are needed to represent an apostrophe. For example: `'IN (''DEPT'',''EMP'')'` The filter value is combined with the object attribute corresponding to the object name to produce a WHERE condition in the query that fetches the objects. In the example above, objects named DEPT and EMP are retrieved. By default, all named objects of `object_type` are selected.
Schema objects	SCHEMA	text	Objects in this schema are selected.
	SCHEMA_EXPR	text	The filter value is the right-hand side of a SQL comparison. The filter value is combined with the object attribute corresponding to the object schema to produce a WHERE condition in the query that fetches the objects. See NAME_EXPR for syntax details. Default: - if BASE_OBJECT_SCHEMA is specified (see below), then objects in that schema are selected; - otherwise, objects in the current schema are selected. See "Security" on page 28-8.
PACKAGE, TYPE	SPECIFICATION	Boolean	If TRUE, retrieve the package or type specification. Defaults to TRUE.
	BODY	Boolean	If TRUE, retrieve the package or type body. Defaults to TRUE.

Table 28–5 SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
TABLE	TABLESPACE	text	Tables in this tablespace (or having this as their default tablespace) are selected.
	TABLESPACE_EXPR	text	The filter value is the right-hand side of a SQL comparison. The filter value is combined with the object attribute corresponding to the object tablespace or default tablespace to produce a WHERE condition in the query that fetches the objects. See NAME_EXPR for syntax details. By default, objects in all tablespaces are selected.
INDEX, OBJECT_GRANT, TRIGGER	BASE_OBJECT_NAME	text	Indexes, triggers, or privileges are selected that are defined or granted on objects with this name. Specify SCHEMA for triggers on schemas. Specify DATABASE for database triggers.
	BASE_OBJECT_SCHEMA	text	Indexes, triggers, or privileges are selected that are defined or granted on objects in this schema. If BASE_OBJECT_NAME is specified with a value other than SCHEMA or DATABASE, this defaults to the current schema.
INDEX, TRIGGER	SYSTEM_GENERATED	Boolean	If TRUE, select indexes or triggers even if they are system-generated. If FALSE, omit system-generated indexes or triggers. Defaults to TRUE.
OBJECT_GRANT, SYSTEM_GRANT	GRANTEE	text	Privileges are selected that are granted to this user or role. Specify PUBLIC for grants to PUBLIC.
OBJECT_GRANT	GRANTOR	text	Privileges are selected that are granted by this user.

Table 28–5 SET_FILTER: Filters

Object Type	Name	Datatype	Meaning
SYNONYM	LONGNAME	text	A synonym name longer than 30 characters. Synonyms with this exact name are selected. If the synonym name is 30 characters or less, the NAME filter must be used.
	LONGNAME_EXPR	text	The filter value is the right-hand side of a SQL comparison. The filter value is combined with the object attribute corresponding to the long name of the object to produce a WHERE condition in the query that fetches the objects. See NAME_EXPR for syntax details. By default no filtering is done on the long name of a synonym.
All objects	CUSTOM_FILTER	text	The text of a WHERE condition. The condition is appended to the query that fetches the objects. By default, no custom filter is used. The other filters are intended to meet the needs of the majority of users. Use CUSTOM_FILTER when no defined filters exists for your purpose. Of necessity such a filter depends on the detailed structure of the UDTs and views used in the query that are defined in admin/catmeta.sql. Because filters may change from version to version, upward compatibility is not guaranteed.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INVALID_OPERATION. SET_FILTER was called after the first call to FETCH_xxx for the OPEN context. After the first call to FETCH_xxx is made, no further calls to SET_FILTER for the current OPEN context are permitted.
- INCONSISTENT_ARGS. The filter name is not valid for the object type associated with the OPEN context, or the filter value is the wrong datatype.

Security

With SET_FILTER, you can specify the schema of objects to be retrieved, but security considerations may override this specification. If the caller is SYS or has SELECT_CATALOG_ROLE, then any object can be retrieved; otherwise, only the following can be retrieved:

- Schema objects owned by the caller

- Public synonyms
- System privileges granted to the caller or to PUBLIC
- Grants on objects for which the caller is owner, grantor or grantee (either explicitly or as PUBLIC).

If you request objects that you are not privileged to retrieve, no exception is raised; the object is not retrieved, as if it did not exist.

Usage Notes

These rules apply to dependent objects such as triggers, grants, and indexes.

- When connected as a nonprivileged user: If BASE_OBJECT_NAME is specified as a filter, BASE_OBJECT_SCHEMA defaults to the current schema:

  ```
  dbms_metadata.set_filter(h,'BASE_OBJECT_NAME','EMP');
  ```

- When connected as a privileged user with SELECT_CATALOG_ROLE: The schema defaults to BASE_OBJECT_SCHEMA if specified; otherwise it defaults to the current schema. For example, to see all indexes in SCOTT that are defined on SCOTT.EMP, the filters are:

  ```
  dbms_metadata.set_filter(h,'BASE_OBJECT_NAME','EMP');
  dbms_metadata.set_filter(h,'BASE_OBJECT_SCHEMA','SCOTT');
  ```

  To see indexes in other schemas:

  ```
  dbms_metadata.set_filter(h,'SCHEMA_EXPR','LIKE ''%''');
  ```

Some indexes and triggers are system generated (such as indexes used to enforce unique constraints). Set the SYSTEM_GENERATED filter to FALSE so that you do not retrieve them.

SET_COUNT Procedure

SET_COUNT specifies the maximum number of objects to be retrieved in a single FETCH_xxx call. By default, each call to FETCH_xxx returns one object. SET_COUNT allows you to override this default. If FETCH_xxx is called from a client, specifying a count value greater than 1 can result in fewer server round trips and, therefore, improved performance. Note that the procedure stops when NULL is returned, but not if less than the maximum number of objects is returned.

Syntax

```
PROCEDURE set_count
 ( handle IN NUMBER,
   value IN NUMBER);
```

Parameters

Table 28–6 SET_COUNT Parameters

Parameter	Description
handle	The handle returned from OPEN.
value	The number of objects to retrieve.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INVALID_OPERATION. SET_COUNT was called after the first call to FETCH_xxx for the OPEN context. After the first call to FETCH_xxx is made, no further calls to SET_COUNT for the current OPEN context are permitted.

GET_QUERY Procedure

GET_QUERY returns the text of the queries that are used by FETCH_xxx. This function assists in debugging.

Syntax

```
FUNCTION get_query
  (handle IN NUMBER)
   RETURN VARCHAR2;
```

Parameters

Table 28–7 GET_QUERY Parameters

Parameter	Description
handle	The handle returned from OPEN.

Returns

The text of the queries that will be used by FETCH_xxx.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for the handle parameter.

SET_PARSE_ITEM Procedure

SET_PARSE_ITEM enables output parsing by specifying an object attribute to be parsed and returned. It should only be used in conjunction with FETCH_DDL.

Syntax

```
PROCEDURE set_parse_item
  (handle IN NUMBER,
   name IN VARCHAR2);
```

Parameters

Table 28–8 SET_PARSE_ITEM Parameters

Parameter	Description
handle	The handle returned from OPEN.
name	The name of the object attribute to be parsed and returned. See Table 28–9 for the attribute object type, name, and meaning.

Table 28–9 SET_PARSE_ITEM: Parse Items

Object Type	Name	Meaning
All objects	VERB	For every row in the sys.ku$_ddls nested table returned by fetch_ddl, the verb in the corresponding ddlText is returned. See the example using sys.ku$_ddls on page 28-18.
	OBJECT_TYPE	The object type as used in a DDL CREATE statement is returned, for example, TABLE or PACKAGE BODY.
	SCHEMA	The object schema is returned. If the object is not a schema object, NULL is returned.
	NAME	The object name is returned. If the object is not a named object, NULL is returned.
TABLE, INDEX	TABLESPACE	The tablespace name of the table or index is returned.
TRIGGER	ENABLE	If the trigger is enabled, ENABLE is returned. If the trigger is disabled, DISABLE is returned.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INVALID_OPERATION. SET_PARSE_ITEM was called after the first call to FETCH_xxx for the OPEN context. After the first call to FETCH_xxx is made, no further calls to SET_PARSE_ITEM are permitted.
- INCONSISTENT_ARGS. The attribute name is not valid for the object type associated with the OPEN context.

Usage Notes

By default fetch_ddl returns object metadata as creation DDL. By calling SET_PARSE_ITEM, you can request that individual attributes of the object be returned also, to avoid the tedious process of parsing SQL text. This is useful when fetching objects based on the value of a returned object, for example, fetching indexes for a returned table.

You can call SET_PARSE_ITEM multiple times to ask for multiple items to be parsed and returned. Parsed items are returned in the sys.ku$_parsed_items nested table. See the example using sys.ku$_parsed_items on page 28-18.

See Also:

- "FETCH_xxx Procedure" on page 28-18
- *Oracle9i Application Developer's Guide - XML*

ADD_TRANSFORM Procedure

ADD_TRANSFORM specifies a transform that FETCH_xxx applies to the XML representation of the retrieved objects. It is possible to add more than one transform.

Syntax

```
FUNCTION add_transform
 (handle IN NUMBER,
  name IN VARCHAR2,
  encoding IN VARCHAR2 DEFAULT NULL)
  RETURN NUMBER;
```

Parameters

Table 28–10 ADD_TRANSFORM Parameters

Parameters	Description
handle	The handle returned from OPEN.
name	The name of the transform. If the name is DDL, creation DDL will be generated using XSL-T stylesheets stored within the Oracle dictionary. If the name contains a period (.), colon (:) or forward slash (/), it is interpreted as the URL of a user-supplied XSL-T stylesheet (see *Oracle9i Application Developer's Guide - XML*.
encoding	The name of NLS character set (see National Language Support Guide) in which the stylesheet pointed to by name is encoded. This is only valid if name is a URL. If left NULL and the URL is external to the database (e.g, /usr/williams/xsl/mystylesheet.xsl), UTF-8 encoding is assumed. If left NULL and the URL is internal to the database, that is, it begins with /oradb/ (see [XPATH-SUPP]), then the database character set is assumed to be the encoding.

Returns

An opaque handle to the transform. This handle is used as input to SET_TRANSFORM_PARAM. Note that this handle is different from the handle returned by OPEN; it refers to the transform, not the set of objects to be retrieved.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INVALID_OPERATION. ADD_TRANSFORM was called after the first call to FETCH_xxx for the OPEN context. After the first call to FETCH_xxx is made, no further calls to ADD_TRANSFORM for the current OPEN context are permitted.

Usage Notes

With no transforms added, objects are returned by default as XML documents. You call ADD_TRANSFORM to specify an XSL-T stylesheet to transform the returned documents.

You can call ADD_TRANSFORM more than once to apply multiple transforms to the returned XML documents. FETCH_xxx will apply the transforms in the order in which they were specified, the output of the first transform being used as input to the second, and so on.

The encoding parameter must be specified if either of the following is true:

- The XSL stylesheet pointed to by an external URL is encoded in a character set that is not a subset of UTF-8
- The XSL stylesheet pointed to by a database-internal URL is encoded in a character set that is not a subset of the database character set.

An example of the latter might be if the database-internal URL pointed to an NCLOB or NVARCHAR column. Normally, this need not be specified, although explicitly setting it to US7ASCII (if applicable) results in slightly better XML parsing performance.

Note: The output of the DDL transform is not an XML document. Therefore, no transform should be added after the DDL transform.

SET_TRANSFORM_PARAM Procedure

SET_TRANSFORM_PARAM specifies parameters to the XSL-T stylesheet identified by transform_handle. Use it to modify or customize the output of the transform.

Syntax

```
PROCEDURE set_transform_param
  (transform_handle IN NUMBER,
   name IN VARCHAR2,
   value IN VARCHAR2);
PROCEDURE set_transform_param
  (transform_handle IN NUMBER,
   name IN VARCHAR2,value IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 28–11 SET_TRANSFORM_PARAM Parameters

Parameters	Description
transform_handle	Either (1) the handle returned from ADD_TRANSFORM, or (2) the enumerated constant SESSION_TRANSFORM that designates the DDL transform for the whole session. Note that the handle returned by OPEN is not a valid transform handle.
name	The name of the parameter. Table 28–12 lists the transform parameters defined for the DDL transform, specifying the object_type it applies to, its datatype (in this case, always Boolean) and its meaning or effect (including its default value, if any).
value	The value of the transform.

Table 28–12 SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform

Object Type	Name	Datatype	Meaning
All objects	PRETTY	Boolean	If TRUE, format the output with indentation and line feeds. Defaults to TRUE.
	SQLTERMINATOR	Boolean	If TRUE, append a SQL terminator (; or /) to each DDL statement. Defaults to FALSE.
TABLE	SEGMENT_ATTRIBUTES	Boolean	If TRUE, emit segment attributes (physical attributes, storage attributes, tablespace, logging). Defaults to TRUE.
	STORAGE	Boolean	If TRUE, emit storage clause. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
	TABLESPACE	Boolean	If TRUE, emit tablespace. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
TABLE	CONSTRAINTS	Boolean	If TRUE, emit all non-referential table constraints. Defaults to TRUE.
	REF_CONSTRAINTS	Boolean	If TRUE, emit all referential constraints (foreign key and scoped refs). Defaults to TRUE.
	CONSTRAINTS_AS_ALTER	Boolean	If TRUE, emit table constraints as separate ALTER TABLE (and, if necessary, CREATE INDEX) statements. If FALSE, specify table constraints as part of the CREATE TABLE statement. Defaults to FALSE. Requires that CONSTRAINTS be TRUE.
	OID	Boolean	If TRUE, emit the OID clause for object tables. Defaults to FALSE.
	SIZE_BYTE_KEYWORD	Boolean	If TRUE, emit the BYTE keyword as part of the size specification of CHAR and VARCHAR2 columns that use byte semantics. If FALSE, omit the keyword. Defaults to FALSE.
INDEX	SEGMENT_ATTRIBUTES	Boolean	If TRUE, emit segment attributes (physical attributes, storage attributes, tablespace, logging). Defaults to TRUE.
	STORAGE	Boolean	If TRUE, emit storage clause. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.
	TABLESPACE	Boolean	If TRUE, emit tablespace. (Ignored if SEGMENT_ATTRIBUTES is FALSE.) Defaults to TRUE.

Table 28–12 SET_TRANSFORM_PARAM: Transform Parameters for the DDL Transform

Object Type	Name	Datatype	Meaning
TYPE	SPECIFICATION	Boolean	If TRUE, emit the type specification. Defaults to TRUE.
	BODY	Boolean	If TRUE, emit the type body. Defaults to TRUE.
PACKAGE	SPECIFICATION	Boolean	If TRUE, emit the package specification. Defaults to TRUE.
	BODY	Boolean	If TRUE, emit the package body. Defaults to TRUE.
VIEW	FORCE	Boolean	If TRUE, use the FORCE keyword in the CREATE VIEW statement. Defaults to TRUE.
All objects	DEFAULT	Boolean	Calling SET_TRANSFORM_PARAM with this parameter set to TRUE has the effect of resetting all parameters for the transform to their default values. Setting this FALSE has no effect. There is no default.
	INHERIT	Boolean	If TRUE, inherits session-level parameters. Defaults to FALSE. If an application calls ADD_TRANSFORM to add the DDL transform, then by default the only transform parameters that apply are those explicitly set for that transform handle. This has no effect if the transform handle is the session transform handle.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INVALID_OPERATION. SET_TRANSFORM_PARAM was called after the first call to FETCH_xxx for the OPEN context. After the first call to FETCH_xxx is made, no further calls to SET_TRANSFORM_PARAM are permitted.
- INCONSISTENT_ARGS. The transform parameter name is not valid for the object type associated with the OPEN context.

Usage Notes

XSL-T allows parameters to be passed to stylesheets. You call SET_TRANSFORM_PARAM to specify the value of a parameter to be passed to the stylesheet identified by transform_handle. The most general way to specify stylesheet parameter values is as text strings. However, for the DDL transform, it is convenient to expose

some parameters as Booleans. Consequently, two variants of the procedure are provided.

The GET_DDL function allows the casual browser to extract the creation DDL for an object. So that you can specify transform parameters, this package defines an enumerated constant SESSION_TRANSFORM as the handle of the DDL transform at the session level. You can call SET_TRANSFORM_PARAM using DBMS_METADATA.SESSION_TRANSFORM as the transform handle to set transform parameters for the whole session. GET_DDL inherits these parameters when it invokes the DDL transform.

Note: The enumerated constant must be prefixed with the package name DBMS_METADATA.SESSION_TRANSFORM.

FETCH_xxx Procedure

FETCH_xxx returns metadata for objects meeting the criteria established by OPEN, SET_FILTER, SET_COUNT, ADD_TRANSFORM, and so on. See "Usage Notes" on page 28-19 for the variants.

Syntax

The FETCH functions and procedures are:

```
FUNCTION fetch_xml
  (handle IN NUMBER)
   RETURN sys.XMLType;
```

> **See Also:** *Oracle9i Application Developer's Guide - XML*, Chapter 9, "XMLType: Native Storage of XML in the Database" for a description of XMLType.

```
FUNCTION fetch_ddl
  (handle IN NUMBER)
   RETURN sys.ku$_ddls;
```

The following types comprise the return nested table type sys.ku$_ddls:

```
TYPE sys.ku$_parsed_item AS OBJECT (
  item VARCHAR2(30),
  value VARCHAR2(4000),
  parent NUMBER );
TYPE sys.ku$_parsed_items IS TABLE OF sys.ku$_parsed_item;
TYPE sys.ku$_ddl AS OBJECT (
```

```
  ddlText CLOB,
  parsedItems sys.ku$_parsed_items );
TYPE sys.ku$_ddls IS TABLE OF sys.ku$_ddl;

FUNCTION fetch_clob (handle IN NUMBER)
    RETURN CLOB;
PROCEDURE fetch_clob (handle IN NUMBER,
    doc IN OUT NOCOPY CLOB);
```

Parameters

Table 28–13 FETCH_xxx Parameters

Parameters	Description
handle	The handle returned from OPEN.
doc (procedure fetch_clob)	The metadata for the objects or NULL if all objects have been returned.

Returns

The metadata for the objects or NULL if all objects have been returned.

Exceptions

Most exceptions raised during execution of the query are propagated to the caller. Also, the following exceptions may be raised:

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- INCONSISTENT_OPERATION. Either (1) FETCH_XML was called when the DDL transform had been specified, or (2) FETCH_DDL was called when the DDL transform had not been specified.

Usage Notes

These functions and procedures return metadata for objects meeting the criteria established by calls to OPEN, SET_FILTER, SET_COUNT, ADD_TRANSFORM, and so on. Each call to FETCH_XXX returns the number of objects specified by SET_COUNT (or less, if fewer objects remain in the underlying cursor) until all objects have been returned. After the last object is returned, subsequent calls to FETCH_XXX return NULL and cause the stream created by OPEN to be transparently closed.

There are several different FETCH_XXX functions and procedures:

- FETCH_XML returns the XML metadata for an object as an XMLType. It assumes that if any transform has been specified, the transform will produce an XML document. In particular, it assumes that the DDL transform has not been specified.
- FETCH_DDL returns the creation DDL in a sys.ku$_ddls nested table. It assumes that the DDL transform has been specified. Each row of the sys.ku$_ddls nested table contains a single DDL statement in the ddlText column; if requested, parsed items for the DDL statement will be returned in the parsedItems column. Multiple DDL statements may be returned under the following circumstances:
  - When you call SET_COUNT to specify a count greater than 1
  - When an object is transformed into multiple DDL statements. For example, A TYPE object can be transformed into both CREATE TYPE and CREATE TYPE BODY statements. A TABLE object can be transformed into a CREATE TABLE, zero or more CREATE INDEX statements, and zero or more ALTER TABLE statements.
- FETCH_CLOB simply returns the object, transformed or not, as a CLOB.

FETCH_CLOB comes in both function and procedure variants. The procedure variant returns the object by reference in an IN OUT NOCOPY parameter.

All LOBs returned by FETCH_xxx are temporary LOBs. You must free the LOB. The same applies to the XMLType object.

If SET_PARSE_ITEM was called, FETCH_DDL returns attributes of the DDL statement in a sys.ku$_parsed_items nested table, which is a column in the returned sys.ku$_ddls nested table. Each row of the sys.ku$_parsed_items nested table corresponds to an item specified by SET_PARSE_ITEM and contains the following columns:

- item—The name of the attribute as specified in the name parameter to SET_PARSE_ITEM.
- value—The attribute value, or NULL if the attribute is not present in the DDL statement.
- parent—For future use.

The order of the rows is undetermined; to find a particular item you must search the table for a match on item.

If SET_PARSE_ITEM was not called, NULL is returned as the value of the sys.ku$_parsed_items nested table.

When Variants of FETCH_xxx Are Called

It is expected that the same variant of FETCH_xxx will be called for all objects selected by OPEN, that is, that programs will not intermix calls to FETCH_XML, FETCH_DDL, and FETCH_CLOB using the same OPEN handle. The effect of calling different variants is undefined; it may not do what you expect.

CLOSE Procedure

CLOSE invalidates the handle returned by OPEN and cleans up the associated state.

Syntax

```
PROCEDURE close (handle IN NUMBER);
```

Parameters

Table 28–14 CLOSE Parameters

Parameter	Description
handle	The handle returned from OPEN.

Exceptions

- INVALID_ARGVAL. The value for the handle parameter is NULL or invalid.

Usage Notes

You can prematurely terminate the stream of objects established by OPEN.

- If a call to FETCH_xxx returns NULL, indicating no more objects, a call to CLOSE is made transparently. In this case, you can still call CLOSE on the handle and not get an exception. (The call to CLOSE is not required.)
- If you know that only one specific object will be returned, you should explicitly call CLOSE after the single FETCH_xxx call to free resources held by the handle.

Example: Retrieving Payroll Tables and their Indexes as DDL

This example retrieves the creation DDL for all tables in the current schema whose names begin with PAYROLL. For each table it also returns the creation DDL for the indexes defined on the table. The returned DDL is written to an output file.

```
CREATE OR REPLACE PACKAGE dbms_metadata_example AS
```

```
   PROCEDURE get_payroll_tables;
END;
/
CREATE OR REPLACE PACKAGE BODY dbms_metadata_example AS

-- Global Variables

fileHandle   UTL_FILE.FILE_TYPE;

-- Exception initialization

file_not_found EXCEPTION;
PRAGMA EXCEPTION_INIT(file_not_found, -1309);

-- Package-private routine to write a CLOB to an output file.

  PROCEDURE write_lob(doc IN CLOB) IS

     outString     varchar2(32760);
     cloblen       number;
     offset        number := 1;
     amount        number;

BEGIN
  cloblen := dbms_lob.getlength(doc);
  WHILE cloblen > 0
  LOOP
    IF cloblen > 32760 THEN
      amount := 32760;
    ELSE
      amount := cloblen;
    END IF;
    outString := dbms_lob.substr(doc, amount, offset);
    utl_file.put(fileHandle, outString);
    utl_file.fflush(fileHandle);
    offset  := offset  + amount;
    cloblen := cloblen - amount;
  END LOOP;
  RETURN;
END;

-- Public routines

-- GET_PAYROLL_TABLES: Fetch DDL for payroll tables and their indexes.
```

```
PROCEDURE  get_payroll_tables IS

tableOpenHandle       NUMBER;
indexOpenHandle       NUMBER;
tableTransHandle      NUMBER;
indexTransHandle      NUMBER;
schemaName            VARCHAR2(30);
tableName             VARCHAR2(30);
tableDDLs             sys.ku$_ddls;
tableDDL              sys.ku$_ddl;
parsedItems           sys.ku$_parsed_items;
indexDDL              CLOB;

BEGIN

--  open the output file... note that the 1st param. (dir. path) must be
--  included in the database's UTL_FILE_DIR init. parameter.
--
  BEGIN
    fileHandle := utl_file.fopen('/private/xml', 'ddl.out', 'w', 32760);
  EXCEPTION
    WHEN OTHERS THEN
        RAISE file_not_found;
  END;

-- Open a handle for tables in the current schema.
  tableOpenHandle := dbms_metadata.open('TABLE');

-- Call 'set_count' to request retrieval of one table at a time.
-- This call is not actually necessary since 1 is the default.
  dbms_metadata.set_count(tableOpenHandle, 1);

-- Retrieve tables whose name starts with 'PAYROLL'. When the filter is
-- 'NAME_EXPR', the filter value string must include the SQL operator. This
-- gives the caller flexibility to use LIKE, IN, NOT IN, subqueries, etc.
  dbms_metadata.set_filter(tableOpenHandle, 'NAME_EXPR', 'LIKE ''PAYROLL%''');

-- Tell Metadata API to parse out each table's schema and name separately
-- so we can use them to set up the calls to retrieve its indexes.
  dbms_metadata.set_parse_item(tableOpenHandle, 'SCHEMA');
  dbms_metadata.set_parse_item(tableOpenHandle, 'NAME');

-- Add the DDL transform so we get SQL creation DDL
  tableTransHandle := dbms_metadata.add_transform(tableOpenHandle, 'DDL');
```

```
-- Tell the XSL stylesheet we don't want physical storage information (storage,
-- tablespace, etc), and that we want a SQL terminator on each DDL. Notice that
-- these calls use the transform handle, not the open handle.
  dbms_metadata.set_transform_param(tableTransHandle,
      'SEGMENT_ATTRIBUTES', FALSE);
  dbms_metadata.set_transform_param(tableTransHandle,
      'SQLTERMINATOR', TRUE);

-- Ready to start fetching tables. We use the FETCH_DDL interface (rather than
-- FETCH_XML or FETCH_CLOB). This interface returns a SYS.KU$_DDLS; a table of
-- SYS.KU$_DDL objects. This is a table because some object types return
-- multiple DDL statements (like types / pkgs which have create header and
-- body statements). Each KU$_DDL has a CLOB containing the 'CREATE TABLE'
-- statement plus a nested table of the parse items specified. In our case,
-- we asked for two parse items; Schema and Name.

  LOOP
    tableDDLs := dbms_metadata.fetch_ddl(tableOpenHandle);
    EXIT WHEN tableDDLs IS NULL;   -- Get out when no more payroll tables

-- In our case, we know there is only one row in tableDDLs (a KU$_DDLS tbl obj)
-- for the current table. Sometimes tables have multiple DDL statements,
-- e.g., if constraints are applied as ALTER TABLE statements,
-- but we didn't ask for that option.
-- So, rather than writing code to loop through tableDDLs,
-- we'll just work with the 1st row.
--
-- First, write the CREATE TABLE text to our output file, then retrieve the
-- parsed schema and table names.
    tableDDL := tableDDLs(1);
    write_lob(tableDDL.ddltext);
    parsedItems := tableDDL.parsedItems;

-- Must check the name of the returned parse items as ordering isn't guaranteed
    FOR i IN 1..2 LOOP
      IF parsedItems(i).item = 'SCHEMA'
      THEN
        schemaName := parsedItems(i).value;
      ELSE
        tableName  := parsedItems(i).value;
      END IF;
    END LOOP;

-- Then use the schema and table names to set up a 2nd stream for retrieval of
```

```
-- the current table's indexes.
-- (Note that we don't have to specify a SCHEMA filter for the indexes,
-- since SCHEMA defaults to the value of BASE_OBJECT_SCHEMA.)
    indexOpenHandle := dbms_metadata.open('INDEX');
    dbms_metadata.set_filter(indexOpenHandle,'BASE_OBJECT_SCHEMA',schemaName);
    dbms_metadata.set_filter(indexOpenHandle,'BASE_OBJECT_NAME',tableName);

-- Add the DDL transform and set the same transform options we did for tables
    indexTransHandle := dbms_metadata.add_transform(indexOpenHandle, 'DDL');
    dbms_metadata.set_transform_param(indexTransHandle,
                        'SEGMENT_ATTRIBUTES', FALSE);
    dbms_metadata.set_transform_param(indexTransHandle,
                        'SQLTERMINATOR', TRUE);

-- Retrieve index DDLs as CLOBs and write them to the output file.
    LOOP
      indexDDL := dbms_metadata.fetch_clob(indexOpenHandle);
      EXIT WHEN indexDDL IS NULL;
      write_lob(indexDDL);
    END LOOP;

-- Free resources allocated for index stream.
    dbms_metadata.close(indexOpenHandle);

  END LOOP;

-- Free resources allocated for table stream and close output file.
  dbms_metadata.close(tableOpenHandle);
  utl_file.fclose(fileHandle);
  RETURN;

END;  -- of procedure get_payroll_tables

END dbms_metadata_example;
/
```

GET_XML and GET_DDL Functions

GET_XML and GET_DDL return the metadata for the specified object as XML or DDL.

Syntax

```
FUNCTION get_xml (
  object_type IN VARCHAR2,
```

```
  name IN VARCHAR2,
  schema IN VARCHAR2 DEFAULT NULL,
  version IN VARCHAR2 DEFAULT 'COMPATIBLE',
  model IN VARCHAR2 DEFAULT 'ORACLE',
  transform IN VARCHAR2 DEFAULT NULL)
RETURN CLOB;

FUNCTION get_ddl (
  object_type IN VARCHAR2,
  name N VARCHAR2,
  schema IN VARCHAR2 DEFAULT NULL,
  version IN VARCHAR2 DEFAULT 'COMPATIBLE',
  model IN VARCHAR2 DEFAULT 'ORACLE',
  transform IN VARCHAR2 DEFAULT 'DDL')
RETURN CLOB;
```

Parameters

Table 28–15 GET_xxx Parameters

Parameter	Description
`object_type`	The type of object to be retrieved. This parameter takes the same values as the `OPEN object_type` parameter. In addition the following types may be specified: ▪ `PACKAGE_SPEC` - package specification (without body) ▪ `PACKAGE_BODY` - package body ▪ `TYPE_SPEC` - type specification (without body) ▪ `TYPE_BODY` - type body
`name`	An object name (case-sensitive). If `object_type` is `SYNONYM` and `name` is longer than 30 characters, then `name` will be treated as a `LONGNAME` filter. See Table 28–5.
`schema`	A schema name (case sensitive). The default is the current schema if `object_type` refers to a schema object; otherwise the default is NULL.
`version`	The version of metadata to be extracted. This parameter takes the same values as the `OPEN` version parameter.
`model`	The object model to use. This parameter takes the same values as the `OPEN` model parameter.
`transform`	The name of a transformation on the output. This parameter takes the same values as the `ADD_TRANSFORM` name parameter. For `GET_XML` this must not be `DDL`.

Returns

The metadata for the specified object as XML or DDL.

Exceptions

- INVALID_ARGVAL. A NULL or invalid value was supplied for an input parameter. The error message text identifies the parameter.
- OBJECT_NOT_FOUND. The specified object was not found in the database.

Usage Notes

These functions provide a simple way to return the metadata for a single object. Conceptually each GET_xxx call is comprised of an OPEN, one or two SET_FILTER calls, optionally an ADD_TRANSFORM, a FETCH_xxx and a CLOSE. The object_type parameter has the same semantics as in OPEN. The schema and name parameters are used for filtering. If a transform is specified, schema-level transform flags are inherited.

This function can only be used to fetch named objects. It cannot be used to fetch objects of type OBJECT_GRANT or SYSTEM_GRANT. To fetch these objects, use the programmatic interface.

Example 1. Fetching the XML Representation of SCOTT.EMP

```
set pagesize 0
set long 90000
SELECT DBMS_METADATA.GET_XML
  (
   'TABLE','EMP','SCOTT')
    FROM DUAL;
```

Example 2. Fetching the DDL for all Complete Tables in the Current Schema, Filtering Out Nested Tables and Overflow Segments

This example fetches the DDL for all "complete" tables in the current schema, filtering out nested tables and overflow segments. The example uses SET_TRANSFORM_PARAM (with the handle value = DBMS_METADATA.SESSION_TRANSFORM meaning "for the current session") to specify that storage clauses are not to be returned in the SQL DDL. Afterwards, the example resets the session-level parameters to their defaults.

```
set pagesize 0
set long 90000
```

```
execute DBMS_METADATA.SET_TRANSFORM_PARAM(
  DBMS_METADATA.SESSION_TRANSFORM,'STORAGE',false);
SELECT DBMS_METADATA.GET_DDL('TABLE',u.table_name)
     FROM USER_ALL_TABLES u
     WHERE u.nested='NO'
     AND (u.iot_type is null or u.iot_type='IOT');
execute DBMS_METADATA.SET_TRANSFORM_PARAM(
   DBMS_METADATA.SESSION_TRANSFORM,'DEFAULT');
```

29

DBMS_MVIEW

DBMS_MVIEW enables you to understand capabilities for materialized views and potential materialized views, including their rewrite availability. It also enables you to refresh materialized views that are not part of the same refresh group and purge logs.

This chapter discusses the following topics:

- Summary of DBMS_MVIEW Subprograms

Note: DBMS_SNAPSHOT is a synonym for DBMS_MVIEW.

See Also:

- *Oracle9i Replication* for more information about using materialized views in a replication environment
- *Oracle9i Data Warehousing Guide* for more information about using materialized views in a data warehousing environment

Summary of DBMS_MVIEW Subprograms

Table 29–1 DBMS_MVIEW Package Subprograms

Subprogram	Description
"BEGIN_TABLE_ REORGANIZATION Procedure" on page 29-4	Performs a process to preserve materialized view data needed for refresh.
"END_TABLE_ REORGANIZATION Procedure" on page 29-5	Ensures that the materialized view data for the master table is valid and that the master table is in the proper state.
"EXPLAIN_MVIEW Procedure" on page 29-6	Explains what is possible with a materialized view or potential materialized view.
"EXPLAIN_REWRITE Procedure" on page 29-7	Explains why a query failed to rewrite.
"I_AM_A_REFRESH Function" on page 29-8	Returns the value of the `I_AM_REFRESH` package state.
"PMARKER Function" on page 29-9	Returns a partition marker from a rowid. This function is used for Partition Change Tracking (PCT).
"PURGE_DIRECT_LOAD_ LOG Procedure" on page 29-9	Purges rows from the direct loader log after they are no longer needed by any materialized views (used with data warehousing).
"PURGE_LOG Procedure" on page 29-10	Purges rows from the materialized view log.
"PURGE_MVIEW_FROM_ LOG Procedure" on page 29-11	Purges rows from the materialized view log.
"REFRESH Procedure" on page 29-13	Consistently refreshes one or more materialized views that are not members of the same refresh group.
"REFRESH_ALL_MVIEWS Procedure" on page 29-16	Refreshes all materialized views that do not reflect changes to their master table or master materialized view.
"REFRESH_DEPENDENT Procedure" on page 29-17	Refreshes all table-based materialized views that depend on a specified master table or master materialized view, or list of master tables or master materialized views.
"REGISTER_MVIEW Procedure" on page 29-19	Enables the administration of individual materialized views.

Table 29–1 DBMS_MVIEW Package Subprograms (Cont.)

Subprogram	Description
"UNREGISTER_MVIEW Procedure" on page 29-22	Enables the administration of individual materialized views. Invoked at a master site or master materialized view site to unregister a materialized view.

BEGIN_TABLE_REORGANIZATION Procedure

This procedure performs a process to preserve materialized view data needed for refresh. It must be called before a master table is reorganized.

Syntax

```
DBMS_MVIEW.BEGIN_TABLE_REORGANIZATION (
   tabowner    IN   VARCHAR2,
   tabname     IN   VARCHAR2);
```

Parameters

Table 29–2 BEGIN_TABLE_REORGANIZATION Procedure Parameters

Parameter	Description
tabowner	Owner of the table being reorganized.
tabname	Name of the table being reorganized.

END_TABLE_REORGANIZATION Procedure

This procedure ensures that the materialized view data for the master table is valid and that the master table is in the proper state. It must be called after a master table is reorganized.

Syntax

```
DBMS_MVIEW.END_TABLE_REORGANIZATION (
   tabowner    IN   VARCHAR2,
   tabname     IN   VARCHAR2);
```

Parameters

Table 29–3 END_TABLE_REORGANIZATION Procedure Parameters

Parameter	Description
tabowner	Owner of the table being reorganized.
tabname	Name of the table being reorganized.

EXPLAIN_MVIEW Procedure

This procedure enables you to learn what is possible with a materialized view or potential materialized view. For example, you can determine if a materialized view is fast refreshable and what types of query rewrite you can perform with a particular materialized view.

Using this procedure is straightforward. You simply call DBMS_MVIEW.EXPLAIN_MVIEW, passing in as parameters the schema and materialized view name for an existing materialized view. Alternatively, you can specify the SELECT string for a potential materialized view. The materialized view or potential materialized view is then analyzed and the results are written into either a table called MV_CAPABILITIES_TABLE, which is the default, or to an array called MSG_ARRAY.

Note that you must run the utlxmv.sql script prior to calling EXPLAIN_MVIEW except when you direct output to a VARRAY. The script is found in the admin directory. In addition, you must create MV_CAPABILITIES_TABLE in the current schema.

Syntax

The following PL/SQL declarations that are made for you in the DBMS_MVIEW package show the order and datatypes of these parameters for explaining an existing materialized view and a potential materialized view with output to a table and to a VARRAY.

To explain an existing or potential materialized view with output to MV_CAPABILITIES_TABLE:

```
DBMS_MVIEW.EXPLAIN_MVIEW (
 mv            IN VARCHAR2,
 statement_id  IN VARCHAR2:= NULL);
```

To explain an existing or potential materialized view with output to a VARRAY:

```
DBMS_MVIEW.EXPLAIN_MVIEW (
 mv          IN VARCHAR2,
 msg_array   OUT SYS.ExplainMVArrayType);
```

Parameters

Table 29–4 EXPLAIN_MVIEW Procedure Parameters

Parameter	Description
mv	The name of an existing materialized view (optionally qualified with the owner name separated by a ".") or a SELECT statement for a potential materialized view.
statement_id	A client-supplied unique identifier to associate output rows with specific invocations of EXPLAIN_MVIEW.
msg_array	The PL/SQL varray that receives the output. Use this parameter to direct EXPLAIN_MVIEW's output to a PL/SQL VARRAY rather than MV_CAPABILITIES_TABLE.

EXPLAIN_REWRITE Procedure

This procedure enables you to learn why a query failed to rewrite, or, if it rewrites, which materialized views will be used. Using the results from the procedure, you can take the appropriate action needed to make a query rewrite if at all possible. The query specified in the EXPLAIN_REWRITE statement is never actually executed.

To obtain the output into a table, you must run the admin/utlxrw.sql script before calling EXPLAIN_REWRITE. This script creates a table named REWRITE_TABLE in the current schema.

Syntax

You can obtain the output from EXPLAIN_REWRITE in two ways. The first is to use a table, while the second is to create a VARRAY. The following shows the basic syntax for using an output table:

```
DBMS_MVIEW.EXPLAIN_REWRITE (
    query           IN VARCHAR2,
    mv              IN VARCHAR2,
    statement_id    IN VARCHAR2;
```

If you want to direct the output of EXPLAIN_REWRITE to a varray, instead of a table, then the procedure should be called as follows:

```
DBMS_MVIEW.EXPLAIN_REWRITE (
    query           IN VARCHAR2(2000),
    mv              IN VARCHAR2(30),
```

```
    msg_array       IN OUT SYS.RewriteArrayType);
```

Parameters

Table 29–5 EXPLAIN_REWRITE Procedure Parameters

Parameter	Description
query	SQL select statement to be explained.
mv	The fully qualified name of an existing materialized view in the form of SCHEMA.MV
statement_id	A client-supplied unique identifier to distinguish output messages
msg_array	The PL/SQL varray that receives the output. Use this parameter to direct EXPLAIN_REWRITE's output to a PL/SQL VARRAY

I_AM_A_REFRESH Function

This function returns the value of the I_AM_REFRESH package state. A return value of TRUE indicates that all local replication triggers for materialized views are effectively disabled in this session because each replication trigger first checks this state. A return value of FALSE indicates that these triggers are enabled.

Syntax

```
DBMS_MVIEW.I_AM_A_REFRESH()
  RETURN BOOLEAN;
```

Parameters

None.

PMARKER Function

This function returns a partition marker from a rowid. It is used for Partition Change Tracking (PCT).

Syntax

```
DBMS_MVIEW.PMARKER(rid IN ROWID)
  RETURN NUMBER;
```

Parameters

Table 29–6 PMARKER Procedure Parameters

Parameter	Description
rid	The rowid of a row entry in a master table.

PURGE_DIRECT_LOAD_LOG Procedure

This procedure removes entries from the direct loader log after they are no longer needed for any known materialized view. This procedure usually is used in environments using Oracle's data warehousing technology.

See Also: *Oracle9i Data Warehousing Guide* for more information

Syntax

```
DBMS_MVIEW.PURGE_DIRECT_LOAD_LOG();
```

Parameters

None.

PURGE_LOG Procedure

This procedure purges rows from the materialized view log.

Syntax

```
DBMS_MVIEW.PURGE_LOG (
   master        IN   VARCHAR2,
   num           IN   BINARY_INTEGER := 1,
   flag          IN   VARCHAR2       := 'NOP');
```

Parameters

Table 29–7 PURGE_LOG Procedure Parameters

Parameter	Description
master	Name of the master table or master materialized view.

num	Number of least recently refreshed materialized views whose rows you want to remove from materialized view log. For example, the following statement deletes rows needed to refresh the two least recently refreshed materialized views:
	`DBMS_MVIEW.PURGE_LOG('master_table', 2);`
	To delete all rows in the materialized view log, indicate a high number of materialized views to disregard, as in this example:
	`DBMS_MVIEW.PURGE_LOG('master_table',9999);`
	This statement completely purges the materialized view log that corresponds to `master_table` if fewer than 9999 materialized views are based on `master_table`. A simple materialized view whose rows have been purged from the materialized view log must be completely refreshed the next time it is refreshed.

flag	Specify `delete` to guarantee that rows are deleted from the materialized view log for at least one materialized view. This parameter can override the setting for the parameter `num`. For example, the following statement deletes rows from the materialized view log that has dependency rows in the least recently refreshed materialized view: `DBMS_MVIEW.PURGE_LOG('master_table',1,'delete');`

PURGE_MVIEW_FROM_LOG Procedure

This procedure is called on the master site or master materialized view site to delete the rows in materialized view refresh related data dictionary tables maintained at the master for the specified materialized view identified by its `mview_id` or the combination of the `mviewowner`, `mviewname`, and the `mviewsite`. If the materialized view specified is the oldest materialized view to have refreshed from any of the master tables or master materialized views, then the materialized view log is also purged. This procedure does not unregister the materialized view.

If there is an error while purging one of the materialized view logs, the successful purge operations of the previous materialized view logs are not rolled back. This is to minimize the size of the materialized view logs. In case of an error, this procedure can be invoked again until all the materialized view logs are purged.

Syntax

```
DBMS_MVIEW.PURGE_MVIEW_FROM_LOG (
   mview_id       IN   BINARY_INTEGER  |
   mviewowner     IN   VARCHAR2,
   mviewname      IN   VARCHAR2,
   mviewsite      IN   VARCHAR2);
```

Note: This procedure is overloaded. The `mview_id` parameter is mutually exclusive with the three remaining parameters: `mviewowner`, `mviewname`, and `mviewsite`.

Parameters

Table 29–8 PURGE_MVIEW_FROM_LOG Procedure Parameters

Parameter	Description
mview_id	If you want to execute this procedure based on the identification of the target materialized view, specify the materialized view identification using the mview_id parameter. Query the DBA_BASE_TABLE_MVIEWS view at the materialized view log site for a listing of materialized view IDs. Executing this procedure based on the materialized view identification is useful if the target materialized view is not listed in the list of registered materialized views (DBA_REGISTERED_MVIEWS).
mviewowner	If you do not specify a mview_id, enter the owner of the target materialized view using the mviewowner parameter. Query the DBA_REGISTERED_MVIEWS view at the materialized view log site to view the materialized view owners.
mviewname	If you do not specify a mview_id, enter the name of the target materialized view using the mviewname parameter. Query the DBA_REGISTERED_MVIEWS view at the materialized view log site to view the materialized view names.
mviewsite	If you do not specify a mview_id, enter the site of the target materialized view using the mviewsite parameter. Query the DBA_REGISTERED_MVIEWS view at the materialized view log site to view the materialized view sites.

REFRESH Procedure

This procedure refreshes a list of materialized views.

Syntax

```
DBMS_MVIEW.REFRESH (
   { list                IN     VARCHAR2,
   | tab                 IN OUT DBMS_UTILITY.UNCL_ARRAY,}
   method                IN     VARCHAR2       := NULL,
   rollback_seg          IN     VARCHAR2       := NULL,
   push_deferred_rpc     IN     BOOLEAN        := true,
   refresh_after_errors  IN     BOOLEAN        := false,
   purge_option          IN     BINARY_INTEGER := 1,
   parallelism           IN     BINARY_INTEGER := 0,
   heap_size             IN     BINARY_INTEGER := 0,
   atomic_refresh        IN     BOOLEAN        := true);
```

Note: This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 29–9 REFRESH Procedure Parameters **(Page 1 of 2)**

Parameter	Description
list | tab	Comma-separated list of materialized views that you want to refresh. (Synonyms are not supported.) These materialized views can be located in different schemas and have different master tables or master materialized views. However, all of the listed materialized views must be in your local database. Alternatively, you may pass in a PL/SQL index-by table of type DBMS_UTILITY.UNCL_ARRAY, where each element is the name of a materialized view.
method	A string of refresh methods indicating how to refresh the listed materialized views. An f indicates fast refresh, ? indicates force refresh, C or c indicates complete refresh, and A or a indicates always refresh. A and C are equivalent. If a materialized view does not have a corresponding refresh method (that is, if more materialized views are specified than refresh methods), then that materialized view is refreshed according to its default refresh method. For example, consider the following EXECUTE statement within SQL*Plus: `DBMS_MVIEW.REFRESH ('countries_mv,regions_mv,hr.employees_mv','cf');` This statement performs a complete refresh of the countries_mv materialized view, a fast refresh of the regions_mv materialized view, and a default refresh of the hr.employees materialized view.
rollback_seg	Name of the materialized view site rollback segment to use while refreshing materialized views.
push_deferred_rpc	Used by updatable materialized views only. Set this parameter to true if you want to push changes from the materialized view to its associated master tables or master materialized views before refreshing the materialized view. Otherwise, these changes may appear to be temporarily lost.
refresh_after_errors	If this parameter is true, an updatable materialized view continues to refresh even if there are outstanding conflicts logged in the DEFERROR view for the materialized view's master table or master materialized view. If this parameter is true and atomic_refresh is false, this procedure continues to refresh other materialized views if it fails while refreshing a materialized view.

Table 29–9 REFRESH Procedure Parameters **(Page 2 of 2)**

Parameter	Description
purge_option	If you are using the parallel propagation mechanism (in other words, parallelism is set to 1 or greater), 0 means do not purge, 1 means lazy purge, and 2 means aggressive purge. In most cases, lazy purge is the optimal setting. Set purge to aggressive to trim the queue if multiple master replication groups are pushed to different target sites, and updates to one or more replication groups are infrequent and infrequently pushed. If all replication groups are infrequently updated and pushed, then set this parameter to 0 and occasionally execute PUSH with this parameter set to 2 to reduce the queue.
parallelism	0 specifies serial propagation. *n* > 1 specifies parallel propagation with *n* parallel processes. 1 specifies parallel propagation using only one parallel process.
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.
atomic_refresh	If this parameter is set to true, then the list of materialized views is refreshed in a single transaction. All of the refreshed materialized views are updated to a single point in time. If the refresh fails for any of the materialized views, none of the materialized views are updated. If this parameter is set to false, then each of the materialized views is refreshed in a separate transaction. The number of job queue processes must be set to 1 or greater if this parameter is false.

REFRESH_ALL_MVIEWS Procedure

This procedure refreshes all materialized views that have the following properties:

- The materialized view has not been refreshed since the most recent change to a master table or master materialized view on which it depends.
- The materialized view and all of the master tables or master materialized views on which it depends are local.
- The materialized view is in the view DBA_MVIEWS.

This procedure is intended for use with data warehouses.

Syntax

```
DBMS_MVIEW.REFRESH_ALL_MVIEWS (
   number_of_failures     OUT   BINARY_INTEGER,
   method                 IN    VARCHAR2         := NULL,
   rollback_seg           IN    VARCHAR2         := NULL,
   refresh_after_errors   IN    BOOLEAN          := false,
   atomic_refresh         IN    BOOLEAN          := true);
```

Parameters

Table 29–10 REFRESH_ALL_MVIEWS Procedure Parameters **(Page 1 of 2)**

Parameter	Description
number_of_failures	Returns the number of failures that occurred during processing.
method	A single refresh method indicating the type of refresh to perform for each materialized view that is refreshed. F or f indicates fast refresh, ? indicates force refresh, C or c indicates complete refresh, and A or a indicates always refresh. A and C are equivalent. If no method is specified, a materialized view is refreshed according to its default refresh method.
rollback_seg	Name of the materialized view site rollback segment to use while refreshing materialized views.
refresh_after_errors	If this parameter is true, an updatable materialized view continues to refresh even if there are outstanding conflicts logged in the DEFERROR view for the materialized view's master table or master materialized view. If this parameter is true and atomic_refresh is false, this procedure continues to refresh other materialized views if it fails while refreshing a materialized view.

Table 29–10 REFRESH_ALL_MVIEWS Procedure Parameters **(Page 2 of 2)**

Parameter	Description
atomic_refresh	If this parameter is set to true, then the refreshed materialized views are refreshed in a single transaction. All of the refreshed materialized views are updated to a single point in time. If the refresh fails for any of the materialized views, none of the materialized views are updated. If this parameter is set to false, then each of the refreshed materialized views is refreshed in a separate transaction. The number of job queue processes must be set to 1 or greater if this parameter is false.

REFRESH_DEPENDENT Procedure

This procedure refreshes all materialized views that have the following properties:

- The materialized view depends on a master table or master materialized view in the list of specified masters.
- The materialized view has not been refreshed since the most recent change to a master table or master materialized view on which it depends.
- The materialized view and all of the master tables or master materialized views on which it depends are local.
- The materialized view is in the view DBA_MVIEWS.

This procedure is intended for use with data warehouses.

Syntax

```
DBMS_MVIEW.REFRESH_DEPENDENT (
   number_of_failures     OUT    BINARY_INTEGER,
   { list                 IN     VARCHAR2,
   | tab                  IN OUT DBMS_UTILITY.UNCL_ARRAY,}
   method                 IN     VARCHAR2    := NULL,
   rollback_seg           IN     VARCHAR2    := NULL,
   refresh_after_errors   IN     BOOLEAN     := false,
   atomic_refresh         IN     BOOLEAN     := true);
```

Note: This procedure is overloaded. The list and tab parameters are mutually exclusive.

Parameters

Table 29–11 REFRESH_DEPENDENT Procedure Parameters **(Page 1 of 2)**

Parameter	Description
number_of_failures	Returns the number of failures that occurred during processing.
list | tab	Comma-separated list of master tables or master materialized views on which materialized views can depend. (Synonyms are not supported.) These tables and the materialized views that depend on them can be located in different schemas. However, all of the tables and materialized views must be in your local database. Alternatively, you may pass in a PL/SQL index-by table of type DBMS_UTILITY.UNCL_ARRAY, where each element is the name of a table.
method	A string of refresh methods indicating how to refresh the dependent materialized views. All of the materialized views that depend on a particular table are refreshed according to the refresh method associated with that table. F or f indicates fast refresh, ? indicates force refresh, C or c indicates complete refresh, and A or a indicates always refresh. A and C are equivalent. If a table does not have a corresponding refresh method (that is, if more tables are specified than refresh methods), then any materialized view that depends on that table is refreshed according to its default refresh method. For example, the following EXECUTE statement within SQL*Plus: `DBMS_MVIEW.REFRESH_DEPENDENT ('employees,deptartments,hr.regions','cf');` performs a complete refresh of the materialized views that depend on the employees table, a fast refresh of the materialized views that depend on the departments table, and a default refresh of the materialized views that depend on the hr.regions table.
rollback_seg	Name of the materialized view site rollback segment to use while refreshing materialized views.
refresh_after_errors	If this parameter is true, an updatable materialized view continues to refresh even if there are outstanding conflicts logged in the DEFERROR view for the materialized view's master table or master materialized view. If this parameter is true and atomic_refresh is false, this procedure continues to refresh other materialized views if it fails while refreshing a materialized view.

Table 29–11 REFRESH_DEPENDENT Procedure Parameters **(Page 2 of 2)**

Parameter	Description
atomic_refresh	If this parameter is set to `true`, then the refreshed materialized views are refreshed in a single transaction. All of the refreshed materialized views are updated to a single point in time. If the refresh fails for any of the materialized views, none of the materialized views are updated. If this parameter is set to `false`, then each of the refreshed materialized views is refreshed in a separate transaction. The number of job queue processes must be set to 1 or greater if this parameter is `false`.

REGISTER_MVIEW Procedure

This procedure enables the administration of individual materialized views. It is invoked at a master site or master materialized view site to register a materialized view.

> **Note:** Typically, a materialized view is registered automatically during materialized view creation. You should only run this procedure to manually register a materialized view if the automatic registration failed or if the registration information was deleted.

Syntax

```
DBMS_MVIEW.REGISTER_MVIEW (
   mviewowner  IN   VARCHAR2,
   mviewname   IN   VARCHAR2,
   mviewsite   IN   VARCHAR2,
   mview_id    IN   DATE | BINARY_INTEGER,
   flag        IN   BINARY_INTEGER,
   qry_txt     IN   VARCHAR2,
   rep_type    IN   BINARY_INTEGER := DBMS_MVIEW.REG_UNKNOWN);
```

Parameters

Table 29–12 REGISTER_MVIEW Procedure Parameters

Parameter	Description
mviewowner	Owner of the materialized view.
mviewname	Name of the materialized view.
mviewsite	Name of the materialized view site for a materialized view registering at an Oracle8 and higher master site or master materialized view site. This name should not contain any double quotes.
mview_id	The identification number of the materialized view. Specify an Oracle8 and higher materialized view as a BINARY_INTEGER. Specify an Oracle7 materialized view registering at an Oracle8 and higher master sites or master materialized view sites as a DATE.
flag	A constant that describes the properties of the materialized view being registered. Valid constants that can be assigned include the following: ▪ dbms_mview.reg_rowid_mview for a rowid materialized view ▪ dbms_mview.reg_primary_key_mview for a primary key materialized view ▪ dbms_mview.reg_object_id_mview for an object id materialized view ▪ dbms_mview.reg_fast_refreshable_mview for a materialized view that can be fast refreshed ▪ dbms_mview.reg_updatable_mview for a materialized view that is updatable A materialized view can have more than one of these properties. In this case, use the plus sign (+) to specify more than one property. For example, if a primary key materialized view can be fast refreshed, you can enter the following for this parameter: dbms_mview.reg_primary_key_mview + dbms_mview.reg_fast_refreshable_mview You can determine the properties of a materialized view by querying the ALL_MVIEWS data dictionary view.
qry_txt	The first 32,000 bytes of the materialized view definition query.

Table 29–12 REGISTER_MVIEW Procedure Parameters

Parameter	Description
rep_type	Version of the materialized view. Valid constants that can be assigned include the following: ■ dbms_mview.reg_v7_snapshot if the materialized view is at an Oracle7 site ■ dbms_mview.reg_v8_snapshot if the materialized view is at an Oracle8 or higher site ■ dbms_mview.reg_unknown (the default) if you do not know whether the materialized view is at an Oracle7 site or an Oracle8 (or higher) site

Usage Notes

This procedure is invoked at the master site or master materialized view site by a remote materialized view site using a remote procedure call. If REGISTER_MVIEW is called multiple times with the same mviewowner, mviewname, and mviewsite, then the most recent values for mview_id, flag, and qry_txt are stored. If a query exceeds the maximum VARCHAR2 size, then qry_txt contains the first 32000 characters of the query and the remainder is truncated. When invoked manually, the value of mview_id must be looked up in the materialized view data dictionary views by the person who calls the procedure.

UNREGISTER_MVIEW Procedure

This procedure enables the administration of individual materialized views. It is invoked at a master site or master materialized view site to unregister a materialized view.

Syntax

```
DBMS_MVIEW.UNREGISTER_MVIEW (
   mviewowner      IN   VARCHAR2,
   mviewname       IN   VARCHAR2,
   mviewsite       IN   VARCHAR2);
```

Parameters

Table 29–13 UNREGISTER_MVIEW Procedure Parameters

Parameters	Description
mviewowner	Owner of the materialized view.
mviewname	Name of the materialized view.
mviewsite	Name of the materialized view site.

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DBMS_OBFUSCATION_TOOLKIT

The DBMS_OBFUSCATION_TOOLKIT package allows an application to encrypt data using either the Data Encryption Standard (DES) or the Triple DES algorithms.

The Data Encryption Standard (DES), also known as the Data Encryption Algorithm (DEA) by the American National Standards Institute (ANSI) and DEA-1 by the International Standards Organization (ISO), has been a worldwide encryption standard for over twenty years. The banking industry has also adopted DES-based standards for transactions between private financial institutions, and between financial institutions and private individuals. DES will eventually be replaced by a new Advanced Encryption Standard (AES).

DES is a symmetric key cipher; that is, the same key is used to encrypt data as well as decrypt data. DES encrypts data in 64-bit blocks using a 56-bit key. The DES algorithm ignores 8 bits of the 64-bit key that is supplied; however, developers must supply a 64-bit key to the algorithm.

Triple DES (3DES) is a far stronger cipher than DES; the resulting ciphertext (encrypted data) is much harder to break using an exhaustive search: 2**112 or 2**168 attempts instead of 2**56 attempts. Triple DES is also not as vulnerable to certain types of cryptanalysis as is DES.

The DES procedures are the following:

- DESEncrypt Procedure
- DESDecrypt Procedure

Oracle installs this package in the SYS schema. You can then grant package access to existing users and roles as needed. The package also grants access to the PUBLIC role so no explicit grant needs to be done.

This chapter discusses the following topics:

- Overview of Key Management

Overview of Key Management

Key management, including both generation and secure storage of cryptographic keys, is one of the most important aspects of encryption. If keys are poorly chosen or stored improperly, then it is far easier for a malefactor to break the encryption. Rather than using an exhaustive key search attack (that is, cycling through all the possible keys in hopes of finding the correct decryption key), cryptanalysts typically seek weaknesses in the choice of keys, or the way in which keys are stored.

Key generation is an important aspect of encryption. Typically, keys are generated automatically through a random-number generator. Provided that the random number generation is cryptographically secure, this can be an acceptable form of key generation. However, if random numbers are not cryptographically secure, but have elements of predictability, the security of the encryption may be easily compromised.

The `DBMS_OBFUSCATION_TOOLKIT` package does not generate encryption keys nor does it maintain them. Care must be taken by the application developer to ensure the secure generation and storage of encryption keys used with this package. Furthermore, the encryption and decryption done by the `DBMS_OBFUSCATION_TOOLKIT` takes place on the server, not the client. If the key is passed over the connection between the client and the server, the connection must be protected using Oracle Advanced Security; otherwise the key is vulnerable to capture over the wire.

Key storage is one of the most important, yet difficult aspects of encryption and one of the hardest to manage properly. To recover data encrypted with a symmetric key, the key must be accessible to the application or user seeking to decrypt data. The key needs to be easy enough to retrieve that users can access encrypted data when they need to without significant performance degradation. The key also needs to be secure enough that it is not easily recoverable by an unauthorized user trying to access encrypted data he is not supposed to see.

The three options available to a developer are:

- Store the key in the database
- Store the key in the operating system
- Have the user manage the key

Storing the Key in the Database

Storing the keys in the database cannot always provide bullet-proof security if you are trying to protect data against the DBA accessing encrypted data (since an

all-privileged DBA can access tables containing encryption keys), but it can provide security against the casual snooper, or against someone compromising the database files on the operating system. Furthermore, the security you can obtain by storing keys in the database does not have to be bullet-proof in order to be extremely useful.

For example, suppose you want to encrypt an employee's social security number, one of the columns in table EMP. You could encrypt each employee's SSN using a key which is stored in a separate column in EMP. However, anyone with SELECT access on the EMP table could retrieve the encryption key and decrypt the matching social security number. Alternatively, you could store the encryption keys in another table, and use a package to retrieve the correct key for the encrypted data item, based on a primary key-foreign key relationship between the tables.

A developer could envelope both the DBMS_OBFUSCATION_TOOLKIT package and the procedure to retrieve the encryption keys supplied to the package. Furthermore, the encryption key itself could be transformed in some way (for example, XORed with the foreign key to the EMP table) so that the key itself is not stored in easily recoverable form.

Oracle recommends using the wrap utility of PL/SQL to obfuscate the code within a PL/ SQL package itself that does the encryption. That prevents people from breaking the encryption by looking at the PL/SQL code that handles keys, calls encrypting routines, and so on. In other words, use the wrap utility to obfuscate the PL/SQL packages themselves. This scheme is secure enough to prevent users with SELECT access to EMP from reading unencrypted sensitive data, and a DBA from easily retrieving encryption keys and using them to decrypt data in the EMP table. It can be made more secure by changing encryption keys regularly, or having a better key storage algorithm (so the keys themselves are encrypted, for example).

Storing the Key in the Operating System

Storing keys in the operating system (e.g. in a flat file) is another option. Oracle8*i* allows you to make callouts from PL/SQL, which you could use to retrieve encryption keys. If you store keys in the O/S and make callouts to retrieve the keys, then the security of your encrypted data is only as secure as the protection of the key file on the O/S. Of course, a user retrieving keys from the operating system would have to be able to either access the Oracle database files (to decrypt encrypted data), or be able to gain access to the table in which the encrypted data is stored as a legitimate user.

User-Supplied Keys

If you ask a user to supply the key, it is crucial that you use network encryption, such as that provided by Oracle Advanced Security, so the key is not passed from client to server in the clear. The user must remember the key, or your data is nonrecoverable.

Summary of DBMS_OBFUSCATION Subprograms

The following table describes the subprograms discussed in this chapter.

Subprogram	Description
"DESEncrypt Procedure" on page 30-5	Generates the encrypted form of the input data.
"DESDecrypt Procedure" on page 30-7	Generates the decrypted form of the input data.
"DES3Encrypt Procedure" on page 30-10	Generates the encrypted form of the input data by passing it through the Triple DES (3DES) encryption algorithm.
"DES3Decrypt Procedure" on page 30-11	Generates the decrypted form of the input data.

DESEncrypt Procedure

The DESEncrypt procedure generates the encrypted form of the input data. An example of the DESEncrypt procedure appears at the end of this chapter.

The DES algorithm encrypts data in 64-bit blocks using a 56-bit key. The DES algorithm throws away 8 bits of the supplied key (the particular bits which are thrown away is beyond the scope of this documentation). However, developers using the algorithm must supply a 64-bit key or the package will raise an error.

Parameters

Table 30–1 and Table 30–2 list the parameters for the DESEncrypt syntax, their modes, types, and descriptions.

Table 30–1 DESEncrypt parameters for raw data

Parameter Name	Mode	Type	Description
input	IN	RAW	data to be encrypted
key	IN	RAW	encryption key

Table 30–1 DESEncrypt parameters for raw data

Parameter Name	Mode	Type	Description
encrypted_data	OUT	RAW	encrypted data

Table 30–2 DESEncrypt parameters for string data

Parameter Name	Mode	Type	Description
input_string	IN	VARCHAR2	string to be encrypted
key_string	IN	VARCHAR2	encryption key string
encrypted_string	OUT	VARCHAR2	encrypted string

If the input data or key given to the PL/SQL DESEncrypt procedure is empty, then the procedure raises the error ORA-28231 "Invalid input to Obfuscation toolkit".

If the input data given to the DESEncrypt procedure is not a multiple of 8 bytes, the procedure raises the error ORA-28232 "Invalid input size for Obfuscation toolkit".

If the user tries to double encrypt data using the DESEncrypt procedure, then the procedure raises the error ORA-28233 "Double encryption not supported".

If the key length is missing or is less than 8 bytes, then the procedure raises the error ORA-28234 "Key length too short." Note that if larger keys are used, extra bytes are ignored. So a 9-byte key will not generate an exception.

Restrictions

The DESEncryption procedure has two restrictions. The first is that the DES key length for encryption is fixed at 56 bits; you cannot alter this key length.

The second is that you cannot execute multiple passes of encryption. That is, you cannot re-encrypt previously encrypted data by calling the function twice.

Note: Both the key length limitation and the prevention of multiple encryption passes are requirements of US regulations governing the export of cryptographic products.

DESDecrypt Procedure

The purpose of the DESDecrypt procedure is to generate the decrypted form of the input data. An example of the DESDecrypt procedure appears at the end of this chapter.

Parameters

Table 30–3 and Table 30–4 list the parameters for the DESDecrypt syntax, their modes, types, and descriptions.

Table 30–3 DESDecrypt parameters for raw data

Parameter Name	Mode	Type	Description
input	IN	RAW	Data to be decrypted
key	IN	RAW	Decryption key
decrypted_data	OUT	RAW	Decrypted data

Table 30–4 DESDecrypt parameters for string data

Parameter Name	Mode	Type	Description
input_string	IN	VARCHAR2	String to be decrypted
key_string	IN	VARCHAR2	Decryption key string
decrypted_string	OUT	VARCHAR2	Decrypted string

If the input data or key given to the PL/SQL DESDecrypt function is empty, then Oracle raises ORA error 28231 "Invalid input to Obfuscation toolkit".

If the input data given to the DESDecrypt function is not a multiple of 8 bytes, Oracle raises ORA error 28232 "Invalid input size for Obfuscation toolkit".

If the key length is missing or is less than 8 bytes, then the procedure raises the error ORA-28234 "Key length too short." Note that if larger keys are used, extra bytes are ignored. So a 9-byte key will not generate an exception.

Note: ORA-28233 is not applicable to the DESDecrypt function.

Restrictions

The DES key length for encryption is fixed at 64 bits (of which 56 bits are used); you cannot alter this key length.

> **Note:** The key length limitation is a requirement of U.S. regulations governing the export of cryptographic products.

Example

A sample PL/SQL program follows. Segments of the code are numbered and contain narrative text explaining portions of the code.

```
DECLARE
   input_string        VARCHAR2(16) := 'tigertigertigert';
   raw_input           RAW(128) := UTL_RAW.CAST_TO_RAW(input_string);
   key_string          VARCHAR2(8)  := 'scottsco';
   raw_key             RAW(128) := UTL_RAW.CAST_TO_RAW(key_string);
   encrypted_raw               RAW(2048);
   encrypted_string            VARCHAR2(2048);
   decrypted_raw               RAW(2048);
   decrypted_string            VARCHAR2(2048);
   error_in_input_buffer_length EXCEPTION;
   PRAGMA EXCEPTION_INIT(error_in_input_buffer_length, -28232);
   INPUT_BUFFER_LENGTH_ERR_MSG VARCHAR2(100) :=
    '*** DES INPUT BUFFER NOT A MULTIPLE OF 8 BYTES - IGNORING
EXCEPTION ***';
   double_encrypt_not_permitted EXCEPTION;
   PRAGMA EXCEPTION_INIT(double_encrypt_not_permitted, -28233);
   DOUBLE_ENCRYPTION_ERR_MSG VARCHAR2(100) :=
    '*** CANNOT DOUBLE ENCRYPT DATA - IGNORING EXCEPTION ***';

-- 1. Begin testing raw data encryption and decryption
   BEGIN
   dbms_output.put_line('> ========= BEGIN TEST RAW DATA =========');
   dbms_output.put_line('> Raw input                          : ' ||
                UTL_RAW.CAST_TO_VARCHAR2(raw_input));
   BEGIN
      dbms_obfuscation_toolkit.DESEncrypt(input => raw_input,
               key => raw_key, encrypted_data => encrypted_raw );
      dbms_output.put_line('> encrypted hex value              : ' ||
               rawtohex(encrypted_raw));
      dbms_obfuscation_toolkit.DESDecrypt(input => encrypted_raw,
               key => raw_key, decrypted_data => decrypted_raw);
```

```
      dbms_output.put_line('> Decrypted raw output             : ' ||
                   UTL_RAW.CAST_TO_VARCHAR2(decrypted_raw));
      dbms_output.put_line('>  ');
      if UTL_RAW.CAST_TO_VARCHAR2(raw_input) =
                   UTL_RAW.CAST_TO_VARCHAR2(decrypted_raw) THEN
         dbms_output.put_line('> Raw DES Encyption and Decryption successful');
      END if;
   EXCEPTION
      WHEN error_in_input_buffer_length THEN
            dbms_output.put_line('> ' || INPUT_BUFFER_LENGTH_ERR_MSG);
   END;
   dbms_output.put_line('>  ');


-- 2. Begin testing string data encryption and decryption
   dbms_output.put_line('> ========= BEGIN TEST STRING DATA =========');

   BEGIN
      dbms_output.put_line('> input string                     : '
                           || input_string);
      dbms_obfuscation_toolkit.DESEncrypt(
               input_string => input_string,
               key_string => key_string,
               encrypted_string => encrypted_string );
      dbms_output.put_line('> encrypted hex value              : ' ||
                  rawtohex(UTL_RAW.CAST_TO_RAW(encrypted_string)));
      dbms_obfuscation_toolkit.DESDecrypt(
               input_string => encrypted_string,
               key_string => key_string,
               decrypted_string => decrypted_string );
      dbms_output.put_line('> decrypted string output          : ' ||
                 decrypted_string);
      if input_string = decrypted_string THEN
         dbms_output.put_line('> String DES Encyption and Decryption
successful');
      END if;
   EXCEPTION
      WHEN error_in_input_buffer_length THEN
            dbms_output.put_line(' ' || INPUT_BUFFER_LENGTH_ERR_MSG);
   END;
   dbms_output.put_line('>  ');
END;
```

DES3Encrypt Procedure

The DES3Encrypt procedure generates the encrypted form of the input data by passing it through the Triple DES (3DES) encryption algorithm. An example of the DESEncrypt procedure appears at the end of this chapter.

Oracle's implementation of 3DES supports either a 2-key or 3-key implementation, in outer cipher-block-chaining (CBC) mode.

A developer using Oracle's 3DES interface with a 2-key implementation must supply a single key of 128 bits as an argument to the DES3Encrypt procedure. With a 3-key implementation, you must supply a single key of 192 bits. Oracle then breaks the supplied key into two 64-bit keys. As with DES, the 3DES algorithm throws away 8 bits of each derived key. However, you must supply a single 128-bit key for the 2-key 3DES implementation or a single 192-bit key for the 3-key 3DES implementation; otherwise the package will raise an error. The DES3Encrypt procedure uses the 2-key implementation by default.

Parameters

Table 30–5 and Table 30–6 list the parameters for the DES3Encrypt syntax, their modes, types, and descriptions.

Table 30–5 DES3Encrypt parameters for raw data

Parameter Name	Mode	Type	Description
input	IN	RAW	data to be encrypted
key	IN	RAW	encryption key
encrypted_data	OUT	RAW	encrypted data
which	IN	PLS_INTEGER	If = 0, (default), then TwoKeyMode is used. If = 1, then ThreeKeyMode is used.

Table 30–6 DES3Encrypt parameters for string data

Parameter Name	Mode	Type	Description
input_string	IN	VARCHAR2	string to be encrypted
key_string	IN	VARCHAR2	encryption key string
encrypted_string	OUT	VARCHAR2	encrypted string
which	IN	PLS_INTEGER	If = 0, (default), then TwoKeyMode is used. If = 1, then ThreeKeyMode is used.

If the input data or key given to the PL/SQL DES3Encrypt procedure is empty, then the procedure raises the error ORA-28231 "Invalid input to Obfuscation toolkit".

If the input data given to the DES3Encrypt procedure is not a multiple of 8 bytes, the procedure raises the error ORA-28232 "Invalid input size for Obfuscation toolkit".

If the user tries to double encrypt data using the DES3Encrypt procedure, then the procedure raises the error ORA-28233 "Double encryption not supported".

If the key length is missing or is less than 8 bytes, then the procedure raises the error ORA-28234 "Key length too short." Note that if larger keys are used, extra bytes are ignored. So a 9-byte key will not generate an exception.

If an incorrect value is specified for the WHICH parameter, ORA-28236 "Invalid Triple DES mode" is generated. Only the values 0 (TwoKeyMode) and 1 (ThreeKeyMode) are valid.

Restrictions

The DES3Encrypt procedure has two restrictions. The first is that the DES key length for encryption is fixed at 128 bits (for 2-key DES) or 192 bits (for 3-key DES); you cannot alter these key lengths.

The second is that you cannot execute multiple passes of encryption using 3DES. (Note: the 3DES algorithm itself encrypts data multiple times; however, you cannot call the 3DESencrypt function itself more than once to encrypt the same data using 3DES.)

Note: Both the key length limitation and the prevention of multiple encryption passes are requirements of US regulations governing the export of cryptographic products.

DES3Decrypt Procedure

The purpose of the DES3Decrypt procedure is to generate the decrypted form of the input data. An example of the DES3Decrypt procedure appears at the end of this chapter.

Parameters

Table 30–7 and Table 30–8 list the parameters for the DES3Decrypt syntax, their modes, types, and descriptions.

Table 30–7 DES3Decrypt parameters for raw data

Parameter Name	Mode	Type	Description
input	IN	RAW	Data to be decrypted
key	IN	RAW	Decryption key
decrypted_data	OUT	RAW	Decrypted data
which	IN	PLS_INTEGER	If = 0, (default), then TwoKeyMode is used. If = 1, then ThreeKeyMode is used.

Table 30–8 DES3Decrypt parameters for string data

Parameter Name	Mode	Type	Description
input_string	IN	VARCHAR2	String to be decrypted
key_string	IN	VARCHAR2	Decryption key string
decrypted_string	OUT	VARCHAR2	Decrypted string
which	IN	PLS_INTEGER	If = 0, (default), then TwoKeyMode is used. If = 1, then ThreeKeyMode is used.

If the input data or key given to the DES3Decrypt procedure is empty, then the procedure raises the error ORA-28231 "Invalid input to Obfuscation toolkit".

If the input data given to the DES3Decrypt procedure is not a multiple of 8 bytes, the procedure raises the error ORA-28232 "Invalid input size for Obfuscation toolkit". ORA-28233 is NOT applicable for the DES3Decrypt function.

If the key length is missing or is less than 8 bytes, then the procedure raises the error ORA-28234 "Key length too short." Note that if larger keys are used, extra bytes are ignored. So a 9-byte key will not generate an exception.

If an incorrect value is specified for the WHICH parameter, ORA-28236 "Invalid Triple DES mode" is generated. Only the values 0 (TwoKeyMode) and 1 (ThreeKeyMode) are valid.

Restrictions

As stated above, a developer must supply a single key of either 128 bits for a 2-key implementation (of which only 112 are used), or a single key of 192 bits for a 3-key implementation (of which 168 bits are used). Oracle automatically truncates the supplied key into 56-bit lengths for decryption. This key length is fixed and cannot be altered.

> **Note:** Both the key length limitation and the prevention of multiple encryption passes are requirements of US regulations governing the export of cryptographic products.

Example

Following is a sample PL/SQL program for your reference. Segments of the code are numbered and contain narrative text explaining portions of the code.

```
DECLARE
   input_string        VARCHAR2(16) := 'tigertigertigert';
   raw_input           RAW(128) := UTL_RAW.CAST_TO_RAW(input_string);
   key_string          VARCHAR2(16)  := 'scottscottscotts';
   raw_key             RAW(128) := UTL_RAW.CAST_TO_RAW(key_string);
encrypted_raw               RAW(2048);
   encrypted_string            VARCHAR2(2048);
decrypted_raw               RAW(2048);
   decrypted_string            VARCHAR2(2048);
   error_in_input_buffer_length EXCEPTION;
   PRAGMA EXCEPTION_INIT(error_in_input_buffer_length, -28232);
   INPUT_BUFFER_LENGTH_ERR_MSG VARCHAR2(100) :=
    '*** DES INPUT BUFFER NOT A MULTIPLE OF 8 BYTES - IGNORING EXCEPTION ***';
   double_encrypt_not_permitted EXCEPTION;
   PRAGMA EXCEPTION_INIT(double_encrypt_not_permitted, -28233);
   DOUBLE_ENCRYPTION_ERR_MSG VARCHAR2(100) :=
    '*** CANNOT DOUBLE ENCRYPT DATA - IGNORING EXCEPTION ***';

-- 1. Begin testing raw data encryption and decryption
   BEGIN
   dbms_output.put_line('> ========= BEGIN TEST RAW DATA =========');
   dbms_output.put_line('> Raw input                          : ' ||
                UTL_RAW.CAST_TO_VARCHAR2(raw_input));
   BEGIN
      dbms_obfuscation_toolkit.DES3Encrypt(input => raw_input,
```

```
            key => raw_key, encrypted_data => encrypted_raw );
      dbms_output.put_line('> encrypted hex value              : ' ||
            rawtohex(encrypted_raw));
      dbms_obfuscation_toolkit.DES3Decrypt(input => encrypted_raw,
            key => raw_key, decrypted_data => decrypted_raw);
      dbms_output.put_line('> Decrypted raw output             : ' ||
                  UTL_RAW.CAST_TO_VARCHAR2(decrypted_raw));
      dbms_output.put_line('>  ');
      if UTL_RAW.CAST_TO_VARCHAR2(raw_input) =
                  UTL_RAW.CAST_TO_VARCHAR2(decrypted_raw) THEN
         dbms_output.put_line('> Raw DES3 Encyption and Decryption successful');
      END if;
   EXCEPTION
      WHEN error_in_input_buffer_length THEN
            dbms_output.put_line('> ' || INPUT_BUFFER_LENGTH_ERR_MSG);
   END;
   dbms_output.put_line('>  ');
END;

-- 2. Begin testing string data encryption and decryption
   dbms_output.put_line('> ========= BEGIN TEST STRING DATA =========');

   BEGIN
      dbms_output.put_line('> input string                     : '
                           || input_string);
      dbms_obfuscation_toolkit.DES3Encrypt(
            input_string => input_string,
            key_string => key_string,
            encrypted_string => encrypted_string );
      dbms_output.put_line('> encrypted hex value              : ' ||
                rawtohex(UTL_RAW.CAST_TO_RAW(encrypted_string)));
      dbms_obfuscation_toolkit.DES3Decrypt(
            input_string => encrypted_string,
            key_string => key_string,
            decrypted_string => decrypted_string );
      dbms_output.put_line('> decrypted string output          : ' ||
              decrypted_string);
      if input_string = decrypted_string THEN
         dbms_output.put_line('> String DES3 Encyption and Decryption
successful');
      END if;
   EXCEPTION
      WHEN error_in_input_buffer_length THEN
            dbms_output.put_line(' ' || INPUT_BUFFER_LENGTH_ERR_MSG);
   END;
```

```
   dbms_output.put_line('>  ');
END;
```

31

DBMS_ODCI

DBMS_ODCI returns the CPU cost of a user function based on the elapsed time of the function. The CPU cost is used by extensible optimizer routines.

This chapter discusses the following topics:

- Summary of DBMS_ODCI Subprograms

Summary of DBMS_ODCI Subprograms

Table 31–1 DBMS_ODCI Subprograms

Subprogram	Description
"ESTIMATE_CPU_UNITS Function" on page 31-2	Returns the approximate number of CPU instructions (in thousands) corresponding to a specified time interval (in seconds).

ESTIMATE_CPU_UNITS Function

ESTIMATE_CPU_UNITS returns the approximate number of CPU instructions (in thousands) corresponding to a specified time interval (in seconds). This information can be used to associate the CPU cost with a user-defined function for the extensible optimizer.

The function takes as input the elapsed time of the user function, measures CPU units by multiplying the elapsed time by the processor speed of the machine, and returns the approximate number of CPU instructions that should be associated with the user function. (For a multiprocessor machine, ESTIMATE_CPU_UNITS considers the speed of a single processor.)

Syntax

```
Function ESTIMATE_CPU_UNITS(elapsed_time NUMBER) RETURN NUMBER;
```

Parameters

elapsed_time	The elapsed time in seconds to execute the function

Usage Notes

When associating CPU cost with a user-defined function, use the full number of CPU units rather than the number of *thousands* of CPU units returned by ESTIMATE_CPU_UNITS. In other words, multiply the number returned by ESTIMATE_CPU_UNITS by 1000.

Example

To determine the number of CPU units used for a function that takes 10 seconds on a machine:

```
DECLARE
```

```
  a INTEGER;
BEGIN
  a := DBMS_ODCI.ESTIMATE_CPU_UNITS(10);
  DBMS_OUTPUT.PUT_LINE('CPU units = '|| a*1000);
END;
```

32

DBMS_OFFLINE_OG

The DBMS_OFFLINE_OG package contains public APIs for offline instantiation of master groups.

This chapter discusses the following topics:

- Summary of DBMS_OFFLINE_OG Subprograms

> **Note:** These procedures are used in performing an offline instantiation of a master table in a multimaster replication environment.
>
> These procedure should not be confused with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Summary of DBMS_OFFLINE_OG Subprograms

Table 32–1 DBMS_OFFLINE_OG Package Subprograms

Subprogram	Description
"BEGIN_INSTANTIATION Procedure" on page 32-3	Starts offline instantiation of a master group.
"BEGIN_LOAD Procedure" on page 32-4	Disables triggers while data is imported to new master site as part of offline instantiation.
"END_INSTANTIATION Procedure" on page 32-6	Completes offline instantiation of a master group.
"END_LOAD Procedure" on page 32-7	Re-enables triggers after importing data to new master site as part of offline instantiation.
"RESUME_SUBSET_OF_ MASTERS Procedure" on page 32-9	Resumes replication activity at all existing sites except the new site during offline instantiation of a master group.

BEGIN_INSTANTIATION Procedure

This procedure starts offline instantiation of a master group. You must call this procedure from the master definition site.

> **Note:** This procedure is used to perform an offline instantiation of a master table in a multimaster replication environment.
>
> This procedure should not be confused with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_OG.BEGIN_INSTANTIATION (
   gname     IN   VARCHAR2,
   new_site  IN   VARCHAR2
   fname     IN   VARCHAR2);
```

Parameters

Table 32–2 BEGIN_INSTANTIATION Procedure Parameters

Parameter	Description
gname	Name of the replication group that you want to replicate to the new site.
new_site	The fully qualified database name of the new site to which you want to replicate the replication group.
fname	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 32–3 BEGIN_INSTANTIATION Procedure Exceptions

Exception	Description
badargument	NULL or empty string for replication group or new master site name.
dbms_repcat.nonmasterdef	This procedure must be called from the master definition site.
sitealreadyexists	Specified site is already a master site for this replication group.
wrongstate	Status of master definition site must be quiesced.
dbms_repcat.missingrepgroup	gname does not exist as a master group.
dbms_repcat.missing_flavor	If you receive this exception, contact Oracle Support Services.

BEGIN_LOAD Procedure

This procedure disables triggers while data is imported to the new master site as part of offline instantiation. You must call this procedure from the new master site.

Note: This procedure is used to perform an offline instantiation of a master table in a multimaster replication environment.

This procedure should not be confused with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_OG.BEGIN_LOAD (
   gname     IN   VARCHAR2,
   new_site  IN   VARCHAR2);
```

Parameters

Table 32–4 BEGIN_LOAD Procedure Parameters

Parameter	Description
gname	Name of the replication group whose members you are importing.
new_site	The fully qualified database name of the new site at which you will be importing the replication group members.

Exceptions

Table 32–5 BEGIN_LOAD Procedure Exceptions

Exception	Description
badargument	NULL or empty string for replication group or new master site name.
wrongsite	This procedure must be called from the new master site.
unknownsite	Specified site is not recognized by replication group.
wrongstate	Status of the new master site must be quiesced.
dbms_repcat.missingrepgroup	gname does not exist as a master group.

END_INSTANTIATION Procedure

This procedure completes offline instantiation of a master group. You must call this procedure from the master definition site.

Note: This procedure is used to perform an offline instantiation of a master table in a multimaster replication environment.

This procedure should not be confused with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_OG.END_INSTANTIATION (
  gname     IN  VARCHAR2,
  new_site  IN  VARCHAR2);
```

Parameters

Table 32–6 END_INSTANTIATION Procedure Parameters

Parameter	Description
gname	Name of the replication group that you are replicating to the new site.
new_site	The fully qualified database name of the new site to which you are replicating the replication group.

Exceptions

Table 32–7 END_INSTANTIATION Procedure Exceptions

Exception	Description
badargument	NULL or empty string for replication group or new master site name.
dbms_repcat.nonmasterdef	This procedure must be called from the master definition site.
unknownsite	Specified site is not recognized by replication group.
wrongstate	Status of master definition site must be quiesced.
dbms_repcat.missingrepgroup	gname does not exist as a master group.

END_LOAD Procedure

This procedure re-enables triggers after importing data to new master site as part of offline instantiation. You must call this procedure from the new master site.

Note: This procedure is used to perform an offline instantiation of a master table in a multimaster replication environment.

This procedure should not be confused with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_OG.END_LOAD (
   gname     IN   VARCHAR2,
   new_site  IN   VARCHAR2
   fname     IN   VARCHAR2);
```

Parameters

Table 32–8 END_LOAD Procedure Parameters

Parameter	Description
gname	Name of the replication group whose members you have finished importing.
new_site	The fully qualified database name of the new site at which you have imported the replication group members.
fname	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 32–9 END_LOAD Procedure Exceptions

Exception	Description
badargument	NULL or empty string for replication group or new master site name.
wrongsite	This procedure must be called from the new master site.
unknownsite	Specified site is not recognized by replication group.
wrongstate	Status of the new master site must be quiesced.
dbms_repcat.missingrepgroup	gname does not exist as a master group.
dbms_repcat.flavor_noobject	If you receive this exception, contact Oracle Support Services.
dbms_repcat.flavor_contains	If you receive this exception, contact Oracle Support Services.

RESUME_SUBSET_OF_MASTERS Procedure

When you add a new master site to a master group by performing an offline instantiation of a master site, it may take some time to complete the offline instantiation process. This procedure resumes replication activity at all existing sites, except the new site, during offline instantiation of a master group. You typically execute this procedure after executing the DBMS_OFFLINE_OG.BEGIN_INSTANTIATION procedure. You must call this procedure from the master definition site.

Note: This procedure is used to perform an offline instantiation of a master table in a multimaster replication environment.

This procedure should not be confused with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_OG.RESUME_SUBSET_OF_MASTERS (
   gname     IN  VARCHAR2,
   new_site  IN  VARCHAR2
   override  IN  BOOLEAN := false);
```

Parameters

Table 32–10 RESUME_SUBSET_OF_MASTERS Procedure Parameters

Parameter	Description
gname	Name of the replication group that you are replicating to the new site.
new_site	The fully qualified database name of the new site to which you are replicating the replication group.
override	If this is `true`, then any pending `RepCat` administrative requests are ignored and normal replication activity is restored at each master as quickly as possible. The `override` parameter should be set to `true` only in emergency situations. If this is `false`, then normal replication activity is restored at each master only when there is no pending `RepCat` administrative request for `gname` at that master.

Exceptions

Table 32–11 RESUME_SUBSET_OF_MASTERS Procedure Exceptions

Exception	Description
badargument	`NULL` or empty string for replication group or new master site name.
dbms_repcat.nonmasterdef	This procedure must be called from the master definition site.
unknownsite	Specified site is not recognized by replication group.
wrongstate	Status of master definition site must be quiesced.
dbms_repcat.missingrepgroup	`gname` does not exist as a master group.

33

DBMS_OFFLINE_SNAPSHOT

The DBMS_OFFLINE_SNAPSHOT package contains public APIs for offline instantiation of materialized views.

This chapter discusses the following topics:

- Summary of DBMS_OFFLINE_SNAPSHOT Subprograms

> **Note:** These procedure are used in performing an offline instantiation of a materialized view.
>
> These procedures should not be confused with the procedures in the DBMS_OFFLINE_OG package (used for performing an offline instantiation of a master table) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Summary of DBMS_OFFLINE_SNAPSHOT Subprograms

Table 33–1 DBMS_OFFLINE_SNAPSHOT Package Subprograms

Subprogram	Description
"BEGIN_LOAD Procedure" on page 33-3	Prepares a materialized view site for import of a new materialized view as part of offline instantiation.
"END_LOAD Procedure" on page 33-5	Completes offline instantiation of a materialized view.

BEGIN_LOAD Procedure

This procedure prepares a materialized view site for import of a new materialized view as part of offline instantiation. You must call this procedure from the materialized view site for the new materialized view.

Note: This procedure is used to perform an offline instantiation of a materialized view.

These procedures should not be confused with the procedures in the DBMS_OFFLINE_OG package (used for performing an offline instantiation of a master table) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_SNAPSHOT.BEGIN_LOAD (
   gname                IN   VARCHAR2,
   sname                IN   VARCHAR2,
   master_site          IN   VARCHAR2,
   snapshot_oname       IN   VARCHAR2,
   storage_c            IN   VARCHAR2 := '',
   comment              IN   VARCHAR2 := '',
   min_communication    IN   BOOLEAN  := true);
```

Parameters

Table 33–2 BEGIN_LOAD Procedure Parameters

Parameter	Description
gname	Name of the replication group for the materialized view that you are creating using offline instantiation.
sname	Name of the schema for the new materialized view.
master_site	Fully qualified database name of the materialized view's master site.
snapshot_oname	Name of the temporary materialized view created at the master site.
storage_c	Storage options to use when creating the new materialized view at the materialized view site.
comment	User comment.
min_communication	If `true`, then the update trigger sends the new value of a column only if the update statement modifies the column. Also, if `true`, the update trigger sends the old value of the column only if it is a key column or a column in a modified column group.

Exceptions

Table 33–3 BEGIN_LOAD Procedure Exceptions

Exception	Description
badargument	`NULL` or empty string for replication group, schema, master site, or materialized view name.
dbms_repcat.missingrepgroup	`gname` does not exist as a replication group.
missingremotemview	Could not locate specified materialized view at specified master site.
dbms_repcat.missingschema	Specified schema does not exist.
mviewtabmismatch	Base table name of the materialized view at the master and materialized view do not match.

END_LOAD Procedure

This procedure completes offline instantiation of a materialized view. You must call this procedure from the materialized view site for the new materialized view.

Note: This procedure is used to perform an offline instantiation of a materialized view.

These procedures should not be confused with the procedures in the DBMS_OFFLINE_OG package (used for performing an offline instantiation of a master table) or with the procedures in the DBMS_REPCAT_INSTANTIATE package (used for instantiating a deployment template). See these respective packages for more information on their usage.

Syntax

```
DBMS_OFFLINE_SNAPSHOT.END_LOAD (
   gname           IN  VARCHAR2,
   sname           IN  VARCHAR2,
   snapshot_oname  IN  VARCHAR2);
```

Parameters

Table 33–4 END_LOAD Procedure Parameters

Parameter	Description
gname	Name of the replication group for the materialized view that you are creating using offline instantiation.
sname	Name of the schema for the new materialized view.
snapshot_oname	Name of the materialized view.

Exceptions

Table 33–5 END_LOAD Procedure Exceptions

Exception	Description
badargument	NULL or empty string for replication group, schema, or materialized view name.
dbms_repcat.missingrepgroup	gname does not exist as a replication group.
dbms_repcat.nonmview	This procedure must be called from the materialized view site.

34

DBMS_OLAP

The DBMS_OLAP package provides a collection of materialized view analysis and advisory functions that are callable from any PL/SQL program. Some of the functions generate output tables.

> **See Also:** *Oracle9i Data Warehousing Guide* for more information regarding how to use DBMS_OLAP and its output tables

This chapter discusses the following topics:

- Requirements
- Error Messages
- Summary of DBMS_OLAP Subprograms
- DBMS_OLAP Interface Views

Requirements

DBMS_OLAP performs seven major functions, which include materialized view strategy recommendation, materialized view strategy evaluation, reporting and script generation, repository management, workload management, filter management, and dimension validation.

To perform materialized view strategy recommendation and evaluation functions, the workload information can either be provided by the user or synthesized by the Advisor engine. In the former case, cardinality information of all tables and materialized views referenced in the workload are required. In the latter case, dimension objects must be present and cardinality information for all dimension tables, fact tables, and materialized views are required. Cardinality information should be gathered with the DBMS_STATS.GATHER_TABLE_STATS procedure. Once these functions are completed, the analysis results can be presented with the reporting and script generation function.

The workload management function handles three types of workload, which are user-specified workload, SQL cache workload, and Oracle Trace workload. To process the user-specified workload, a user-defined workload table must be present in the user's schema. To process Oracle Trace workload, Oracle Trace formatter must be run to pre-process collected workload statistics into default V-tables in the user's schema.

Error Messages

Table 34–1 lists basic DBMS_OLAP error messages.

Table 34–1 DBMS_OLAP Error Messages

Error Code	Description
ORA-30442	Cannot find the definition for filter <NUMBER>
ORA-30443	Definition for filter <NUMBER>'s item <NUMBER> is invalid
ORA-30444	Rewrite terminated by the SQL Analyzer
ORA-30445	Workload queries not found
ORA-30446	Valid workload queries not found
ORA-30447	internal data for run number <NUMBER> is inconsistent
ORA-30448	Internal data of the Advisor repository is inconsistent
ORA-30449	Syntax error in parameter <NUMBER>

Table 34–1 DBMS_OLAP Error Messages

Error Code	Description
ORA-30465	Supplied run_id is not valid: <NUMBER>
ORA-30466	Cannot find the specified workload <NUMBER>
ORA-30477	The input `select_clause` is incorrectly specified
ORA-30478	Specified dimension does not exist
ORA-30479	Summary Advisor error QSM message with more details
QSM-00501	Unable to initialize Summary Advisor environment
QSM-00502	OCI error
QSM-00503	Out of memory
QSM-00504	Internal error
QSM-00505	Syntax error in <parse_entity_name> - <error_description>
QSM-00506	No fact-tables could be found
QSM-00507	No dimensions could be found
QSM-00508	Statistics missing on tables / columns
QSM-00509	Invalid parameter - <parameter_name>
QSM-00510	Statistics missing on summaries
QSM-00511	Invalid fact-tables specified in fact-filter
QSM-00512	Invalid summaries specified in the retention-list
QSM-00513	One or more of the workload tables is missing
QSM-00550	The filter item type <NAME> is missing the required data
QSM-00551	The file <NAME> was not found
QSM-00552	The workload source was not defined or was not recognized
QSM-00553	The string value for filter item <NAME> has a maximum length of <NUMBER> characters
QSM-00554	The required table name was not provided
QSM-00555	The table <NAME> can not be accessed or does not exist
QSM-00556	The file <NAME> could not be opened
QSM-00557	The owner <NAME> can not be accessed or does not exist

Table 34–1 DBMS_OLAP Error Messages

Error Code	Description
QSM-00558	An error occurred while reading file <NAME>
QSM-00559	A workload already exists for the specified collection ID
QSM-00560	The character <NAME> is invalid at line <LINE_NUMBER>, column <COLUMN_NUMBER
QSM-00561	Found <TOKEN> at line <NUMBER>, column <NUMBER>. Expecting 1of the following items: <ITEMS>
QSM-00562	The requested Advisor task was not found
QSM-00563	Found <TOKEN> at line <NUMBER>, column <NUMBER> of file <NAME>. Expecting 1 of the following items: <ITEMS>
QSM-00564	An internal lexical error occurred: <Additional error text>
QSM-00565	The <NAME> was not found while validating the <TABLE or COLUMN> at line <NUMBER>, column <NUMBER>
QSM-00566	The <TOKEN> is ambiguous while validating the <TABLE or COLUMN> at line <NUMBER>, column <NUMBER>
QSM-00567	A runtime error occurred: <Additional error text>
QSM-00568	The end-of-file was encountered
QSM-00569	The required column <NAME> was not found in table <NAME>
QSM-00570	The job has ended in error. Status changes are not permitted
QSM-00571	The job has already completed. Status changes are unnecessary
QSM-00572	No repository connection has been established
QSM-00573	The date <VALUE> must be in the form 'DD/MM/YYYY HH24:MI:SS'
QSM-00574	The file <NAME> could not be accessed due to a security violation
QSM-00575	The string <VALUE> can not be converted to a number
QSM-00576	A usable Oracle Trace collection was not found in schema <NAME>
QSM-00577	The current operation was cancelled by the user
QSM-00578	A temporary file cannot be created using the specification <FILE_NAME>
QSM-00579	The job has already completed. Cancellation is unnecessary
QSM-00580	The job has ended in error. Cancellation is not permitted
QSM-00581	Internal error: <Additional error text>

Table 34–1 DBMS_OLAP Error Messages

Error Code	Description
QSM-00582	A database error has occurred. <Additional error text>
QSM-00583	The filter item type <NAME> is invalid
QSM-00584	The SQL cache is not accessible by user <NAME>
QSM-00585	The workload was not found for collection ID <NUMBER>
QSM-00586	The filter was not found for filter ID <NUMBER>
QSM-00587	The analysis data was not found for run ID <NUMBER>
QSM-00588	The current user does not have the privilege to access the requested workload, which is owned by user <NAME>
QSM-00589	The current user does not have the privilege to access the requested workload filter, which is owned by user <NAME>
QSM-00590	The current user does not have the privilege to access the requested Advisor items, which are owned by user <NAME>
QSM-00591	The specified report style <NAME> was not found
QSM-00592	The specified report field <NAME> already exists
QSM-00593	The specified report field <NAME> was not found
QSM-00594	The specified ID number is already being used by another user
QSM-00595	The specified ID number is being used by an Advisor <NAME> object and can not be used for this operation
QSM-00596	A specified ID number cannot be NULL or zero
QSM-00597	Found <TOKEN> at line <NUMBER>, column <NUMBER>
QSM-00598	The minimum range value for filter item <NAME> is greater than the maximum range value
QSM-00599	The supplied workload filter contains items that are unsupported for the requested workload operation: <OPERATION>
QSM-00602	The ID <NUMBER> is not a valid Summary Advisor run or collection ID for the current user
QSM-00601	The flags value of <NUMBER> for the Summary Advisor detail report is invalid

Summary of DBMS_OLAP Subprograms

Table 34–2 lists the subprograms available with DBMS_OLAP.

Table 34–2 DBMS_OLAP Package Subprograms

Subprogram	Description
"ADD_FILTER_ITEM Procedure" on page 34-7	Filters the contents being used during the recommendation process.
"CREATE_ID Procedure" on page 34-9	Generates an internal ID used by a new workload collection, a new filter, or a new advisor run
"ESTIMATE_MVIEW_SIZE Procedure" on page 34-9	Estimates the size of a materialized view that you might create, in bytes and rows.
"EVALUATE_MVIEW_ STRATEGY Procedure" on page 34-10	Measures the utilization of each existing materialized view.
"GENERATE_MVIEW_ REPORT Procedure" on page 34-10	Generates an HTML-based report on the given Advisor run
"GENERATE_MVIEW_SCRIPT Procedure" on page 34-11	Generates a simple script containing the SQL commands to implement Summary Advisor recommendations
"LOAD_WORKLOAD_ CACHE Procedure" on page 34-12	Obtains a SQL cache workload.
"LOAD_WORKLOAD_TRACE Procedure" on page 34-13	Loads a workload collected by Oracle Trace.
"LOAD_WORKLOAD_USER Procedure" on page 34-14	Loads a user-defined workload.
"PURGE_FILTER Procedure" on page 34-15	Deletes a specific filter or all filters.
"PURGE_RESULTS Procedure" on page 34-16	Removes all results or those for a specific run.
"PURGE_WORKLOAD Procedure" on page 34-16	Deletes all workloads or a specific collection.
"RECOMMEND_MVIEW_ STRATEGY Procedure" on page 34-17	Generates a set of recommendations about which materialized views should be created, retained, or dropped.
"SET_CANCELLED Procedure" on page 34-18	Stops the Advisor if it takes too long returning results.

Table 34–2 DBMS_OLAP Package Subprograms (Cont.)

Subprogram	Description
"VALIDATE_DIMENSION Procedure" on page 34-19	Verifies that the relationships specified in a `dimension` are correct.
"VALIDATE_WORKLOAD_CACHE Procedure" on page 34-20	Validates the SQL Cache workload before performing load operations
"VALIDATE_WORKLOAD_TRACE Procedure" on page 34-20	Validates the Oracle Trace workload before performing load operations
"VALIDATE_WORKLOAD_USER Procedure" on page 34-21	Validates the user-supplied workload before performing load operations

ADD_FILTER_ITEM Procedure

This procedure adds a new filter item to an existing filter to make it more restrictive. It also creates a filter to restrict what is analyzed for the workload.

Syntax

```
ADD_FILTER_ITEM (
   filter_id    IN NUMBER,
   filter_name  IN VARCHAR2,
   string_list  IN VARCHAR2,
   number_min   IN NUMBER,
   number_max   IN NUMBER,
   date_min     IN VARCHAR2,
   date_max     IN VARCHAR2);
```

Table 34–3 ADD_FILTER_ITEM Procedure Parameters

Parameter	Datatype	Description
`filter_id`	`NUMBER`	An ID that uniquely describes the filter. It is generated by the `DBMS_OLAP.CREATE_ID` procedure

Table 34–3 ADD_FILTER_ITEM Procedure Parameters

Parameter	Datatype	Description
filter_name	VARCHAR2	APPLICATION String-workload's application column. An example of how to load a SQL Cache workload is shown below. BASETABLE String-base tables referenced by workload queries. Name must be fully qualified including owner and table name i.e. SH.SALES CARDINALITY Numerical-sum of cardinality of the referenced base tables FREQUENCY Numerical-workload's frequency column LASTUSE Date-workload's lastuse column. Not used by SQL Cache workload. OWNER String-workload's owner column. Expected in uppercase unless owner defined explicitly to be not all in uppercase. PRIORITY Numerical-workload's priority column. Not used by SQL Cache workload. RESPONSETIME Numerical-workload's responsetime column. Not used by SQL Cache workload. TRACENAME String-list of oracle trace collection names. Only used by a Trace Workload
string_list	VARCHAR2	A comma-separated list of strings. This parameter is only used by the filter items of the string type
number_min	NUMBER	The lower bound of a numerical range. NULL represents the lowest possible value. This parameter is only used by the parameters of the numerical type
number_max	NUMBER	The upper bound of a numerical range, NULL for no upper bound. NULL represents the highest possible value. This parameter is only used by the parameters of the numerical type
date_min	VARCHAR2	The lower bound of a date range. NULL represents the lowest possible date value. This parameter is only used by the parameters of the date type

Table 34–3 ADD_FILTER_ITEM Procedure Parameters

Parameter	Datatype	Description
date_max	VARCHAR2	The upper bound of a date range. NULL represents the highest possible date value. This parameter is only used by the parameters of the date type

CREATE_ID Procedure

This creates a unique identifier, which is used to identify a filter, a workload or results of an advisor or dimension validation run.

Syntax

```
CALL DBMS_OLAP.CREATE_ID (
  id        OUT NUMBER);
```

Table 34–4 CREATE_ID Procedure Parameters

Parameter	Datatype	Description
id	NUMBER	The unique identifier that can be used to identify a filter, a workload, or an Advisor run

ESTIMATE_MVIEW_SIZE Procedure

This estimates the size of a materialized view that you might create, in bytes and number of rows.

Syntax

```
DBMS_OLAP.ESTIMATE_MVIEW_SIZE (
   stmt_id       IN  VARCHAR2,
   select_clause IN  VARCHAR2,
   num_rows      OUT NUMBER,
   num_bytes     OUT NUMBER);
```

Parameters

Table 34–5 ESTIMATE_MVIEW_SIZE Procedure Parameters

Parameter	Datatype	Description
stmt_id	NUMBER	Arbitrary string used to identify the statement in an EXPLAIN PLAN.

Table 34–5 ESTIMATE_MVIEW_SIZE Procedure Parameters

Parameter	Datatype	Description
select_clause	STRING	The SELECT statement to be analyzed.
num_rows	NUMBER	Estimated cardinality.
num_bytes	NUMBER	Estimated number of bytes.

EVALUATE_MVIEW_STRATEGY Procedure

This procedure measures the utilization of each existing materialized view based on the materialized view usage statistics collected from the workload. The workload_id is optional. If not provided, EVALUATE_MVIEW_STRATEGY uses a hypothetical workload.

Periodically, the unused results can be purged from the system by calling the DBMS_OLAP.PURGE_RESULTS procedure.

See Also: "DBMS_OLAP Interface Views" on page 34-21

Syntax

```
DBMS_OLAP.EVALUATE_MVIEW_STRATEGY (
run_id        IN NUMBER,
workload_id   IN NUMBER,
filter_id     IN NUMBER);
```

Parameters

Table 34–6 EVALUATE_MVIEW_STRATEGY Procedure Parameters

Parameter	Datatype	Description
run_id	NUMBER	An ID generated by the DBMS_OLAP.CREATE_ID procedure to identify results of a run
workload_id	NUMBER	An optional workload ID that maps to a workload in the current repository. Use the parameter DBMS_OLAP.WORKLOAD_ALL to choose all workloads
filter_id	NUMBER	Specify filter for the workload to be used. The value DBMS_OLAP.FILTER_NONE indicates no filtering

GENERATE_MVIEW_REPORT Procedure

Generates an HTML-based report on the given Advisor run.

Syntax

```
DBMS_OLAP.GENERATE_MVIEW_REPORT (
filename     IN VARCHAR2,
id           IN NUMBER,
flags        IN NUMBER);
```

Table 34–7 GENERATE_MVIEW_REPORT Procedure Parameters

Parameter	Datatype	Description
filename	VARCHAR2	Fully qualified output file name to receive HTML data. Note that the Oracle server restricts file access within Oracle stored procedures. See the "Security and Performance" section of the Java Developer's Guide for more information on file permissions
id	NUMBER	An ID that identifies an advisor run. Or use the parameter DBMS_OLAP.RUNID_ALL to indicate all advisor runs should be reported
flags	NUMBER	Bit masked flags indicating what sections should be reported DBMS_OLAP.RPT_ACTIVITY -- Overall activities DBMS_OLAP.RPT_JOURNAL -- Runtime journals DBMS_OLAP.RPT_WORKLOAD_FILTER -- Filters DBMS_OLAP.RPT_WORKLOAD_DETAIL -- Workload information DBMS_OLAP.RPT_WORKLOAD_QUERY -- Workload query information DBMS_OLAP.RPT_RECOMMENDATION -- Recommendations DBMS_OLAP.RPT_USAGE -- Materialized view usage DBMS_OLAP.RPT_ALL -- All sections

GENERATE_MVIEW_SCRIPT Procedure

Generates a simple script containing the SQL commands to implement Summary Advisor recommendations.

Syntax

```
DBMS_OLAP.GENERATE_MVIEW_SCRIPT(
filename     IN VARCHAR2,
id           IN NUMBER,
```

```
tspace        IN VARCHAR2);
```

Table 34–8 GENERATE_MVIEW_SCRIPT Procedure Parameters

Parameter	Datatype	Description
filename	VARCHAR2	Fully qualified output file name to receive HTML data. Note that the Oracle server restricts file access within Oracle stored procedures. See the "Security and Performance" section of the Java Developer's Guide for more information on file permissions
id	NUMBER	An ID that identifies an advisor run. The parameter DBMS_OLAP.RUNID_ALL indicates all advisor runs should be reported.
tspace	VARCHAR2	Optional tablespace name to use when creating materialized views.

LOAD_WORKLOAD_CACHE Procedure

Loads a SQL cache workload.

Syntax

```
DBMS_OLAP.LOAD_WORKLOAD_CACHE (
workload_id  IN NUMBER,
flags        IN NUMBER,
filter_id    IN NUMBER,
application  IN VARCHAR2,
priority     IN NUMBER);
```

Table 34–9 LOAD_WORKLOAD_CACHE Procedure Parameters

Parameter	Datatype	Description
workload_id	NUMBER	Fully qualified output file name to receive HTML data. Note that the Oracle server restricts file access within Oracle stored procedures. See the "Security and Performance" section of the Java Developer's Guide for more information on file permission

Table 34–9 LOAD_WORKLOAD_CACHE Procedure Parameters

Parameter	Datatype	Description
flags	NUMBER	DBMS_OLAP.WORKLOAD_OVERWRITE The load routine will explicitly remove any existing queries from the workload that are owned by the specified collection ID DBMS_OLAP.WORKLOAD_APPEND The load routine preserves any existing queries in the workload. Any queries collected by the load operation will be appended to the end of the specified workload DBMS_OLAP.WORKLOAD_NEW The load routine assumes there are no existing queries in the workload. If it finds an existing workload element, the call will fail with an error Note: the flags have the same behavior irrespective of the LOAD_WORKLOAD operation
filter_id	NUMBER	Specify filter for the workload to be loaded
application	VARCHAR2	The default business application name. This value will be used for a query if one is not found in the target workload
priority	NUMBER	The default business priority to be assigned to every query in the target workload

LOAD_WORKLOAD_TRACE Procedure

Loads an Oracle Trace workload.

Syntax

```
DBMS_OLAP.LOAD_WORKLOAD_TRACE (
workload_id  IN NUMBER,
flags        IN NUMBER,
filter_id    IN NUMBER,
application  IN VARCHAR2,
priority     IN NUMBER,
owner_name   IN VARCHAR2);
```

Table 34–10 LOAD_WORKLOAD_TRACE Procedure Parameters

Parameter	Datatype	Description
collectionid	NUMBER	Fully qualified output file name to receive HTML data. Note that the Oracle server restricts file access within Oracle stored procedures. See the "Security and Performance" section of the Java Developer's Guide for more information on file permission
flags	NUMBER	DBMS_OLAP.WORKLOAD_OVERWRITE The load routine will explicitly remove any existing queries from the workload that are owned by the specified collection ID DBMS_OLAP.WORKLOAD_APPEND The load routine preserves any existing queries in the workload. Any queries collected by the load operation will be appended to the end of the specified workload DBMS_OLAP.WORKLOAD_NEW The load routine assumes there are no existing queries in the workload. If it finds an existing workload element, the call will fail with an error Note: the flags have the same behavior irrespective of the LOAD_WORKLOAD operation
filter_id	NUMBER	Specify filter for the workload to be loaded
application	VARCHAR2	The default business application name. This value will be used for a query if one is not found in the target workload
priority	NUMBER	The default business priority to be assigned to every query in the target workload
owner_name	VARCHAR2	The schema that contains the Oracle Trace data. If omitted, the current user will be used

LOAD_WORKLOAD_USER Procedure

A user-defined workload is loaded using the procedure LOAD_WORKLOAD_USER.

Syntax

```
DBMS_OLAP.LOAD_WORKLOAD_USER (
workload_id  IN NUMBER,
flags        IN NUMBER,
filter_id    IN NUMBER,
```

```
owner_name   IN VARCHAR2,
table_name   IN VARCHAR2);
```

Table 34–11 LOAD_WORKLOAD_USER Procedure Parameters

Parameter	Datatype	Description
workload_id	NUMBER	The required id that was returned by the DBMS_OLAP.CREATE_ID call
flags	NUMBER	DBMS_OLAP.WORKLOAD_OVERWRITE The load routine will explicitly remove any existing queries from the workload that are owned by the specified collection ID DBMS_OLAP.WORKLOAD_APPEND The load routine preserves any existing queries in the workload. Any queries collected by the load operation will be appended to the end of the specified workload DBMS_OLAP.WORKLOAD_NEW The load routine assumes there are no existing queries in the workload. If it finds an existing workload element, the call will fail with an error Note: the flags have the same behavior irrespective of the LOAD_WORKLOAD operation
filter_id	NUMBER	Specify filter for the workload to be loaded
owner_name	VARCHAR2	The schema that contains the user supplied table or view
table_name	VARCHAR2	The table or view name containing valid workload data

PURGE_FILTER Procedure

A filter can be removed at anytime by calling the procedure PURGE_FILTER which is described below. You can delete a specific filter or all filters.

Syntax

```
DBMS_OLAP.PURGE_FILTER (
filter_id    IN NUMBER);
```

Table 34–12 PURGE_FILTER Procedure Parameters

Parameter	Datatype	Description
filter_id	NUMBER	The parameter DBMS_OLAP.FILTER_ALL indicates all filters should be removed.

PURGE_RESULTS Procedure

Many procedures in the DBMS_OLAP package generate output in system tables, such as recommendation results for DBMS_OLAP.RECOMMEND_MVIEW_STRATEGY and evaluation results for DBMS_OLAP.EVALUATE_MVIEW_STRATEGY, dimension validation results for DBMS_OLAP.VALIDATE_DIMENSION. These results can be accessed through a set of interface views, as shown in "DBMS_OLAP Interface Views" on page 34-21. When they are no longer required, they should be removed using the procedure PURGE_RESULTS. You can remove all results or those for a specific run.

Syntax

```
DBMS_OLAP.PURGE_RESULTS (
run_id IN NUMBER);
```

Parameters

Table 34–13 PURGE_RESULTS Procedure Parameters

Parameter	Datatype	Description
run_id	NUMBER	An ID generated with the DBMS_OLAP.CREATE_ID procedure. The ID should be associated with a DBMS_OLAP.RECOMMEND_MVIEW_STRATEGY or a DBMS_OLAP.EVALUATE_MVIEW_STRATEGY or a DBMS_OLAP.VALIDATE_DIMENSION run. Use the value DBMS_OLAP.RUNID_ALL to specify all such runs

PURGE_WORKLOAD Procedure

When workloads are no longer needed, they can be removed using the procedure PURGE_WORKLOAD. You can delete all workloads or a specific collection.

Syntax

```
DBMS_OLAP.PURGE_WORKLOAD (
workload_id IN NUMBER);
```

Table 34–14 DBMS_OLAP.PURGE_WORKLOAD Procedure Parameters

Parameter	Datatype	Description
workload_id	NUMBER	An ID number originally assigned by the create_id call. If the value of workload_id is set to DBMS_OLAP.WORKLOAD_ALL, then all workloads for the current user will be deleted

RECOMMEND_MVIEW_STRATEGY Procedure

This procedure generates a set of recommendations about which materialized views should be created, retained, or dropped, based on information in the workload (gathered by Oracle Trace, the user workload, or the SQL cache), and an analysis of table and column cardinality statistics gathered by the DBMS_STATS.GATHER_TABLE_STATS procedure.

RECOMMEND_MVIEW_STRATEGY requires that you have run the DBMS_STATS.GATHER_TABLE_STATS procedure to gather table and column cardinality statistics and have collected and formatted the workload statistics.

The workload is aggregated to determine the count of each request in the workload, and this count is used as a weighting factor during the optimization process. If the workload_id is not provided, then RECOMMEND_MVIEW_STRATEGY uses a hypothetical workload based on dimension definitions and other embedded statistics.

The space of all dimensional materialized views that include the specified fact tables identifies the set of materialized views that optimize performance across the workload. The recommendation results are stored in system tables, which can be accessed through the view SYSTEM.MVIEW_RECOMMENDATIONS.

Periodically, the unused results can be purged from the system by calling the DBMS_OLAP.PURGE_RESULTS procedure

See Also: "DBMS_OLAP Interface Views" on page 34-21

Syntax

```
DBMS_OLAP.RECOMMEND_MVIEW_STRATEGY (
   run_id              IN  NUMBER,
   workload_id         IN  NUMBER,
   filter_id           IN  NUMBER,
   storage_in_bytes    IN  NUMBER,
   retention_pct       IN  NUMBER,
   retention_list      IN  VARCHAR2,
```

```
    fact_table_filter  IN  VARCHAR2);
```

Parameters

Table 34–15 RECOMMEND_MVIEW_STRATEGY Procedure Parameters

Parameter	Description
run_id	An ID generated by the DBMS_OLAP.CREATE_ID procedure to uniquely identify results of a run
workload_id	An optional workload ID that maps to a workload in the current repository. Use the parameter DBMS_OLAP.WORKLOAD_ALL to choose all workloads. If the workload_id is set to NULL, the call will use a hypothetical workload
filter_id	An optional filter ID that maps to a set of user-supplied filter items. Use the parameter DBMS_OLAP.FILTER_NONE to avoid filtering
storage_in_bytes	Maximum storage, in bytes, that can be used for storing materialized views. This number must be non-negative.
retention_pct	Number between 0 and 100 that specifies the percent of existing materialized view storage that must be retained, based on utilization on the actual or hypothetical workload. A materialized view is retained if the cumulative space, ranked by utilization, is within the retention threshold specified (or if it is explicitly listed in retention_list). Materialized views that have a NULL utilization (e.g. non-dimensional materialized views) are always retained.
retention_list	Comma-separated list of materialized view table names. A drop recommendation is not made for any materialized view that appears in this list.
fact_table_filter	Optional list of fact tables used to filter real or ideal workload

SET_CANCELLED Procedure

If the Summary Advisor takes too long to make its recommendations using the procedures RECOMMEND_MVIEW_STRATEGY, you can stop it by calling the procedure SET_CANCELLED and passing in the run_id for this recommendation process.

Syntax

```
DBMS_OLAP.SET_CANCELLED (
   run_id     IN  NUMBER);
```

Table 34–16 DBMS_OLAP.SET_CANCELLED Procedure Parameters

Parameter	Datatype	Description
run_id	NUMBER	Id that uniquely identifies an advisor analysis operation. This call can be used to cancel a long running workload collection as well as an Advisor analysis session

VALIDATE_DIMENSION Procedure

This procedure verifies that the hierarchical and attribute relationships, and join relationships, specified in an existing dimension object are correct. This provides a fast way to ensure that referential integrity is maintained.

The validation results are stored in system tables, which can be accessed through the view SYSTEM.MVIEW_EXCEPTIONS.

Periodically, the unused results can be purged from the system by calling the DBMS_OLAP.PURGE_RESULTS procedure.

See Also: "DBMS_OLAP Interface Views" on page 34-21

Syntax

```
DBMS_OLAP.VALIDATE_DIMENSION (
   dimension_name    IN VARCHAR2,
   dimension_owner   IN VARCHAR2,
   incremental       IN BOOLEAN,
   check_nulls       IN BOOLEAN,
   run_id            IN NUMBER);
```

Parameters

Table 34–17 VALIDATE_DIMENSION Procedure Parameters

Parameter	Description
dimension_name	Name of the dimension to analyze.
dimension_owner	Name of the dimension owner.

Table 34–17 VALIDATE_DIMENSION Procedure Parameters

Parameter	Description
incremental	If TRUE, then tests are performed only for the rows specified in the sumdelta$ table for tables of this dimension; otherwise, check all rows.
check_nulls	If TRUE, then all level columns are verified to be non-NULL; otherwise, this check is omitted. Specify FALSE when non-nullness is guaranteed by other means, such as NOT NULL constraints.
run_id	An ID generated by the DBMS_OLAP.CREATE_ID procedure to identify a run

VALIDATE_WORKLOAD_CACHE Procedure

This procedure validates the SQL Cache workload before performing load operations.

Syntax

```
DBMS_OLAP.VALIDATE_WORKLOAD_CACHE (
   valid            OUT NUMBER,
   error            OUT VARCHAR2);
```

Parameters

Table 34–18 VALIDATE_WORKLOAD_USER Procedure Parameters

Parameter	Description
valid	Return DBMS_OLAP.VALID or DBMS_OLAP.INVALID Indicate whether a workload is valid.
error	VARCHAR2, return error set

VALIDATE_WORKLOAD_TRACE Procedure

This procedure validates the Oracle Trace workload before performing load operations.

Syntax

```
DBMS_OLAP.VALIDATE_WORKLOAD_TRACE (
   owner_name       IN  VARCHAR2,
```

```
   valid           OUT NUMBER,
   error           OUT VARCHAR2);
```

Parameters

Table 34–19 VALIDATE_WORKLOAD_TRACE Procedure Parameters

Parameter	Description
owner_name	Owner of the trace workload table
valid	Return DBMS_OLAP.VALID or DBMS_OLAP.INVALID Indicate whether a workload is valid.
error	VARCHAR2, return error text

VALIDATE_WORKLOAD_USER Procedure

This procedure validates the user-supplied workload before performing load operations.

Syntax

```
DBMS_OLAP.VALIDATE_WORKLOAD_USER (
   owner_name      IN  VARCHAR2,
   table_name      IN  VARCHAR2,
   valid           OUT NUMBER,
   error           OUT VARCHAR2);
```

Parameters

Table 34–20 VALIDATE_WORKLOAD_USER Procedure Parameters

Parameter	Description
owner_name	Owner of the user workload table
table_name	User workload table name
valid	Return DBMS_OLAP.VALID or DBMS_OLAP.INVALID Indicate whether a workload is valid.
error	VARCHAR2, return error set

DBMS_OLAP Interface Views

Several views are created when using DBMS_OLAP. All are in the SYSTEM schema. To access these views, you must have a DBA role.

> **See Also:** *Oracle9i Data Warehousing Guide* for more information regarding how to use DBMS_OLAP

SYSTEM.MVIEW_EVALUATIONS

Table 34–21 SYSTEM.MVIEW_EVALUATIONS

Column	NULL?	Datatype	Description
RUNID	NOT NULL	NUMBER	Run id identifying a unique advisor call
MVIEW_OWNER		VARCHAR2(30)	Owner of materialized view
MVIEW_NAME		VARCHAR2(30)	Name of an exiting materialized view in this database
RANK	NOT NULL	NUMBER	Rank of this materialized view in descending order of benefit_to_cost_ ratio
STORAGE_IN_BYTES		NUMBER	Size of the materialized view in bytes
FREQUENCY		NUMBER	Number of times this materialized view appears in the workload
CUMULATIVE_BENEFIT		NUMBER	The cumulative benefit of the materialized view
BENEFIT_TO_COST_ RATIO	NOT NULL	NUMBER	The ratio of cumulative_benefit to storage_in_bytes

SYSTEM.MVIEW_EXCEPTIONS

Table 34–22 SYSTEM.MVIEW_EXCEPTIONS

Column	NULL?	Datatype	Description
RUNID		NUMBER	Run id identifying a unique advisor call
OWNER		VARCHAR2(30)	Owner name
TABLE_NAME		VARCHAR2(30)	Table name

Table 34–22 SYSTEM.MVIEW_EXCEPTIONS

Column	NULL?	Datatype	Description
DIMENSION_NAME		VARCHAR2(30)	Dimension name
RELATIONSHIP		VARCHAR2(11)	Violated relation name
BAD_ROWID		ROWID	Location of offending entry

SYSTEM.MVIEW_FILTER

Table 34–23 SYSTEM.MVIEW_FILTER

Column	NULL?	Datatype	Description
FILTERID	NOT NULL	NUMBER	Unique number used to identify the operation that used this filter
SUBFILTERNUM	NOT NULL	NUMBER	A unique id number that groups all filter items together. A corresponding filter header record can be found in the MVIEW_LOG table
SUBFILTERTYPE		VARCHAR2(12)	Filter item number
STR_VALUE		VARCHAR2(1028)	String attribute for items that require strings
NUM_VALUE1		NUMBER	Numeric low for items that require numbers
NUM_VALUE2		NUMBER	Numeric high for items that require numbers
DATE_VALUE1		DATE	Date low for items that require dates
DATE_VALUE2		DATE	Date high for items that require dates

SYSTEM.MVIEW_FILTERINSTANCE

Table 34–24 SYSTEM.MVIEW_FILTER

Column	NULL?	Datatype	Description
RUNID	NOT NULL	NUMBER	Unique number used to identify the operation that used this filter
FILTERID		NUMBER	A unique id number that groups all filter items together. A corresponding filter header record can be found in the MVIEW_LOG table
SUBFILTERNUM		NUMBER	Filter item number
SUBFILTERTYPE		VARCHAR2(12)	Filter item type
STR_VALUE		VARCHAR2(1028)	String attribute for items that require strings
NUM_VALUE1		NUMBER	Numeric low for items that require numbers
NUM_VALUE2		NUMBER	Numeric high for items that require numbers
DATE_VALUE1		DATE	Date low for items that require dates
DATE_VALUE2		DATE	Date high for items that require dates

SYSTEM.MVIEW_LOG

Table 34–25 SYSTEM.MVIEW_LOG

Column	NULL?	Datatype	Description
ID	NOT NULL	NUMBER	Unique number used to identify the table entry. The number must be created using the CREATE_ID routine
FILTERID		NUMBER	Optional filter id. Zero indicates no user-supplied filter has been applied to the operation
RUN_BEGIN		DATE	Date at which the operation began
RUN_END		DATE	Date at which the operation ended
TYPE		VARCHAR2(11)	A name that identifies the type of operation
STATUS		VARCHAR2(11)	The current operational status

Table 34–25 SYSTEM.MVIEW_LOG

Column	NULL?	Datatype	Description
MESSAGE		VARCHAR2(2000)	Informational message indicating current operation or condition
COMPLETED		NUMBER	Number of steps completed by operation
TOTAL		NUMBER	Total number steps to be performed
ERROR_CODE		VARCHAR2(20)	Oracle error code in the event of an error

SYSTEM.MVIEW_RECOMMENDATIONS

Table 34–26 SYSTEM.MVIEW_RECOMMENDATIONS

Column	NULL?	Datatype	Description
RUNID		NUMBER	Run id identifying a unique advisor call
ALL_TABLES		VARCHAR2(2000)	A comma-separated list of fully qualified table names for structured recommendations
FACT_TABLES		VARCHAR2(1000)	A comma-separated list of grouping levels, if any, for structured recommendation
GROUPING_LEVELS		VARCHAR2(2000)	
QUERY_TEXT		LONG	Query text of materialized view if RECOMMENDED_ACTION is CREATE; null otherwise
RECOMMENDATION_ NUMBER	NOT NULL	NUMBER	Unique identifier for this recommendation
RECOMMENDED_ACTION		VARCHAR2(6)	CREATE, RETAIN, or DROP, Retain, Create, or Drop
MVIEW_OWNER		VARCHAR2(30)	Owner of the materialized view if RECOMMENDED_ACTION is RETAIN or DROP; null otherwise
MVIEW_NAME		VARCHAR2(30)	Name of the materialized view if RECOMMENDED_ACTION is RETAIN or DROP; null otherwise

Table 34–26 SYSTEM.MVIEW_RECOMMENDATIONS

Column	NULL?	Datatype	Description
STORAGE_IN_BYTES		NUMBER	Actual or estimated storage in bytes
PCT_PERFORMANCE_GAIN		NUMBER	The expected incremental improvement in performance obtained by accepting this recommendation relative to the initial condition, assuming that all previous recommendations have been accepted, or NULL if unknown
BENEFIT_TO_COST_RATIO	NOT NULL	NUMBER	Ratio of the incremental improvement in performance to the size of the materialized view in bytes, or NULL if unknown

SYSTEM.MVIEW_WORKLOAD

Table 34–27 SYSTEM.MVIEW_WORKLOAD

Column	NULL?	Datatype	Description
APPLICATION		VARCHAR2(30)	Optional application name for the query
CARDINALITY		NUMBER	Total cardinality of all of tables in query
WORKLOADID		NUMBER	Workload id identifying a unique sampling
FREQUENCY		NUMBER	Number of times query executed
IMPORT_TIME		DATE	Date at which item was collected
LASTUSE		DATE	Last date of execution
OWNER		VARCHAR2(30)	User who last executed query
PRIORITY		NUMBER	User-supplied ranking of query
QUERY		LONG	Query text
QUERYID		NUMBER	Id number identifying a unique query
RESPONSETIME		NUMBER	Execution time in seconds
RESULTSIZE		NUMBER	Total bytes selected by the query

35

DBMS_ORACLE_TRACE_AGENT

The DBMS_ORACLE_TRACE_AGENT package provides some system level utilities.

This chapter discusses the following topics:

- Security
- Summary of DBMS_ORACLE_TRACE_AGENT Subprograms

Security

This package is only accessible to user SYS by default. You can control access to these routines by only granting execute to privileged users.

Note: This package should only be granted to DBA or the Oracle TRACE collection agent.

Summary of DBMS_ORACLE_TRACE_AGENT Subprograms

This package contains only one subprogram: SET_ORACLE_TRACE_IN_SESSION.

SET_ORACLE_TRACE_IN_SESSION Procedure

This procedure collects Oracle Trace data for a database session other than your own. It enables Oracle TRACE in the session identified by (sid, serial#). These value are taken from v$session.

Syntax

```
DBMS_ORACLE_TRACE_AGENT.SET_ORACLE_TRACE_IN_SESSION (
   sid                NUMBER   DEFAULT 0,
   serial#            NUMBER   DEFAULT 0,
   on_off IN          BOOLEAN  DEFAULT false,
   collection_name IN VARCHAR2 DEFAULT '',
   facility_name   IN VARCHAR2 DEFAULT '');
```

Parameters

Table 35–1 SET_ORACLE_TRACE_IN_SESSION Procedure Parameters

Parameter	Description
sid	Session ID.
serial#	Session serial number.
on_off	TRUE or FALSE. Turns tracing on or off.
collection_name	The Oracle TRACE collection name to be used.
facility_name	The Oracle TRACE facility name to be used.

Usage Notes

If the collection does not occur, then check the following:

- Be sure that the server event set file identified by <facility_name> exists. If there is no full file specification on this field, then the file should be located in the directory identified by ORACLE_TRACE_FACILITY_PATH in the initialization file.
- The following files should exist in your Oracle Trace admin directory: REGID.DAT, PROCESS.DAT, and COLLECT.DAT. If they do not, then you must run the OTRCCREF executable to create them.

  Note: PROCESS.DAT was changed to FACILITY.DAT with Oracle8.

- The stored procedure packages should exist in the database. If the packages do not exist, then run the OTRCSVR.SQL file (in your Oracle Trace or RDBMS admin directories) to create the packages.
- The user has the EXECUTE privilege on the stored procedure.

Example

```
EXECUTE DBMS_ORACLE_TRACE_AGENT.SET_ORACLE_TRACE_IN_SESSION
(8,12,TRUE,'NEWCOLL','oracled');
```

36

DBMS_ORACLE_TRACE_USER

DBMS_ORACLE_TRACE_USER provides public access to the Oracle TRACE instrumentation for the calling user. Using the Oracle Trace stored procedures, you can invoke an Oracle Trace collection for your own session or for another session.

This chapter discusses the following topics:

- Summary of DBMS_ORACLE_TRACE_USER Subprograms

Summary of DBMS_ORACLE_TRACE_USER Subprograms

This package contains only one subprogram: SET_ORACLE_TRACE.

SET_ORACLE_TRACE Procedure

This procedure collects Oracle Trace data for your own database session.

Syntax

```
DBMS_ORACLE_TRACE_USER.SET_ORACLE_TRACE (
   on_off          IN BOOLEAN  DEFAULT false,
   collection_name IN VARCHAR2 DEFAULT '',
   facility_name   IN VARCHAR2 DEFAULT '');
```

Parameters

Table 36–1 SET_ORACLE_TRACE Procedure Parameters

Parameter	Description
on_off	TRUE or FALSE: Turns tracing on or off.
collection_name	Oracle TRACE collection name to be used.
facility_name	Oracle TRACE facility name to be used.

Example

```
EXECUTE DBMS_ORACLE_TRACE_USER.SET_ORACLE_TRACE
(TRUE,'MYCOLL','oracle');
```

37

DBMS_OUTLN

The DBMS_OUTLN package, synonymous with OUTLN_PKG, contains the functional interface for subprograms associated with the management of stored outlines.

A stored outline is the stored data that pertains to an execution plan for a given SQL statement. It enables the optimizer to repeatedly recreate execution plans that are equivalent to the plan originally generated along with the outline.The data stored in an outline consists, in part, of a set of hints that are used to achieve plan stability.

This chapter discusses the following topics:

Requirements and Security for DBMS_OUTLN

Requirements

DBMS_OUTLN contains management procedures that should be available to appropriate users only. EXECUTE privilege is not extended to the general user community unless the DBA explicitly does so.

Security

PL/SQL functions that are available for outline management purposes can be executed only by users with EXECUTE privilege on the procedure (or package).

Summary of DBMS_OUTLN Subprograms

Table 37–1 DBMS_OUTLN Package Subprograms

Subprogram	Description
"DROP_BY_CAT Procedure" on page 37-1	Drops outlines that belong to a specified category.
"DROP_COLLISION Procedure" on page 37-3	Drops an outline with an `ol$.hintcount` value that does not match the number of hints for that outline in `ol$hints`.
"DROP_EXTRAS Procedure" on page 37-3	Cleans up after an import by dropping extra hint tuples not accounted for by hintcount.
"DROP_UNREFD_HINTS Procedure" on page 37-4	Drops hint tuples that have no corresponding outline in the OL$ table.
"DROP_BY_CAT Procedure" on page 37-2	Drops outlines that have never been applied in the compilation of a SQL statement.
"UPDATE_BY_CAT Procedure" on page 37-4	Changes the category of outlines in one category to a new category.
"GENERATE_SIGNATURE Procedure" on page 37-5	Generates a signature for the specified SQL text.

DROP_BY_CAT Procedure

This procedure drops outlines that belong to a specified category.

Syntax

```
DBMS_OUTLN.DROP_BY_CAT
```

```
   cat VARCHAR2);
```

Parameters

Table 37–2 DROP_BY_CAT Procedure Parameters

Parameter	Description
cat	Category of outlines to drop.

Usage Notes

This procedure purges a category of outlines in a single call.

Example

This example drops all outlines in the DEFAULT category:

```
DBMS_OUTLN.DROP_BY_CAT('DEFAULT');
```

DROP_COLLISION Procedure

This procedure drops an outline with an `ol$.hintcount` value that does not match the number of hints for that outline in `ol$hints`.

Syntax

```
DBMS_OUTLN.DROP_COLLISION;
```

Usage Notes

A concurrency problem can occur if an outline is created or altered at the same time it is being imported. Because the outline must be imported according to its original design, if the concurrent operation changes the outline in mid-import, the outline will be dropped as unreliable based on the inconsistent metadata.

DROP_EXTRAS Procedure

This procedure cleans up after an import by dropping extra hint tuples not accounted for by hintcount.

Syntax

```
DBMS_OUTLN.DROP_EXTRAS;
```

Usage Notes

The OL$-tuple of an outline will be rejected if an outline already exists in the target database, either with the same name or the same signature. Hint tuples will also be rejected, up to the number of hints in the already existing outline. Therefore, if the rejected outline has more hint tuples than the existing one, spurious tuples will be inserted into the OL$HINTS table. This procedure, executed automatically as a post table action, will remove the wrongly inserted hint tuples.

DROP_UNREFD_HINTS Procedure

This procedure drops hint tuples that have no corresponding outline in the OLSable.

Syntax

```
DBMS_OUTLN.DROP_UNREFD_HINTS;
```

Usage Notes

This procedure will execute automatically as a post table action to remove hints with no corresponding entry in the OL$ table, a condition that can arise if an outline is dropped and imported concurrently.

DROP_UNUSED Procedure

This procedure drops outlines that have never been applied in the compilation of a SQL statement.

Syntax

```
DBMS_OUTLN.DROP_UNUSED;
```

Usage Notes

You can use DROP_UNUSED for outlines generated by an application for one-time use only, created as a result of dynamic SQL statements. These outlines are never used and take up valuable disk space.

UPDATE_BY_CAT Procedure

This procedure changes the category of all outlines in one category to a new category. If the SQL text in an outline already has an outline in the target category, it is not merged into the new category.

Syntax

```
DBMS.OUTLN.UPDATE_BY_CAT (
   oldcat VARCHAR2 DEFAULT 'DEFAULT',
   newcat VARCHAR2 DEFAULT 'DEFAULT');
```

Parameters

Table 37–3 UPDATE_BY_CAT Procedure Parameters

Parameter	Description
oldcat	Current category to be changed.
newcat	Target category to change outline to.

Usage Notes

Once satisfied with a set of outlines, you can move outlines from an *experimental* category to a *production* category. Likewise, you may want to merge a set of outlines from one category into another pre-existing category.

Example

This example changes all outlines in the DEFAULT category to the CAT1 category:

```
DBMS_OUTLN.UPDATE_BY_CAT('DEFAULT', 'CAT1');
```

GENERATE_SIGNATURE Procedure

This procedure generates a signature for the specified SQL text.

Syntax

```
DBMS_OUTLN.GENERATE_SIGNATURE (
   sqltxt      IN   VARCHAR2,
   signature   OUT  RAW);
```

Parameters

Table 37–4 GENERATE_SIGNATURE Procedure Parameters

Parameter	Description
sqltxt	The specified SQL.
signature	The signature to be generated.

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DBMS_OUTLN_EDIT

The DBMS_OUTLN_EDIT package is an invoker's rights package.

This chapter discusses the following topics:

- Summary of DBMS_OUTLN_EDIT Subprograms

Summary of DBMS_OUTLN_EDIT Subprograms

Table 38–1 DBMS_OUTLN_EDIT Package Subprograms

Subprogram	Description
"CHANGE_JOIN_POS Procedure" on page 38-2	Changes the join position for the hint identified by outline name and hint number to the position specified by newpos.
"CREATE_EDIT_TABLES Procedure" on page 38-2	Creates outline editing tables in calling a user's schema.
"DROP_EDIT_TABLES Procedure" on page 38-3	Drops outline editing tables in calling the user's schema.
"REFRESH_PRIVATE_OUTLINE Procedure" on page 38-3	Refreshes the in-memory copy of the outline, synchronizing its data with the edits made to the outline hints.

CHANGE_JOIN_POS Procedure

This function changes the join position for the hint identified by outline name and hint number to the position specified by newpos.

Syntax

```
DBMS_OUTLN_EDIT.CHANGE_JOIN_POS (
name     VARCHAR2
hintno   NUMBER
newpos   NUMBER);
```

Parameters

Table 38–2 CHANGE_JOIN_POS Procedure Parameters

Parameter	Description
name	Name of the private outline to be modified.
hintno	Hint number to be modified.
newpos	New join position for the target hint.

CREATE_EDIT_TABLES Procedure

This procedure creates outline editing tables in calling a user's schema.

Syntax

```
DBMS_OUTLN_EDIT.CREATE_EDIT_TABLES;
```

DROP_EDIT_TABLES Procedure

This procedure drops outline editing tables in calling the user's schema.

Syntax

```
DBMS_OUTLN_EDIT.DROP_EDIT_TABLES;
```

REFRESH_PRIVATE_OUTLINE Procedure

This procedure refreshes the in-memory copy of the outline, synchronizing its data with the edits made to the outline hints.

Syntax

```
DBMS_OUTLN_EDIT.REFRESH_PRIVATE_OUTLINE (
   name  IN  VARCHAR2);
```

Parameters

Table 38–3 REFRESH_PRIVATE_OUTLINE Procedure Parameters

Parameter	Description
name	Name of the private outline to be refreshed.

39

DBMS_OUTPUT

The DBMS_OUTPUT package enables you to send messages from stored procedures, packages, and triggers.

The PUT and PUT_LINE procedures in this package enable you to place information in a buffer that can be read by another trigger, procedure, or package. In a separate PL/SQL procedure or anonymous block, you can display the buffered information by calling the GET_LINE procedure.

If you do not call GET_LINE, or if you do not display the messages on your screen in SQL*Plus or Enterprise Manager, then the buffered messages are ignored. The DBMS_OUTPUT package is especially useful for displaying PL/SQL debugging information.

Note: Messages sent using DBMS_OUTPUT are not actually sent until the sending subprogram or trigger completes. There is no mechanism to flush output during the execution of a procedure.

This chapter discusses the following topics:

Security, Errors, and Types for DBMS_OUTPUT

Security

At the end of this script, a public synonym (DBMS_OUTPUT) is created and EXECUTE permission on this package is granted to public.

Errors

DBMS_OUTPUT subprograms raise the application error ORA-20000, and the output procedures can return the following errors:

Table 39–1 DBMS_OUTPUT Errors

Error	Description
ORU-10027:	Buffer overflow
ORU-10028:	Line length overflow

Types

Type CHARARR is a table type.

Using DBMS_OUTPUT

A trigger might want to print out some debugging information. To do this, the trigger would do:

```
DBMS_OUTPUT.PUT_LINE('I got here:'||:new.col||' is the new value');
```

If you have enabled the DBMS_OUTPUT package, then this PUT_LINE would be buffered, and you could, after executing the statement (presumably some INSERT, DELETE, or UPDATE that caused the trigger to fire), get the line of information back. For example:

```
BEGIN
   DBMS_OUTPUT.GET_LINE(:buffer, :status);
END;
```

It could then display the buffer on the screen. You repeat calls to GET_LINE until status comes back as non-zero. For better performance, you should use calls to GET_LINES which can return an array of lines.

Enterprise Manager and SQL*Plus implement a SET SERVEROUTPUT ON command to know whether to make calls to GET_LINE(S) after issuing INSERT, UPDATE, DELETE or anonymous PL/SQL calls (these are the only ones that can cause triggers or stored procedures to be executed).

Summary of DBMS_OUTPUT Subprograms

Table 39–2 DBMS_OUTPUT Package Subprograms

Subprogram	Description
"ENABLE Procedure" on page 39-3	Enables message output.
"DISABLE Procedure" on page 39-4	Disables message output.
"PUT and PUT_LINE Procedures" on page 39-4	PUT: Places a line in the buffer. PUT_LINE: Places partial line in buffer.
"NEW_LINE Procedure" on page 39-6	Terminates a line created with PUT.
"GET_LINE and GET_LINES Procedures" on page 39-6	Retrieves one line, or an array of lines, from buffer.

ENABLE Procedure

This procedure enables calls to PUT, PUT_LINE, NEW_LINE, GET_LINE, and GET_LINES. Calls to these procedures are ignored if the DBMS_OUTPUT package is not enabled.

> **Note:** It is not necessary to call this procedure when you use the SERVEROUTPUT option of Enterprise Manager or SQL*Plus.

If there are multiple calls to ENABLE, then buffer_size is the largest of the values specified. The maximum size is 1,000,000, and the minimum is 2,000.

Syntax

```
DBMS_OUTPUT.ENABLE (
   buffer_size IN INTEGER DEFAULT 20000);
```

Parameters

Table 39–3 ENABLE Procedure Parameters

Parameter	Description
buffer_size	Amount of information, in bytes, to buffer.

Pragmas

```
pragma restrict_references(enable,WNDS,RNDS);
```

Errors

Table 39–4 ENABLE Procedure Errors

Error	Description
ORA-20000:, ORU-10027:	Buffer overflow, limit of <buffer_limit> bytes.

DISABLE Procedure

This procedure disables calls to PUT, PUT_LINE, NEW_LINE, GET_LINE, and GET_LINES, and purges the buffer of any remaining information.

As with ENABLE, you do not need to call this procedure if you are using the SERVEROUTPUT option of Enterprise Manager or SQL*Plus.

Syntax

```
DBMS_OUTPUT.DISABLE;
```

Pragmas

```
pragma restrict_references(disable,WNDS,RNDS);
```

PUT and PUT_LINE Procedures

You can either place an entire line of information into the buffer by calling PUT_LINE, or you can build a line of information piece by piece by making multiple calls to PUT. Both of these procedures are overloaded to accept items of type VARCHAR2, NUMBER, or DATE to place in the buffer.

All items are converted to VARCHAR2 as they are retrieved. If you pass an item of type NUMBER or DATE, then when that item is retrieved, it is formatted with TO_

CHAR using the default format. If you want to use a different format, then you should pass in the item as VARCHAR2 and format it explicitly.

When you call PUT_LINE, the item that you specify is automatically followed by an end-of-line marker. If you make calls to PUT to build a line, then you must add your own end-of-line marker by calling NEW_LINE. GET_LINE and GET_LINES do not return lines that have not been terminated with a newline character.

If your line exceeds the buffer limit, then you receive an error message.

Note: Output that you create using PUT or PUT_LINE is buffered. The output cannot be retrieved until the PL/SQL program unit from which it was buffered returns to its caller.

For example, Enterprise Manager or SQL*Plus do not display DBMS_OUTPUT messages until the PL/SQL program completes. There is no mechanism for flushing the DBMS_OUTPUT buffers within the PL/SQL program. For example:

```
SQL> SET SERVER OUTPUT ON
SQL> BEGIN
     2 DBMS_OUTPUT.PUT_LINE ('hello');
     3 DBMS_LOCK.SLEEP (10);
     4 END;
```

Syntax

```
DBMS_OUTPUT.PUT      (item IN NUMBER);
DBMS_OUTPUT.PUT      (item IN VARCHAR2);
DBMS_OUTPUT.PUT      (item IN DATE);
DBMS_OUTPUT.PUT_LINE (item IN NUMBER);
DBMS_OUTPUT.PUT_LINE (item IN VARCHAR2);
DBMS_OUTPUT.PUT_LINE (item IN DATE);
DBMS_OUTPUT.NEW_LINE;
```

Parameters

Table 39–5 PUT and PUT_LINE Procedure Parameters

Parameter	Description
a	Item to buffer.

Errors

Table 39–6 PUT and PUT_LINE Procedure Errors

Error	Description
ORA-20000, ORU-10027:	Buffer overflow, limit of <buf_limit> bytes.
ORA-20000, ORU-10028:	Line length overflow, limit of 255 bytes per line.

NEW_LINE Procedure

This procedure puts an end-of-line marker. GET_LINE(S) returns "lines" as delimited by "newlines". Every call to PUT_LINE or NEW_LINE generates a line that is returned by GET_LINE(S).

Syntax

```
DBMS_OUTPUT.NEW_LINE;
```

Errors

Table 39–7 NEW_LINE Procedure Errors

Error	Description
ORA-20000, ORU-10027:	Buffer overflow, limit of <buf_limit> bytes.
ORA-20000, ORU-10028:	Line length overflow, limit of 255 bytes per line.

GET_LINE and GET_LINES Procedures

You can choose to retrieve from the buffer a single line or an array of lines. Call the GET_LINE procedure to retrieve a single line of buffered information. To reduce the number of calls to the server, call the GET_LINES procedure to retrieve an array of lines from the buffer.

You can choose to automatically display this information if you are using Enterprise Manager or SQL*Plus by using the special SET SERVEROUTPUT ON command.

After calling GET_LINE or GET_LINES, any lines not retrieved before the next call to PUT, PUT_LINE, or NEW_LINE are discarded to avoid confusing them with the next message.

Syntax

```
DBMS_OUTPUT.GET_LINE (
   line   OUT VARCHAR2,
   status OUT INTEGER);
```

Parameters

Table 39–8 GET_LINE Procedure Parameters

Parameter	Description
line	Returns a single line of buffered information, excluding a final newline character: The maximum length is 255 bytes.
status	If the call completes successfully, then the status returns as 0. If there are no more lines in the buffer, then the status is 1.

Syntax

```
DBMS_OUTPUT.GET_LINES (
   lines       OUT  CHARARR,
   numlines IN OUT  INTEGER);
```

CHARARR is a table of VARCHAR2(255).

Parameters

Table 39–9 GET_LINES Procedure Parameters

Parameter	Description
lines	Returns an array of lines of buffered information. The maximum length of each line in the array is 255 bytes.
numlines	Number of lines you want to retrieve from the buffer. After retrieving the specified number of lines, the procedure returns the number of lines actually retrieved. If this number is less than the number of lines requested, then there are no more lines in the buffer.

Examples

The DBMS_OUTPUT package is commonly used to debug stored procedures and triggers, as shown in Example 1. This package can also be used to enable you to retrieve information about an object and format this output, as shown in Example 2 on page 39-9.

Example 1 This is an example of a function that queries the employee table and returns the total salary for a specified department. The function includes several calls to the PUT_LINE procedure:

```
CREATE FUNCTION dept_salary (dnum NUMBER) RETURN NUMBER IS
   CURSOR emp_cursor IS
      SELECT sal, comm FROM emp WHERE deptno = dnum;
   total_wages    NUMBER(11, 2) := 0;
   counter        NUMBER(10) := 1;
BEGIN

   FOR emp_record IN emp_cursor LOOP
      emp_record.comm := NVL(emp_record.comm, 0);
      total_wages := total_wages + emp_record.sal
         + emp_record.comm;
      DBMS_OUTPUT.PUT_LINE('Loop number = ' || counter ||
         '; Wages = '|| TO_CHAR(total_wages));    /* Debug line */
      counter := counter + 1; /* Increment debug counter */
   END LOOP;
   /* Debug line */
   DBMS_OUTPUT.PUT_LINE('Total wages = ' ||
     TO_CHAR(total_wages));
   RETURN total_wages;

END dept_salary;
```

Assume the EMP table contains the following rows:

```
EMPNO          SAL     COMM     DEPT
-----        ------- -------- -------
1002           1500      500       20
1203           1000                30
1289           1000                10
1347           1000      250       20
```

Assume the user executes the following statements in the Enterprise Manager SQL Worksheet input pane:

```
SET SERVEROUTPUT ON
VARIABLE salary NUMBER;
EXECUTE :salary := dept_salary(20);
```

The user would then see the following information displayed in the output pane:

```
Loop number = 1; Wages = 2000
Loop number = 2; Wages = 3250
Total wages = 3250


PL/SQL procedure successfully executed.
```

Example 2 In this example, the user has used the EXPLAIN PLAN command to retrieve information about the execution plan for a statement and has stored it in PLAN_TABLE. The user has also assigned a statement ID to this statement. The example EXPLAIN_OUT procedure retrieves the information from this table and formats the output in a nested manner that more closely depicts the order of steps undergone in processing the SQL statement.

```
 /************************************************************/
/* Create EXPLAIN_OUT procedure. User must pass STATEMENT_ID to */
/* to procedure, to uniquely identify statement.               */
/************************************************************/
CREATE OR REPLACE PROCEDURE explain_out
   (statement_id IN VARCHAR2) AS

   -- Retrieve information from PLAN_TABLE into cursor EXPLAIN_ROWS.

   CURSOR explain_rows IS
      SELECT level, id, position, operation, options,
         object_name
      FROM plan_table
      WHERE statement_id = explain_out.statement_id
      CONNECT BY PRIOR id = parent_id
         AND statement_id = explain_out.statement_id
      START WITH id = 0
       ORDER BY id;

BEGIN


   -- Loop through information retrieved from PLAN_TABLE:

   FOR line IN explain_rows LOOP
```

```
      -- At start of output, include heading with estimated cost.

      IF line.id = 0 THEN
         DBMS_OUTPUT.PUT_LINE ('Plan for statement '
            || statement_id
            || ', estimated cost = ' || line.position);
      END IF;

      -- Output formatted information. LEVEL determines indention level.

      DBMS_OUTPUT.PUT_LINE (lpad(' ',2*(line.level-1)) ||
         line.operation || ' ' || line.options || ' ' ||
         line.object_name);
   END LOOP;

END;
```

See Also: Chapter 77, "UTL_FILE"

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DBMS_PCLXUTIL

The DBMS_PCLXUTIL package provides intra-partition parallelism for creating partition-wise local indexes.

> **See Also:** There are several rules concerning partitions and indexes. For more information, see *Oracle9i Database Concepts* and *Oracle9i Database Administrator's Guide.*

DBMS_PCLXUTIL circumvents the limitation that, for local index creation, the degree of parallelism is restricted to the number of partitions as only one slave process per partition is utilized.

DBMS_PCLXUTIL uses the DBMS_JOB package to provide a greater degree of parallelism for creating a local index for a partitioned table. This is achieved by asynchronous inter-partition parallelism using the background processes (with DBMS_JOB), in combination with intra-partition parallelism using the parallel query slave processes.

DBMS_PCLXUTIL works with both range and range-hash composite partitioning.

> **Note:** For range partitioning, the minimum compatibility mode is 8.0; for range-hash composite partitioning, the minimum compatibility mode is 8*i*.

This chapter discusses the following topics:

- Using DBMS_PCLXUTIL
- Limitations
- Summary of DBMS_PCLUTTL Subprograms

Using DBMS_PCLXUTIL

The DBMS_PCLXUTIL package can be used during the following DBA tasks:

1. Local index creation

   The procedure BUILD_PART_INDEX assumes that the dictionary information for the local index already exists. This can be done by issuing the create index SQL command with the UNUSABLE option.

   ```
   CREATE INDEX <idx_name> on <tab_name>(...) local(...) unusable;
   ```

   This causes the dictionary entries to be created without "building" the index itself, the time consuming part of creating an index. Now, invoking the procedure BUILD_PART_INDEX causes a concurrent build of local indexes with the specified degree of parallelism.

   ```
   EXECUTE dbms_pclxutil.build_part_index(4,4,<tab_name>,<idx_name>,FALSE);
   ```

   For composite partitions, the procedure automatically builds local indices for all subpartitions of the composite table.

2. Local index maintenance

   By marking desired partitions usable or unusable, the BUILD_PART_INDEX procedure also enables selective rebuilding of local indexes. The force_opt parameter provides a way to override this and build local indexes for all partitions.

   ```
   ALTER INDEX <idx_name> local(...) unusable;
   ```

   Rebuild only the desired (sub)partitions (that are marked unusable):

   ```
   EXECUTE dbms_pclxutil.build_part_index(4,4,<tab_name>,<idx_name>,FALSE);
   ```

   Rebuild all (sub)partitions using force_opt = TRUE:

   ```
   EXECUTE dbms_pclxutil.build_part_index(4,4,<tab_name>,<idx_name>,TRUE);
   ```

   A progress report is produced, and the output appears on screen when the program is ended (because the DBMS_OUTPUT package writes messages to a buffer first, and flushes the buffer to the screen only upon termination of the program).

Limitations

Because DBMS_PCLXUTIL uses the DBMS_JOB package, you must be aware of the following limitations pertaining to DBMS_JOB:

- You must decide appropriate values for the job_queue_processes initalization parameter. Clearly, if the job processes are not started before calling BUILD_PART_INDEX(), then the package will not function properly. The background processes are specified by the following init.ora parameters:

  ```
  job_queue_processes=n   #the number of background processes = n
  ```

- There is an upper limit to the number of simultaneous jobs in the queue, dictated by the upper limit on the number of background processes marked SNP[0..9] and SNP[A..Z], which is 36.

  See Also: *Oracle9i Database Administrator's Guide*

- Failure conditions are reported only in the trace files (a DBMS_JOB limitation), making it impossible to give interactive feedback to the user. This package simply prints a failure message, removes unfinished jobs from the queue, and requests the user to take a look at the snp*.trc trace files.
- The primary ramification of the above point is that you are expected to know how to tune Oracle (especially to set various storage parameters) in order to build large indexes. This package is not intended to assist in that tuning process.

Summary of DBMS_PCLUTTL Subprograms

DBMS_PCLXUTIL contains just one procedure: BUILD_PART_INDEX.

BUILD_PART_INDEX Procedure

Syntax

```
DBMS_PCLXUTIL.build_part_index (
   procs_per_job   IN NUMBER   DEFAULT 1,
   tab_name        IN VARCHAR2 DEFAULT NULL,
   idx_name        IN VARCHAR2 DEFAULT NULL,
   force_opt       IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 40–1 BUILD_PART_INDEX Procedure Parameters

Parameter	Description
procs_per_job	Number of parallel query slaves to be utilized per local index build (1 <= procs_per_job <= max_slaves).
tab_name	Name of the partitioned table (an exception is raised if the table does not exist or not partitioned).
idx_name	Name given to the local index (an exception is raised if a local index is not created on the table tab_name).
force_opt	If TRUE, then force rebuild of all partitioned indices; otherwise, rebuild only the partitions marked 'UNUSABLE'.

Example

Suppose a table PROJECT is created with two partitions PROJ001 and PROJ002, along with a local index IDX.

A call to the procedure BUILD_PART_INDEX(2,4,'PROJECT','IDX',TRUE) produces the following output:

```
SQLPLUS> EXECUTE dbms_pclxutil.build_part_index(2,4,'PROJECT','IDX',TRUE);
Statement processed.
INFO: Job #21 created for partition PROJ002 with 4 slaves
INFO: Job #22 created for partition PROJ001 with 4 slaves
```

41

DBMS_PIPE

The DBMS_PIPE package lets two or more sessions in the same instance communicate. Oracle pipes are similar in concept to the pipes used in UNIX, but Oracle pipes are not implemented using the operating system pipe mechanisms.

Information sent through Oracle pipes is buffered in the system global area (SGA). All information in pipes is lost when the instance is shut down.

Depending upon your security requirements, you may choose to use either a *public* or a *private* pipe.

> **Caution:** Pipes are independent of transactions. Be careful using pipes when transaction control can be affected.

This chapter discusses the following topics:

- Public Pipes, Private Pipes, and Pipe Uses
- Security, Constants, and Errors
- Summary of DBMS_PIPE Subprograms

Public Pipes, Private Pipes, and Pipe Uses

Public Pipes

You may create a public pipe either implicitly or explicitly. For *implicit* public pipes, the pipe is automatically created when it is referenced for the first time, and it disappears when it no longer contains data. Because the pipe descriptor is stored in the SGA, there is some space usage overhead until the empty pipe is aged out of the cache.

You create an *explicit* public pipe by calling the CREATE_PIPE function with the `private` flag set to FALSE. You must deallocate explicitly-created pipes by calling the REMOVE_PIPE function.

The domain of a public pipe is the schema in which it was created, either explicitly or implicitly.

Writing and Reading Pipes

Each public pipe works asynchronously. Any number of schema users can write to a public pipe, as long as they have EXECUTE permission on the DBMS_PIPE package, and they know the name of the public pipe. However, once buffered information is read by one user, it is emptied from the buffer, and is not available for other readers of the same pipe.

The sending session builds a message using one or more calls to the PACK_MESSAGE procedure. This procedure adds the message to the session's local message buffer. The information in this buffer is sent by calling the SEND_MESSAGE function, designating the pipe name to be used to send the message. When SEND_MESSAGE is called, all messages that have been stacked in the local buffer are sent.

A process that wants to receive a message calls the RECEIVE_MESSAGE function, designating the pipe name from which to receive the message. The process then calls the UNPACK_MESSAGE procedure to access each of the items in the message.

Private Pipes

You explicitly create a private pipe by calling the CREATE_PIPE function. Once created, the private pipe persists in shared memory until you explicitly deallocate it by calling the REMOVE_PIPE function. A private pipe is also deallocated when the database instance is shut down.

You cannot create a private pipe if an implicit pipe exists in memory and has the same name as the private pipe you are trying to create. In this case, CREATE_PIPE returns an error.

Access to a private pipe is restricted to:

- Sessions running under the same userid as the creator of the pipe
- Stored subprograms executing in the same userid privilege domain as the pipe creator
- Users connected as SYSDBA

An attempt by any other user to send or receive messages on the pipe, or to remove the pipe, results in an immediate error. Any attempt by another user to create a pipe with the same name also causes an error.

As with public pipes, you must first build your message using calls to PACK_MESSAGE before calling SEND_MESSAGE. Similarly, you must call RECEIVE_MESSAGE to retrieve the message before accessing the items in the message by calling UNPACK_MESSAGE.

Pipe Uses

The pipe functionality has several potential applications:

- External service interface: You can communicate with user-written services that are external to the RDBMS. This can be done effectively in a multi-threaded manner, so that several instances of the service are executing simultaneously. Additionally, the services are available asynchronously. The requestor of the service does not need to block a waiting reply. The requestor can check (with or without timeout) at a later time. The service can be written in any of the 3GL languages that Oracle supports.
- Independent transactions: The pipe can communicate to a separate session which can perform an operation in an independent transaction (such as logging an attempted security violation detected by a trigger).
- Alerters (non-transactional): You can post another process without requiring the waiting process to poll. If an "after-row" or "after-statement" trigger were to alert an application, then the application would treat this alert as an indication that the data probably changed. The application would then read the data to get the current value. Because this is an "after" trigger, the application would want to do a "select for update" to make sure it read the correct data.
- Debugging: Triggers and stored procedures can send debugging information to a pipe. Another session can keep reading out of the pipe and display it on the screen or write it to a file.

- Concentrator: This is useful for multiplexing large numbers of users over a fewer number of network connections, or improving performance by concentrating several user-transactions into one DBMS transaction.

Security, Constants, and Errors

Security

Security can be achieved by use of `GRANT EXECUTE` on the `DBMS_PIPE` package by creating a pipe using the `private` parameter in the `CREATE_PIPE` function and by writing cover packages that only expose particular features or pipenames to particular users or roles.

Constants

```
maxwait   constant integer := 86400000; /* 1000 days */
```

This is the maximum time to wait attempting to send or receive a message.

Errors

`DBMS_PIPE` package subprograms can return the following errors:

Table 41–1 DBMS_PIPE Errors

Error	Description
`ORA-23321:`	Pipename may not be null. This can be returned by the `CREATE_PIPE` function, or any subprogram that takes a pipe name as a parameter.
`ORA-23322:`	Insufficient privilege to access pipe. This can be returned by any subprogram that references a private pipe in its parameter list.

Summary of DBMS_PIPE Subprograms

Table 41–2 DBMS_PIPE Package Subprograms

Subprogram	Description
"CREATE_PIPE Function" on page 41-5	Explicitly creates a pipe (necessary for private pipes).
"PACK_MESSAGE Procedure" on page 41-7	Builds message in local buffer.

Table 41–2 DBMS_PIPE Package Subprograms (Cont.)

Subprogram	Description
"SEND_MESSAGE Function" on page 41-8	Sends message on named pipe: This implicitly creates a public pipe if the named pipe does not exist.
"RECEIVE_MESSAGE Function" on page 41-10	Copies message from named pipe into local buffer.
"NEXT_ITEM_TYPE Function" on page 41-12	Returns datatype of next item in buffer.
"UNPACK_MESSAGE Procedure" on page 41-13	Accesses next item in buffer.
"REMOVE_PIPE Function" on page 41-14	Removes the named pipe.
"PURGE Procedure" on page 41-15	Purges contents of named pipe.
"RESET_BUFFER Procedure" on page 41-16	Purges contents of local buffer.
"UNIQUE_SESSION_NAME Function" on page 41-16	Returns unique session name.

CREATE_PIPE Function

This function explicitly creates a public or private pipe. If the `private` flag is `TRUE`, then the pipe creator is assigned as the owner of the private pipe.

Explicitly-created pipes can only be removed by calling `REMOVE_PIPE`, or by shutting down the instance.

Syntax

```
DBMS_PIPE.CREATE_PIPE (
   pipename    IN VARCHAR2,
   maxpipesize IN INTEGER DEFAULT 8192,
   private     IN BOOLEAN DEFAULT TRUE)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(create_pipe,WNDS,RNDS);
```

Parameters

Table 41–3 CREATE_PIPE Function Parameters

Parameter	Description
pipename	Name of the pipe you are creating. You must use this name when you call SEND_MESSAGE and RECEIVE_MESSAGE. This name must be unique across the instance. Caution: Do not use pipe names beginning with ORA$. These are reserved for use by procedures provided by Oracle Corporation. Pipename should not be longer than 128 bytes, and is case_insensitive. At this time, the name cannot contain NLS characters.
maxpipesize	The maximum size allowed for the pipe, in bytes. The total size of all of the messages on the pipe cannot exceed this amount. The message is blocked if it exceeds this maximum. The default maxpipesize is 8192 bytes. The maxpipesize for a pipe becomes a part of the characteristics of the pipe and persists for the life of the pipe. Callers of SEND_MESSAGE with larger values cause the maxpipesize to be increased. Callers with a smaller value use the existing, larger value.
private	Uses the default, TRUE, to create a private pipe. Public pipes can be implicitly created when you call SEND_MESSAGE.

Returns

Table 41–4 CREATE_PIPE Function Returns

Return	Description
0	Successful. If the pipe already exists and the user attempting to create it is authorized to use it, then Oracle returns 0, indicating success, and any data already in the pipe remains. If a user connected as SYSDBA/SYSOPER re-creates a pipe, then Oracle returns status 0, but the ownership of the pipe remains unchanged.

Table 41–4 CREATE_PIPE Function Returns

Return	Description
ORA-23322	Failure due to naming conflict. If a pipe with the same name exists and was created by a different user, then Oracle signals error ORA-23322, indicating the naming conflict.

Exceptions

Table 41–5 CREATE_PIPE Function Exception

Exception	Description
Null pipe name	Permission error: Pipe with the same name already exists, and you are not allowed to use it.

PACK_MESSAGE Procedure

This procedure builds your message in the local message buffer.

To send a message, first make one or more calls to PACK_MESSAGE. Then, call SEND_MESSAGE to send the message in the local buffer on the named pipe.

The PACK_MESSAGE procedure is overloaded to accept items of type VARCHAR2, NUMBER, or DATE. In addition to the data bytes, each item in the buffer requires one byte to indicate its type, and two bytes to store its length. One additional byte is needed to terminate the message.The overhead for all types other than VARCHAR is 4 bytes.

In Oracle8, the char-set-id (2 bytes) and the char-set-form (1 byte) are stored with each data item. Therefore, the overhead when using Oracle8 is 7 bytes.

When you call SEND_MESSAGE to send this message, you must indicate the name of the pipe on which you want to send the message. If this pipe already exists, then you must have sufficient privileges to access this pipe. If the pipe does not already exist, then it is created automatically.

Syntax

```
DBMS_PIPE.PACK_MESSAGE       (item  IN  VARCHAR2);
DBMS_PIPE.PACK_MESSAGE       (item  IN  NCHAR);
DBMS_PIPE.PACK_MESSAGE       (item  IN  NUMBER);
DBMS_PIPE.PACK_MESSAGE       (item  IN  DATE);
DBMS_PIPE.PACK_MESSAGE_RAW   (item  IN  RAW);
```

```
DBMS_PIPE.PACK_MESSAGE_ROWID (item  IN  ROWID);
```

Note: The PACK_MESSAGE procedure is overloaded to accept items of type VARCHAR2, NCHAR, NUMBER, or DATE. There are two additional procedures to pack RAW and ROWID items.

Pragmas

```
pragma restrict_references(pack_message,WNDS,RNDS);
pragma restrict_references(pack_message_raw,WNDS,RNDS);
pragma restrict_references(pack_message_rowid,WNDS,RNDS);
```

Parameters

Table 41–6 PACK_MESSAGE Procedure Parameters

Parameter	Description
item	Item to pack into the local message buffer.

Exceptions

ORA-06558 is raised if the message buffer overflows (currently 4096 bytes). Each item in the buffer takes one byte for the type, two bytes for the length, plus the actual data. There is also one byte needed to terminate the message.

SEND_MESSAGE Function

This function sends a message on the named pipe.

The message is contained in the local message buffer, which was filled with calls to PACK_MESSAGE. A pipe could be explicitly using CREATE_PIPE; otherwise, it is created implicitly.

Syntax

```
DBMS_PIPE.SEND_MESSAGE (
    pipename     IN VARCHAR2,
    timeout      IN INTEGER DEFAULT MAXWAIT,
    maxpipesize  IN INTEGER DEFAULT 8192)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(send_message,WNDS,RNDS);
```

Parameters

Table 41–7 SEND_MESSAGE Function Parameters

Parameter	Description
pipename	Name of the pipe on which you want to place the message. If you are using an explicit pipe, then this is the name that you specified when you called CREATE_PIPE. Caution: Do not use pipe names beginning with 'ORA$'. These names are reserved for use by procedures provided by Oracle Corporation. Pipename should not be longer than 128 bytes, and is case-insensitive. At this time, the name cannot contain NLS characters.
timeout	Time to wait while attempting to place a message on a pipe, in seconds. The default value is the constant MAXWAIT, which is defined as 86400000 (1000 days).
maxpipesize	Maximum size allowed for the pipe, in bytes. The total size of all the messages on the pipe cannot exceed this amount. The message is blocked if it exceeds this maximum. The default is 8192 bytes. The maxpipesize for a pipe becomes a part of the characteristics of the pipe and persists for the life of the pipe. Callers of SEND_MESSAGE with larger values cause the maxpipesize to be increased. Callers with a smaller value simply use the existing, larger value. Specifying maxpipesize as part of the SEND_MESSAGE procedure eliminates the need for a separate call to open the pipe. If you created the pipe explicitly, then you can use the optional maxpipesize parameter to override the creation pipe size specifications.

Returns

Table 41–8 SEND_MESSAGE Function Returns

Return	Description
0	Success. If the pipe already exists and the user attempting to create it is authorized to use it, then Oracle returns 0, indicating success, and any data already in the pipe remains. If a user connected as SYSDBS/SYSOPER re-creates a pipe, then Oracle returns status 0, but the ownership of the pipe remains unchanged.
1	Timed out. This procedure can timeout either because it cannot get a lock on the pipe, or because the pipe remains too full to be used. If the pipe was implicitly-created and is empty, then it is removed.
3	An interrupt occurred. If the pipe was implicitly created and is empty, then it is removed.
ORA-23322	Insufficient privileges. If a pipe with the same name exists and was created by a different user, then Oracle signals error ORA-23322, indicating the naming conflict.

Exceptions

Table 41–9 SEND_MESSAGE Function Exception

Exception	Description
Null pipe name	Permission error. Insufficient privilege to write to the pipe. The pipe is private and owned by someone else.

RECEIVE_MESSAGE Function

This function copies the message into the local message buffer.

To receive a message from a pipe, first call RECEIVE_MESSAGE. When you receive a message, it is removed from the pipe; hence, a message can only be received once. For implicitly-created pipes, the pipe is removed after the last record is removed from the pipe.

If the pipe that you specify when you call RECEIVE_MESSAGE does not already exist, then Oracle implicitly creates the pipe and waits to receive the message. If the message does not arrive within a designated timeout interval, then the call returns and the pipe is removed.

After receiving the message, you must make one or more calls to UNPACK_MESSAGE to access the individual items in the message. The UNPACK_MESSAGE procedure is overloaded to unpack items of type DATE, NUMBER, VARCHAR2, and there are two additional procedures to unpack RAW and ROWID items. If you do not know the type of data that you are attempting to unpack, then call NEXT_ITEM_TYPE to determine the type of the next item in the buffer.

Syntax

```
DBMS_PIPE.RECEIVE_MESSAGE (
   pipename     IN VARCHAR2,
   timeout      IN INTEGER      DEFAULT maxwait)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(receive_message,WNDS,RNDS);
```

Parameters

Table 41–10 RECEIVE_MESSAGE Function Parameters

Parameter	Description
pipename	Name of the pipe on which you want to receive a message. Names beginning with ORA$ are reserved for use by Oracle
timeout	Time to wait for a message, in seconds. The default value is the constant MAXWAIT, which is defined as 86400000 (1000 days). A timeout of 0 allows you to read without blocking.

Returns

Table 41–11 RECEIVE_MESSAGE Function Returns

Return	Description
0	Success

Table 41–11 RECEIVE_MESSAGE Function Returns

Return	Description
1	Timed out. If the pipe was implicitly-created and is empty, then it is removed.
2	Record in the pipe is too large for the buffer. (This should not happen.)
3	An interrupt occurred.
ORA-23322	User has insufficient privileges to read from the pipe.

Exceptions

Table 41–12 RECEIVE_MESSAGE Function Exceptions

Exception	Description
Null pipe name	Permission error. Insufficient privilege to remove the record from the pipe. The pipe is owned by someone else.

NEXT_ITEM_TYPE Function

This function determines the datatype of the next item in the local message buffer.

After you have called RECEIVE_MESSAGE to place pipe information in a local buffer, call NEXT_ITEM_TYPE.

Syntax

```
DBMS_PIPE.NEXT_ITEM_TYPE
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(next_item_type,WNDS,RNDS);
```

Returns

Table 41–13 NEXT_ITEM_TYPE Function Returns

Return	Description
0	No more items
6	NUMBER

Table 41–13 NEXT_ITEM_TYPE Function Returns

Return	Description
9	VARCHAR2
11	ROWID
12	DATE
23	RAW

UNPACK_MESSAGE Procedure

This procedure retrieves items from the buffer.

After you have called RECEIVE_MESSAGE to place pipe information in a local buffer, call UNPACK_MESSAGE.

Syntax

```
DBMS_PIPE.UNPACK_MESSAGE       (item  OUT VARCHAR2);
DBMS_PIPE.UNPACK_MESSAGE       (item  OUT NCHAR);
DBMS_PIPE.UNPACK_MESSAGE       (item  OUT NUMBER);
DBMS_PIPE.UNPACK_MESSAGE       (item  OUT DATE);
DBMS_PIPE.UNPACK_MESSAGE_RAW   (item  OUT RAW);
DBMS_PIPE.UNPACK_MESSAGE_ROWID (item  OUT ROWID);
```

Note: The UNPACK_MESSAGE procedure is overloaded to return items of type VARCHAR2, NCHAR, NUMBER, or DATE. There are two additional procedures to unpack RAW and ROWID items.

Pragmas

```
pragma restrict_references(unpack_message,WNDS,RNDS);
pragma restrict_references(unpack_message_raw,WNDS,RNDS);
pragma restrict_references(unpack_message_rowid,WNDS,RNDS);
```

Parameters

Table 41–14 UNPACK_MESSAGE Procedure Parameters

Parameter	Description
item	Argument to receive the next unpacked item from the local message buffer.

Exceptions

ORA-06556 or 06559 are generated if the buffer contains no more items, or if the item is not of the same type as that requested.

REMOVE_PIPE Function

This function removes explicitly-created pipes.

Pipes created implicitly by SEND_MESSAGE are automatically removed when empty. However, pipes created explicitly by CREATE_PIPE are removed only by calling REMOVE_PIPE, or by shutting down the instance. All unconsumed records in the pipe are removed before the pipe is deleted.

This is similar to calling PURGE on an implicitly-created pipe.

Syntax

```
DBMS_PIPE.REMOVE_PIPE (
   pipename  IN  VARCHAR2)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(remove_pipe,WNDS,RNDS);
```

Parameters

Table 41–15 REMOVE_PIPE Function Parameters

Parameter	Description
pipename	Name of pipe that you want to remove.

Returns

Table 41–16 REMOVE_PIPE Function Returns

Return	Description
0	Success If the pipe does not exist, or if the pipe already exists and the user attempting to remove it is authorized to do so, then Oracle returns 0, indicating success, and any data remaining in the pipe is removed.

Table 41–16 REMOVE_PIPE Function Returns

Return	Description
ORA-23322	Insufficient privileges. If the pipe exists, but the user is not authorized to access the pipe, then Oracle signals error ORA-23322, indicating insufficient privileges.

Exceptions

Table 41–17 REMOVE_PIPE Function Exception

Exception	Description
Null pipe name	Permission error: Insufficient privilege to remove pipe. The pipe was created and is owned by someone else.

PURGE Procedure

This procedure empties the contents of the named pipe.

An empty implicitly-created pipe is aged out of the shared global area according to the least-recently-used algorithm. Thus, calling PURGE lets you free the memory associated with an implicitly-created pipe.

Because PURGE calls RECEIVE_MESSAGE, the local buffer might be overwritten with messages as they are purged from the pipe. Also, you can receive an ORA-23322 (insufficient privileges) error if you attempt to purge a pipe with which you have insufficient access rights.

Syntax

```
DBMS_PIPE.PURGE (
   pipename  IN  VARCHAR2);
```

Pragmas

```
pragma restrict_references(purge,WNDS,RNDS);
```

Parameters

Table 41–18 Purge Procedure Parameters

Parameter	Description
pipename	Name of pipe from which to remove all messages. The local buffer may be overwritten with messages as they are discarded. Pipename should not be longer than 128 bytes, and is case-insensitive.

Exceptions

Permission error if pipe belongs to another user.

RESET_BUFFER Procedure

This procedure resets the PACK_MESSAGE and UNPACK_MESSAGE positioning indicators to 0.

Because all pipes share a single buffer, you may find it useful to reset the buffer before using a new pipe. This ensures that the first time you attempt to send a message to your pipe, you do not inadvertently send an expired message remaining in the buffer.

Syntax

```
DBMS_PIPE.RESET_BUFFER;
```

Pragmas

```
pragma restrict_references(reset_buffer,WNDS,RNDS);
```

UNIQUE_SESSION_NAME Function

This function receives a name that is unique among all of the sessions that are currently connected to a database.

Multiple calls to this function from the same session always return the same value. You might find it useful to use this function to supply the PIPENAME parameter for your SEND_MESSAGE and RECEIVE_MESSAGE calls.

Syntax

```
DBMS_PIPE.UNIQUE_SESSION_NAME
```

```
  RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(unique_session_name,WNDS,RNDS,WNPS);
```

Returns

This function returns a unique name. The returned name can be up to 30 bytes.

Example 1: Debugging

This example shows the procedure that a PL/SQL program can call to place debugging information in a pipe.

```
CREATE OR REPLACE PROCEDURE debug (msg VARCHAR2) AS
    status  NUMBER;
BEGIN
  DBMS_PIPE.PACK_MESSAGE(LENGTH(msg));
  DBMS_PIPE.PACK_MESSAGE(msg);
  status := DBMS_PIPE.SEND_MESSAGE('plsql_debug');
  IF status != 0 THEN
    raise_application_error(-20099, 'Debug error');
  END IF;
END debug;
```

The following Pro*C code receives messages from the PLSQL_DEBUG pipe in "Example 1: Debugging" and displays the messages. If the Pro*C session is run in a separate window, then it can be used to display any messages that are sent to the debug procedure from a PL/SQL program executing in a separate session.

```
#include <stdio.h>
#include <string.h>

EXEC SQL BEGIN DECLARE SECTION;
   VARCHAR username[20];
   int     status;
   int     msg_length;
   char    retval[2000];
EXEC SQL END DECLARE SECTION;

EXEC SQL INCLUDE SQLCA;

void sql_error();

main()
```

```
{

-- Prepare username:
   strcpy(username.arr, "SCOTT/TIGER");
   username.len = strlen(username.arr);

   EXEC SQL WHENEVER SQLERROR DO sql_error();
   EXEC SQL CONNECT :username;

   printf("connected\n");

-- Start an endless loop to look for and print messages on the pipe:
   FOR (;;)
   {
      EXEC SQL EXECUTE
         DECLARE
            len INTEGER;
            typ INTEGER;
            sta INTEGER;
            chr VARCHAR2(2000);
         BEGIN
            chr := '';
            sta := dbms_pipe.receive_message('plsql_debug');
            IF sta = 0 THEN
               DBMS_PIPE.UNPACK_MESSAGE(len);
               DBMS_PIPE.UNPACK_MESSAGE(chr);
            END IF;
            :status := sta;
            :retval := chr;
            IF len IS NOT NULL THEN
               :msg_length := len;
            ELSE
               :msg_length := 2000;
            END IF;
         END;
      END-EXEC;
      IF (status == 0)
         printf("\n%.*s\n", msg_length, retval);
      ELSE
         printf("abnormal status, value is %d\n", status);
   }
}

void sql_error()
{
```

```
   char msg[1024];
   int rlen, len;
   len = sizeof(msg);
   sqlglm(msg, &len, &rlen);
   printf("ORACLE ERROR\n");
   printf("%.*s\n", rlen, msg);
   exit(1);
}
```

Example 2: Execute System Commands

This example shows PL/SQL and Pro*C code let a PL/SQL stored procedure (or anonymous block) call PL/SQL procedures to send commands over a pipe to a Pro*C program that is listening for them.

The Pro*C program sleeps and waits for a message to arrive on the named pipe. When a message arrives, the C program processes it, carrying out the required action, such as executing a UNIX command through the *system*() call or executing a SQL command using embedded SQL.

DAEMON.SQL is the source code for the PL/SQL package. This package contains procedures that use the DBMS_PIPE package to send and receive message to and from the Pro*C daemon. Note that full handshaking is used. The daemon always sends a message back to the package (except in the case of the STOP command). This is valuable, because it allows the PL/SQL procedures to be sure that the Pro*C daemon is running.

You can call the DAEMON packaged procedures from an anonymous PL/SQL block using SQL*Plus or Enterprise Manager. For example:

```
SQLPLUS> variable rv number
SQLPLUS> execute :rv := DAEMON.EXECUTE_SYSTEM('ls -la');
```

On a UNIX system, this causes the Pro*C daemon to execute the command *system*("*ls -la*").

Remember that the daemon needs to be running first. You might want to run it in the background, or in another window beside the SQL*Plus or Enterprise Manager session from which you call it.

The DAEMON.SQL also uses the DBMS_OUTPUT package to display the results. For this example to work, you must have execute privileges on this package.

DAEMON.SQL Example. This is the code for the PL/SQL DAEMON package:

```
CREATE OR REPLACE PACKAGE daemon AS
  FUNCTION execute_sql(command VARCHAR2,
```

```
                        timeout NUMBER DEFAULT 10)
    RETURN NUMBER;

  FUNCTION execute_system(command VARCHAR2,
                          timeout NUMBER DEFAULT 10)
    RETURN NUMBER;

  PROCEDURE stop(timeout NUMBER DEFAULT 10);
END daemon;
/
CREATE OR REPLACE PACKAGE BODY daemon AS

  FUNCTION execute_system(command VARCHAR2,
                          timeout NUMBER DEFAULT 10)
  RETURN NUMBER IS

    status       NUMBER;
    result       VARCHAR2(20);
    command_code NUMBER;
    pipe_name    VARCHAR2(30);
  BEGIN
    pipe_name := DBMS_PIPE.UNIQUE_SESSION_NAME;

    DBMS_PIPE.PACK_MESSAGE('SYSTEM');
    DBMS_PIPE.PACK_MESSAGE(pipe_name);
    DBMS_PIPE.PACK_MESSAGE(command);
    status := DBMS_PIPE.SEND_MESSAGE('daemon', timeout);
    IF status <> 0 THEN
      RAISE_APPLICATION_ERROR(-20010,
        'Execute_system: Error while sending.  Status = ' ||
         status);
    END IF;

    status := DBMS_PIPE.RECEIVE_MESSAGE(pipe_name, timeout);
    IF status <> 0 THEN
      RAISE_APPLICATION_ERROR(-20011,
        'Execute_system: Error while receiving.
         Status = ' || status);
    END IF;

    DBMS_PIPE.UNPACK_MESSAGE(result);
    IF result <> 'done' THEN
      RAISE_APPLICATION_ERROR(-20012,
        'Execute_system: Done not received.');
    END IF;
```

```
  DBMS_PIPE.UNPACK_MESSAGE(command_code);
  DBMS_OUTPUT.PUT_LINE('System command executed.  result = ' ||
                       command_code);
  RETURN command_code;
END execute_system;

FUNCTION execute_sql(command VARCHAR2,
                     timeout NUMBER DEFAULT 10)
RETURN NUMBER IS

  status       NUMBER;
  result       VARCHAR2(20);
  command_code NUMBER;
  pipe_name    VARCHAR2(30);

BEGIN
  pipe_name := DBMS_PIPE.UNIQUE_SESSION_NAME;

  DBMS_PIPE.PACK_MESSAGE('SQL');
  DBMS_PIPE.PACK_MESSAGE(pipe_name);
  DBMS_PIPE.PACK_MESSAGE(command);
  status := DBMS_PIPE.SEND_MESSAGE('daemon', timeout);
  IF status <> 0 THEN
    RAISE_APPLICATION_ERROR(-20020,
      'Execute_sql: Error while sending.  Status = ' || status);
  END IF;

  status := DBMS_PIPE.RECEIVE_MESSAGE(pipe_name, timeout);

  IF status <> 0 THEN
    RAISE_APPLICATION_ERROR(-20021,
      'execute_sql: Error while receiving.
       Status = ' || status);
  END IF;

  DBMS_PIPE.UNPACK_MESSAGE(result);
  IF result <> 'done' THEN
    RAISE_APPLICATION_ERROR(-20022,
      'execute_sql: done not received.');
  END IF;

  DBMS_PIPE.UNPACK_MESSAGE(command_code);
  DBMS_OUTPUT.PUT_LINE
      ('SQL command executed.  sqlcode = ' || command_code);
```

```
    RETURN command_code;
  END execute_sql;

  PROCEDURE stop(timeout NUMBER DEFAULT 10) IS
    status NUMBER;
  BEGIN
    DBMS_PIPE.PACK_MESSAGE('STOP');
    status := DBMS_PIPE.SEND_MESSAGE('daemon', timeout);
    IF status <> 0 THEN
      RAISE_APPLICATION_ERROR(-20030,
        'stop: error while sending.  status = ' || status);
    END IF;
  END stop;
END daemon;
```

daemon.pc Example. This is the code for the Pro*C daemon. You must precompile this using the Pro*C Precompiler, Version 1.5.x or later. You must also specify the USERID and SQLCHECK options, as the example contains embedded PL/SQL code.

> **Note:** To use a VARCHAR output host variable in a PL/SQL block, you must initialize the length component before entering the block.

```
proc iname=daemon userid=scott/tiger sqlcheck=semantics
```

Then C-compile and link in the normal way.

```
#include <stdio.h>
#include <string.h>

EXEC SQL INCLUDE SQLCA;

EXEC SQL BEGIN DECLARE SECTION;
  char *uid = "scott/tiger";
  int status;
  VARCHAR command[20];
  VARCHAR value[2000];
  VARCHAR return_name[30];
EXEC SQL END DECLARE SECTION;

void
connect_error()
```

```
{
  char msg_buffer[512];
  int msg_length;
  int buffer_size = 512;

  EXEC SQL WHENEVER SQLERROR CONTINUE;
  sqlglm(msg_buffer, &buffer_size, &msg_length);
  printf("Daemon error while connecting:\n");
  printf("%.*s\n", msg_length, msg_buffer);
  printf("Daemon quitting.\n");
  exit(1);
}

void
sql_error()
{
  char msg_buffer[512];
  int msg_length;
  int buffer_size = 512;

  EXEC SQL WHENEVER SQLERROR CONTINUE;
  sqlglm(msg_buffer, &buffer_size, &msg_length);
  printf("Daemon error while executing:\n");
  printf("%.*s\n", msg_length, msg_buffer);
  printf("Daemon continuing.\n");
}
main()
{
command.len = 20; /*initialize length components*/
value.len = 2000;
return_name.len  = 30;
  EXEC SQL WHENEVER SQLERROR DO connect_error();
  EXEC SQL CONNECT :uid;
  printf("Daemon connected.\n");

  EXEC SQL WHENEVER SQLERROR DO sql_error();
  printf("Daemon waiting...\n");
  while (1) {
    EXEC SQL EXECUTE
      BEGIN
        :status := DBMS_PIPE.RECEIVE_MESSAGE('daemon');
        IF :status = 0 THEN
          DBMS_PIPE.UNPACK_MESSAGE(:command);
        END IF;
      END;
```

```
END-EXEC;
IF (status == 0)
{
  command.arr[command.len] = '\0';
  IF (!strcmp((char *) command.arr, "STOP"))
  {
    printf("Daemon exiting.\n");
    break;
  }

  ELSE IF (!strcmp((char *) command.arr, "SYSTEM"))
  {
    EXEC SQL EXECUTE
      BEGIN
        DBMS_PIPE.UNPACK_MESSAGE(:return_name);
        DBMS_PIPE.UNPACK_MESSAGE(:value);
      END;
    END-EXEC;
    value.arr[value.len] = '\0';
    printf("Will execute system command '%s'\n", value.arr);

    status = system(value.arr);
    EXEC SQL EXECUTE
      BEGIN
        DBMS_PIPE.PACK_MESSAGE('done');
        DBMS_PIPE.PACK_MESSAGE(:status);
        :status := DBMS_PIPE.SEND_MESSAGE(:return_name);
      END;
    END-EXEC;

    IF (status)
    {
      printf
       ("Daemon error while responding to system command.");
      printf("  status: %d\n", status);
    }
  }
  ELSE IF (!strcmp((char *) command.arr, "SQL")) {
    EXEC SQL EXECUTE
      BEGIN
        DBMS_PIPE.UNPACK_MESSAGE(:return_name);
        DBMS_PIPE.UNPACK_MESSAGE(:value);
      END;
    END-EXEC;
    value.arr[value.len] = '\0';
```

```
        printf("Will execute sql command '%s'\n", value.arr);

        EXEC SQL WHENEVER SQLERROR CONTINUE;
        EXEC SQL EXECUTE IMMEDIATE :value;
        status = sqlca.sqlcode;

        EXEC SQL WHENEVER SQLERROR DO sql_error();
        EXEC SQL EXECUTE
          BEGIN
            DBMS_PIPE.PACK_MESSAGE('done');
            DBMS_PIPE.PACK_MESSAGE(:status);
            :status := DBMS_PIPE.SEND_MESSAGE(:return_name);
          END;
        END-EXEC;

        IF (status)
        {
          printf("Daemon error while responding to sql command.");
          printf("  status: %d\n", status);
        }
      }
      ELSE
      {
        printf
          ("Daemon error: invalid command '%s' received.\n",
            command.arr);
      }
    }
    ELSE
    {
      printf("Daemon error while waiting for signal.");
      printf("  status = %d\n", status);
    }
  }
  EXEC SQL COMMIT WORK RELEASE;
  exit(0);
```

Example 3: External Service Interface

Put the user-written 3GL code into an OCI or Precompiler program. The program connects to the database and executes PL/SQL code to read its request from the pipe, computes the result, and then executes PL/SQL code to send the result on a pipe back to the requestor.

Below is an example of a stock service request. The recommended sequence for the arguments to pass on the pipe for all service requests is:

```
protocol_version      VARCHAR2          - '1', 10 bytes or less
returnpipe            VARCHAR2          - 30 bytes or less
service               VARCHAR2          - 30 bytes or less
arg1                  VARCHAR2/NUMBER/DATE
   ...
argn                  VARCHAR2/NUMBER/DATE
```

The recommended format for returning the result is:

```
success               VARCHAR2          - 'SUCCESS' if OK,
                                          otherwise error message
arg1                  VARCHAR2/NUMBER/DATE
   ...
argn                  VARCHAR2/NUMBER/DATE
```

The "stock price request server" would do, using OCI or PRO* (in pseudo-code):

```
<loop forever>
  BEGIN dbms_stock_server.get_request(:stocksymbol); END;
  <figure out price based on stocksymbol (probably from some radio
        signal), set error if can't find such a stock>
  BEGIN dbms_stock_server.return_price(:error, :price); END;
```

A client would do:

```
BEGIN :price := stock_request('YOURCOMPANY'); end;
```

The stored procedure, `dbms_stock_server`, which is called by the "stock price request server" above is:

```
CREATE OR REPLACE PACKAGE dbms_stock_server IS
  PROCEDURE get_request(symbol OUT VARCHAR2);
  PROCEDURE return_price(errormsg IN VARCHAR2, price IN VARCHAR2);
END;

CREATE OR REPLACE PACKAGE BODY dbms_stock_server IS
  returnpipe    VARCHAR2(30);

  PROCEDURE returnerror(reason VARCHAR2) IS
    s INTEGER;
  BEGIN
    dbms_pipe.pack_message(reason);
    s := dbms_pipe.send_message(returnpipe);
    IF s <> 0 THEN
```

```
      raise_application_error(-20000, 'Error:' || to_char(s) ||
        ' sending on pipe');
    END IF;
  END;

  PROCEDURE get_request(symbol OUT VARCHAR2) IS
    protocol_version VARCHAR2(10);
    s                INTEGER;
    service          VARCHAR2(30);
  BEGIN
    s := dbms_pipe.receive_message('stock_service');
    IF s <> 0 THEN
      raise_application_error(-20000, 'Error:' || to_char(s) ||
        'reading pipe');
    END IF;
    dbms_pipe.unpack_message(protocol_version);
    IF protocol_version <> '1' THEN
      raise_application_error(-20000, 'Bad protocol: ' ||
        protocol_version);
    END IF;
    dbms_pipe.unpack_message(returnpipe);
    dbms_pipe.unpack_message(service);
    IF service != 'getprice' THEN
      returnerror('Service ' || service || ' not supported');
    END IF;
    dbms_pipe.unpack_message(symbol);
  END;

  PROCEDURE return_price(errormsg in VARCHAR2, price in VARCHAR2) IS
    s INTEGER;
  BEGIN
    IF errormsg is NULL THEN
      dbms_pipe.pack_message('SUCCESS');
      dbms_pipe.pack_message(price);
    ELSE
      dbms_pipe.pack_message(errormsg);
    END IF;
    s := dbms_pipe.send_message(returnpipe);
    IF s <> 0 THEN
      raise_application_error(-20000, 'Error:'||to_char(s)||
        ' sending on pipe');
    END IF;
  END;
END;
```

The procedure called by the client is:

```
CREATE OR REPLACE FUNCTION stock_request (symbol VARCHAR2)
    RETURN VARCHAR2 IS
  s        INTEGER;
  price    VARCHAR2(20);
  errormsg VARCHAR2(512);
BEGIN
  dbms_pipe.pack_message('1');  -- protocol version
  dbms_pipe.pack_message(dbms_pipe.unique_session_name); -- return pipe
  dbms_pipe.pack_message('getprice');
  dbms_pipe.pack_message(symbol);
  s := dbms_pipe.send_message('stock_service');
  IF s <> 0 THEN
    raise_application_error(-20000, 'Error:'||to_char(s)||
      ' sending on pipe');
  END IF;
  s := dbms_pipe.receive_message(dbms_pipe.unique_session_name);
  IF s <> 0 THEN
    raise_application_error(-20000, 'Error:'||to_char(s)||
      ' receiving on pipe');
  END IF;
  dbms_pipe.unpack_message(errormsg);
  IF errormsg <> 'SUCCESS' THEN
    raise_application_error(-20000, errormsg);
  END IF;
  dbms_pipe.unpack_message(price);
  RETURN price;
END;
```

You would typically only grant execute on `dbms_stock_service` to the stock service application server, and would only grant execute on `stock_request` to those users allowed to use the service.

See Also: Chapter 2, "DBMS_ALERT"

42

DBMS_PROFILER

Oracle8*i* provides a Profiler API to profile existing PL/SQL applications and to identify performance bottlenecks. You can use the collected profiler (performance) data for performance improvement or for determining code coverage for PL/SQL applications. Application developers can use code coverage data to focus their incremental testing efforts.

The profiler API is implemented as a PL/SQL package, `DBMS_PROFILER`, that provides services for collecting and persistently storing PL/SQL profiler data.

This chapter discusses the following topics:

Using DBMS_PROFILER

Improving application performance is an iterative process. Each iteration involves the following steps:

1. Running the application with one or more benchmark tests with profiler data collection enabled.
2. Analyzing the profiler data and identifying performance problems.
3. Fixing the problems.

The PL/SQL profiler supports this process using the concept of a "run". A run involves running the application through benchmark tests with profiler data collection enabled. You can control the beginning and the ending of a run by calling the START_PROFILER and STOP_PROFILER functions.

A typical run involves:

- Starting profiler data collection in the run.
- Executing PL/SQL code for which profiler and code coverage data is required.
- Stopping profiler data collection, which writes the collected data for the run into database tables

> **Note:** The collected profiler data is not automatically stored when the user disconnects. You must issue an explicit call to the FLUSH_DATA or the STOP_PROFILER function to store the data at the end of the session. Stopping data collection stores the collected data.

As the application executes, profiler data is collected in memory data structures that last for the duration of the run. You can call the FLUSH_DATA function at intermediate points during the run to get incremental data and to free memory for allocated profiler data structures.

Flushing the collected data involves storing collected data in database tables. The tables should already exist in the profiler user's schema. The PROFTAB.SQL script creates the tables and other data structures required for persistently storing the profiler data.

Note that running PROFTAB.SQL drops the current tables. The PROFTAB.SQL script is in the RDBMS/ADMIN directory. Some PL/SQL operations, such as the first execution of a PL/SQL unit, may involve I/O to catalog tables to load the byte code

for the PL/SQL unit being executed. Also, it may take some time executing package initialization code the first time a package procedure or function is called.

To avoid timing this overhead, "warm up" the database before collecting profile data. To do this, run the application once without gathering profiler data.

System-Wide Profiling

You can allow profiling across all users of a system, for example, to profile all users of a package, independent of who is using it. In such cases, the SYSADMIN should use a modified `PROFLOAD.SQL` script which:

- Creates the profiler tables and sequence
- Grants SELECT/INSERT/UPDATE on those tables and sequence to all users
- Defines public synonyms for the tables and sequence

Note: Do not alter the actual fields of the tables.

See Also: "FLUSH_DATA Function" on page 42-8.

Requirements

`DBMS_PROFILER` must be installed as `SYS`.

Use the `PROFLOAD.SQL` script to load the PL/SQL Profiler packages.

Collected Data

With the Probe Profiler API, you can generate profiling information for all named library units that are executed in a session. The profiler gathers information at the PL/SQL virtual machine level. This information includes the total number of times each line has been executed, the total amount of time that has been spent executing that line, and the minimum and maximum times that have been spent on a particular execution of that line.

Note: It is possible to infer the code coverage figures for PL/SQL units for which data has been collected.

The profiling information is stored in database tables. This enables ad-hoc querying on the data: you can build customizable reports (summary reports, hottest lines, code coverage data, and so on. It also allows you to analyze the data.

PROFTAB.SQL

The PROFTAB.SQL script creates tables with the columns, datatypes, and definitions as shown in Table 42–1, Table 42–2, and Table 42–3.

Table 42–1 Columns in Table PLSQL_PROFILER_RUNS

Column	Datatype	Definition
runid	number primary key	Unique run identifier from plsql_profiler_runnumber
related_run	number	Runid of related run (for client/server correlation)
run_owner	varchar2(32),	User who started run
run_date	date	Start time of run
run_comment	varchar2(2047)	User provided comment for this run
run_total_time	number	Elapsed time for this run in nanoseconds
run_system_info	varchar2(2047)	Currently unused
run_comment1	varchar2(2047)	Additional comment
spare1	varchar2(256)	Unused

Table 42–2 Columns in Table PLSQL_PROFILER_UNITS

Column	Datatype	Definition
runid	number	Primary key, references plsql_profiler_runs,
unit_number	number	Primary key, internally generated library unit #
unit_type	varchar2(32)	Library unit type
unit_owner	varchar2(32)	Library unit owner name
unit_name	varchar2(32)	Library unit name timestamp on library unit

Table 42–2 Columns in Table PLSQL_PROFILER_UNITS

Column	Datatype	Definition
unit_timestamp	date	In the future will be used to detect changes to unit between runs
total_time	number	Total time spent in this unit in nanoseconds. The profiler does not set this field, but it is provided for the convenience of analysis tools.
spare1	number	Unused
spare2	number	Unused

Table 42–3 Columns in Table PLSQL_PROFILER_DATA

Column	Datatype	Definition
runid	number	Primary key, unique (generated) run identifier
unit_number	number	Primary key, internally generated library unit number
line#	number	Primary key, not null, line number in unit
total_occur	number	Number of times line was executed
total_time	number	Total time spent executing line in nanoseconds
min_time	number	Minimum execution time for this line in nanoseconds
max_time	number	Maximum execution time for this line in nanoseconds
spare1	number	Unused
spare2	number	Unused
spare3	number	Unused
spare4	number	Unused

With Oracle8, a sample textual report writer(profrep.sql) is provided with the PL/SQL demo scripts.

Security

The profiler only gathers data for units for which a user has CREATE privilege; you cannot use the package to profile units for which EXECUTE ONLY access has been granted. In general, if a user can debug a unit, the same user can profile it. However, a unit can be profiled whether or not it has been compiled DEBUG.

Oracle advises that modules that are being profiled should be compiled DEBUG, since this provides additional information about the unit in the database

Two Methods of Exception Generation

Each routine in this package has two versions that allow you to determine how errors are reported.

- A function that returns success/failure as a status value and will never raise an exception
- A procedure that returns normally if it succeeds and raises an exception if it fails

In each case, the parameters of the function and procedure are identical. Only the method by which errors are reported differs. If there is an error, there is a correspondence between the error codes that the functions return, and the exceptions that the procedures raise.

To avoid redundancy, the following section only provides details about the functional form.

Exceptions

Table 42–4 shows the exceptions for DBMS_PROFILER.

Table 42–4 DBMS_PROFILER Exceptions

Exception	Description
version_mismatch	Corresponds to error_version.
profiler_error	Corresponds to either "error_param" or "error_io".

Error Codes

A `0` return value from any function denotes successful completion; a non-zero return value denotes an error condition. The possible errors are listed below:

- 'A subprogram was called with an incorrect parameter.'

  ```
  error_param constant binary_integer := 1;
  ```

- 'Data flush operation failed. Check whether the profiler tables have been created, are accessible, and that there is adequate space.'

```
error_io     constant binary_integer := 2;
```

- There is a mismatch between package and database implementation. Oracle returns this error if an incorrect version of the DBMS_PROFILER package is installed, and if the version of the profiler package cannot work with this database version. The only recovery is to install the correct version of the package.

  ```
  error_version constant binary_integer := -1;
  ```

Summary of DBMS_PROFILER Subprograms

Table 42–5 DBMS_PROFILER Subprograms

Subprogram	Description
"START_PROFILER Function" on page 42-7	Starts profiler data collection in the user's session.
"STOP_PROFILER Function" on page 42-8	Stops profiler data collection in the user's session.
"FLUSH_DATA Function" on page 42-8	Flushes profiler data collected in the user's session.
"PAUSE_PROFILER Function" on page 42-9	Pauses profiler data collection.
"RESUME_PROFILER Function" on page 42-9	Resumes profiler data collection.
"GET_VERSION Procedure" on page 42-9	Gets the version of this API.
"INTERNAL_VERSION_CHECK Function" on page 42-9	Verifies that this version of the DBMS_PROFILER package can work with the implementation in the database.

START_PROFILER Function

This function starts profiler data collection in the user's session.

Syntax

There are two overloaded forms of the START_PROFILER function; one returns the run number of the started run, as well as the result of the call. The other does not

return the run number. The first form is intended for use with GUI-based tools controlling the profiler.

The first form is:

```
DBMS_PROFILER.START_PROFILER(run_comment IN VARCHAR2 := sysdate,
run_comment1 IN VARCHAR2 :='',
run_number OUT BINARY_INTEGER)
RETURN BINARY_INTEGER;
```

The second form is:

```
DBMS_PROFILER.START_PROFILER(run_comment IN VARCHAR2 := sysdate,
run_comment1 IN VARCHAR2 :='')
RETURN BINARY_INTEGER;
```

Parameters

Table 42–6 START_PROFILER Function Parameters

Parameter	Description
run_comment	Each profiler run can be associated with a comment. For example, the comment could provide the name and version of the benchmark test that was used to collect data.
run_number	Stores the number of the run so you can store and later recall the run's data.
comment1	Allows you to make interesting comments about the run.

STOP_PROFILER Function

This function stops profiler data collection in the user's session.

This function has the side effect of flushing data collected so far in the session, and it signals the end of a run.

Syntax

```
DBMS_PROFILER.STOP_PROFILER
  RETURN BINARY_INTEGER;
```

FLUSH_DATA Function

This function flushes profiler data collected in the user's session. The data is flushed to database tables, which are expected to pre-exist.

Note: Use the PROFTAB.SQL script to create the tables and other data structures required for persistently storing the profiler data.

Syntax

```
DBMS_PROFILER.FLUSH_DATA
  RETURN BINARY_INTEGER;
```

PAUSE_PROFILER Function

This function pauses profiler data collection.

RESUME_PROFILER Function

This function resumes profiler data collection.

GET_VERSION Procedure

This procedure gets the version of this API.

Syntax

```
DBMS_PROFILER.GET_VERSION (
   major OUT BINARY_INTEGER,
   minor OUT BINARY_INTEGER);
```

Parameters

Table 42–7 GET_VERSION Procedure Parameters

Parameter	Description
major	Major version of DBMS_PROFILER.
minor	Minor version of DBMS_PROFILER.

INTERNAL_VERSION_CHECK Function

This function verifies that this version of the DBMS_PROFILER package can work with the implementation in the database.

Syntax

```
DBMS_PROFILER.INTERNAL_VERSION_CHECK
  RETURN BINARY_INTEGER;
```

43

DBMS_RANDOM

The DBMS_RANDOM package provides a built-in random number generator. It is faster than generators written in PL/SQL because it calls Oracle's internal random number generator.

This chapter discusses the following topics:

Requirements

DBMS_RANDOM must be initialized prior to calling the random number generator. The generator produces 8 digit integers. If the initialization subprogram is not called, then the package raises an exception.

Summary of DBMS_RANDOM Subprograms

Table 43–1 DBMS_RANDOM Package Subprograms

Subprogram	Description
"INITIALIZE Procedure" on page 43-2	Initializes the package with a seed value.
"SEED Procedure" on page 43-3	Resets the seed.
"RANDOM Function" on page 43-3	Gets the random number.
"TERMINATE Procedure" on page 43-3	Closes the package.

INITIALIZE Procedure

To use the package, first call the initialize subprogram with the seed to use.

Syntax

```
DBMS_RANDOM.INITIALIZE (
   seed  IN  BINARY_INTEGER);
```

Note: Use a seed that is sufficiently large, more than 5 digits. A single digit might not return sufficiently random numbers. Also consider getting the seed from variable values such as the time.

Parameters

Table 43–2 INITIALIZE Procedure Parameters

Parameter	Description
seed	Seed number used to generate a random number.

SEED Procedure

This procedure resets the seed.

Syntax

```
DBMS_RANDOM.SEED (
   seed  IN  BINARY_INTEGER);
```

Parameters

Table 43–3 INITIALIZE Procedure Parameters

Parameter	Description
seed	Seed number used to generate a random number.

RANDOM Function

This function gets the random number.

Syntax

```
DBMS_RANDOM.RANDOM
   RETURN BINARY_INTEGER;
```

TERMINATE Procedure

When you are finished with the package, call the TERMINATE procedure.

Syntax

```
DBMS_RANDOM.TERMINATE;
```

44

DBMS_RECTIFIER_DIFF

The DBMS_RECTIFIER_DIFF package contains APIs used to detect and resolve data inconsistencies between two replicated sites.

This chapter discusses the following topics:

Summary of DBMS_RECTIFIER_DIFF Subprograms

Table 44–1 DBMS_RECTIFIER_DIFF Package Subprograms

Subprogram	Description
"DIFFERENCES Procedure" on page 44-3	Determines the differences between two tables.
"RECTIFY Procedure" on page 44-6	Resolves the differences between two tables.

DIFFERENCES Procedure

This procedure determines the differences between two tables. It accepts the storage table of a nested table.

> **Note:** This procedure cannot be used on LOB columns, nor on columns based on user-defined types.

Syntax

```
DBMS_RECTIFIER_DIFF.DIFFERENCES (
   sname1               IN  VARCHAR2,
   oname1               IN  VARCHAR2,
   reference_site       IN  VARCHAR2 := '',
   sname2               IN  VARCHAR2,
   oname2               IN  VARCHAR2,
   comparison_site      IN  VARCHAR2 := '',
   where_clause         IN  VARCHAR2 := '',
   { column_list        IN  VARCHAR2 := '',
   | array_columns      IN  dbms_utility.name_array, }
   missing_rows_sname   IN  VARCHAR2,
   missing_rows_oname1  IN  VARCHAR2,
   missing_rows_oname2  IN  VARCHAR2,
   missing_rows_site    IN  VARCHAR2 := '',
   max_missing          IN  INTEGER,
   commit_rows          IN  INTEGER := 500);
```

> **Note:** This procedure is overloaded. The `column_list` and `array_columns` parameters are mutually exclusive.

Parameters

Table 44–2 DIFFERENCES Procedure Parameters **(Page 1 of 2)**

Parameter	Description
sname1	Name of the schema at reference_site.
oname1	Name of the table at reference_site.
reference_site	Name of the reference database site. The default, NULL, indicates the current site.
sname2	Name of the schema at comparison_site.
oname2	Name of the table at comparison_site.
comparison_site	Name of the comparison database site. The default, NULL, indicates the current site.
where_clause	Only rows satisfying this clause are selected for comparison. The default, NULL, indicates all rows are compared.
column_list	A comma-separated list of one or more column names being compared for the two tables. You must not have any spaces before or after a comma. The default, NULL, indicates that all columns will be compared.
array_columns	A PL/SQL index-by table of column names being compared for the two tables. Indexing begins at 1, and the final element of the array must be NULL. If position 1 is NULL, then all columns are used.
missing_rows_sname	Name of the schema containing the tables with the missing rows.
missing_rows_oname1	Name of an existing table at missing_rows_site that stores information about the rows in the table at reference_site that are missing from the table at comparison_site, and information about the rows at comparison_site site that are missing from the table at reference_site.
missing_rows_oname2	Name of an existing table at missing_rows_site that stores information about the missing rows. This table has three columns: the R_ID column shows the rowid of the row in the missing_rows_oname1 table, the PRESENT column shows the name of the site where the row is present, and the ABSENT column shows name of the site from which the row is absent.
missing_rows_site	Name of the site where the missing_rows_oname1 and missing_rows_oname2 tables are located. The default, NULL, indicates that the tables are located at the current site.

Table 44–2 DIFFERENCES Procedure Parameters **(Page 2 of 2)**

Parameter	Description
max_missing	Integer that specifies the maximum number of rows that should be inserted into the missing_rows_oname table. If more than max_missing rows are missing, then that many rows are inserted into missing_rows_oname, and the routine then returns normally without determining whether more rows are missing. This parameter is useful if the fragments are so different that the missing rows table has too many entries and there is no point in continuing. Raises exception badnumber if max_missing is less than 1 or NULL.
commit_rows	Maximum number of rows to insert to or delete from the reference or comparison table before a COMMIT occurs. By default, a COMMIT occurs after 500 inserts or 500 deletes. An empty string (' ') or NULL indicates that a COMMIT should be issued only after all rows for a single table have been inserted or deleted.

Exceptions

Table 44–3 DIFFERENCES Procedure Exceptions

Exception	Description
nosuchsite	Database site could not be found.
badnumber	The commit_rows parameter is less than 1.
missingprimarykey	Column list must include primary key (or SET_COLUMNS equivalent).
badname	NULL or empty string for table or schema name.
cannotbenull	Parameter cannot be NULL.
notshapeequivalent	Tables being compared are not shape equivalent. Shape refers to the number of columns, their column names, and the column datatypes.
unknowncolumn	Column does not exist.
unsupportedtype	Type not supported.
dbms_repcat.commfailure	Remote site is inaccessible.
dbms_repcat.missingobject	Table does not exist.

Restrictions

The error ORA-00001 (unique constraint violated) is issued when there are any unique or primary key constraints on the missing rows table.

RECTIFY Procedure

This procedure resolves the differences between two tables. It accepts the storage table of a nested table.

> **Note:** This procedure cannot be used on LOB columns, nor on columns based on user-defined types.

Syntax

```
DBMS_RECTIFIER_DIFF.RECTIFY (
   sname1               IN  VARCHAR2,
   oname1               IN  VARCHAR2,
   reference_site       IN  VARCHAR2 := '',
   sname2               IN  VARCHAR2,
   oname2               IN  VARCHAR2,
   comparison_site      IN  VARCHAR2 := '',
   { column_list        IN  VARCHAR2 := '',
   | array_columns      IN  dbms_utility.name_array, }
   missing_rows_sname   IN  VARCHAR2,
   missing_rows_oname1  IN  VARCHAR2,
   missing_rows_oname2  IN  VARCHAR2,
   missing_rows_site    IN  VARCHAR2 := '',
   commit_rows          IN  INTEGER := 500);
```

> **Note:** This procedure is overloaded. The column_list and array_columns parameters are mutually exclusive.

Parameters

Table 44–4 RECTIFY Procedure Parameters

Parameter	Description
sname1	Name of the schema at reference_site.
oname1	Name of the table at reference_site.
reference_site	Name of the reference database site. The default, NULL, indicates the current site.
sname2	Name of the schema at comparison_site.
oname2	Name of the table at comparison_site.
comparison_site	Name of the comparison database site. The default, NULL, indicates the current site.
column_list	A comma-separated list of one or more column names being compared for the two tables. You must not have any spaces before or after a comma. The default, NULL, indicates that all columns will be compared.
array_columns	A PL/SQL index-by table of column names being compared for the two tables. Indexing begins at 1, and the final element of the array must be NULL. If position 1 is NULL, then all columns are used.
missing_rows_sname	Name of the schema containing the tables with the missing rows.
missing_rows_oname1	Name of the table at missing_rows_site that stores information about the rows in the table at reference_site that are missing from the table at comparison_site, and information about the rows at comparison_site that are missing from the table at reference_site.
missing_rows_oname2	Name of the table at missing_rows_site that stores information about the missing rows. This table has three columns: the rowid of the row in the missing_rows_oname1 table, the name of the site at which the row is present, and the name of the site from which the row is absent.
missing_rows_site	Name of the site where the missing_rows_oname1 and missing_rows_oname2 tables are located. The default, NULL, indicates that the tables are located at the current site.
commit_rows	Maximum number of rows to insert to or delete from the reference or comparison table before a COMMIT occurs. By default, a COMMIT occurs after 500 inserts or 500 deletes. An empty string ('') or NULL indicates that a COMMIT should be issued only after all rows for a single table have been inserted or deleted.

Exceptions

Table 44–5 RECTIFY Procedure Exceptions

Exception	Description
nosuchsite	Database site could not be found.
badnumber	The commit_rows parameter is less than 1.
badname	NULL or empty string for table or schema name.
dbms_repcat.commfailure	Remote site is inaccessible.
dbms_repcat.missingobject	Table does not exist.

45

DBMS_REDEFINITION

With DBMS_REDEFINITION, you can perform an online reorganization of tables. To achieve this online reorganization, incrementally maintainable local materialized views are used. Snapshot logs need to be defined on the master tables to support incrementally maintainable materialized views. These logs keep track of the changes to the master tables and are used by the materialized views during refresh synchronization. Restrictions on the tables that can be reorganized online are as follows:

- Tables with no primary keys cannot be reorganized online.
- Tables that have materialized views and materialized view logs defined on them cannot be reorganized online.
- Tables that are materialized view container tables and AQ tables cannot be reorganized online.
- The overflow table of an IOT table cannot be reorganized online.

See Also: *Oracle9i Database Administrator's Guide* for more information.

This chapter discusses the following topics:

Summary of DBMS_REDEFINITION Subprograms

Table 45–1 DBMS_REDEFINITION Subprograms

Subprogram	Description
"CAN_REDEF_TABLE Procedure" on page 45-2	Determines if a given table can be reorganized online.
"START_REDEF_TABLE Procedure" on page 45-3	Initiates the reorganization process.
"FINISH_REDEF_TABLE Procedure" on page 45-3	Completes the reorganization process.
"SYNC_INTERIM_TABLE Procedure" on page 45-4	Keeps the interim table synchronized with the original table.
"ABORT_REDEF_TABLE Procedure" on page 45-4	Cleans up errors that occur during the reorganization process.

CAN_REDEF_TABLE Procedure

This procedure determines if a given table can be reorganized online. This is the first step of the online reorganization process. If the table is not a candidate for online redefinition, an error message is raised.

Syntax

```
DBMS_REDEFINITION.can_redef_table (
    uname  IN VARCHAR2,
    tname  IN VARCHAR2);
```

Exceptions

If the table is not a candidate for online reorganization, an error message is raised.

Parameters

Table 45–2 CAN_REDEF_TABLE Procedure Parameters

Parameter	Description
uname	The schema name of the table.
tname	The name of the table to be reorganized.

START_REDEF_TABLE Procedure

This procedure initiates the reorganization process. After verifying that the table can be reorganized online, you create an empty interim table (in the same schema as the table to be reorganized) with the desired attributes of the post-reorganization table.

Syntax

```
DBMS_REDINITION.start_redef_table (
    uname  IN VARCHAR2,
    orig_table  IN VARCHAR2,
    int_table  IN VARCHAR2,
    col_mapping  IN VARCHAR2 := NULL);
```

Parameters

Table 45–3 START_REDEF_TABLE Procedure Parameters

Parameter	Description
uname	The schema name of the tables.
orig_table	The name of the table to be reorganized.
int_table	The name of the interim table.
col_mapping	The mapping information from the columns in the interim table to the columns in the original table. (This is similar to the column list on the SELECT clause of a query.) If NULL, all the columns in the original table are selected and have the same name after reorganization.

FINISH_REDEF_TABLE Procedure

This procedure completes the reorganization process. Before this step, you can create new indexes, triggers, grants, and constraints on the interim table. The referential constraints involving the interim table must be disabled. After completing this step, the original table is reorganized with the attributes and data of the interim table. The original table is locked briefly during this procedure.

Syntax

```
DBMS_REDFINITION.finish_redef_table (
    uname  IN VARCHAR2,
    orig_table  IN VARCHAR2,
    int_table  IN VARCHAR2);
```

Parameters

Table 45–4 FINISH_REDEF_TABLE Procedure Parameters

Parameters	Description
uname	The schema name of the tables.
orig_table	The name of the table to be reorganized.
int_table	The name of the interim table.

SYNC_INTERIM_TABLE Procedure

This procedure keeps the interim table synchronized with the original table. This step is useful in minimizing the amount of synchronization needed to be done by `finish_reorg_table` before completing the online reorganization. This procedure can be called between long running operations (such as create index) on the interim table to sync it up with the data in the original table and speed up subsequent operations.

Syntax

```
DBMS_REDFINITION.sync_interim_table (
    uname  IN VARCHAR2,
    orig_table IN  VARCHAR2,
    int_table  IN VARCHAR2);
```

Parameters

Table 45–5 SYNC_INTERIM_TABLE Procedure Parameters

Parameter	Description
uname	The schema name of the table.
orig_table	The name of the table to be reorganized.
int_table	The name of the interim table.

ABORT_REDEF_TABLE Procedure

This procedure cleans up errors that occur during the reorganization process. This procedure can also be used to abort the reorganization process any time after `start_reorg_table` has been called and before `finish_reorg_table` is called.

Syntax

```
DBMS_REDEFINITION.abort_redef_table (
    uname  IN VARCHAR2,
    orig_table  IN VARCHAR2,
    int_table  IN VARCHAR2);
```

Parameters

Table 45–6 ABORT_REDEF_TABLE Procedure Parameters

Parameter	Description
uname	The schema name of the tables.
orig_table	The name of the table to be reorganized.
int_table	The name of the interim table.

46

DBMS_REFRESH

DBMS_REFRESH enables you to create groups of materialized views that can be refreshed together to a transactionally consistent point in time.

This chapter discusses the following topics:

- Summary of DBMS_REFRESH Subprograms

Summary of DBMS_REFRESH Subprograms

Table 46–1 DBMS_REFRESH Package Subprograms

Subprogram	Description
"ADD Procedure" on page 46-3	Adds materialized views to a refresh group.
"CHANGE Procedure" on page 46-4	Changes the refresh interval for a refresh group.
"DESTROY Procedure" on page 46-6	Removes all of the materialized views from a refresh group and deletes the refresh group.
"MAKE Procedure" on page 46-7	Specifies the members of a refresh group and the time interval used to determine when the members of this group should be refreshed.
"REFRESH Procedure" on page 46-10	Manually refreshes a refresh group.
"SUBTRACT Procedure" on page 46-10	Removes materialized views from a refresh group.

ADD Procedure

This procedure adds materialized views to a refresh group.

See Also: *Oracle9i Replication* for more information

Syntax

```
DBMS_REFRESH.ADD (
   name     IN VARCHAR2,
   { list   IN VARCHAR2,
   | tab    IN DBMS_UTILITY.UNCL_ARRAY, }
   lax      IN BOOLEAN := false);
```

Note: This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 46–2 ADD Procedures Parameters

Parameter	Description
name	Name of the refresh group to which you want to add members.
list	Comma-separated list of materialized views that you want to add to the refresh group. (Synonyms are not supported.)
tab	Instead of a comma-separated list, you can supply a PL/SQL index-by table of type DBMS_UTILITY.UNCL_ARRAY, where each element is the name of a materialized view. The first materialized view should be in position 1. The last position must be NULL.
lax	A materialized view can belong to only one refresh group at a time. If you are moving a materialized view from one group to another, then you must set the lax flag to true to succeed. Oracle then automatically removes the materialized view from the other refresh group and updates its refresh interval to be that of its new group. Otherwise, the call to ADD generates an error message.

CHANGE Procedure

This procedure changes the refresh interval for a refresh group.

> **See Also:** *Oracle9i Replication* for more information about refresh groups

Syntax

```
DBMS_REFRESH.CHANGE (
   name                 IN VARCHAR2,
   next_date            IN DATE           := NULL,
   interval             IN VARCHAR2       := NULL,
   implicit_destroy     IN BOOLEAN        := NULL,
   rollback_seg         IN VARCHAR2       := NULL,
   push_deferred_rpc    IN BOOLEAN        := NULL,
   refresh_after_errors IN BOOLEAN        := NULL,
   purge_option         IN BINARY_INTEGER := NULL,
   parallelism          IN BINARY_INTEGER := NULL,
   heap_size            IN BINARY_INTEGER := NULL);
```

Parameters

Table 46–3 CHANGE Procedures Parameters **(Page 1 of 2)**

Parameter	Description
name	Name of the refresh group for which you want to alter the refresh interval.
next_date	Next date that you want a refresh to occur. By default, this date remains unchanged.
interval	Function used to calculate the next time to refresh the materialized views in the refresh group. This interval is evaluated immediately before the refresh. Thus, you should select an interval that is greater than the time it takes to perform a refresh. By default, the interval remains unchanged.
implicit_destroy	Allows you to reset the value of the `implicit_destroy` flag. If this flag is set, then Oracle automatically deletes the group if it no longer contains any members. By default, this flag remains unchanged.

Table 46–3 CHANGE Procedures Parameters **(Page 2 of 2)**

Parameter	Description
rollback_seg	Allows you to change the rollback segment used. By default, the rollback segment remains unchanged. To reset this parameter to use the default rollback segment, specify NULL, including the quotes. Specifying NULL without quotes indicates that you do not want to change the rollback segment currently being used.
push_deferred_rpc	Used by updatable materialized views only. Set this parameter to true if you want to push changes from the materialized view to its associated master table or master materialized view before refreshing the materialized view. Otherwise, these changes may appear to be temporarily lost. By default, this flag remains unchanged.
refresh_after_errors	Used by updatable materialized views only. Set this parameter to true if you want the refresh to proceed even if there are outstanding conflicts logged in the DEFERROR view for the materialized view's master table or master materialized view. By default, this flag remains unchanged.
purge_option	If you are using the parallel propagation mechanism (that is, parallelism is set to 1 or greater), then: ■ 0 = do not purge ■ 1 = lazy (default) ■ 2 = aggressive In most cases, *lazy* purge is the optimal setting. Set purge to *aggressive* to trim back the queue if multiple master replication groups are pushed to different target sites, and updates to one or more replication groups are infrequent and infrequently pushed. If all replication groups are infrequently updated and pushed, then set purge to *do not purge* and occasionally execute PUSH with purge set to *aggressive* to reduce the queue.
parallelism	0 specifies serial propagation. *n* > 1 specifies parallel propagation with *n* parallel processes. 1 specifies parallel propagation using only one parallel process.
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

DESTROY Procedure

This procedure removes all of the materialized views from a refresh group and delete the refresh group.

See Also: *Oracle9i Replication* for more information refresh groups

Syntax

```
DBMS_REFRESH.DESTROY (
   name    IN    VARCHAR2);
```

Parameters

Table 46–4 DESTROY Procedure Parameters

Parameter	Description
name	Name of the refresh group that you want to destroy.

MAKE Procedure

This procedure specifies the members of a refresh group and the time interval used to determine when the members of this group should be refreshed.

See Also: *Oracle9i Replication* for more information

Syntax

```
DBMS_REFRESH.MAKE (
   name                  IN    VARCHAR2
   { list                IN    VARCHAR2,
   | tab                 IN      DBMS_UTILITY.UNCL_ARRAY,}
   next_date             IN     DATE,
   interval              IN     VARCHAR2,
   implicit_destroy      IN      BOOLEAN          := false,
   lax                   IN      BOOLEAN          := false,
   job                   IN      BINARY INTEGER   := 0,
   rollback_seg          IN      VARCHAR2         := NULL,
   push_deferred_rpc     IN      BOOLEAN          := true,
   refresh_after_errors IN       BOOLEAN          := false)
   purge_option           IN     BINARY_INTEGER := NULL,
   parallelism            IN     BINARY_INTEGER := NULL,
   heap_size              IN     BINARY_INTEGER := NULL);
```

Note: This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 46–5 MAKE Procedure Parameters **(Page 1 of 2)**

Parameter	Description
name	Unique name used to identify the refresh group. Refresh groups must follow the same naming conventions as tables.
list	Comma-separated list of materialized views that you want to refresh. (Synonyms are not supported.) These materialized views can be located in different schemas and have different master tables or master materialized views. However, all of the listed materialized views must be in your current database.
tab	Instead of a comma separated list, you can supply a PL/SQL index-by table of names of materialized views that you want to refresh using the datatype DBMS_UTILITY.UNCL_ARRAY. If the table contains the names of *n* materialized views, then the first materialized view should be in position 1 and the *n* + 1 position should be set to NULL.
next_date	Next date that you want a refresh to occur.
interval	Function used to calculate the next time to refresh the materialized views in the group. This field is used with the next_date value. For example, if you specify NEXT_DAY(SYSDATE+1, "MONDAY") as your interval, and if your next_date evaluates to Monday, then Oracle refreshes the materialized views every Monday. This interval is evaluated immediately before the refresh. Thus, you should select an interval that is greater than the time it takes to perform a refresh.
implicit_destroy	Set this to true if you want to delete the refresh group automatically when it no longer contains any members. Oracle checks this flag only when you call the SUBTRACT procedure. That is, setting this flag still enables you to create an empty refresh group.
lax	A materialized view can belong to only one refresh group at a time. If you are moving a materialized view from an existing group to a new refresh group, then you must set this to true to succeed. Oracle then automatically removes the materialized view from the other refresh group and updates its refresh interval to be that of its new group. Otherwise, the call to MAKE generates an error message.
job	Needed by the Import utility. Use the default value, 0.
rollback_seg	Name of the rollback segment to use while refreshing materialized views. The default, NULL, uses the default rollback segment.

Table 46–5 MAKE Procedure Parameters **(Page 2 of 2)**

Parameter	Description
push_deferred_rpc	Used by updatable materialized views only. Use the default value, `true`, if you want to push changes from the materialized view to its associated master table or master materialized view before refreshing the materialized view. Otherwise, these changes may appear to be temporarily lost.
refresh_after_errors	Used by updatable materialized views only. Set this to 0 if you want the refresh to proceed even if there are outstanding conflicts logged in the DEFERROR view for the materialized view's master table or master materialized view.
purge_option	If you are using the parallel propagation mechanism (in other words, parallelism is set to 1 or greater), then 0 = do not purge; 1 = lazy (default); 2 = aggressive. In most cases, *lazy* purge is the optimal setting. Set purge to *aggressive* to trim back the queue if multiple master replication groups are pushed to different target sites, and updates to one or more replication groups are infrequent and infrequently pushed. If all replication groups are infrequently updated and pushed, then set purge to *do not purge* and occasionally execute PUSH with purge set to *aggressive* to reduce the queue.
parallelism	0 specifies serial propagation. *n* > 1 specifies parallel propagation with *n* parallel processes. 1 specifies parallel propagation using only one parallel process.
heap_size	Maximum number of transactions to be examined simultaneously for parallel propagation scheduling. Oracle automatically calculates the default setting for optimal performance. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

REFRESH Procedure

This procedure manually refreshes a refresh group.

> **See Also:** *Oracle9i Replication* for more information about refresh groups

Syntax

```
DBMS_REFRESH.REFRESH (
   name   IN    VARCHAR2);
```

Parameters

Table 46–6 REFRESH Procedure Parameters

Parameter	Description
name	Name of the refresh group that you want to refresh manually.

SUBTRACT Procedure

This procedure removes materialized views from a refresh group.

> **See Also:** *Oracle9i Replication* for more information about refresh groups

Syntax

```
DBMS_REFRESH.SUBTRACT (
   name       IN    VARCHAR2,
   { list     IN    VARCHAR2,
   | tab      IN     DBMS_UTILITY.UNCL_ARRAY, }
   lax        IN     BOOLEAN := false);
```

> **Note:** This procedure is overloaded. The `list` and `tab` parameters are mutually exclusive.

Parameters

Table 46–7 SUBTRACT Procedure Parameters

Parameter	Description
name	Name of the refresh group from which you want to remove members.
list	Comma-separated list of materialized views that you want to remove from the refresh group. (Synonyms are not supported.) These materialized views can be located in different schemas and have different master tables or master materialized views. However, all of the listed materialized views must be in your current database.
tab	Instead of a comma-separated list, you can supply a PL/SQL index-by table of names of materialized views that you want to refresh using the datatype DBMS_UTILITY.UNCL_ARRAY. If the table contains the names of *n* materialized views, then the first materialized view should be in position 1 and the *n* + 1 position should be set to NULL.
lax	Set this to false if you want Oracle to generate an error message if the materialized view you are attempting to remove is not a member of the refresh group.

47

DBMS_REPAIR

DBMS_REPAIR contains data corruption repair procedures that enable you to detect and repair corrupt blocks in tables and indexes. You can address corruptions where possible and continue to use objects while you attempt to rebuild or repair them.

Note: The DBMS_REPAIR package is intended for use by database administrators only. It is not intended for use by application developers.

See Also: For detailed information about using the DBMS_REPAIR package, see *Oracle9i Database Administrator's Guide*.

This chapter discusses the following topics:

Security, Enumeration Types, and Exceptions

Security

The package is owned by SYS. Execution privilege is not granted to other users.

Enumeration Types

The DBMS_REPAIR package defines several enumerated constants that should be used for specifying parameter values. Enumerated constants must be prefixed with the package name. For example, DBMS_REPAIR.TABLE_OBJECT.

Table 47–1 lists the parameters and the enumerated constants.

Table 47–1 DBMS_REPAIR Enumeration Types

Parameter	Constant
object_type	TABLE_OBJECT, INDEX_OBJECT, CLUSTER_OBJECT
action	CREATE_ACTION, DROP_ACTION, PURGE_ACTION
table_type	REPAIR_TABLE, ORPHAN_TABLE
flags	SKIP_FLAG, NOSKIP_FLAG

Note: The default table_name will be REPAIR_TABLE when table_type is REPAIR_TABLE, and will be ORPHAN_KEY_TABLE when table_type is ORPHAN_TABLE.

Exceptions

Table 47–2 DBMS_REPAIR Exceptions

Exception	Description	Action
942	Reported by DBMS_REPAIR.ADMIN_TABLES during a DROP_ACTION when the specified table doesn't exist.	
955	Reported by DBMS_REPAIR.CREATE_ACTION when the specified table already exists.	

Table 47–2 DBMS_REPAIR Exceptions

Exception	Description	Action
24120	An invalid parameter was passed to the specified DBMS_REPAIR procedure.	Specify a valid parameter value or use the parameter's default.
24122	An incorrect block range was specified.	Specify correct values for the BLOCK_START and BLOCK_END parameters.
24123	An attempt was made to use the specified feature, but the feature is not yet implemented.	Do not attempt to use the feature.
24124	An invalid ACTION parameter was specified.	Specify CREATE_ACTION, PURGE_ACTION or DROP_ACTION for the ACTION parameter.
24125	An attempt was made to fix corrupt blocks on an object that has been dropped or truncated since DBMS_REPAIR.CHECK_OBJECT was run.	Use DBMS_REPAIR.ADMIN_TABLES to purge the repair table and run DBMS_REPAIR.CHECK_OBJECT to determine whether there are any corrupt blocks to be fixed.
24127	TABLESPACE parameter specified with an ACTION other than CREATE_ACTION.	Do not specify TABLESPACE when performing actions other than CREATE_ACTION.
24128	A partition name was specified for an object that is not partitioned.	Specify a partition name only if the object is partitioned.
24129	An attempt was made to pass a table name parameter without the specified prefix.	Pass a valid table name parameter.
24130	An attempt was made to specify a repair or orphan table that does not exist.	Specify a valid table name parameter.
24131	An attempt was made to specify a repair or orphan table that does not have a correct definition.	Specify a table name that refers to a properly created table.
24132	An attempt was made to specify a table name is greater than 30 characters long.	Specify a valid table name parameter.

Summary of DBMS_REPAIR Subprograms

Table 47–3 DBMS_REPAIR Package Subprograms

Subprogram	Description
"ADMIN_TABLES Procedure" on page 47-4	Provides administrative functions for the DBMS_REPAIR package repair and orphan key tables, including create, purge, and drop functions.
"CHECK_OBJECT Procedure" on page 47-5	Detects and reports corruptions in a table or index.
"DUMP_ORPHAN_KEYS Procedure" on page 47-7	Reports on index entries that point to rows in corrupt data blocks.
"FIX_CORRUPT_BLOCKS Procedure" on page 47-8	Marks blocks software corrupt that have been previously detected as corrupt by CHECK_OBJECT.
"REBUILD_FREELISTS Procedure" on page 47-9	Rebuilds an object's freelists.
"SKIP_CORRUPT_BLOCKS Procedure" on page 47-10	Sets whether to ignore blocks marked corrupt during table and index scans or to report ORA-1578 when blocks marked corrupt are encountered.
"SEGMENT_FIX_STATUS Procedure" on page 47-11	Fixes the corrupted state of a bitmap entry.

ADMIN_TABLES Procedure

This procedure provides administrative functions for the DBMS_REPAIR package repair and orphan key tables.

Syntax

```
DBMS_REPAIR.ADMIN_TABLES (
   table_name IN   VARCHAR2,
   table_type IN   BINARY_INTEGER,
   action     IN   BINARY_INTEGER,
   tablespace IN   VARCHAR2        DEFAULT NULL);
```

Parameters

Table 47–4 ADMIN_TABLES Procedure Parameters

Parameter	Description
table_name	Name of the table to be processed. Defaults to ORPHAN_KEY_TABLE or REPAIR_TABLE based on the specified table_type. When specified, the table name must have the appropriate prefix: ORPHAN_ or REPAIR_.
table_type	Type of table; must be either ORPHAN_TABLE or REPAIR_TABLE. See "Enumeration Types" on page 47-2.
action	Indicates what administrative action to perform. Must be either CREATE_ACTION, PURGE_ACTION, or DROP_ACTION. If the table already exists, and if CREATE_ACTION is specified, then an error is returned. PURGE_ACTION indicates to delete all rows in the table that are associated with non-existent objects. If the table does not exist, and if DROP_ACTION is specified, then an error is returned. When CREATE_ACTION and DROP_ACTION are specified, an associated view named DBA_<table_name> is created and dropped respectively. The view is defined so that rows associated with non-existent objects are eliminated. Created in the SYS schema. See "Enumeration Types" on page 47-2.
tablespace	Indicates the tablespace to use when creating a table. By default, the SYS default tablespace is used. An error is returned if the tablespace is specified and if the action is not CREATE_ACTION.

CHECK_OBJECT Procedure

This procedure checks the specified objects and populates the repair table with information about corruptions and repair directives.

Validation consists of block checking all blocks in the object. You may optionally specify a DBA range, partition name, or subpartition name when you want to check a portion of an object.

Syntax

```
DBMS_REPAIR.CHECK_OBJECT (
```

```
schema_name       IN  VARCHAR2,
object_name       IN  VARCHAR2,
partition_name    IN  VARCHAR2       DEFAULT NULL,
object_type       IN  BINARY_INTEGER DEFAULT TABLE_OBJECT,
repair_table_name IN  VARCHAR2       DEFAULT 'REPAIR_TABLE',
flags             IN  BINARY_INTEGER DEFAULT NULL,
relative_fno      IN  BINARY_INTEGER DEFAULT NULL,
block_start       IN  BINARY_INTEGER DEFAULT NULL,
block_end         IN  BINARY_INTEGER DEFAULT NULL,
corrupt_count     OUT BINARY_INTEGER);
```

Parameters

Table 47–5 CHECK_OBJECT Procedure Parameters

Parameter	Description
schema_name	Schema name of the object to be checked.
object_name	Name of the table or index to be checked.
partition_name	Partition or subpartition name to be checked. If this is a partitioned object, and if partition_name is not specified, then all partitions and subpartitions are checked. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are checked.
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or INDEX_OBJECT. See "Enumeration Types" on page 47-2.
repair_table_name	Name of the repair table to be populated. The table must exist in the SYS schema. Use the admin_tables procedure to create a repair table. The default name is REPAIR_TABLE.
flags	Reserved for future use.
relative_fno	Relative file number: Used when specifying a block range.
block_start	First block to process if specifying a block range. May be specified only if the object is a single table, partition, or subpartition.
block_end	Last block to process if specifying a block range. May be specified only if the object is a single table, partition, or subpartition. If only one of block_start or block_end is specified, then the other defaults to the first or last block in the file respectively.

Table 47–5 CHECK_OBJECT Procedure Parameters

Parameter	Description
corrupt_count	Number of corruptions reported.

DUMP_ORPHAN_KEYS Procedure

This procedure reports on index entries that point to rows in corrupt data blocks. For each such index entry encountered, a row is inserted into the specified orphan table.

If the repair table is specified, then any corrupt blocks associated with the base table are handled in addition to all data blocks that are marked software corrupt. Otherwise, only blocks that are marked corrupt are handled.

This information may be useful for rebuilding lost rows in the table and for diagnostic purposes.

Syntax

```
DBMS_REPAIR.DUMP_ORPHAN_KEYS (
   schema_name       IN  VARCHAR2,
   object_name       IN  VARCHAR2,
   partition_name    IN  VARCHAR2       DEFAULT NULL,
   object_type       IN  BINARY_INTEGER DEFAULT INDEX_OBJECT,
   repair_table_name IN  VARCHAR2       DEFAULT 'REPAIR_TABLE',
   orphan_table_name IN  VARCHAR2       DEFAULT 'ORPHAN_KEYS_TABLE',
   flags             IN  BINARY_INTEGER DEFAULT NULL,
   key_count         OUT BINARY_INTEGER);
```

Parameters

Table 47–6 DUMP_ORPHAN_KEYS Procedure Parameters

Parameter	Description
schema_name	Schema name.
object_name	Object name.
partition_name	Partition or subpartition name to be processed. If this is a partitioned object, and if partition_name is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are processed.

Table 47–6 DUMP_ORPHAN_KEYS Procedure Parameters

Parameter	Description
object_type	Type of the object to be processed. The default is INDEX_OBJECT See "Enumeration Types" on page 47-2.
repair_table_name	Name of the repair table that has information regarding corrupt blocks in the base table. The specified table must exist in the SYS schema. The admin_tables procedure is used to create the table.
orphan_table_name	Name of the orphan key table to populate with information regarding each index entry that refers to a row in a corrupt data block. The specified table must exist in the SYS schema. The admin_tables procedure is used to create the table.
flags	Reserved for future use.
key_count	Number of index entries processed.

FIX_CORRUPT_BLOCKS Procedure

This procedure fixes the corrupt blocks in specified objects based on information in the repair table that was previously generated by the check_object procedure.

Prior to effecting any change to a block, the block is checked to ensure the block is still corrupt. Corrupt blocks are repaired by marking the block software corrupt. When a repair is effected, the associated row in the repair table is updated with a fix timestamp.

Syntax

```
DBMS_REPAIR.FIX_CORRUPT_BLOCKS (
   schema_name       IN  VARCHAR2,
   object_name       IN  VARCHAR2,
   partition_name    IN  VARCHAR2       DEFAULT NULL,
   object_type       IN  BINARY_INTEGER DEFAULT TABLE_OBJECT,
   repair_table_name IN  VARCHAR2       DEFAULT 'REPAIR_TABLE',
   flags             IN  BINARY_INTEGER DEFAULT NULL,
   fix_count         OUT BINARY_INTEGER);
```

Parameters

Table 47–7 FIX_CORRUPT_BLOCKS Procedure Parameters

Parameter	Description
schema_name	Schema name.
object_name	Name of the object with corrupt blocks to be fixed.
partition_name	Partition or subpartition name to be processed. If this is a partitioned object, and if partition_name is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are processed.
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or INDEX_OBJECT. See "Enumeration Types" on page 47-2.
repair_table_name	Name of the repair table with the repair directives. Must exist in the SYS schema.
flags	Reserved for future use.
fix_count	Number of blocks fixed.

REBUILD_FREELISTS Procedure

This procedure rebuilds the freelists for the specified object. All free blocks are placed on the master freelist. All other freelists are zeroed.

If the object has multiple freelist groups, then the free blocks are distributed among all freelists, allocating to the different groups in round-robin fashion.

Syntax

```
DBMS_REPAIR.REBUILD_FREELISTS (
   schema_name    IN VARCHAR2,
   partition_name IN VARCHAR2       DEFAULT NULL,
   object_type    IN BINARY_INTEGER DEFAULT TABLE_OBJECT);
```

Parameters

Table 47–8 REBUILD_FREELISTS Procedure Parameters

Parameter	Description
schema_name	Schema name.
object_name	Name of the object whose freelists are to be rebuilt.
partition_name	Partition or subpartition name whose freelists are to be rebuilt. If this is a partitioned object, and partition_name is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and the specified partition contains subpartitions, then all subpartitions are processed.
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or INDEX_OBJECT. See "Enumeration Types" on page 47-2.

SKIP_CORRUPT_BLOCKS Procedure

This procedure enables or disables the skipping of corrupt blocks during index and table scans of the specified object.

When the object is a table, skip applies to the table and its indexes. When the object is a cluster, it applies to all of the tables in the cluster, and their respective indexes.

> **Note:** When Oracle performs an index range scan on a corrupt index after DBMS_REPAIR.SKIP_CORRUPT_BLOCKS has been set for the base table, corrupt branch blocks and root blocks are not skipped. Only corrupt non-root leaf blocks are skipped.

Syntax

```
DBMS_REPAIR.SKIP_CORRUPT_BLOCKS (
   schema_name IN VARCHAR2,
   object_name IN VARCHAR2,
   object_type IN BINARY_INTEGER DEFAULT TABLE_OBJECT,
   flags       IN BINARY_INTEGER DEFAULT SKIP_FLAG);
```

Parameters

Table 47–9 SKIP_CORRUPT_BLOCKS Procedure Parameters

Parameter	Description
schema_name	Schema name of the object to be processed.
object_name	Name of the object.
partition_name (optional)	Partition or subpartition name to be processed. If this is a partitioned object, and if partition_name is not specified, then all partitions and subpartitions are processed. If this is a partitioned object, and if the specified partition contains subpartitions, then all subpartitions are processed.
object_type	Type of the object to be processed. This must be either TABLE_OBJECT (default) or CLUSTER_OBJECT. See "Enumeration Types" on page 47-2.
flags	If SKIP_FLAG is specified, then it turns on the skip of software corrupt blocks for the object during index and table scans. If NOSKIP_FLAG is specified, then scans that encounter software corrupt blocks return an ORA-1578. See "Enumeration Types" on page 47-2.

SEGMENT_FIX_STATUS Procedure

With this procedure you can fix the corrupted state of a bitmap entry. The procedure either recalculates the state based on the current contents of the corresponding block or sets the state to a specific value.

Syntax

```
DBMS_REPAIR.SEGMENT_FIX_STATUS (
   segment_owner   IN VARCHAR2,
   segment_name    IN VARCHAR2,
   segment_type    IN BINARY_INTEGER DEFAULT TABLE_OBJECT,
   file_number     IN BINARY_INTEGER DEFAULT NULL,
   block_number    IN BINARY_INTEGER DEFAULT NULL,
   status_value    IN BINARY_INTEGER DEFAULT NULL,
   partition_name  IN VARCHAR2 DEFAULT NULL,);
```

Parameters

Table 47–10 SEGMENT_FIX_STATUS Procedure Parameters

Parameter	Description
schema_owner	Schema name of the segment.
segment_name	Segment name.
partition_name	Optional. Name of an individual partition. NULL for nonpartitioned objects. Default is NULL.
segment_type	Optional Type of the segment (for example, TABLE or INDEX). Default is NULL.
file_number	(optional) The tablespace-relative file number of the data block whose status has to be fixed. If omitted, all the blocks in the segment will be checked for state correctness and fixed.
block_number	(optional) The file-relative file number of the data block whose status has to be fixed. If omitted, all the blocks in the segment will be checked for state correctness and fixed.
status_value	(optional) The value to which the block status described by the file_number and block_number will be set. If omitted, the status will be set based on the current state of the block. This is almost always the case, but if there is a bug in the calculation algorithm, the value can be set manually. Status values: 1 = block is full 2 = block is 0-25% free 3 = block is 25-50% free 4 = block is 50-75% free 5 = block is 75-100% free The status for bitmap blocks, segment headers, and extent map blocks cannot be altered. The status for blocks in a fixed hash area cannot be altered. For index blocks, there are only two possible states: 1 = block is full and 3 = block has free space.

Examples

```
/* Fix the bitmap status for all the blocks in table mytab in schema sys */
execute dbms_repair.segment_fix_status('SYS', 'MYTAB');

/* Mark block number 45, filenumber 1 for table mytab in sys schema as FULL.*/
execute dbms_repair.segment_fix_status('SYS', 'MYTAB', 1,1, 45, 1);
```

48

DBMS_REPCAT

DBMS_REPCAT provides routines to administer and update the replication catalog and environment.

This chapter discusses the following topics:

- Summary of DBMS_REPCAT Subprograms

Summary of DBMS_REPCAT Subprograms

Table 48–1 DBMS_REPCAT Package Subprograms **(Page 1 of 6)**

Subprogram	Description
"ADD_GROUPED_COLUMN Procedure" on page 48-8	Adds members to an existing column group.
"ADD_MASTER_DATABASE Procedure" on page 48-9	Adds another master site to your replication environment.
"ADD_NEW_MASTERS Procedure" on page 48-11	Adds the master sites in the DBA_REPSITES_NEW data dictionary view to the replication catalog at all available master sites.
"ADD_PRIORITY_datatype Procedure" on page 48-17	Adds a member to a priority group.
"ADD_SITE_PRIORITY_SITE Procedure" on page 48-19	Adds a new site to a site priority group.
"ADD_conflicttype_RESOLUTION Procedure" on page 48-20	Designates a method for resolving an update, delete, or uniqueness conflict.
"ALTER_CATCHUP_PARAMETERS Procedure" on page 48-26	Alters the values for parameters stored in the DBA_REPEXTENSIONS data dictionary view.
"ALTER_MASTER_PROPAGATION Procedure" on page 48-28	Alters the propagation method for a specified replication group at a specified master site.
"ALTER_MASTER_REPOBJECT Procedure" on page 48-29	Alters an object in your replication environment.
"ALTER_MVIEW_PROPAGATION Procedure" on page 48-32	Alters the propagation method for a specified replication group at the current materialized view site.
"ALTER_PRIORITY Procedure" on page 48-34	Alters the priority level associated with a specified priority group member.
"ALTER_PRIORITY_datatype Procedure" on page 48-35	Alters the value of a member in a priority group.
"ALTER_SITE_PRIORITY Procedure" on page 48-37	Alters the priority level associated with a specified site.
"ALTER_SITE_PRIORITY_SITE Procedure" on page 48-39	Alters the site associated with a specified priority level.

Table 48–1 DBMS_REPCAT Package Subprograms **(Page 2 of 6)**

Subprogram	Description
"CANCEL_STATISTICS Procedure" on page 48-40	Stops collecting statistics about the successful resolution of update, uniqueness, and delete conflicts for a table.
"COMMENT_ON_COLUMN_GROUP Procedure" on page 48-41	Updates the comment field in the ALL_REPCOLUMN_GROUP view for a column group.
"COMMENT_ON_conflicttype_RESOLUTION Procedure" on page 48-48	Updates the SCHEMA_COMMENT field in the ALL_REPGROUP view for a materialized view site.
"COMMENT_ON_PRIORITY_GROUP/COMMENT_ON_SITE_PRIORITY Procedures" on page 48-43	Updates the comment field in the ALL_REPPRIORITY_GROUP view for a (site) priority group.
"COMMENT_ON_REPGROUP Procedure" on page 48-44	Updates the comment field in the ALL_REPGROUP view for a master group.
"COMMENT_ON_REPOBJECT Procedure" on page 48-45	Updates the comment field in the ALL_REPOBJECT view for a replicated object.
"COMMENT_ON_REPSITES Procedure" on page 48-46	Updates the comment field in the ALL_REPSITE view for a replicated site.
"COMMENT_ON_conflicttype_RESOLUTION Procedure" on page 48-48	Updates the comment field in the ALL_REPRESOLUTION view for a conflict resolution routine.
"COMPARE_OLD_VALUES Procedure" on page 48-50	Specifies whether to compare old column values at each master site for each nonkey column of a replicated table for updates and deletes.
"CREATE_MASTER_REPGROUP Procedure" on page 48-52	Creates a new, empty, quiesced master group.
"CREATE_MASTER_REPOBJECT Procedure" on page 48-53	Specifies that an object is a replicated object.
"CREATE_MVIEW_REPGROUP Procedure" on page 48-57	Creates a new, empty materialized view group in your local database.
"CREATE_MVIEW_REPOBJECT Procedure" on page 48-58	Adds a replicated object to a materialized view group.
"DEFINE_COLUMN_GROUP Procedure" on page 48-61	Creates an empty column group.
"DEFINE_PRIORITY_GROUP Procedure" on page 48-62	Creates a new priority group for a master group.

Table 48–1 DBMS_REPCAT Package Subprograms **(Page 3 of 6)**

Subprogram	Description
"DEFINE_SITE_PRIORITY Procedure" on page 48-64	Creates a new site priority group for a master group.
"DO_DEFERRED_REPCAT_ADMIN Procedure" on page 48-65	Executes the local outstanding deferred administrative procedures for the specified master group at the current master site, or for all master sites.
"DROP_COLUMN_GROUP Procedure" on page 48-66	Drops a column group.
"DROP_GROUPED_COLUMN Procedure" on page 48-67	Removes members from a column group.
"DROP_MASTER_REPGROUP Procedure" on page 48-68	Drops a master group from your current site.
"DROP_MASTER_REPOBJECT Procedure" on page 48-69	Drops a replicated object from a master group.
"DROP_PRIORITY Procedure" on page 48-73	Drops a replicated object from a master group.
"DROP_MVIEW_REPGROUP Procedure" on page 48-71	Drops a materialized view site from your replication environment.
"DROP_MVIEW_REPOBJECT Procedure" on page 48-72	Drops a replicated object from a materialized view site.
"DROP_PRIORITY Procedure" on page 48-73	Drops a member of a priority group by priority level.
"DROP_PRIORITY_GROUP Procedure" on page 48-74	Drops a priority group for a specified master group.
"DROP_PRIORITY_datatype Procedure" on page 48-75	Drops a member of a priority group by value.
"DROP_SITE_PRIORITY Procedure" on page 48-76	Drops a site priority group for a specified master group.
"DROP_SITE_PRIORITY_SITE Procedure" on page 48-77	Drops a specified site, by name, from a site priority group.
"DROP_conflicttype_RESOLUTION Procedure" on page 48-78	Drops an update, delete, or uniqueness conflict resolution method.
"EXECUTE_DDL Procedure" on page 48-80	Supplies DDL that you want to have executed at each master site.

Table 48–1 DBMS_REPCAT Package Subprograms **(Page 4 of 6)**

Subprogram	Description
"GENERATE_MVIEW_SUPPORT Procedure" on page 48-82	Activates triggers and generate packages needed to support the replication of updatable materialized views or procedural replication.
"GENERATE_REPLICATION_ SUPPORT Procedure" on page 48-83	Generates the triggers, packages, and procedures needed to support replication for a specified object.
"MAKE_COLUMN_GROUP Procedure" on page 48-85	Creates a new column group with one or more members.
"PREPARE_INSTANTIATED_MASTER Procedure" on page 48-87	Changes the global name of the database you are adding to a master group.
"PURGE_MASTER_LOG Procedure" on page 48-88	Removes local messages in the DBA_REPCATLOG associated with a specified identification number, source, or master group.
"PURGE_STATISTICS Procedure" on page 89	Removes information from the ALL_ REPRESOLUTION_STATISTICS view.
"REFRESH_MVIEW_REPGROUP Procedure" on page 48-90	Refreshes a materialized view group with the most recent data from its associated master site or master materialized view site.
"REGISTER_MVIEW_REPGROUP Procedure" on page 48-92	Facilitates the administration of materialized views at their respective master sites or master materialized view sites by inserting, modifying, or deleting from DBA_REGISTERED_MVIEW_ GROUPS.
"REGISTER_STATISTICS Procedure" on page 48-94	Collects information about the successful resolution of update, delete, and uniqueness conflicts for a table.
"RELOCATE_MASTERDEF Procedure" on page 95	Changes your master definition site to another master site in your replication environment.
"REMOVE_MASTER_DATABASES Procedure" on page 48-97	Removes one or more master databases from a replication environment.
"RENAME_SHADOW_COLUMN_ GROUP Procedure" on page 48-98	Renames the shadow column group of a replicated table to make it a named column group.

Table 48–1 DBMS_REPCAT Package Subprograms **(Page 5 of 6)**

Subprogram	Description
"REPCAT_IMPORT_CHECK Procedure" on page 48-99	Ensures that the objects in the master group have the appropriate object identifiers and status values after you perform an export/import of a replicated object or an object used by the advanced replication facility.
"RESUME_MASTER_ACTIVITY Procedure" on page 48-100	Resumes normal replication activity after quiescing a replication environment.
"RESUME_PROPAGATION_TO_MDEF Procedure" on page 48-101	Indicates that export is effectively finished and propagation for both extended and unaffected replication groups existing at master sites can be enabled.
"SEND_OLD_VALUES Procedure" on page 48-102	Specifies whether to send old column values for each nonkey column of a replicated table for updates and deletes.
"SET_COLUMNS Procedure" on page 48-105	Specifies use of an alternate column or group of columns, instead of the primary key, to determine which columns of a table to compare when using row-level replication.
"SPECIFY_NEW_MASTERS Procedure" on page 48-107	Specifies the master sites you intend to add to an existing replication group without quiescing the group.
"SUSPEND_MASTER_ACTIVITY Procedure" on page 48-109	Suspends replication activity for a master group.
"SWITCH_MVIEW_MASTER Procedure" on page 48-110	Changes the master site of a materialized view group to another master site.
"UNDO_ADD_NEW_MASTERS_ REQUEST Procedure" on page 48-111	Undoes all of the changes made by the `SPECIFY_NEW_MASTERS` and `ADD_NEW_ MASTERS` procedures for a specified `extension_id`.
"UNREGISTER_MVIEW_REPGROUP Procedure" on page 48-114	Facilitates the administration of materialized views at their respective master sites and master materialized view sites by inserting, modifying, or deleting from `DBA_REGISTERED_MVIEW_ GROUPS`.
"VALIDATE Function" on page 48-114	Validates the correctness of key conditions of a multimaster replication environment.

Table 48–1 DBMS_REPCAT Package Subprograms **(Page 6 of 6)**

Subprogram	Description
"WAIT_MASTER_LOG Procedure" on page 48-118	Determines whether changes that were asynchronously propagated to a master site have been applied.

ADD_GROUPED_COLUMN Procedure

This procedure adds members to an existing column group. You must call this procedure from the master definition site.

Syntax

```
DBMS_REPCAT.ADD_GROUPED_COLUMN (
   sname                 IN   VARCHAR2,
   oname                 IN   VARCHAR2,
   column_group          IN   VARCHAR2,
   list_of_column_names  IN   VARCHAR2 | DBMS_REPCAT.VARCHAR2s);
```

Parameters

Table 48–2 ADD_GROUPED_COLUMN Procedure Parameters

Parameter	Description
sname	Schema in which the replicated table is located.
oname	Name of the replicated table with which the column group is associated. The table can be the storage table of a nested table.
column_group	Name of the column group to which you are adding members.
list_of_column_names	Names of the columns that you are adding to the designated column group. This can either be a comma-separated list or a PL/SQL index-by table of column names. The PL/SQL index-by table must be of type DBMS_REPCAT.VARCHAR2. Use the single value '*' to create a column group that contains all of the columns in your table. You can specify column objects, but you cannot specify attributes of column objects. If the table is an object, then you can specify SYS_NC_OID$ to add the object identifier column to the column group. This column tracks the object identifier of each row object. If the table is a storage table of a nested table, then you can specify NESTED_TABLE_ID to add the column that tracks the identifier for each row of the nested table.

Table 48–3 ADD_GROUPED_COLUMN Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified table does not exist.
missinggroup	Specified column group does not exist.
missingcolumn	Specified column does not exist in the specified table.
duplicatecolumn	Specified column is already a member of another column group.
missingschema	Specified schema does not exist.
notquiesced	Replication group to which the specified table belongs is not quiesced.

ADD_MASTER_DATABASE Procedure

This procedure adds another master site to your replication environment. This procedure regenerates all the triggers and their associated packages at existing master sites. You must call this procedure from the master definition site.

Syntax

```
DBMS_REPCAT.ADD_MASTER_DATABASE (
   gname                IN   VARCHAR2,
   master               IN   VARCHAR2,
   use_existing_objects IN   BOOLEAN  := true,
   copy_rows            IN   BOOLEAN  := true,
   comment              IN   VARCHAR2 := '',
   propagation_mode     IN   VARCHAR2 := 'ASYNCHRONOUS',
   fname                IN   VARCHAR2 := NULL);
```

Parameters

Table 48–4 ADD_MASTER_DATABASE Procedure Parameters

Parameter	Description
gname	Name of the replication group being replicated. This replication group must already exist at the master definition site.
master	Fully qualified database name of the new master database.
use_existing_objects	Indicate `true` if you want to reuse any objects of the same type and shape that already exist in the schema at the new master site.
copy_rows	Indicate `true` if you want the initial contents of a table at the new master site to match the contents of the table at the master definition site.
comment	This comment is added to the `MASTER_COMMENT` field of the `DBA_REPSITES` view.
propagation_mode	Method of forwarding changes to and receiving changes from new master database. Accepted values are `synchronous` and `asynchronous`.
fname	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 48–5 ADD_MASTER_DATABASE Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
notquiesced	Replication has not been suspended for the master group.
missingrepgroup	Replication group does not exist at the specified database site.
commfailure	New master is not accessible.
typefailure	An incorrect propagation mode was specified.
notcompat	Compatibility mode must be 7.3.0.0 or greater.
duplrepgrp	Master site already exists.

ADD_NEW_MASTERS Procedure

This procedure adds the master sites in the DBA_REPSITES_NEW data dictionary view to the master groups specified when the SPECIFY_NEW_MASTERS procedure was run. Information about these new master sites are added to the replication catalog at all available master sites.

All master sites instantiated with object-level export/import must be accessible at this time. Their new replication groups are added in the quiesced state. Master sites instantiated through full database export/import or through changed-based recovery do not need to be accessible.

Run this procedure after you run the SPECIFY_NEW_MASTERS procedure.

Caution: After running this procedure, do not disable or enable propagation of the deferred transactions queue until after the new master sites are added. The DBA_REPEXTENSIONS data dictionary view must be clear before you disable or enable propagation. You can use the Replication Management tool or the SET_DISABLED procedure in the DBMS_DEFER_SYS package to disable or enable propagation.

See Also: "SPECIFY_NEW_MASTERS Procedure" on page 48-107

Syntax

```
DBMS_REPCAT.ADD_NEW_MASTERS (
   export_required                IN    BOOLEAN,
   { available_master_list        IN    VARCHAR2,
    | available_master_table       IN    DBMS_UTILITY.DBLINK_ARRAY,}
   masterdef_flashback_scn        OUT   NUMBER,
   extension_id                   OUT   RAW,
   break_trans_to_masterdef       IN    BOOLEAN   := false,
   break_trans_to_new_masters     IN    BOOLEAN   := false,
   percentage_for_catchup_mdef    IN    BINARY_INTEGER  := 100,
   cycle_seconds_mdef             IN    BINARY_INTEGER  := 60,
   percentage_for_catchup_new     IN    BINARY_INTEGER  := 100,
   cycle_seconds_new              IN    BINARY_INTEGER  := 60);
```

Note: This procedure is overloaded. The `available_master_list` and `available_master_table` parameters are mutually exclusive.

Parameters

Table 48–6 ADD_NEW_MASTERS Procedure Parameters **(Page 1 of 3)**

Parameter	Description
export_required	Set to `true` if either object-level or full database export is required for at least one of the new master sites. Set to `false` if you are using change-based recovery for all of the new master sites.
available_master_list	A comma-separated list of the new master sites to be instantiated using object-level export/import. The sites listed must match the sites specified in the SPECIFY_NEW_MASTERS procedure. List only the new master sites, not the existing master sites. Do not put any spaces between site names. Specify NULL if all masters will be instantiated using full database export/import or change-based recovery.
available_master_table	A table that lists the new master sites to be instantiated using object-level export/import. The sites in the table must match the sites specified in the SPECIFY_NEW_MASTERS procedure. Do not specify masters that will be instantiated using full database export/import or change-based recovery. In the table that lists the master sites to be instantiated using object-level export/import, list only the new master sites for the master groups being extended. Do not list the existing master sites in the master groups being extended. The first master site should be at position 1, the second at position 2, and so on.
masterdef_flashback_scn	This OUT parameter returns a system change number (SCN) that must be used during export or change-based recovery. Use the value returned by this parameter for the FLASHBACK_SCN export parameter when you perform the export. You can find the `flashback_scn` value by querying the DBA_REPEXTENSIONS data dictionary view.
extension_id	This OUT parameter returns an identifier for the current pending request to add master databases without quiesce. You can find the `extension_id` by querying the DBA_REPSITES_NEW and DBA_REPEXTENSIONS data dictionary views.

Table 48–6 ADD_NEW_MASTERS Procedure Parameters **(Page 2 of 3)**

Parameter	Description
break_trans_to_masterdef	This parameter is meaningful only if `export_required` is set to `true`. If `break_trans_to_masterdef` is set to `true`, then existing masters may continue to propagate their deferred transactions to the master definition site for replication groups that are not adding master sites. Deferred transactions for replication groups that are adding master sites cannot be propagated until the export completes. Each deferred transaction is composed of one or more remote procedure calls (RPCs). If set to `false` and a transaction occurs that references objects in both unaffected master groups and master groups that are being extended, then the transaction may be split into two parts and sent to a destination in two separate transactions at different times. Such transactions are called split-transactions. If split-transactions are possible, then you must disable integrity constraints that may be violated by this behavior until the new master sites are added. If `break_trans_to_masterdef` is set to `false`, then existing masters cannot propagate their deferred transactions to the master definition site.
break_trans_to_new_masters	If `break_trans_to_new_masters` is set to `true`, then existing master sites may continue to propagate deferred transactions to the new master sites for replication groups that are not adding master sites. Each deferred transaction is composed of one or more remote procedure calls (RPCs). If set to `true` and a transaction occurs that references objects in both unaffected master groups and master groups that are being extended, then the transaction may be split into two parts and sent to a destination in two separate transactions at different times. Such transactions are called split-transactions. If split-transactions are possible, then you must disable integrity constraints that may be violated by this behavior until the new master sites are added. If `break_trans_to_new_masters` is set to `false`, then propagation of deferred transaction queues to the new masters is disabled.

Table 48–6 ADD_NEW_MASTERS Procedure Parameters **(Page 3 of 3)**

Parameter	Description
percentage_for_catchup_mdef	This parameter is meaningful only if `export_required` and `break_trans_to_masterdef` are both set to `true`. The percentage of propagation resources that should be used for catching up propagation to the master definition site. Must be a multiple of 10 and must be between 0 and 100.
cycle_seconds_mdef	This parameter is meaningful when `percentage_for_catchup_mdef` is both meaningful and set to a value between 10 and 90, inclusive. In this case, propagation to the masterdef alternates between replication groups that are not being extended and replication groups that are being extended, with one push to each during each cycle. This parameter indicates the length of the cycle in seconds.
percentage_for_catchup_new	This parameter is meaningful only if `break_trans_to_new_masters` is set to `true`. The percentage of propagation resources that should be used for catching up propagation to new master sites. Must be a multiple of 10 and must be between 0 and 100.
cycle_seconds_new	This parameter is meaningful when `percentage_for_catchup_new` is both meaningful and set to a value between 10 and 90, inclusive. In this case, propagation to a new master alternates between replication groups that are not being extended and replication groups that are being extended, with one push to each during each cycle. This parameter indicates the length of the cycle in seconds.

Exceptions

Table 48–7 ADD_NEW_MASTERS Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
typefailure	The parameter value specified for one of the parameters is not appropriate.
novalidextreq	No valid extension request. The extension_id is not valid.
nonewsites	No new master sites to be added for the specified extension request.
notanewsite	Not a new site for extension request. A site was specified that was not specified when you ran the SPECIFY_NEW_MASTERS procedure.
dbnotcompatible	Feature is incompatible with database version. All databases must be at 9.0.0 or higher compatibility level.

Usage Notes

For a new master site to be instantiated using change-based recovery or full database export/import, the following conditions apply:

- The new master sites cannot have any existing replication groups.
- The master definition site cannot have any materialized view groups.
- The master definition site must be the same for all of the master groups. If one or more of these master groups have a different master definition site, then do not use change-based recovery or full database export/import. Use object-level export/import instead.
- The new master site must include all of the replication groups in the master definition site when the extension process is complete. That is, you cannot add a subset of the master groups at the master definition site to the new master site; all of the groups must be added.

> **Note:** To use change-based recovery, the existing master site and the new master site must be running under the same operating system, although the release of the operating system can differ.

For object-level export/import, before importing ensure that all the requests in the DBA_REPCATLOG data dictionary view for the extended groups have been processed without any error.

ADD_PRIORITY_*datatype* Procedure

This procedure adds a member to a priority group. You must call this procedure from the master definition site. The procedure that you must call is determined by the datatype of your `priority` column. You must call this procedure once for each of the possible values of the `priority` column.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.ADD_PRIORITY_datatype (
   gname              IN   VARCHAR2,
   pgroup             IN   VARCHAR2,
   value              IN   datatype,
   priority           IN   NUMBER);
```

where *datatype*:

```
{ NUMBER
| VARCHAR2
| CHAR
| DATE
| RAW
| NCHAR
| NVARCHAR2 }
```

Parameters

Table 48–8 ADD_PRIORITY_datatype Procedure Parameters

Parameter	Description
gname	Master group for which you are creating a priority group.
pgroup	Name of the priority group.
value	Value of the priority group member. This is one of the possible values of the associated priority column of a table using this priority group.
priority	Priority of this value. The higher the number, the higher the priority.

Exceptions

Table 48–9 ADD_PRIORITY_datatype Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
duplicatevalue	Specified value already exists in the priority group.
duplicatepriority	Specified priority already exists in the priority group.
missingrepgroup	Specified master group does not exist.
missingprioritygroup	Specified priority group does not exist.
typefailure	Specified value has the incorrect datatype for the priority group.
notquiesced	Specified master group is not quiesced.

ADD_SITE_PRIORITY_SITE Procedure

This procedure adds a new site to a site priority group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.ADD_SITE_PRIORITY_SITE (
   gname          IN   VARCHAR2,
   name           IN   VARCHAR2
   site           IN   VARCHAR2,
   priority       IN   NUMBER);
```

Parameters

Table 48–10 ADD_SITE_PRIORITY_SITE Procedure Parameters

Parameter	Description
gname	Master group for which you are adding a site to a group.
name	Name of the site priority group to which you are adding a member.
site	Global database name of the site that you are adding.
priority	Priority level of the site that you are adding. A higher number indicates a higher priority level.

Exceptions

Table 48–11 ADD_SITE_PRIORITY_SITE Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingpriority	Specified site priority group does not exist.
duplicatepriority	Specified priority level already exists for another site in the group.
duplicatevalue	Specified site already exists in the site priority group.
notquiesced	Master group is not quiesced.

ADD_*conflicttype*_RESOLUTION Procedure

These procedures designate a method for resolving an update, delete, or uniqueness conflict. You must call these procedures from the master definition site. The procedure that you need to call is determined by the type of conflict that the routine resolves.

Table 48–12 ADD_conflicttype_RESOLUTION Procedures

Conflict Type	Procedure Name
update	ADD_UPDATE_RESOLUTION
uniqueness	ADD_UNIQUE_RESOLUTION
delete	ADD_DELETE_RESOLUTION

See Also: *Oracle9i Replication* for more information about designating methods to resolve update conflicts, selecting uniqueness conflict resolution methods, and assigning delete conflict resolution methods

Syntax

```
DBMS_REPCAT.ADD_UPDATE_RESOLUTION (
   sname                  IN   VARCHAR2,
   oname                  IN   VARCHAR2,
   column_group           IN   VARCHAR2,
   sequence_no            IN   NUMBER,
   method                 IN   VARCHAR2,
   parameter_column_name  IN   VARCHAR2
                               | DBMS_REPCAT.VARCHAR2s
                               | DBMS_UTILITY.LNAME_ARRAY,
   priority_group         IN   VARCHAR2     := NULL,
   function_name          IN   VARCHAR2     := NULL,
   comment                IN   VARCHAR2     := NULL);

DBMS_REPCAT.ADD_DELETE_RESOLUTION (
   sname                  IN   VARCHAR2,
   oname                  IN   VARCHAR2,
   sequence_no            IN   NUMBER,
   parameter_column_name  IN   VARCHAR2 | DBMS_REPCAT.VARCHAR2s,
   function_name          IN   VARCHAR2,
   comment                IN   VARCHAR2     := NULL
   method                 IN   VARCHAR2     := 'USER FUNCTION');

DBMS_REPCAT.ADD_UNIQUE_RESOLUTION(
   sname                 IN   VARCHAR2,
   oname                 IN   VARCHAR2,
   constraint_name       IN   VARCHAR2,
   sequence_no           IN   NUMBER,
   method                IN   VARCHAR2,
   parameter_column_name IN   VARCHAR2
                              | DBMS_REPCAT.VARCHAR2s
                              | DBMS_UTILITY.LNAME_ARRAY,
   function_name         IN   VARCHAR2     := NULL,
   comment               IN   VARCHAR2     := NULL);
```

Parameters

Table 48–13 ADD_conflicttype_RESOLUTION Procedure Parameters **(Page 1 of 2)**

Parameter	Description
sname	Name of the schema containing the table to be replicated.
oname	Name of the table to which you are adding a conflict resolution routine. The table can be the storage table of a nested table.
column_group	Name of the column group to which you are adding a conflict resolution routine. Column groups are required for update conflict resolution routines only.
constraint_name	Name of the unique constraint or unique index for which you are adding a conflict resolution routine. Use the name of the unique index if it differs from the name of the associated unique constraint. Constraint names are required for uniqueness conflict resolution routines only.
sequence_no	Order in which the designated conflict resolution methods should be applied.
method	Type of conflict resolution routine that you want to create. This can be the name of one of the standard routines provided with advanced replication, or, if you have written your own routine, you should choose `user function`, and provide the name of your method as the `function_name` parameter. The standard methods supported in this release for update conflicts are: ▪ `minimum` ▪ `maximum` ▪ `latest timestamp` ▪ `earliest timestamp` ▪ `additive`, `average` ▪ `priority group` ▪ `site priority` ▪ `overwrite` ▪ `discard` The standard methods supported in this release for uniqueness conflicts are: `append site name`, `append sequence`, and `discard`. There are no built-in (Oracle supplied) methods for delete conflicts.

Table 48–13 ADD_conflicttype_RESOLUTION Procedure Parameters **(Page 2 of 2)**

Parameter	Description
parameter_column_name	Name of the columns used to resolve the conflict. The standard methods operate on a single column. For example, if you are using the `latest timestamp` method for a column group, then you should pass the name of the column containing the timestamp value as this parameter. If your are using a `user function`, then you can resolve the conflict using any number of columns. For update or unique conflicts, this parameter accepts either a comma-separated list of column names, or a PL/SQL index-by table of type `DBMS_REPCAT.VARCHAR2` or `DBMS_UTILITY.LNAME_ARRAY`. Use `DBMS_UTILITY.LNAME_ARRAY` if any column name is greater than or equal to 30 bytes, which may occur when you specify the attributes of column objects. For delete conflicts, this parameter accepts either a comma-separated list of column names or a PL/SQL index-by table of type `DBMS_REPCAT.VARCHAR2`. The single value `'*'` indicates that you want to use all of the columns in the table (or column group, for update conflicts) to resolve the conflict. If you specify `'*'`, then the columns are passed to your function in alphabetical order. LOB columns cannot be specified for this parameter. **See Also:** "Usage Notes" on page 48-25 if you are using column objects
priority_group	If you are using the `priority group` or `site priority` update conflict resolution method, then you must supply the name of the priority group that you have created. See *Oracle9i Replication* for more information. If you are using a different method, you can use the default value for this parameter, `NULL`. This parameter is applicable to update conflicts only.
function_name	If you selected the `user function` method, or if you are adding a delete conflict resolution routine, then you must supply the name of the conflict resolution routine that you have written. If you are using one of the standard methods, then you can use the default value for this parameter, `NULL`.
comment	This user comment is added to the `DBA_REPRESOLUTION` view.

Exceptions

Table 48–14 ADD_conflicttype_RESOLUTION Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist as a table in the specified schema using row-level replication.
missingschema	Specified schema does not exist.
missingcolumn	Column that you specified as part of the parameter_column_name parameter does not exist.
missinggroup	Specified column group does not exist.
missingprioritygroup	The priority group that you specified does not exist for the table.
invalidmethod	Resolution method that you specified is not recognized.
invalidparameter	Number of columns that you specified for the parameter_column_name parameter is invalid. (The standard routines take only one column name.)
missingfunction	User function that you specified does not exist.
missingconstraint	Constraint that you specified for a uniqueness conflict does not exist.
notquiesced	Replication group to which the specified table belongs is not quiesced.
duplicateresolution	Specified conflict resolution method is already registered.
duplicatesequence	The specified sequence number already exists for the specified object.
invalidprioritygroup	The specified priority group does not exist.
paramtype	Type is different from the type assigned to the priority group.

Usage Notes

If you are using column objects, then whether you can specify the attributes of the column objects for the `parameter_column_name` parameter depends on whether the conflict resolution method is built-in (Oracle supplied) or user-created:

- If you are using a built-in conflict resolution method, then you can specify attributes of objects for this parameter. For example, if a column object named `cust_address` has `street_address` as an attribute, then you can specify `cust_address.street_address` for this parameter.
- If you are using a built-in conflict resolution method, the following types of columns cannot be specified for this parameter: LOB attribute of a column object, collection or collection attribute of a column object, REF, or an entire column object.
- If you are using a user-created conflict resolution method, then you must specify an entire column object. You cannot specify the attributes of a column object. For example, if a column object named `cust_address` has `street_address` as an attribute (among other attributes), then you can specify only `cust_address` for this parameter.

ALTER_CATCHUP_PARAMETERS Procedure

This procedure alters the values for the following parameters stored in the DBA_REPEXTENSIONS data dictionary view:

- percentage_for_catchup_mdef
- cycle_seconds_mdef
- percentage_for_catchup_new
- cycle_seconds_new

These parameters were originally set by the ADD_NEW_MASTERS procedure. The new values you specify for these parameters are used during the remaining steps in the process of adding new master sites to a master group. These changes are only to the site at which it is executed. Therefore, it must be executed at each master site, including the master definition site, if you want to alter parameters at all sites.

See Also: "ADD_NEW_MASTERS Procedure" on page 48-11

Syntax

```
DBMS_REPCAT.ALTER_CATCHUP_PARAMETERS (
   extension_id                  IN    RAW,
   percentage_for_catchup_mdef   IN    BINARY_INTEGER  := NULL,
   cycle_seconds_mdef            IN    BINARY_INTEGER  := NULL,
   percentage_for_catchup_new    IN    BINARY_INTEGER  := NULL,
   cycle_seconds_new             IN    BINARY_INTEGER  := NULL);
```

Parameters

Table 48–15 ALTER_CATCHUP_PARAMETERS Procedure Parameters

Parameter	Description
extension_id	The identifier for the current pending request to add master database without quiesce. You can find the extension_id by querying the DBA_REPSITES_NEW and DBA_REPEXTENSIONS data dictionary views.
percentage_for_catchup_mdef	The percentage of propagation resources that should be used for catching up propagation to the master definition site. Must be a multiple of 10 and must be between 0 and 100.
cycle_seconds_mdef	This parameter is meaningful when percentage_for_catchup_mdef is both meaningful and set to a value between 10 and 90, inclusive. In this case, propagation to the masterdef alternates between replication groups that are not being extended and replication groups that are being extended, with one push to each during each cycle. This parameter indicates the length of the cycle in seconds.
percentage_for_catchup_new	The percentage of propagation resources that should be used for catching up propagation to new master sites. Must be a multiple of 10 and must be between 0 and 100.
cycle_seconds_new	This parameter is meaningful when percentage_for_catchup_new is both meaningful and set to a value between 10 and 90, inclusive. In this case, propagation to a new master alternates between replication groups that are not being extended and replication groups that are being extended, with one push to each during each cycle. This parameter indicates the length of the cycle in seconds.

Exceptions

Table 48–16 ALTER_CATCHUP_PARAMETERS Procedure Exceptions

Exception	Description
typefailure	The parameter value specified for one of the parameters is not appropriate.
dbnotcompatible	Feature is incompatible with database version. All databases must be at 9.0.0 or higher compatibility level.

ALTER_MASTER_PROPAGATION Procedure

This procedure alters the propagation method for a specified replication group at a specified master site. This replication group must be quiesced. You must call this procedure from the master definition site. If the master appears in the dblink_list or dblink_table, then ALTER_MASTER_PROPAGATION ignores that database link. You cannot change the propagation mode from a master to itself.

Syntax

```
DBMS_REPCAT.ALTER_MASTER_PROPAGATION (
   gname               IN   VARCHAR2,
   master              IN   VARCHAR2,
   { dblink_list       IN   VARCHAR2,
   | dblink_table      IN   dbms_utility.dblink_array,}
   propagation_mode    IN   VARCHAR2 : ='asynchronous',
   comment             IN   VARCHAR2 := '');
```

Note: This procedure is overloaded. The dblink_list and dblink_table parameters are mutually exclusive.

Parameters

Table 48–17 ALTER_MASTER_PROPAGATION Procedure Parameters

Parameter	Description
gname	Name of the replication group to which to alter the propagation mode.
master	Name of the master site at which to alter the propagation mode.
dblink_list	A comma-separated list of database links for which to alter the propagation method. If NULL, then all masters except the master site being altered are used by default.
dblink_table	A PL/SQL index-by table, indexed from position 1, of database links for which to alter propagation.
propagation_mode	Determines the manner in which changes from the specified master site are propagated to the sites identified by the list of database links. Appropriate values are synchronous and asynchronous.
comment	This comment is added to the DBA_REPPROP view.

Exceptions

Table 48–18 ALTER_MASTER_PROPAGATION Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
notquiesced	Invocation site is not quiesced.
typefailure	Propagation mode specified was not recognized.
nonmaster	List of database links includes a site that is not a master site.

ALTER_MASTER_REPOBJECT Procedure

This procedure alters an object in your replication environment. You must call this procedure from the master definition site.

This procedure requires that you quiesce the master group of the object if either of the following conditions is true:

- You are altering a table in a multimaster replication environment.
- You are altering a table with the `safe_table_change` parameter set to `false` in a single master replication environment.

You can use this procedure to alter nontable objects without quiescing the master group.

Syntax

```
DBMS_REPCAT.ALTER_MASTER_REPOBJECT (
   sname               IN   VARCHAR2,
   oname               IN   VARCHAR2,
   type                IN   VARCHAR2,
   ddl_text            IN   VARCHAR2,
   comment             IN   VARCHAR2     := '',
   retry               IN   BOOLEAN      := false
   safe_table_change   IN   BOOLEAN      := false);
```

Parameters

Table 48–19 ALTER_MASTER_REPOBJECT Procedure Parameters **(Page 1 of 2)**

Parameter	Description
sname	Schema containing the object that you want to alter.
oname	Name of the object that you want to alter. The object cannot be a storage table for a nested table.
type	Type of the object that you are altering. The following types are supported: FUNCTION SYNONYM INDEX TABLE INDEXTYPE TRIGGER OPERATOR TYPE PACKAGE TYPE BODY PACKAGE BODY VIEW PROCEDURE
ddl_text	The DDL text that you want used to alter the object. Oracle does not parse this DDL before applying it. Therefore, you must ensure that your DDL text provides the appropriate schema and object name for the object being altered. If the DDL is supplied without specifying a schema, then the default schema is the replication administrator's schema. Be sure to specify the schema if it is other than the replication administrator's schema.
comment	If not NULL, then this comment is added to the COMMENT field of the DBA_REPOBJECT view.
retry	If retry is true, then ALTER_MASTER_REPOBJECT alters the object only at masters whose object status is not VALID.

Table 48–19 ALTER_MASTER_REPOBJECT Procedure Parameters **(Page 2 of 2)**

Parameter	Description
safe_table_change	Specify `true` if the change to a table is safe. Specify `false` if the change to a table is unsafe. You can make safe changes to a master table in a single master replication environment without quiescing the master group that contains the table. To make unsafe changes, you must quiesce the master group. Only specify this parameter for tables in single master replication environments. This parameter is ignored in multimaster replication environments and when the object specified is not a table. In multimaster replication environments, you must quiesce the master group to run the `ALTER_MASTER_REPOBJECT` procedure on a table. The following are safe changes: ▪ Changing storage and extent information ▪ Making existing columns larger. For example, changing a `VARCHAR2(20)` column to a `VARCHAR2(50)` column. ▪ Adding non primary key constraints ▪ Altering non primary key constraints ▪ Enabling and disabling non primary key constraints The following are unsafe changes: ▪ Changing the primary key by adding or deleting columns in the key ▪ Adding or deleting columns ▪ Making existing columns smaller. For example, changing a `VARCHAR2(50)` column to a `VARCHAR2(20)` column. ▪ Disabling a primary key constraint ▪ Changing the datatype of an existing column ▪ Dropping an existing column If you are unsure whether a change is safe or unsafe, then quiesce the master group before you run the `ALTER_MASTER_REPOBJECT` procedure.

Exceptions

Table 48–20 ALTER_MASTER_REPOBJECT Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
notquiesced	Associated replication group has not been suspended.
missingobject	Object identified by sname and oname does not exist.
typefailure	Specified type parameter is not supported.
ddlfailure	DDL at the master definition site did not succeed.
commfailure	At least one master site is not accessible.

ALTER_MVIEW_PROPAGATION Procedure

This procedure alters the propagation method for a specified replication group at the current materialized view site. This procedure pushes the deferred transaction queue at the materialized view site, locks the materialized view base tables, and regenerates any triggers and their associated packages. You must call this procedure from the materialized view site.

Syntax

```
DBMS_REPCAT.ALTER_MVIEW_PROPAGATION (
   gname                IN  VARCHAR2,
   propagation_mode     IN  VARCHAR2,
   comment              IN  VARCHAR2   := ''
   gowner               IN  VARCHAR2   := 'PUBLIC');
```

Parameters

Table 48–21 ALTER_MVIEW_PROPAGATION Procedure Parameters

Parameter	Description
gname	Name of the replication group for which to alter the propagation method.
propagation_mode	Manner in which changes from the current materialized view site are propagated to its associated master site or master materialized view site. Appropriate values are synchronous and asynchronous.
comment	This comment is added to the DBA_REPPROP view.
gowner	Owner of the materialized view group.

Exceptions

Table 48–22 ALTER_MVIEW_PROPAGATION Procedure Exceptions

Exception	Description
missingrepgroup	Specified replication group does not exist.
typefailure	Propagation mode was specified incorrectly.
nonmview	Current site is not a materialized view site for the specified replication group.
commfailure	Cannot contact master site or master materialized view site.
notcompat	Compatibility mode must be 7.3.0.0 or greater.
failaltermviewrop	Materialized view group propagation can be altered only when there are no other materialized view groups with the same master site or master materialized view site sharing the materialized view site.

ALTER_PRIORITY Procedure

This procedure alters the priority level associated with a specified priority group member. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.ALTER_PRIORITY (
   gname            IN   VARCHAR2,
   pgroup           IN   VARCHAR2,
   old_priority     IN   NUMBER,
   new_priority     IN   NUMBER);
```

Parameters

Table 48–23 ALTER_PRIORITY Procedure Parameters

Parameter	Description
gname	Master group with which the priority group is associated.
pgroup	Name of the priority group containing the priority that you want to alter.
old_priority	Current priority level of the priority group member.
new_priority	New priority level that you want assigned to the priority group member.

Exceptions

Table 48–24 ALTER_PRIORITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
duplicatepriority	New priority level already exists in the priority group.
missingrepgroup	Specified master group does not exist.
missingvalue	Value was not registered by a call to DBMS_REPCAT.ADD_PRIORITY_*datatype*.
missingprioritygroup	Specified priority group does not exist.
notquiesced	Specified master group is not quiesced.

ALTER_PRIORITY_*datatype* Procedure

This procedure alters the value of a member in a priority group. You must call this procedure from the master definition site. The procedure that you must call is determined by the datatype of your `priority` column.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.ALTER_PRIORITY_datatype (
   gname        IN   VARCHAR2,
   pgroup       IN   VARCHAR2,
   old_value    IN   datatype,
   new_value    IN   datatype);
```

where *datatype*:

```
{ NUMBER
| VARCHAR2
| CHAR
| DATE
| RAW
| NCHAR
| NVARCHAR2 }
```

Parameters

Table 48–25 ALTER_PRIORITY_datatype Procedure Parameters

Parameter	Description
gname	Master group with which the priority group is associated.
pgroup	Name of the priority group containing the value that you want to alter.
old_value	Current value of the priority group member.
new_value	New value that you want assigned to the priority group member.

Exceptions

Table 48–26 ALTER_PRIORITY_datatype Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
duplicatevalue	New value already exists in the priority group.
missingrepgroup	Specified master group does not exist.
missingprioritygroup	Specified priority group does not exist.
missingvalue	Old value does not exist.
paramtype	New value has the incorrect datatype for the priority group.
typefailure	Specified value has the incorrect datatype for the priority group.
notquiesced	Specified master group is not quiesced.

ALTER_SITE_PRIORITY Procedure

This procedure alters the priority level associated with a specified site. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods:

Syntax

```
DBMS_REPCAT.ALTER_SITE_PRIORITY (
   gname         IN   VARCHAR2,
   name          IN   VARCHAR2,
   old_priority  IN   NUMBER,
   new_priority  IN   NUMBER);
```

Parameters

Table 48–27 ALTER_SITE_PRIORITY Procedure Parameters

Parameter	Description
gname	Master group with which the site priority group is associated.
name	Name of the site priority group whose member you are altering.
old_priority	Current priority level of the site whose priority level you want to change.
new_priority	New priority level for the site. A higher number indicates a higher priority level.

Exceptions

Table 48–28 ALTER_SITE_PRIORITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingpriority	Old priority level is not associated with any group members.
duplicatepriority	New priority level already exists for another site in the group.
missingvalue	Old value does not already exist.
paramtype	New value has the incorrect datatype for the priority group.
notquiesced	Master group is not quiesced.

ALTER_SITE_PRIORITY_SITE Procedure

This procedure alters the site associated with a specified priority level. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.ALTER_SITE_PRIORITY_SITE (
   gname     IN   VARCHAR2,
   name      IN   VARCHAR2,
   old_site  IN   VARCHAR2,
   new_site  IN   VARCHAR2);
```

Parameters

Table 48–29 ALTER_SITE_PRIORITY_SITE Procedure Parameters

Parameter	Description
gname	Master group with which the site priority group is associated.
name	Name of the site priority group whose member you are altering.
old_site	Current global database name of the site to disassociate from the priority level.
new_site	New global database name that you want to associate with the current priority level.

Exceptions

Table 48–30 ALTER_SITE_PRIORITY_SITE Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingpriority	Specified site priority group does not exist.
missingvalue	Old site is not a group member.
notquiesced	Master group is not quiesced

CANCEL_STATISTICS Procedure

This procedure stops the collection of statistics about the successful resolution of update, uniqueness, and delete conflicts for a table.

Syntax

```
DBMS_REPCAT.CANCEL_STATISTICS (
   sname    IN   VARCHAR2,
   oname    IN   VARCHAR2);
```

Parameters

Table 48–31 CANCEL_STATISTICS Procedure Parameters

Parameter	Description
sname	Name of the schema in which the table is located.
oname	Name of the table for which you do not want to gather conflict resolution statistics.

Exceptions

Table 48–32 CANCEL_STATISTICS Procedure Exceptions

Exception	Description
missingschema	Specified schema does not exist.
missingobject	Specified table does not exist.
statnotreg	Specified table is not currently registered to collect statistics.

COMMENT_ON_COLUMN_GROUP Procedure

This procedure updates the comment field in the DBA_REPCOLUMN_GROUP view for a column group. This comment is not added at all master sites until the next call to DBMS_REPCAT.GENERATE_REPLICATION_SUPPORT.

Syntax

```
DBMS_REPCAT.COMMENT_ON_COLUMN_GROUP (
   sname           IN   VARCHAR2,
   oname           IN   VARCHAR2,
   column_group    IN   VARCHAR2,
   comment         IN   VARCHAR2);
```

Parameters

Table 48–33 COMMENT_ON_COLUMN_GROUP Procedure Parameters

Parameter	Description
sname	Name of the schema in which the object is located.
oname	Name of the replicated table with which the column group is associated.
column_group	Name of the column group.
comment	Text of the updated comment that you want included in the GROUP_COMMENT field of the DBA_REPCOLUMN_GROUP view.

Exceptions

Table 48–34 COMMENT_ON_COLUMN_GROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missinggroup	Specified column group does not exist.
missingobj	Object is missing.

COMMENT_ON_MVIEW_REPSITES Procedure

This procedure updates the SCHEMA_COMMENT field in the DBA_REPGROUP data dictionary view for the specified materialized view group. The group name must be registered locally as a replicated materialized view group. This procedure must be executed at the materialized view site.

Syntax

```
DBMS_REPCAT.COMMENT_ON_MVIEW_REPSITES (
   gowner    IN   VARCHAR2,
   gname     IN   VARCHAR2,
   comment   IN   VARCHAR2);
```

Parameters

Table 48–35 COMMENT_ON_MVIEW_REPSITES Procedure Parameters

Parameter	Description
gowner	Owner of the materialized view group.
gname	Name of the materialized view group.
comment	Updated comment to include in the SCHEMA_COMMENT field of the DBA_REPGROUP view.

Table 48–36 COMMENT_ON_MVIEW_REPSITES Procedure Exceptions

Parameter	Description
missingrepgroup	The materialized view group does not exist.
nonmview	The connected site is not a materialized view site.

COMMENT_ON_PRIORITY_GROUP/COMMENT_ON_SITE_PRIORITY Procedures

COMMENT_ON_PRIORITY_GROUP updates the comment field in the DBA_REPPRIORITY_GROUP view for a priority group. This comment is not added at all master sites until the next call to GENERATE_REPLICATION_SUPPORT.

COMMENT_ON_SITE_PRIORITY updates the comment field in the DBA_REPPRIORITY_GROUP view for a site priority group. This procedure is a wrapper for the COMMENT_ON_COLUMN_GROUP procedure and is provided as a convenience only. This procedure must be issued at the master definition site.

Syntax

```
DBMS_REPCAT.COMMENT_ON_PRIORITY_GROUP (
   gname       IN   VARCHAR2,
   pgroup      IN   VARCHAR2,
   comment     IN   VARCHAR2);

DBMS_REPCAT.COMMENT_ON_SITE_PRIORITY (
   gname       IN   VARCHAR2,
   name        IN   VARCHAR2,
   comment     IN   VARCHAR2);
```

Parameters

Table 48–37 COMMENT_ON_PRIORITY_GROUP and COMMENT_ON_SITE_PRIORITY Parameters

Parameter	Description
gname	Name of the master group.
pgroup/name	Name of the priority or site priority group.
comment	Text of the updated comment that you want included in the PRIORITY_COMMENT field of the DBA_REPPRIORITY_GROUP view.

Exceptions

Table 48–38 COMMENT_ON_PRIORITY_GROUP and COMMENT_ON_SITE_PRIORITY Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingprioritygroup	Specified priority group does not exist.

COMMENT_ON_REPGROUP Procedure

This procedure updates the comment field in the DBA_REPGROUP view for a master group. This procedure must be issued at the master definition site.

Syntax

```
DBMS_REPCAT.COMMENT_ON_REPGROUP (
   gname     IN   VARCHAR2,
   comment   IN   VARCHAR2);
```

Parameters

Table 48–39 COMMENT_ON_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the replication group that you want to comment on.
comment	Updated comment to include in the SCHEMA_COMMENT field of the DBA_REPGROUP view.

Exceptions

Table 48–40 COMMENT_ON_REPGROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
commfailure	At least one master site is not accessible.

COMMENT_ON_REPOBJECT Procedure

This procedure updates the comment field in the DBA_REPOBJECT view for a replicated object in a master group. This procedure must be issued at the master definition site.

Syntax

```
DBMS_REPCAT.COMMENT_ON_REPOBJECT (
   sname    IN   VARCHAR2,
   oname    IN   VARCHAR2,
   type     IN   VARCHAR2,
   comment  IN   VARCHAR2);
```

Parameters

Table 48–41 COMMENT_ON_REPOBJECT Procedure Parameters

Parameter	Description
sname	Name of the schema in which the object is located.
oname	Name of the object that you want to comment on. The object cannot be a storage table for a nested table.
type	Type of the object. The following types are supported: FUNCTION SYNONYM INDEX TABLE INDEXTYPE TRIGGER OPERATOR TYPE PACKAGE TYPE BODY PACKAGE BODY VIEW PROCEDURE
comment	Text of the updated comment that you want to include in the OBJECT_COMMENT field of the DBA_REPOBJECT view.

Exceptions

Table 48–42 COMMENT_ON_REPOBJECT Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist.
typefailure	Specified type parameter is not supported.
commfailure	At least one master site is not accessible.

COMMENT_ON_REPSITES Procedure

If the replication group is a master group, then this procedure updates the MASTER_COMMENT field in the DBA_REPSITES view for a master site. If the replication group is a materialized view group, this procedure updates the SCHEMA_COMMENT field in the DBA_REPGROUP view for a materialized view site.

This procedure can be executed at either a master site or a materialized view site. If you execute this procedure on a a materialized view site, then the materialized view group owner must be PUBLIC.

> **See Also:** "COMMENT_ON_conflicttype_RESOLUTION Procedure" on page 48-48 for instructions on placing a comment in the SCHEMA_COMMENT field of the DBA_REPGROUP view for a materialized view site if the materialized view group owner is not PUBLIC

Syntax

```
DBMS_REPCAT.COMMENT_ON_REPSITES (
   gname       IN   VARCHAR2,
   [ master    IN   VARCHAR,]
   comment     IN   VARCHAR2);
```

Parameters

Table 48–43 COMMENT_ON_REPSITES Procedure Parameters

Parameter	Description
gname	Name of the replication group. This avoids confusion if a database is a master site in more than one replication environment.
master	The fully qualified database name of the master site on which you want to comment. If you are executing the procedure on a master site, then this parameter is required. To update comments at a materialized view site, omit this parameter. This parameter is optional.
comment	Text of the updated comment that you want to include in the comment field of the appropriate dictionary view. If the site is a master site, then this procedure updates the MASTER_COMMENT field of the DBA_REPSITES view. If the site is a materialized view site, then this procedure updates the SCHEMA_COMMENT field of the DBA_REPGROUP view.

Exceptions

Table 48–44 COMMENT_ON_REPSITES Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
nonmaster	Invocation site is not a master site.
commfailure	At least one master site is not accessible.
missingrepgroup	Replication group does not exist.
commfailure	One or more master sites are not accessible.
corrupt	There is an inconsistency in the replication catalog views.

COMMENT_ON_*conflicttype*_RESOLUTION Procedure

This procedure updates the RESOLUTION_COMMENT field in the DBA_REPRESOLUTION view for a conflict resolution routine. The procedure that you need to call is determined by the type of conflict that the routine resolves. These procedures must be issued at the master definition site.

Table 48–45 COMMENT_ON_conflicttype_RESOLUTION Procedures

Conflict Type	Procedure Name
update	COMMENT_ON_UPDATE_RESOLUTION
uniqueness	COMMENT_ON_UNIQUE_RESOLUTION
delete	COMMENT_ON_DELETE_RESOLUTION

The comment is not added at all master sites until the next call to GENERATE_REPLICATION_SUPPORT.

Syntax

```
DBMS_REPCAT.COMMENT_ON_UPDATE_RESOLUTION (
   sname                IN   VARCHAR2,
   oname                IN   VARCHAR2,
   column_group         IN   VARCHAR2,
   sequence_no          IN   NUMBER,
   comment              IN   VARCHAR2);

DBMS_REPCAT.COMMENT_ON_UNIQUE_RESOLUTION (
   sname                IN   VARCHAR2,
   oname                IN   VARCHAR2,
   constraint_name      IN   VARCHAR2,
   sequence_no          IN   NUMBER,
   comment              IN   VARCHAR2);

DBMS_REPCAT.COMMENT_ON_DELETE_RESOLUTION (
   sname                IN   VARCHAR2,
   oname                IN   VARCHAR2,
   sequence_no          IN   NUMBER,
   comment              IN   VARCHAR2);
```

Parameters

Table 48–46 COMMENT_ON_conflicttype_RESOLUTION Procedure Parameters

Parameter	Description
sname	Name of the schema.
oname	Name of the replicated table with which the conflict resolution routine is associated.
column_group	Name of the column group with which the update conflict resolution routine is associated.
constraint_name	Name of the unique constraint with which the uniqueness conflict resolution routine is associated.
sequence_no	Sequence number of the conflict resolution procedure.
comment	The text of the updated comment that you want included in the RESOLUTION_COMMENT field of the DBA_REPRESOLUTION view.

Exceptions

Table 48–47 COMMENT_ON_conflicttype_RESOLUTION Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist.
missingresolution	Specified conflict resolution routine is not registered.

COMPARE_OLD_VALUES Procedure

This procedure specifies whether to compare old column values during propagation of deferred transactions at each master site for each nonkey column of a replicated table for updates and deletes. The default is to compare old values for all columns. You can change this behavior at all master sites and materialized view sites by invoking DBMS_REPCAT.COMPARE_OLD_VALUES at the master definition site.

When you use user-defined types, you can specify leaf attributes of a column object, or you can specify an entire column object. For example, if a column object named cust_address has street_address as an attribute, then you can specify cust_address.street_address for the column_list parameter or as part of the column_table parameter, or you can specify only cust_address.

When performing equality comparisons for conflict detection, Oracle treats objects as equal only if one of the following conditions is true:

- Both objects are atomically NULL (the entire object is NULL)
- All of the corresponding attributes are equal in the objects

Given these conditions, if one object is atomically NULL while the other is not, then Oracle does not consider the objects to be equal. Oracle does not consider MAP and ORDER methods when performing equality comparisons.

Syntax

```
DBMS_REPCAT.COMPARE_OLD_VALUES(
   sname           IN  VARCHAR2,
   oname           IN  VARCHAR2,
   { column_list   IN  VARCHAR2,
   | column_table  IN  DBMS_UTILITY.VARCHAR2s | DBMS_UTILITY.LNAME_ARRAY,}
   operation       IN  VARCHAR2 := 'UPDATE',
   compare         IN  BOOLEAN := true );
```

Note: This procedure is overloaded. The column_list and column_table parameters are mutually exclusive.

Parameters

Table 48–48 COMPARE_OLD_VALUES Procedure Parameters

Parameter	Description
sname	Schema in which the table is located.
oname	Name of the replicated table. The table can be the storage table of a nested table.
column_list	A comma-separated list of the columns in the table. There must be no spaces between entries.
column_table	Instead of a list, you can use a PL/SQL index-by table of type DBMS_REPCAT.VARCHAR2 or DBMS_UTILITY.LNAME_ARRAY to contain the column names. The first column name should be at position 1, the second at position 2, and so on. Use DBMS_UTILITY.LNAME_ARRAY if any column name is greater than or equal to 30 bytes, which may occur when you specify the attributes of column objects.
operation	Possible values are: update, delete, or the asterisk wildcard '*', which means update and delete.
compare	If compare is true, the old values of the specified columns are compared when sent. If compare is false, the old values of the specified columns are not compared when sent. Unspecified columns and unspecified operations are not affected. The specified change takes effect at the master definition site as soon as min_communication is true for the table. The change takes effect at a master site or at a materialized view site the next time replication support is generated at that site with min_communication true.

Note: The operation parameter enables you to decide whether or not to compare old values for nonkey columns when rows are deleted or updated. If you do not compare the old value, then Oracle assumes the old value is equal to the current value of the column at the target side when the update or delete is applied.

See *Oracle9i Replication* for more information about reduced data propagation using the COMPARE_OLD_VALUES procedure before changing the default behavior of Oracle.

Exceptions

Table 48–49 COMPARE_OLD_VALUES Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist as a table in the specified schema waiting for row-level replication information.
missingcolumn	At least one column is not in the table.
notquiesced	Master group has not been quiesced.
typefailure	An illegal operation is specified.
keysendcomp	A specified column is a key column in a table.
dbnotcompatible	Feature is incompatible with database version. Typically, this exception arises when you are trying to compare the attributes of column objects. In this case, all databases must be at 9.0.0 or higher compatibility level.

CREATE_MASTER_REPGROUP Procedure

This procedure creates a new, empty, quiesced master group.

Syntax

```
DBMS_REPCAT.CREATE_MASTER_REPGROUP (
   gname            IN   VARCHAR2,
   group_comment    IN   VARCHAR2     := '',
   master_comment   IN   VARCHAR2     := ''),
   qualifier        IN   VARCHAR2     := '');
```

Parameters

Table 48–50 CREATE_MASTER_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the master group that you want to create.
group_comment	This comment is added to the DBA_REPGROUP view.
master_comment	This comment is added to the DBA_REPSITES view.
qualifier	Connection qualifier for master group. Be sure to use the @ sign. See *Oracle9i Replication* and *Oracle9i Database Administrator's Guide* for more information about connection qualifiers.

Exceptions

Table 48–51 CREATE_MASTER_REPGROUP Procedure Exceptions

Exception	Description
duplicaterepgroup	Master group already exists.
norepopt	Advanced replication option is not installed.
missingrepgroup	Master group name was not specified.
qualifiertoolong	Connection qualifier is too long.

CREATE_MASTER_REPOBJECT Procedure

This procedure makes an object a replicated object by adding the object to a master group. This procedure preserves the object identifier for user-defined types and object tables at all replication sites.

Replication of clustered tables is supported, but the use_existing_object parameter cannot be set to false for clustered tables. In other words, you must create the clustered table at all master sites participating in the master group before you execute the CREATE_MASTER_REPOBJECT procedure. However, these tables do not need to contain the table data. So, the copy_rows parameter can be set to true for clustered tables.

Syntax

```
DBMS_REPCAT.CREATE_MASTER_REPOBJECT (
   sname                IN   VARCHAR2,
   oname                IN   VARCHAR2,
   type                 IN   VARCHAR2,
   use_existing_object  IN   BOOLEAN    := true,
   ddl_text             IN   VARCHAR2   := NULL,
   comment              IN   VARCHAR2   := '',
   retry                IN   BOOLEAN    := false
   copy_rows            IN   BOOLEAN    := true,
   gname                IN   VARCHAR2   := '');
```

Parameters

The following table describes the parameters for this procedure.

Table 48–52 CREATE_MASTER_REPOBJECT Procedure Parameters **(Page 1 of 2)**

Parameters	Description
sname	Name of the schema in which the object that you want to replicate is located.
oname	Name of the object you are replicating. If `ddl_text` is `NULL`, then this object must already exist in the specified schema. To ensure uniqueness, table names should be a maximum of 27 bytes long, and package names should be no more than 24 bytes. The object cannot be a storage table for a nested table.

type	Type of the object that you are replicating. The following types are supported:
	`FUNCTION` `SYNONYM`
	`INDEX` `TABLE`
	`INDEXTYPE` `TRIGGER`
	`OPERATOR` `TYPE`
	`PACKAGE` `TYPE BODY`
	`PACKAGE BODY` `VIEW`
	`PROCEDURE`

Table 48–52 CREATE_MASTER_REPOBJECT Procedure Parameters **(Page 2 of 2)**

Parameters	Description
use_existing_object	Indicate `true` if you want to reuse any objects of the same type and shape at the current master sites. See Table 48–54 for more information. **Note:** This parameter must be set to `true` for clustered tables.
ddl_text	If the object does not already exist at the master definition site, then you must supply the DDL text necessary to create this object. PL/SQL packages, package bodies, procedures, and functions must have a trailing semicolon. SQL statements do not end with trailing semicolon. Oracle does not parse this DDL before applying it; therefore, you must ensure that your DDL text provides the appropriate schema and object name for the object being created. If the DDL is supplied without specifying a schema (`sname` parameter), then the default schema is the replication administrator's schema. Be sure to specify the schema if it is other than the replication administrator's schema. **Note:** Do not use the `ddl_text` parameter to add user-defined types or object tables. Instead, create the object first and then add the object.
comment	This comment is added to the `OBJECT_COMMENT` field of the `DBA_REPOBJECT` view.
retry	Indicate `true` if you want Oracle to reattempt to create an object that it was previously unable to create. Use this if the error was transient or has since been rectified, or if you previously had insufficient resources. If this is `true`, then Oracle creates the object only at master sites whose object status is not `VALID`.
copy_rows	Indicate `true` if you want the initial contents of a newly replicated object to match the contents of the object at the master definition site. See Table 48–54 for more information.
gname	Name of the replication group in which you want to create the replicated object. The schema name is used as the default replication group name if none is specified, and a replication group with the same name as the schema must exist for the procedure to complete successfully in that case.

Table 48–53 CREATE_MASTER_REPOBJECT Procedure Exceptions

Exceptions	Description
nonmasterdef	Invocation site is not the master definition site.
notquiesced	Master group is not quiesced.
duplicateobject	Specified object already exists in the master group and retry is false, or if a name conflict occurs.
missingobject	Object identified by sname and oname does not exist and appropriate DDL has not been provided.
typefailure	Objects of the specified type cannot be replicated.
ddlfailure	DDL at the master definition site did not succeed.
commfailure	At least one master site is not accessible.
notcompat	Not all remote masters in at least 7.3 compatibility mode.

Object Creations

Table 48–54 Object Creation at Master Sites

Object Already Exists?	COPY_ROWS	USE_EXISTING_OBJECTS	Result
yes	true	true	duplicatedobject message if objects do not match. For tables, use data from master definition site.
yes	false	true	duplicatedobject message if objects do not match. For tables, DBA must ensure contents are identical.
yes	true/false	false	duplicatedobject message.
no	true	true/false	Object is created. Tables populated using data from master definition site.
no	false	true/false	Object is created. DBA must populate tables and ensure consistency of tables at all sites.

CREATE_MVIEW_REPGROUP Procedure

This procedure creates a new, empty materialized view group in your local database. CREATE_MVIEW_REPGROUP automatically calls REGISTER_MIEW_REPGROUP, but ignores any errors that may have happened during registration.

Syntax

```
DBMS_REPCAT.CREATE_MVIEW_REPGROUP (
   gname              IN   VARCHAR2,
   master             IN   VARCHAR2,
   comment            IN   VARCHAR2     := '',
   propagation_mode   IN   VARCHAR2     := 'ASYNCHRONOUS',
   fname              IN   VARCHAR2     := NULL
   gowner             IN   VARCHAR2     := 'PUBLIC');
```

Parameters

Table 48–55 CREATE_MVIEW_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the replication group. This group must exist at the specified master site or master materialized view site.
master	Fully qualified database name of the database in the replication environment to use as the master site or master materialized view site. You can include a connection qualifier if necessary. See *Oracle9i Replication* and *Oracle9i Database Administrator's Guide* for information about using connection qualifiers.
comment	This comment is added to the DBA_REPGROUP view.
propagation_mode	Method of propagation for all updatable materialized views in the replication group. Acceptable values are synchronous and asynchronous.
fname	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.
gowner	Owner of the materialized view group.

Exceptions

Table 48–56 CREATE_MVIEW_REPGROUP Procedure Exceptions

Exception	Description
duplicaterepgroup	Replication group already exists at the invocation site.
nonmaster	Specified database is not a master site or master materialized view site.
commfailure	Specified database is not accessible.
norepopt	Advanced replication option is not installed.
typefailure	Propagation mode was specified incorrectly.
missingrepgroup	Replication group does not exist at master site.
invalidqualifier	Connection qualifier specified for the master site or master materialized view site is not valid for the replication group.
alreadymastered	At the local site, there is another materialized view group with the same group name, but different master site or master materialized view site.

CREATE_MVIEW_REPOBJECT Procedure

This procedure adds a replicated object to a materialized view group.

Syntax

```
DBMS_REPCAT.CREATE_MVIEW_REPOBJECT (
   sname                   IN   VARCHAR2,
   oname                   IN   VARCHAR2,
   type                    IN   VARCHAR2,
   ddl_text                IN   VARCHAR2  := '',
   comment                 IN   VARCHAR2  := '',
   gname                   IN   VARCHAR2  := '',
   gen_objs_owner          IN   VARCHAR2  := '',
   min_communication       IN   BOOLEAN   := true,
   generate_80_compatible  IN   BOOLEAN   := true,
   gowner                  IN   VARCHAR2  := 'PUBLIC');
```

Parameters

Table 48–57 CREATE_MVIEW_REPOBJECT Procedure Parameters **(Page 1 of 2)**

Parameter	Description
sname	Name of the schema in which the object is located. The schema must be same as the schema that owns the master table or master materialized view on which this materialized view is based.
oname	Name of the object that you want to add to the replicated materialized view group.
type	Type of the object that you are replicating. The following types are supported: FUNCTION SNAPSHOT INDEX SYNONYM INDEXTYPE TRIGGER OPERATOR TYPE PACKAGE TYPE BODY PACKAGE BODY VIEW PROCEDURE
ddl_text	For objects of type SNAPSHOT, the DDL needed to create the object. For other types, use the default: '' (an empty string) If a materialized view with the same name already exists, then Oracle ignores the DDL and registers the existing materialized view as a replicated object. If the master table or master materialized view for a materialized view does not exist in the replication group of the master designated for this schema, then Oracle raises a missingobject error. If the DDL is supplied without specifying a schema, then the default schema is the replication administrator's schema. Be sure to specify the schema if it is other than the replication administrator's schema. If the object is not of type SNAPSHOT, then the materialized view site connects to the master site or master materialized view site and pulls down the DDL text to create the object. If the object type is TYPE or TYPE BODY, then the object identifier (OID) for the object at the materialized view site is the same as the OID at the master site or master materialized view site.

Table 48–57 CREATE_MVIEW_REPOBJECT Procedure Parameters **(Page 2 of 2)**

Parameter	Description
comment	This comment is added to the OBJECT_COMMENT field of the DBA_REPOBJECT view.
gname	Name of the replicated materialized view group to which you are adding an object. The schema name is used as the default group name if none is specified, and a materialized view group with the same name as the schema must exist for the procedure to complete successfully.
gen_objs_owner	Name of the user you want to assign as owner of the transaction.
min_communication	Set to false if the materialized view's master site is running Oracle7 release 7.3. Set to true to minimize new and old values of propagation. The default is true. For more information about conflict resolution methods, see *Oracle9i Replication*.
generate_80_compatible	Set to true if the materialized view's master site is running a version of Oracle server prior to Oracle8*i* release 8.1.5. Set to false if the materialized view's master site or master materialized view site is running Oracle8*i* release 8.1.5 or greater.
gowner	Owner of the materialized view group.

Exceptions

Table 48–58 CREATE_MVIEW_REPOBJECT Procedure Exceptions

Exception	Description
nonmview	Invocation site is not a materialized view site.
nonmaster	Master is no longer a master site or master materialized view site.
missingobject	Specified object does not exist in the master's replication group.
duplicateobject	Specified object already exists with a different shape.
typefailure	Type is not an allowable type.
ddlfailure	DDL did not succeed.
commfailure	Master site or master materialized view site is not accessible.
missingschema	Schema does not exist as a database schema.
badmviewddl	DDL was executed but materialized view does not exist.
onlyonemview	Only one materialized view for master table or master materialized view can be created.
badmviewname	Materialized view base table differs from master table or master materialized view.
missingrepgroup	Replication group at the master does not exist.

DEFINE_COLUMN_GROUP Procedure

This procedure creates an empty column group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DEFINE_COLUMN_GROUP (
   sname            IN   VARCHAR2,
   oname            IN   VARCHAR2,
   column_group     IN   VARCHAR2,
   comment          IN   VARCHAR2 := NULL);
```

Parameters

Table 48–59 DEFINE_COLUMN_GROUP Procedure Parameters

Parameter	Description
sname	Schema in which the replicated table is located.
oname	Name of the replicated table for which you are creating a column group.
column_group	Name of the column group that you want to create.
comment	This user text is displayed in the DBA_REPCOLUMN_GROUP view.

Exceptions

Table 48–60 DEFINE_COLUMN_GROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified table does not exist.
duplicategroup	Specified column group already exists for the table.
notquiesced	Replication group to which the specified table belongs is not quiesced.

DEFINE_PRIORITY_GROUP Procedure

This procedure creates a new priority group for a master group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DEFINE_PRIORITY_GROUP (
   gname         IN   VARCHAR2,
   pgroup        IN   VARCHAR2,
   datatype      IN   VARCHAR2,
   fixed_length  IN   INTEGER := NULL,
   comment       IN   VARCHAR2 := NULL);
```

Parameters

Table 48–61 DEFINE_PRIORITY_GROUP Procedure Parameters

Parameter	Description
gname	Master group for which you are creating a priority group.
pgroup	Name of the priority group that you are creating.
datatype	Datatype of the priority group members. The datatypes supported are: CHAR, VARCHAR2, NUMBER, DATE, RAW, NCHAR, and NVARCHAR2.
fixed_length	You must provide a column length for the CHAR datatype. All other types can use the default, NULL.
comment	This user comment is added to the DBA_REPPRIORITY view.

Exceptions

Table 48–62 DEFINE_PRIORITY_GROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
duplicatepriority group	Specified priority group already exists in the master group.
typefailure	Specified datatype is not supported.
notquiesced	Master group is not quiesced.

DEFINE_SITE_PRIORITY Procedure

This procedure creates a new site priority group for a master group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DEFINE_SITE_PRIORITY (
   gname        IN   VARCHAR2,
   name         IN   VARCHAR2,
   comment      IN   VARCHAR2 := NULL);
```

Parameters

Table 48–63 DEFINE_SITE_PRIORITY Procedure Parameters

Parameter	Description
gname	The master group for which you are creating a site priority group.
name	Name of the site priority group that you are creating.
comment	This user comment is added to the DBA_REPPRIORITY view.

Exceptions

Table 48–64 DEFINE_SITE_PRIORITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
duplicate prioritygroup	Specified site priority group already exists in the master group.
notquiesced	Master group is not quiesced.

DO_DEFERRED_REPCAT_ADMIN Procedure

This procedure executes the local outstanding deferred administrative procedures for the specified master group at the current master site, or (with assistance from job queues) for all master sites.

DO_DEFERRED_REPCAT_ADMIN executes only those administrative requests submitted by the connected user who called DO_DEFERRED_REPCAT_ADMIN. Requests submitted by other users are ignored.

Syntax

```
DBMS_REPCAT.DO_DEFERRED_REPCAT_ADMIN (
   gname          IN   VARCHAR2,
   all_sites      IN   BOOLEAN := false);
```

Parameters

Table 48–65 DO_DEFERRED_REPCAT_ADMIN Procedure Parameters

Parameter	Description
gname	Name of the master group.
all_sites	If this is true, then use a job to execute the local administrative procedures at each master site.

Exceptions

Table 48–66 DO_DEFERRED_REPCAT_ADMIN Procedure Exceptions

Exception	Description
nonmaster	Invocation site is not a master site.
commfailure	At least one master site is not accessible and all_sites is true.

DROP_COLUMN_GROUP Procedure

This procedure drops a column group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_COLUMN_GROUP (
   sname        IN   VARCHAR2,
   oname        IN   VARCHAR2,
   column_group IN   VARCHAR2);
```

Parameters

Table 48–67 DROP_COLUMN_GROUP Procedure Parameters

Parameter	Description
sname	Schema in which the replicated table is located.
oname	Name of the replicated table whose column group you are dropping.
column_group	Name of the column group that you want to drop.

Exceptions

Table 48–68 DROP_COLUMN_GROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
referenced	Specified column group is being used in conflict detection and resolution.
missingobject	Specified table does not exist.
missinggroup	Specified column group does not exist.
notquiesced	Master group to which the table belongs is not quiesced.

DROP_GROUPED_COLUMN Procedure

This procedure removes members from a column group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_GROUPED_COLUMN (
   sname                 IN   VARCHAR2,
   oname                 IN   VARCHAR2,
   column_group          IN   VARCHAR2,
   list_of_column_names  IN   VARCHAR2 | DBMS_REPCAT.VARCHAR2s);
```

Parameters

Table 48–69 DROP_GROUPED_COLUMN Procedure Parameters

Parameter	Description
sname	Schema in which the replicated table is located.
oname	Name of the replicated table in which the column group is located. The table can be the storage table of a nested table.
column_group	Name of the column group from which you are removing members.
list_of_column_names	Names of the columns that you are removing from the designated column group. This can either be a comma-separated list or a PL/SQL index-by table of column names. The PL/SQL index-by table must be of type DBMS_REPCAT.VARCHAR2. You can specify column objects, but you cannot specify attributes of column objects. If the table is an object, then you can specify SYS_NC_OID$ to add the object identifier column to the column group. This column tracks the object identifier of each row object. If the table is a storage table of a nested table, then you can specify NESTED_TABLE_ID to add the column that tracks the identifier for each row of the nested table.

Exceptions

Table 48–70 DROP_GROUPED_COLUMN Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified table does not exist.
notquiesced	Master group that the table belongs to is not quiesced.

DROP_MASTER_REPGROUP Procedure

This procedure drops a master group from your current site. To drop the master group from all master sites, including the master definition site, you can call this procedure at the master definition site, and set `all_sites` to `true`.

Syntax

```
DBMS_REPCAT.DROP_MASTER_REPGROUP (
   gname             IN VARCHAR2,
   drop_contents     IN BOOLEAN    := false,
   all_sites         IN BOOLEAN    := false);
```

Parameters

Table 48–71 DROP_MASTER_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the master group that you want to drop from the current master site.
drop_contents	By default, when you drop the replication group at a master site, all of the objects remain in the database. They simply are no longer replicated. That is, the replicated objects in the replication group no longer send changes to, or receive changes from, other master sites. If you set this to `true`, then any replicated objects in the master group are dropped from their associated schemas.
all_sites	If this is `true` and if the invocation site is the master definition site, then the procedure synchronously multicasts the request to all masters. In this case, execution is immediate at the master definition site and may be deferred at all other master sites.

Exceptions

Table 48–72 DROP_MASTER_REPGROUP Procedure Exceptions

Exception	Description
nonmaster	Invocation site is not a master site.
nonmasterdef	Invocation site is not the master definition site and all_sites is true.
commfailure	At least one master site is not accessible and all_sites is true.
fullqueue	Deferred remote procedure call (RPC) queue has entries for the master group.
masternotremoved	Master does not recognize the master definition site and all_sites is true.

DROP_MASTER_REPOBJECT Procedure

This procedure drops a replicated object from a master group. You must call this procedure from the master definition site.

Syntax

```
DBMS_REPCAT.DROP_MASTER_REPOBJECT (
   sname          IN   VARCHAR2,
   oname          IN   VARCHAR2,
   type           IN   VARCHAR2,
   drop_objects   IN   BOOLEAN     := false);
```

Parameters

Table 48–73 DROP_MASTER_REPOBJECT Procedure Parameters

Parameter	Description
sname	Name of the schema in which the object is located.
oname	Name of the object that you want to remove from the master group. The object cannot be a storage table for a nested table.
type	Type of object that you want to drop. The following types are supported: FUNCTION SYNONYM INDEX TABLE INDEXTYPE TRIGGER OPERATOR TYPE PACKAGE TYPE BODY PACKAGE BODY VIEW PROCEDURE
drop_objects	By default, the object remains in the schema, but is dropped from the master group. That is, any changes to the object are no longer replicated to other master and materialized view sites. To completely remove the object from the replication environment, set this parameter to `true`. If the parameter is set to `true`, the object is dropped from the database at each master site.

Exceptions

Table 48–74 DROP_MASTER_REPOBJECT Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist.
typefailure	Specified type parameter is not supported.
commfailure	At least one master site is not accessible.

DROP_MVIEW_REPGROUP Procedure

This procedure drops a materialized view site from your replication environment. DROP_MVIEW_REPGROUP automatically calls UNREGISTER_MVIEW_REPGROUP at the master site or master materialized view site to unregister the materialized view, but ignores any errors that may have occurred during unregistration. If DROP_MVIEW_REPGROUP is unsuccessful, then connect to the master site or master materialized view site and run UNREGISTER_MVIEW_REPGROUP.

Syntax

```
DBMS_REPCAT.DROP_MVIEW_REPGROUP (
   gname                IN   VARCHAR2,
   drop_contents        IN   BOOLEAN   := false
   gowner               IN   VARCHAR2  := 'PUBLIC');
```

Parameters

Table 48–75 DROP_MVIEW_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the replication group that you want to drop from the current materialized view site. All objects generated to support replication, such as triggers and packages, are dropped.
drop_contents	By default, when you drop the replication group at a materialized view site, all of the objects remain in their associated schemas. They simply are no longer replicated. If you set this to true, then any replicated objects in the replication group are dropped from their schemas.
gowner	Owner of the materialized view group.

Exceptions

Table 48–76 DROP_MVIEW_REPGROUP Procedure Exceptions

Exception	Description
nonmview	Invocation site is not a materialized view site.
missingrepgroup	Specified replication group does not exist.

DROP_MVIEW_REPOBJECT Procedure

This procedure drops a replicated object from a materialized view site.

Syntax

```
DBMS_REPCAT.DROP_MVIEW_REPOBJECT (
   sname          IN   VARCHAR2,
   oname          IN   VARCHAR2,
   type           IN   VARCHAR2,
   drop_objects   IN   BOOLEAN  := false);
```

Parameters

Table 48–77 DROP_MVIEW_REPOBJECT Procedure Parameters

Parameter	Description
sname	Name of the schema in which the object is located.
oname	Name of the object that you want to drop from the replication group.
type	Type of the object that you want to drop. The following types are supported: FUNCTION — SNAPSHOT INDEX — SYNONYM INDEXTYPE — TRIGGER OPERATOR — TYPE PACKAGE — TYPE BODY PACKAGE BODY — VIEW PROCEDURE
drop_objects	By default, the object remains in its associated schema, but is dropped from its associated replication group. To completely remove the object from its schema at the current materialized view site, set this parameter to `true`. If the parameter is set to `true`, the object is dropped from the database at the materialized view site.

Exceptions

Table 48–78 DROP_MVIEW_REPOBJECT Procedure Exceptions

Exception	Description
nonmview	Invocation site is not a materialized view site.
missingobject	Specified object does not exist.
typefailure	Specified type parameter is not supported.

DROP_PRIORITY Procedure

This procedure drops a member of a priority group by priority level. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_PRIORITY(
      gname          IN   VARCHAR2,
      pgroup         IN   VARCHAR2,
      priority_num   IN   NUMBER);
```

Parameters

Table 48–79 DROP_PRIORITY Procedure Parameters

Parameter	Description
gname	Master group with which the priority group is associated.
pgroup	Name of the priority group containing the member that you want to drop.
priority_num	Priority level of the priority group member that you want to remove from the group.

Exceptions

Table 48–80 DROP_PRIORITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingprioritygroup	Specified priority group does not exist.
notquiesced	Master group is not quiesced.

DROP_PRIORITY_GROUP Procedure

This procedure drops a priority group for a specified master group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_PRIORITY_GROUP (
   gname      IN   VARCHAR2,
   pgroup     IN   VARCHAR2);
```

Parameters

Table 48–81 DROP_PRIORITY_GROUP Procedure Parameters

Parameter	Description
gname	Master group with which the priority group is associated.
pgroup	Name of the priority group that you want to drop.

Exceptions

Table 48–82 DROP_PRIORITY_GROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
referenced	Specified priority group is being used in conflict resolution.
notquiesced	Specified master group is not quiesced.

DROP_PRIORITY_*datatype* Procedure

This procedure drops a member of a priority group by value. You must call this procedure from the master definition site. The procedure that you must call is determined by the datatype of your `priority` column.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_PRIORITY_datatype (
   gname    IN   VARCHAR2,
   pgroup   IN   VARCHAR2,
   value    IN   datatype);
```

where *datatype*:

```
{ NUMBER
| VARCHAR2
| CHAR
| DATE
| RAW
| NCHAR
| NVARCHAR2 }
```

Parameters

Table 48–83 DROP_PRIORITY_datatype Procedure Parameters

Parameter	Description
gname	Master group with which the priority group is associated.
pgroup	Name of the priority group containing the member that you want to drop.
value	Value of the priority group member that you want to remove from the group.

Exceptions

Table 48–84 DROP_PRIORITY_datatype Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingprioritygroup	Specified priority group does not exist.
paramtype, typefailure	Value has the incorrect datatype for the priority group.
notquiesced	Specified master group is not quiesced

DROP_SITE_PRIORITY Procedure

This procedure drops a site priority group for a specified master group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_SITE_PRIORITY (
   gname      IN   VARCHAR2,
   name       IN   VARCHAR2);
```

Parameters

Table 48–85 DROP_SITE_PRIORITY Procedure Parameters

Parameter	Description
gname	Master group with which the site priority group is associated.
name	Name of the site priority group that you want to drop.

Exceptions

Table 48–86 DROP_SITE_PRIORITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
referenced	Specified site priority group is being used in conflict resolution.
notquiesced	Specified master group is not quiesced

DROP_SITE_PRIORITY_SITE Procedure

This procedure drops a specified site, by name, from a site priority group. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.DROP_SITE_PRIORITY_SITE (
   gname      IN   VARCHAR2,
   name       IN   VARCHAR2,
   site       IN   VARCHAR2);
```

Parameters

Table 48–87 DROP_SITE_PRIORITY_SITE Procedure Parameters

Parameter	Description
gname	Master group with which the site priority group is associated.
name	Name of the site priority group whose member you are dropping.
site	Global database name of the site you are removing from the group.

Exceptions

Table 48–88 DROP_SITE_PRIORITY_SITE Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingrepgroup	Specified master group does not exist.
missingpriority	Specified site priority group does not exist.
notquiesced	Specified master group is not quiesced.

DROP_*conflicttype*_RESOLUTION Procedure

This procedure drops an update, delete, or uniqueness conflict resolution routine. You must call these procedures from the master definition site. The procedure that you must call is determined by the type of conflict that the routine resolves.

Conflict Resolution Routines

The following table shows the procedure name for each conflict resolution routine.

Table 48–89 Conflict Resolution Routines

Routine	Procedure Name
update	DROP_UPDATE_RESOLUTION
uniqueness	DROP_UNIQUE_RESOLUTION
delete	DROP_DELETE_RESOLUTION

Syntax

```
DBMS_REPCAT.DROP_UPDATE_RESOLUTION (
   sname               IN   VARCHAR2,
   oname               IN   VARCHAR2,
   column_group        IN   VARCHAR2,
   sequence_no         IN   NUMBER);

DBMS_REPCAT.DROP_DELETE_RESOLUTION (
   sname               IN   VARCHAR2,
   oname               IN   VARCHAR2,
   sequence_no         IN   NUMBER);

DBMS_REPCAT.DROP_UNIQUE_RESOLUTION (
   sname               IN   VARCHAR2,
   oname               IN   VARCHAR2,
   constraint_name     IN   VARCHAR2,
   sequence_no         IN   NUMBER);
```

Parameters

Table 48–90 DROP_conflicttype_RESOLUTION Procedure Parameters

Parameter	Description
sname	Schema in which the table is located.
oname	Name of the table for which you want to drop a conflict resolution routine.
column_group	Name of the column group for which you want to drop an update conflict resolution routine.
constraint_name	Name of the unique constraint for which you want to drop a unique conflict resolution routine.
sequence_no	Sequence number assigned to the conflict resolution method that you want to drop. This number uniquely identifies the routine.

Exceptions

Table 48–91 DROP_conflicttype_RESOLUTION Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist as a table in the specified schema, or a conflict resolution routine with the specified sequence number is not registered.
notquiesced	Master group is not quiesced.

EXECUTE_DDL Procedure

This procedure supplies DDL that you want to have executed at some or all master sites. You can call this procedure only from the master definition site.

Syntax

```
DBMS_REPCAT.EXECUTE_DDL (
   gname           IN   VARCHAR2,
   { master_list   IN   VARCHAR2     := NULL,
    | master_table  IN   DBMS_UTILITY.DBLINK_ARRAY,}
   DDL_TEXT        IN   VARCHAR2);
```

Note: This procedure is overloaded. The `master_list` and `master_table` parameters are mutually exclusive.

Parameters

Table 48–92 EXECUTE_DDL Procedure Parameters

Parameter	Description
gname	Name of the master group.
master_list	A comma-separated list of master sites at which you want to execute the supplied DDL. Do not put any spaces between site names. The default value, NULL, indicates that the DDL should be executed at all sites, including the master definition site.
master_table	A table that lists the master sites where you want to execute the supplied DDL. The first master should be at position 1, the second at position 2, and so on.
ddl_text	The DDL that you want to execute at each of the specified master sites. If the DDL is supplied without specifying a schema, then the default schema is the replication administrator's schema. Be sure to specify the schema if it is other than the replication administrator's schema.

Exceptions

Table 48–93 EXECUTE_DDL Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
nonmaster	At least one site is not a master site.
ddlfailure	DDL at the master definition site did not succeed.
commfailure	At least one master site is not accessible.

GENERATE_MVIEW_SUPPORT Procedure

This procedure activates triggers and generate packages needed to support the replication of updatable materialized views or procedural replication.You must call this procedure from the materialized view site.

> **Note:** CREATE_MVIEW_REPOBJECT automatically generates materialized view support for updatable materialized views.

Syntax

```
DBMS_REPCAT.GENERATE_MVIEW_SUPPORT (
   sname                  IN VARCHAR2,
   oname                  IN VARCHAR2,
   type                   IN VARCHAR2,
   gen_objs_owner         IN VARCHAR2 := '',
   min_communication      IN BOOLEAN  := true,
   generate_80_compatible IN BOOLEAN  := true);
```

Parameters

Table 48–94 GENERATE_MVIEW_SUPPORT Procedure Parameters

Parameter	Description
sname	Schema in which the object is located.
oname	The name of the object for which you are generating support.
type	Type of the object. The types supported are SNAPSHOT, PACKAGE, and PACKAGE BODY.
gen_objs_owner	For objects of type PACKAGE or PACKAGE BODY, the schema in which the generated object should be created. If NULL, the objects are created in SNAME.
min_communication	If true, then the update trigger sends the new value of a column only if the update statement modifies the column. The update trigger sends the old value of the column only if it is a key column or a column in a modified column group.
generate_80_compatible	Set to true if the materialized view's master site is running a version of Oracle server prior to Oracle8*i* release 8.1.5. Set to false if the materialized view's master site or master materialized view site is running Oracle8*i* release 8.1.5 or higher.

Exceptions

Table 48–95 GENERATE_MVIEW_SUPPORT Procedure Exceptions

Exceptions	Descriptions
nonmview	Invocation site is not a materialized view site.
missingobject	Specified object does not exist as a materialized view in the replicated schema waiting for row/column-level replication information or as a package (body) waiting for wrapper generation.
typefailure	Specified type parameter is not supported.
missingschema	Specified owner of generated objects does not exist.
missingremoteobject	Object at master site or master materialized view site has not yet generated replication support.
commfailure	Master site or master materialized view site is not accessible.

GENERATE_REPLICATION_SUPPORT Procedure

This procedure generates the triggers and packages needed to support replication for a specified object. You must call this procedure from the master definition site.

Syntax

```
DBMS_REPCAT.GENERATE_REPLICATION_SUPPORT (
  sname                     IN    VARCHAR2,
  oname                     IN    VARCHAR2,
  type                      IN    VARCHAR2,
  package_prefix            IN    VARCHAR2   := NULL,
  procedure_prefix          IN    VARCHAR2   := NULL,
  distributed               IN    BOOLEAN    := true,
  gen_objs_owner            IN    VARCHAR2   := NULL,
  min_communication         IN    BOOLEAN    := true,
  generate_80_compatible    IN    BOOLEAN    := true);
```

Parameters

Table 48–96 GENERATE_REPLICATION_SUPPORT Procedure Parameters

Parameter	Description
sname	Schema in which the object is located.
oname	Name of the object for which you are generating replication support.
type	Type of the object. The types supported are: TABLE, PACKAGE, and PACKAGE BODY.
package_prefix	For objects of type PACKAGE or PACKAGE BODY this value is prepended to the generated wrapper package name. The default is DEFER_.
procedure_prefix	For objects of type PACKAGE or PACKAGE BODY, this value is prepended to the generated wrapper procedure names. By default, no prefix is assigned.
distributed	This must be set to true.
gen_objs_owner	For objects of type PACKAGE or PACKAGE BODY, the schema in which the generated object should be created. If NULL, the objects are created in sname.
min_communication	Set to false if any master site is running Oracle7 release 7.3. Set to true when you want propagation of new and old values to be minimized. The default is true. For more information, see *Oracle9i Replication*.
generate_80_compatible	Set to true if any master site is running a version of Oracle server prior to Oracle8*i* release 8.1.5. Set to false if all master sites are running Oracle8*i* release 8.1.5 or higher.

Exceptions

Table 48–97 GENERATE_REPLICATION_SUPPORT Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
missingobject	Specified object does not exist as a table in the specified schema waiting for row-level replication information or as a package (body) waiting for wrapper generation.
typefailure	Specified type parameter is not supported.
notquiesced	Replication group has not been quiesced.
commfailure	At least one master site is not accessible.
missingschema	Schema does not exist.
dbnotcompatible	One of the master sites is not 7.3.0.0 compatible.
notcompat	One of the master sites is not 7.3.0.0 compatible. (Equivalent to dbnotcompatible.)
duplicateobject	Object already exists.

MAKE_COLUMN_GROUP Procedure

This procedure creates a new column group with one or more members. You must call this procedure from the master definition site.

> **See Also:** *Oracle9i Replication* for more information about conflict resolution methods

Syntax

```
DBMS_REPCAT.MAKE_COLUMN_GROUP (
   sname                 IN   VARCHAR2,
   oname                 IN   VARCHAR2,
   column_group          IN   VARCHAR2,
   list_of_column_names  IN   VARCHAR2 | DBMS_REPCAT.VARCHAR2s);
```

Parameters

Table 48–98 MAKE_COLUMN_GROUP Procedure Parameters

Parameter	Description
sname	Schema in which the replicated table is located.
oname	Name of the replicated table for which you are creating a new column group. The table can be the storage table of a nested table.
column_group	Name that you want assigned to the column group that you are creating.
list_of_column_names	Names of the columns that you are grouping. This can either be a comma-separated list or a PL/SQL index-by table of column names. The PL/SQL index-by table must be of type DBMS_REPCAT.VARCHAR2. Use the single value '*' to create a column group that contains all of the columns in your table. You can specify column objects, but you cannot specify attributes of column objects. If the table is an object table, then you can specify SYS_NC_OID$ to add the object identifier column to the column group. This column tracks the object identifier of each row object. If the table is the storage table of a nested table, then you can specify NESTED_TABLE_ID to add the column that tracks the identifier for each row of the nested table.

Exceptions

Table 48–99 MAKE_COLUMN_GROUP Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the masterdef site.
duplicategroup	Specified column group already exists for the table.
missingobject	Specified table does not exist.
missingcolumn	Specified column does not exist in the designated table.
duplicatecolumn	Specified column is already a member of another column group.
notquiesced	Master group is not quiesced.

PREPARE_INSTANTIATED_MASTER Procedure

This procedure enables the propagation of deferred transactions from other prepared new master sites and existing master sites to the invocation master site. This procedure also enables the propagation of deferred transactions from the invocation master site to the other prepared new master sites and existing master sites.

If you performed a full database export/import or a change-based recovery, then the new master site includes all of the deferred transactions that were in the deferred transactions queue at the master definition site. Because these deferred transactions should not exist at the new master site, this procedure deletes all transactions in the deferred transactions queue and error queue if full database export/import or change-based recovery was used.

For object-level export/import, ensure that all the requests in the DBA_REPCATLOG data dictionary view for the extended groups have been processed without error before running this procedure.

Caution:

- Do not invoke this procedure until instantiation (export/import or change-based recovery) for the new master site is complete.
- Do not allow any data manipulation language (DML) statements directly on the objects in the extended master group in the new master site until execution of this procedure returns successfully. These DML statements may not be replicated.
- Do not use the DBMS_DEFER package to create deferred transactions until execution of this procedure returns successfully. These deferred transactions may not be replicated.

Note: To use change-based recovery, the existing master site and the new master site must be running under the same operating system, although the release of the operating system can differ.

Syntax

```
DBMS_REPCAT.PREPARE_INSTANTIATED_MASTER (
   extension_id             IN       RAW);
```

Parameters

Table 48–100 PREPARE_INSTANTIATED_MASTER Procedure Parameters

Parameter	Description
extension_id	The identifier for the current pending request to add master databases to a master group without quiesce. You can find the extension_id by querying the DBA_REPSITES_NEW and DBA_REPEXTENSIONS data dictionary views.

Exceptions

Table 48–101 PREPARE_INSTANTIATED_MASTER Procedure Exceptions

Exception	Description
typefailure	The parameter value specified for one of the parameters is not appropriate.
dbnotcompatible	Feature is incompatible with database version. All databases must be at 9.0.0 or higher compatibility level.

PURGE_MASTER_LOG Procedure

This procedure removes local messages in the DBA_REPCATLOG view associated with a specified identification number, source, or master group.

To purge all of the administrative requests from a particular source, specify NULL for the id parameter. To purge all administrative requests from all sources, specify NULL for both the id parameter and the source parameter.

Syntax

```
DBMS_REPCAT.PURGE_MASTER_LOG (
   id      IN   BINARY_INTEGER,
   source  IN   VARCHAR2,
   gname   IN   VARCHAR2);
```

Parameters

Table 48–102 PURGE_MASTER_LOG Procedure Parameters

Parameter	Description
id	Identification number of the request, as it appears in the DBA_REPCATLOG view.
source	Master site from which the request originated.
gname	Name of the master group for which the request was made.

Exceptions

Table 48–103 PURGE_MASTER_LOG Procedure Exceptions

Exception	Description
nonmaster	gname is not NULL, and the invocation site is not a master site.

PURGE_STATISTICS Procedure

This procedure removes information from the DBA_REPRESOLUTION_STATISTICS view.

Syntax

```
DBMS_REPCAT.PURGE_STATISTICS (
   sname      IN   VARCHAR2,
   oname      IN   VARCHAR2,
   start_date IN   DATE,
   end_date   IN   DATE);
```

Parameters

Table 48–104 PURGE_STATISTICS Procedure Parameters

Parameter	Description
sname	Name of the schema in which the replicated table is located.
oname	Name of the table whose conflict resolution statistics you want to purge.
start_date/end_date	Range of dates for which you want to purge statistics. If start_date is NULL, then purge all statistics up to the end_date. If end_date is NULL, then purge all statistics after the start_date.

Exceptions

Table 48–105 PURGE_STATISTICS Procedure Exceptions

Exception	Description
missingschema	Specified schema does not exist.
missingobject	Specified table does not exist.
statnotreg	Table not registered to collect statistics.

REFRESH_MVIEW_REPGROUP Procedure

This procedure refreshes a materialized view group with the most recent data from its associated master site or master materialized view site.

Syntax

```
DBMS_REPCAT.REFRESH_MVIEW_REPGROUP (
   gname                 IN   VARCHAR2,
   drop_missing_contents IN   BOOLEAN    := false,
   refresh_mviews        IN   BOOLEAN    := false,
   refresh_other_objects IN   BOOLEAN    := false
   gowner                IN   VARCHAR2   := 'PUBLIC');
```

Parameters

Table 48–106 REFRESH_MVIEW_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the replication group.
drop_missing_contents	If an object was dropped from the replication group at the master site or master materialized view site, then it is not automatically dropped from the schema at the materialized view site. It is simply no longer replicated. That is, changes to this object are no longer sent to its associated master site or master materialized view site. Materialized views can continue to be refreshed from their associated master tables or master materialized views. However, any changes to an updatable materialized view are lost. When an object is dropped from the replication group, you can choose to have it dropped from the schema entirely by setting this parameter to `true`.
refresh_mviews	Set to `true` to refresh the contents of the materialized views in the replication group.
refresh_other_objects	Set this to `true` to refresh the contents of the nonmaterialized view objects in the replication group. Nonmaterialized view objects may include the following: ■ Tables ■ Views ■ Indexes ■ PL/SQL packages and package bodies ■ PL/SQL procedures and functions ■ Triggers ■ Synonyms
gowner	Owner of the materialized view group.

Exceptions

Table 48–107 REFRESH_MVIEW_REPGROUP Procedure Exceptions

Exception	Description
nonmview	Invocation site is not a materialized view site.
nonmaster	Master is no longer a master site or master materialized view site.
commfailure	Master site or master materialized view site is not accessible.
missingrepgroup	Replication group name not specified.

REGISTER_MVIEW_REPGROUP Procedure

This procedure facilitates the administration of materialized views at their respective master sites or master materialized view sites by inserting or modifying a materialized view group in DBA_REGISTERED_MVIEW_GROUPS.

Syntax

```
DBMS_REPCAT.REGISTER_MVIEW_REPGROUP (
   gname            IN   VARCHAR2,
   mviewsite         IN   VARCHAR2,
   comment          IN   VARCHAR2  := NULL,
   rep_type         IN   NUMBER    := reg_unknown,
   fname            IN   VARCHAR2  := NULL
   gowner           IN   VARCHAR2  := 'PUBLIC');
```

Parameters

Table 48–108 REGISTER_MVIEW_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the materialized view group to be registered.
mviewsite	Global name of the materialized view site.
comment	Comment for the materialized view site or update for an existing comment.
rep_type	Version of the materialized view group. Valid constants that can be assigned include the following: ▪ dbms_repcat.reg_unknown (the default) ▪ dbms_repcat.reg_v7_group ▪ dbms_repcat.reg_v8_group
fname	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.
gowner	Owner of the materialized view group.

Exceptions

Table 48–109 REGISTER_MVIEW_REPGROUP Procedure Exceptions

Exception	Description
failregmviewrepgroup	Registration of materialized view group failed.
missingrepgroup	Replication group name not specified.
nullsitename	A materialized view site was not specified.
nonmaster	Procedure must be executed at the materialized view's master site or master materialized view site.
duplicaterepgroup	Replication group already exists.

REGISTER_STATISTICS Procedure

This procedure collects information about the successful resolution of update, delete, and uniqueness conflicts for a table.

Syntax

```
DBMS_REPCAT.REGISTER_STATISTICS (
   sname IN   VARCHAR2,
   oname IN   VARCHAR2);
```

Parameters

Table 48–110 REGISTER_STATISTICS Procedure Parameters

Parameter	Description
sname	Name of the schema in which the table is located.
oname	Name of the table for which you want to gather conflict resolution statistics.

Exceptions

Table 48–111 REGISTER_STATISTICS Procedure Exceptions

Exception	Description
missingschema	Specified schema does not exist.
missingobject	Specified table does not exist.

RELOCATE_MASTERDEF Procedure

This procedure changes your master definition site to another master site in your replication environment.

It is not necessary for either the old or new master definition site to be available when you call RELOCATE_MASTERDEF. In a planned reconfiguration, you should invoke RELOCATE_MASTERDEF with `notify_masters` set to `true` and `include_old_masterdef` set to `true`.

Syntax

```
DBMS_REPCAT.RELOCATE_MASTERDEF (
   gname                  IN   VARCHAR2,
   old_masterdef          IN   VARCHAR2,
   new_masterdef          IN   VARCHAR2,
   notify_masters         IN   BOOLEAN    := true,
   include_old_masterdef  IN   BOOLEAN    := true,
   require_flavor_change  IN   BOOLEAN    := false);
```

Parameters

Table 48–112 RELOCATE_MASTERDEF Procedure Parameters

Parameter	Description
gname	Name of the replication group whose master definition you want to relocate.
old_masterdef	Fully qualified database name of the current master definition site.
new_masterdef	Fully qualified database name of the existing master site that you want to make the new master definition site.
notify_masters	If this is `true`, then the procedure synchronously multicasts the change to all masters (including `old_masterdef` only if `include_old_masterdef` is `true`). If any master does not make the change, then roll back the changes at all masters. If just the master definition site fails, then you should invoke `RELOCATE_MASTERDEF` with `notify_masters` set to `true` and `include_old_masterdef` set to `false`. If several master sites and the master definition site fail, then the administrator should invoke `RELOCATE_MASTERDEF` at each operational master with `notify_masters` set to `false`.
include_old_masterdef	If `notify_masters` is `true` and if `include_old_masterdef` is also `true`, then the old master definition site is also notified of the change.
require_flavor_change	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 48–113 RELOCATE_MASTERDEF Procedure Exceptions

Exception	Description
nonmaster	`new_masterdef` is not a master site or the invocation site is not a master site.
nonmasterdef	`old_masterdef` is not the master definition site.
commfailure	At least one master site is not accessible and `notify_masters` is `true`.

REMOVE_MASTER_DATABASES Procedure

This procedure removes one or more master databases from a replication environment. This procedure regenerates the triggers and their associated packages at the remaining master sites. You must call this procedure from the master definition site.

Syntax

```
DBMS_REPCAT.REMOVE_MASTER_DATABASES (
   gname           IN   VARCHAR2,
   master_list     IN   VARCHAR2 |
   master_table    IN   DBMS_UTILITY.DBLINK_ARRAY);
```

> **Note:** This procedure is overloaded. The `master_list` and `master_table` parameters are mutually exclusive.

Parameters

Table 48–114 REMOVE_MASTER_DATABASES Procedure Parameters

Parameter	Description
gname	Name of the replication group associated with the replication environment. This prevents confusion if a master database is involved in more than one replication environment.
master_list	A comma-separated list of fully qualified master database names that you want to remove from the replication environment. There must be no spaces between names in the list.
master_table	In place of a list, you can specify the database names in a PL/SQL index-by table of type DBMS_UTILITY.DBLINK_ARRAY.

Exceptions

Table 48–115 REMOVE_MASTER_DATABASES Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
nonmaster	At least one of the specified databases is not a master site.
reconfigerror	One of the specified databases is the master definition site.
commfailure	At least one remaining master site is not accessible.

RENAME_SHADOW_COLUMN_GROUP Procedure

This procedure renames the shadow column group of a replicated table to make it a named column group. The replicated table's master group does not need to be quiesced to run this procedure.

Syntax

```
DBMS_REPCAT.RENAME_SHADOW_COLUMN_GROUP (
   sname                IN VARCHAR2,
   oname                IN VARCHAR2,
   new_col_group_name   IN VARCHAR2)
```

Parameters

Table 48–116 RENAME_SHADOW_COLUMN_GROUP Procedure Parameters

Parameter	Description
sname	Schema in which the replicated table is located.
oname	Name of the replicated table.
new_col_group_name	Name of the new column group. The columns currently in the shadow group are placed in a column group with the name you specify.

Exceptions

Table 48–117 RENAME_SHADOW_COLUMN_GROUP Procedure Exceptions

Exception	Description
missmview	The specified schema does not exist.
nonmasterdef	Invocation site is not the master definition site.
missingobject	The specified object does not exist.
duplicategroup	The column group that was specified for creation already exists.

REPCAT_IMPORT_CHECK Procedure

This procedure ensures that the objects in the master group have the appropriate object identifiers and status values after you perform an export/import of a replicated object or an object used by Oracle Replication.

Syntax

```
DBMS_REPCAT.REPCAT_IMPORT_CHECK (
   gname      IN   VARCHAR2,
   master     IN   BOOLEAN
   gowner     IN   VARCHAR2  := 'PUBLIC');
```

Parameters

Table 48–118 REPCAT_IMPORT_CHECK Procedure Parameters

Parameter	Description
gname	Name of the master group. If you omit both parameters, then the procedure checks all master groups at your current site.
master	Set this to `true` if you are checking a master site and `false` if you are checking a materialized view site.
gowner	Owner of the master group.

Exceptions

Table 48–119 REPCAT_IMPORT_CHECK Procedure Exceptions

Exception	Description
nonmaster	master is true and either the database is not a master site for the replication group or the database is not the expected database.
nonmview	master is false and the database is not a materialized view site for the replication group.
missingobject	A valid replicated object in the replication group does not exist.
missingrepgroup	The specified replicated replication group does not exist.
missingschema	The specified replicated replication group does not exist.

RESUME_MASTER_ACTIVITY Procedure

This procedure resumes normal replication activity after quiescing a replication environment.

Syntax

```
DBMS_REPCAT.RESUME_MASTER_ACTIVITY (
   gname       IN  VARCHAR2,
   override    IN  BOOLEAN := false);
```

Parameters

Table 48–120 RESUME_MASTER_ACTIVITY Procedure Parameters

Parameter	Description
gname	Name of the master group.
override	If this is true, then it ignores any pending RepCat administrative requests and restores normal replication activity at each master as quickly as possible. This should be considered only in emergency situations. If this is false, then it restores normal replication activity at each master only when there is no pending RepCat administrative request for gname at that master.

Exceptions

Table 48–121 RESUME_MASTER_ACTIVITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
notquiesced	Master group is not quiescing or quiesced.
commfailure	At least one master site is not accessible.
notallgenerated	Generate replication support before resuming replication activity.

RESUME_PROPAGATION_TO_MDEF Procedure

During the process of adding new master sites to a master group without quiesce, this procedure indicates that export is effectively finished and propagation to the master definition site for both extended and unaffected replication groups existing at master sites can be enabled. Run this procedure after the export required to add new master sites to a master group is complete.

Syntax

```
DBMS_REPCAT.RESUME_PROPAGATION_TO_MDEF (
   extension_id                IN    RAW);
```

Parameters

Table 48–122 RESUME_PROPAGATION_TO_MDEF Procedure Parameters

Parameter	Description
extension_id	The identifier for the current pending request to add master databases to a master group without quiesce. You can find the extension_id by querying the DBA_REPSITES_NEW and DBA_REPEXTENSIONS data dictionary views.

Exceptions

Table 48–123 RESUME_PROPAGATION_TO_MDEF Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
extstinapp	Extension status is inappropriate. The extension status should be EXPORTING when you run this procedure. To check the extension status, query the DBA_REPEXTENSIONS data dictionary view.
dbnotcompatible	Feature is incompatible with database version. All databases must be at 9.0.0 or higher compatibility level.

SEND_OLD_VALUES Procedure

You have the option of sending old column values during propagation of deferred transactions for each nonkey column of a replicated table when rows are updated or deleted in the table. When min_communication is set to true, the default is the following:

- For a deleted row, to send old values for all columns
- For an updated row, to send old values for key columns and the modified columns in a column group

You can change this behavior at all master sites and materialized view sites by invoking DBMS_REPCAT.SEND_OLD_VALUES at the master definition site. Then, generate replication support at all master sites and at each materialized view site.

When you use user-defined types, you can specify the leaf attributes of a column object, or an entire column object. For example, if a column object named cust_address has street_address as an attribute, then you can specify cust_address.street_address for the column_list parameter or as part of the column_table parameter, or you can specify only cust_address.

Syntax

```
DBMS_REPCAT.SEND_OLD_VALUES(
   sname           IN  VARCHAR2,
   oname           IN  VARCHAR2,
   { column_list   IN  VARCHAR2,
   | column_table  IN  DBMS_UTILITY.VARCHAR2s | DBMS_UTILITY.LNAME_ARRAY,}
   operation       IN  VARCHAR2 := 'UPDATE',
   send            IN  BOOLEAN  := true );
```

Note: This procedure is overloaded. The `column_list` and `column_table` parameters are mutually exclusive.

Parameters

Table 48–124 SEND_OLD_VALUES Procedure Parameters

Parameter	Description
sname	Schema in which the table is located.
oname	Name of the replicated table. The table can be the storage table of a nested table.
column_list	A comma-separated list of the columns in the table. There must be no spaces between entries.
column_table	Instead of a list, you can use a PL/SQL index-by table of type DBMS_REPCAT.VARCHAR2 or DBMS_UTILITY.LNAME_ARRAY to contain the column names. The first column name should be at position 1, the second at position 2, and so on. Use DBMS_UTILITY.LNAME_ARRAY if any column name is greater than or equal to 30 bytes, which may occur when you specify the attributes of column objects.
operation	Possible values are: `update`, `delete`, or the asterisk wildcard `'*'`, which means update and delete.
send	If `true`, then the old values of the specified columns are sent. If `false`, then the old values of the specified columns are not sent. Unspecified columns and unspecified operations are not affected. The specified change takes effect at the master definition site as soon as `min_communication` is `true` for the table. The change takes effect at a master site or at a materialized view site the next time replication support is generated at that site with `min_communication true`.

Note: The `operation` parameter enables you to specify whether or not to transmit old values for nonkey columns when rows are deleted or updated. If you do not send the old value, then Oracle sends a `NULL` in place of the old value and assumes the old value is equal to the current value of the column at the target side when the update or delete is applied.

See *Oracle9i Replication* for information about reduced data propagation using the `SEND_OLD_VALUES` procedure before changing the default behavior of Oracle.

Exceptions

Table 48–125 SEND_OLD_VALUES Procedure Exceptions

Exception	Description
`nonmasterdef`	Invocation site is not the master definition site.
`missingobject`	Specified object does not exist as a table in the specified schema waiting for row-level replication information.
`missingcolumn`	At least one column is not in the table.
`notquiesced`	Master group has not been quiesced.
`typefailure`	An illegal operation is specified.
`keysendcomp`	A specified column is a key column in a table.
`dbnotcompatible`	Feature is incompatible with database version. Typically, this exception arises when you are trying to send the attributes of column objects. In this case, all databases must be at 9.0.0 or higher compatibility level.

SET_COLUMNS Procedure

This procedure enables you to use an alternate column or group of columns, instead of the primary key, to determine which columns of a table to compare when using row-level replication. You must call this procedure from the master definition site.

When you use column objects, if an attribute of a column object can be used as a primary key or part of a primary key, then the attribute can be part of an alternate key column. For example, if a column object named `cust_address` has `street_address` as a `VARCHAR2` attribute, then you can specify `cust_address.street_address` for the `column_list` parameter or as part of the `column_table` parameter. However, the entire column object, `cust_address`, cannot be specified.

For the storage table of a nested table column, this procedure accepts the `NESTED_TABLE_ID` as an alternate key column.

When you use object tables, you cannot specify alternate key columns. If the object identifier (OID) is system-generated for an object table, then Oracle uses the OID column in the object table as the key for the object table. If the OID is user-defined for an object table, then Oracle uses the primary key in the object table as the key.

The following types of columns cannot be alternate key columns:

- LOB or LOB attribute of a column object
- Collection or collection attribute of a column object
- `REF`
- An entire column object

> **See Also:** The *constraint_clause* in *Oracle9i SQL Reference* for more information about restrictions on primary key columns

Syntax

```
DBMS_REPCAT.SET_COLUMNS (
   sname           IN    VARCHAR2,
   oname           IN    VARCHAR2,
   { column_list   IN    VARCHAR2
   | column_table  IN    DBMS_UTILITY.NAME_ARRAY | DBMS_UTILITY.LNAME_ARRAY } );
```

Note: This procedure is overloaded. The `column_list` and `column_table` parameters are mutually exclusive.

Parameters

Table 48–126 SET_COLUMNS Procedure Parameters

Parameter	Description
`sname`	Schema in which the table is located.
`oname`	Name of the table.
`column_list`	A comma-separated list of the columns in the table that you want to use as a primary key. There must be no spaces between entries.
`column_table`	Instead of a list, you can use a PL/SQL index-by table of type `DBMS_UTILITY.NAME_ARRAY` or `DBMS_UTILITY.LNAME_ARRAY` to contain the column names. The first column name should be at position 1, the second at position 2, and so on. Use `DBMS_UTILITY.LNAME_ARRAY` if any column name is greater than or equal to 30 bytes, which may occur when you specify the attributes of column objects.

Exceptions

Table 48–127 SET_COLUMNS Procedure Exceptions

Exception	Description
`nonmasterdef`	Invocation site is not the master definition site.
`missingobject`	Specified object does not exist as a table in the specified schema waiting for row-level replication information.
`missingcolumn`	At least one column is not in the table.
`notquiesced`	Replication group is not quiescing or quiesced.

SPECIFY_NEW_MASTERS Procedure

This procedure specifies the master sites you intend to add to an existing replication group without quiescing the group. This procedure must be run at the master definition site of the specified master group.

If necessary, this procedure creates an `extension_id` that tracks the process of adding new master sites to a master group. You use this `extension_id` in the other procedures that you run at various stages in the process. You can view information about the `extension_id` in the DBA_REPSITES_NEW and DBA_REPEXTENSIONS data dictionary views.

This procedure adds the new master sites to the DBA_REPSITES_NEW data dictionary view for the specified replication group. This procedure can be run any number of times for a given replication group. If it is run more than once, then it replaces any masters in the local DBA_REPSITES_NEW data dictionary view for the specified replication group with the masters specified in the `master_list`/`master_table` parameters.

You must run this procedure before you run the ADD_NEW_MASTERS procedure. No new master sites are added to the master group until you run the ADD_NEW_MASTERS procedure.

See Also: "ADD_NEW_MASTERS Procedure" on page 48-11

Syntax

```
DBMS_REPCAT.SPECIFY_NEW_MASTERS (
   gname           IN    VARCHAR2,
   { master_list   IN    VARCHAR2
    | master_table  IN   DBMS_UTILITY.DBLINK_ARRAY});
```

Note: This procedure is overloaded. The `master_list` and `master_table` parameters are mutually exclusive.

Parameters

Table 48–128 SPECIFY_NEW_MASTERS Procedure Parameters

Parameter	Description
gname	Master group to which you are adding new master sites.
master_list	A comma-separated list of new master sites that you want to add to the master group. List only the new master sites, not the existing master sites. Do not put any spaces between site names. If master_list is NULL, all master sites for the given replication group are removed from the DBA_REPSITES_NEW data dictionary view. Specify NULL to indicate that the master group is not being extended.
master_table	A table that lists the new master sites that you want to add to the master group. In the table, list only the new master sites, not the existing master sites. The first master site should be at position 1, the second at position 2, and so on. If the table is empty, then all master sites for the specified replication group are removed from the DBA_REPSITES_NEW data dictionary view. Use an empty table to indicate that the master group is not being extended.

Exceptions

Table 48–129 SPECIFY_NEW_MASTERS Procedure Exceptions

Exception	Description
duplicaterepgroup	A master site that you are attempting to add is already part of the master group.
nonmasterdef	Invocation site is not the master definition site.
propmodenotallowed	Synchronous propagation mode not allowed for this operation. Only asynchronous propagation mode is allowed.
extstinapp	Extension request with status not allowed. There must either be no extension_id for the master group or the extension_id status must be READY. You can view the status for each extension_id at a master site in the DBA_REPEXTENSIONS data dictionary view.
dbnotcompatible	Feature is incompatible with database version. All databases must be at 9.0.0 or higher compatibility level.
notsamecq	Master groups do not have the same connection qualifier.

SUSPEND_MASTER_ACTIVITY Procedure

This procedure suspends replication activity for a master group. You use this procedure to quiesce the master group. You must call this procedure from the master definition site.

Syntax

```
DBMS_REPCAT.SUSPEND_MASTER_ACTIVITY (
   gname    IN    VARCHAR2);
```

Parameters

Table 48–130 SUSPEND_MASTER_ACTIVITY Procedure Parameters

Parameter	Description
gname	Name of the master group for which you want to suspend activity.

Exceptions

Table 48–131 SUSPEND_MASTER_ACTIVITY Procedure Exceptions

Exception	Description
nonmasterdef	Invocation site is not the master definition site.
notnormal	Master group is not in normal operation.
commfailure	At least one master site is not accessible.

SWITCH_MVIEW_MASTER Procedure

This procedure changes the master site of a materialized view group to another master site. This procedure does a full refresh of the affected materialized views and regenerates the triggers and their associated packages as needed. This procedure does not push the queue to the old master site before changing master sites.

If `min_communication` is `true` for the materialized view and the new master site is an Oracle7 master site, then regenerate replication support for the materialized view with `min_communication` set to `false`.

If `generate_80_compatible` is `false` for the materialized view and the new master site is a release lower than Oracle8*i* (Oracle7 or Oracle8), then regenerate replication support for the materialized view with `generate_80_compatible` set to `true`.

You can set both parameters for a materialized view in one call to `DBMS_REPCAT.GENERATE_MVIEW_SUPPORT`.

Note: You cannot switch the master of materialized views that are based on other materialized views (level 2 and greater materialized views). Such a materialized view must be dropped and recreated if you want to base it on a different master.

See Also: "GENERATE_MVIEW_SUPPORT Procedure" on page 48-82

Syntax

```
DBMS_REPCAT.SWITCH_MVIEW_MASTER (
   gname          IN   VARCHAR2,
   master         IN   VARCHAR2
   gowner         IN   VARCHAR2  := 'PUBLIC');
```

Parameters

Table 48–132 SWITCH_MVIEW_MASTER Procedure Parameters

Parameter	Description
gname	Name of the materialized view group for which you want to change the master site.
master	Fully qualified database name of the new master site to use for the materialized view group.
gowner	Owner of the materialized view group.

Exceptions

Table 48–133 SWITCH_MVIEW_MASTER Procedure Exceptions

Exception	Description
nonmview	Invocation site is not a materialized view site.
nonmaster	Specified database is not a master site.
commfailure	Specified database is not accessible.
missingrepgroup	Materialized view group does not exist.
qrytoolong	Materialized view definition query is greater 32 KB.
alreadymastered	At the local site, there is another materialized view group with the same group name mastered at the old master site.

UNDO_ADD_NEW_MASTERS_REQUEST Procedure

This procedure undoes all of the changes made by the SPECIFY_NEW_MASTERS and ADD_NEW_MASTERS procedures for a specified extension_id.

This procedure is executed at one master site, which may be the master definition site, and it only affects that master site. If you run this procedure at one master site affected by the request, you must run it at all new and existing master sites affected by the request. You can query the DBA_REPSITES_NEW data dictionary view to see the new master sites affected by the extension_id. This data dictionary view also lists the replication group name, and you must run this procedure at all existing master sites in the replication group.

Caution: This procedure is not normally called. Use this procedure only if the adding new masters without quiesce operation cannot proceed at one or more master sites. Run this procedure after you have already run the SPECIFY_NEW_MASTERS and ADD_NEW_MASTERS procedures, but *before* you have run the RESUME_PROPAGATION_TO_MDEF and PREPARE_INSTANTIATED_MASTER procedures.

Do not run this procedure after you have run either RESUME_PROPAGATION_TO_MDEF or PREPARE_INSTANTIATED_MASTER for a particular extension_id.

See Also:

- "SPECIFY_NEW_MASTERS Procedure" on page 48-107
- "ADD_NEW_MASTERS Procedure" on page 48-11
- "RESUME_PROPAGATION_TO_MDEF Procedure" on page 48-101
- "PREPARE_INSTANTIATED_MASTER Procedure" on page 48-87

Syntax

```
DBMS_REPCAT.UNDO_ADD_NEW_MASTERS_REQUEST (
   extension_id         IN RAW,
   drop_contents        IN BOOLEAN := TRUE);
```

Parameters

Table 48–134 UNDO_ADD_NEW_MASTERS_REQUEST Procedure Parameters

Parameter	Description
extension_id	The identifier for the current pending request to add master databases to a master group without quiesce. You can find the extension_id by querying the DBA_REPSITES_NEW and DBA_REPEXTENSIONS data dictionary views.
drop_contents	Specify true, the default, to drop the contents of objects in new replication groups being extended at the local site. Specify false to retain the contents.

Exceptions

Table 48–135 UNDO_ADD_NEW_MASTERS_REQUEST Procedure Exceptions

Exception	Description
dbnotcompatible	Feature is incompatible with database version. All databases must be at 9.0.0 or higher compatibility level.
typefail	A parameter value that you specified is not appropriate.

UNREGISTER_MVIEW_REPGROUP Procedure

This procedure facilitates the administration of materialized views at their respective master sites or master materialized view sites by deleting a materialized view group from DBA_REGISTERED_MVIEW_GROUPS. Run this procedure at the master site or master materialized view site.

Syntax

```
DBMS_REPCAT.UNREGISTER_MVIEW_REPGROUP (
   gname      IN   VARCHAR2,
   mviewsite  IN   VARCHAR2
   gowner     IN   VARCHAR2  := 'PUBLIC');
```

Parameters

Table 48–136 UNREGISTER_MVIEW_REPGROUP Procedure Parameters

Parameter	Description
gname	Name of the materialized view group to be unregistered.
mviewsite	Global name of the materialized view site.
gowner	Owner of the materialized view group.

VALIDATE Function

This function validates the correctness of key conditions of a multimaster replication environment.

Syntax

```
DBMS_REPCAT.VALIDATE (
   gname               IN  VARCHAR2,
   check_genflags      IN  BOOLEAN := false,
   check_valid_objs    IN  BOOLEAN := false,
   check_links_sched   IN  BOOLEAN := false,
   check_links         IN  BOOLEAN := false,
   error_table         OUT DBMS_REPCAT.VALIDATE_ERR_TABLE)
  RETURN BINARY_INTEGER;
```

```
DBMS_REPCAT.VALIDATE (
   gname               IN  VARCHAR2,
   check_genflags      IN  BOOLEAN := false,
   check_valid_objs    IN  BOOLEAN := false,
   check_links_sched   IN  BOOLEAN := false,
   check_links         IN  BOOLEAN := false,
   error_msg_table     OUT DBMS_UTILITY.UNCL_ARRAY,
   error_num_table     OUT DBMS_UTILITY.NUMBER_ARRAY )
  RETURN BINARY_INTEGER;
```

Note: This function is overloaded. The return value of VALIDATE is the number of errors found. The function's OUT parameter returns any errors that are found. In the first interface function shown under "Syntax" on page 48-114, the error_table consists of an array of records. Each record has a VARCHAR2 and a NUMBER in it. The string field contains the error message, and the number field contains the Oracle error number.

The second interface function shown under "Syntax" on page 48-114 is similar except that there are two OUT arrays: a VARCHAR2 array with the error messages and a NUMBER array with the error numbers.

Parameters

Table 48–137 VALIDATE Function Parameters **(Page 1 of 2)**

Parameter	Description
gname	Name of the master group to validate.
check_genflags	Check whether all the objects in the group are generated. This must be done at the master definition site only.
check_valid_objs	Check that the underlying objects for objects in the group valid. This must be done at the master definition site only. The master definition site goes to all other sites and checks that the underlying objects are valid. The validity of the objects is checked within the schema of the connected user.
check_links_sched	Check whether the links are scheduled for execution. This should be invoked at each master site.

Table 48–137 VALIDATE Function Parameters **(Page 2 of 2)**

Parameter	Description
check_links	Check whether the connected user (repadmin), as well as the propagator, have correct links for replication to work properly. Checks that the links exist in the database and are accessible. This should be invoked at each master site.
error_table	Returns the messages and numbers of all errors that are found.
error_msg_table	Returns the messages of all errors that are found.
error_num_table	Returns the numbers of all errors that are found.

Exceptions

Table 48–138 VALIDATE Function Exceptions

Exception	Description
missingdblink	Database link does not exist in the schema of the replication propagator or has not been scheduled. Ensure that the database link exists in the database, is accessible, and is scheduled for execution.
dblinkmismatch	Database link name at the local node does not match the global name of the database that the link accesses. Ensure that the GLOBAL_NAMES initialization parameter is set to true and the link name matches the global name.
dblinkuidmismatch	User name of the replication administration user at the local node and the user name at the node corresponding to the database link are not the same. Oracle Replication expects the two users to be the same. Ensure that the user identification of the replication administration user at the local node and the user identification at the node corresponding to the database link are the same.
objectnotgenerated	Object has not been generated at other master sites or is still being generated. Ensure that the object is generated by calling GENERATE_REPLICATION_SUPPORT and DO_DEFERRED_REPCAT_ADMIN for the object at the master definition site.
opnotsupported	Operation is not supported if the replication group is replicated at a pre-Oracle8 node. Ensure that all nodes of the master group are running Oracle8 and higher.

Usage Notes

The return value of VALIDATE is the number of errors found. The function's OUT parameter returns any errors that are found. In the first interface function, the error_table consists of an array of records. Each record has a VARCHAR2 and a NUMBER in it. The string field contains the error message and the number field contains the Oracle error number.

The second interface is similar except that there are two OUT arrays. A VARCHAR2 array with the error messages and a NUMBER array with the error numbers.

WAIT_MASTER_LOG Procedure

This procedure determines whether changes that were asynchronously propagated to a master site have been applied.

Syntax

```
DBMS_REPCAT.WAIT_MASTER_LOG (
   gname          IN    VARCHAR2,
   record_count   IN    NATURAL,
   timeout        IN    NATURAL,
   true_count     OUT   NATURAL);
```

Parameters

Table 48–139 WAIT_MASTER_LOG Procedure Parameters

Parameter	Description
gname	Name of the master group.
record_count	Procedure returns whenever the number of incomplete activities is at or below this threshold.
timeout	Maximum number of seconds to wait before the procedure returns.
true_count (out parameter)	Returns the number of incomplete activities.

Exceptions

Table 48–140 WAIT_MASTER_LOG Procedure Exceptions

Exception	Description
nonmaster	Invocation site is not a master site.

49

DBMS_REPCAT_ADMIN

DBMS_REPCAT_ADMIN enables you to create users with the privileges needed by the symmetric replication facility.

This chapter discusses the following topics:

Summary of DBMS_REPCAT_ADMIN Subprograms

Table 49–1 DBMS_REPCAT_ADMIN Package Subprograms

Subprogram	Description
"GRANT_ADMIN_ANY_SCHEMA Procedure" on page 49-3	Grants the necessary privileges to the replication administrator to administer any replication group at the current site.
"GRANT_ADMIN_SCHEMA Procedure" on page 49-4	Grants the necessary privileges to the replication administrator to administer a schema at the current site.
"REGISTER_USER_REPGROUP Procedure" on page 5	Assigns proxy materialized view administrator or receiver privileges at the master site or master materialized view site for use with remote sites.
"REVOKE_ADMIN_ANY_SCHEMA Procedure" on page 49-7	Revokes the privileges and roles from the replication administrator that were granted by `GRANT_ADMIN_ANY_SCHEMA`.
"REVOKE_ADMIN_SCHEMA Procedure" on page 49-8	Revokes the privileges and roles from the replication administrator that were granted by `GRANT_ADMIN_SCHEMA`.
"UNREGISTER_USER_REPGROUP Procedure" on page 49-9	Revokes the privileges and roles from the proxy materialized view administrator or receiver that were granted by the `REGISTER_USER_REPGROUP` procedure.

GRANT_ADMIN_ANY_SCHEMA Procedure

This procedure grants the necessary privileges to the replication administrator to administer any replication groups at the current site.

Syntax

```
DBMS_REPCAT_ADMIN.GRANT_ADMIN_ANY_SCHEMA (
   username  IN   VARCHAR2);
```

Parameters

Table 49–2 GRANT_ADMIN_ANY_SCHEMA Procedure Parameters

Parameter	Description
username	Name of the replication administrator to whom you want to grant the necessary privileges and roles to administer any replication groups at the current site.

Exceptions

Table 49–3 GRANT_ADMIN_ANY_REPGROUP Procedure Exceptions

Exception	Description
ORA-01917	User does not exist.

GRANT_ADMIN_SCHEMA Procedure

This procedure grants the necessary privileges to the replication administrator to administer a schema at the current site. This procedure is most useful if your replication group does not span schemas.

Syntax

```
DBMS_REPCAT_ADMIN.GRANT_ADMIN_SCHEMA (
   username IN VARCHAR2);
```

Parameters

Table 49–4 GRANT_ADMIN_REPSCHEMA Procedure Parameters

Parameter	Description
username	Name of the replication administrator. This user is then granted the necessary privileges and roles to administer the schema of the same name within a replication group at the current site.

Exceptions

Table 49–5 GRANT_ADMIN_REPSCHEMA Procedure Exceptions

Exception	Description
ORA-01917	User does not exist.

REGISTER_USER_REPGROUP Procedure

This procedure assigns proxy materialized view administrator or receiver privileges at the master site or master materialized view site for use with remote sites. This procedure grants only the necessary privileges to the proxy materialized view administrator or receiver. It does not grant the powerful privileges granted by the GRANT_ADMIN_SCHEMA or GRANT_ADMIN_ANY_SCHEMA procedures.

Syntax

```
DBMS_REPCAT_ADMIN.REGISTER_USER_REPGROUP (
   username         IN   VARCHAR2,
   privilege_type   IN   VARCHAR2,
   {list_of_gnames  IN   VARCHAR2 |
   table_of_gnames  IN   DBMS_UTILITY.NAME_ARRAY)};
```

Note: This procedure is overloaded. The list_of_gnames and table_of_gnames parameters are mutually exclusive.

Parameters

Table 49–6 REGISTER_USER_REPGROUP Procedure Parameters

Parameter	Description
username	Name of the user to whom you are giving either proxy materialized view administrator or receiver privileges.
privilege_type	Specifies the privilege type you are assigning. Use the following values for to define your privilege_type: ▪ receiver for receiver privileges ▪ proxy_snapadmin for proxy materialized view administration privileges
list_of_gnames	Comma-separated list of replication groups you want a user registered for receiver privileges. There must be no spaces between entries in the list. If you set list_of_gnames to NULL, then the user is registered for all replication groups, even replication groups that are not yet known when this procedure is called. You must use named notation in order to set list_of_gnames to NULL. An invalid replication group in the list causes registration to fail for the entire list.
table_of_gnames	PL/SQL index-by table of replication groups you want a user registered for receiver privileges. The PL/SQL index-by table must be of type DBMS_UTILITY.NAME_ARRAY. This table is 1-based (the positions start at 1 and increment by 1). Use the single value NULL to register the user for all replication groups. An invalid replication group in the table causes registration to fail for the entire table.

Exceptions

Table 49–7 REGISTER_USER_REPGROUP Procedure Exceptions

Exception	Description
nonmaster	Specified replication group does not exist or the invocation database is not a master site or master materialized view site.
ORA-01917	User does not exist.
typefailure	Incorrect privilege type was specified.

REVOKE_ADMIN_ANY_SCHEMA Procedure

This procedure revokes the privileges and roles from the replication administrator that were granted by GRANT_ADMIN_ANY_SCHEMA.

> **Note:** Identical privileges and roles that were granted independently of GRANT_ADMIN_ANY_SCHEMA are also revoked.

Syntax

```
DBMS_REPCAT_ADMIN.REVOKE_ADMIN_ANY_SCHEMA (
   username IN VARCHAR2);
```

Parameters

Table 49–8 REVOKE_ADMIN_ANY_SCHEMA Procedure Parameters

Parameter	Description
username	Name of the replication administrator whose privileges you want to revoke.

Exceptions

Table 49–9 REVOKE_ADMIN_ANY_SCHEMA Procedure Exceptions

Exception	Description
ORA-01917	User does not exist.

REVOKE_ADMIN_SCHEMA Procedure

This procedure revokes the privileges and roles from the replication administrator that were granted by GRANT_ADMIN_SCHEMA.

Note: Identical privileges and roles that were granted independently of GRANT_ADMIN_SCHEMA are also revoked.

Syntax

```
DBMS_REPCAT_ADMIN.REVOKE_ADMIN_SCHEMA (
   username IN VARCHAR2);
```

Parameters

Table 49–10 REVOKE_ADMIN_SCHEMA Procedure Parameters

Parameter	Description
username	Name of the replication administrator whose privileges you want to revoke.

Exceptions

Table 49–11 REVOKE_ADMIN_SCHEMA Procedure Exceptions

Exception	Description
ORA-01917	User does not exist.

UNREGISTER_USER_REPGROUP Procedure

This procedure revokes the privileges and roles from the proxy materialized view administrator or receiver that were granted by the REGISTER_USER_REPGROUP procedure.

Syntax

```
DBMS_REPCAT_ADMIN.UNREGISTER_USER_REPGROUP (
   username         IN   VARCHAR2,
   privilege_type   IN   VARCHAR2,
   {list_of_gnames  IN   VARCHAR2 |
   table_of_gnames  IN   DBMS_UTILITY.NAME_ARRAY)};
```

Note: This procedure is overloaded. The `list_of_gnames` and `table_of_gnames` parameters are mutually exclusive.

Parameters

Table 49–12 UNREGISTER_USER_REPGROUP Procedure Parameters

Parameter	Description
username	Name of the user you are unregistering.
privilege_type	Specifies the privilege type you are revoking. Use the following values for to define your privilege_type: ▪ receiver for receiver privileges ▪ proxy_snapadmin for proxy materialized view administration privileges
list_of_gnames	Comma-separated list of replication groups you want a user unregistered for receiver privileges. There must be no spaces between entries in the list. If you set list_of_gnames to NULL, then the user is unregistered for all replication groups registered. You must use named notation in order to set list_of_gnames to NULL. An invalid replication group in the list causes unregistration to fail for the entire list.
table_of_gnames	PL/SQL index-by table of replication groups you want a user unregistered for receiver privileges. The PL/SQL index-by table must be of type DBMS_UTILITY.NAME_ARRAY. This table is 1-based (the positions start at 1 and increment by 1). Use the single value NULL to unregister the user for all replication groups registered. An invalid replication group in the table causes unregistration to fail for the entire table.

Exceptions

Table 49–13 UNREGISTER_USER_REPGROUP Procedure Exceptions

Exception	Description
nonmaster	Specified replication group does not exist or the invocation database is not a master site or master materialized view site.
ORA-01917	User does not exist.
typefailure	Incorrect privilege type was specified.

50

DBMS_REPCAT_INSTANTIATE

The DBMS_REPCAT_INSTANTIATE package instantiates deployment templates.

This chapter discusses the following topics:

- Summary of DBMS_REPCAT_INSTANTIATE Subprograms

Summary of DBMS_REPCAT_INSTANTIATE Subprograms

Table 50–1 DBMS_REPCAT_INSTANTIATE Package Subprograms

Subprogram	Description
"DROP_SITE_ INSTANTIATION Procedure" on page 50-3	Public procedure that removes the target site from the DBA_ REPCAT_TEMPLATE_SITES view.
"INSTANTIATE_OFFLINE Function" on page 50-3	Public function that generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while offline.
"INSTANTIATE_ONLINE Function" on page 50-6	Public function that generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while online.

DROP_SITE_INSTANTIATION Procedure

This procedure drops a template instantiation at a target site. This procedure removes all related metadata at the master site and disables the specified site from refreshing its materialized views. You must execute this procedure as the user who originally instantiated the template. To see who instantiated the template, query the ALL_REPCAT_TEMPLATE_SITES view.

Syntax

```
DBMS_REPCAT_INSTANTIATE.DROP_SITE_INSTANTIATION(
     refresh_template_name  IN   VARCHAR2,
     site_name              IN   VARCHAR2);
```

Table 50–2 DROP_SITE_INSTANTIATION Procedure Parameters

Parameter	Description
refresh_template_name	The name of the deployment template to be dropped.
site_name	Identifies the master site where you want to drop the specified template instantiation.

INSTANTIATE_OFFLINE Function

This function generates a file at the master site that is used to create the materialized view environment at the remote materialized view site while offline. This generated file is an offline instantiation file and should be used at remote materialized view sites that are not able to remain connected to the master site for an extended amount of time.

This is an ideal solution when the remote materialized view site is a laptop. Use the packaging interface in the Replication Management tool to package the generated file and data into a single file that can be posted on an FTP site or loaded to a CD-ROM, floppy disk, and so on.

The script generated by this function is stored in the USER_REPCAT_TEMP_OUTPUT temporary view and is used by several Oracle tools, including the Replication Management tool, during the distribution of deployment templates. The number returned by this function is used to retrieve the appropriate information from the USER_REPCAT_TEMP_OUTPUT view.

The user who executes this public function becomes the "registered" user of the instantiated template at the specified site.

Note: This function is used in performing an offline instantiation of a deployment template.

This function should not be confused with the procedures in the DBMS_OFFLINE_OG package (used for performing an offline instantiation of a master table) or with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view). See these respective packages for more information on their usage.

See Also:

- *Oracle9i Replication*
- The Replication Management tool's online help

Syntax

```
DBMS_REPCAT_INSTANTIATE.INSTANTIATE_OFFLINE(
     refresh_template_name   IN   VARCHAR2,
     site_name               IN   VARCHAR2,
     runtime_parm_id         IN   NUMBER    := -1e-130,
     next_date               IN   DATE      := SYSDATE,
     interval                IN   VARCHAR2  := 'SYSDATE + 1',
     use_default_gowner      IN   BOOLEAN   := true)
     return NUMBER;
```

Table 50–3 INSTANTIATE_OFFLINE Function Parameters

Parameter	Description
refresh_template_name	The name of the deployment template to be instantiated.
site_name	The name of the remote site that is instantiating the deployment template.
runtime_parm_id	If you have defined runtime parameter values using the INSERT_RUNTIME_PARMS procedure, specify the identification used when creating the runtime parameters (the identification was retrieved by using the GET_RUNTIME_PARM_ID function).
next_date	The next refresh date value to be used when creating the refresh group.
interval	The refresh interval to be used when creating the refresh group.
use_default_gowner	If true, then any materialized view groups created are owned by the default user PUBLIC. If false, then any materialized view groups created are owned by the user performing the instantiation.

Exceptions

Table 50–4 INSTANTIATE_OFFLINE Function Exceptions

Exception	Description
miss_refresh_template	The deployment template name specified is invalid or does not exist.
dupl_template_site	The deployment template has already been instantiated at the materialized view site. A deployment template can be instantiated only once at a particular materialized view site.
not_authorized	The user attempting to instantiate the deployment template is not authorized to do so.

Returns

Table 50–5 INSTANTIATE_OFFLINE Function Returns

Return Value	Description
<system-generated number>	Specifies the generated system number for the output_id when you select from the USER_REPCAT_TEMP_OUTPUT view to retrieve the generated instantiation script.

INSTANTIATE_ONLINE Function

This function generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while online. This generated script should be used at remote materialized view sites that are able to remain connected to the master site for an extended amount of time, as the instantiation process at the remote materialized view site may be lengthy (depending on the amount of data that is populated to the new materialized views).

The script generated by this function is stored in the USER_REPCAT_TEMP_OUTPUT temporary view and is used by several Oracle tools, including the Replication Management tool, during the distribution of deployment templates. The number returned by this function is used to retrieve the appropriate information from the USER_REPCAT_TEMP_OUTPUT view.

The user who executes this public function becomes the "registered" user of the instantiated template at the specified site.

See Also:

- *Oracle9i Replication*
- The Replication Management tool's online help

Syntax

```
DBMS_REPCAT_INSTANTIATE.INSTANTIATE_ONLINE(
     refresh_template_name   IN   VARCHAR2,
     site_name               IN   VARCHAR2,
     runtime_parm_id         IN   NUMBER    := -1e-130,
     next_date               IN   DATE      := SYSDATE,
     interval                IN   VARCHAR2  := 'SYSDATE + 1',
     use_default_gowner      IN   BOOLEAN   := true)
     return NUMBER;
```

Table 50–6 INSTANTIATE_ONLINE Function Parameters

Parameter	Description
refresh_template_name	The name of the deployment template to be instantiated.
site_name	The name of the remote site that is instantiating the deployment template.
runtime_parm_id	If you have defined runtime parameter values using the INSERT_RUNTIME_PARMS procedure, specify the identification used when creating the runtime parameters (the identification was retrieved by using the GET_RUNTIME_PARM_ID function).
next_date	Specifies the next refresh date value to be used when creating the refresh group.
interval	Specifies the refresh interval to be used when creating the refresh group.
use_default_gowner	If true, then any materialized view groups created are owned by the default user PUBLIC. If false, then any materialized view groups created are owned by the user performing the instantiation.

Table 50–7 INSTANTIATE_ONLINE Function Exceptions

Exception	Description
miss_refresh_ template	The deployment template name specified is invalid or does not exist.
dupl_template_site	The deployment template has already been instantiated at the materialized view site. A deployment template can be instantiated only once at a particular materialized view site.
not_authorized	The user attempting to instantiate the deployment template is not authorized to do so.

Returns

Table 50–8 INSTANTIATE_ONLINE Function Returns

Return Value	Description
<*system-generated number*>	Specifies the generated system number for the output_id when you select from the USER_REPCAT_TEMP_OUTPUT view to retrieve the generated instantiation script.

51

DBMS_REPCAT_RGT

DBMS_REPCAT_RGT controls the maintenance and definition of refresh group templates.

This chapter discusses the following topics:

Summary of DBMS_REPCAT_RGT Subprograms

Table 51–1 DBMS_REPCAT_RGT Package Subprograms (Page 1 of 3)

Subprogram	Description
"ALTER_REFRESH_TEMPLATE Procedure" on page 51-5	Allows the DBA to alter existing deployment templates.
"ALTER_TEMPLATE_OBJECT Procedure" on page 51-7	Alters objects that have been added to a specified deployment template.
"ALTER_TEMPLATE_PARM Procedure" on page 51-10	Allows the DBA to alter the parameters for a specific deployment template.
"ALTER_USER_ AUTHORIZATION Procedure" on page 51-12	Alters the contents of the DBA_REPCAT_USER_ AUTHORIZATIONS view.
"ALTER_USER_PARM_VALUE Procedure" on page 51-14	Changes existing parameter values that have been defined for a specific user.
"COMPARE_TEMPLATES Function" on page 51-16	Allows the DBA to compare the contents of two deployment templates.
"COPY_TEMPLATE Function" on page 51-18	Allows the DBA to copy a deployment template.
"CREATE_OBJECT_FROM_ EXISTING Function" on page 51-20	Creates a template object definition from existing database objects and adds it to a target deployment template.
"CREATE_REFRESH_ TEMPLATE Function" on page 51-22	Creates the deployment template, which allows the DBA to define the template name, private / public status, and target refresh group.
"CREATE_TEMPLATE_OBJECT Function" on page 51-24	Adds object definitions to a target deployment template container.
"CREATE_TEMPLATE_PARM Function" on page 51-27	Creates parameters for a specific deployment template to allow custom data sets to be created at the remote materialized view site.
"CREATE_USER_ AUTHORIZATION Function" on page 51-30	Authorizes specific users to instantiate private deployment templates.
"CREATE_USER_PARM_VALUE Function" on page 51-31	Predefines deployment template parameter values for specific users.

Table 51–1 DBMS_REPCAT_RGT Package Subprograms **(Page 2 of 3)**

Subprogram	Description
"DELETE_RUNTIME_PARMS Procedure" on page 51-33	Deletes a runtime parameter value that you defined using the INSERT_RUNTIME_PARMS procedure.
"DROP_ALL_OBJECTS Procedure" on page 51-34	Allows the DBA to drop all objects or specific object types from a deployment template.
"DROP_ALL_TEMPLATE_ PARMS Procedure" on page 51-36	Allows the DBA to drop template parameters for a specified deployment template.
"DROP_ALL_TEMPLATE_SITES Procedure" on page 51-37	Removes all entries from the DBA_REPCAT_TEMPLATE_ SITES view.
"DROP_ALL_TEMPLATES Procedure" on page 51-38	Removes all deployment templates at the site where the procedure is called.
"DROP_ALL_USER_ AUTHORIZATIONS Procedure" on page 51-38	Allows the DBA to drop all user authorizations for a specified deployment template.
"DROP_ALL_USER_PARM_ VALUES Procedure" on page 51-39	Drops user parameter values for a specific deployment template.
"DROP_REFRESH_TEMPLATE Procedure" on page 51-40	Drops a deployment template.
"DROP_SITE_INSTANTIATION Procedure" on page 51-41	Removes the target site from the DBA_REPCAT_ TEMPLATE_SITES view.
"DROP_TEMPLATE_OBJECT Procedure" on page 51-42	Removes a template object from a specific deployment template.
"DROP_TEMPLATE_PARM Procedure" on page 51-44	Removes an existing template parameter from the DBA_ REPCAT_TEMPLATE_PARMS view.
"DROP_USER_ AUTHORIZATION Procedure" on page 51-45	Removes a user authorization entry from the DBA_ REPCAT_USER_AUTHORIZATIONS view.
"DROP_USER_PARM_VALUE Procedure" on page 51-46	Removes a predefined user parameter value for a specific deployment template.
"GET_RUNTIME_PARM_ID Function" on page 51-47	Retrieves an identification to be used when defining a runtime parameter value.
"INSERT_RUNTIME_PARMS Procedure" on page 51-47	Defines runtime parameter values prior to instantiating a template.

Table 51–1 DBMS_REPCAT_RGT Package Subprograms **(Page 3 of 3)**

Subprogram	Description
"INSTANTIATE_OFFLINE Function" on page 51-49	Generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while offline.
"INSTANTIATE_ONLINE Function" on page 51-52	Generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while online.
"LOCK_TEMPLATE_ EXCLUSIVE Procedure" on page 55	Prevents users from reading or instantiating the template when a deployment template is being updated or modified.
"LOCK_TEMPLATE_SHARED Procedure" on page 51-55	Makes a specified deployment template read-only.

ALTER_REFRESH_TEMPLATE Procedure

This procedure allows the DBA to alter existing deployment templates. Alterations may include defining a new deployment template name, a new refresh group, or a new owner and changing the public/private status.

Syntax

```
DBMS_REPCAT_RGT.ALTER_REFRESH_TEMPLATE (
   refresh_template_name      IN   VARCHAR2,
   new_owner                  IN   VARCHAR2 := '-',
   new_refresh_group_name     IN   VARCHAR2 := '-',
   new_refresh_template_name  IN   VARCHAR2 := '-',
   new_template_comment       IN   VARCHAR2 := '-',
   new_public_template        IN   VARCHAR2 := '-',
   new_last_modified          IN   DATE := to_date('1', 'J'),
   new_modified_by            IN   NUMBER := -1e-130);
```

Parameters

Table 51–2 ALTER_REFRESH_TEMPLATE Procedure Parameters

Parameter	Description
refresh_template_name	The name of the deployment template that you want to alter.
new_owner	The name of the new deployment template owner. Do not specify a value to keep the current owner.
new_refresh_group_name	If necessary, use this parameter to specify a new refresh group name to which the template objects will be added. Do not specify a value to keep the current refresh group.
new_refresh_template_name	Use this parameter to specify a new deployment template name. Do not specify a value to keep the current deployment template name.
new_template_comment	New deployment template comments. Do not specify a value to keep the current template comment.
new_public_template	Determines whether the deployment template is public or private. Only acceptable values are 'Y' and 'N' ('Y' = public and 'N' = private). Do not specify a value to keep the current value.
new_last_modified	Contains the date of the last modification made to this deployment template. If a value is not specified, then the current date is automatically used.
new_modified_by	Contains the name of the user who last modified this deployment template. If a value is not specified, then the current user is automatically used.

Exceptions

Table 51–3 ALTER_REFRESH_TEMPLATE Procedure Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
bad_public_template	The public_template parameter is specified incorrectly. The public_template parameter must be specified as a 'Y' for a public template or an 'N' for a private template.
dupl_refresh_template	A template with the specified name already exists.

ALTER_TEMPLATE_OBJECT Procedure

This procedure alters objects that have been added to a specified deployment template. The most common changes are altering the object DDL and assigning the object to a different deployment template.

Changes made to the template are reflected only at new sites instantiating the deployment template. Remote sites that have already instantiated the template must re-instantiate the deployment template to apply the changes.

Syntax

```
DBMS_REPCAT_RGT.ALTER_TEMPLATE_OBJECT (
   refresh_template_name       IN   VARCHAR2,
   object_name                 IN   VARCHAR2,
   object_type                 IN   VARCHAR2,
   new_refresh_template_name   IN   VARCHAR2 := '-',
   new_object_name             IN   VARCHAR2 := '-',
   new_object_type             IN   VARCHAR2 := '-',
   new_ddl_text                IN   CLOB  := '-',
   new_master_rollback_seg     IN   VARCHAR2 := '-',
   new_flavor_id               IN   NUMBER := -1e-130);
```

Parameters

Table 51–4 ALTER_TEMPLATE_OBJECT Procedure Parameters

Parameter	Description
refresh_template_name	Deployment template name that contains the object that you want to alter.
object_name	Name of the template object that you want to alter.
object_type	Type of object that you want to alter.
new_refresh_template_name	Name of the new deployment template to which you want to reassign this object. Do not specify a value to keep the object assigned to the current deployment template.
new_object_name	New name of the template object. Do not specify a value to keep the current object name.
new_object_type	If specified, then the new object type. Objects of the following type may be specified: SNAPSHOT, PROCEDURE INDEX, FUNCTION TABLE, PACKAGE VIEW, PACKAGE BODY SYNONYM, TRIGGER SEQUENCE, DATABASE LINK
new_ddl_text	New object DDL for specified object. Do not specify any new DDL text to keep the current object DDL.
new_master_rollback_seg	New master rollback segment for specified object. Do not specify a value to keep the current rollback segment.
new_flavor_id	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 51–5 ALTER_TEMPLATE_OBJECT Procedure Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
miss_flavor_id	If you receive this exception, contact Oracle Support Services.
bad_object_type	Object type is specified incorrectly. See Table 51–4 for a list of valid object types.
miss_template_object	Template object name specified is invalid or does not exist.
dupl_template_object	New template name specified in the new_refresh_template_name parameter already exists.

Usage Notes

Because the ALTER_TEMPLATE_OBJECT procedure utilizes a CLOB, you must use the DBMS_LOB package when using the ALTER_TEMPLATE_OBJECT procedure. The following example illustrates how to use the DBMS_LOB package with the ALTER_TEMPLATE_OBJECT procedure:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'CREATE MATERIALIZED VIEW mview_sales AS SELECT *
      FROM sales WHERE salesperson = :salesid and region_id = :region';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   DBMS_REPCAT_RGT.ALTER_TEMPLATE_OBJECT(
      refresh_template_name => 'rgt_personnel',
      object_name => 'MVIEW_SALES',
      object_type => 'SNAPSHOT',
      new_ddl_text => templob);
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

ALTER_TEMPLATE_PARM Procedure

This procedure allows the DBA to alter the parameters for a specific deployment template. Alterations include renaming the parameter and redefining the default value and prompt string.

Syntax

```
DBMS_REPCAT_RGT.ALTER_TEMPLATE_PARM (
   refresh_template_name       IN   VARCHAR2,
   parameter_name              IN   VARCHAR2,
   new_refresh_template_name   IN   VARCHAR2 := '-',
   new_parameter_name          IN   VARCHAR2 := '-',
   new_default_parm_value      IN   CLOB := NULL,
   new_prompt_string           IN   VARCHAR2 := '-',
   new_user_override           IN   VARCHAR2 := '-');
```

Parameters

Table 51–6 ALTER_TEMPLATE_PARM Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the parameter that you want to alter.
parameter_name	Name of the parameter that you want to alter.
new_refresh_template_name	Name of the deployment template that the specified parameter should be reassigned to (useful when you want to move a parameter from one template to another). Do not specify a value to keep the parameter assigned to the current template.
new_parameter_name	New name of the template parameter. Do not specify a value to keep the current parameter name.
new_default_parm_value	New default value for the specified parameter. Do not specify a value to keep the current default value.
new_prompt_string	New prompt text for the specified parameter. Do not specify a value to keep the current prompt string.
new_user_override	Determines whether the user can override the default value if prompted during the instantiation process. The user is prompted if no user parameter value has been defined for this parameter. Set this parameter to 'Y' to allow a user to override the default value or set this parameter to 'N' to prevent an override.

Exceptions

Table 51–7 ALTER_TEMPLATE_PARM Procedure Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
miss_template_parm	Template parameter specified is invalid or does not exist.
dupl_template_parm	Combination of new_refresh_template_name and new_parameter_name already exists.

Usage Notes

Because the ALTER_TEMPLATE_PARM procedure utilizes a CLOB, you must use the DBMS_LOB package when using the ALTER_TEMPLATE_PARM procedure. The following example illustrates how to use the DBMS_LOB package with the ALTER_TEMPLATE_PARM procedure:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'REGION 20';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   DBMS_REPCAT_RGT.ALTER_TEMPLATE_PARM(
      refresh_template_name => 'rgt_personnel',
      parameter_name => 'region',
      new_default_parm_value => templob);
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

ALTER_USER_AUTHORIZATION Procedure

This procedure alters the contents of the DBA_REPCAT_USER_AUTHORIZATIONS view. Specifically, you can change user/deployment template authorization assignments. This procedure is helpful, for example, if an employee is reassigned and requires the materialized view environment of another deployment template. The DBA simply assigns the employee the new deployment template and the user is authorized to instantiate the target template.

Syntax

```
DBMS_REPCAT_RGT.ALTER_USER_AUTHORIZATION (
   user_name                  IN   VARCHAR2,
   refresh_template_name      IN   VARCHAR2,
   new_user_name              IN   VARCHAR2 := '-',
   new_refresh_template_name  IN   VARCHAR2 := '-');
```

Parameters

Table 51–8 ALTER_USER_AUTHORIZATION Procedure Parameters

Parameter	Description
user_name	Name of the user whose authorization you want to alter.
refresh_template_name	Name of the deployment template that is currently assigned to the specified user that you want to alter.
new_user_name	Use this parameter to define a new user for this template authorization. Do not specify a value to keep the current user.
new_refresh_template_name	The deployment template that the specified user (either the existing or, if specified, the new user) is authorized to instantiate. Do not specify a value to keep the current deployment template.

Exceptions

Table 51–9 ALTER_USER_AUTHORIZATION Procedure Exceptions

Exception	Description
miss_user_authorization	The combination of user_name and refresh_template_name values specified does not exist in the DBA_REPCAT_USER_AUTHORIZATIONS view.
miss_user	The user name specified for the new_user_name or user_name parameter is invalid or does not exist.
miss_refresh_template	The deployment template specified for the new_refresh_template parameter is invalid or does not exist.
dupl_user_authorization	A row already exists for the specified user name and deployment template name.

ALTER_USER_PARM_VALUE Procedure

This procedure changes existing parameter values that have been defined for a specific user. This procedure is especially helpful if your materialized view environment uses assignment tables. Change a user parameter value to quickly and securely change the data set of a remote materialized view site.

> **See Also:** *Oracle9i Replication* for more information on using assignment tables

Syntax

```
DBMS_REPCAT_RGT.ALTER_USER_PARM_VALUE(
   refresh_template_name         IN   VARCHAR2,
   parameter_name                IN   VARCHAR2,
   user_name                     IN   VARCHAR2,
   new_refresh_template_name     IN   VARCHAR2 := '-',
   new_parameter_name            IN   VARCHAR2 := '-',
   new_user_name                 IN   VARCHAR2 := '-',
   new_parm_value                IN   CLOB := NULL);
```

Parameters

Table 51–10 ALTER_USER_PARM_VALUE Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the user parameter value that you want to alter.
parameter_name	Name of the parameter that you want to alter.
user_name	Name of the user whose parameter value you want to alter.
new_refresh_template_name	Name of the deployment template that the specified user parameter value should be reassigned to (useful when you are authorizing a user for a different template). Do not specify a value to keep the parameter assigned to the current template.
new_parameter_name	The new template parameter name. Do not specify a value to keep the user value defined for the existing parameter.
new_user_name	The new user name that this parameter value is for. Do not specify a value to keep the parameter value assigned to the current user.
new_parm_value	The new parameter value for the specified user parameter. Do not specify a value to keep the current parameter value.

Exceptions

Table 51–11 ALTER_USER_PARM_VALUE Procedure Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
miss_template_parm	Template parameter specified is invalid or does not exist.
miss_user	User name specified for the user_name or new_user_name parameters is invalid or does not exist.
miss_user_parm_values	User parameter value specified does not exist.
dupl_user_parm_values	New user parameter specified already exists.

Usage Notes

Because the ALTER_USER_PARM_VALUE procedure utilizes a CLOB, you must use the DBMS_LOB package when using the ALTER_USER_PARM_VALUE procedure. The following example illustrates how to use the DBMS_LOB package with the ALTER_USER_PARM_VALUE procedure:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'REGION 20';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   DBMS_REPCAT_RGT.ALTER_USER_PARM_VALUE(
      refresh_template_name => 'rgt_personnel',
      parameter_name => 'region',
      user_name => 'BOB',
      new_parm_value => templob);
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

COMPARE_TEMPLATES Function

This function allows a DBA to compare the contents of two deployment templates. Any discrepancies between the two deployment templates is stored in the USER_REPCAT_TEMP_OUTPUT temporary view.

The COMPARE_TEMPLATES function returns a number that you specify in the WHERE clause when querying the USER_REPCAT_TEMP_OUTPUT temporary view. For example, if the COMPARE_TEMPLATES procedure returns the number 10, you would execute the following SELECT statement to view all discrepancies between two specified templates (your SELECT statement returns no rows if the templates are identical):

```
SELECT TEXT FROM USER_REPCAT_TEMP_OUTPUT
   WHERE OUTPUT_ID =  10 ORDER BY LINE;
```

The contents of the USER_REPCAT_TEMP_OUTPUT temporary view are lost after you disconnect or a rollback has been performed.

Syntax

```
DBMS_REPCAT_RGT.COMPARE_TEMPLATES (
   source_template_name    IN   VARCHAR2,
   compare_template_name   IN   VARCHAR2)
  return NUMBER;
```

Parameters

Table 51–12 COMPARE_TEMPLATES Function Parameters

Parameter	Description
source_template_name	Name of the first deployment template to be compared.
compare_template_name	Name of the second deployment template to be compared.

Exceptions

Table 51–13 COMPARE_TEMPLATES Function Exceptions

Exception	Description
miss_refresh_template	The deployment template name to be compared is invalid or does not exist.

Returns

Table 51–14 COMPARE_TEMPLATES Function Returns

Return Value	Description
<system-generated number>	Specifies the number returned for the output_id value when you select from the USER_REPCAT_TEMP_OUTPUT temporary view to view the discrepancies between the compared templates.

COPY_TEMPLATE Function

This function enables you to copy a deployment template and is helpful when a new deployment template uses many of the objects contained in an existing deployment template. This function copies the deployment template, template objects, template parameters, and user parameter values. The DBA can optionally have the function copy the user authorizations for this template. The number returned by this function is used internally by Oracle to manage deployment templates.

> **Note:** The values in the DBA_REPCAT_TEMPLATE_SITES view are not copied.

This function also allows the DBA to copy a deployment template to another master site, which is helpful for deployment template distribution and to split network loads between multiple sites.

Syntax

```
DBMS_REPCAT_RGT.COPY_TEMPLATE (
   old_refresh_template_name     IN   VARCHAR2,
   new_refresh_template_name     IN   VARCHAR2,
   copy_user_authorizations      IN   VARCHAR2,
   dblink                        IN   VARCHAR2 := NULL)
  return NUMBER;
```

Parameters

Table 51–15 COPY_TEMPLATE Function Parameters

Parameter	Description
old_refresh_template_name	Name of the deployment template to be copied.
new_refresh_template_name	Name of the new deployment template.
copy_user_authorizations	Specifies whether the template authorizations for the original template should be copied for the new deployment template. Valid values for this parameter are Y, N, and NULL. **Note**: All users must exist at the target database.
dblink	Optionally defines where the deployment template should be copied from (this is helpful to distribute deployment templates to other master sites). If none is specified, then the deployment template is copied from the local master site.

Exceptions

Table 51–16 COPY_TEMPLATE Function Exceptions

Exception	Description
miss_refresh_template	Deployment template name to be copied is invalid or does not exist.
dupl_refresh_template	Name of the new refresh template specified already exists.
bad_copy_auth	Value specified for the copy_user_authorization parameter is invalid. Valid values are Y, N, and NULL.

Returns

Table 51–17 COPY_TEMPLATES Function Returns

Return Value	Description
<system-generated number>	System-generated number used internally by Oracle.

CREATE_OBJECT_FROM_EXISTING Function

This function creates a template object definition from existing database objects and adds it to a target deployment template. The object DDL that created the original database object is executed when the target deployment template is instantiated at the remote materialized view site. This is ideal for adding existing triggers and procedures to your template. The number returned by this function is used internally by Oracle to manage deployment templates.

Syntax

```
DBMS_REPCAT_RGT.CREATE_OBJECT_FROM_EXISTING(
     refresh_template_name  IN   VARCHAR2,
     object_name            IN   VARCHAR2,
     sname                  IN   VARCHAR2,
     oname                  IN   VARCHAR2,
     otype                  IN   VARCHAR2)
     return NUMBER;
```

Parameters

Table 51–18 CREATE_OBJECT_FROM_EXISTING Function Parameters

Parameter	Description
refresh_template_name	Name of the deployment template to which you want to add this object.
object_name	Optionally, the new name of the existing object that you are adding to your deployment template (enables you to define a new name for an existing object).
sname	The schema that contains the object that you are creating your template object from.
oname	Name of the object that you are creating your template object from.
otype	The type of database object that you are adding to the template (that is, PROCEDURE, TRIGGER, and so on). The object type must be specified using the following numerical identifiers (DATABASE LINK, MATERIALIZED VIEW, and SNAPSHOT are not a valid object types for this function): SEQUENCE PROCEDURE INDEX FUNCTION TABLE PACKAGE VIEW PACKAGE BODY SYNONYM TRIGGER

Exceptions

Table 51–19 CREATE_OBJECT_FROM_EXISTING Function Exceptions

Exception	Description
miss_refresh_template	The specified refresh template name is invalid or missing. Query the DBA_REPCAT_REFRESH_TEMPLATES view for a list of existing deployment templates.
bad_object_type	The object type is specified incorrectly.
dupl_template_object	An object of the same name and type has already been added to the specified deployment template.
objectmissing	The object specified does not exist.

Returns

Table 51–20 CREATE_OBJECT_FROM_EXISTING Function Returns

Return Value	Description
<system-generated number>	System-generated number used internally by Oracle.

CREATE_REFRESH_TEMPLATE Function

This function creates the deployment template, which enables you to define the template name, private / public status, and target refresh group. Each time that you create a template object, user authorization, or template parameter, you reference the deployment template created with this function. This function adds a row to the DBA_REPCAT_REFRESH_TEMPLATES view. The number returned by this function is used internally by Oracle to manage deployment templates.

Syntax

```
DBMS_REPCAT_RGT.CREATE_REFRESH_TEMPLATE (
   owner                  IN   VARCHAR2,
   refresh_group_name     IN   VARCHAR2,
   refresh_template_name  IN   VARCHAR2,
   template_comment       IN   VARCHAR2 := NULL,
   public_template        IN   VARCHAR2 := NULL,
   last_modified          IN   DATE := SYSDATE,
   modified_by            IN   VARCHAR2 := USER,
   creation_date          IN   DATE := SYSDATE,
   created_by             IN   VARCHAR2 := USER)
  return NUMBER;
```

Parameters

Table 51–21 CREATE_REFRESH_TEMPLATE Function Parameters

Parameter	Description
owner	User name of the deployment template owner is specified with this parameter. If an owner is not specified, then the name of the user creating the template is automatically used.
refresh_group_name	Name of the refresh group that is created when this template is instantiated. All objects created by this template are assigned to the specified refresh group.
refresh_template_name	Name of the deployment template that you are creating. This name is referenced in all activities that involve this deployment template.
template_comment	User comments defined with this parameter are listed in the DBA_REPCAT_REFRESH_TEMPLATES view.
public_template	Specifies whether the deployment template is public or private. Only acceptable values are 'Y' and 'N' ('Y' = public and 'N' = private).
last_modified	The date of the last modification made to this deployment template. If a value is not specified, then the current date is automatically used.
modified_by	Name of the user who last modified this deployment template. If a value is not specified, then the current user is automatically used.
creation_date	The date that this deployment template was created. If a value is not specified, then the current date is automatically used.
created_by	Name of the user who created this deployment template. If a value is not specified, then the current user is automatically used.

Exceptions

Table 51–22 CREATE_REFRESH_TEMPLATE Function Exceptions

Exception	Description
dupl_refresh_template	A template with the specified name already exists.
bad_public_template	The public_template parameter is specified incorrectly. The public_template parameter must be specified as a 'Y' for a public template or an 'N' for a private template.

Returns

Table 51–23 CREATE_REFRESH_TEMPLATE Function Returns

Return Value	Description
<*system-generated number*>	System-generated number used internally by Oracle.

CREATE_TEMPLATE_OBJECT Function

This function adds object definitions to a target deployment template container. The specified object DDL is executed when the target deployment template is instantiated at the remote materialized view site. In addition to adding materialized views, this function can add tables, procedures, and other objects to your template. The number returned by this function is used internally by Oracle to manage deployment templates.

Syntax

```
DBMS_REPCAT_RGT.CREATE_TEMPLATE_OBJECT (
   refresh_template_name  IN   VARCHAR2,
   object_name            IN   VARCHAR2,
   object_type            IN   VARCHAR2,
   ddl_text               IN   CLOB,
   master_rollback_seg    IN   VARCHAR2 := NULL,
   flavor_id              IN   NUMBER := -1e-130)
  return NUMBER;
```

Parameters

Table 51–24 CREATE_TEMPLATE_OBJECT Function Parameters

Parameter	Description
refresh_template_name	Name of the deployment template to which you want to add this object.
object_name	Name of the template object that you are creating.
object_type	The type of database object that you are adding to the template (that is, SNAPSHOT, TRIGGER, PROCEDURE, and so on). Objects of the following type may be specified: SNAPSHOT — PROCEDURE INDEX — FUNCTION TABLE — PACKAGE VIEW — PACKAGE BODY SYNONYM — TRIGGER SEQUENCE — DATABASE LINK
ddl_text	Contains the DDL that creates the object that you are adding to the template. Be sure to end your DDL with a semi-colon. You can use a colon (:) to create a template parameter for your template object. When you add a materialized view (snapshot) with a CREATE MATERIALIZED VIEW statement, make sure you specify the schema name of the owner of the master table in the materialized view query.
master_rollback_seg	Specifies the name of the rollback segment to use when executing the defined object DDL at the remote materialized view site.
flavor_id	This parameter is for internal use only. **Note:** Do not set this parameter unless directed to do so by Oracle Support Services.

Exceptions

Table 51–25 CREATE_TEMPLATE_OBJECT Function Exceptions

Exception	Description
miss_refresh_template	Specified refresh template name is invalid or missing. Query the DBA_REPCAT_REFRESH_TEMPLATES view for a list of existing deployment templates.
bad_object_type	Object type is specified incorrectly. See Table 51–24 for a list of valid object types.
dupl_template_object	An object of the same name and type has already been added to the specified deployment template.

Returns

Table 51–26 CREATE_TEMPLATE_OBJECT Function Returns

Return Value	Description
<*system-generated number*>	System-generated number used internally by Oracle.

Usage Notes

Because CREATE_TEMPLATE_OBJECT utilizes a CLOB, you must use the DBMS_LOB package when using the CREATE_TEMPLATE_OBJECT function. The following example illustrates how to use the DBMS_LOB package with the CREATE_TEMPLATE_OBJECT function:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
   a NUMBER;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'CREATE MATERIALIZED VIEW mview_sales AS SELECT *
        FROM sales WHERE salesperson = :salesid';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   a := DBMS_REPCAT_RGT.CREATE_TEMPLATE_OBJECT(
        refresh_template_name => 'rgt_personnel',
        object_name => 'mview_sales',
        object_type => 'SNAPSHOT',
        ddl_text => templob,
        master_rollback_seg => 'RBS');
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

CREATE_TEMPLATE_PARM Function

This function creates parameters for a specific deployment template to allow custom data sets to be created at the remote materialized view site. This function is only required when the DBA wants to define a set of template variables before adding any template objects. When objects are added to the template using the CREATE_TEMPLATE_OBJECT function, any variables in the object DDL are automatically added to the DBA_REPCAT_TEMPLATE_PARMS view.

The DBA typically uses the ALTER_TEMPLATE_PARM function to modify the default parameter values and/or prompt strings (see "ALTER_TEMPLATE_PARM Procedure" on page 51-10 for more information). The number returned by this function is used internally by Oracle to manage deployment templates.

Syntax

```
DBMS_REPCAT_RGT.CREATE_TEMPLATE_PARM (
   refresh_template_name  IN   VARCHAR2,
   parameter_name         IN   VARCHAR2,
   default_parm_value     IN   CLOB := NULL,
   prompt_string          IN   VARCHAR2 := NULL,
   user_override          IN   VARCHAR2 := NULL)
   return NUMBER;
```

Parameters

Table 51–27 CREATE_TEMPLATE_PARM Function Parameters

Parameter	Description
refresh_template_name	Name of the deployment template for which you want to create the parameter.
parameter_name	Name of the parameter you are creating.
default_parm_value	Default values for this parameter are defined using this parameter. If a user parameter value or runtime parameter value is not present, then this default value is used during the instantiation process.
prompt_string	The descriptive prompt text that is displayed for this template parameter during the instantiation process.
user_override	Determines whether the user can override the default value if prompted during the instantiation process. The user is prompted if no user parameter value has been defined for this parameter. Set this parameter to 'Y' to allow a user to override the default value or set this parameter to 'N' to not allow an override.

Exceptions

Table 51–28 CREATE_TEMPLATE_PARM Function Exceptions

Exception	Description
miss_refresh_template	The specified refresh template name is invalid or missing.
dupl_template_parm	A parameter of the same name has already been defined for the specified deployment template.

Returns

Table 51–29 CREATE_TEMPLATE_PARM Function Returns

Return Value	Description
<system-generated number>	System-generated number used internally by Oracle.

Usage Notes

Because the CREATE_TEMPLATE_PARM function utilizes a CLOB, you must use the DBMS_LOB package when using the CREATE_TEMPLATE_PARM function. The following example illustrates how to use the DBMS_LOB package with the CREATE_TEMPLATE_PARM function:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
   a NUMBER;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'REGION 20';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   a := DBMS_REPCAT_RGT.CREATE_TEMPLATE_PARM(
        refresh_template_name => 'rgt_personnel',
        parameter_name => 'region',
        default_parm_value => templob,
        prompt_string => 'Enter your region ID:',
        user_override => 'Y');
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

CREATE_USER_AUTHORIZATION Function

This function authorizes specific users to instantiate private deployment templates. Users not authorized for a private deployment template are not able to instantiate the private template. This function adds a row to the DBA_REPCAT_USER_AUTHORIZATIONS view.

Before you authorize a user, verify that the user exists at the master site where the user will instantiate the deployment template. The number returned by this function is used internally by Oracle to manage deployment templates.

Syntax

```
DBMS_REPCAT_RGT.CREATE_USER_AUTHORIZATION (
   user_name               IN   VARCHAR2,
   refresh_template_name   IN   VARCHAR2)
   return NUMBER;
```

Parameters

Table 51–30 CREATE_USER_AUTHORIZATION Function Parameters

Parameter	Description
user_name	Name of the user that you want to authorize to instantiate the specified template. Specify multiple users by separating user names with a comma (for example, 'john, mike, bob')
refresh_template_name	Name of the template that you want to authorize the specified user to instantiate.

Exceptions

Table 51–31 CREATE_USER_AUTHORIZATION Function Exceptions

Exception	Description
miss_user	User name supplied is invalid or does not exist.
miss_refresh_template	Refresh template name supplied is invalid or does not exist.
dupl_user_authorization	An authorization has already been created for the specified user and deployment template.

Returns

Table 51–32 CREATE_USER_AUTHORIZATION Function Returns

Return Value	Description
<system-generated number>	System-generated number used internally by Oracle.

CREATE_USER_PARM_VALUE Function

This function predefines deployment template parameter values for specific users. For example, if you want to predefine the region parameter as `west` for user 33456, then you would use the this function.

Any values specified with this function take precedence over default values specified for the template parameter. The number returned by this function is used internally by Oracle to manage deployment templates.

Syntax

```
DBMS_REPCAT_RGT.CREATE_USER_PARM_VALUE (
   refresh_template_name    IN   VARCHAR2,
   parameter_name           IN   VARCHAR2,
   user_name                IN   VARCHAR2,
   parm_value               IN   CLOB := NULL)
  return NUMBER;
```

Parameters

Table 51–33 CREATE_USER_PARM_VALUE Function Parameters

Parameter	Description
refresh_template_name	Specifies the name of the deployment template that contains the parameter you are creating a user parameter value for.
parameter_name	Name of the template parameter that you are defining a user parameter value for.
user_name	Specifies the name of the user that you are predefining a user parameter value for.
parm_value	The predefined parameter value that will be used during the instantiation process initiated by the specified user.

Exceptions

Table 51–34 CREATE_USER_PARM_VALUE Function Exceptions

Exception	Description
miss_refresh_template	Specified deployment template name is invalid or missing.
dupl_user_parm_values	A parameter value for the specified user, parameter, and deployment template has already been defined. Query the DBA_REPCAT_USER_PARM_VALUES view for a listing of existing user parameter values.
miss_template_parm	Specified deployment template parameter name is invalid or missing.
miss_user	Specified user name is invalid or missing.

Returns

Table 51–35 CREATE_USER_PARM_VALUE Function Returns

Return Value	Description
<*system-generated number*>	System-generated number used internally by Oracle.

Usage Notes

Because the CREATE_USER_PARM_VALUE function utilizes a CLOB, you must use the DBMS_LOB package when using the this function. The following example illustrates how to use the DBMS_LOB package with the CREATE_USER_PARM_VALUE function:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
   a NUMBER;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'REGION 20';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   a := DBMS_REPCAT_RGT.CREATE_USER_PARM_VALUE(
        refresh_template_name => 'rgt_personnel',
        parameter_name => 'region',
        user_name => 'BOB',
        user_parm_value => templob);
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

DELETE_RUNTIME_PARMS Procedure

Use this procedure before instantiating a deployment template to delete a runtime parameter value that you defined using the INSERT_RUNTIME_PARMS procedure.

Syntax

```
DBMS_REPCAT_RGT.DELETE_RUNTIME_PARMS(
   runtime_parm_id    IN   NUMBER,
   parameter_name     IN   VARCHAR2);
```

Parameters

Table 51–36 DELETE_RUNTIME_PARMS Procedure Parameters

Parameter	Description
runtime_parm_id	Specifies the identification that you previously assigned the runtime parameter value to (this value was retrieved using the GET_RUNTIME_PARM_ID function).
parameter_name	Specifies the name of the parameter value that you want to drop (query the DBA_REPCAT_TEMPLATE_PARMS view for a list of deployment template parameters).

Exceptions

Table 51–37 DELETE_RUNTIME_PARMS Procedure Exceptions

Exception	Description
miss_template_parm	The specified deployment template parameter name is invalid or missing.

DROP_ALL_OBJECTS Procedure

This procedure allows the DBA to drop all objects or specific object types from a deployment template.

Caution: This is a dangerous procedure that cannot be undone.

Syntax

```
DBMS_REPCAT_RGT.DROP_ALL_OBJECTS (
   refresh_template_name   IN   VARCHAR2,
   object_type             IN   VARCHAR2 := NULL);
```

Parameters

Table 51–38 DROP_ALL_OBJECTS Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the objects that you want to drop.
object_type	If NULL, then all objects in the template are dropped. If an object type is specified, then only objects of that type are dropped. Objects of the following type may be specified: SNAPSHOT — PROCEDURE INDEX — FUNCTION TABLE — PACKAGE VIEW — PACKAGE BODY SYNONYM — TRIGGER SEQUENCE — DATABASE LINK

Exceptions

Table 51–39 DROP_ALL_OBJECTS Procedure Exceptions

Exception	Description
miss_refresh_template	Specified deployment template name is invalid or does not exist.
bad_object_type	Object type is specified incorrectly. See Table 51–38 for a list of valid object types.

DROP_ALL_TEMPLATE_PARMS Procedure

This procedure lets you drop template parameters for a specified deployment template. You can use this procedure to drop all parameters that are not referenced by a template object or to drop from the template all objects that reference any parameter, along with all of the parameters themselves.

Caution: This is a dangerous procedure that cannot be undone.

Syntax

```
DBMS_REPCAT_RGT.DROP_ALL_TEMPLATE_PARMS (
   refresh_template_name   IN   VARCHAR2,
   drop_objects            IN   VARCHAR2 := n);
```

Parameters

Table 51–40 DROP_ALL_TEMPLATE_PARMS Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the parameters and objects that you want to drop.
drop_objects	If no value is specified, then this parameter defaults to N, which drops all parameters not referenced by a template object. If Y is specified, then all objects that reference any template parameter and the template parameters themselves are dropped. The objects are dropped from the template, not from the database.

Exceptions

Table 51–41 DROP_ALL_TEMPLATE_PARMS Procedure Exceptions

Exception	Description
miss_refresh_template	Specified deployment template name is invalid or does not exist.

DROP_ALL_TEMPLATE_SITES Procedure

This procedure removes all entries from the DBA_REPCAT_TEMPLATE_SITES view, which keeps a record of sites that have instantiated a particular deployment template.

Caution: This is a dangerous procedure that cannot be undone.

Syntax

```
DBMS_REPCAT_RGT.DROP_ALL_TEMPLATE_SITES (
   refresh_template_name   IN   VARCHAR2);
```

Parameters

Table 51–42 DROP_ALL_TEMPLATE_SITES Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the sites that you want to drop.

Exceptions

Table 51–43 DROP_ALL_TEMPLATE_SITES Procedure Exceptions

Exception	Description
miss_refresh_template	Specified deployment template name is invalid or does not exist.

DROP_ALL_TEMPLATES Procedure

This procedure removes all deployment templates at the site where the procedure is called.

Caution: This is a dangerous procedure that cannot be undone.

Syntax

```
DBMS_REPCAT_RGT.DROP_ALL_TEMPLATES;
```

Parameters

None

DROP_ALL_USER_AUTHORIZATIONS Procedure

This procedure enables the DBA to drop all user authorizations for a specified deployment template. Executing this procedure removes rows from the DBA_REPCAT_USER_AUTHORIZATIONS view.

This procedure might be implemented after converting a private template to a public template and the user authorizations are no longer required.

Syntax

```
DBMS_REPCAT_RGT.DROP_ALL_USER_AUTHORIZATIONS (
   refresh_template_name   IN   VARCHAR2);
```

Parameters

Table 51–44 DROP_ALL_USER_AUTHORIZATIONS Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the user authorizations that you want to drop.

Exceptions

Table 51–45 DROP_ALL_USER_AUTHORIZATIONS Procedure Exceptions

Exception	Description
miss_refresh_template	Specified deployment template name is invalid or does not exist.

DROP_ALL_USER_PARM_VALUES Procedure

This procedure drops user parameter values for a specific deployment template. This procedure is very flexible and enables you to define a set of user parameter values to be deleted. For example, defining the following parameters has the effect described:

refresh_template_name	Drops all user parameters for the specified deployment template
refresh_template_name and user_name	Drops all of the specified user parameters for the specified deployment template
refresh_template_name and parameter_name	Drops all user parameter values for the specified deployment template parameter
refresh_template_name, parameter_name, and user_name	Drops the specified user's value for the specified deployment template parameter (equivalent to drop_user_parm)

Syntax

```
DBMS_REPCAT_RGT.DROP_ALL_USER_PARMS (
   refresh_template_name   IN   VARCHAR2,
   user_name               IN   VARCHAR2,
   parameter_name          IN   VARCHAR2);
```

Parameters

Table 51–46 DROP_ALL_USER_PARMS Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template that contains the parameter values that you want to drop.
user_name	Name of the user whose parameter values you want to drop.
parameter_name	Template parameter that contains the values that you want to drop.

Exceptions

Table 51–47 DROP_ALL_USER_PARMS Procedure Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
miss_user	User name specified is invalid or does not exist.
miss_user_parm_values	Deployment template, user, and parameter combination does not exist in the DBA_REPCAT_USER_PARM_VALUES view.

DROP_REFRESH_TEMPLATE Procedure

This procedure drops a deployment template. Dropping a deployment template has a cascading effect, removing all related template parameters, user authorizations, template objects, and user parameters (this procedure does not drop template sites).

Syntax

```
DBMS_REPCAT_RGT.DROP_REFRESH_TEMPLATE (
   refresh_template_name  IN   VARCHAR2);
```

Parameters

Table 51–48 DROP_REFRESH_TEMPLATE Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template to be dropped.

Exceptions

Table 51–49 DROP_REFRESH_TEMPLATE Procedure Exceptions

Exception	Description
miss_refresh_template	The deployment template name specified is invalid or does not exist. Query the DBA_REPCAT_REFRESH_TEMPLATES view for a list of deployment templates.

DROP_SITE_INSTANTIATION Procedure

This procedure drops a template instantiation at any target site. This procedure removes all related metadata at the master site and disables the specified site from refreshing its materialized views.

Syntax

```
DBMS_REPCAT_RGT.DROP_SITE_INSTANTIATION (
     refresh_template_name  IN   VARCHAR2,
     user_name              IN   VARCHAR2,
     site_name              IN   VARCHAR2);
```

Table 51–50 DROP_SITE_INSTANTIATION Procedure Parameters

Parameter	Description
refresh_template_name	The name of the deployment template to be dropped.
user_name	The name of the user who originally instantiated the template at the remote materialized view site. Query the ALL_REPCAT_TEMPLATE_SITES view to see the users that instantiated templates.
site_name	Identifies the master site where you want to drop the specified template instantiation.

Exceptions

Table 51–51 DROP_SITE_INSTANTIATION Procedure Exceptions

Exception	Description
miss_refresh_template	The deployment template name specified is invalid or does not exist.
miss_user	The username specified does not exist.
miss_template_site	The deployment template has not been instantiated for user and site.

DROP_TEMPLATE_OBJECT Procedure

This procedure removes a template object from a specific deployment template. For example, a DBA would use this procedure to remove an outdated materialized view from a deployment template. Changes made to the template are reflected at new sites instantiating the deployment template. Remote sites that have already instantiated the template must re-instantiate the deployment template to apply the changes.

Syntax

```
DBMS_REPCAT_RGT.DROP_TEMPLATE_OBJECT (
   refresh_template_name  IN   VARCHAR2,
   object_name            IN   VARCHAR2,
   object_type            IN   VARCHAR2);
```

Parameters

Table 51–52 DROP_TEMPLATE_OBJECT Procedure Parameters

Parameter	Description	
refresh_template_name	Name of the deployment template from which you are dropping the object.	
object_name	Name of the template object to be dropped.	
object_type	The type of object that is to be dropped. Objects of the following type may be specified:	
	SNAPSHOT	PROCEDURE
	INDEX	FUNCTION
	TABLE	PACKAGE
	VIEW	PACKAGE BODY
	SYNONYM	TRIGGER
	SEQUENCE	DATABASE LINK

Exceptions

Table 51–53 DROP_TEMPLATE_OBJECT Procedure Exceptions

Exception	Description
miss_refresh_template	The deployment template name specified is invalid or does not exist.
miss_template_object	The template object specified is invalid or does not exist. Query the DBA_REPCAT_TEMPLATE_OBJECTS view to see a list of deployment template objects.

DROP_TEMPLATE_PARM Procedure

This procedure removes an existing template parameter from the DBA_REPCAT_TEMPLATE_PARMS view. This procedure is useful when you have dropped a template object and a particular parameter is no longer needed.

Syntax

```
DBMS_REPCAT_RGT.DROP_TEMPLATE_PARM (
   refresh_template_name  IN   VARCHAR2,
   parameter_name         IN   VARCHAR2);
```

Parameters

Table 51–54 DROP_TEMPLATE_PARM Procedure Parameters

Parameter	Description
refresh_template_name	The deployment template name that has the parameter that you want to drop
parameter_name	Name of the parameter that you want to drop.

Exceptions

Table 51–55 DROP_TEMPLATE_PARM Procedure Exceptions

Exception	Description
miss_refresh_template	The deployment template name specified is invalid or does not exist.
miss_template_parm	The parameter name specified is invalid or does not exist. Query the DBA_REPCAT_TEMPLATE_PARMS view to see a list of template parameters.

DROP_USER_AUTHORIZATION Procedure

This procedure removes a user authorization entry from the DBA_REPCAT_USER_AUTHORIZATIONS view. This procedure is used when removing a user's template authorization. If a user's authorization is removed, then the user is no longer able to instantiate the target deployment template.

> **See Also:** "DROP_ALL_USER_AUTHORIZATIONS Procedure" on page 51-38

Syntax

```
DBMS_REPCAT_RGT.DROP_USER_AUTHORIZATION (
   refresh_template_name   IN   VARCHAR2,
   user_name               IN   VARCHAR2);
```

Parameters

Table 51–56 DROP_USER_AUTHORIZATION Procedure Parameters

Parameter	Description
refresh_template_name	Name of the deployment template from which the user's authorization is being removed.
user_name	Name of the user whose authorization is being removed.

Exceptions

Table 51–57 DROP_USER_AUTHORIZATION Procedure Exceptions

Exception	Description
miss_user	Specified user name is invalid or does not exist.
miss_user_authorization	Specified user and deployment template combination does not exist. Query the DBA_REPCAT_USER_AUTHORIZATIONS view to see a list of user/deployment template authorizations.
miss_refresh_template	Specified deployment template name is invalid or does not exist.

DROP_USER_PARM_VALUE Procedure

This procedure removes a predefined user parameter value for a specific deployment template. This procedure is often executed after a user's template authorization has been removed.

Syntax

```
DBMS_REPCAT_RGT.DROP_USER_PARM_VALUE (
   refresh_template_name    IN   VARCHAR2,
   parameter_name           IN   VARCHAR2,
   user_name                IN   VARCHAR2);
```

Parameters

Table 51–58 DROP_USER_PARM_VALUE Procedure Parameters

Parameter	Description
refresh_template_name	Deployment template name that contains the parameter value that you want to drop.
parameter_name	Parameter name that contains the predefined value that you want to drop.
user_name	Name of the user whose parameter value you want to drop.

Exceptions

Table 51–59 DROP_USER_PARM_VALUE Procedure Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
miss_user	User name specified is invalid or does not exist.
miss_user_parm_values	Deployment template, user, and parameter combination does not exist in the DBA_REPCAT_USER_PARM_VALUES view.

GET_RUNTIME_PARM_ID Function

This function retrieves an identification to be used when defining a runtime parameter value. All runtime parameter values are assigned to this identification and are also used during the instantiation process.

Syntax

```
DBMS_REPCAT_RGT.GET_RUNTIME_PARM_ID
  RETURN NUMBER;
```

Parameters

None

Returns

Table 51–60 GET_RUNTIME_PARM_ID Function Returns

Return Value	Corresponding Datatype
<system-generated number>	Runtime parameter values are assigned to the system-generated number and are also used during the instantiation process.

INSERT_RUNTIME_PARMS Procedure

This procedure defines runtime parameter values prior to instantiating a template. This procedure should be used to define parameter values when no user parameter values have been defined and you do not want to accept the default parameter values.

Before using the this procedure, be sure to execute the GET_RUNTIME_PARM_ID function to retrieve a parameter identification to use when inserting a runtime parameter. This identification is used for defining runtime parameter values and instantiating deployment templates.

Syntax

```
DBMS_REPCAT_RGT.INSERT_RUNTIME_PARMS (
   runtime_parm_id    IN   NUMBER,
   parameter_name     IN   VARCHAR2,
   parameter_value    IN   CLOB);
```

Parameters

Table 51–61 INSERT_RUNTIME_PARMS Procedure Parameters

Parameter	Description
runtime_parm_id	The identification retrieved by the GET_RUNTIME_PARM_ID function. This identification is also used when instantiating the deployment template. Be sure to use the same identification for all parameter values for a deployment template.
parameter_name	Name of the template parameter for which you are defining a runtime parameter value. Query the DBA_REPCAT_TEMPLATE_PARMS view for a list of template parameters.
parameter_value	The runtime parameter value that you want to use during the deployment template instantiation process.

Exceptions

Table 51–62 INSERT_RUNTIME_PARMS Procedure Exceptions

Exception	Description
miss_refresh_template	The deployment template name specified is invalid or does not exist.
miss_user	The user name specified is invalid or does not exist.
miss_user_parm_values	The deployment template, user, and parameter combination does not exist in the DBA_REPCAT_USER_PARM_VALUES view.

Usage Notes

Because the this procedure utilizes a CLOB, you must use the DBMS_LOB package when using the INSERT_RUNTIME_PARMS procedure. The following example illustrates how to use the DBMS_LOB package with the INSERT_RUNTIME_PARMS procedure:

```
DECLARE
   tempstring VARCHAR2(100);
   templob CLOB;
BEGIN
   DBMS_LOB.CREATETEMPORARY(templob, TRUE, DBMS_LOB.SESSION);
   tempstring := 'REGION 20';
   DBMS_LOB.WRITE(templob, length(tempstring), 1, tempstring);
   DBMS_REPCAT_RGT.INSERT_RUNTIME_PARMS(
      runtime_parm_id => 20,
      parameter_name => 'region',
      parameter_value => templob);
   DBMS_LOB.FREETEMPORARY(templob);
END;
/
```

INSTANTIATE_OFFLINE Function

This function generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while the materialized view site disconnected from the master (that is, while the materialized view site is offline). This generated script should be used at remote materialized view sites that are not able to remain connected to the master site for an extended amount of time, as the instantiation process at the remote materialized view site may be lengthy (depending on the amount of data that is populated to the new materialized views). This function must be executed separately for each user instantiation.

The script generated by this function is stored in the USER_REPCAT_TEMP_OUTPUT temporary view and is used by several Oracle tools, including Replication Manager, during the distribution of deployment templates. The number returned by this function is used to retrieve the appropriate information from the USER_REPCAT_TEMP_OUTPUT temporary view.

Note: This function is used to perform an offline instantiation of a deployment template. Additionally, this function is for replication administrators who are instantiating for another user. Users wanting to perform their own instantiation should use the public version of the INSTANTIATE_OFFLINE function. See the "INSTANTIATE_OFFLINE Function" on page 51-49 for more information.

This function should not be confused with the procedures in the DBMS_OFFLINE_OG package (used for performing an offline instantiation of a master table) or with the procedures in the DBMS_OFFLINE_SNAPSHOT package (used for performing an offline instantiation of a materialized view). See these respective packages for more information on their usage.

Syntax

```
DBMS_REPCAT_RGT.INSTANTIATE_OFFLINE(
     refresh_template_name   IN   VARCHAR2,
     site_name               IN   VARCHAR2,
     user_name               IN   VARCHAR2  := NULL,
     runtime_parm_id         IN   NUMBER    := -1e-130,
     next_date               IN   DATE      := SYSDATE,
     interval                IN   VARCHAR2  := 'SYSDATE + 1',
     use_default_gowner      IN   BOOLEAN   := true)
     return NUMBER;
```

Parameters

Table 51–63 INSTANTIATE_OFFLINE Function Parameters

Parameter	Description
refresh_template_name	Name of the deployment template to be instantiated.
site_name	Name of the remote site that is instantiating the deployment template.
user_name	Name of the authorized user who is instantiating the deployment template.
runtime_parm_id	If you have defined runtime parameter values using the INSERT_RUNTIME_PARMS procedure, then specify the identification used when creating the runtime parameters (the identification was retrieved by using the GET_RUNTIME_PARM_ID function).
next_date	Specifies the next refresh date value to be used when creating the refresh group.
interval	Specifies the refresh interval to be used when creating the refresh group.
use_default_gowner	If true, then any materialized view groups created are owned by the default user PUBLIC. If false, then any materialized view groups created are owned by the user performing the instantiation.

Exceptions

Table 51–64 INSTANTIATE_OFFLINE Function Exceptions

Exception	Description
miss_refresh_template	Deployment template name specified is invalid or does not exist.
miss_user	Name of the authorized user is invalid or does not exist. Verify that the specified user is listed in the DBA_REPCAT_USER_AUTHORIZATIONS view. If user is not listed, then the specified user is not authorized to instantiate the target deployment template.

Returns

Table 51–65 INSTANTIATE_OFFLINE Function Returns

Return Value	Description
<system-generated number>	Specifies the generated system number for the `output_id` when you select from the `USER_REPCAT_TEMP_OUTPUT` temporary view to retrieve the generated instantiation script.

INSTANTIATE_ONLINE Function

This function generates a script at the master site that is used to create the materialized view environment at the remote materialized view site while the materialized view site is connected to the master (that is, while the materialized view site is online). This generated script should be used at remote materialized view sites that are able to remain connected to the master site for an extended amount of time, as the instantiation process at the remote materialized view site may be lengthy (depending on the amount of data that is populated to the new materialized views). This function must be executed separately for each user instantiation.

The script generated by this function is stored in the `USER_REPCAT_TEMP_OUTPUT` temporary view and is used by several Oracle tools, including Replication Manager, during the distribution of deployment templates. The number returned by this function is used to retrieve the appropriate information from the `USER_REPCAT_TEMP_OUTPUT` temporary view.

Note: This function is for replication administrators who are instantiating for another user. Users wanting to perform their own instantiation should use the public version of the `INSTANTIATE_OFFLINE` function, described in "INSTANTIATE_OFFLINE Function" on page 51-49 section.

Syntax

```
DBMS_REPCAT_RGT.INSTANTIATE_ONLINE(
   refresh_template_name   IN   VARCHAR2,
   site_name               IN   VARCHAR2  := NULL,
   user_name               IN   VARCHAR2  := NULL,
   runtime_parm_id         IN   NUMBER    := -1e-130,
   next_date               IN   DATE      := SYSDATE,
   interval                IN   VARCHAR2  := 'SYSDATE + 1',
   use_default_gowner      IN   BOOLEAN   := true)
   return NUMBER;
```

Parameters

Table 51–66 INSTANTIATE_ONLINE Function Parameters

Parameter	Description
refresh_template_name	Name of the deployment template to be instantiated.
site_name	Name of the remote site that is instantiating the deployment template.
user_name	Name of the authorized user who is instantiating the deployment template.
runtime_parm_id	If you have defined runtime parameter values using the INSERT_RUNTIME_PARMS procedure, then specify the identification used when creating the runtime parameters (the identification was retrieved by using the GET_RUNTIME_PARM_ID function).
next_date	Specifies the next refresh date value to be used when creating the refresh group.
interval	Specifies the refresh interval to be used when creating the refresh group.
use_default_gowner	If true, then any materialized view groups created are owned by the default user PUBLIC. If false, then any materialized view groups created are owned by the user performing the instantiation.

Exceptions

Table 51–67 INSTANTIATE_ONLINE Function Exceptions

Exception	Description
miss_refresh_template	Specified deployment template name is invalid or does not exist.
miss_user	Name of the authorized user is invalid or does not exist. Verify that the specified user is listed in the DBA_REPCAT_USER_AUTHORIZATIONS view. If user is not listed, then the specified user is not authorized to instantiate the target deployment template.
bad_parms	Not all of the template parameters were populated by the defined user parameter values and / or template default values. The number of predefined values may not have matched the number of template parameters or a predefined value was invalid for the target parameter (that is, type mismatch).

Returns

Table 51–68 INSTANTIATE_ONLINE Function Returns

Return Value	Description
<system-generated number>	Specifies the system-generated number for the output_id when you select from the USER_REPCAT_TEMP_OUTPUT temporary view to retrieve the generated instantiation script.

LOCK_TEMPLATE_EXCLUSIVE Procedure

When a deployment template is being updated or modified, you should use the LOCK_TEMPLATE_EXCLUSIVE procedure to prevent users from reading or instantiating the template.

The lock is released when a ROLLBACK or COMMIT is performed.

> **Note:** This procedure should be executed before you make any modifications to your deployment template.

Syntax

```
DBMS_REPCAT_RGT.LOCK_TEMPLATE_EXCLUSIVE();
```

Parameters

None

LOCK_TEMPLATE_SHARED Procedure

The LOCK_TEMPLATE_SHARED procedure is used to make a specified deployment template "read-only." This procedure should be called before instantiating a template, as this ensures that nobody can change the deployment template while it is being instantiated.

The lock is released when a ROLLBACK or COMMIT is performed.

Syntax

```
DBMS_REPCAT_RGT.LOCK_TEMPLATE_SHARED();
```

Parameters

None

52

DBMS_REPUTIL

DBMS_REPUTIL contains subprograms to generate shadow tables, triggers, and packages for table replication, as well as subprograms to generate wrappers for replication of standalone procedure invocations and packaged procedure invocations. This package is referenced only by the generated code.

This chapter discusses the following topics:

- Summary of DBMS_REPUTIL Subprograms

Summary of DBMS_REPUTIL Subprograms

Table 52–1 DBMS_REPUTIL Package Subprograms

Subprogram	Description
"REPLICATION_OFF Procedure" on page 52-3	Modifies tables without replicating the modifications to any other sites in the replication environment, or disables row-level replication when using procedural replication.
"REPLICATION_ON Procedure" on page 52-3	Re-enables replication of changes after replication has been temporarily suspended.
"REPLICATION_IS_ON Function" on page 52-4	Determines whether or not replication is running.
"FROM_REMOTE Function" on page 52-4	Returns TRUE at the beginning of procedures in the internal replication packages, and returns FALSE at the end of these procedures.
"GLOBAL_NAME Function" on page 52-5	Determines the global database name of the local database (the global name is the returned value).
"MAKE_INTERNAL_ PKG Procedure" on page 52-5	Synchronizes internal packages and tables in the replication catalog. **Note:** Do not execute this procedure unless directed to do so by Oracle Support Services.
"SYNC_UP_REP Procedure" on page 52-6	Synchronizes internal triggers and tables / materialized views in the replication catalog. **Note:** Do not execute this procedure unless directed to do so by Oracle Support Services.

REPLICATION_OFF Procedure

This procedure enables you to modify tables without replicating the modifications to any other sites in the replication environment. It also disables row-level replication when using procedural replication. In general, you should suspend replication activity for all master groups in your replication environment before setting this flag.

Syntax

```
DBMS_REPUTIL.REPLICATION_OFF();
```

Parameters

None

REPLICATION_ON Procedure

This procedure re-enables replication of changes after replication has been temporarily suspended.

Syntax

```
DBMS_REPUTIL.REPLICATION_ON();
```

Parameters

None

REPLICATION_IS_ON Function

This function determines whether or not replication is running. A returned value of TRUE indicates that the generated replication triggers are enabled. A return value of FALSE indicates that replication is disabled at the current site for the replication group.

The returning value of this function is set by calling the REPLICATION_ON or REPLICATION_OFF procedures in the DBMS_REPUTIL package.

Syntax

```
DBMS_REPUTIL.REPLICATION_IS_ON()
  return BOOLEAN;
```

Parameters

None

FROM_REMOTE Function

This function returns TRUE at the beginning of procedures in the internal replication packages, and returns FALSE at the end of these procedures. You may need to check this function if you have any triggers that could be fired as the result of an update by an internal package.

Syntax

```
DBMS_REPUTIL.FROM_REMOTE()
   return BOOLEAN;
```

Parameters

None

GLOBAL_NAME Function

This function determines the global database name of the local database (the global name is the returned value).

Syntax

```
DBMS_REPUTIL.GLOBAL_NAME()
   return VARCHAR2;
```

Parameters

None

MAKE_INTERNAL_PKG Procedure

This procedure synchronizes the existence of an internal package with a table or materialized view in the replication catalog. If the table has replication support, then execute this procedure to create the internal package. If replication support does not exist, then this procedure destroys any related internal package. This procedure does not accept the storage table of a nested table.

Caution: Do not execute this procedure unless directed to do so by Oracle Support Services.

Syntax

```
DBMS_REPUTIL.MAKE_INTERNAL_PKG (
   canon_sname     IN   VARCHAR2,
   canon_oname     IN   VARCHAR2);
```

Parameters

Table 52–2 MAKE_INTERNAL_PKG Procedure Parameters

Parameter	Description
canon_sname	Schema containing the table to be synchronized. This parameter value must be canonically defined (capitalization must match object and must not be enclosed in double quotes).
canon_oname	Name of the table to be synchronized. This parameter value must be canonically defined (capitalization must match object and must not be enclosed in double quotes).

SYNC_UP_REP Procedure

This procedure synchronizes the existence of an internal trigger with a table or materialized view in the replication catalog. If the table or materialized view has replication support, then execute this procedure to create the internal replication trigger. If replication support does not exist, then this procedure destroys any related internal trigger. This procedure does not accept the storage table of a nested table.

Caution: Do not execute this procedure unless directed to do so by Oracle Support Services.

Syntax

```
DBMS_REPUTIL.SYNC_UP_REP (
   canon_sname     IN   VARCHAR2,
   canon_oname     IN   VARCHAR2);
```

Parameters

Table 52–3 SYNC_UP_REP Procedure Parameters

Parameter	Description
canon_sname	Schema containing the table or materialized view to be synchronized. This parameter value must be canonically defined (capitalization must match object and must not be enclosed in double quotes).
canon_oname	Name of the table or materialized view to be synchronized. This parameter value must be canonically defined (capitalization must match object and must not be enclosed in double quotes).

53

DBMS_RESOURCE_MANAGER

The DBMS_RESOURCE_MANAGER package maintains plans, consumer groups, and plan directives. It also provides semantics so that you may group together changes to the plan schema.

> **See Also:** For more information on using the Database Resource Manager, see *Oracle9i Database Administrator's Guide*.

This chapter discusses the following topics:

Requirements

The invoker must have the ADMINISTER_RESOURCE_MANAGER system privilege to execute these procedures. The procedures to grant and revoke this privilege are in the package DBMS_RESOURCE_MANAGER_PRIVS.

Summary of DBMS_RESOURE_MANAGER Subprograms

Table 53–1 DBMS_RESOURCE_MANAGER Package Subprograms

Subprogram	Description
"CREATE_PLAN Procedure" on page 53-3	Creates entries which define resource plans.
"CREATE_SIMPLE_PLAN Procedure" on page 53-4	Creates a single-level resource plan containing up to eight consumer groups in one step.
"UPDATE_PLAN Procedure" on page 53-5	Updates entries which define resource plans.
"DELETE_PLAN Procedure" on page 53-5	Deletes the specified plan as well as all the plan directives it refers to.
"DELETE_PLAN_CASCADE Procedure" on page 53-6	Deletes the specified plan as well as all its descendants (plan directives, subplans, consumer groups).
"CREATE_CONSUMER_ GROUP Procedure" on page 53-7	Creates entries which define resource consumer groups.
"UPDATE_CONSUMER_ GROUP Procedure" on page 53-7	Updates entries which define resource consumer groups.
"DELETE_CONSUMER_ GROUP Procedure" on page 53-8	Deletes entries which define resource consumer groups.
"CREATE_PLAN_DIRECTIVE Procedure" on page 53-8	Creates resource plan directives.
"UPDATE_PLAN_DIRECTIVE Procedure" on page 53-10	Updates resource plan directives.
"DELETE_PLAN_DIRECTIVE Procedure" on page 53-12	Deletes resource plan directives.
"CREATE_PENDING_AREA Procedure" on page 53-12	Creates a work area for changes to resource manager objects.

Table 53–1 DBMS_RESOURCE_MANAGER Package Subprograms

Subprogram	Description
"VALIDATE_PENDING_AREA Procedure" on page 53-13	Validates pending changes for the resource manager.
"CLEAR_PENDING_AREA Procedure" on page 53-14	Clears the work area for the resource manager.
SUBMIT_PENDING_AREA Procedure on page 53-14	Submits pending changes for the resource manager.
"SET_INITIAL_CONSUMER_ GROUP Procedure" on page 53-17	Assigns the initial resource consumer group for a user.
"SWITCH_CONSUMER_ GROUP_FOR_SESS Procedure" on page 53-18	Changes the resource consumer group of a specific session.
"SWITCH_CONSUMER_ GROUP_FOR_USER Procedure" on page 53-19	Changes the resource consumer group for all sessions with a given user name.

CREATE_PLAN Procedure

This procedure creates entries which define resource plans. For release 8.2, max_ active_sess_target_mth was renamed active_sess_pool_mth and new_queueing_ mth was added.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_PLAN (
   plan                      IN VARCHAR2,
   comment                   IN VARCHAR2,
   cpu_mth                   IN VARCHAR2 DEFAULT 'EMPHASIS',
   active_sess_pool_mth      IN VARCHAR2 DEFAULT 'ACTIVE_SESS_POOL_ABSOLUTE',
   parallel_degree_limit_mth IN VARCHAR2 DEFAULT
                             'PARALLEL_DEGREE_LIMIT_ABSOLUTE',
   queueing_mth              IN VARCHAR2 DEFAULT 'FIFO_TIMEOUT',);
```

Parameters

Table 53–2 CREATE_PLAN Procedure Parameters

Parameter	Description
plan	Name of resource plan.
comment	User's comment.
cpu_mth	Allocation method for CPU resources.
active_sess_pool_mth	Allocation method for maximum active sessions.
parallel_degree_limit_mth	Allocation method for degree of parallelism.
new_queueing_mth	Specifies type of queuing policy to use with active session pool feature.

CREATE_SIMPLE_PLAN Procedure

This procedure creates a single-level resource plan containing up to eight consumer groups in one step. You do not need to create a pending area manually before creating a resource plan, or use the CREATE_CONSUMER_GROUP and CREATE_RESOURCE_PLAN_DIRECTIVES procedures separately.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_SIMPLE_PLAN (
   SIMPLE_PLAN      IN  VARCHAR2  DEFAULT,
   CONSUMER_GROUP1  IN  VARCHAR2  DEFAULT,
   GROUP1_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP2  IN  VARCHAR2  DEFAULT,
   GROUP2_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP3  IN  VARCHAR2  DEFAULT,
   GROUP3_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP4  IN  VARCHAR2  DEFAULT,
   GROUP4_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP5  IN  VARCHAR2  DEFAULT,
   GROUP5_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP6  IN  VARCHAR2  DEFAULT,
   GROUP6_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP7  IN  VARCHAR2  DEFAULT,
   GROUP7_CPU       IN  NUMBER    DEFAULT,
   CONSUMER_GROUP8  IN  VARCHAR2  DEFAULT,
   GROUP8_CPU       IN  NUMBER    DEFAULT);
```

UPDATE_PLAN Procedure

This procedure updates entries which define resource plans.For release 8.2 new_max_active_sess_target_mth was renamed new_active_sess_pool_mth and new_queueing_mth was added.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_PLAN (
   plan                          IN VARCHAR2,
   new_comment                   IN VARCHAR2 DEFAULT NULL,
   new_cpu_mth                   IN VARCHAR2 DEFAULT NULL,
   new_active_sess_pool_mth          IN VARCHAR2 DEFAULT NULL,
   new_parallel_degree_limit_mth IN VARCHAR2 DEFAULT NULL,
   new_queueing_mth                  IN VARCHAR2 DEFAULT NULL,
   new_group_switch_mth              IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53–3 UPDATE_PLAN Procedure Parameters

Parameter	Description
plan	Name of resource plan.
new_comment	New user's comment.
new_cpu_mth	Name of new allocation method for CPU resources.
new_active_sess_pool_mth	Name of new method for maximum active sessions.
new_parallel_degree_limit_mth	Name of new method for degree of parallelism.
new_queueing_mth	Specifies type of queuing policy to use with active seesion pool feature.

Usage Notes

If the parameters to UPDATE_PLAN are not specified, then they remain unchanged in the data dictionary.

DELETE_PLAN Procedure

This procedure deletes the specified plan as well as all the plan directives to which it refers.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_PLAN (
   plan IN VARCHAR2);
```

Parameters

Table 53–4 DELETE_PLAN Procedure Parameters

Parameter	Description
plan	Name of resource plan to delete.

DELETE_PLAN_CASCADE Procedure

This procedure deletes the specified plan and all of its descendants (plan directives, subplans, consumer groups). Mandatory objects and directives are not deleted.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_PLAN_CASCADE (
   plan IN VARCHAR2);
```

Parameters

Table 53–5 DELETE_PLAN_CASCADE Procedure Parameters

Parameters	Description
plan	Name of plan.

Errors

If DELETE_PLAN_CASCADE encounters any error, then it rolls back, and nothing is deleted.

> **Note:** If you want to use any default resource allocation method, then you do not need not specify it when creating or updating a plan.

Usage Notes

Defaults are:

- cpu_method = EMPHASIS
- parallel_degree_limit_mth = PARALLEL_DEGREE_LIMIT_ABSOLUTE
- active_sess_pool_mth = MAX_ACTIVE_SESS_ABSOLUTE

Note: The parameter max_active_sess_target_mth is undocumented in this release: It is reserved for future use.

CREATE_CONSUMER_GROUP Procedure

This procedure lets you create entries which define resource consumer groups.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP (
   consumer_group IN VARCHAR2,
   comment        IN VARCHAR2,
   cpu_mth        IN VARCHAR2 DEFAULT 'ROUND-ROBIN');
```

Parameters

Table 53–6 CREATE_CONSUMER_GROUP Procedure Parameters

Parameter	Description
consumer_group	Name of consumer group.
comment	User's comment.
cpu_mth	Name of CPU resource allocation method.

UPDATE_CONSUMER_GROUP Procedure

This procedure lets you update entries which define resource consumer groups.

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_CONSUMER_GROUP (
   consumer_group IN VARCHAR2,
   new_comment    IN VARCHAR2 DEFAULT NULL,
   new_cpu_mth    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 53–7 UPDATE_CONSUMER_GROUP Procedure Parameter

Parameter	Description
consumer_group	Name of consumer group.
new_comment	New user's comment.
new_cpu_mth	Name of new method for CPU resource allocation.

If the parameters to the UPDATE_CONSUMER_GROUP procedure are not specified, then they remain unchanged in the data dictionary.

DELETE_CONSUMER_GROUP Procedure

This procedure lets you delete entries which define resource consumer groups.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_CONSUMER_GROUP (
   consumer_group IN VARCHAR2);
```

Parameters

Table 53–8 DELETE_CONSUMER_GROUP Procedure Parameters

Parameters	Description
consumer_group	Name of consumer group to be deleted.

CREATE_PLAN_DIRECTIVE Procedure

This procedure lets you create resource plan directives.For release 8.2 new_max_ active_sess_target_mth was renamed new_active_sess_pool_mth and several new parameters added.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE (
   plan                    IN VARCHAR2,
   group_or_subplan        IN VARCHAR2,
   comment                 IN VARCHAR2,
   cpu_p1                  IN NUMBER   DEFAULT NULL,
   cpu_p2                  IN NUMBER   DEFAULT NULL,
```

```
   cpu_p3                    IN NUMBER   DEFAULT NULL,
   cpu_p4                    IN NUMBER   DEFAULT NULL,
   cpu_p5                    IN NUMBER   DEFAULT NULL,
   cpu_p6                    IN NUMBER   DEFAULT NULL,
   cpu_p7                    IN NUMBER   DEFAULT NULL,
   cpu_p8                    IN NUMBER   DEFAULT NULL,
   active_sess_pool_p1       IN NUMBER   DEFAULT UNLIMITED,
   queueing_p1               IN NUMBER   DEFAULT UNLIMITED,
   switch_group              IN VARCHAR2 DEFAULT NULL,
   switch_time               IN NUMBER   DEFAULT UNLIMITED,
   switch_estimate           IN BOOLEAN  DEFAULT FALSE,
   max_est_exec_time         IN NUMBER   DEFAULT UNLIMITED,
   undo_pool                 IN NUMBER   DEFAULT UNLIMITED,
   parallel_degree_limit_p1  IN NUMBER   DEFAULT UNLIMITED);
```

Parameters

Table 53–9 CREATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of resource plan.
group_or_subplan	Name of consumer group or subplan.
comment	Comment for the plan directive.
cpu_p1	First parameter for the CPU resource allocation method.
cpu_p2	Second parameter for the CPU resource allocation method.
cpu_p3	Third parameter for the CPU resource allocation method.
cpu_p4	Fourth parameter for the CPU resource allocation method.
cpu_p5	Fifth parameter for the CPU resource allocation method.
cpu_p6	Sixth parameter for the CPU resource allocation method.
cpu_p7	Seventh parameter for the CPU resource allocation method.
cpu_p8	Eighth parameter for the CPU resource allocation method.
active_sess_pool_p1	First parameter for the maximum active sessions allocation method (Reserved for future use).
queueing_p1	queue timeout in seconds
switch_group	group to switch into once switch time is reached
switch_time	switch time

Table 53–9 CREATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
switch_estimate	If TRUE, tells Oracle to use its execution time estimate to automatically switch the consumer group of an operation before beginning its execution. Default is FALSE.
max_est_exec_time	maximum estimated execution time in seconds
undo_pool	undo pool size for the consumer group, in Kbytes
parallel_degree_limit_p1	First parameter for the degree of parallelism allocation method.

All parameters default to NULL. However, for the EMPHASIS CPU resource allocation method, this case would starve all the users.

UPDATE_PLAN_DIRECTIVE Procedure

This procedure lets you update resource plan directives. For release 8.2 new_max_active_sess_target_mth was renamed new_active_sess_pool_mth and several new parameters added

Syntax

```
DBMS_RESOURCE_MANAGER.UPDATE_PLAN_DIRECTIVE (
   plan                          IN VARCHAR2,
   group_or_subplan              IN VARCHAR2,
   new_comment                   IN VARCHAR2 DEFAULT NULL,
   new_cpu_p1                    IN NUMBER   DEFAULT NULL,
   new_cpu_p2                    IN NUMBER   DEFAULT NULL,
   new_cpu_p3                    IN NUMBER   DEFAULT NULL,
   new_cpu_p4                    IN NUMBER   DEFAULT NULL,
   new_cpu_p5                    IN NUMBER   DEFAULT NULL,
   new_cpu_p6                    IN NUMBER   DEFAULT NULL,
   new_cpu_p7                    IN NUMBER   DEFAULT NULL,
   new_cpu_p8                    IN NUMBER   DEFAULT NULL,
   new_active_sess_pool_p1       IN NUMBER   DEFAULT NULL,
   new_queueing_p1               IN NUMBER   DEFAULT NULL,
   new_parallel_degree_limit_p1  IN NUMBER   DEFAULT NULL
   new_switch_group              IN VARCHAR2 DEFAULT NULL,
   new_switch_time               IN NUMBER   DEFAULT NULL,
   new_switch_estimate           IN BOOLEAN  DEFAULT FALSE,
   new_max_est_exec_time         IN NUMBER   DEFAULT NULL,
   new_undo_pool                 IN NUMBER   DEFAULT UNLIMITED);
```

Parameters

Table 53–10 UPDATE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of resource plan.
group_or_subplan	Name of consumer group or subplan.
comment	Comment for the plan directive.
new_cpu_p1	First parameter for the CPU resource allocation method.
new_cpu_p2	Second parameter for the CPU resource allocation method.
new_cpu_p3	Third parameter for the CPU resource allocation method.
new_cpu_p4	Fourth parameter for the CPU resource allocation method.
new_cpu_p5	Fifth parameter for the CPU resource allocation method.
new_cpu_p6	Sixth parameter for the CPU resource allocation method.
new_cpu_p7	Seventh parameter for the CPU resource allocation method.
new_cpu_p8	Eighth parameter for the CPU resource allocation method.
new_active_sess_pool_p1	First parameter for the maximum active sessions allocation method (Reserved for future use).
new_queueing_p1	queue timeout in seconds
new_switch_group	group to switch into once switch time is reached
new_switch_time	switch time
new_switch_estimate	If TRUE, tells Oracle to use its execution time estimate to automatically switch the consumer group of an operation before beginning its execution. Default is FALSE.
new_max_est_exec_time	maximum estimated execution time in seconds
new_undo_pool	undo pool size for the consumer group, in Kbytes
new_parallel_degree_limit_p1	First parameter for the degree of parallelism allocation method.

If the parameters for UPDATE_PLAN_DIRECTIVE are left unspecified, then they remain unchanged in the data dictionary.

DELETE_PLAN_DIRECTIVE Procedure

This procedure lets you delete resource plan directives.

Syntax

```
DBMS_RESOURCE_MANAGER.DELETE_PLAN_DIRECTIVE (
   plan             IN VARCHAR2,
   group_or_subplan IN VARCHAR2);
```

Parameters

Table 53–11 DELETE_PLAN_DIRECTIVE Procedure Parameters

Parameter	Description
plan	Name of resource plan.
group_or_subplan	Name of group or subplan.

CREATE_PENDING_AREA Procedure

This procedure lets you make changes to resource manager objects.

All changes to the plan schema must be done within a pending area. The pending area can be thought of as a "scratch" area for plan schema changes. The administrator creates this pending area, makes changes as necessary, possibly validates these changes, and only when the submit is completed do these changes become active.

You may, at any time while the pending area is active, view the current plan schema with your changes by selecting from the appropriate user views.

At any time, you may clear the pending area if you want to stop the current changes. You may also call the VALIDATE procedure to confirm whether the changes you has made are valid. You do not have to do your changes in a given order to maintain a consistent group of entries. These checks are also implicitly done when the pending area is submitted.

Note: Oracle allows "orphan" consumer groups (in other words, consumer groups that have no plan directives that refer to them). This is in anticipation that an administrator may want to create a consumer group that is not currently being used, but will be used in the future.

Syntax

```
DBMS_RESOURCE_MANAGER.CREATE_PENDING_AREA;
```

Usage Notes

The following rules must be adhered to, and they are checked whenever the validate or submit procedures are executed:

1. No plan schema may contain any loops.
2. All plans and consumer groups referred to by plan directives must exist.
3. All plans must have plan directives that refer to either plans or consumer groups.
4. All percentages in any given level must not add up to greater than 100 for the emphasis resource allocation method.
5. No plan may be deleted that is currently being used as a top plan by an active instance.
6. For Oracle8*i*, the plan directive parameter, `parallel_degree_limit_p1`, may only appear in plan directives that refer to consumer groups (i.e., not at subplans).
7. There cannot be more than 32 plan directives coming from any given plan (i.e., no plan can have more than 32 children).
8. There cannot be more than 32 consumer groups in any active plan schema.
9. Plans and consumer groups use the same namespace; therefore, no plan can have the same name as any consumer group.
10. There must be a plan directive for `OTHER_GROUPS` somewhere in any active plan schema.This ensures that a session not covered by the currently active plan is allocated resources as specified by the `OTHER_GROUPS` directive.

If any of the above rules are broken when checked by the `VALIDATE` or `SUBMIT` procedures, then an informative error message is returned. You may then make changes to fix the problem(s) and reissue the validate or submit procedures.

VALIDATE_PENDING_AREA Procedure

This procedure lets you validate pending changes for the resource manager.

Syntax

```
DBMS_RESOURCE_MANAGER.VALIDATE_PENDING_AREA;
```

CLEAR_PENDING_AREA Procedure

This procedure lets you clear pending changes for the resource manager.

Syntax

```
DBMS_RESOURCE_MANAGER.CLEAR_PENDING_AREA;
```

SUBMIT_PENDING_AREA Procedure

This procedure lets you submit pending changes for the resource manager: It clears the pending area after validating and committing the changes (if valid).

> **Note:** A call to SUBMIT_PENDING_AREA may fail even if VALIDATE_PENDING_AREA succeeds. This may happen if a plan being deleted is loaded by an instance after a call to VALIDATE_PENDING_AREA, but before a call to SUBMIT_PENDING_AREA.

Syntax

```
DBMS_RESOURCE_MANAGER.SUBMIT_PENDING_AREA;
```

Example

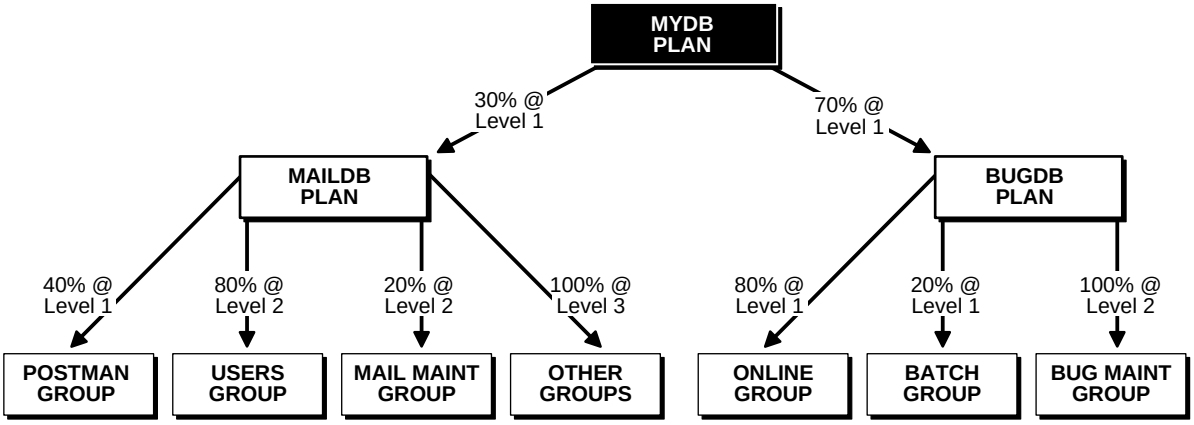
One of the advantages of plans is that they can refer to each other. The entries in a plan can either be consumer groups or subplans. For example, the following is also a set of valid CPU plan directives:

Table 53–12 MYDB PLAN CPU Plan Directives

Subplan/Group	CPU_Level 1
MAILDB Plan	30%
BUGDB Plan	70%

If these plan directives were in effect and there were an infinite number of runnable sessions in all consumer groups, then the MAILDB plan would be assigned 30% of the available CPU resources, while the BUGDB plan would be assigned 70% of the available CPU resources. Breaking this further down, sessions in the "Postman"

consumer group would be run 12% (40% of 30%) of the time, while sessions in the "Online" consumer group would be run 56% (80% of 70%) of the time. The following diagram depicts this scenario:



Conceptually below the consumer groups are the active sessions. In other words, a session belongs to a resource consumer group, and this consumer group is used by a plan to determine allocation of processing resources.

A multi-plan (plan with one or more subplans) definition of CPU plan directives cannot be collapsed into a single plan with one set of plan directives, because each plan is its own entity. The CPU quanta that is allotted to a plan or subplan gets used only within that plan, unless that plan contains no consumer groups with active sessions. Therefore, in this example, if the Bug Maintenance Group did not use any of its quanta, then it would get recycled within that plan, thus going back to level 1 within the BUGDB PLAN. If the multi-plan definition in the above example got collapsed into a single plan with multiple consumer groups, then there would be no way to explicitly recycle the Bug Maintenance Group's unused quanta. It would have to be recycled globally, thus giving the mail sessions an opportunity to use it.

The resources for a database can be partitioned at a high level among multiple applications and then repartitioned within an application. If a given group within an application does not need all the resources it is assigned, then the resource is only repartitioned within the same application.

The following example uses the default plan and consumer group allocation methods:

```
BEGIN
```

```
DBMS_RESOURCE_MANAGER.CREATE_PENDING_AREA();
DBMS_RESOURCE_MANAGER.CREATE_PLAN(PLAN => 'bugdb_plan',
   COMMENT => 'Resource plan/method for bug users sessions');
DBMS_RESOURCE_MANAGER.CREATE_PLAN(PLAN => 'maildb_plan',
   COMMENT => 'Resource plan/method for mail users sessions');
DBMS_RESOURCE_MANAGER.CREATE_PLAN(PLAN => 'mydb_plan',
   COMMENT => 'Resource plan/method for bug and mail users sessions');
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP(CONSUMER_GROUP => 'Bug_Online_group',
   COMMENT => 'Resource consumer group/method for online bug users sessions');
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP(CONSUMER_GROUP => 'Bug_Batch_group',
COMMENT => 'Resource consumer group/method for bug users sessions who run batch jobs');
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP(CONSUMER_GROUP => 'Bug_Maintenance_group',
   COMMENT => 'Resource consumer group/method for users sessions who maintain
   the bug  db');
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP(CONSUMER_GROUP => 'Mail_users_group',
   COMMENT => 'Resource consumer group/method for mail users sessions');
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP(CONSUMER_GROUP => 'Mail_Postman_group',
   COMMENT => 'Resource consumer group/method for mail postman');
DBMS_RESOURCE_MANAGER.CREATE_CONSUMER_GROUP(CONSUMER_GROUP => 'Mail_Maintenance_group',
   COMMENT => 'Resource consumer group/method for users sessions who maintain the mail
   db');
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'bugdb_plan', GROUP_OR_SUBPLAN =>
'Bug_Online_group',
   COMMENT => 'online bug users sessions at level 1', CPU_P1 => 80, CPU_P2=> 0,
   PARALLEL_DEGREE_LIMIT_P1 => 8);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'bugdb_plan', GROUP_OR_SUBPLAN =>
'Bug_Batch_group',
   COMMENT => 'batch bug users sessions at level 1', CPU_P1 => 20, CPU_P2 => 0,
   PARALLEL_DEGREE_LIMIT_P1 => 2);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'bugdb_plan', GROUP_OR_SUBPLAN =>
'Bug_Maintenance_group',
   COMMENT => 'bug maintenance users sessions at level 2', CPU_P1 => 0, CPU_P2 => 100,
PARALLEL_DEGREE_LIMIT_P1 => 3);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'bugdb_plan', GROUP_OR_SUBPLAN =>
'OTHER_GROUPS',
   COMMENT => 'all other users sessions at level 3', CPU_P1 => 0, CPU_P2 => 0, CPU_P3 =>
100);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'maildb_plan', GROUP_OR_SUBPLAN =>
'Mail_Postman_group',
   COMMENT => 'mail postman at level 1', CPU_P1 => 40, CPU_P2 => 0,
   PARALLEL_DEGREE_LIMIT_P1 => 4);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'maildb_plan', GROUP_OR_SUBPLAN =>
'Mail_users_group',
   COMMENT => 'mail users sessions at level 2', CPU_P1 => 0, CPU_P2 => 80,
   PARALLEL_DEGREE_LIMIT_P1 => 4);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'maildb_plan', GROUP_OR_SUBPLAN =>
'Mail_Maintenance_group',
   COMMENT => 'mail maintenance users sessions at level 2', CPU_P1 => 0, CPU_P2 => 20,
   PARALLEL_DEGREE_LIMIT_P1 => 2);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'maildb_plan', GROUP_OR_SUBPLAN =>
```

```
'OTHER_GROUPS',
   COMMENT => 'all other users sessions at level 3', CPU_P1 => 0, CPU_P2 => 0, CPU_P3 =>
100);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'mydb_plan', GROUP_OR_SUBPLAN =>
'maildb_plan',
   COMMENT=> 'all mail users sessions at level 1', CPU_P1 => 30);
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE(PLAN => 'mydb_plan', GROUP_OR_SUBPLAN =>
'bugdb_plan',
   COMMENT => 'all bug users sessions at level 1', CPU_P1 => 70);
DBMS_RESOURCE_MANAGER.VALIDATE_PENDING_AREA();
DBMS_RESOURCE_MANAGER.SUBMIT_PENDING_AREA();
end;
```

The above call to VALIDATE_PENDING_AREA is optional, because the validation is implicitly done in SUBMIT_PENDING_AREA.

SET_INITIAL_CONSUMER_GROUP Procedure

The initial consumer group of a user is the consumer group to which any session created by that user initially belongs. This procedure sets the initial resource consumer group for a user.

Syntax

```
DBMS_RESOURCE_MANAGER.SET_INITIAL_CONSUMER_GROUP (
   user           IN VARCHAR2,
   consumer_group IN VARCHAR2);
```

Parameters

Table 53–13 SET_INITIAL_CONSUMER_GROUP Procedure Parameters

Parameters	Description
user	Name of the user.
consumer_group	The user's initial consumer group.

Usage Notes

The ADMINISTER_RESOURCE_MANAGER or the ALTER USER system privilege are required to be able to execute this procedure. The user, or PUBLIC, must be directly granted switch privilege to a consumer group before it can be set to be the user's initial consumer group. Switch privilege for the initial consumer group cannot come from a role granted to that user.

Note: These semantics are similar to those for ALTER USER DEFAULT ROLE.

If the initial consumer group for a user has never been set, then the user's initial consumer group is automatically the consumer group: DEFAULT_CONSUMER_GROUP.

DEFAULT_CONSUMER_GROUP has switch privileges granted to PUBLIC; therefore, all users are automatically granted switch privilege for this consumer group. Upon deletion of a consumer group, all users having the deleted group as their initial consumer group now have DEFAULT_CONSUMER_GROUP as their initial consumer group. All currently active sessions belonging to a deleted consumer group are switched to DEFAULT_CONSUMER_GROUP.

SWITCH_CONSUMER_GROUP_FOR_SESS Procedure

This procedure lets you change the resource consumer group of a specific session. It also changes the consumer group of any (PQ) slave sessions that are related to the top user session.

Syntax

```
DBMS_RESOURCE_MANAGER.SWITCH_CONSUMER_GROUP_FOR_SESS (
   session_id     IN NUMBER,
   session_serial IN NUMBER,
   consumer_group IN VARCHAR2);
```

Parameters

Table 53–14 SWITCH_CONSUMER_GROUP_FOR_SESS Procedure Parameters

Parameter	Description
session_id	SID column from the view V$SESSION.
session_serial	SERIAL# column from view V$SESSION.
consumer_group	Name of the consumer group to switch to.

SWITCH_CONSUMER_GROUP_FOR_USER Procedure

This procedure lets you change the resource consumer group for all sessions with a given user ID. It also change the consumer group of any (PQ) slave sessions that are related to the top user session.

Syntax

```
DBMS_RESOURCE_MANAGER.SWITCH_CONSUMER_GROUP_FOR_USER (
   user           IN VARCHAR2,
   consumer_group IN VARCHAR2);
```

Parameters

Table 53–15 SWITCH_CONSUMER_GROUP_FOR_USER Procedure Parameters

Parameter	Description
user	Name of the user.
consumer_group	Name of the consumer group to switch to.

Usage Notes

The SWITCH_CONSUMER_GROUP_FOR_SESS and SWITCH_CONSUMER_GROUP_FOR_USER procedures let you to raise or lower the allocation of CPU resources of certain sessions or users. This provides a functionality similar to the nice command on UNIX.

These procedures cause the session to be moved into the newly specified consumer group immediately.

54

DBMS_RESOURCE_MANAGER_PRIVS

The DBMS_RESOURCE_MANAGER_PRIVS package maintains privileges associated with the Resource Manager.

> **See Also:** For more information on using the Database Resource Manager, see *Oracle9i Database Administrator's Guide*.

This chapter discusses the following topics:

Summary of DBMS_RESOURCE_MANAGER_PRIVS Subprograms

Table 54–1 DBMS_RESOURCE_MANAGER_PRIVS Subprograms

Subprogram	Description
"GRANT_SYSTEM_PRIVILEGE Procedure" on page 54-2	Performs a grant of a system privilege.
"REVOKE_SYSTEM_PRIVILEGE Procedure" on page 54-3	Performs a revoke of a system privilege.
"GRANT_SWITCH_ CONSUMER_GROUP Procedure" on page 54-3	Grants the privilege to switch to resource consumer groups.
"REVOKE_SWITCH_ CONSUMER_GROUP Procedure" on page 54-5	Revokes the privilege to switch to resource consumer groups.

GRANT_SYSTEM_PRIVILEGE Procedure

This procedure performs a grant of a system privilege to a user or role.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SYSTEM_PRIVILEGE (
   grantee_name   IN VARCHAR2,
   privilege_name IN VARCHAR2 DEFAULT 'ADMINISTER_RESOURCE_MANAGER',
   admin_option   IN BOOLEAN);
```

Parameters

Table 54–2 GRANT_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
grantee_name	Name of the user or role to whom privilege is to be granted.
privilege_name	Name of the privilege to be granted.
admin_option	TRUE if the grant is with admin_option, FALSE otherwise.

Currently, Oracle provides only one system privilege for the Resource Manager: ADMINISTER_RESOURCE_MANAGER. Database administrators have this system privilege with the admin option. The grantee and the revokee can either be a user or

a role. Users that have been granted the system privilege with the admin option can also grant this privilege to others.

Example

The following call grants this privilege to a user called scott without the admin option:

```
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SYSTEM_PRIVILEGE (
   grantee_name => 'scott',
   admin_option => FALSE);
```

REVOKE_SYSTEM_PRIVILEGE Procedure

This procedure performs a revoke of a system privilege from a user or role.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SYSTEM_PRIVILEGE (
   revokee_name   IN VARCHAR2,
   privilege_name IN VARCHAR2 DEFAULT 'ADMINISTER_RESOURCE_MANAGER');
```

Parameters

Table 54–3 REVOKE_SYSTEM_PRIVILEGE Procedure Parameters

Parameter	Description
revokee_name	Name of the user or role from whom privilege is to be revoked.
privilege_name	Name of the privilege to be revoked.

Example

The following call revokes the ADMINISTER_RESOURCE_MANAGER from user scott:

```
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SYSTEM_PRIVILEGE ('scott');
```

GRANT_SWITCH_CONSUMER_GROUP Procedure

This procedure grants the privilege to switch to a resource consumer group.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SWITCH_CONSUMER_GROUP (
   grantee_name   IN VARCHAR2,
```

```
   consumer_group IN VARCHAR2,
   grant_option   IN BOOLEAN);
```

Parameters

Table 54–4 GRANT_SWITCH_CONSUMER_GROUP Procedure Parameters

Parameter	Description
grantee_name	Name of the user or role to whom privilege is to be granted.
consumer_group	Name of consumer group.
grant_option	TRUE if grantee should be allowed to grant access, FALSE otherwise.

Usage Notes

If you grant permission to switch to a particular consumer group to a user, then that user can immediately switch their current consumer group to the new consumer group.

If you grant permission to switch to a particular consumer group to a role, then any users who have been granted that role and have enabled that role can immediately switch their current consumer group to the new consumer group.

If you grant permission to switch to a particular consumer group to PUBLIC, then any user can switch to that consumer group.

If the grant_option parameter is TRUE, then users granted switch privilege for the consumer group may also grant switch privileges for that consumer group to others.

In order to set the initial consumer group of a user, you must grant the switch privilege for that group to the user.

See Also: Chapter 53, "DBMS_RESOURCE_MANAGER"

Example

```
DBMS_RESOURCE_MANAGER_PRIVS.GRANT_SWITCH_COMSUMER_GROUP (
   'scott', 'mail_maintenance_group', true);

DBMS_RESOURCE_MANAGER.SET_INITIAL_CONSUMER_GROUP (
   'scott', 'mail_maintenance_group');
```

REVOKE_SWITCH_CONSUMER_GROUP Procedure

This procedure revokes the privilege to switch to a resource consumer group.

Syntax

```
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SWITCH_CONSUMER_GROUP (
   revokee_name   IN VARCHAR2,
   consumer_group IN VARCHAR2);
```

Parameters

Table 54–5 REVOKE_SWITCH_CONSUMER_GROUP Procedure Parameter

Parameter	Description
revokee_name	Name of user / role from which to revoke access.
consumer_group	Name of consumer group.

Usage Notes

If you revoke a user's switch privilege for a particular consumer group, then any subsequent attempts by that user to switch to that consumer group will fail.

If you revoke the initial consumer group from a user, then that user will automatically be part of the DEFAULT_CONSUMER_GROUP consumer group when logging in.

If you revoke the switch privilege for a consumer group from a role, then any users who only had switch privilege for the consumer group via that role will not be subsequently able to switch to that consumer group.

If you revoke the switch privilege for a consumer group from PUBLIC, then any users who could previously only use the consumer group via PUBLIC will not be subsequently able to switch to that consumer group.

Example

The following example revokes the privileges to switch to mail_maintenance_group from Scott:

```
DBMS_RESOURCE_MANAGER_PRIVS.REVOKE_SWITCH_CONSUMER_GROUP (
   'scott', 'mail_maintenance_group');
```

55

DBMS_RESUMABLE

With DBMS_RESUMABLE, you can suspend large operations that run out of space or reach space limits after executing for a long time, fix the problem, and make the statement resume execution. Thus, you can write applications without worrying about running into space-related errors.

When a statement is suspended, the act of suspending should be logged in the alert log. You should also register a procedure to be executed when the statement is suspended. Using a view, you can monitor the progress of the statement and indicate whether the statement is currently executing or suspended.

Suspending a statement automatically results in suspending the transaction. Thus all transactional resources are held during a statement suspend and resume. When the error condition disappears, the suspended statement automatically resumes execution. A resumable space allocation can be suspended and resumed multiple times during execution.

A suspension timeout interval is associated with resumable space allocations. A resumable space allocation that is suspended for the timeout interval (the default is two hours) wakes up and returns an exception to the user. A suspended statement may be forced to throw an exception using the DMBS_RESUMABLE.ABORT( ) procedure.

This chapter discusses the following topics:

Summary of DBMS_RESUMABLE Subprograms

Table 55–1 DBMS_RESUMABLE Subprograms

Subprogram	Description
"ABORT Procedure" on page 55-2	Aborts a suspended resumable space allocation.
"GET_SESSION_ TIMEOUT Function" on page 55-3	Returns the current timeout value of the resumable space allocations for a session with `session_id`.
"SET_SESSION_TIMEOUT Procedure" on page 55-3	Sets the timeout of resumable space allocations for a session with `session_id`.
"GET_TIMEOUT Function" on page 55-4	Returns the current timeout value of resumable space allocations for the current session.
"SET_TIMEOUT Procedure" on page 55-4	Sets the timeout of resumable space allocations for the current session.
"SPACE_ERROR_INFO Function" on page 55-4	Looks for space-related errors in the error stack. If it cannot find a space-related error, it will return `FALSE`.

ABORT Procedure

This procedure aborts a suspended resumable space allocation. The parameter `session_id` is the session ID in which the statement is executed. For a parallel DML / DDL, `session_id` is any session ID that participates in the parallel DML / DDL. This operation is guaranteed to succeed. The procedure can be called either inside or outside of the `AFTER SUSPEND` trigger.

To call an `ABORT` procedure, you must be the owner of the session with `session_id`, have `ALTER SYSTEM` privileges, or be a DBA.

Syntax

```
DBMS_RESUMABLE.ABORT (
    session_id IN NUMBER);
```

Parameters

Table 55–2 shows the parameters for the `ABORT` procedure.

Table 55–2 ABORT Procedure Parameters

Parameter	Description
session_id	The session identifier of the resumable space allocation.

GET_SESSION_TIMEOUT Function

This function returns the current timeout value of resumable space allocations for a session with session_id. The timeout is returned in seconds. If session_id does not exist, the GET_SESSION_TIMEOUT function returns -1.

Syntax

```
DBMS_RESUMABLE.GET_SESSION_TIMEOUT (
    session_id  IN NUMBER);
```

Parameters

Table 55–3 shows the parameters for the GET_SESSION_TIMEOUT function.

Table 55–3 GET_SESSION_TIMEOUT Function Parameters

Parameter	Description
session_id	The session identifier of the resumable space allocation.

SET_SESSION_TIMEOUT Procedure

This procedure sets the timeout of resumable space allocations for a session with session_id. The timeout is returned in seconds. The new timeout setting applies to the session immediately. If session_id does not exist, no operation occurs.

Syntax

```
DBMS_RESUMABLE.SET_SESSION_TIMEOUT (
    session_id  IN NUMBER,
    timeout IN NUMBER);
```

Parameters

Table 55–4 shows the parameters for the SET_SESSION_TIMEOUT procedure.

Table 55–4 SET_SESSION_TIMEOUT Procedure Parameters

Parameter	Description
session_id	The session identifier of the resumable space allocation.
timeout	The timeout of the resumable space allocation.

GET_TIMEOUT Function

This function returns the current timeout value of resumable space allocations for the current session. The returned value is in seconds. If session_id does not exist, the GET_TIMEOUT function returns -1.

Syntax

```
DBMS_RESUMABLE.GET_TIMEOUT;
```

SET_TIMEOUT Procedure

This procedure sets the timeout of resumable space allocations for the current session. The timeout is returned in seconds. The new timeout setting applies to the session immediately. If session_id does not exist, no operation occurs.

Syntax

```
DBMS_RESUMABLE.SET_TIMEOUT (
    timeout IN NUMBER);
```

Parameters

Table 55–5 shows the parameters for the SET_TIMEOUT procedure.

Table 55–5 SET_TIMEOUT Procedure Parameters

Parameter	Description
timeout	The timeout of the resumable space allocation.

SPACE_ERROR_INFO Function

This function looks for space-related errors in the error stack. If it cannot find a space related error, it will return FALSE. Otherwise, TRUE is returned and information about the particular object that causes the space error is returned.

Syntax

```
DBMS_RESUMABLE.SPACE_ERROR_INFO
    error_type        OUT VARCHAR2,
    object_type       OUT VARCHAR2,
    object_owner      OUT VARCHAR2,
    table_space_name  OUT VARCHAR2,
    object_name       OUT VARCHAR2,
    sub_object_name   OUT VARCHAR2)
return boolean;
```

Parameters

Table 55–6 SPACE_ERROR_INFO Function Parameters

Parameter	Description
error_type	The space error type. It will be one of the following: ▪ NO MORE SPACE ▪ MAX EXTENTS REACHED ▪ SPACE QUOTA EXCEEDED
object_type	The object type. It will be one of the following: ▪ TABLE SPACE ▪ ROLLBACK SEGMENT ▪ UNDO SEGMENT ▪ TABLE ▪ INDEX ▪ CLUSTER ▪ TEMP SEGMENT ▪ INDEX PARTITION ▪ TABLE PARTITION ▪ LOB SEGMENT ▪ TABLE SUBPARTITION ▪ INDEX SUBPARTITION ▪ LOB SUBPARTITION
object_owner	The owner of the object. NULL if it cannot be determined.
table_space_name	The table space where the object resides. NULL if it cannot be determined.

Table 55–6 SPACE_ERROR_INFO Function Parameters

Parameter	Description
`object_name`	The name of rollback segment, temp segment, table, index, or cluster.
`sub_object_name`	The partition name or sub-partition name of `LOB`, `TABLE`, or `INDEX`. `NULL` if it cannot be determined.

56

DBMS_RLS

The DBMS_RLS package contains the fine-grained access control administrative interface. DBMS_RLS is available with the Enterprise Edition only.

> **See Also:** *Oracle9i Application Developer's Guide - Fundamentals* for a fuller discussion and more usage information on DBMS_RLS.

This chapter discusses the following topics:

Dynamic Predicates

The functionality to support fine-grained access control is based on dynamic predicates, where security rules are not embedded in views, but are acquired at the statement parse time, when the base table or view is referenced in a DML statement.

A dynamic predicate for a table or view is generated by a PL/SQL function, which is associated with a security policy through a PL/SQL interface. For example:

```
DBMS_RLS.ADD_POLICY (
   'scott', 'emp', 'emp_policy', 'secusr', 'emp_sec', 'select');
```

Whenever EMP table, under SCOTT schema, is referenced in a query or subquery (SELECT), the server calls the EMP_SEC function (under SECUSR schema). This returns a predicate specific to the current user for the EMP_POLICY policy. The policy function may generate the predicates based on whatever session environment variables are available during the function call. These variables usually appear in the form of application contexts.

The server then produces a transient view with the text:

```
SELECT * FROM scott.emp WHERE P1
```

Here, P1 (e.g., SAL > 10000, or even a subquery) is the predicate returned from the EMP_SEC function. The server treats the EMP table as a view and does the view expansion just like the ordinary view, except that the view text is taken from the transient view instead of the data dictionary.

If the predicate contains subqueries, then the owner (definer) of the policy function is used to resolve objects within the subqueries and checks security for those objects. In other words, users who have access privilege to the policy protected objects do not need to know anything about the policy. They do not need to be granted object privileges for any underlying security policy. Furthermore, the users also do not require EXECUTE privilege on the policy function, because the server makes the call with the function definer's right.

Note: The transient view can preserve the updatability of the parent object because it is derived from a single table or view with predicate only; that is, no JOIN, ORDER BY, GROUP BY, and so on.

DBMS_RLS also provides the interface to drop and enable/disable security policies. For example, you can drop or disable the EMP_POLICY with the following PL/SQL statements:

```
DBMS_RLS.DROP_POLICY('scott', 'emp', 'emp_policy');
DBMS_RLS.ENABLE_POLICY('scott', 'emp', 'emp_policy', FALSE)
```

Security

A security check is performed when the transient view is created with subquery. The schema owning the policy function, which generates the dynamic predicate, is the transient view's definer for the purpose of security check and object look-up.

Usage Notes

The DBMS_RLS procedures cause current DML transactions, if any, to commit before the operation. However, the procedures do not cause a commit first if they are inside a DDL event trigger. With DDL transactions, the DBMS_RLS procedures are part of the DDL transaction.

For example, you may create a trigger for CREATE TABLE. Inside the trigger, you may add a column through ALTER TABLE, and you can add a policy through DBMS_RLS. All these operations are in the same transaction as CREATE TABLE, even though each one is a DDL statement. The CREATE TABLE succeeds only if the trigger is completed successfully.

Views of current cursors and corresponding predicates are available from v$vpd_policies.

Summary of DBMS_RLS Subprograms

Table 56–1 DBMS_RLS Subprograms

Subprogram	Description
"ADD_POLICY Procedure" on page 56-4	Adds a fine-grained access control policy to a table or view.
"DROP_POLICY Procedure" on page 56-6	Drops a fine-grained access control policy from a table or view.
"REFRESH_POLICY Procedure" on page 56-7	Causes all the cached statements associated with the policy to be reparsed.
"ENABLE_POLICY Procedure" on page 56-7	Enables or disables a fine-grained access control policy.
"CREATE_POLICY_GROUP Procedure" on page 56-8	Creates a policy group.

Table 56–1 DBMS_RLS Subprograms

Subprogram	Description
"ADD_GROUPED_POLICY Procedure" on page 56-9	Adds a policy associated with a policy group.
"ADD_POLICY_CONTEXT Procedure" on page 56-10	Adds the context for the active application.
"DELETE_POLICY_GROUP Procedure" on page 56-11	Deletes a policy group.
"DROP_GROUPED_POLICY Procedure" on page 56-12	Drops a policy associated with a policy group.
"DROP_POLICY_CONTEXT Procedure" on page 56-13	Drops a driving context from the object so that it will have one less driving context.
"ENABLE__GROUPED_POLICY Procedure" on page 56-13	Enables or disables a row-level group security policy.
"REFRESH_GROUPED_POLICY Procedure" on page 56-14	Reparses the SQL statements associated with a refreshed policy.

ADD_POLICY Procedure

This procedure adds a fine-grained access control policy to a table or view.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.

See Also: Usage Notes on page 56-3

A commit is also performed at the end of the operation.

Syntax

```
DBMS_RLS.ADD_POLICY (
   object_schema   IN VARCHAR2 := NULL,
   object_name     IN VARCHAR2,
   policy_name     IN VARCHAR2,
   function_schema IN VARCHAR2 := NULL,
   policy_function IN VARCHAR2,
   statement_types IN VARCHAR2 := NULL,
   update_check    IN BOOLEAN  := FALSE,
   enable          IN BOOLEAN  := TRUE);
```

Parameters

Table 56–2 ADD_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table or view (logon user, if NULL).
object_name	Name of table or view to which the policy is added.
policy_name	Name of policy to be added. It must be unique for the same table or view.
function_schema	Schema of the policy function (logon user, if NULL).
policy_function	Name of a function which generates a predicate for the policy. If the function is defined within a package, then the name of the package must be present.
statement_types	Statement types that the policy will apply. It can be any combination of SELECT, INSERT, UPDATE, and DELETE. The default is to apply to all of these types.
update_check	Optional argument for INSERT or UPDATE statement types. The default is FALSE. Setting update_check to TRUE causes the server to also check the policy against the value after insert or update.
enable	Indicates if the policy is enabled when it is added. The default is TRUE

Usage Notes

- SYS is free of any security policy.
- The policy functions which generate dynamic predicates are called by the server. Following is the interface for the function:

```
FUNCTION policy_function (object_schema IN VARCHAR2, object_name VARCHAR2)
    RETURN VARCHAR2
--- object_schema is the schema owning the table of view.
--- object_name is the name of table of view that the policy will apply.
```

  The maximum length of the predicate that the policy function can return is 32K.

- The policy functions must have the purity level of WNDS (write no database state).

  See Also: The *Oracle9i Application Developer's Guide - Fundamentals* has more details about the RESTRICT_REFERENCES pragma.

- Dynamic predicates generated out of different policies for the same object have the combined effect of a conjunction (ANDed) of all the predicates.
- The security check and object lookup are performed against the owner of the policy function for objects in the subqueries of the dynamic predicates.
- If the function returns a zero length predicate, then it is interpreted as no restriction being applied to the current user for the policy.
- When table alias is required (for example, parent object is a type table) in the predicate, the name of the table or view itself must be used as the name of the alias. The server constructs the transient view as something like "select c1, c2, ... from tab where <predicate>".
- The checking of the validity of the function is done at runtime for ease of installation and other dependency issues during import/export.

DROP_POLICY Procedure

This procedure drops a fine-grained access control policy from a table or view.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.

See Also: Usage Notes on page 56-3

A commit is also performed at the end of the operation.

Syntax

```
DBMS_RLS.DROP_POLICY (
   object_schema IN VARCHAR2 := NULL,
   object_name   IN VARCHAR2,
   policy_name   IN VARCHAR2);
```

Parameters

Table 56–3 DROP_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table or view (logon user if NULL).
object_name	Name of table or view.
policy_name	Name of policy to be dropped from the table or view.

REFRESH_POLICY Procedure

This procedure causes all the cached statements associated with the policy to be reparsed. This guarantees that the latest change to this policy will have immediate effect after the procedure is executed.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.

See Also: Usage Notes on page 56-3

A commit is also performed at the end of the operation.

Syntax

```
DBMS_RLS.REFRESH_POLICY (
   object_schema IN VARCHAR2 := NULL,
   object_name   IN VARCHAR2 := NULL,
   policy_name   IN VARCHAR2 := NULL);
```

Parameters

Table 56–4 REFRESH_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table or view.
object_name	Name of table or view that the policy is associated with.
policy_name	Name of policy to be refreshed.

Errors

The procedure returns an error if it tries to refresh a disabled policy.

ENABLE_POLICY Procedure

This procedure enables or disables a fine-grained access control policy. A policy is enabled when it is created.

The procedure causes the current transaction, if any, to commit before the operation is carried out. However, this does not cause a commit first if it is inside a DDL event trigger.

See Also: Usage Notes on page 56-3

A commit is also performed at the end of the operation.

Syntax

```
DBMS_RLS.ENABLE_POLICY (
   object_schema IN VARCHAR2 := NULL,
   object_name   IN VARCHAR2,
   policy_name   IN VARCHAR2,
   enable        IN BOOLEAN);
```

Parameters

Table 56–5 ENABLE_POLICY Procedure Parameters

Parameter	Description
object_schema	Schema containing the table or view (logon user if NULL).
object_name	Name of table or view that the policy is associated with.
policy_name	Name of policy to be enabled or disabled.
enable	TRUE to enable the policy, FALSE to disable the policy.

CREATE_POLICY_GROUP Procedure

This procedure creates a policy group.

Syntax

```
DBMS_RLS.CREATE_POLICY_GROUP (
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   policy_group    VARCHAR2 );
```

Parameters

Table 56–6 CREATE_POLICY_GROUP Procedure Parameters

Parameter	Description
object_schema	Schema containing the table or view.
object_name	Name of the table or view to which the policy is added.

Table 56–6 CREATE_POLICY_GROUP Procedure Parameters

Parameter	Description
policy_group	Name of the policy group that the policy belongs to.

Usage Notes

The group must be unique for each table or view.

ADD_GROUPED_POLICY Procedure

This procedure adds a policy associated with a policy group.

Syntax

```
DBMS_RLS.ADD_GROUPED_POLICY(
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   policy_group    VARCHAR2,
   policy_name     VARCHAR2,
   function_schema VARCHAR2,
   policy_function VARCHAR2,
   statement_types VARCHAR2,
   update_check    BOOLEAN,
   enabled         BOOLEAN  );
```

Parameters

Table 56–7 ADD_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.
object_name	The name of the table or view to which the policy is added.
policy_group	The name of the policy group that the policy belongs to.
policy_name	The name of the policy; must be unique for the same table or view.
function_schema	The schema owning the policy function.
policy_function	The name of the function that generates a predicate for the policy. If the function is defined within a package, the name of the package must be present.

Table 56–7 ADD_GROUPED_POLICY Procedure Parameters

Parameter	Description
statement_types	The list of statement types to which the policy can apply. It can be any combination of SELECT, INSERT, UPDATE, or DELETE. Optional.
update_check	For INSERT and UPDATE statements only, setting update_check to TRUE causes the server to check the policy against the value after INSERT or UPDATE.
enable	Indicates if the policy is enable when it is added. The default is TRUE.

Usage Notes

Note the following:

- This procedure adds a policy to the specified table or view and associates the policy with the specified policy group.
- The policy group must have been created using the CREATE_POLICY_GROUP interface.
- The policy name must be unique within a policy group for a specific object.
- Policies from the default policy group, SYS_DEFAULT, are always executed regardless of the active policy group; however, fine-grained access control policies do not apply to users with EXEMPT ACCESS POLICY system privilege.

ADD_POLICY_CONTEXT Procedure

This procedure adds the context for the active application.

Syntax

```
DBMS_RLS.ADD_POLICY_CONTEXT (
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   namespace       VARCHAR2,
   attribute       VARCHAR2 );
```

Parameters

Table 56–8 ADD_POLICY_CONTEXT Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.
object_name	The name of the table or view to which the policy is added.
namespace	The namespace of the driving context
attribute	The attribute of the driving context.

Usage Notes

Note the following:

- This procedure indicates the application context that drives the enforcement of policies; this is the context that determines which application is running.
- The driving context can be session or global.
- At execution time, the server retrieves the name of the active policy group from the value of this context.
- There must be at least one driving context defined for each object that has fine grained access control policies; otherwise, all policies for the object will be executed.
- Adding multiple context to the same object will cause policies from multiple policy groups to be enforced.
- If the driving context is `NULL`, policies from all policy groups are used.
- If the driving context is a policy group with policies, all enabled policies from that policy group will be applied, along with all policies from the SYS_DEFAULT policy group.
- To add a policy to table `hr.emp` in group `access_control_group`, the following command is issued:

```
DBMS_RLS.ADD_GROUPED_POLICY('hr','emp','access_control_
group','policy1','SYS', 'HR.ACCESS');
```

DELETE_POLICY_GROUP Procedure

This procedure deletes a policy group.

Syntax

```
DBMS_RLS.DELETE_POLICY_GROUP (
  object_schema   VARCHAR2,
  object_name     VARCHAR2,
  policy_group    VARCHAR2 );
```

Parameters

Table 56–9 DELETE_POLICY_GROUP Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.
object_name	The name of the table or view to which the policy is added.
policy_group	The name of the policy group that the policy belongs to

Usage Notes

Note the following:

- This procedure deletes a policy group for the specified table or view.
- No policy can be in the policy group.

DROP_GROUPED_POLICY Procedure

This procedure drops a policy associated with a policy group.

Syntax

```
DBMS_RLS.DROP_GROUPED_POLICY (
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   policy_group    VARCHAR2,
   policy_name     VARCHAR2 );
```

Parameters

Table 56–10 DROP_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.

Table 56–10 DROP_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_name	The name of the table or view to which the policy is dropped.
policy_group	The name of the policy group that the policy belongs to.
policy_name	The name of the policy.

DROP_POLICY_CONTEXT Procedure

This procedure drops a driving context from the object so that it will have one less driving context.

Syntax

```
DBMS_RLS.DROP_POLICY_CONTEXT (
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   namespace       VARCHAR2,
   attribute       VARCHAR2 );
```

Parameters

Table 56–11 DROP_POLICY_CONTEXT Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.
object_name	The name of the table or view to which the policy is dropped.
namespace	The namespace of the driving context.
attribute	The attribute of the driving context.

ENABLE__GROUPED_POLICY Procedure

This procedure enables or disables a row-level group security policy.

Syntax

```
DBMS_RLS.ENABLE_GROUPED_POLICY (
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   group_name      VARCHAR2,
   policy_name     VARCHAR2,
```

```
   enable          BOOLEAN  );
```

Parameters

Table 56–12 ENABLE_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.
object_name	The name of the table or view with which the policy is associated.
group_name	The name of the group of the policy.
policy_name	The name of the policy to be enabled or disabled.
enable	TRUE enables the policy; FALSE disables the policy.

Usage Notes

- The procedure causes the current transaction, if any, to commit before the operation is carried out.
- A commit is performed at the end of the operation.
- A policy is enabled when it is created.

REFRESH_GROUPED_POLICY Procedure

This procedure reparses the SQL statements associated with a refreshed policy.

Syntax

```
DBMS_RLS.REFRESH_GROUPED_POLICY (
   object_schema   VARCHAR2,
   object_name     VARCHAR2,
   group_name      VARCHAR2,
   policy_name     VARCHAR2 );
```

Parameters

Table 56–13 REFRESH_GROUPED_POLICY Procedure Parameters

Parameter	Description
object_schema	The schema containing the table or view.
object_name	The name of the table or view with which the policy is associated.

Table 56–13 REFRESH_GROUPED_POLICY Procedure Parameters

Parameter	Description
group_name	The name of the group of the policy.
policy_name	The name of the policy.

Usage Notes

- This procedure causes all the cached statements associated with the policy to be reparsed. This guarantees that the latest change to the policy will have immediate effect after the procedure is executed.
- The procedure causes the current transaction, if any, to commit before the operation is carried out.
- A commit is performed at the end of the operation.
- The procedure returns an error if it tries to refresh a disabled policy.

Example

This example illustrates the necessary steps to enforce a fine-grained access control policy.

In an Oracle HR application, PER_PEOPLE is a view for the PER_ALL_PEOPLE table, and both objects are under APPS schema.

```
CREATE TABLE per_all_people
            (person_id NUMBER(15),
             last_name VARCHAR2(30),
             emp_no VARCHAR2(15), ...);
CREATE VIEW per_people AS
       SELECT * FROM per_all_people;
```

There should be a security policy that limits access to the PER_PEOPLE view based on the user's role in the company. The predicates for the policy can be generated by the SECURE_PERSON function in the HR_SECURITY package. The package is under schema APPS and contains functions to support all security policies related to the HR application. Also, all the application contexts are under the APPS_SEC namespace.

```
CREATE PACKAGE BODY hr_security IS
  FUNCTION secure_person(obj_schema VARCHAR2, obj_name VARCHAR2)
                    RETURN VARCHAR2 IS
      d_predicate VARCHAR2(2000);
```

```
  BEGIN
      -- for users with HR_ROLE set to EMP, map logon user name
      -- to employee id. FND_USER table stores relationship
      -- among database users, application users,
      -- and people held in the HR person table.
      IF SYS_CONTEXT('apps_sec', 'hr_role') = 'EMP' THEN
        d_predicate = 'person_id IN
                      (SELECT employee_id FROM apps.fnd_user
                       WHERE user_name = SYS_CONTEXT(''userenv'', ''session_
user''))';
      -- for users with HR_ROLE set to MGR (manager), map
      -- security profile id to a list of employee id that
      -- the user can access
      ELSE IF SYS_CONTEXT('apps_sec', 'hr_role') = 'MGR' THEN
        d_predicate = 'person_id IN
                      (SELECT ppl.employee_id FROM per_person_list ppl WHERE
                       ppl.security_profile_id = SYS_CONTEXT(''apps_sec'',
''security_profile_id''))
                      OR EXISTS (SELECT NULL FROM apps.per security_profiles psp
WHERE
                       SYS_CONTEXT(''apps_sec'', ''security_profile_id'') =
                       psp.security_profile_id AND psp.view_all_flag = ''Y''))';
      ELSE
           d_predicate = '1=2';  -- deny access to other users, may use
something like 'keycol=null'
      END IF;
      RETURN d_predicate;
     END secure_person;
    END hr_security;
```

The next step is to associate a policy (here we call it PER_PEOPLE_SEC) for the PER_PEOPLE view to the HR_SECURITY.SECURE_PERSON function that generates the dynamic predicates:

```
DBMS_RLS.ADD_POLICY('apps', 'per_people', 'per_people_sec', 'apps'
                    'hr_security.secure_person', 'select, update, delete');
```

Now, any SELECT, UPDATE, and DELETE statement with the PER_PEOPLE view involved will pick up one of the three predicates based on the value of the application context HR_ROLE.

Note: The same security function that secured the PER_ALL_PEOPLE table can also be used to generate the dynamic predicates to secure the PER_ADDRESSES table, because they have the same policy to limit access to data.

57

DBMS_ROWID

The DBMS_ROWID package lets you create ROWIDs and obtain information about ROWIDs from PL/SQL programs and SQL statements. You can find the data block number, the object number, and other ROWID components without writing code to interpret the base-64 character external ROWID.

> **Note:** DBMS_ROWID is not to be used with universal ROWIDs (UROWIDs).

This chapter discusses the following topics:

Usage Notes

Some of the functions in this package take a single parameter, such as a ROWID. This can be a character or a PL/SLQ ROWID, either restricted or extended, as required.

You can call the DBMS_ROWID functions and procedures from PL/SQL code, and you can also use the functions in SQL statements.

> **Note:** ROWID_INFO is a procedure. It can only be used in PL/SQL code.

You can use functions from the DBMS_ROWID package just like built-in SQL functions; in other words, you can use them wherever you can use an expression. In this example, the ROWID_BLOCK_NUMBER function is used to return just the block number of a single row in the EMP table:

```
SELECT dbms_rowid.rowid_block_number(rowid)
    FROM emp
    WHERE ename = 'KING';
```

Troubleshooting Use of the RESTRICT_REFERENCES Pragma

If Oracle returns the error "ORA:452, 0, 'Subprogram '%s' violates its associated pragma' for pragma restrict_references", it could mean the violation is due to:

- A problem with the current procedure or function
- Calling a procedure or function without a pragma or due to calling one with a less restrictive pragma
- Calling a package procedure or function that touches the initialization code in a package or that sets the default values

PL/SQL Example

This example returns the ROWID for a row in the EMP table, extracts the data object number from the ROWID, using the ROWID_OBJECT function in the DBMS_ROWID package, then displays the object number:

```
DECLARE
  object_no   INTEGER;
  row_id      ROWID;
  ...
BEGIN
```

```
SELECT ROWID INTO row_id FROM emp
  WHERE empno = 7499;
object_no := dbms_rowid.rowid_object(row_id);
dbms_output.put_line('The obj. # is '|| object_no);
...
```

Requirements

This package runs with the privileges of calling user, rather than the package owner ('sys').

ROWID Types

RESTRICTED	Restricted ROWID
EXTENDED	Extended ROWID

For example:

```
rowid_type_restricted constant integer := 0;
rowid_type_extended   constant integer := 1;
```

Note: Extended ROWIDs are only used in Oracle8*i* and above.

ROWID Verification Results

VALID	Valid ROWID
INVALID	Invalid ROWID

For example:

```
rowid_is_valid   constant integer := 0;
rowid_is_invalid constant integer := 1;
```

Object Types

UNDEFINED	Object Number not defined (for restricted ROWIDs)

For example:

```
rowid_object_undefined constant integer := 0;
```

ROWID Conversion Types

INTERNAL	Convert to / from column of ROWID type
EXTERNAL	Convert to / from string format

For example:

```
rowid_convert_internal constant integer := 0;
rowid_convert_external constant integer := 1;
```

Exceptions

ROWID_INVALID	Invalid rowid format
ROWID_BAD_BLOCK	Block is beyond end of file

For example:

```
ROWID_INVALID exception;
   pragma exception_init(ROWID_INVALID, -1410);

ROWID_BAD_BLOCK exception;
   pragma exception_init(ROWID_BAD_BLOCK, -28516);
```

Summary of DBMS_ROWID Subprograms

Table 57–1 DBMS_ROWID Subprograms

Subprogram	Description
"ROWID_CREATE Function" on page 57-5	Creates a ROWID, for testing only.
"ROWID_INFO Procedure" on page 57-6	Returns the type and components of a ROWID.
"ROWID_TYPE Function" on page 57-7	Returns the ROWID type: 0 is restricted, 1 is extended.
"ROWID_OBJECT Function" on page 57-8	Returns the object number of the extended ROWID.
"ROWID_RELATIVE_FNO Function" on page 57-9	Returns the file number of a ROWID.

Table 57–1 DBMS_ROWID Subprograms

Subprogram	Description
"ROWID_BLOCK_NUMBER Function" on page 57-10	Returns the block number of a ROWID.
"ROWID_ROW_NUMBER Function" on page 57-10	Returns the row number.
"ROWID_TO_ABSOLUTE_FNO Function" on page 57-11	Returns the absolute file number associated with the ROWID for a row in a specific table.
"ROWID_TO_EXTENDED Function" on page 57-12	Converts a ROWID from restricted format to extended.
"ROWID_TO_RESTRICTED Function" on page 57-14	Converts an extended ROWID to restricted format.
"ROWID_VERIFY Function" on page 57-15	Checks if a ROWID can be correctly extended by the ROWID_TO_EXTENDED function.

ROWID_CREATE Function

This function lets you create a ROWID, given the component parts as parameters.

This is useful for testing ROWID operations, because only the Oracle Server can create a valid ROWID that points to data in a database.

Syntax

```
DBMS_ROWID.ROWID_CREATE (
   rowid_type    IN NUMBER,
   object_number IN NUMBER,
   relative_fno  IN NUMBER,
   block_number  IN NUMBER,
   row_number    IN NUMBER)
  RETURN ROWID;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_create,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–2 ROWID_CREATE Function Parameters

Parameter	Description
rowid_type	Type (restricted or extended). Set the rowid_type parameter to 0 for a restricted ROWID. Set it to 1 to create an extended ROWID. If you specify rowid_type as 0, then the required object_number parameter is ignored, and ROWID_CREATE returns a restricted ROWID.
object_number	Data object number (rowid_object_undefined for restricted).
relative_fno	Relative file number.
block_number	Block number in this file.
file_number	File number in this block.

Example

Create a dummy extended ROWID:

```
my_rowid := DBMS_ROWID.ROWID_CREATE(1, 9999, 12, 1000, 13);
```

Find out what the rowid_object function returns:

```
obj_number := DBMS_ROWID.ROWID_OBJECT(my_rowid);
```

The variable obj_number now contains 9999.

ROWID_INFO Procedure

This procedure returns information about a ROWID, including its type (restricted or extended), and the components of the ROWID. This is a procedure, and it cannot be used in a SQL statement.

Syntax

```
DBMS_ROWID.ROWID_INFO (
   rowid_in          IN   ROWID,
   rowid_type        OUT  NUMBER,
   object_number     OUT  NUMBER,
   relative_fno      OUT  NUMBER,
```

```
block_number     OUT  NUMBER,
row_number       OUT  NUMBER);
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_info,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–3 ROWID_INFO Procedure Parameters

Parameter	Description
rowid_in	ROWID to be interpreted. This determines if the ROWID is a restricted (0) or extended (1) ROWID.
rowid_type	Returns type (restricted / extended).
object_number	Returns data object number (rowid_object_undefined for restricted).
relative_fno	Returns relative file number.
block_number	Returns block number in this file.
file_number	Returns file number in this block.

See Also: "ROWID_TYPE Function" on page 57-7

Example

This example reads back the values for the ROWID that you created in the ROWID_CREATE:

```
DBMS_ROWID.ROWID_INFO(my_rowid, rid_type, obj_num,
  file_num, block_num, row_num);

DBMS_OUTPUT.PUT_LINE('The type is ' || rid_type);
DBMS_OUTPUT.PUT_LINE('Data object number is ' || obj_num);
-- and so on...
```

ROWID_TYPE Function

This function returns 0 if the ROWID is a restricted ROWID, and 1 if it is extended.

Syntax

```
DBMS_ROWID.ROWID_TYPE (
   rowid_id IN ROWID)
  RETURN NUMBER;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_type,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–4 ROWID_TYPE Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Example

```
IF DBMS_ROWID.ROWID_TYPE(my_rowid) = 1 THEN
    my_obj_num := DBMS_ROWID.ROWID_OBJECT(my_rowid);
```

ROWID_OBJECT Function

This function returns the data object number for an extended ROWID. The function returns zero if the input ROWID is a restricted ROWID.

Syntax

```
DBMS_ROWID.ROWID_OBJECT (
   rowid_id IN ROWID)
  RETURN NUMBER;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_object,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–5 ROWID_OBJECT Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Note: The ROWID_OBJECT_UNDEFINED constant is returned for restricted ROWIDs.

Example

```
SELECT dbms_rowid.rowid_object(ROWID)
    FROM emp
    WHERE empno = 7499;
```

ROWID_RELATIVE_FNO Function

This function returns the relative file number of the ROWID specified as the IN parameter. (The file number is relative to the tablespace.)

Syntax

```
DBMS_ROWID.ROWID_RELATIVE_FNO (
   rowid_id IN ROWID)
  RETURN NUMBER;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_relative_fno,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–6 ROWID_RELATIVE_FNO Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Example

The example PL/SQL code fragment returns the relative file number:

```
DECLARE
    file_number    INTEGER;
    rowid_val      ROWID;
BEGIN
    SELECT ROWID INTO rowid_val
      FROM dept
      WHERE loc = 'Boston';
    file_number :=
```

```
    dbms_rowid.rowid_relative_fno(rowid_val);
  ...
```

ROWID_BLOCK_NUMBER Function

This function returns the database block number for the input ROWID.

Syntax

```
DBMS_ROWID.ROWID_BLOCK_NUMBER (
   row_id IN ROWID)
  RETURN NUMBER;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_block_number,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–7 ROWID_BLOCK_NUMBER Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Example

The example SQL statement selects the block number from a ROWID and inserts it into another table:

```
INSERT INTO T2 (SELECT dbms_rowid.rowid_block_number(ROWID)
    FROM some_table
    WHERE key_value = 42);
```

ROWID_ROW_NUMBER Function

This function extracts the row number from the ROWID IN parameter.

Syntax

```
DBMS_ROWID.ROWID_ROW_NUMBER (
   row_id IN ROWID)
  RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_row_number,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–8 ROWID_ROW_NUMBER Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Example

Select a row number:

```
SELECT dbms_rowid.rowid_row_number(ROWID)
    FROM emp
    WHERE ename = 'ALLEN';
```

ROWID_TO_ABSOLUTE_FNO Function

This function extracts the absolute file number from a ROWID, where the file number is absolute for a row in a given schema and table. The schema name and the name of the schema object (such as a table name) are provided as IN parameters for this function.

Syntax

```
DBMS_ROWID.ROWID_TO_ABSOLUTE_FNO (
   row_id      IN ROWID,
   schema_name IN VARCHAR2,
   object_name IN VARCHAR2)
  RETURN NUMBER;
```

Pragmas

```
pragma RESTRICT_REFERENCES(rowid_to_absolute_fno,WNDS,WNPS,RNPS);
```

Parameters

Table 57–9 ROWID_TO_ABSOLUTE_FNO Function Parameters

Parameter	Description
row_id	ROWID to be interpreted.

Table 57–9 ROWID_TO_ABSOLUTE_FNO Function Parameters

Parameter	Description
schema_name	Name of the schema which contains the table.
object_name	Table name.

Example

```
DECLARE
    abs_fno        INTEGER;
    rowid_val      CHAR(18);
    object_name    VARCHAR2(20) := 'EMP';
BEGIN
    SELECT ROWID INTO rowid_val
    FROM emp
    WHERE empno = 9999;
     abs_fno := dbms_rowid.rowid_to_absolute_fno(
     rowid_val, 'SCOTT', object_name);
```

Note: For partitioned objects, the name must be a table name, not a partition or a sub / partition name.

ROWID_TO_EXTENDED Function

This function translates a restricted ROWID that addresses a row in a schema and table that you specify to the extended ROWID format. Later, it may be removed from this package into a different place.

Syntax

```
DBMS_ROWID.ROWID_TO_EXTENDED (
   old_rowid       IN ROWID,
   schema_name     IN VARCHAR2,
   object_name     IN VARCHAR2,
   conversion_type IN INTEGER)
  RETURN ROWID;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_to_extended,WNDS,WNPS,RNPS);
```

Parameters

Table 57–10 ROWID_TO_EXTENDED Function Parameters

Parameter	Description
old_rowid	ROWID to be converted.
schema_name	Name of the schema which contains the table (optional).
object_name	Table name (optional).
conversion_type	rowid_convert_internal/external_convert_external (whether old_rowid was stored in a column of ROWID type, or the character string).

Returns

ROWID_TO_EXTENDED returns the ROWID in the extended character format. If the input ROWID is NULL, then the function returns NULL. If a zero-valued ROWID is supplied (00000000.0000.0000), then a zero-valued restricted ROWID is returned.

Example

Assume that there is a table called RIDS in the schema SCOTT, and that the table contains a column ROWID_COL that holds ROWIDs (restricted), and a column TABLE_COL that point to other tables in the SCOTT schema. You can convert the ROWIDs to extended format with the statement:

```
UPDATE SCOTT.RIDS
    SET rowid_col =
    dbms_rowid.rowid_to_extended (
       rowid_col, 'SCOTT", TABLE_COL, 0);
```

Usage Notes

If the schema and object names are provided as IN parameters, then this function verifies SELECT authority on the table named, and converts the restricted ROWID provided to an extended ROWID, using the data object number of the table. That ROWID_TO_EXTENDED returns a value, however, does not guarantee that the converted ROWID actually references a valid row in the table, either at the time that the function is called, or when the extended ROWID is actually used.

If the schema and object name are not provided (are passed as NULL), then this function attempts to fetch the page specified by the restricted ROWID provided. It treats the file number stored in this ROWID as the absolute file number. This can cause problems if the file has been dropped, and its number has been reused prior

to the migration. If the fetched page belongs to a valid table, then the data object number of this table is used in converting to an extended ROWID value. This is very inefficient, and Oracle recommends doing this only as a last resort, when the target table is not known. The user must still know the correct table name at the time of using the converted value.

If an extended ROWID value is supplied, the data object number in the input extended ROWID is verified against the data object number computed from the table name parameter. If the two numbers do not match, the INVALID_ROWID exception is raised. If they do match, the input ROWID is returned.

> **See Also:** The ROWID_VERIFY Function has a method to determine if a given ROWID can be converted to the extended format.

ROWID_TO_RESTRICTED Function

This function converts an extended ROWID into restricted ROWID format.

Syntax

```
DBMS_ROWID.ROWID_TO_RESTRICTED (
   old_rowid       IN ROWID,
   conversion_type IN INTEGER)
  RETURN ROWID;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_to_restricted,WNDS,RNDS,WNPS,RNPS);
```

Parameters

Table 57–11 ROWID_TO_RESTRICTED Function Parameters

Parameter	Description
old_rowid	ROWID to be converted.
conversion_type	Internal or external - format of returned ROWID. rowid_convert_internal/external_convert_external (whether returned ROWID will be stored in a column of ROWID type or the character string)

ROWID_VERIFY Function

This function verifies the ROWID. It returns 0 if the input restricted ROWID can be converted to extended format, given the input schema name and table name, and it returns 1 if the conversion is not possible.

> **Note:** You can use this function in a WHERE clause of a SQL statement, as shown in the example.

Syntax

```
DBMS_ROWID.ROWID_VERIFY (
   rowid_in        IN ROWID,
   schema_name     IN VARCHAR2,
   object_name     IN VARCHAR2,
   conversion_type IN INTEGER
  RETURN NUMBER;
```

Pragmas

```
   pragma RESTRICT_REFERENCES(rowid_verify,WNDS,WNPS,RNPS);
```

Parameters

Table 57–12 ROWID_VERIFY Function Parameters

Parameter	Description
rowid_in	ROWID to be verified.
schema_name	Name of the schema which contains the table.
object_name	Table name.
conversion_type	rowid_convert_internal/external_convert_external (whether old_rowid was stored in a column of ROWID type or the character string).

Example

Considering the schema in the example for the ROWID_TO_EXTENDED function, you can use the following statement to find bad ROWIDs prior to conversion. This enables you to fix them beforehand.

```
SELECT ROWID, rowid_col
    FROM SCOTT.RIDS
```

```
WHERE dbms_rowid.rowid_verify(rowid_col, NULL, NULL, 0) =1;
```

See Also: Chapter 80, "UTL_RAW", Chapter 81, "UTL_REF"

58

DBMS_SESSION

This package provides access to SQL `ALTER SESSION` and `SET ROLE` statements, and other session information, from PL/SQL. You can use this to set preferences and security levels.

This chapter discusses the following topics:

Requirements

This package runs with the privileges of the calling user, rather than the package owner SYS.

Summary of DBMS_SESSION Subprograms

Table 58–1 DBMS_SESSION Subprograms

Subprogram	Description
"SET_IDENTIFIER" on page 58-3	Sets the indentifier.
"SET_CONTEXT" on page 58-3 and on page 58-4	Sets the context.
"CLEAR_CONTEXT" on page 58-5	Clears the context.
"CLEAR_IDENTIFIER" on page 58-6	Clears the identifier.
"SET_ROLE Procedure" on page 58-6	Sets role.
"SET_SQL_TRACE Procedure" on page 58-7	Turns tracing on or off.
"SET_NLS Procedure" on page 58-7	Sets national language support (NLS).
"CLOSE_DATABASE_LINK Procedure" on page 58-8	Closes database link.
"RESET_PACKAGE Procedure" on page 58-8	Deinstantiates all packages in the session.
"UNIQUE_SESSION_ID Function" on page 58-10	Returns an identifier that is unique for all sessions currently connected to this database.
"IS_ROLE_ENABLED Function" on page 58-10	Determines if the named role is enabled for the session.
"IS_SESSION_ALIVE Function" on page 58-11	Determines if the specified session is alive.
"SET_CLOSE_CACHED_OPEN_CURSORS Procedure" on page 58-11	Turns `close_cached_open_cursors` on or off.
"FREE_UNUSED_USER_MEMORY Procedure" on page 58-12	Lets you reclaim unused memory after performing operations requiring large amounts of memory.

Table 58–1 DBMS_SESSION Subprograms

Subprogram	Description
"SET_CONTEXT Procedure" on page 58-14	Sets or resets the value of a context attribute.
"LIST_CONTEXT Procedure" on page 58-15	Returns a list of active namespace and context for the current session.
"SWITCH_CURRENT_CONSUMER_GROUP Procedure" on page 58-16	Facilitates changing the current resource consumer group of a user's current session.

SET_IDENTIFIER

This procedure sets the client ID in the session.

Syntax

```
DBMS_SESSION.SET_IDENTIFIER (
   client_id VARCHAR2);
```

Parameters

Table 58–2 SET_IDENTIFIER Procedure Parameters

Parameter	Description
client_id	The application-specific identifier of the current database session.

Usage Notes

Note the following:

- SET_IDENTIFIER initializes the current session with a client identifier to identify the associated global application context
- client_id is case sensitive; it must match the client_id parameter in the set_context
- This procedure is executable by public

SET_CONTEXT

This procedure sets the context.

Syntax

```
DBMS_SESSION.SET_CONTEXT (
   namespace VARCHAR2,
   attribute VARCHAR2,
   value     VARCHAR2);
```

Parameters

Table 58–3 SET_CONTEXT Procedure Parameters

Parameter	Description
namespace	The namespace of the application context to be set
attribute	The attribute of the application context to be set
value	The value of the application context to be set

Usage Notes

Note the following:

- This interface is maintained for 8i compatibility
- If the namespace is a global context namespace, then `username` is assigned the current user name, and `client_id` will be assigned the current `client_id` in the session; NULL if not set.
- This procedure must be invoked directly or indirectly by the trusted package

SET_CONTEXT Procedure

This procedure sets the context.

Syntax

```
DBMS_SESSION.SET_CONTEXT (
   namespace VARCHAR2,
   attribute VARCHAR2,
   value     VARCHAR2,
   username  VARCHAR2,
   client_id VARCHAR2 );
```

Parameters

Table 58–4 SET_CONTEXT Procedure Parameters

Parameter	Description
namespace	The namespace of the application context to be set
attribute	The attribute of the application context to be set
value	The value of the application context to be set
username	The username attribute of the application context
client_id	The client_id attribute of the applicaton context (64-byte maximum)

Usage Notes

Note the following:

- Sets the application context and associates it with the client_id
- Username must be a valid sql identifier
- client_id is a string of at most 64 bytes
- client_id is case sensitive; it must match the argument to set_identifier
- Must be invoked directly or indirectly by the trusted package
- Can only be used on global namespaces

CLEAR_CONTEXT

Syntax

```
DBMS_SESSION.CLEAR_CONTEXT
   namespace VARCHAR2,
   attribute VARCHAR2,
   username  VARCHAR2,
   client_id VARCHAR2);
```

Parameters

Table 58–5 CLEAR_CONTEXT Procedure Parameters

Parameter	Description
namespace	The namespace in which the application context is to be cleared. Required.
client_id	Applies to global context and is optional for other types of contexts; 64-byte maximum.
attribute	The specific attribute in the namespace to be cleared. Optional. the default is NULL; all attributes are to be considered.
username	The username attribute of the application context

Usage Notes

This procedure must be invoked directly or indirectly by the trusted package.

CLEAR_IDENTIFIER

This procedure removes the `set_client_id` in the session.

Syntax

```
DBMS_SESSION.CLEAR_IDENTIFIER();
```

Usage Notes

This procedure is executable by public.

SET_ROLE Procedure

This procedure enables and disables roles. It is equivalent to the `SET ROLE` SQL statement.

Syntax

```
DBMS_SESSION.SET_ROLE (
   role_cmd VARCHAR2);
```

Parameters

Table 58–6 SET_ROLE Procedure Parameters

Parameter	Description
role_cmd	This text is appended to "set role" and then run as SQL.

SET_SQL_TRACE Procedure

This procedure turns tracing on or off. It is equivalent to the following SQL statement:

```
ALTER SESSION SET SQL_TRACE ...
```

Syntax

```
DBMS_SESSION.SET_SQL_TRACE (
   sql_trace boolean);
```

Parameters

Table 58–7 SET_SQL_TRACE Procedure Parameters

Parameter	Description
sql_trace	TRUE turns tracing on, FALSE turns tracing off.

SET_NLS Procedure

This procedure sets up your national language support (NLS). It is equivalent to the following SQL statement:

```
ALTER SESSION SET <nls_parameter> = <value>
```

Syntax

```
DBMS_SESSION.SET_NLS (
   param VARCHAR2,
   value VARCHAR2);
```

Parameters

Table 58–8 SET_NLS Procedure Parameters

Parameter	Description
param	NLS parameter. The parameter name must begin with 'NLS'.
value	Parameter value. If the parameter is a text literal, then it needs embedded single-quotes. For example, "set_nls('nls_date_format','''DD-MON-YY''')"

CLOSE_DATABASE_LINK Procedure

This procedure closes an open database link. It is equivalent to the following SQL statement:

```
ALTER SESSION CLOSE DATABASE LINK <name>
```

Syntax

```
DBMS_SESSION.CLOSE_DATABASE_LINK (
   dblink VARCHAR2);
```

Parameters

Table 58–9 CLOSE_DATABASE_LINK Procedure Parameters

Parameter	Description
dblink	Name of the database link to close.

RESET_PACKAGE Procedure

This procedure deinstantiates all packages in this session: It frees all package state.

Memory used for caching execution state is associated with all PL/SQL functions, procedures, and packages that have been run in a session.

For packages, this collection of memory holds the current values of package variables and controls the cache of cursors opened by the respective PL/SQL programs. A call to RESET_PACKAGE frees the memory associated with each of the previously run PL/SQL programs from the session, and, consequently, clears the current values of any package globals and closes any cached cursors.

RESET_PACKAGE can also be used to reliably restart a failed program in a session. If a program containing package variables fails, then it is hard to determine which variables need to be reinitialized. RESET_PACKAGE guarantees that all package variables are reset to their initial values.

Syntax

```
DBMS_SESSION.RESET_PACKAGE;
```

Usage Notes

Because the amount of memory consumed by all executed PL/SQL can become large, you might use RESET_PACKAGE to trim down the session memory footprint at certain points in your database application. However, make sure that resetting package variable values will not affect the application. Also, remember that later execution of programs that have lost their cached memory and cursors will perform slower, because they need to recreate the freed memory and cursors.

RESET_PACKAGE does not free the memory, cursors, and package variables immediately when called.

> **Note:** RESET_PACKAGE only frees the memory, cursors, and package variables *after* the PL/SQL call that made the invocation finishes running.

For example, PL/SQL procedure P1 calls PL/SQL procedure P2, and P2 calls RESET_PACKAGE. The RESET_PACKAGE effects do not occur until procedure P1 finishes execution (the PL/SQL call ends).

Example

This SQL*Plus script runs a large program with many PL/SQL program units that may or may not use global variables, but it doesn't need them beyond this execution:

```
EXCECUTE large_plsql_program1;
```

To free up PL/SQL cached session memory:

```
EXECUTE DBMS_SESSION.RESET_PACKAGE;
```

To run another large program:

```
EXECUTE large_plsql_program2;
```

UNIQUE_SESSION_ID Function

This function returns an identifier that is unique for all sessions currently connected to this database. Multiple calls to this function during the same session always return the same result.

Syntax

```
DBMS_SESSION.UNIQUE_SESSION_ID
  RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(unique_session_id,WNDS,RNDS,WNPS);
```

Returns

Table 58–10 UNIQUE_SESSION_ID Function Returns

Return	Description
unique_session_id	Returns up to 24 bytes.

IS_ROLE_ENABLED Function

This function determines if the named role is enabled for this session.

Syntax

```
DBMS_SESSION.IS_ROLE_ENABLED (
   rolename VARCHAR2)
  RETURN BOOLEAN;
```

Parameters

Table 58–11 IS_ROLE_ENABLED Function Parameters

Parameter	Description
rolename	Name of the role.

Returns

Table 58–12 IS_ROLE_ENABLED Function Returns

Return	Description
is_role_enabled	TRUE or FALSE, depending on whether the role is enabled.

IS_SESSION_ALIVE Function

This function determines if the specified session is alive.

Syntax

```
DBMS_SESSION.IS_SESSION_ALIVE (
   uniqueid VARCHAR2)
  RETURN BOOLEAN;
```

Parameters

Table 58–13 IS_SESSION_ALIVE Function Parameters

Parameter	Description
uniqueid	Unique ID of the session: This is the same one as returned by UNIQUE_SESSION_ID.

Returns

Table 58–14 IS_SESSION_ALIVE Function Returns

Return	Description
is_session_alive	TRUE or FALSE, depending on whether the session is alive.

SET_CLOSE_CACHED_OPEN_CURSORS Procedure

This procedure turns close_cached_open_cursors on or off. It is equivalent to the following SQL statement:

```
ALTER SESSION SET CLOSE_CACHED_OPEN_CURSORS ...
```

Syntax

```
DBMS_SESSION.SET_CLOSE_CACHED_OPEN_CURSORS (
   close_cursors BOOLEAN);
```

Parameters

Table 58–15 SET_CLOSE_CACHED_OPEN_CURSORS Procedure Parameters

Parameter	Description
close_cursors	TRUE or FALSE

FREE_UNUSED_USER_MEMORY Procedure

This procedure reclaims unused memory after performing operations requiring large amounts of memory (more than 100K).

Examples of operations that use large amounts of memory include:

- Large sorting where entire sort_area_size is used and sort_area_size is hundreds of KB.
- Compiling large PL/SQL packages, procedures, or functions.
- Storing hundreds of KB of data within PL/SQL indexed tables.

You can monitor user memory by tracking the statistics "session uga memory" and "session pga memory" in the v$sesstat or v$statname fixed views. Monitoring these statistics also shows how much memory this procedure has freed.

> **Note:** This procedure should only be used in cases where memory is at a premium. It should be used infrequently and judiciously.

Syntax

```
DBMS_SESSION.FREE_UNUSED_USER_MEMORY;
```

Returns

The behavior of this procedure depends upon the configuration of the server operating on behalf of the client:

- **Dedicated server**: This returns unused PGA memory and session memory to the operating system. Session memory is allocated from the PGA in this configuration.
- **MTS server**: This returns unused session memory to the shared_pool. Session memory is allocated from the shared_pool in this configuration.

Usage Notes

In order to free memory using this procedure, the memory must not be in use.

After an operation allocates memory, only the same type of operation can reuse the allocated memory. For example, after memory is allocated for sort, even if the sort is complete and the memory is no longer in use, only another sort can reuse the sort-allocated memory. For both sort and compilation, after the operation is complete, the memory is no longer in use, and the user can call this procedure to free the unused memory.

An indexed table implicitly allocates memory to store values assigned to the indexed table's elements. Thus, the more elements in an indexed table, the more memory the RDBMS allocates to the indexed table. As long as there are elements within the indexed table, the memory associated with an indexed table is in use.

The scope of indexed tables determines how long their memory is in use. Indexed tables declared globally are indexed tables declared in packages or package bodies. They allocate memory from session memory. For an indexed table declared globally, the memory remains in use for the lifetime of a user's login (lifetime of a user's session), and is freed after the user disconnects from ORACLE.

Indexed tables declared locally are indexed tables declared within functions, procedures, or anonymous blocks. These indexed tables allocate memory from PGA memory. For an indexed table declared locally, the memory remains in use for as long as the user is still running the procedure, function, or anonymous block in which the indexed table is declared.After the procedure, function, or anonymous block is finished running, the memory is then available for other locally declared indexed tables to use (in other words, the memory is no longer in use).

Assigning an uninitialized, "empty" indexed table to an existing index table is a method to explicitly re-initialize the indexed table and the memory associated with the indexed table. After this operation, the memory associated with the indexed table is no longer in use, making it available to be freed by calling this procedure. This method is particularly useful on indexed tables declared globally which can grow during the lifetime of a user's session, as long as the user no longer needs the contents of the indexed table.

The memory rules associated with an indexed table's scope still apply; this method and this procedure, however, allow users to intervene and to explicitly free the memory associated with an indexed table.

Example

The PL/SQL fragment below illustrates the method and the use of procedure FREE_UNUSED_USER_MEMORY.

```
CREATE PACKAGE foobar
   type number_idx_tbl is table of number indexed by binary_integer;

   store1_table  number_idx_tbl;     --  PL/SQL indexed table
   store2_table  number_idx_tbl;     --  PL/SQL indexed table
   store3_table  number_idx_tbl;     --  PL/SQL indexed table
   ...
END;            --  end of foobar

DECLARE
   ...
   empty_table   number_idx_tbl;     --  uninitialized ("empty") version
BEGIN
   FOR i in 1..1000000 loop
     store1_table(i) := i;           --  load data
   END LOOP;
   ...
   store1_table := empty_table;      --  "truncate" the indexed table
   ...
   -
   dbms_session.free_unused_user_memory;  -- give memory back to system

   store1_table(1) := 100;           --  index tables still declared;
   store2_table(2) := 200;           --  but truncated.
   ...
END;
```

SET_CONTEXT Procedure

This procedure sets or resets the value of a context attribute.

Syntax

```
DBMS_SESSION.SET_CONTEXT (
   namespace VARCHAR2,
   attribute VARCHAR2,
   value     VARCHAR2,
   username  VARCHAR2,
   client_id VARCHAR2);
```

Parameters

Table 58–16 SET_CONTEXT Procedure Parameters

Parameter	Description
namespace	Name of the namespace to use for the application context (limited to 30 bytes).
attribute	Name of the attribute to be set (limited to 30 bytes).
value	Value to be set (limited to 4 kilobytes).
username	The username attribute of the application context
client_id	The application-specific identifier of the current database session.

Usage Notes

The caller of this function must be in the calling stack of a procedure which has been associated to the context namespace through a CREATE CONTEXT statement. The checking of the calling stack does not cross DBMS boundary.

There is no limit on the number of attributes that can be set in a namespace. An attribute value remains for user session, or until it is reset by the user.

LIST_CONTEXT Procedure

This procedure returns a list of active namespaces and contexts for the current session.

Syntax

```
TYPE AppCtxRecTyp IS RECORD (
   namespace VARCHAR2(30),
   attribute VARCHAR2(30),
   value     VARCHAR2(256));

TYPE AppCtxTabTyp IS TABLE OF AppCtxRecTyp INDEX BY BINARY_INTEGER;

DBMS_SESSION.LIST_CONTEXT (
   list OUT AppCtxTabTyp,
   size OUT NUMBER);
```

Parameters

Table 58–17 LIST_CONTEXT Procedure Parameters

Parameter	Description
list	Buffer to store a list of application context set in the current session.

Returns

Table 58–18 LIST_CONTEXT Procedure Returns

Return	Description
list	A list of (namespace, attribute, values) set in current session
size	Returns the number of entries in the buffer returned

Usage Notes

The context information in the list appears as a series of <namespace> <attribute> <value>. Because list is a table type variable, its size is dynamically adjusted to the size of returned list.

SWITCH_CURRENT_CONSUMER_GROUP Procedure

This procedure changes the current resource consumer group of a user's current session.

This lets you switch to a consumer group if you have the switch privilege for that particular group. If the caller is another procedure, then this enables the user to switch to a consumer group for which the owner of that procedure has switch privilege.

Syntax

```
DBMS_SESSION.switch_current_consumer_group (
   new_consumer_group     IN  VARCHAR2,
   old_consumer_group     OUT VARCHAR2,
   initial_group_on_error IN  BOOLEAN);
```

Parameters

Table 58–19 SWITCH_CURRENT_CONSUMER_GROUP Procedure Parameters

Parameter	Description
new_consumer_group	Name of consumer group to which you want to switch.
old_consumer_group	Name of the consumer group from which you just switched out.
initial_group_on_error	If TRUE, then sets the current consumer group of the caller to his/her initial consumer group in the event of an error.

Returns

This procedure outputs the old consumer group of the user in the parameter old_consumer_group.

Note: You can switch back to the old consumer group later using the value returned in old_consumer_group.

Exceptions

Table 58–20 SWITCH_CURRENT_CONSUMER_GROUP Procedure Exceptions

Exception	Description
29368	Non-existent consumer group.
1031	Insufficient privileges.
29396	Cannot switch to OTHER_GROUPS consumer group.

Usage Notes

The owner of a procedure must have privileges on the group from which a user was switched (old_consumer_group) in order to switch them back. There is one exception: The procedure can always switch the user back to his/her initial consumer group (skipping the privilege check).

By setting initial_group_on_error to TRUE, SWITCH_CURRENT_CONSUMER_GROUP puts the current session into the default group, if it can't put it into the group designated by new_consumer_group. The error associated with the

attempt to move a session into new_consumer_group is raised, even though the current consumer group has been changed to the initial consumer group.

Example

```
CREATE OR REPLACE PROCEDURE high_priority_task is
   old_group varchar2(30);
   prev_group varchar2(30);
   curr_user varchar2(30);
BEGIN
  -- switch invoker to privileged consumer group. If we fail to do so, an
  -- error will be thrown, but the consumer group will not change
  -- because 'initial_group_on_error' is set to FALSE

  dbms_session.switch_current_consumer_group('tkrogrp1', old_group, FALSE);
  -- set up exception handler (in the event of an error, we do not want to
  -- return to caller while leaving the session still in the privileged
  -- group)

  BEGIN
    -- perform some operations while under privileged group

  EXCEPTION
    WHEN OTHERS THEN
     -- It is possible that the procedure owner does not have privileges
     -- on old_group. 'initial_group_on_error' is set to TRUE to make sure
     -- that the user is moved out of the privileged group in such a
     -- situation

     dbms_session.switch_current_consumer_group(old_group,prev_group,TRUE);
     RAISE;
    END;

  -- we've succeeded. Now switch to old_group, or if cannot do so, switch
  -- to caller's initial consumer group

  dbms_session.switch_current_consumer_group(old_group,prev_group,TRUE);
END high_priority_task;
/
```

59

DBMS_SHARED_POOL

DBMS_SHARED_POOL provides access to the shared pool, which is the shared memory area where cursors and PL/SQL objects are stored. DBMS_SHARED_POOL enables you to display the sizes of objects in the shared pool, and mark them for keeping or unkeeping in order to reduce memory fragmentation.

This chapter discusses the following topics:

Installation Notes

To create DBMS_SHARED_POOL, run the DBMSPOOL.SQL script. The PRVTPOOL.PLB script is automatically executed after DBMSPOOL.SQL runs. These scripts are *not* run by CATPROC.SQL.

Usage Notes

The procedures provided here may be useful when loading large PL/SQL objects. When large PL/SQL objects are loaded, users response time is affected because of the large number of smaller objects that need to be aged out from the shared pool to make room (due to memory fragmentation). In some cases, there may be insufficient memory to load the large objects.

DBMS_SHARED_POOL is also useful for frequently executed triggers. You may want to keep compiled triggers on frequently used tables in the shared pool. Additionally, DBMS_SHARED_POOL supports sequences. Sequence numbers are lost when a sequence is aged out of the shared pool. DBMS_SHARED_POOL is useful for keeping sequences in the shared pool and thus preventing the loss of sequence numbers.

Summary of DBMS_SHARED_POOL Subprograms

Table 59–1 DBMS_SHARED_POOL Subprograms

Subprogram	Description
"SIZES Procedure" on page 59-2	Shows objects in the shared pool that are larger than the specified size
"KEEP Procedure" on page 59-3	Keeps an object in the shared pool
"UNKEEP Procedure" on page 59-5	Unkeeps the named object
"ABORTED_REQUEST_THRESHOLD Procedure" on page 59-5	Sets the aborted request threshold for the shared pool

SIZES Procedure

This procedure shows objects in the shared_pool that are larger than the specified size. The name of the object is also given, which can be used as an argument to either the KEEP or UNKEEP calls below.

Syntax

```
DBMS_SHARED_POOL.SIZES (
   minsize NUMBER);
```

Parameters

Table 59–2 SIZES Procedure Parameters

Parameter	Description
minsize	Size, in kilobytes, over which an object must be occupying in the shared pool, in order for it to be displayed.

Usage Notes

Issue the SQLDBA or SQLPLUS 'SET SERVEROUTPUT ON SIZE XXXXX' command prior to using this procedure so that the results are displayed.

KEEP Procedure

This procedure keeps an object in the shared pool. Once an object has been kept in the shared pool, it is not subject to aging out of the pool. This may be useful for frequently used large objects. When large objects are brought into the shared pool, several objects may need to be aged out to create a contiguous area large enough.

Syntax

```
DBMS_SHARED_POOL.KEEP (
   name VARCHAR2,
   flag CHAR      DEFAULT 'P');
```

> **Note:** This procedure may not be supported in the future if automatic mechanisms are implemented to make this unnecessary.

Parameters

Table 59–3 KEEP Procedure Parameters

Parameter	Description
name	Name of the object to keep. The value for this identifier is the concatenation of the address and hash_value columns from the v$sqlarea view. This is displayed by the SIZES procedure. Currently, TABLE and VIEW objects may not be keeped.
flag	(Optional) If this is not specified, then the package assumes that the first parameter is the name of a package / procedure / function and resolves the name. Set to 'P' or 'p' to fully specify that the input is the name of a package / procedure / function. Set to 'T' or 't' to specify that the input is the name of a type. Set to 'R' or 'r' to specify that the input is the name of a trigger. Set to 'Q' or 'q' to specify that the input is the name of a sequence. In case the first argument is a cursor address and hash-value, the parameter should be set to any character except 'P' or 'p' or 'Q' or 'q' or 'R' or 'r' or 'T' or 't'.

Exceptions

An exception is raised if the named object cannot be found.

Usage Notes

There are two kinds of objects:

- PL / SQL objects, triggers, sequences, and types which are specified by name
- SQL cursor objects which are specified by a two-part number (indicating a location in the shared pool).

For example:

```
DBMS_SHARED_POOL.KEEP('scott.hispackage')
```

This keeps package HISPACKAGE, owned by SCOTT. The names for PL / SQL objects follow SQL rules for naming objects (i.e., delimited identifiers, multi-byte names, etc. are allowed). A cursor can be keeped by DBMS_SHARED_

POOL.KEEP('0034CDFF, 20348871'). The complete hexadecimal address must be in the first 8 characters.

UNKEEP Procedure

This procedure unkeeps the named object.

Syntax

```
DBMS_SHARED_POOL.UNKEEP (
   name VARCHAR2,
   flag CHAR     DEFAULT 'P');
```

> **Caution:** This procedure may not be supported in the future if automatic mechanisms are implemented to make this unnecessary.

Parameters

Table 59–4 UNKEEP Procedure Parameters

Parameter	Description
name	Name of the object to unkeep. See description of the name object for the KEEP procedure.
flag	See description of the flag parameter for the KEEP procedure.

Exceptions

An exception is raised if the named object cannot be found.

ABORTED_REQUEST_THRESHOLD Procedure

This procedure sets the aborted request threshold for the shared pool.

Syntax

```
DBMS_SHARED_POOL.ABORTED_REQUEST_THRESHOLD (
   threshold_size NUMBER);
```

Parameters

Table 59–5 ABORTED_REQUEST_THRESHOLD Procedure Parameters

Parameter	Description
threshold_size	Size, in bytes, of a request which does not try to free unpinned (not "unkeep-ed") memory within the shared pool. The range of threshold_size is 5000 to ~2 GB inclusive.

Exceptions

An exception is raised if the threshold is not in the valid range.

Usage Notes

Usually, if a request cannot be satisfied on the free list, then the RDBMS tries to reclaim memory by freeing objects from the LRU list and checking periodically to see if the request can be fulfilled. After finishing this step, the RDBMS has performed a near equivalent of an 'ALTER SYSTEM FLUSH SHARED_POOL'.

Because this impacts all users on the system, this procedure "localizes" the impact to the process failing to find a piece of shared pool memory of size greater than thresh_hold size. This user gets the 'out of memory' error without attempting to search the LRU list.

60

DBMS_SPACE

The DBMS_SPACE package enables you to analyze segment growth and space requirements.

This chapter discusses the following topics:

- Security
- Requirements
- Summary of DBMS_SPACE Subprograms

Security

This package runs with SYS privileges.

Requirements

The execution privilege is granted to PUBLIC. Subprograms in this package run under the caller security. The user must have ANALYZE privilege on the object.

Summary of DBMS_SPACE Subprograms

Table 60–1 DBMS_SPACE Subprograms

Subprogram	Description
"UNUSED_SPACE Procedure" on page 60-2	Returns information about unused space in an object (table, index, or cluster).
"FREE_BLOCKS Procedure" on page 60-3	Returns information about free blocks in an object (table, index, or cluster).
"SPACE_USAGE Procedure" on page 60-5	Returns information about free blocks in a bitmapped segment.

UNUSED_SPACE Procedure

This procedure returns information about unused space in an object (table, index, or cluster).

Syntax

```
DBMS_SPACE.UNUSED_SPACE (
   segment_owner              IN  VARCHAR2,
   segment_name               IN  VARCHAR2,
   segment_type               IN  VARCHAR2,
   total_blocks               OUT NUMBER,
   total_bytes                OUT NUMBER,
   unused_blocks              OUT NUMBER,
   unused_bytes               OUT NUMBER,
   last_used_extent_file_id   OUT NUMBER,
   last_used_extent_block_id  OUT NUMBER,
   last_used_block            OUT NUMBER,
   partition_name             IN  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 60–2 UNUSED_SPACE Procedure Parameters

Parameter	Description
segment_owner	Schema name of the segment to be analyzed.
segment_name	Segment name of the segment to be analyzed.
segment_type	Type of the segment to be analyzed: TABLE TABLE PARTITION TABLE SUBPARTITION INDEX INDEX PARTITION INDEX SUBPARTITION CLUSTER LOB
total_blocks	Returns total number of blocks in the segment.
total_bytes	Returns total number of blocks in the segment, in bytes.
unused_blocks	Returns number of blocks which are not used.
unused_bytes	Returns, in bytes, number of blocks which are not used.
last_used_extent_ file_ id	Returns the file ID of the last extent which contains data.
last_used_extent_ block_id	Returns the block ID of the last extent which contains data.
last_used_block	Returns the last block within this extent which contains data.
partition_name	Partition name of the segment to be analyzed. This is only used for partitioned tables; the name of subpartition should be used when partitioning is compose.

FREE_BLOCKS Procedure

This procedure returns information about free blocks in an object (table, index, or cluster). See "SPACE_USAGE Procedure" for returning free block information in a bitmapped segment.

Syntax

```
DBMS_SPACE.FREE_BLOCKS (
```

```
   segment_owner     IN  VARCHAR2,
   segment_name      IN  VARCHAR2,
   segment_type      IN  VARCHAR2,
   freelist_group_id IN  NUMBER,
   free_blks         OUT NUMBER,
   scan_limit        IN  NUMBER DEFAULT NULL,
   partition_name    IN  VARCHAR2 DEFAULT NULL);
```

Pragmas

```
pragma restrict_references(free_blocks,WNDS);
```

Parameters

Table 60–3 FREE_BLOCKS Procedure Parameters

Parameter	Description
segment_owner	Schema name of the segment to be analyzed.
segment_name	Segment name of the segment to be analyzed.
segment_type	Type of the segment to be analyzed: TABLE TABLE PARTITION TABLE SUBPARTITION INDEX INDEX PARTITION INDEX SUBPARTITION CLUSTER LOB
freelist_group_id	Freelist group (instance) whose free list size is to be computed.
free_blks	Returns count of free blocks for the specified group.
scan_limit	Maximum number of free list blocks to read (optional). Use a scan limit of X you are interested only in the question, "Do I have X blocks on the free list?"
partition_name	Partition name of the segment to be analyzed. This is only used for partitioned tables; the name of subpartition should be used when partitioning is compose.

Example 1

The following declares the necessary bind variables and executes.

```
DBMS_SPACE.UNUSED_SPACE('SCOTT', 'EMP', 'TABLE', :total_blocks,
   :total_bytes,:unused_blocks, :unused_bytes, :lastextf,
   :last_extb, :lastusedblock);
```

This fills the unused space information for bind variables in EMP table in SCOTT schema.

Example 2

The following uses the CLUS cluster in SCOTT schema with 4 freelist groups. It returns the number of blocks in freelist group 3 in CLUS.

```
DBMS_SPACE.FREE_BLOCKS('SCOTT', 'CLUS', 'CLUSTER', 3, :free_blocks);
```

Note: An error is raised if scan_limit is not a positive number.

SPACE_USAGE Procedure

This procedure shows the space usage of data blocks under the segment High Water Mark. The bitmap blocks, segment header, and extent map blocks are not accounted for by this procedure. This procedure can only be used on tablespaces that are created with auto segment space management.

Syntax

```
DBMS_SPACE.SPACE_USAGE(
   segment_owner IN varchar2,
   segment_name IN varchar2,
   segment_type IN varchar2,
   unformatted_blocks OUT number,
   unformatted_bytes OUT number,
   fs1_blocks OUT number,
   fs1_bytes  OUT number,
   fs2_blocks OUT number,
   fs2_bytes  OUT number,
   fs3_blocks OUT number,
   fs3_bytes  OUT number,
   fs4_blocks OUT number,
   fs4_bytes  OUT number,
   full_blocks OUT number,
   full_bytes OUT number,
   partition_name IN varchar2 DEFAULT NULL);
```

Parameters

Table 60–4 SPACE_USAGE Procedure Parameters

Parameter	Description
segment_owner	Schema name of the segment to be analyzed
segment_name	Name of the segment to be analyzed
partition_name	Partition name of the segment to be analyzed
segment_type	Type of the segment to be analyzed (TABLE, INDEX, or CLUSTER)
OUTPUT ARGUMENTS	
unformatted_blocks	Total number of blocks that are unformatted
unformatted bytes	Total number of bytes that are unformatted
fs1_blocks	Number of blocks that has at least 0 to 25% free space
fs1_bytes	Number of bytes that has at least 0 to 25% free space
fs2_blocks	Number of blocks that has at least 25 to 50% free space
fs2_bytes	Number of bytes that has at least 25 to 50% free space
fs3_blocks	Number of blocks that has at least 50 to 75% free space
fs3_bytes	Number of bytes that has at least 50 to 75% free space
fs4_blocks	Number of blocks that has at least 75 to 100% free space
fs4_bytes	Number of bytes that has at least 75 to 100% free space
ful1_blocks	Total number of blocks that are full in the segment
full_bytes	Total number of bytes that are full in the segment

Example

```
variable unf number;
variable unfb number;
variable fs1 number;
variable fs1b number;
variable fs2 number;
variable fs2b number;
variable fs3 number;
variable fs3b number;
variable fs4 number;
variable fs4b number;
```

```
variable full number;
variable fullb number;

begin
dbms_space.space_usage('U1','T',
                       'TABLE',
                       :unf, :unfb,
                       :fs1, :fs1b,
                       :fs2, :fs2b,
                       :fs3, :fs3b,
                       :fs4, :fs4b,
                       :full, :fullb);
end;
/
print unf ;
print unfb ;
print fs4 ;
print fs4b;
print fs3 ;
print fs3b;
print fs2 ;
print fs2b;
print fs1 ;
print fs1b;
print full;
print fullb;
```

61

DBMS_SPACE_ADMIN

The DBMS_SPACE_ADMIN package provides functionality for locally managed tablespaces.

> **See Also:** *Oracle9i Database Administrator's Guide* for an example and description of using DBMS_SPACE_ADMIN.

This chapter discusses the following topics:

- Security and Constants for DBMS_SPACE_ADMIN
- Summary of DBMS_SPACE_ADMIN Subprograms

Security and Constants for DBMS_SPACE_ADMIN

Security

This package runs with SYS privileges; therefore, any user who has privilege to execute the package can manipulate the bitmaps.

Constants

SEGMENT_VERIFY_EXTENTS	Verifies that the space owned by segment is appropriately reflected in the bitmap as used.
SEGMENT_VERIFY_EXTENTS_GLOBAL	Verifies that the space owned by segment is appropriately reflected in the bitmap as used and that no other segment claims any of this space to be used by it.
SEGMENT_MARK_CORRUPT	Marks a temporary segment as corrupt whereby facilitating its elimination from the dictionary (without space reclamation).
SEGMENT_MARK_VALID	Marks a corrupt temporary segment as valid. It is useful when the corruption in the segment extent map or elsewhere has been resolved and the segment can be dropped normally.
SEGMENT_DUMP_EXTENT_MAP	Dumps the extent map for a given segment.
TABLESPACE_VERIFY_BITMAP	Verifies the bitmap of the tablespace with extent maps of the segments in that tablespace to make sure everything is consistent.
TABLESPACE_EXTENT_MAKE_FREE	Makes this range (extent) of space free in the bitmaps.
TABLESPACE_EXTENT_MAKE_USED	Makes this range (extent) of space used in the bitmaps.

Summary of DBMS_SPACE_ADMIN Subprograms

Table 61–1 DBMS_SPACE_ADMIN Subprograms

Subprogram	Description
"SEGMENT_VERIFY Procedure" on page 61-3	Verifies the consistency of the extent map of the segment.

Table 61–1 DBMS_SPACE_ADMIN Subprograms

Subprogram	Description
"SEGMENT_CORRUPT Procedure" on page 61-4	Marks the segment corrupt or valid so that appropriate error recovery can be done.
"SEGMENT_DROP_CORRUPT Procedure" on page 61-5	Drops a segment currently marked corrupt (without reclaiming space).
"SEGMENT_DUMP Procedure" on page 61-6	Dumps the segment header and extent map(s) of a given segment.
"TABLESPACE_VERIFY Procedure" on page 61-7	Verifies that the bitmaps and extent maps for the segments in the tablespace are in sync.
"TABLESPACE_FIX_BITMAPS Procedure" on page 61-7	Marks the appropriate DBA range (extent) as free or used in bitmap.
"TABLESPACE_REBUILD_ BITMAPS Procedure" on page 61-8	Rebuilds the appropriate bitmap(s).
"TABLESPACE_REBUILD_ QUOTAS Procedure" on page 61-9	Rebuilds quotas for given tablespace.
"TABLESPACE_MIGRATE_ FROM_LOCAL Procedure" on page 61-9	Migrates a locally-managed tablespace to dictionary-managed tablespace.
"TABLESPACE_MIGRATE_TO_ LOCAL Procedure" on page 61-10	Migrates a tablespace from dictionary managed format to locally managed format.
"TABLESPACE_RELOCATE_ BITMAPS Procedure" on page 61-12	Relocates the bitmaps to the destination specified.
"TABLESPACE_FIX_SEGMENT_ STATES Procedure" on page 61-13	Fixes the state of the segments in a tablespace in which migration was aborted.

SEGMENT_VERIFY Procedure

This procedure verifies that the extent map of the segment is consistent with the bitmap.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_VERIFY (
   tablespace_name         IN    VARCHAR2,
   header_relative_file    IN    POSITIVE,
   header_block            IN    POSITIVE,
```

```
   verify_option          IN    POSITIVE  DEFAULT SEGMENT_VERIFY_EXTENTS);
```

Parameters

Table 61–2 SEGMENT_VERIFY Procedure Parameters

Parameters	Description
tablespace_name	Name of tablespace in which segment resides.
header_relative_file	Relative file number of segment header.
header_block	Block number of segment header.
verify_option	What kind of check to do: SEGMENT_VERIFY_EXTENTS or SEGMENT_VERIFY_EXTENTS_GLOBAL.

Usage Notes

Anomalies are output as dba-range, bitmap-block, bitmap-block-range, anomaly-information, in the trace file for all dba-ranges found to have incorrect space representation. The kinds of problems which would be reported are free space not considered free, used space considered free, and the same space considered used by multiple segments.

Example

The following example verifies that the segment with segment header at relative file number 4, block number 33, has its extent maps and bitmaps in sync.

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_VERIFY('USERS', 4, 33, 1);
```

> **Note:** All DBMS_SPACE_ADMIN package examples use the tablespace USERS which contains SCOTT.EMP.

SEGMENT_CORRUPT Procedure

This procedure marks the segment corrupt or valid so that appropriate error recovery can be done.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_CORRUPT (
   tablespace_name         IN    VARCHAR2,
   header_relative_file    IN    POSITIVE,
```

```
   header_block            IN    POSITIVE,
   corrupt_option          IN    POSITIVE  DEFAULT SEGMENT_MARK_CORRUPT);
```

Parameters

Table 61–3 SEGMENT_CORRUPT Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace in which segment resides.
header_relative_file	Relative file number of segment header.
header_block	Block number of segment header.
corrupt_option	SEGMENT_MARK_CORRUPT (default) or SEGMENT_MARK_VALID.

Example

The following example marks the segment as corrupt:

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_CORRUPT('USERS', 4, 33, 3);
```

Alternately, the next example marks a corrupt segment valid:

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_CORRUPT('USERS', 4, 33, 4);
```

SEGMENT_DROP_CORRUPT Procedure

This procedure drops a segment currently marked corrupt (without reclaiming space). For this to work, the segment should have been marked *temporary*. To mark a corrupt segment as temporary, issue a DROP command on the segment.

The space for the segment is not released, and it must be fixed by using the TABLESPACE_FIX_BITMAPS or TABLESPACE_REBUILD_BITMAPS procedure. These are described later in this chapter.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_DROP_CORRUPT (
   tablespace_name         IN    VARCHAR2,
   header_relative_file    IN    POSITIVE,
   header_block            IN    POSITIVE);
```

Parameters

Table 61–4 SEGMENT_DROP_CORRUPT Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace in which segment resides.
header_relative_file	Relative file number of segment header.
header_block	Block number of segment header.

Example

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_DROP_CORRUPT('USERS', 4, 33);
```

SEGMENT_DUMP Procedure

This procedure dumps the segment header and extent map blocks of the given segment.

Syntax

```
DBMS_SPACE_ADMIN.SEGMENT_DUMP (
   tablespace_name         IN    VARCHAR2,
   header_relative_file    IN    POSITIVE,
   header_block            IN    POSITIVE,
   dump_option             IN    POSITIVE  DEFAULT SEGMENT_DUMP_EXTENT_MAP);
```

Parameters

Table 61–5 SEGMENT_DUMP Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace in which segment resides.
header_relative_file	Relative file number of segment header.
header_block	Block number of segment header.
dump_option	SEGMENT_DUMP_EXTENT_MAP

Example

```
EXECUTE DBMS_SPACE_ADMIN.SEGMENT_DUMP('USERS', 4, 33);
```

TABLESPACE_VERIFY Procedure

This procedure verifies that the bitmaps and extent maps for the segments in the tablespace are in sync.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_VERIFY (
   tablespace_name         IN    VARCHAR2,
   verify_option           IN    POSITIVE DEFAULT TABLESPACE_VERIFY_BITMAP);
```

Parameters

Table 61–6 TABLESPACE_VERIFY Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace.
verify_option	TABLESPACE_VERIFY_BITMAP

Example

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_VERIFY('USERS');
```

TABLESPACE_FIX_BITMAPS Procedure

This procedure marks the appropriate DBA range (extent) as free or used in bitmap.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_FIX_BITMAPS (
   tablespace_name         IN    VARCHAR2,
   dbarange_relative_file  IN    POSITIVE,
   dbarange_begin_block    IN    POSITIVE,
   dbarange_end_block      IN    POSITIVE,
   fix_option              IN    POSITIVE);
```

Parameters

Table 61–7 TABLESPACE_FIX_BITMAPS Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace.

Table 61–7 TABLESPACE_FIX_BITMAPS Procedure Parameters

Parameter	Description
dbarange_relative_file	Relative file number of DBA range (extent).
dbarange_begin_block	Block number of beginning of extent.
dbarange_end_block	Block number (inclusive) of end of extent.
fix_option	TABLESPACE_EXTENT_MAKE_FREE or TABLESPACE_EXTENT_MAKE_USED.

Example

The following example marks bits for 50 blocks for relative file number 4, beginning at block number 33 and ending at 83, as USED in bitmaps.

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_FIX_BITMAPS('USERS', 4, 33, 83, 7);
```

Alternately, specifying an option of 8 marks the bits FREE in bitmaps. The BEGIN and END blocks should be in extent boundary and should be extent multiple. Otherwise, an error is raised.

TABLESPACE_REBUILD_BITMAPS Procedure

This procedure rebuilds the appropriate bitmap(s). If no bitmap block DBA is specified, then it rebuilds all bitmaps for the given tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_BITMAPS (
   tablespace_name         IN    VARCHAR2,
   bitmap_relative_file    IN    POSITIVE   DEFAULT NULL,
   bitmap_block            IN    POSITIVE   DEFAULT NULL);
```

Parameters

Table 61–8 TABLESPACE_REBUILD_BITMAPS Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace.
bitmap_relative_file	Relative file number of bitmap block to rebuild.
bitmap_block	Block number of bitmap block to rebuild.

Example

The following example rebuilds bitmaps for all the files in the USERS tablespace.

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_BITMAPS('USERS');
```

Note: Currently, only full rebuild is supported.

TABLESPACE_REBUILD_QUOTAS Procedure

This procedure rebuilds quotas for the given tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_QUOTAS (
   tablespace_name          IN     VARCHAR2);
```

Parameters

Table 61–9 TABLESPACE_REBUILD_QUOTAS Procedure Parameters

Parameter	Description
tablespace_name	Name of tablespace.

Example

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_REBUILD_QUOTAS('USERS');
```

TABLESPACE_MIGRATE_FROM_LOCAL Procedure

This procedure migrates a locally-managed tablespace to a dictionary-managed tablespace.

Syntax

```
DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_FROM_LOCAL (
   tablespace_name          IN     VARCHAR2);
```

Parameter

Table 61–10 TABLESPACE_MIGRATE_FROM_LOCAL Procedure Parameter

Parameter	Description
tablespace_name	Name of tablespace.

Usage Notes

The tablespace must be kept online and read write during migration. Migration of temporary tablespaces and migration of SYSTEM tablespaces are not supported.

Note: Migration of SYSTEM tablespaces will be supported in the future.

Example

```
EXECUTE DBMS_SPACE_ADMIN.TABLESPACE_MIGRATE_FROM_LOCAL('USERS');
```

TABLESPACE_MIGRATE_TO_LOCAL Procedure

Use this procedure to migrate the tablespace from dictionary managed format to locally managed format. Tablespaces migrated to locally managed format are user-managed.

Syntax

```
TABLESPACE_MIGRATE_TO_LOCAL(tablespace_name, allocation_unit, relative_fno)
```

Parameters

Table 61–11 Parameters for TABLESPACE_MIGRATE_TO_LOCAL

Parameter Name	Purpose	Datatype	Parameter Type
Tablespace Name	Name of the tablespace to be migrated.	VARCHAR	IN
Allocation Unit	Unit size (which is the size of the smallest possible chunk of space that can be allocated) in the tablespace.	INTEGER	IN
Relative File Number	Relative File Number of the file where the bitmap blocks should be placed (optional)	INTEGER	IN

Usage Notes

The tablespace must be kept online and read write during migration. Note that temporary tablespaces cannot be migrated. Migration of SYSTEM tablespace is not permitted in this release.

Allocation Unit may be specified optionally. The default is calculated by the system based on the highest common divisor of all extents (used or free) for the tablespace. This number is further trimmed based on the MINIMUM EXTENT for the tablespace (5 if MINIMUM EXTENT is not specified). Thus, the calculated value will not be larger than the MINIMUM EXTENT for the tablespace. The last free extent in every file will be ignored for GCD calculation. If you specify the unit size, it has to be a factor of the UNIT size calculated by the system, otherwise an error message is returned.

The Relative File Number parameter is used to place the bitmaps in a desired file. If space is not found in the file, an error is issued. The datafile specified should be part of the tablespace being migrated. If the datafile is not specified then the system will choose a datafile in which to place the initial bitmap blocks. If space is not found for the initial bitmaps, an error will be raised.

Example

To migrate a tablespace 'TS1' with minimum extent size 1m, use

```
execute dbms_space_admin.tablespace_migrate_to_local('TS1', 512, 2);
```

The bitmaps will be placed in file with relative file number 2.

TABLESPACE_RELOCATE_BITMAPS Procedure

Use this procedure to relocate the bitmaps to the destination specified. Migration of a tablespace from dictionary managed to locally managed format could result in the creation of SPACE HEADER segment that contains the bitmap blocks. The SPACE HEADER segment is treated as user data. If the user wishes to explicitly resize a file at or below the space header segment, an error is issued. Use tablespace_relocate_ bitmaps command to move the control information to a different destination and then resize the file.

Syntax

```
TABLESPACE_RELOCATE_BITMAPS (Tablespace_Name, Relative_fno, Block_Number)
```

Parameters

Table 61–12 Parameters for TABLESPACE_RELOCATE_BITMAPS

Parameter Name	Purpose	Datatype	Parameter Type
Tablespace_Name	Name of Tablespace.	VARCHAR	IN
RFNO	Relative File Number of the destination file.	NUMBER	IN
BLKNO	Block Number of the destination dba.	NUMBER	IN

Usage Notes

The tablespace must be kept online and read write during relocation of bitmaps. Can be done only on migrated locally managed tablespaces.

Example

```
execute  dbms_space_admin.tablespace_relocate_bitmaps('TS1', 3, 4);
```

Moves the bitmaps to file 3, block 4.

Note: The source and the destination addresses should not overlap. The destination block number is rounded down to the unit boundary. If there is user data in that location an error is raised.

TABLESPACE_FIX_SEGMENT_STATES Procedure

Use this procedure to fix the state of the segments in a tablespace in which migration was aborted. During tablespace migration to or from local, the segments are put in a transient state. If migration is aborted, the segment states are corrected by SMON when event 10906 is set. Database with segments is such a transient state cannot be downgraded. The procedure can be used to fix the state of such segments.

Syntax

```
TABLESPACE_FIX_SEGMENT_STATES(Tablespace_Name);
```

Parameters

Table 61–13 Parameter for TABLESPACE_FIX_SEGMENT_STATES

Parameter Name	Purpose	Datatype	Parameter Type
Tablespace_Name	Name of the tablespace whose segments needs to be fixed.	VARCHAR	IN

Usage Notes

The tablespace must be kept online and read write when this procedure is called.

Example

```
execute dbms_space_admin.tablespace_fix_segment_states('TS1');
```

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DBMS_SQL

Oracle lets you to write stored procedures and anonymous PL/SQL blocks that use dynamic SQL. Dynamic SQL statements are not embedded in your source program; rather, they are stored in character strings that are input to, or built by, the program at runtime. This enables you to create more general-purpose procedures. For example, dynamic SQL lets you create a procedure that operates on a table whose name is not known until runtime.

Additionally, DBMS_SQL enables you to parse any data manipulation language (DML) or data definition language (DDL) statement. Therefore, you can parse DDL statements directly using PL/SQL. For example, you might now choose to enter a DROP TABLE statement from within a stored procedure by using the PARSE procedure supplied with the DBMS_SQL package.

Note: Oracle8*i* introduces native dynamic SQL, an alternative to DBMS_SQL. Using native dynamic SQL, you can place dynamic SQL statements directly into PL/SQL blocks.

In most situations, native dynamic SQL can replace DBMS_SQL. Native dynamic SQL is easier to use and performs better than DBMS_SQL.

See Also: For more information on native dynamic SQL, see *PL/SQL User's Guide and Reference.*

For a comparison of DBMS_SQL and native dynamic SQL, see *Oracle9i Application Developer's Guide - Fundamentals.*

This chapter discusses the following topics:

- Constants, Types, and Exceptions for DBMS_SQL
- Security
- Processing Queries
- Examples
- Processing Updates, Inserts, and Deletes
- Locating Errors
- Summary of DBMS_SQL Subprograms

Using DBMS_SQL

The ability to use dynamic SQL from within stored procedures generally follows the model of the Oracle Call Interface (OCI).

See Also: *Oracle Call Interface Programmer's Guide*

PL/SQL differs somewhat from other common programming languages, such as C. For example, addresses (also called pointers) are not user-visible in PL/SQL. As a result, there are some differences between the Oracle Call Interface and the DBMS_SQL package. These differences include the following:

- The OCI uses bind by address, while the DBMS_SQL package uses bind by value.
- With DBMS_SQL you must call VARIABLE_VALUE to retrieve the value of an OUT parameter for an anonymous block, and you must call COLUMN_VALUE after fetching rows to actually retrieve the values of the columns in the rows into your program.
- The current release of the DBMS_SQL package does not provide CANCEL cursor procedures.
- Indicator variables are not required, because NULLs are fully supported as values of a PL/SQL variable.

A sample usage of the DBMS_SQL package is shown below. For users of the Oracle Call Interfaces, this code should seem fairly straightforward.

Example

This example does not actually require the use of dynamic SQL, because the text of the statement is known at compile time. It does, however, illustrate the concepts of this package.

The DEMO procedure deletes all of the employees from the EMP table whose salaries are greater than the salary that you specify when you run DEMO.

```
CREATE OR REPLACE PROCEDURE demo(salary IN NUMBER) AS
    cursor_name INTEGER;
    rows_processed INTEGER;
BEGIN
    cursor_name := dbms_sql.open_cursor;
    DBMS_SQL.PARSE(cursor_name, 'DELETE FROM emp WHERE sal > :x',
                   dbms_sql.native);
    DBMS_SQL.BIND_VARIABLE(cursor_name, ':x', salary);
```

```
    rows_processed := dbms_sql.execute(cursor_name);
    DBMS_SQL.close_cursor(cursor_name);
EXCEPTION
WHEN OTHERS THEN
    DBMS_SQL.CLOSE_CURSOR(cursor_name);
END;
```

Constants, Types, and Exceptions for DBMS_SQL

Constants

```
v6 constant INTEGER     := 0;
native constant INTEGER := 1;
v7 constant INTEGER     := 2;
```

Types

```
TYPE varchar2s IS TABLE OF VARCHAR2(256) INDEX BY BINARY_INTEGER;
TYPE desc_rec  IS RECORD (
      col_type            BINARY_INTEGER := 0,
      col_max_len         BINARY_INTEGER := 0,
      col_name            VARCHAR2(32)   := '',
      col_name_len        BINARY_INTEGER := 0,
      col_schema_name     VARCHAR2(32)   := '',
      col_schema_name_len BINARY_INTEGER := 0,
      col_precision       BINARY_INTEGER := 0,
      col_scale           BINARY_INTEGER := 0,
      col_charsetid       BINARY_INTEGER := 0,
      col_charsetform     BINARY_INTEGER := 0,
      col_null_ok         BOOLEAN        := TRUE);
TYPE desc_tab IS TABLE OF desc_rec INDEX BY BINARY_INTEGER;
```

Bulk SQL Types

```
type Number_Table   IS TABLE OF NUMBER         INDEX BY BINARY_INTEGER;
type Varchar2_Table IS TABLE OF VARCHAR2(2000) INDEX BY BINARY_INTEGER;
type Date_Table     IS TABLE OF DATE           INDEX BY BINARY_INTEGER;
type Blob_Table     IS TABLE OF BLOB           INDEX BY BINARY_INTEGER;
type Clob_Table     IS TABLE OF CLOB           INDEX BY BINARY_INTEGER;
type Bfile_Table    IS TABLE OF BFILE          INDEX BY BINARY_INTEGER;
type Urowid_Table   IS TABLE OF UROWID         INDEX BY BINARY_INTEGER;
```

Exceptions

```
inconsistent_type exception;
```

```
pragma exception_init(inconsistent_type, -6562);
```

This exception is raised by procedure COLUMN_VALUE or VARIABLE_VALUE when the type of the given OUT parameter (for where to put the requested value) is different from the type of the value.

Execution Flow

OPEN_CURSOR

To process a SQL statement, you must have an open cursor. When you call the OPEN_CURSOR function, you receive a cursor ID number for the data structure representing a valid cursor maintained by Oracle. These cursors are distinct from cursors defined at the precompiler, OCI, or PL/SQL level, and are used only by the DBMS_SQL package.

PARSE

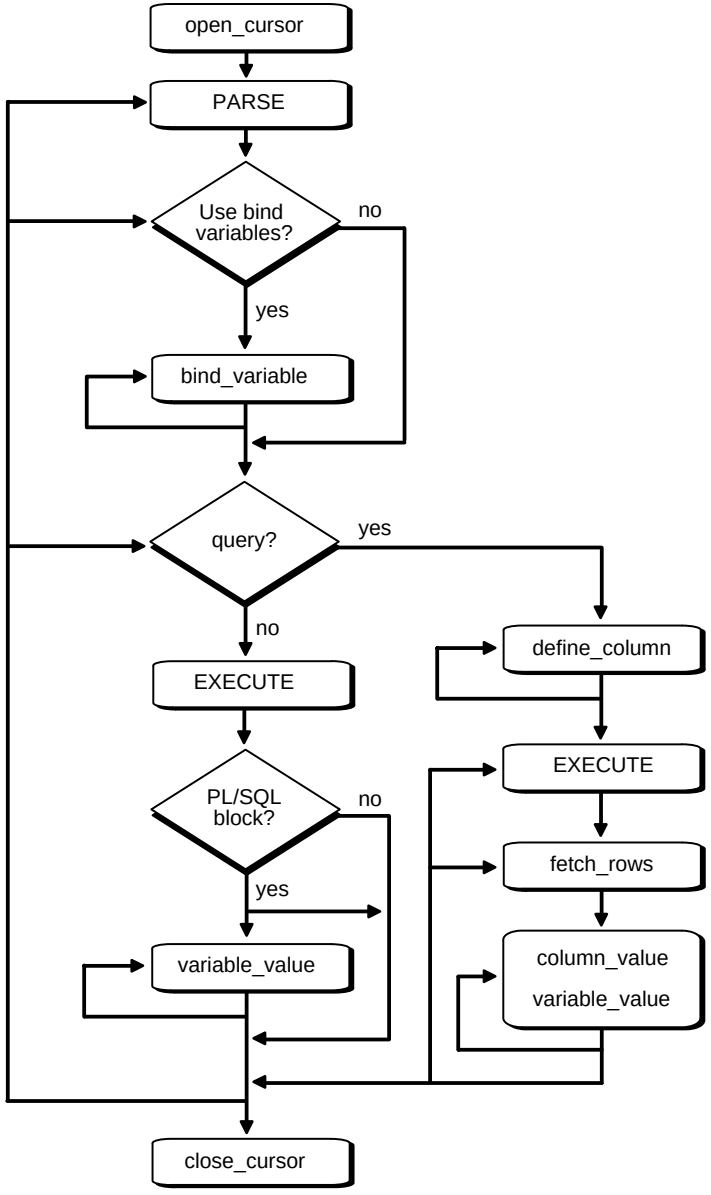
Every SQL statement must be parsed by calling the PARSE procedure. Parsing the statement checks the statement's syntax and associates it with the cursor in your program.

> **See Also:** *Oracle8 Concepts* provides an explanation of how SQL statements are parsed.

You can parse any DML or DDL statement. DDL statements are run on the parse, which performs the implied commit.

Note: When parsing a DDL statement to drop a package or a procedure, a deadlock can occur if you're still using a procedure in the package. After a call to a procedure, that procedure is considered to be in use until execution has returned to the user side. Any such deadlock timeouts after five minutes.

Figure 62–1 DBMS_SQL Execution Flow



BIND_VARIABLE or BIND_ARRAY

Many DML statements require that data in your program be input to Oracle. When you define a SQL statement that contains input data to be supplied at runtime, you must use placeholders in the SQL statement to mark where data must be supplied.

For each placeholder in the SQL statement, you must call one of the bind procedures, BIND_VARIABLE or BIND_ARRAY, to supply the value of a variable in your program (or the values of an array) to the placeholder. When the SQL statement is subsequently run, Oracle uses the data that your program has placed in the output and input, or bind, variables.

DBMS_SQL can run a DML statement multiple times — each time with a different bind variable. The BIND_ARRAY procedure lets you bind a collection of scalars, each value of which is used as an input variable once per EXECUTE. This is similar to the array interface supported by the OCI.

DEFINE_COLUMN, DEFINE_COLUMN_LONG, or DEFINE_ARRAY

The columns of the row being selected in a SELECT statement are identified by their relative positions as they appear in the select list, from left to right. For a query, you must call one of the define procedures (DEFINE_COLUMN, DEFINE_COLUMN_LONG, or DEFINE_ARRAY) to specify the variables that are to receive the SELECT values, much the way an INTO clause does for a static query.

Use the DEFINE_COLUMN_LONG procedure to define LONG columns, in the same way that DEFINE_COLUMN is used to define non-LONG columns. You must call DEFINE_COLUMN_LONG before using the COLUMN_VALUE_LONG procedure to fetch from the LONG column.

Use the DEFINE_ARRAY procedure to define a PL/SQL collection into which you want to fetch rows in a single SELECT statement. DEFINE_ARRAY provides an interface to fetch multiple rows at one fetch. You must call DEFINE_ARRAY before using the COLUMN_VALUE procedure to fetch the rows.

EXECUTE

Call the EXECUTE function to run your SQL statement.

FETCH_ROWS or EXECUTE_AND_FETCH

The FETCH_ROWS function retrieves the rows that satisfy the query. Each successive fetch retrieves another set of rows, until the fetch is unable to retrieve anymore rows. Instead of calling EXECUTE and then FETCH_ROWS, you may find it more efficient to call EXECUTE_AND_FETCH if you are calling EXECUTE for a single execution.

VARIABLE_VALUE, COLUMN_VALUE, or COLUMN_VALUE_LONG

For queries, call COLUMN_VALUE to determine the value of a column retrieved by the FETCH_ROWS call. For anonymous blocks containing calls to PL/SQL procedures or DML statements with `returning` clause, call VARIABLE_VALUE to retrieve the values assigned to the output variables when statements were run.

To fetch just part of a LONG database column (which can be up to two gigabytes in size), use the COLUMN_VALUE_LONG procedure. You can specify the offset (in bytes) into the column value, and the number of bytes to fetch.

CLOSE_CURSOR

When you no longer need a cursor for a session, close the cursor by calling CLOSE_CURSOR. If you are using an Oracle Open Gateway, then you may need to close cursors at other times as well. Consult your *Oracle Open Gateway* documentation for additional information.

If you neglect to close a cursor, then the memory used by that cursor remains allocated even though it is no longer needed.

Security

Definer Rights Modules

Definer rights modules run under the privileges of the owner of the module. DBMS_SQL subprograms called from definer rights modules run with respect to the schema in which the module is defined.

Note: Prior to Oracle 8*i*, all PL/SQL stored procedures and packages were definer rights modules.

Invoker Rights Modules

Invoker rights modules run under the privileges of the invoker of the module. Therefore, DBMS_SQL subprograms called from invoker rights modules run under the privileges of the invoker of the module.

When a module has AUTHID set to `current_user`, the unqualified names are resolved with respect to the invoker's schema.

Example:

income is an invoker rights stored procedure in USER1's schema, and USER2 has been granted EXECUTE privilege on it.

```
CREATE PROCEDURE income(amount number)
   AUTHID current_user IS
   c number;
   n number;
BEGIN
   c:= dbms_sql.open_cursor;
   dbms_sql.parse(c, 'insert into accts(''income'', :1)', dbms_sql.native);
   dbms_sql.bind_variable(c, '1', amount);
   n := dbms_sql.execute(c);
   dbms_sql.close_cursor(c);
END;
```

If USER1 calls USER1.income, then USER1's privileges are used, and name resolution of unqualified names is done with respect to USER1's schema.

If USER2 calls USER1.income, then USER2's privileges are used, and name resolution of unqualified names (such as accts) is done with respect to USER2's schema.

See Also: *PL/SQL User's Guide and Reference*

Anonymous Blocks

Any DBMS_SQL subprograms called from an anonymous PL/SQL block are run using the privileges of the current user.

Processing Queries

If you are using dynamic SQL to process a query, then you must perform the following steps:

1. Specify the variables that are to receive the values returned by the SELECT statement by calling DEFINE_COLUMN, DEFINE_COLUMN_LONG, or DEFINE_ARRAY.
2. Run your SELECT statement by calling EXECUTE.
3. Call FETCH_ROWS (or EXECUTE_AND_FETCH) to retrieve the rows that satisfied your query.

4. Call COLUMN_VALUE or COLUMN_VALUE_LONG to determine the value of a column retrieved by the FETCH_ROWS call for your query. If you used anonymous blocks containing calls to PL/SQL procedures, then you must call VARIABLE_VALUE to retrieve the values assigned to the output variables of these procedures.

Examples

This section provides example procedures that make use of the DBMS_SQL package.

Example 1

The following sample procedure is passed a SQL statement, which it then parses and runs:

```
CREATE OR REPLACE PROCEDURE exec(STRING IN varchar2) AS
    cursor_name INTEGER;
    ret INTEGER;
BEGIN
   cursor_name := DBMS_SQL.OPEN_CURSOR;
```

DDL statements are run by the parse call, which performs the implied commit.

```
   DBMS_SQL.PARSE(cursor_name, string, DBMS_SQL.native);
   ret := DBMS_SQL.EXECUTE(cursor_name);
   DBMS_SQL.CLOSE_CURSOR(cursor_name);
END;
```

Creating such a procedure enables you to perform the following operations:

- The SQL statement can be dynamically generated at runtime by the calling program.
- The SQL statement can be a DDL statement or a DML without binds.

For example, after creating this procedure, you could make the following call:

```
exec('create table acct(c1 integer)');
```

You could even call this procedure remotely, as shown in the following example. This lets you perform remote DDL.

```
exec@hq.com('CREATE TABLE acct(c1 INTEGER)');
```

Example 2

The following sample procedure is passed the names of a source and a destination table, and copies the rows from the source table to the destination table. This sample procedure assumes that both the source and destination tables have the following columns:

```
id        of type NUMBER
name      of type VARCHAR2(30)
birthdate of type DATE
```

This procedure does not specifically require the use of dynamic SQL; however, it illustrates the concepts of this package.

```
CREATE OR REPLACE PROCEDURE copy (
     source      IN VARCHAR2,
     destination IN VARCHAR2) IS
     id_var             NUMBER;
     name_var           VARCHAR2(30);
     birthdate_var      DATE;
     source_cursor      INTEGER;
     destination_cursor INTEGER;
     ignore             INTEGER;
  BEGIN

  -- Prepare a cursor to select from the source table:
     source_cursor := dbms_sql.open_cursor;
     DBMS_SQL.PARSE(source_cursor,
         'SELECT id, name, birthdate FROM ' || source,
          DBMS_SQL.native);
     DBMS_SQL.DEFINE_COLUMN(source_cursor, 1, id_var);
     DBMS_SQL.DEFINE_COLUMN(source_cursor, 2, name_var, 30);
     DBMS_SQL.DEFINE_COLUMN(source_cursor, 3, birthdate_var);
     ignore := DBMS_SQL.EXECUTE(source_cursor);

  -- Prepare a cursor to insert into the destination table:
     destination_cursor := DBMS_SQL.OPEN_CURSOR;
     DBMS_SQL.PARSE(destination_cursor,
                 'INSERT INTO ' || destination ||
                 ' VALUES (:id_bind, :name_bind, :birthdate_bind)',
                  DBMS_SQL.native);

  -- Fetch a row from the source table and insert it into the destination table:
     LOOP
       IF DBMS_SQL.FETCH_ROWS(source_cursor)>0 THEN
         -- get column values of the row
```

```
        DBMS_SQL.COLUMN_VALUE(source_cursor, 1, id_var);
        DBMS_SQL.COLUMN_VALUE(source_cursor, 2, name_var);
        DBMS_SQL.COLUMN_VALUE(source_cursor, 3, birthdate_var);

  -- Bind the row into the cursor that inserts into the destination table. You
  -- could alter this example to require the use of dynamic SQL by inserting an
  -- if condition before the bind.
      DBMS_SQL.BIND_VARIABLE(destination_cursor, ':id_bind', id_var);
      DBMS_SQL.BIND_VARIABLE(destination_cursor, ':name_bind', name_var);
      DBMS_SQL.BIND_VARIABLE(destination_cursor, ':birthdate_bind',
birthdate_var);
      ignore := DBMS_SQL.EXECUTE(destination_cursor);
    ELSE

  -- No more rows to copy:
      EXIT;
    END IF;
  END LOOP;

  -- Commit and close all cursors:
    COMMIT;
    DBMS_SQL.CLOSE_CURSOR(source_cursor);
    DBMS_SQL.CLOSE_CURSOR(destination_cursor);
 EXCEPTION
    WHEN OTHERS THEN
      IF DBMS_SQL.IS_OPEN(source_cursor) THEN
        DBMS_SQL.CLOSE_CURSOR(source_cursor);
      END IF;
      IF DBMS_SQL.IS_OPEN(destination_cursor) THEN
        DBMS_SQL.CLOSE_CURSOR(destination_cursor);
      END IF;
      RAISE;
  END;
/
```

Examples 3, 4, and 5: Bulk DML

This series of examples shows how to use bulk array binds (table items) in the SQL DML statements DELETE, INSERT, and UPDATE.

In a DELETE statement, for example, you could bind in an array in the WHERE clause and have the statement be run for each element in the array:

```
declare
  stmt varchar2(200);
  dept_no_array dbms_sql.Number_Table;
```

```
  c number;
  dummy number;
begin
  dept_no_array(1) := 10; dept_no_array(2) := 20;
  dept_no_array(3) := 30; dept_no_array(4) := 40;
  dept_no_array(5) := 30; dept_no_array(6) := 40;
  stmt := 'delete from emp where deptno = :dept_array';
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, stmt, dbms_sql.native);
  dbms_sql.bind_array(c, ':dept_array', dept_no_array, 1, 4);
  dummy := dbms_sql.execute(c);
  dbms_sql.close_cursor(c);

  exception when others then
    if dbms_sql.is_open(c) then
      dbms_sql.close_cursor(c);
    end if;
    raise;
end;
/
```

In the example above, only elements 1 through 4 are used as specified by the bind_array call. Each element of the array potentially deletes a large number of employees from the database.

Here is an example of a bulk `INSERT` statement:

```
declare
  stmt varchar2(200);
  empno_array dbms_sql.Number_Table;
  empname_array dbms_sql.Varchar2_Table;
  c number;
  dummy number;
begin
  for i in 0..9 loop
    empno_array(i) := 1000 + i;
    empname_array(I) := get_name(i);
  end loop;
  stmt := 'insert into emp values(:num_array, :name_array)';
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, stmt, dbms_sql.native);
  dbms_sql.bind_array(c, ':num_array', empno_array);
  dbms_sql.bind_array(c, ':name_array', empname_array);
  dummy := dbms_sql.execute(c);
  dbms_sql.close_cursor(c);
```

```
  exception when others then
    if dbms_sql.is_open(c) then
      dbms_sql.close_cursor(c);
    end if;
    raise;
end;
/
```

When the execute takes place, all 10 of the employees are inserted into the table.

Finally, here is an example of an bulk UPDATE statement.

```
declare
  stmt varchar2(200);
  emp_no_array dbms_sql.Number_Table;
  emp_addr_array dbms_sql.Varchar2_Table;
  c number;
  dummy number;
begin
  for i in 0..9 loop
    emp_no_array(i) := 1000 + i;
    emp_addr_array(I) := get_new_addr(i);
  end loop;
  stmt := 'update emp set ename = :name_array
    where empno = :num_array';
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, stmt, dbms_sql.native);
  dbms_sql.bind_array(c, ':num_array', empno_array);
  dbms_sql.bind_array(c, ':name_array', empname_array);
  dummy := dbms_sql.execute(c);
  dbms_sql.close_cursor(c);

  exception when others then
    if dbms_sql.is_open(c) then
      dbms_sql.close_cursor(c);
    end if;
    raise;
end;
/
```

When the EXECUTE call happens, the addresses of all employees are updated at once. The two collections are always stepped in unison. If the WHERE clause returns more than one row, then all those employees get the address the addr_array happens to be pointing to at that time.

Examples 6 and 7: Defining an Array

The following examples show how to use the DEFINE_ARRAY procedure:

```
declare
  c       number;
  d       number;
  n_tab   dbms_sql.Number_Table;
  indx    number := -10;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'select n from t order by 1', dbms_sql);

  dbms_sql.define_array(c, 1, n_tab, 10, indx);

  d := dbms_sql.execute(c);
  loop
    d := dbms_sql.fetch_rows(c);

    dbms_sql.column_value(c, 1, n_tab);

    exit when d != 10;
  end loop;

  dbms_sql.close_cursor(c);

  exception when others then
    if dbms_sql.is_open(c) then
      dbms_sql.close_cursor(c);
    end if;
    raise;
end;
/
```

Each time the example above does a FETCH_ROWS call, it fetches 10 rows that are kept in DBMS_SQL buffers. When the COLUMN_VALUE call is run, those rows move into the PL/SQL table specified (in this case n_tab), at positions -10 to -1, as specified in the DEFINE statements. When the second batch is fetched in the loop, the rows go to positions 0 to 9; and so on.

A current index into each array is maintained automatically. This index is initialized to "indx" at EXECUTE and keeps getting updated every time a COLUMN_VALUE call is made. If you re-execute at any point, then the current index for each DEFINE is re-initialized to "indx".

In this way the entire result of the query is fetched into the table. When FETCH_ROWS cannot fetch 10 rows, it returns the number of rows actually fetched (if no rows could be fetched, then it returns zero) and exits the loop.

Here is another example of using the DEFINE_ARRAY procedure:

Consider a table MULTI_TAB defined as:

```
create table multi_tab (num number,
                        dat1 date,
                        var varchar2(24),
                        dat2 date)
```

To select everything from this table and move it into four PL/SQL tables, you could use the following simple program:

```
declare
  c       number;
  d       number;
  n_tab  dbms_sql.Number_Table;
  d_tab1 dbms_sql.Date_Table;
  v_tab  dbms_sql.Varchar2_Table;
  d_tab2 dbms_sql.Date_Table;
  indx number := 10;
begin

  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'select * from multi_tab order by 1', dbms_sql);

  dbms_sql.define_array(c, 1, n_tab,  5, indx);
  dbms_sql.define_array(c, 2, d_tab1, 5, indx);
  dbms_sql.define_array(c, 3, v_tab,  5, indx);
  dbms_sql.define_array(c, 4, d_tab2, 5, indx);

  d := dbms_sql.execute(c);

  loop
    d := dbms_sql.fetch_rows(c);

    dbms_sql.column_value(c, 1, n_tab);
    dbms_sql.column_value(c, 2, d_tab1);
    dbms_sql.column_value(c, 3, v_tab);
    dbms_sql.column_value(c, 4, d_tab2);

    exit when d != 5;
  end loop;
```

```
  dbms_sql.close_cursor(c);

/*
```

The four tables can be used for anything. One usage might be to use BIND_ARRAY to move the rows to another table by using a query such as 'INSERT into SOME_T values (:a, :b, :c, :d);

```
*/

exception when others then
    if dbms_sql.is_open(c) then
      dbms_sql.close_cursor(c);
    end if;
    raise;
end;
/
```

Example 8: Describe Columns

This can be used as a substitute to the SQL*Plus DESCRIBE call by using a SELECT * query on the table that you want to describe.

```
declare
  c number;
  d number;
  col_cnt integer;
  f boolean;
  rec_tab dbms_sql.desc_tab;
  col_num number;
  procedure print_rec(rec in dbms_sql.desc_rec) is
  begin
    dbms_output.new_line;
    dbms_output.put_line('col_type            =    '
                         || rec.col_type);
    dbms_output.put_line('col_maxlen          =    '
                         || rec.col_max_len);
    dbms_output.put_line('col_name            =    '
                         || rec.col_name);
    dbms_output.put_line('col_name_len        =    '
                         || rec.col_name_len);
    dbms_output.put_line('col_schema_name     =    '
                         || rec.col_schema_name);
    dbms_output.put_line('col_schema_name_len =    '
                         || rec.col_schema_name_len);
```

```
    dbms_output.put_line('col_precision       =    '
                         || rec.col_precision);
    dbms_output.put_line('col_scale           =    '
                         || rec.col_scale);
    dbms_output.put('col_null_ok         =    ');
    if (rec.col_null_ok) then
      dbms_output.put_line('true');
    else
      dbms_output.put_line('false');
    end if;
  end;
begin
  c := dbms_sql.open_cursor;

  dbms_sql.parse(c, 'select * from scott.bonus', dbms_sql);

  d := dbms_sql.execute(c);

  dbms_sql.describe_columns(c, col_cnt, rec_tab);

/*
 * Following loop could simply be for j in 1..col_cnt loop.
 * Here we are simply illustrating some of the PL/SQL table
 * features.
 */
  col_num := rec_tab.first;
  if (col_num is not null) then
    loop
      print_rec(rec_tab(col_num));
      col_num := rec_tab.next(col_num);
      exit when (col_num is null);
    end loop;
  end if;

  dbms_sql.close_cursor(c);
end;
/
```

Example 9: RETURNING clause The `RETURNING` clause was added to DML statements in Oracle 8.0.3. With this clause, `INSERT`, `UPDATE`, and `DELETE` statements can return values of expressions. These values are returned in bind variables.

`DBMS_SQL.BIND_VARIABLE` is used to bind these outbinds if a single row is inserted, updated, or deleted. If multiple rows are inserted, updated, or deleted,

then DBMS_SQL.BIND_ARRAY is used. DBMS_SQL.VARIABLE_VALUE must be called to get the values in these bind variables.

> **Note:** This is similar to DBMS_SQL.VARIABLE_VALUE, which must be called after running a PL/SQL block with an out-bind inside DBMS_SQL.

i) Single row insert

```
create or replace procedure single_Row_insert
     (c1 number, c2 number, r out number) is
c number;
n number;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'insert into tab values (:bnd1, :bnd2) ' ||
                    'returning c1*c2 into :bnd3', 2);
dbms_sql.bind_variable(c, 'bnd1', c1);
  dbms_sql.bind_variable(c, 'bnd2', c2);
  dbms_sql.bind_variable(c, 'bnd3', r);
  n := dbms_sql.execute(c);
  dbms_sql.variable_value(c, 'bnd3', r); -- get value of outbind variable
  dbms_Sql.close_Cursor(c);
end;
/
```

ii) Single row update

```
create or replace procedure single_Row_update
     (c1 number, c2 number, r out number) is
c number;
n number;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'update tab set c1 = :bnd1, c2 = :bnd2 ' ||
                    'where rownum < 2' ||
                    'returning c1*c2 into :bnd3', 2);
  dbms_sql.bind_variable(c, 'bnd1', c1);
  dbms_sql.bind_variable(c, 'bnd2', c2);
  dbms_sql.bind_variable(c, 'bnd3', r);
  n := dbms_sql.execute(c);
  dbms_sql.variable_value(c, 'bnd3', r);-- get value of outbind variable
  dbms_Sql.close_Cursor(c);
end;
```

```
/
```

iii) Single row delete

```
create or replace procedure single_Row_Delete
     (c1 number, c2 number, r out number) is
c number;
n number;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'delete from tab ' ||
                    'where rownum < 2 ' ||
                   'returning c1*c2 into :bnd3', 2);
  dbms_sql.bind_variable(c, 'bnd1', c1);
  dbms_sql.bind_variable(c, 'bnd2', c2);
  dbms_sql.bind_variable(c, 'bnd3', r);
  n := dbms_sql.execute(c);
  dbms_sql.variable_value(c, 'bnd3', r);-- get value of outbind variable
  dbms_Sql.close_Cursor(c);
end;
/
```

iv) Multi-row insert

```
create or replace procedure multi_Row_insert
     (c1 dbms_sql.number_table, c2 dbms_sql.number_table,
      r out dbms_sql.number_table) is
c number;
n number;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'insert into tab values (:bnd1, :bnd2) ' ||
                    'returning c1*c2 into :bnd3', 2);
  dbms_sql.bind_array(c, 'bnd1', c1);
  dbms_sql.bind_array(c, 'bnd2', c2);
  dbms_sql.bind_array(c, 'bnd3', r);
  n := dbms_sql.execute(c);
  dbms_sql.variable_value(c, 'bnd3', r);-- get value of outbind variable
  dbms_Sql.close_Cursor(c);
end;
/
```

v) Multi row Update.

```
create or replace procedure multi_Row_update
     (c1 number, c2 number, r out dbms_Sql.number_table) is
```

```
 c number;
 n number;
begin
   c := dbms_sql.open_cursor;
   dbms_sql.parse(c, 'update tab set c1 = :bnd1 where c2 = :bnd2 ' ||
                     'returning c1*c2 into :bnd3', 2);
   dbms_sql.bind_variable(c, 'bnd1', c1);
   dbms_sql.bind_variable(c, 'bnd2', c2);
   dbms_sql.bind_array(c, 'bnd3', r);
   n := dbms_sql.execute(c);
   dbms_sql.variable_value(c, 'bnd3', r);-- get value of outbind variable
   dbms_Sql.close_Cursor(c);
 end;
 /
```

Note: bnd1 and bnd2 can be array as well. The value of the expression for all the rows updated will be in bnd3. There is no way of differentiating which rows got updated of each value of bnd1 and bnd2.

vi) Multi-row delete

```
create or replace procedure multi_row_delete
     (c1 dbms_Sql.number_table,
      r out dbms_sql.number_table) is
c number;
n number;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'delete from tab where c1 = :bnd1' ||
                    'returning c1*c2 into :bnd2', 2);
  dbms_sql.bind_array(c, 'bnd1', c1);
  dbms_sql.bind_array(c, 'bnd2', r);
  n := dbms_sql.execute(c);
  dbms_sql.variable_value(c, 'bnd2', r);-- get value of outbind variable
  dbms_Sql.close_Cursor(c);
end;
/
```

vii) Out-bind in bulk PL/SQL

```
create or replace foo (n number, square out number) is
begin square := n * n; end;/
```

```
create or replace procedure bulk_plsql
   (n dbms_sql.number_Table, square out dbms_sql.number_table) is
c number;
r number;
begin
  c := dbms_sql.open_cursor;
  dbms_sql.parse(c, 'begin foo(:bnd1, :bnd2); end;', 2);
  dbms_sql.bind_array(c, 'bnd1', n);
  dbms_Sql.bind_Array(c, 'bnd2', square);
  r := dbms_sql.execute(c);
  dbms_Sql.variable_Value(c, 'bnd2', square);
end;
/
```

Note: DBMS_SQL.BIND_ARRAY of number_Table internally binds a number. The number of times statement is run depends on the number of elements in an inbind array.

Processing Updates, Inserts, and Deletes

If you are using dynamic SQL to process an INSERT, UPDATE, or DELETE, then you must perform the following steps:

1. You must first run your INSERT, UPDATE, or DELETE statement by calling EXECUTE.
2. If statements have the returning clause, then you must call VARIABLE_VALUE to retrieve the values assigned to the output variables.

Locating Errors

There are additional functions in the DBMS_SQL package for obtaining information about the last referenced cursor in the session. The values returned by these functions are only meaningful immediately after a SQL statement is run. In addition, some error-locating functions are only meaningful after certain DBMS_SQL calls. For example, you call LAST_ERROR_POSITION immediately after a PARSE.

Summary of DBMS_SQL Subprograms

Table 62–1 DBMS_SQL Subprograms

Subprogram	Description
"OPEN_CURSOR Function" on page 62-24	Returns cursor ID number of new cursor.
"PARSE Procedure" on page 62-24	Parses given statement.
"BIND_VARIABLE and BIND_ARRAY Procedures" on page 62-27	Binds a given value to a given variable.
"BIND_VARIABLE and BIND_ARRAY Procedures" on page 62-27	Binds a given value to a given collection.
"DEFINE_COLUMN Procedure" on page 62-31	Defines a column to be selected from the given cursor, used only with SELECT statements.
"DEFINE_ARRAY Procedure" on page 62-33	Defines a collection to be selected from the given cursor, used only with SELECT statements.
"DEFINE_COLUMN_LONG Procedure" on page 62-35	Defines a LONG column to be selected from the given cursor, used only with SELECT statements.
"EXECUTE Function" on page 62-35	Executes a given cursor.
"EXECUTE_AND_FETCH Function" on page 62-36	Executes a given cursor and fetch rows.
"FETCH_ROWS Function" on page 62-37	Fetches a row from a given cursor.
"COLUMN_VALUE Procedure" on page 62-37	Returns value of the cursor element for a given position in a cursor.
"COLUMN_VALUE_LONG Procedure" on page 62-40	Returns a selected part of a LONG column, that has been defined using DEFINE_COLUMN_LONG.
"VARIABLE_VALUE Procedure" on page 62-40	Returns value of named variable for given cursor.
"IS_OPEN Function" on page 62-42	Returns TRUE if given cursor is open.
"DESCRIBE_COLUMNS Procedure" on page 62-43	Describes the columns for a cursor opened and parsed through DBMS_SQL.
"CLOSE_CURSOR Procedure" on page 62-45	Closes given cursor and frees memory.

Table 62–1 DBMS_SQL Subprograms

Subprogram	Description
"LAST_ERROR_POSITION Function" on page 62-45	Returns byte offset in the SQL statement text where the error occurred.
"LAST_ROW_COUNT Function" on page 62-46	Returns cumulative count of the number of rows fetched.
"LAST_ROW_ID Function" on page 62-46	Returns ROWID of last row processed.
"LAST_SQL_FUNCTION_CODE Function" on page 62-47	Returns SQL function code for statement.

OPEN_CURSOR Function

This procedure opens a new cursor. When you no longer need this cursor, you must close it explicitly by calling CLOSE_CURSOR.

You can use cursors to run the same SQL statement repeatedly or to run a new SQL statement. When a cursor is reused, the contents of the corresponding cursor data area are reset when the new SQL statement is parsed. It is never necessary to close and reopen a cursor before reusing it.

Syntax

```
DBMS_SQL.OPEN_CURSOR
   RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(open_cursor,RNDS,WNDS);
```

Returns

This function returns the cursor ID number of the new cursor.

PARSE Procedure

This procedure parses the given statement in the given cursor. All statements are parsed immediately. In addition, DDL statements are run immediately when parsed.

There are two versions of the PARSE procedure: one uses a VARCHAR2 statement as an argument, and the other uses a VARCHAR2S (table of VARCHAR2) as an argument.

Caution: Using DBMS_SQL to dynamically run DDL statements can result in the program hanging. For example, a call to a procedure in a package results in the package being locked until the execution returns to the user side. Any operation that results in a conflicting lock, such as dynamically trying to drop the package before the first lock is released, results in a hang.

The size limit for parsing SQL statements with the syntax above is 32KB.

Syntax

```
DBMS_SQL.PARSE (
   c                IN INTEGER,
   statement        IN VARCHAR2,
   language_flag    IN INTEGER);
```

The PARSE procedure also supports the following syntax for large SQL statements:

Note: The procedure concatenates elements of a PL/SQL table statement and parses the resulting string. You can use this procedure to parse a statement that is longer than the limit for a single VARCHAR2 variable by splitting up the statement.

```
DBMS_SQL.PARSE (
   c                IN INTEGER,
   statement        IN VARCHAR2S,
   lb               IN INTEGER,
   ub               IN INTEGER,
   lfflg            IN BOOLEAN,
   language_flag    IN INTEGER);
```

Parameters

Table 62–2 PARSE Procedure Parameters

Parameter	Description
c	ID number of the cursor in which to parse the statement.

statement	SQL statement to be parsed.
	Unlike PL/SQL statements, your SQL statement should not include a final semicolon. For example:
	`DBMS_SQL.PARSE(cursor1, 'BEGIN proc; END;', 2);`
	`DBMS_SQL.PARSE(cursor1, 'INSERT INTO tab values(1)', 2);`

lb	Lower bound for elements in the statement.
ub	Upper bound for elements in the statement.
lfflg	If TRUE, then insert a linefeed after each element on concatenation.
language_flag	Determines how Oracle handles the SQL statement. The following options are recognized: ▪ V6 (or 0) specifies version 6 behavior. ▪ NATIVE (or 1) specifies normal behavior for the database to which the program is connected. ▪ V7 (or 2) specifies Oracle7 behavior.

Note: Because client-side code cannot reference remote package variables or constants, you must explicitly use the values of the constants.

For example, the following code does *not* compile on the client:

```
DBMS_SQL.PARSE(cur_hdl, stmt_str, dbms_sql.V7); -- uses constant
dbms_sql.V7
```

The following code works on the client, because the argument is explicitly provided:

```
DBMS_SQL.PARSE(cur_hdl, stmt_str, 2); -- compiles on the client
```

VARCHAR2S Datatype for Parsing Large SQL Strings To parse SQL statements larger than 32 KB, DBMS_SQL makes use of PL/SQL tables to pass a table of strings to the PARSE procedure. These strings are concatenated and then passed on to the Oracle server.

You can declare a local variable as the VARCHAR2S table-item type, and then use the PARSE procedure to parse a large SQL statement as VARCHAR2S.

The definition of the VARCHAR2S datatype is:

```
TYPE varchar2s IS TABLE OF VARCHAR2(256) INDEX BY BINARY_INTEGER;
```

Exceptions

If you create a type / procedure / function / package using DBMS_SQL that has compilation warnings, an ORA-24344 exception is raised, and the procedure is still created.

BIND_VARIABLE and BIND_ARRAY Procedures

These two procedures bind a given value or set of values to a given variable in a cursor, based on the name of the variable in the statement. If the variable is an IN or IN/OUT variable or an IN collection, then the given bind value must be valid for the variable or array type. Bind values for OUT variables are ignored.

Note:

The bind variables or collections of a SQL statement are identified by their names. When binding a value to a bind variable or bind array, the string identifying it in the statement must contain a leading colon, as shown in the following example:

```
SELECT emp_name FROM emp WHERE SAL > :X;
```

For this example, the corresponding bind call would look similar to

```
BIND_VARIABLE(cursor_name, ':X', 3500);
```

or

```
BIND_VARIABLE (cursor_name, 'X', 3500);
```

Syntax

```
DBMS_SQL.BIND_VARIABLE (
   c              IN INTEGER,
   name           IN VARCHAR2,
   value          IN <datatype>)
```

Where <datatype> can be any one of the following types:

```
NUMBER
DATE
VARCHAR2 CHARACTER SET ANY_CS
BLOB
CLOB CHARACTER SET ANY_CS
BFILE
UROWID
```

Notice that BIND_VARIABLE is overloaded to accept different datatypes.

> **See Also:** *Oracle9i Application Developer's Guide - Large Objects (LOBs)*

Pragmas

```
pragma restrict_references(bind_variable,WNDS);
```

Usage Notes

The following syntax is also supported for BIND_VARIABLE. The square brackets [] indicate an optional parameter for the BIND_VARIABLE function.

```
DBMS_SQL.BIND_VARIABLE (
   c              IN INTEGER,
   name           IN VARCHAR2,
   value          IN VARCHAR2 CHARACTER SET ANY_CS [,out_value_size IN
INTEGER]);
```

To bind CHAR, RAW, and ROWID data, you can use the following variations on the syntax:

```
DBMS_SQL.BIND_VARIABLE_CHAR (
   c              IN INTEGER,
   name           IN VARCHAR2,
   value          IN CHAR CHARACTER SET ANY_CS [,out_value_size IN INTEGER]);

DBMS_SQL.BIND_VARIABLE_RAW (
   c              IN INTEGER,
   name           IN VARCHAR2,
   value          IN RAW [,out_value_size IN INTEGER]);

DBMS_SQL.BIND_VARIABLE_ROWID (
   c              IN INTEGER,
   name           IN VARCHAR2,
   value          IN ROWID);
```

Parameters

Table 62–3 BIND_VARIABLE Procedure Parameters

Parameter	Description
c	ID number of the cursor to which you want to bind a value.
name	Name of the variable in the statement.
value	Value that you want to bind to the variable in the cursor. For IN and IN/OUT variables, the value has the same type as the type of the value being passed in for this parameter.
out_value_size	Maximum expected OUT value size, in bytes, for the VARCHAR2, RAW, CHAR OUT or IN/OUT variable. If no size is given, then the length of the current value is used. This parameter must be specified if the value parameter is not initialized.

Bulk Array Binds

Bulk selects, inserts, updates, and deletes can enhance the performance of applications by bundling many calls into one. The DBMS_SQL package lets you work on collections of data using the PL/SQL table type.

Table items are unbounded homogeneous collections. In persistent storage, they are like other relational tables and have no intrinsic ordering. But when a table item is brought into the workspace (either by querying or by navigational access of persistent data), or when it is created as the value of a PL/SQL variable or parameter, its elements are given subscripts that can be used with array-style syntax to get and set the values of elements.

The subscripts of these elements need not be dense, and can be any number including negative numbers. For example, a table item can contain elements at locations -10, 2, and 7 only.

When a table item is moved from transient workspace to persistent storage, the subscripts are not stored; the table item is unordered in persistent storage.

At bind time the table is copied out from the PL/SQL buffers into local DBMS_SQL buffers (the same as for all scalar types) and then the table is manipulated from the local DBMS_SQL buffers. Therefore, if you change the table after the bind call, then that change does not affect the way the execute acts.

Types for Scalar and LOB Collections

You can declare a local variable as one of the following table-item types, which are defined as public types in DBMS_SQL.

```
type Number_Table   IS TABLE OF NUMBER         INDEX BY BINARY_INTEGER;
type Varchar2_Table IS TABLE OF VARCHAR2(2000) INDEX BY BINARY_INTEGER;
type Date_Table     IS TABLE OF DATE           INDEX BY BINARY_INTEGER;
type Blob_Table     IS TABLE OF BLOB           INDEX BY BINARY_INTEGER;
type Clob_Table     IS TABLE OF CLOB           INDEX BY BINARY_INTEGER;
type Bfile_Table    IS TABLE OF BFILE          INDEX BY BINARY_INTEGER;
type Urowid_Table   IS TABLE OF UROWID         INDEX BY BINARY_INTEGER;
```

Syntax

```
DBMS_SQL.BIND_ARRAY (
   c                  IN INTEGER,
   name               IN VARCHAR2,
   <table_variable>   IN <datatype>
 [,index1             IN INTEGER,
   index2             IN INTEGER)] );
```

Where the <table_variable> and its corresponding <datatype> can be any one of the following matching pairs:

```
<num_tab>      Number_Table
<vchr2_tab>    Varchar2_Table
<date_tab>     Date_Table
<blob_tab>     Blob_Table
<clob_tab>     Clob_Table
<bfile_tab>    Bfile_Table
<urowid_tab>   Urowid_Table
```

Notice that the BIND_ARRAY procedure is overloaded to accept different datatypes.

Parameters

Table 62–4 BIND_ARRAY Procedure Parameters

Parameter	Description
c	ID number of the cursor to which you want to bind a value.
name	Name of the collection in the statement.
table_variable	Local variable that has been declared as <datatype>.
index1	Index for the table element that marks the lower bound of the range.
index2	Index for the table element that marks the upper bound of the range.

Usage Notes

For binding a range, the table must contain the elements that specify the range — tab(index1) and tab(index2) — but the range does not have to be dense. Index1 must be less than or equal to index2. All elements between tab(index1) and tab(index2) are used in the bind.

If you do not specify indexes in the bind call, and two different binds in a statement specify tables that contain a different number of elements, then the number of elements actually used is the minimum number between all tables. This is also the case if you specify indexes — the minimum range is selected between the two indexes for all tables.

Not all bind variables in a query have to be array binds. Some can be regular binds and the same value are used for each element of the collections in expression evaluations (and so forth).

> **See Also:** "Examples 3, 4, and 5: Bulk DML" on page 62-12 for examples of how to bind collections.

DEFINE_COLUMN Procedure

This procedure defines a column to be selected from the given cursor. This procedure is only used with SELECT cursors.

The column being defined is identified by its relative position in the SELECT list of the statement in the given cursor. The type of the COLUMN value determines the type of the column being defined.

Syntax

```
DBMS_SQL.DEFINE_COLUMN (
   c              IN INTEGER,
   position       IN INTEGER,
   column         IN <datatype>)
```

Where <datatype> can be any one of the following types:

```
NUMBER
DATE
BLOB
CLOB CHARACTER SET ANY_CS
BFILE
UROWID
```

Notice that DEFINE_COLUMN is overloaded to accept different datatypes.

> **See Also:** *Oracle9i Application Developer's Guide - Large Objects (LOBs)*

Pragmas

```
pragma restrict_references(define_column,RNDS,WNDS);
```

The following syntax is also supported for the DEFINE_COLUMN procedure:

```
DBMS_SQL.DEFINE_COLUMN (
   c              IN INTEGER,
   position       IN INTEGER,
   column         IN VARCHAR2 CHARACTER SET ANY_CS,
   column_size    IN INTEGER),
   urowid         IN INTEGER;
```

To define columns with CHAR, RAW, and ROWID data, you can use the following variations on the procedure syntax:

```
DBMS_SQL.DEFINE_COLUMN_CHAR (
   c              IN INTEGER,
   position       IN INTEGER,
   column         IN CHAR CHARACTER SET ANY_CS,
   column_size    IN INTEGER);

DBMS_SQL.DEFINE_COLUMN_RAW (
   c              IN INTEGER,
   position       IN INTEGER,
```

```
   column         IN RAW,
   column_size    IN INTEGER);

DBMS_SQL.DEFINE_COLUMN_ROWID (
   c              IN INTEGER,
   position       IN INTEGER,
   column         IN ROWID);
```

Parameters

Table 62–5 DEFINE_COLUMN Procedure Parameters

Parameter	Description
c	ID number of the cursor for the row being defined to be selected.
position	Relative position of the column in the row being defined. The first column in a statement has position 1.
column	Value of the column being defined. The type of this value determines the type for the column being defined.
column_size	Maximum expected size of the column value, in bytes, for columns of type VARCHAR2, CHAR, and RAW.

DEFINE_ARRAY Procedure

This procedure defines the collection for column into which you want to fetch rows (with a FETCH_ROWS call). This procedure lets you do batch fetching of rows from a single SELECT statement. A single fetch call brings over a number of rows into the PL/SQL aggregate object.

When you fetch the rows, they are copied into DBMS_SQL buffers until you run a COLUMN_VALUE call, at which time the rows are copied into the table that was passed as an argument to the COLUMN_VALUE call.

Scalar and LOB Types for Collections

You can declare a local variable as one of the following table-item types, and then fetch any number of rows into it using DBMS_SQL. (These are the same types as you can specify for the BIND_ARRAY procedure.)

```
type Number_Table   IS TABLE OF NUMBER         INDEX BY BINARY_INTEGER;
type Varchar2_Table IS TABLE OF VARCHAR2(2000) INDEX BY BINARY_INTEGER;
type Date_Table     IS TABLE OF DATE           INDEX BY BINARY_INTEGER;
```

```
type Blob_Table     IS TABLE OF BLOB          INDEX BY BINARY_INTEGER;
type Clob_Table     IS TABLE OF CLOB          INDEX BY BINARY_INTEGER;
type Bfile_Table    IS TABLE OF BFILE         INDEX BY BINARY_INTEGER;
type Urowid_Table   IS TABLE OF UROWID        INDEX BY BINARY_INTEGER;
```

Syntax

```
DBMS_SQL.DEFINE_ARRAY (
   c           IN INTEGER,
   position    IN INTEGER,
   bf_tab      IN Bfile_Table,
   cnt         IN INTEGER,
   lower_bound IN INTEGER);
```

Pragmas

```
pragma restrict_references(define_array,RNDS,WNDS);
```

The subsequent FETCH_ROWS call fetch "count" rows. When the COLUMN_VALUE call is made, these rows are placed in positions indx, indx+1, indx+2, and so on. While there are still rows coming, the user keeps issuing FETCH_ROWS/COLUMN_VALUE calls. The rows keep accumulating in the table specified as an argument in the COLUMN_VALUE call.

Parameters

Table 62–6 DEFINE_ARRAY Procedure Parameters

Parameter	Description
c	ID number of the cursor to which you want to bind an array.
position	Relative position of the column in the array being defined. The first column in a statement has position 1.
column	Type of the value being passed in for this parameter is the type of the column to be defined.
column_size	Maximum expected size of the value in bytes for the VARCHAR2 column.

The count has to be an integer greater than zero, otherwise an exception is raised. The indx can be positive, negative, or zero. A query on which a DEFINE_ARRAY call was issued cannot contain array binds.

See Also: "Examples 6 and 7: Defining an Array" on page 62-15 for examples of how to define collections.

DEFINE_COLUMN_LONG Procedure

This procedure defines a LONG column for a SELECT cursor. The column being defined is identified by its relative position in the SELECT list of the statement for the given cursor. The type of the COLUMN value determines the type of the column being defined.

Syntax

```
DBMS_SQL.DEFINE_COLUMN_LONG (
   c              IN INTEGER,
   position       IN INTEGER);
```

Parameters

Table 62–7 DEFINE_COLUMN_LONG Procedure Parameters

Parameter	Description
c	ID number of the cursor for the row being defined to be selected.
position	Relative position of the column in the row being defined. The first column in a statement has position 1.

EXECUTE Function

This function executes a given cursor. This function accepts the ID number of the cursor and returns the number of rows processed. The return value is only valid for INSERT, UPDATE, and DELETE statements; for other types of statements, including DDL, the return value is undefined and should be ignored.

Syntax

```
DBMS_SQL.EXECUTE (
   c   IN INTEGER)
  RETURN INTEGER;
```

Parameters

Table 62–8 EXECUTE Function Parameters

Parameter	Description
c	Cursor ID number of the cursor to execute.

EXECUTE_AND_FETCH Function

This function executes the given cursor and fetches rows. This function provides the same functionality as calling EXECUTE and then calling FETCH_ROWS. Calling EXECUTE_AND_FETCH instead, however, may reduce the number of network round-trips when used against a remote database.

The EXECUTE_AND_FETCH function returns the number of rows actually fetched.

Syntax

```
DBMS_SQL.EXECUTE_AND_FETCH (
   c              IN INTEGER,
   exact          IN BOOLEAN DEFAULT FALSE)
  RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(execute_and_fetch,WNDS);
```

Parameters

Table 62–9 EXECUTE_AND_FETCH Function Parameters

Parameter	Description
c	ID number of the cursor to execute and fetch.
exact	Set to TRUE to raise an exception if the number of rows actually matching the query differs from one. Note: Oracle does not support the exact fetch TRUE option with LONG columns. Even if an exception is raised, the rows are still fetched and available.

FETCH_ROWS Function

This function fetches a row from a given cursor. You can call FETCH_ROWS repeatedly as long as there are rows remaining to be fetched. These rows are retrieved into a buffer, and must be read by calling COLUMN_VALUE, for each column, after each call to FETCH_ROWS.

The FETCH_ROWS function accepts the ID number of the cursor to fetch, and returns the number of rows actually fetched.

Syntax

```
DBMS_SQL.FETCH_ROWS (
   c              IN INTEGER)
  RETURN INTEGER;
```

Parameters

Table 62–10 FETCH_ROWS Function Parameters

Parameter	Description
c	ID number.

Pragmas

```
pragma restrict_references(fetch_rows,WNDS);
```

COLUMN_VALUE Procedure

This procedure returns the value of the cursor element for a given position in a given cursor. This procedure is used to access the data fetched by calling FETCH_ROWS.

Syntax

```
DBMS_SQL.COLUMN_VALUE (
   c                IN  INTEGER,
   position         IN  INTEGER,
   value            OUT <datatype>
 [,column_error     OUT NUMBER]
 [,actual_length    OUT INTEGER]);
```

Where <datatype> can be any one of the following types:

```
NUMBER
```

```
DATE
VARCHAR2 CHARACTER SET ANY_CS
BLOB
CLOB CHARACTER SET ANY_CS
BFILE
UROWID
```

Note: The square brackets [ ] indicate optional parameters.

See Also: *Oracle9i Application Developer's Guide - Large Objects (LOBs)*

Pragmas

```
pragma restrict_references(column_value,RNDS,WNDS);
```

The following syntax is also supported for the COLUMN_VALUE procedure:

```
DBMS_SQL.COLUMN_VALUE(
   c                IN  INTEGER,
   position         IN  INTEGER,
   <table_variable> IN  <datatype>);
```

Where the <table_variable> and its corresponding <datatype> can be any one of these matching pairs:

```
<num_tab>      Number_Table
<vchr2_tab>    Varchar2_Table
<date_tab>     Date_Table
<blob_tab>     Blob_Table
<clob_tab>     Clob_Table
<bfile_tab>    Bfile_Table
<urowid_tab>   Urowid_Table
```

For columns containing CHAR, RAW, and ROWID data, you can use the following variations on the syntax:

```
DBMS_SQL.COLUMN_VALUE_CHAR (
   c               IN  INTEGER,
   position        IN  INTEGER,
   value           OUT CHAR CHARACTER SET ANY_CS
 [,column_error    OUT NUMBER]
 [,actual_length   OUT INTEGER]);
```

```
DBMS_SQL.COLUMN_VALUE_RAW (
   c               IN  INTEGER,
   position        IN  INTEGER,
   value           OUT RAW
 [,column_error    OUT NUMBER]
 [,actual_length   OUT INTEGER]);

DBMS_SQL.COLUMN_VALUE_ROWID (
   c               IN  INTEGER,
   position        IN  INTEGER,
   value           OUT ROWID
 [,column_error    OUT NUMBER]
 [,actual_length   OUT INTEGER]);
```

Parameters

Table 62–11 COLUMN_VALUE Procedure Parameters

Parameter	Description
c	ID number of the cursor from which you are fetching the values.
position	Relative position of the column in the cursor. The first column in a statement has position 1.
value	Returns the value at the specified column and row. If the row number specified is greater than the total number of rows fetched, then you receive an error message. Oracle raises exception ORA-06562, inconsistent_type, if the type of this output parameter differs from the actual type of the value, as defined by the call to DEFINE_COLUMN.
table_variable	Local variable that has been declared <datatype>.
column_error	Returns any error code for the specified column value.
actual_length	The actual length, before any truncation, of the value in the specified column.

Exceptions:

inconsistent_type (ORA-06562) is raised if the type of the given OUT parameter value is different from the actual type of the value. This type was the given type when the column was defined by calling procedure DEFINE_COLUMN.

COLUMN_VALUE_LONG Procedure

This procedure gets part of the value of a long column.

Syntax

```
DBMS_SQL.COLUMN_VALUE_LONG (
   c            IN  INTEGER,
   position     IN  INTEGER,
   length       IN  INTEGER,
   offset       IN  INTEGER,
   value        OUT VARCHAR2,
   value_length OUT INTEGER);
```

Pragmas

```
pragma restrict_references(column_value_long,RNDS,WNDS);
```

Parameters

Table 62–12 COLUMN_VALUE_LONG Procedure Parameters

Parameter	Description
c	Cursor ID number of the cursor from which to get the value.
position	Position of the column of which to get the value.
length	Number of bytes of the long value to fetch.
offset	Offset into the long field for start of fetch.
value	Value of the column as a VARCHAR2.
value_length	Number of bytes actually returned in value.

VARIABLE_VALUE Procedure

This procedure returns the value of the named variable for a given cursor. It is used to return the values of bind variables inside PL/SQL blocks or DML statements with `returning` clause.

Syntax

```
DBMS_SQL.VARIABLE_VALUE (
   c               IN  INTEGER,
   name            IN  VARCHAR2,
   value           OUT <datatype>);
```

Where <datatype> can be any one of the following types:

```
NUMBER
DATE
VARCHAR2 CHARACTER SET ANY_CS
BLOB
CLOB CHARACTER SET ANY_CS
BFILE
UROWID
```

Pragmas

```
pragma restrict_references(variable_value,RNDS,WNDS);
```

The following syntax is also supported for the VARIABLE_VALUE procedure:

```
DBMS_SQL.VARIABLE_VALUE (
   c                IN  INTEGER,
   name             IN  VARCHAR2,
   <table_variable>  IN  <datatype>);
```

Where the <table_variable> and its corresponding <datatype> can be any one of these matching pairs:

```
<num_tab>      Number_Table
<vchr2_tab>    Varchar2_Table
<date_tab>     Date_Table
<blob_tab>     Blob_Table
<clob_tab>     Clob_Table
<bfile_tab>    Bfile_Table
<urowid_tab>   Urowid_Table
```

For variables containing CHAR, RAW, and ROWID data, you can use the following variations on the syntax:

```
DBMS_SQL.VARIABLE_VALUE_CHAR (
   c               IN  INTEGER,
   name            IN  VARCHAR2,
   value           OUT CHAR CHARACTER SET ANY_CS);

DBMS_SQL.VARIABLE_VALUE_RAW (
   c               IN  INTEGER,
   name            IN  VARCHAR2,
   value           OUT RAW);
```

```
DBMS_SQL.VARIABLE_VALUE_ROWID (
   c               IN  INTEGER,
   name            IN  VARCHAR2,
   value           OUT ROWID);
```

Parameters

Table 62–13 VARIABLE_VALUE Procedure Parameters

Parameter	Description
c	ID number of the cursor from which to get the values.
name	Name of the variable for which you are retrieving the value.
value	Returns the value of the variable for the specified position.
	Oracle raises exception ORA-06562, inconsistent_type, if the type of this output parameter differs from the actual type of the value, as defined by the call to BIND_VARIABLE.
position	Relative position of the column in the cursor.
	The first column in a statement has position 1.

IS_OPEN Function

This function checks to see if the given cursor is currently open.

Syntax

```
DBMS_SQL.IS_OPEN (
   c              IN INTEGER)
  RETURN BOOLEAN;
```

Pragmas

```
pragma restrict_references(is_open,RNDS,WNDS);
```

Parameters

Table 62–14 IS_OPEN Function Parameters

Parameter	Description
c	Cursor ID number of the cursor to check.

Returns

Table 62–15 IS_OPEN Function Return Values

Return Value	Description
TRUE	Given cursor is currently open.
FALSE	Given cursor is currently not open.

DESCRIBE_COLUMNS Procedure

This procedure describes the columns for a cursor opened and parsed through DBMS_SQL.

The DESC_REC Type

The DBMS_SQL package declares the DESC_REC record type as follows:

```
type desc_rec is record (
   col_type            BINARY_INTEGER := 0,
   col_max_len         BINARY_INTEGER := 0,
   col_name            VARCHAR2(32)   := '',
   col_name_len        BINARY_INTEGER := 0,
   col_schema_name     VARCHAR2(32)   := '',
   col_schema_name_len BINARY_INTEGER := 0,
   col_precision       BINARY_INTEGER := 0,
   col_scale           BINARY_INTEGER := 0,
   col_charsetid       BINARY_INTEGER := 0,
   col_charsetform     BINARY_INTEGER := 0,
   col_null_ok         BOOLEAN        := TRUE);
```

Parameters

Table 62–16 DESC_REC Type Parameters

Parameter	Description
col_type	Type of the column being described.
col_max_len	Maximum length of the column.
col_name	Name of the column.
col_name_len	Length of the column name.
col_schema_name	Name of the schema the column type was defined in, if an object type.
col_schema_name_len	Length of the schema.
col_precision	Column precision, if a number.
col_scale	Column scale, if a number.
col_charsetid	Column character set identifier.
col_charsetform	Column character set form.
col_null_ok	True if column can be null.

The DESC_TAB Type

The DESC_TAB type is a PL/SQL table of DESC_REC records:

```
type desc_tab is table of desc_rec index by BINARY_INTEGER;
```

You can declare a local variable as the PL/SQL table type DESC_TAB, and then call the DESCRIBE_COLUMNS procedure to fill in the table with the description of each column. All columns are described; you cannot describe a single column.

Syntax

```
DBMS_SQL.DESCRIBE_COLUMNS (
   c             IN  INTEGER,
   col_cnt       OUT INTEGER,
   desc_t        OUT DESC_TAB);
```

Parameters

Table 62–17 DBMS_SQL.DESCRIBE_COLUMNS Procedure Parameters

Parameter	Description
c	ID number of the cursor for the columns being described.
col_cnt	Number of columns in the select list of the query.
desc_t	Table of DESC_REC, each DESC_REC describing a column in the query.

See Also: "Example 8: Describe Columns" on page 62-17 illustrates how to use DESCRIBE_COLUMNS.

CLOSE_CURSOR Procedure

This procedure closes a given cursor.

Syntax

```
DBMS_SQL.CLOSE_CURSOR (
   c    IN OUT INTEGER);
```

Pragmas

```
pragma restrict_references(close_cursor,RNDS,WNDS);
```

Parameters

Table 62–18 CLOSE_CURSOR Procedure Parameters

Parameter	Mode	Description
c	IN	ID number of the cursor that you want to close.
c	OUT	Cursor is set to null. After you call CLOSE_CURSOR, the memory allocated to the cursor is released and you can no longer fetch from that cursor.

LAST_ERROR_POSITION Function

This function returns the byte offset in the SQL statement text where the error occurred. The first character in the SQL statement is at position 0.

Syntax

```
DBMS_SQL.LAST_ERROR_POSITION
   RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(last_error_position,RNDS,WNDS);
```

Usage Notes

Call this function after a PARSE call, before any other DBMS_SQL procedures or functions are called.

LAST_ROW_COUNT Function

This function returns the cumulative count of the number of rows fetched.

Syntax

```
DBMS_SQL.LAST_ROW_COUNT
   RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(last_row_count,RNDS,WNDS);
```

Usage Notes

Call this function after a FETCH_ROWS or an EXECUTE_AND_FETCH call. If called after an EXECUTE call, then the value returned is zero.

LAST_ROW_ID Function

This function returns the ROWID of the last row processed.

Syntax

```
DBMS_SQL.LAST_ROW_ID
   RETURN ROWID;
```

Pragmas

```
pragma restrict_references(last_row_id,RNDS,WNDS);
```

Usage Notes

Call this function after a FETCH_ROWS or an EXECUTE_AND_FETCH call.

LAST_SQL_FUNCTION_CODE Function

This function returns the SQL function code for the statement. These codes are listed in the *Oracle Call Interface Programmer's Guide*.

Syntax

```
DBMS_SQL.LAST_SQL_FUNCTION_CODE
   RETURN INTEGER;
```

Pragmas

```
pragma restrict_references(last_sql_function_code,RNDS,WNDS);
```

Usage Notes

You should call this function immediately after the SQL statement is run; otherwise, the return value is undefined.

63

DBMS_STATS

DBMS_STATS provides a mechanism for you to view and modify optimizer statistics gathered for database objects. The statistics can reside in the dictionary or in a table created in the user's schema for this purpose. Only statistics stored in the dictionary have an impact on the cost-based optimizer. You can also use DBMS_STATS to gather statistics in parallel.

This chapter contains the following topics:

Using DBMS_STATS

The DBMS_STATS subprograms perform the following general functions:

- PREPARE_COLUMN_VALUES Procedure
- Transferring Statistics
- Gathering Optimizer Statistics

Most of the DBMS_STATS procedures include the three parameters statown, stattab, and statid. These parameters allow you to store statistics in your own tables (outside of the dictionary), which does not affect the optimizer. Therefore, you can maintain and experiment with *sets* of statistics.

The stattab parameter specifies the name of a table in which to hold statistics, and it is assumed that it resides in the same schema as the object for which statistics are collected (unless the statown parameter is specified). Users may create multiple tables with different stattab identifiers to hold separate sets of statistics.

Additionally, users can maintain different sets of statistics within a single stattab by using the statid parameter, which can help avoid cluttering the user's schema.

For all of the SET or GET procedures, if stattab is not provided (i.e., NULL), then the operation works directly on the dictionary statistics; therefore, users do not need to create these statistics tables if they only plan to modify the dictionary directly. However, if stattab is not NULL, then the SET or GET operation works on the specified user statistics table, and not the dictionary.

Most of the procedures in this package commit the current transaction, perform the operation, and then commit again. These include:

- SET_*
- DELETE_*
- EXPORT_*
- IMPORT_*
- GATHER_*
- *_STAT_TABLE

Types

Types for minimum / maximum values and histogram endpoints:

```
TYPE numarray  IS VARRAY(256) OF NUMBER;
TYPE datearray IS VARRAY(256) OF DATE;
```

```
TYPE chararray IS VARRAY(256) OF VARCHAR2(4000);
TYPE rawarray  IS VARRAY(256) OF RAW(2000);

type StatRec is record (
  epc    NUMBER,
  minval RAW(2000),
  maxval RAW(2000),
  bkvals NUMARRAY,
  novals NUMARRAY);
```

Types for listing stale tables:

```
type ObjectElem is record (
  ownname     VARCHAR2(30),     -- owner
  objtype     VARCHAR2(6),      -- 'TABLE' or 'INDEX'
  objname     VARCHAR2(30),     -- table/index
  partname    VARCHAR2(30),     -- partition
  subpartname VARCHAR2(30),     -- subpartition
  confidence  NUMBER);          -- not used
type ObjectTab is TABLE of ObjectElem;
```

The constant used to indicate that auto-sample size algorithms should be used is:

```
AUTO_SAMPLE_SIZE CONSTANT NUMBER;
```

The constant used to determine the system default degree of parallelism, based on the initialization parameters, is:

```
DEFAULT_DEGREE CONSTANT NUMBER;
```

Setting or Getting Statistics

The following procedures enable the storage and retrieval of individual column-, index-, and table-related statistics:

```
PREPARE_COLUMN_VALUES
SET_COLUMN_STATS
SET_INDEX_STATS
SET_SYSTEM_STATS
SET_TABLE_STATS

CONVERT_RAW_VALUE
GET_COLUMN_STATS
GET_INDEX_STATS
GET_SYSTEM_STATS
```

```
GET_TABLE_STATS

DELETE_COLUMN_STATS
DELETE_INDEX_STATS
DELETE_SYSTEM_STATS
DELETE_TABLE_STATS
DELETE_SCHEMA_STATS
DELETE_DATABASE_STATS
```

Gathering Optimizer Statistics

The following procedures enable the gathering of certain classes of optimizer statistics, with possible performance improvements over the ANALYZE command:

```
GATHER_INDEX_STATS
GATHER_TABLE_STATS
GATHER_SCHEMA_STATS
GATHER_DATABASE_STATS
GATHER_SYSTEM_STATS
```

The `statown`, `stattab`, and `statid` parameters instruct the package to backup current statistics in the specified table before gathering new statistics.

Oracle also provides the following procedure for generating some statistics for derived objects when we have sufficient statistics on related objects:

```
GENERATE_STATS
```

Transferring Statistics

The following procedures enable the transference of statistics from the dictionary to a user stat table (`export_*`) and from a user stat table to the dictionary (`import_*`):

```
CREATE_STAT_TABLE
DROP_STAT_TABLE

EXPORT_COLUMN_STATS
EXPORT_INDEX_STATS
EXPORT_SYSTEM_STATS
EXPORT_TABLE_STATS
EXPORT_SCHEMA_STATS
EXPORT_DATABASE_STATS

IMPORT_COLUMN_STATS
IMPORT_INDEX_STATS
```

IMPORT_SYSTEM_STATS
IMPORT_TABLE_STATS
IMPORT_SCHEMA_STATS
IMPORT_DATABASE_STATS

Summary of DBMS_STATS Subprograms

Table 63–1 DBMS_STATS Subprograms

Subprogram	Description
"PREPARE_COLUMN_VALUES Procedure" on page 63-7	Converts user-specified minimum, maximum, and histogram endpoint datatype-specific values into Oracle's internal representation for future storage via SET_COLUMN_STATS.
"SET_COLUMN_STATS Procedure" on page 63-10	Sets column-related information.
"SET_INDEX_STATS Procedure" on page 63-11	Sets index-related information.
"SET_SYSTEM_STATS Procedure" on page 63-13	Sets system statistics.
"SET_TABLE_STATS Procedure" on page 63-14	Sets table-related information.
"CONVERT_RAW_VALUE Procedure" on page 63-15	Convert the internal representation of a minimum or maximum value into a datatype-specific value.
"GET_COLUMN_STATS Procedure" on page 63-16	Gets all column-related information.
"GET_INDEX_STATS Procedure" on page 63-17	Gets all index-related information.
"GET_SYSTEM_STATS Procedure" on page 63-19	Gets system statistics from stattab, or from the dictionary if stattab is null.
"GET_TABLE_STATS Procedure" on page 63-20	Gets all table-related information.
"DELETE_COLUMN_STATS Procedure" on page 63-21	Deletes column-related statistics.
"DELETE_INDEX_STATS Procedure" on page 63-22	Deletes index-related statistics.
"DELETE_SYSTEM_STATS Procedure" on page 63-23	Deletes system statistics.

Table 63–1 DBMS_STATS Subprograms

Subprogram	Description
"DELETE_TABLE_STATS Procedure" on page 63-24	Deletes table-related statistics.
"DELETE_SCHEMA_STATS Procedure" on page 63-25	Deletes schema-related statistics.
"DELETE_DATABASE_STATS Procedure" on page 63-26	Deletes statistics for the entire database.
"CREATE_STAT_TABLE Procedure" on page 63-27	Creates a table with name `stattab` in ownname's schema which is capable of holding statistics.
"DROP_STAT_TABLE Procedure" on page 63-28	Drops a user stat table created by CREATE_STAT_TABLE.
"EXPORT_COLUMN_STATS Procedure" on page 63-28	Retrieves statistics for a particular column and stores them in the user stat table identified by `stattab`.
"EXPORT_INDEX_STATS Procedure" on page 63-29	Retrieves statistics for a particular index and stores them in the user stat table identified by `stattab`.
"EXPORT_SYSTEM_STATS Procedure" on page 63-30	Retrieves system statistics and stores them in the user stat table.
"EXPORT_TABLE_STATS Procedure" on page 63-31	Retrieves statistics for a particular table and stores them in the user stat table.
"EXPORT_SCHEMA_STATS Procedure" on page 63-32	Retrieves statistics for all objects in the schema identified by ownname and stores them in the user stat table identified by `stattab`.
"EXPORT_DATABASE_STATS Procedure" on page 63-33	Retrieves statistics for all objects in the database and stores them in the user stat table identified by `statown.stattab`.
"IMPORT_COLUMN_STATS Procedure" on page 63-33	Retrieves statistics for a particular column from the user stat table identified by `stattab` and stores them in the dictionary.
"IMPORT_INDEX_STATS Procedure" on page 63-34	Retrieves statistics for a particular index from the user stat table identified by `stattab` and stores them in the dictionary.
"IMPORT_SYSTEM_STATS Procedure" on page 63-35	Retrieves system statistics from the user stat table and stores them in the dictionary
"IMPORT_TABLE_STATS Procedure" on page 63-36	Retrieves statistics for a particular table from the user stat table identified by `stattab` and stores them in the dictionary.

Table 63–1 DBMS_STATS Subprograms

Subprogram	Description
"IMPORT_SCHEMA_STATS Procedure" on page 63-37	Retrieves statistics for all objects in the schema identified by ownname from the user stat table and stores them in the dictionary.
"IMPORT_DATABASE_STATS Procedure" on page 63-38	Retrieves statistics for all objects in the database from the user stat table and stores them in the dictionary.
"GATHER_INDEX_STATS Procedure" on page 63-39	Gathers index statistics.
"GATHER_TABLE_STATS Procedure" on page 63-40	Gathers table and column (and index) statistics.
"GATHER_SCHEMA_STATS Procedure" on page 63-42	Gathers statistics for all objects in a schema.
"GATHER_DATABASE_STATS Procedure" on page 63-44	Gathers statistics for all objects in the database.
"GATHER_SYSTEM_STATS Procedure" on page 63-47	Gathers system statistics.
"GENERATE_STATS Procedure" on page 63-47	Generates object statistics from previously collected statistics of related objects.
"FLUSH_SCHEMA_MONITORING_INFO Procedure" on page 63-51	Flushes in-memory monitoring information for the tables in the specified schema in the dictionary.
"FLUSH_DATABASE_MONITORING_INFO Procedure" on page 63-51	Flushes in-memory monitoring information for all the tables to the dictionary.
"ALTER_SCHEMA_TABLE_MONITORING Procedure" on page 63-52	Enables or disables the DML monitoring feature of all the tables in the schema, except for snapshot logs and the tables, which monitoring does not support.
"ALTER_DATABASE_TABLE_MONITORING Procedure" on page 63-52	Enables or disables the S‘DML monitoring feature of all the tables in the database, except for snapshot logs and the tables, which monitoring does not support.

PREPARE_COLUMN_VALUES Procedure

This procedure converts user-specified minimum, maximum, and histogram endpoint datatype-specific values into Oracle’s internal representation for future storage via SET_COLUMN_STATS.

Syntax

```
DBMS_STATS.PREPARE_COLUMN_VALUES (
   srec     IN OUT StatRec,
   charvals        CHARARRAY);

DBMS_STATS.PREPARE_COLUMN_VALUES (
   srec      IN OUT StatRec,
   datevals         DATEARRAY);

DBMS_STATS.PREPARE_COLUMN_VALUES (
   srec     IN OUT StatRec,
   numvals         NUMARRAY);

DBMS_STATS.PREPARE_COLUMN_VALUES (
   srec     IN OUT StatRec,
   rawvals         RAWARRAY);

DBMS_STATS.PREPARE_COLUMN_VALUES_NVARCHAR (
   srec  IN OUT StatRec,
   nvmin        NVARCHAR2,
   nvmax        NVARCHAR2);

DBMS_STATS.PREPARE_COLUMN_VALUES_ROWID (
   srec  IN OUT StatRec,
   rwmin        ROWID,
   rwmax        ROWID);
```

Pragmas

```
pragma restrict_references(prepare_column_values, WNDS, RNDS, WNPS, RNPS);
pragma restrict_references(prepare_column_values_nvarchar, WNDS, RNDS, WNPS,
RNPS);
pragma restrict_references(prepare_column_values_rowid, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 63–2 PREPARE_COLUMN_VALUES Procedure Parameters

Parameter	Description
srec.epc	Number of values specified in charvals, datevals, numvals, or rawvals. This value must be between 2 and 256, inclusive, and it should be set to 2 for procedures which do not allow histogram information (nvarchar and rowid). The first corresponding array entry should hold the minimum value for the column, and the last entry should hold the maximum. If there are more than two entries, then all the others hold the remaining height-balanced or frequency histogram endpoint values (with in-between values ordered from next-smallest to next-largest). This value may be adjusted to account for compression, so the returned value should be left as is for a call to SET_COLUMN_STATS.
srec.bkvals	If you want a frequency distribution, then this array contains the number of occurrences of each distinct value specified in charvals, datevals, numvals, or rawvals. Otherwise, it is merely an output parameter, and it must be set to NULL when this procedure is called.

Datatype specific input parameters (one of the following):

charvals	The array of values when the column type is character-based. Up to the first 32 bytes of each string should be provided. Arrays must have between 2 and 256 entries, inclusive. If the datatype is fixed CHAR, the strings must be space-padded to 15 characters for correct normalization.
datevals	The array of values when the column type is date-based.
numvals	The array of values when the column type is numeric-based.
rawvals	The array of values when the column type is RAW. Up to the first 32 bytes of each strings should be provided.
nvmin, nvmax	The minimum and maximum values when the column type is national character set based (NLS). No histogram information can be provided for a column of this type. If the datatype is fixed CHAR, the strings must be space-padded to 15 characters for correct normalization.

rwmin, rwmax	The minimum and maximum values when the column type is rowid. No histogram information can be provided for a column of this type.

Output parameters

Table 63–3 PREPARE_COLUMN_VALUES Procedure Output Parameters

Parameter	Description
srec.minval	Internal representation of the minimum which is suitable for use in a call to SET_COLUMN_STATS.
srec.maxval	Internal representation of the maximum which is suitable for use in a call to SET_COLUMN_STATS.
srec.bkvals	Array suitable for use in a call to SET_COLUMN_STATS.
srec.novals	Array suitable for use in a call to SET_COLUMN_STATS.

Exceptions

ORA-20001: Invalid or inconsistent input values.

SET_COLUMN_STATS Procedure

This procedure sets column-related information.

Syntax

```
DBMS_STATS.SET_COLUMN_STATS (
   ownname  VARCHAR2,
   tabname  VARCHAR2,
   colname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2 DEFAULT NULL,
   statid   VARCHAR2 DEFAULT NULL,
   distcnt  NUMBER   DEFAULT NULL,
   density  NUMBER   DEFAULT NULL,
   nullcnt  NUMBER   DEFAULT NULL,
   srec     StatRec  DEFAULT NULL,
   avgclen  NUMBER   DEFAULT NULL,
   flags    NUMBER   DEFAULT NULL,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–4 SET_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
colname	Name of the column.
partname	Name of the table partition in which to store the statistics. If the table is partitioned and partname is NULL, then the statistics are stored at the global table level.
stattab	User stat table identifier describing where to store the statistics. If stattab is NULL, then the statistics are stored directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
distcnt	Number of distinct values.
density	Column density. If this value is NULL and if distcnt is not NULL, then density is derived from distcnt.
nullcnt	Number of NULLs.
srec	StatRec structure filled in by a call to PREPARE_COLUMN_VALUES or GET_COLUMN_STATS.
avgclen	Average length for the column (in bytes).
flags	For internal Oracle use (should be left as NULL).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent input values.

SET_INDEX_STATS Procedure

This procedure sets index-related information.

Syntax

```
DBMS_STATS.SET_INDEX_STATS (
```

```
   ownname  VARCHAR2,
   indname  VARCHAR2,
   partname VARCHAR2  DEFAULT NULL,
   stattab  VARCHAR2  DEFAULT NULL,
   statid   VARCHAR2  DEFAULT NULL,
   numrows  NUMBER    DEFAULT NULL,
   numlblks NUMBER    DEFAULT NULL,
   numdist  NUMBER    DEFAULT NULL,
   avglblk  NUMBER    DEFAULT NULL,
   avgdblk  NUMBER    DEFAULT NULL,
   clstfct  NUMBER    DEFAULT NULL,
   indlevel NUMBER    DEFAULT NULL,
   flags    NUMBER    DEFAULT NULL,
   statown  VARCHAR2  DEFAULT NULL);
```

Parameters

Table 63–5 SET_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
indname	Name of the index.
partname	Name of the index partition in which to store the statistics. If the index is partitioned and if partname is NULL, then the statistics are stored at the global index level.
stattab	User stat table identifier describing where to store the statistics. If stattab is NULL, then the statistics are stored directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
numrows	Number of rows in the index (partition).
numlblks	Number of leaf blocks in the index (partition).
numdist	Number of distinct keys in the index (partition).
avglblk	Average integral number of leaf blocks in which each distinct key appears for this index (partition). If not provided, then this value is derived from numlblks and numdist.
avgdblk	Average integral number of data blocks in the table pointed to by a distinct key for this index (partition). If not provided, then this value is derived from clstfct and numdist.

Table 63–5 SET_INDEX_STATS Procedure Parameters

Parameter	Description
clstfct	See clustering_factor column of the user_indexes view for a description.
indlevel	Height of the index (partition).
flags	For internal Oracle use (should be left as NULL).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid input value.

SET_SYSTEM_STATS Procedure

This procedure sets systems statistics.

Syntax

```
DBMS_STATS.SET_SYSTEM_STATS (
   pname          VARCHAR2,
   pvalue         NUMBER,
   stattab   IN   VARCHAR2 DEFAULT NULL,
   statid    IN   VARCHAR2 DEFAULT NULL,
   statown   IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–6 SET_SYSTEM_STATS Procedure Parameters

Parameter	Description
pname	Parameter name to get, which, which can have one of the following values: sreadtim (wait time to read single block, in milliseconds); mreadtim (wait time to read a multiblock, in milliseconds); cpuspeed (cycles per second, in millions).
pvalue	Parameter value to get
stattab	Identifier of the user stat table where the statistics will be obtained. If stattab is null, the statistics will be obtained from the dictionary.

Table 63–6 SET_SYSTEM_STATS Procedure Parameters

Parameter	Description
statid	Optional identifier associated with the statistics saved in the stattab.
statown	The schema containing stattab, if different from the user's schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid input value.

ORA-20002: Bad user statistics table; may need to be upgraded.

ORA-20003: Unable to set system statistics.

ORA-20004: Parameter does not exist.

SET_TABLE_STATS Procedure

This procedure sets table-related information.

Syntax

```
DBMS_STATS.SET_TABLE_STATS (
   ownname  VARCHAR2,
   tabname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2 DEFAULT NULL,
   statid   VARCHAR2 DEFAULT NULL,
   numrows  NUMBER   DEFAULT NULL,
   numblks  NUMBER   DEFAULT NULL,
   avgrlen  NUMBER   DEFAULT NULL,
   flags    NUMBER   DEFAULT NULL,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–7 SET_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.

Table 63–7 SET_TABLE_STATS Procedure Parameters

Parameter	Description
tabname	Name of the table.
partname	Name of the table partition in which to store the statistics. If the table is partitioned and partname is NULL, then the statistics are stored at the global table level.
stattab	User stat table identifier describing where to store the statistics. If stattab is NULL, then the statistics are stored directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
numrows	Number of rows in the table (partition).
numblks	Number of blocks the table (partition) occupies.
avgrlen	Average row length for the table (partition).
flags	For internal Oracle use (should be left as NULL).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid input value.

CONVERT_RAW_VALUE Procedure

This procedure converts the internal representation of a minimum or maximum value into a datatype-specific value. The minval and maxval fields of the StatRec structure as filled in by GET_COLUMN_STATS or PREPARE_COLUMN_VALUES are appropriate values for input.

Syntax

```
DBMS_STATS.CONVERT_RAW_VALUE (
   rawval     RAW,
   resval OUT VARCHAR2);

DBMS_STATS.CONVERT_RAW_VALUE (
   rawval     RAW,
   resval OUT DATE);
```

```
DBMS_STATS.CONVERT_RAW_VALUE (
   rawval     RAW,
   resval OUT NUMBER);

DBMS_STATS.CONVERT_RAW_VALUE_NVARCHAR (
   rawval     RAW,
   resval OUT NVARCHAR2);

DBMS_STATS.CONVERT_RAW_VALUE_ROWID (
   rawval     RAW,
   resval OUT ROWID);
```

Pragmas

```
pragma restrict_references(convert_raw_value, WNDS, RNDS, WNPS, RNPS);
pragma restrict_references(convert_raw_value_nvarchar, WNDS, RNDS, WNPS, RNPS);
pragma restrict_references(convert_raw_value_rowid, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 63–8 CONVERT_RAW_VALUE Procedure Parameters

Parameter	Description
rawval	The raw representation of a column minimum or maximum datatype-specific output parameters.
resval	The converted, type-specific value.

GET_COLUMN_STATS Procedure

This procedure gets all column-related information.

Syntax

```
DBMS_STATS.GET_COLUMN_STATS (
   ownname     VARCHAR2,
   tabname     VARCHAR2,
   colname     VARCHAR2,
   partname    VARCHAR2 DEFAULT NULL,
   stattab     VARCHAR2 DEFAULT NULL,
   statid      VARCHAR2 DEFAULT NULL,
   distcnt OUT NUMBER,
   density OUT NUMBER,
   nullcnt OUT NUMBER,
```

```
srec    OUT StatRec,
avgclen OUT NUMBER,
statown     VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–9 GET_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
colname	Name of the column.
partname	Name of the table partition from which to get the statistics. If the table is partitioned and if partname is NULL, then the statistics are retrieved from the global table level.
stattab	User stat table identifier describing from where to retrieve the statistics. If stattab is NULL, then the statistics are retrieved directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
distcnt	Number of distinct values.
density	Column density.
nullcnt	Number of NULLs.
srec	Structure holding internal representation of column minimum, maximum, and histogram values.
avgclen	Average length of the column (in bytes).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges or no statistics have been stored for requested object.

GET_INDEX_STATS Procedure

This procedure gets all index-related information.

Syntax

```
DBMS_STATS.GET_INDEX_STATS (
   ownname      VARCHAR2,
   indname      VARCHAR2,
   partname     VARCHAR2 DEFAULT NULL,
   stattab      VARCHAR2 DEFAULT NULL,
   statid       VARCHAR2 DEFAULT NULL,
   numrows  OUT NUMBER,
   numlblks OUT NUMBER,
   numdist  OUT NUMBER,
   avglblk  OUT NUMBER,
   avgdblk  OUT NUMBER,
   clstfct  OUT NUMBER,
   indlevel OUT NUMBER,
   statown      VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–10 GET_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
indname	Name of the index.
partname	Name of the index partition for which to get the statistics. If the index is partitioned and if `partname` is `NULL`, then the statistics are retrieved for the global index level.
stattab	User stat table identifier describing from where to retrieve the statistics. If `stattab` is `NULL`, then the statistics are retrieved directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within `stattab` (Only pertinent if `stattab` is not `NULL`).
numrows	Number of rows in the index (partition).
numlblks	Number of leaf blocks in the index (partition).
numdist	Number of distinct keys in the index (partition).
avglblk	Average integral number of leaf blocks in which each distinct key appears for this index (partition).
avgdblk	Average integral number of data blocks in the table pointed to by a distinct key for this index (partition).
clstfct	Clustering factor for the index (partition).

Table 63–10 GET_INDEX_STATS Procedure Parameters

Parameter	Description
indlevel	Height of the index (partition).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges or no statistics have been stored for requested object.

GET_SYSTEM_STATS Procedure

This procedure gets system statistics from stattab, or from the dictionary if stattab is null.

Syntax

```
DBMS_STATS.GET_SYSTEM_STATS (
   status    OUT  VARCHAR2,
   dstart    OUT  DATE,
   dstop     OUT  DATE,
   pname          VARCHAR2,
   pvalue    OUT  NUMBER,
   stattab   IN   VARCHAR2 DEFAULT NULL,
   statid    IN   VARCHAR2 DEFAULT NULL,
   statown   IN   VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–11 GET_SYSTEM_STATS Procedure Parameters

Parameter	Description
status (OUT)	Output is one of the following: COMPLETED: AUTOGATHERING: MANUALGATHERING: BADSTATS:
dstart (OUT)	Date when statistics gathering started. If status = MANUALGATHERING, the start date is returned.

Table 63–11 GET_SYSTEM_STATS Procedure Parameters

Parameter	Description
dstop (OUT)	Date when statistics gathering stopped. If status = COMPLETE, the finish date is returned. If status = AUTOGATHERING, the future finish date is returned. If status = BADSTATS, the had-to-be-finished-by date is returned.
pname	The parameter name to get, which can have one of the following values: sreadtim (wait time to read single block, in milliseconds); mreadtim (wait time to read a multiblock, in milliseconds); cpuspeed (cycles per second, in millions).
pvalue	The parameter value to get
stattab	Identifier of the user stat table where the statistics will be obtained. If stattab is null, the statistics will be obtained from the dictionary.
statid	Optional identifier associated with the statistics saved in the stattab.
statown	The schema containing stattab, if different from the user's schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20002: Bad user statistics table; may need to be upgraded.

ORA-20003: Unable to gather system statistics.

ORA-20004: Parameter does not exist.

GET_TABLE_STATS Procedure

This procedure gets all table-related information.

Syntax

```
DBMS_STATS.GET_TABLE_STATS (
   ownname     VARCHAR2,
   tabname     VARCHAR2,
   partname    VARCHAR2 DEFAULT NULL,
   stattab     VARCHAR2 DEFAULT NULL,
```

```
   statid      VARCHAR2 DEFAULT NULL,
   numrows OUT NUMBER,
   numblks OUT NUMBER,
   avgrlen OUT NUMBER,
   statown     VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–12 GET_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
partname	Name of the table partition from which to get the statistics. If the table is partitioned and if partname is NULL, then the statistics are retrieved from the global table level.
stattab	User stat table identifier describing from where to retrieve the statistics. If stattab is NULL, then the statistics are retrieved directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
numrows	Number of rows in the table (partition).
numblks	Number of blocks the table (partition) occupies.
avgrlen	Average row length for the table (partition).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges or no statistics have been stored for requested object

DELETE_COLUMN_STATS Procedure

This procedure deletes column-related statistics.

Syntax

```
DBMS_STATS.DELETE_COLUMN_STATS (
   ownname       VARCHAR2,
   tabname       VARCHAR2,
```

```
   colname       VARCHAR2,
   partname      VARCHAR2 DEFAULT NULL,
   stattab       VARCHAR2 DEFAULT NULL,
   statid        VARCHAR2 DEFAULT NULL,
   cascade_parts BOOLEAN  DEFAULT TRUE,
   statown       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–13 DELETE_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
colname	Name of the column.
partname	Name of the table partition for which to delete the statistics. If the table is partitioned and if `partname` is `NULL`, then global column statistics are deleted.
stattab	User stat table identifier describing from where to delete the statistics. If `stattab` is `NULL`, then the statistics are deleted directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within `stattab` (Only pertinent if `stattab` is not `NULL`).
cascade_parts	If the table is partitioned and if `partname` is `NULL`, then setting this to true causes the deletion of statistics for this column for all underlying partitions as well.
statown	Schema containing `stattab` (if different than `ownname`).

Exceptions

`ORA-20000`: Object does not exist or insufficient privileges

DELETE_INDEX_STATS Procedure

This procedure deletes index-related statistics.

Syntax

```
DBMS_STATS.DELETE_INDEX_STATS (
   ownname       VARCHAR2,
   indname       VARCHAR2,
```

```
   partname      VARCHAR2 DEFAULT NULL,
   stattab       VARCHAR2 DEFAULT NULL,
   statid        VARCHAR2 DEFAULT NULL,
   cascade_parts BOOLEAN  DEFAULT TRUE,
   statown       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–14 DELETE_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
indname	Name of the index.
partname	Name of the index partition for which to delete the statistics. If the index is partitioned and if `partname` is `NULL`, then index statistics are deleted at the global level.
stattab	User stat table identifier describing from where to delete the statistics. If `stattab` is `NULL`, then the statistics are deleted directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within `stattab` (Only pertinent if `stattab` is not `NULL`).
cascade_parts	If the index is partitioned and if `partname` is `NULL`, then setting this to `TRUE` causes the deletion of statistics for this index for all underlying partitions as well.
statown	Schema containing `stattab` (if different than `ownname`).

Exceptions

`ORA-20000`: Object does not exist or insufficient privileges.

DELETE_SYSTEM_STATS Procedure

This procedure deletes system statistics.

Syntax

```
DBMS_STATS.DELETE_INDEX_STATS (
   stattab       VARCHAR2 DEFAULT NULL,
   statid        VARCHAR2 DEFAULT NULL,
   statown       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–15 DELETE_INDEX_STATS Procedure Parameters

Parameter	Description
stattab	Identifier of the user stat table where the statistics will be saved.
statid	Optional identifier associated with the statistics saved in the stattab.
statown	The schema containing stattab, if different from the user's schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20002: Bad user statistics table; may need to be upgraded.

DELETE_TABLE_STATS Procedure

This procedure deletes table-related statistics.

Syntax

```
DBMS_STATS.DELETE_TABLE_STATS (
   ownname          VARCHAR2,
   tabname          VARCHAR2,
   partname         VARCHAR2  DEFAULT NULL,
   stattab          VARCHAR2  DEFAULT NULL,
   statid           VARCHAR2  DEFAULT NULL,
   cascade_parts    BOOLEAN   DEFAULT TRUE,
   cascade_columns  BOOLEAN   DEFAULT TRUE,
   cascade_indexes  BOOLEAN   DEFAULT TRUE,
   statown          VARCHAR2  DEFAULT NULL);
```

Parameters

Table 63–16 DELETE_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.

Table 63–16 DELETE_TABLE_STATS Procedure Parameters

Parameter	Description
colname	Name of the column.
partname	Name of the table partition from which to get the statistics. If the table is partitioned and if partname is NULL, then the statistics are retrieved from the global table level.
stattab	User stat table identifier describing from where to retrieve the statistics. If stattab is NULL, then the statistics are retrieved directly from the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
cascade_parts	If the table is partitioned and if partname is NULL, then setting this to TRUE causes the deletion of statistics for this table for all underlying partitions as well.
cascade_columns	Indicates that DELETE_COLUMN_STATS should be called for all underlying columns (passing the cascade_parts parameter).
cascade_indexes	Indicates that DELETE_INDEX_STATS should be called for all underlying indexes (passing the cascade_parts parameter).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

DELETE_SCHEMA_STATS Procedure

This procedure deletes statistics for an entire schema.

Syntax

```
DBMS_STATS.DELETE_SCHEMA_STATS (
   ownname VARCHAR2,
   stattab VARCHAR2 DEFAULT NULL,
   statid  VARCHAR2 DEFAULT NULL,
   statown VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–17 DELETE_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
stattab	User stat table identifier describing from where to delete the statistics. If stattab is NULL, then the statistics are deleted directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges

DELETE_DATABASE_STATS Procedure

This procedure deletes statistics for an entire database.

Syntax

```
DBMS_STATS.DELETE_DATABASE_STATS (
   stattab VARCHAR2 DEFAULT NULL,
   statid  VARCHAR2 DEFAULT NULL,
   statown VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–18 DELETE_DATABASE_STATS Procedure Parameters

Parameter	Description
stattab	User stat table identifier describing from where to delete the statistics. If stattab is NULL, then the statistics are deleted directly in the dictionary.
statid	Identifier (optional) to associate with these statistics within stattab (Only pertinent if stattab is not NULL).

Table 63–18 DELETE_DATABASE_STATS Procedure Parameters

Parameter	Description
statown	Schema containing stattab. If stattab is not NULL and if statown is NULL, then it is assumed that every schema in the database contains a user statistics table with the name stattab.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

CREATE_STAT_TABLE Procedure

This procedure creates a table with name stattab in ownname's schema which is capable of holding statistics. The columns and types that compose this table are not relevant as it should be accessed solely through the procedures in this package.

Syntax

```
DBMS_STATS.CREATE_STAT_TABLE (
   ownname  VARCHAR2,
   stattab  VARCHAR2,
   tblspace VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–19 CREATE_STAT_TABLE Procedure Parameters

Parameter	Description
ownname	Name of the schema.
stattab	Name of the table to create. This value should be passed as the stattab parameter to other procedures when the user does not want to modify the dictionary statistics directly.
tblspace	Tablespace in which to create the stat tables. If none is specified, then they are created in the user's default tablespace.

Exceptions

ORA-20000: Table already exists or insufficient privileges.

ORA-20001: Tablespace does not exist.

DROP_STAT_TABLE Procedure

This procedure drops a user stat table.

Syntax

```
DBMS_STATS.DROP_STAT_TABLE (
   ownname VARCHAR2,
   stattab VARCHAR2);
```

Parameters

Table 63–20 DROP_STAT_TABLE Procedure Parameters

Parameter	Description
ownname	Name of the schema.
stattab	User stat table identifier.

Exceptions

ORA-20000: Table does not exists or insufficient privileges.

EXPORT_COLUMN_STATS Procedure

This procedure retrieves statistics for a particular column and stores them in the user stat table identified by stattab.

Syntax

```
DBMS_STATS.EXPORT_COLUMN_STATS (
   ownname  VARCHAR2,
   tabname  VARCHAR2,
   colname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2,
   statid   VARCHAR2 DEFAULT NULL,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–21 EXPORT_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
colname	Name of the column.
partname	Name of the table partition. If the table is partitioned and if partname is NULL, then global and partition column statistics are exported.
stattab	User stat table identifier describing where to store the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

EXPORT_INDEX_STATS Procedure

This procedure retrieves statistics for a particular index and stores them in the user stat table identified by stattab.

Syntax

```
DBMS_STATS.EXPORT_INDEX_STATS (
   ownname  VARCHAR2,
   indname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2,
   statid   VARCHAR2 DEFAULT NULL,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–22 EXPORT_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
indname	Name of the index.
partname	Name of the index partition. If the index is partitioned and if partname is NULL, then global and partition index statistics are exported.
stattab	User stat table identifier describing where to store the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

EXPORT_SYSTEM_STATS Procedure

This procedure retrieves system statistics and stores them in the user stat table, identified by stattab.

Syntax

```
DBMS_STATS.EXPORT_SYSTEM_STATS (
   stattab       VARCHAR2,
   statid        VARCHAR2 DEFAULT NULL,
   statown       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–23 EXPORT_SYSTEM_STATS Procedure Parameters

Parameter	Description
stattab	Identifier of the user stat table that describes where the statistics will be stored.
statid	Optional identifier associated with the statistics stored from the stattab.

Table 63–23 EXPORT_SYSTEM_STATS Procedure Parameters

Parameter	Description
statown	The schema containing stattab, if different from the user's schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20002: Bad user statistics table; may need to be upgraded.

ORA-20003: Unable to export system statistics.

EXPORT_TABLE_STATS Procedure

This procedure retrieves statistics for a particular table and stores them in the user stat table. Cascade results in all index and column stats associated with the specified table being exported as well.

Syntax

```
DBMS_STATS.EXPORT_TABLE_STATS (
   ownname  VARCHAR2,
   tabname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2,
   statid   VARCHAR2 DEFAULT NULL,
   cascade  BOOLEAN  DEFAULT TRUE,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–24 EXPORT_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table.
partname	Name of the table partition. If the table is partitioned and if partname is NULL, then global and partition table statistics are exported.
stattab	User stat table identifier describing where to store the statistics.

Table 63–24 EXPORT_TABLE_STATS Procedure Parameters

Parameter	Description
statid	Identifier (optional) to associate with these statistics within stattab.
cascade	If true, then column and index statistics for this table are also exported.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

EXPORT_SCHEMA_STATS Procedure

This procedure retrieves statistics for all objects in the schema identified by ownname and stores them in the user stat tables identified by stattab.

Syntax

```
DBMS_STATS.EXPORT_SCHEMA_STATS (
   ownname VARCHAR2,
   stattab VARCHAR2,
   statid  VARCHAR2 DEFAULT NULL,
   statown VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–25 EXPORT_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
stattab	User stat table identifier describing where to store the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

EXPORT_DATABASE_STATS Procedure

This procedure retrieves statistics for all objects in the database and stores them in the user stat tables identified by `statown.stattab`

Syntax

```
DBMS_STATS.EXPORT_DATABASE_STATS (
   stattab VARCHAR2,
   statid  VARCHAR2 DEFAULT NULL,
   statown VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–26 EXPORT_DATABASE_STATS Procedure Parameters

Parameter	Description
`stattab`	User stat table identifier describing where to store the statistics
`statid`	Identifier (optional) to associate with these statistics within `stattab`
`statown`	Schema containing `stattab`. If `statown` is `NULL`, then it is assumed that every schema in the database contains a user statistics table with the name `stattab`.

Exceptions

`ORA-20000`: Object does not exist or insufficient privileges.

IMPORT_COLUMN_STATS Procedure

This procedure retrieves statistics for a particular column from the user stat table identified by `stattab` and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_COLUMN_STATS (
   ownname  VARCHAR2,
   tabname  VARCHAR2,
   colname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2,
   statid   VARCHAR2 DEFAULT NULL,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–27 IMPORT_COLUMN_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table to which this column belongs.
colname	Name of the column.
partname	Name of the table partition. If the table is partitioned and if partname is NULL, then global and partition column statistics are imported.
stattab	User stat table identifier describing from where to retrieve the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent values in the user stat table.

IMPORT_INDEX_STATS Procedure

This procedure retrieves statistics for a particular index from the user stat table identified by stattab and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_INDEX_STATS (
   ownname  VARCHAR2,
   indname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2,
   statid   VARCHAR2 DEFAULT NULL,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–28 IMPORT_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
indname	Name of the index.
partname	Name of the index partition. If the index is partitioned and if partname is NULL, then global and partition index statistics are imported.
stattab	User stat table identifier describing from where to retrieve the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent values in the user stat table.

IMPORT_SYSTEM_STATS Procedure

This procedure retrieves system statistics from the user stat table, identified by stattab, and stores the statistics in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_SYSTEM_STATS (
   stattab       VARCHAR2,
   statid        VARCHAR2 DEFAULT NULL,
   statown       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–29 IMPORT_SYSTEM_STATS Procedure Parameters

Parameter	Description
stattab	Identifier of the user stat table where the statistics will be retrieved.

Table 63–29 IMPORT_SYSTEM_STATS Procedure Parameters

Parameter	Description
statid	Optional identifier associated with the statistics retrieved from the stattab.
statown	The schema containing stattab, if different from the user's schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent values in the user stat table.

ORA-20002: Bad user statistics table; may need to be upgraded.

ORA-20003: Unable to import system statistics.

IMPORT_TABLE_STATS Procedure

This procedure retrieves statistics for a particular table from the user stat table identified by stattab and stores them in the dictionary. Cascade results in all index and column stats associated with the specified table being imported as well.

Syntax

```
DBMS_STATS.IMPORT_TABLE_STATS (
   ownname  VARCHAR2,
   tabname  VARCHAR2,
   partname VARCHAR2 DEFAULT NULL,
   stattab  VARCHAR2,
   statid   VARCHAR2 DEFAULT NULL,
   cascade  BOOLEAN  DEFAULT TRUE,
   statown  VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–30 IMPORT_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
tabname	Name of the table.

Table 63–30 IMPORT_TABLE_STATS Procedure Parameters

Parameter	Description
partname	Name of the table partition. If the table is partitioned and if partname is NULL, then global and partition table statistics are imported.
stattab	User stat table identifier describing from where to retrieve the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
cascade	If true, then column and index statistics for this table are also imported.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent values in the user stat table.

IMPORT_SCHEMA_STATS Procedure

This procedure retrieves statistics for all objects in the schema identified by ownname from the user stat table and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_SCHEMA_STATS (
   ownname VARCHAR2,
   stattab VARCHAR2,
   statid  VARCHAR2 DEFAULT NULL,
   statown VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–31 IMPORT_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Name of the schema.
stattab	User stat table identifier describing from where to retrieve the statistics.

Table 63–31 IMPORT_SCHEMA_STATS Procedure Parameters

Parameter	Description
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent values in the user stat table.

IMPORT_DATABASE_STATS Procedure

This procedure retrieves statistics for all objects in the database from the user stat table(s) and stores them in the dictionary.

Syntax

```
DBMS_STATS.IMPORT_DATABASE_STATS (
   stattab VARCHAR2,
   statid  VARCHAR2 DEFAULT NULL,
   statown VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–32 IMPORT_DATABASE_STATS Procedure Parameters

Parameter	Description
stattab	User stat table identifier describing from where to retrieve the statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab. If statown is NULL, then it is assumed that every schema in the database contains a user statistics table with the name stattab.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid or inconsistent values in the user stat table.

GATHER_INDEX_STATS Procedure

This procedure gathers index statistics. It does not execute in parallel.

Syntax

```
DBMS_STATS.GATHER_INDEX_STATS (
   ownname          VARCHAR2,
   indname          VARCHAR2,
   partname         VARCHAR2 DEFAULT NULL,
   estimate_percent NUMBER   DEFAULT NULL,
   stattab          VARCHAR2 DEFAULT NULL,
   statid           VARCHAR2 DEFAULT NULL,
   statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–33 GATHER_INDEX_STATS Procedure Parameters

Parameter	Description
ownname	Schema of index to analyze.
indname	Name of index.
partname	Name of partition.
estimate_percent	Percentage of rows to estimate (`NULL` means compute). The valid range is [0.000001,100). Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the best sample size for good statistics.
stattab	User stat table identifier describing where to save the current statistics.
statid	Identifier (optional) to associate with these statistics within `stattab`.
statown	Schema containing `stattab` (if different than `ownname`).

Exceptions

`ORA-20000`: Index does not exist or insufficient privileges.

`ORA-20001`: Bad input value.

GATHER_TABLE_STATS Procedure

This procedure gathers table and column (and index) statistics. It attempts to parallelize as much of the work as possible, but there are some restrictions as described in the individual parameters. This operation does not parallelize if the user does not have select privilege on the table being analyzed.

Syntax

```
DBMS_STATS.GATHER_TABLE_STATS (
   ownname          VARCHAR2,
   tabname          VARCHAR2,
   partname         VARCHAR2 DEFAULT NULL,
   estimate_percent NUMBER   DEFAULT NULL,
   block_sample     BOOLEAN  DEFAULT FALSE,
   method_opt       VARCHAR2 DEFAULT 'FOR ALL COLUMNS SIZE 1',
   degree           NUMBER   DEFAULT NULL,
   granularity      VARCHAR2 DEFAULT 'DEFAULT',
   cascade          BOOLEAN  DEFAULT FALSE,
   stattab          VARCHAR2 DEFAULT NULL,
   statid           VARCHAR2 DEFAULT NULL,
   statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–34 GATHER_TABLE_STATS Procedure Parameters

Parameter	Description
ownname	Schema of table to analyze.
tabname	Name of table.
partname	Name of partition.
estimate_percent	Percentage of rows to estimate (NULL means compute) The valid range is [0.000001,100). Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the best sample size for good statistics.
block_sample	Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. Only pertinent when doing an estimate statistics.

Table 63–34 GATHER_TABLE_STATS Procedure Parameters

Parameter	Description
method_opt	Accepts: FOR ALL [INDEXED | HIDDEN] COLUMNS [size_clause] FOR COLUMNS [size clause] column|attribute [size_clause] [,column|attribute [size_clause]...], where size_clause is defined as: size_clause := SIZE {integer | REPEAT | AUTO | SKEWONLY}, where integer is in the range [1,254]. Optimizer-related table statistics are always gathered.
degree	Degree of parallelism. NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters.
granularity	Granularity of statistics to collect (only pertinent if the table is partitioned). DEFAULT: Gather global- and partition-level statistics. SUBPARTITION: Gather subpartition-level statistics. PARTITION: Gather partition-level statistics. GLOBAL: Gather global statistics. ALL: Gather all (subpartition, partition, and global) statistics.
cascade	Gather statistics on the indexes for this table. Index statistics gathering is not parallelized. Using this option is equivalent to running the gather_index_stats procedure on each of the table's indexes.
stattab	User stat table identifier describing where to save the current statistics.
statid	Identifier (optional) to associate with these statistics within stattab.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Table does not exist or insufficient privileges.

ORA-20001: Bad input value.

GATHER_SCHEMA_STATS Procedure

This procedure gathers statistics for all objects in a schema.

Syntax

```
DBMS_STATS.GATHER_SCHEMA_STATS (
   ownname          VARCHAR2,
   estimate_percent NUMBER   DEFAULT NULL,
   block_sample     BOOLEAN  DEFAULT FALSE,
   method_opt       VARCHAR2 DEFAULT 'FOR ALL COLUMNS SIZE 1',
   degree           NUMBER   DEFAULT NULL,
   granularity      VARCHAR2 DEFAULT 'DEFAULT',
   cascade          BOOLEAN  DEFAULT FALSE);

DBMS_STATS.GATHER_SCHEMA_STATS (
   ownname          VARCHAR2,
   estimate_percent NUMBER   DEFAULT NULL,
   block_sample     BOOLEAN  DEFAULT FALSE,
   method_opt       VARCHAR2 DEFAULT 'FOR ALL COLUMNS SIZE 1',
   degree           NUMBER   DEFAULT NULL,
   granularity      VARCHAR2 DEFAULT 'DEFAULT',
   cascade          BOOLEAN  DEFAULT FALSE,
   stattab          VARCHAR2 DEFAULT NULL,
   statid           VARCHAR2 DEFAULT NULL,
   options          VARCHAR2 DEFAULT 'GATHER',
   objlist     OUT  ObjectTab,
   statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–35 GATHER_SCHEMA_STATS Procedure Parameters

Parameter	Description
ownname	Schema to analyze (NULL means current schema).
estimate_percent	Percentage of rows to estimate (NULL means compute): The valid range is [0.000001,100). Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the best sample size for good statistics.
block_sample	Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. Only pertinent when doing an estimate statistics.

Table 63–35 GATHER_SCHEMA_STATS Procedure Parameters

Parameter	Description
method_opt	Accepts: FOR ALL [INDEXED | HIDDEN] COLUMNS [size_clause] FOR COLUMNS [size clause] column|attribute [size_clause] [,column|attribute [size_clause]...], where size_clause is defined as: size_clause := SIZE {integer | REPEAT | AUTO | SKEWONLY}, where integer is in the range [1,254]. This value is passed to all of the individual tables.
degree	Degree of parallelism. NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters.
granularity	Granularity of statistics to collect (only pertinent if the table is partitioned). DEFAULT: Gather global- and partition-level statistics. SUBPARTITION: Gather subpartition-level statistics. PARTITION: Gather partition-level statistics. GLOBAL: Gather global statistics. ALL: Gather all (subpartition, partition, and global) statistics.
cascade	Gather statistics on the indexes as well. Index statistics gathering is not parallelized. Using this option is equivalent to running the gather_index_stats procedure on each of the indexes in the schema in addition to gathering table and column statistics.
stattab	User stat table identifier describing where to save the current statistics.
statid	Identifier (optional) to associate with these statistics within stattab.

Table 63–35 GATHER_SCHEMA_STATS Procedure Parameters

Parameter	Description
options	Further specification of which objects to gather statistics for: GATHER: Gathers statistics on all objects in the schema. GATHER AUTO: Gathers all necessary statistics automatically. Oracle implicitly determines which objects need new statistics, and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are ownname, stattab, statid, objlist and statown; all other parameter settings are ignored. Returns a list of processed objects. GATHER STALE: Gathers statistics on stale objects as determined by looking at the *_tab_modifications views. Also, return a list of objects found to be stale. GATHER EMPTY: Gathers statistics on objects which currently have no statistics. also, return a list of objects found to have no statistics. LIST AUTO: Returns a list of objects to be processed with GATHER AUTO. LIST STALE: Returns list of stale objects as determined by looking at the *_tab_modifications views. LIST EMPTY: Returns list of objects which currently have no statistics.
objlist	List of objects found to be stale or empty.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Schema does not exist or insufficient privileges.

ORA-20001: Bad input value.

GATHER_DATABASE_STATS Procedure

This procedure gathers statistics for all objects in the database.

Syntax

```
DBMS_STATS.GATHER_DATABASE_STATS (
   estimate_percent NUMBER   DEFAULT NULL,
   block_sample     BOOLEAN  DEFAULT FALSE,
```

```
   method_opt       VARCHAR2 DEFAULT 'FOR ALL COLUMNS SIZE 1',
   degree           NUMBER   DEFAULT NULL,
   granularity      VARCHAR2 DEFAULT 'DEFAULT',
   cascade          BOOLEAN  DEFAULT FALSE);

DBMS_STATS.GATHER_DATABASE_STATS (
   estimate_percent NUMBER   DEFAULT NULL,
   block_sample     BOOLEAN  DEFAULT FALSE,
   method_opt       VARCHAR2 DEFAULT 'FOR ALL COLUMNS SIZE 1',
   degree           NUMBER   DEFAULT NULL,
   granularity      VARCHAR2 DEFAULT 'DEFAULT',
   cascade          BOOLEAN  DEFAULT FALSE,
   stattab          VARCHAR2 DEFAULT NULL,
   statid           VARCHAR2 DEFAULT NULL,
   options          VARCHAR2 DEFAULT 'GATHER',
   objlist     OUT  ObjectTab,
   statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–36 GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
estimate_percent	Percentage of rows to estimate (NULL means compute): The valid range is [0.000001,100). Use the constant DBMS_STATS.AUTO_SAMPLE_SIZE to have Oracle determine the best sample size for good statistics.
block_sample	Whether or not to use random block sampling instead of random row sampling. Random block sampling is more efficient, but if the data is not randomly distributed on disk, then the sample values may be somewhat correlated. Only pertinent when doing an estimate statistics.
method_opt	Accepts: FOR ALL [INDEXED | HIDDEN] COLUMNS [size_clause] FOR COLUMNS [size clause] column|attribute [size_clause] [,column|attribute [size_clause]...], where size_clause is defined as: size_clause := SIZE {integer | REPEAT | AUTO | SKEWONLY}, where integer is in the range [1,254]. This value is passed to all of the individual tables.

Table 63–36 GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
degree	Degree of parallelism. NULL means use the table default value specified by the DEGREE clause in the CREATE TABLE or ALTER TABLE statement. Use the constant DBMS_STATS.DEFAULT_DEGREE to specify the default value based on the initialization parameters.
granularity	Granularity of statistics to collect (only pertinent if the table is partitioned). DEFAULT: Gather global- and partition-level statistics. SUBPARTITION: Gather subpartition-level statistics. PARTITION: Gather partition-level statistics. GLOBAL: Gather global statistics. ALL: Gather all (subpartition, partition, and global) statistics.
cascade	Gather statistics on the indexes as well. Index statistics gathering is not parallelized. Using this option is equivalent to running the gather_index_stats procedure on each of the indexes in the database in addition to gathering table and column statistics.
stattab	User stat table identifier describing where to save the current statistics. The statistics table is assumed to reside in the same schema as the object being analyzed, so there must be one such table in each schema to use this option.
statid	Identifier (optional) to associate with these statistics within stattab.

Table 63–36 GATHER_DATABASE_STATS Procedure Parameters

Parameter	Description
options	Further specification of which objects to gather statistics for: GATHER: Gathers statistics on all objects in the schema. GATHER AUTO: Gathers all necessary statistics automatically. Oracle implicitly determines which objects need new statistics, and determines how to gather those statistics. When GATHER AUTO is specified, the only additional valid parameters are stattab, statid, objlist and statown; all other parameter settings are ignored. Returns a list of processed objects. GATHER STALE: Gathers statistics on stale objects as determined by looking at the *_tab_modifications views. Also, return a list of objects found to be stale. GATHER EMPTY: Gathers statistics on objects which currently have no statistics. Return a list of objects found to have no statistics. LIST AUTO: Returns a list of objects to be processed with GATHER AUTO. LIST STALE: Returns a list of stale objects as determined by looking at the *_tab_modifications views. LIST EMPTY: Returns a list of objects which currently have no statistics.
objlist	List of objects found to be stale or empty.
statown	Schema containing stattab (if different than ownname).

Exceptions

ORA-20000: Insufficient privileges.

ORA-20001: Bad input value.

GATHER_SYSTEM_STATS Procedure

This procedure gathers system statistics.

Syntax

```
DBMS_STATS.GATHER_SYSTEM_STATS (
   gathering_mode   VARCHAR2 DEFAULT 'INTERVAL',
   interval         INTEGER  DEFAULT 60,
```

```
   stattab          VARCHAR2 DEFAULT NULL,
   statid           VARCHAR2 DEFAULT NULL,
   statown          VARCHAR2 DEFAULT NULL);
```

Parameters

Table 63–37 GATHER_SYSTEM_STATS Procedure Parameters

Parameter	Description
gathering_mode	Mode values are: INTERVAL: Captures system activity during a specified interval. The user can provide an interval value in minutes, after which system statistics will be created or updated in the dictionary or stattab. START | STOP: Captures system activity during specified start and stop times and refreshes the dictionary or stattab with statistics for the elapsed period. Interval mode is ignored.
interval	Time, in minutes, to gather statistics.
stattab	Identifier of the user stat table where the statistics will be saved.
statid	Optional identifier associated with the statistics saved in the stattab.
statown	The schema containing stattab, if different from the user's schema.

Exceptions

ORA-20000: Object does not exist or insufficient privileges.

ORA-20001: Invalid input value.

ORA-20002: Bad user statistics table; may need to be upgraded.

ORA-20003: Unable to gather system statistics.

ORA-20004: Error in the INTERVAL mode: system parameter job_queue_processes must be >0.

GENERATE_STATS Procedure

This procedure generates object statistics from previously collected statistics of related objects. For fully populated schemas, the gather procedures should be used

instead when more accurate statistics are desired.The currently supported objects are b-tree and bitmap indexes.

Syntax

```
DBMS_STATS.GENERATE_STATS (
   ownname   VARCHAR2,
   objname   VARCHAR2,
   organized NUMBER DEFAULT 7);
```

Parameters

Table 63–38 GENERATE_STATS Procedure Parameters

Parameter	Description
ownname	Schema of object.
objname	Name of object.
organized	Amount of ordering associated between the index and its underlying table. A heavily organized index would have consecutive index keys referring to consecutive rows on disk for the table (the same block). A heavily disorganized index would have consecutive keys referencing different table blocks on disk. This parameter is only used for b-tree indexes. The number can be in the range of 0-10, with 0 representing a completely organized index and 10 a completely disorganized one.

Exceptions

ORA-20000: Unsupported object type of object does not exist.

ORA-20001: Invalid option or invalid statistics.

Example 1

Assume many modifications have been made to the emp table since the last time statistics were gathered. To ensure that the cost-based optimizer is still picking the best plan, statistics should be gathered once again; however, the user is concerned that new statistics will cause the optimizer to choose bad plans when the current ones are acceptable. The user can do the following:

```
BEGIN
   DBMS_STATS.CREATE_STAT_TABLE ('scott', 'savestats');
   DBMS_STATS.GATHER_TABLE_STATS ('scott', 'emp', 5, stattab => 'savestats');
```

```
END;
```

This operation gathers new statistics on emp, but first saves the original statistics in a user stat table: emp.savestats.

If the user believes that the new statistics are causing the optimizer to generate poor plans, then the original stats can be restored as follows:

```
BEGIN
   DBMS_STATS.DELETE_TABLE_STATS ('scott', 'emp');
   DBMS_STATS.IMPORT_TABLE_STATS ('scott', 'emp', stattab => 'savestats');
END;
```

Example 2

Assume that you want to perform database application processing OLTP transactions during the day and run reports at night.

To collect daytime system statistics, gather statistics for 720 minutes. Store the stats in the MYSTATS table.

```
BEGIN
   DBMS_STATS.GATHER_SYSTEM_STATS (
      interval => 720,
      stattab  => 'mystats',
      statid   => 'OLTP');
END;
```

To collect nighttime system statistics, gather statistics for 720 minutes. Store the stats in the MYSTATS table.

```
BEGIN
   DBMS_STATS.GATHER_SYSTEM_STATS (
      interval => 720,
      stattab  => 'mystats',
      statid   => 'OLAP');
END;
```

Update the dictionary with the gathered statistics.

```
VARIABLE   jobno   number;
BEGIN
   DBMS_JOB.SUBMIT (:jobno, 'DBMS_STATS.IMPORT_SYSTEM_STATS
   (''mystats'',''OLTP'');'
   sysdate, 'sysdate + 1');
   COMMIT;
END;
```

```
BEGIN
   DBMS_JOB.SUBMIT (:jobno, 'DBMS_STATS.IMPORT_SYSTEM_STATS
   (''mystats'',''OLAP'');'
   sysdate + 0.5, 'sysdate + 1');
   COMMIT;
END;
```

FLUSH_SCHEMA_MONITORING_INFO Procedure

This procedure flushes in-memory monitoring information for the tables in the specified schema to the dictionary.

Syntax

```
DBMS_STATS.FLUSH_SCHEMA_MONITORING_INFO (
    ownname varchar2 default null);
```

Parameters

Table 63–39 FLUSH_SCHEMA_MONITORING_INFO Procedure Parameters

Parameter	Description
ownname	The name of the schema. (NULL means the current schema.)

Exceptions

ORA-20000: The object does not exist or it contains insufficient privileges.

FLUSH_DATABASE_MONITORING_INFO Procedure

This procedure flushes in-memory monitoring information for all the tables to the dictionary.

Exceptions

ORA-20000: Insufficient privileges.

ALTER_SCHEMA_TABLE_MONITORING Procedure

This procedure enable or disables the DML monitoring feature of all the tables in the schema, except for snapshot logs and the tables, which monitoring does not

support. Equivalent to issuing ALTER TABLE ... MONITORING (or NOMONITORING) individually. It is recommended to enable monitoring if you use gather_database_stats or gather_schema_stats with GATHER AUTO or GATHER STALE option.

Syntax

```
DBMS_STATS.alter_schema_table_monitoring (
    ownname varchar2 default NULL,
    monitoring boolean default TRUE);
```

Parameters

Table 63–40 ALTER_SCHEMA_TABLE_MONITORING Procedure Parameters

Parameter	Description
ownname	The name of the schema. (NULL means the current schema.)
monitoring	Enables monitoring if true, and disables monitoring if false.

Exceptions

ORA-20000: Insufficient privileges.

ALTER_DATABASE_TABLE_MONITORING Procedure

This procedure enables or diables the DML monitoring feature of all the tables in the schema, except for snapshot logs and the tables, which monitoring does not support. Equivalent to issuing ALTER TABLE ... MONITORING (or NOMONITORING) individually. It is recommended to enable monitoring if you use gather_database_stats or gather_schema_stats with the GATHER AUTO or GATHER STALE options.

Syntax

```
DBMS_STATS.ALTER_DATABASE_TABLE_MONITORING (
    monitoring boolean default TRUE,
    sysobjs boolean default FALSE);
```

Parameters

Table 63–41

Parameter	Description
monitoring	Enables monitoring if true, and disables monitoring if false.
sysobjs	If true, changes monitoring on the dictionary objects.

Exzceptions

ORA-20000: Insufficient privileges.

64

DBMS_TRACE

Oracle8*i* PL/SQL provides an API for tracing the execution of PL/SQL programs on the server. You can use the trace API, implemented on the server as the DBMS_TRACE package, to trace PL/SQL functions, procedures, and exceptions.

DBMS_TRACE provides subprograms to start and stop PL/SQL tracing in a session. Oracle collects the trace data as the program executes and writes it to database tables.

A typical session involves:

- Starting PL/SQL tracing in session (DBMS_TRACE.SET_PLSQL_TRACE).
- Running an application to be traced.
- Stopping PL/SQL tracing in session (DBMS_TRACE.CLEAR_PLSQL_TRACE).

This chapter discusses the following topics:

Requirements, Restrictions, and Constants for DBMS_TRACE

Requirements

This package must be created under SYS.

Restrictions

You cannot use PL/SQL tracing with the multi-threaded server (MTS).

Constants

DBMS_TRACE uses these constants:

```
trace_all_calls          constant INTEGER := 1;
trace_enabled_calls      constant INTEGER := 2;
trace_all_exceptions     constant INTEGER := 4;
trace_enabled_exceptions constant INTEGER := 8;
trace_all_sql            constant INTEGER := 32;
trace_enabled_sql        constant INTEGER := 64;
trace_all_lines          constant INTEGER := 128;
trace_enabled_lines      constant INTEGER := 256;
trace_stop               constant INTEGER := 16384;
trace_pause              constant INTEGER := 4096;
trace_resume             constant INTEGER := 8192;
trace_limit              constant INTEGER := 16;
trace_major_version      constant BINARY_INTEGER := 1;
trace_minor_version      constant BINARY_INTEGER := 0;
```

Oracle recommends using the symbolic form for all these constants.

Using DBMS_TRACE

Controlling Data Volume

Profiling large applications may produce a large volume of data. You can control the volume of data collected by enabling specific program units for trace data collection.

You can enable a program unit by compiling it debug. This can be done in one of two ways:

```
alter session set plsql_debug=true;
create or replace ... /* create the library units - debug information will be
```

```
generated */
```

or:

```
/* recompile specific library unit with debug option */
alter [PROCEDURE | FUNCTION | PACKAGE BODY]  <libunit-name> compile debug;
```

Note: You cannot use the second method for anonymous blocks.

You can limit the amount of storage used in the database by retaining only the most recent 8,192 records (approximately) by including `TRACE_LIMIT` in the `TRACE_LEVEL` parameter of the `SET_PLSQL_TRACE` procedure.

Creating Database Tables to Collect DBMS_TRACE Output

You must create database tables into which the DBMS_TRACE package writes output. Otherwise, the data is not collected. To create these tables, run the script `TRACETAB.SQL`. The tables this script creates are owned by SYSTEM.

Collecting Trace Data

The PL/SQL features you can trace are described in the script `DBMSPBT.SQL`. Some of the key tracing features are:

- Tracing Calls
- Tracing Exceptions
- Tracing SQL
- Tracing Lines

Additional features of DBMS_TRACE also allow pausing and resuming trace, and limiting the output.

Tracing Calls

Two levels of call tracing are available:

- Level 1: Trace all calls. This corresponds to the constant `trace_all_calls`.
- Level 2: Trace calls to enabled program units only. This corresponds to the constant `trace_enabled_calls`.

Enabling cannot be detected for remote procedure calls (RPCs); hence, RPCs are only traced with level 1.

Tracing Exceptions

Two levels of exception tracing are available:

- Level 1: Trace all exceptions. This corresponds to `trace_all_exceptions`.
- Level 2: Trace exceptions raised in enabled program units only. This corresponds to `trace_enabled_exceptions`.

Tracing SQL

Two levels of SQL tracing are available:

- Level 1: Trace all SQL. This corresponds to the constant `trace_all_sql`.
- Level 2: Trace SQL in enabled program units only. This corresponds to the constant `trace_enabled_sql`.

Tracing Lines

Two levels of line tracing are available:

- Level 1: Trace all lines. This corresponds to the constant `trace_all_lines`.
- Level 2: Trace lines in enabled program units only. This corresponds to the constant `trace_enabled_lines`.

When tracing lines, Oracle adds a record to the database each time the line number changes. This includes line number changes due to procedure calls and returns.

Note: For both all types of tracing, level 1 overrides level 2. For example, if both level 1 and level 2 are enabled, then level 1 takes precedence.

Collected Data

If tracing is requested only for enabled program units, and if the current program unit is not enabled, then no trace data is written.

When tracing calls, both the call and return are traced. The check for whether tracing is "enabled" passes if either the called routine or the calling routine is "enabled".

Call tracing will always output the program unit type, program unit name, and line number for both the caller and the callee. It will output the caller's stack depth. If the caller's unit is enabled, the calling procedure name will also be output. If the callee's unit is enabled, the called procedure name will be output

Exception tracing writes out the line number. Raising the exception shows information on whether the exception is user-defined or pre-defined. It also shows the exception number in the case of pre-defined exceptions. Both the place where the exceptions are raised and their handler is traced. The check for tracing being "enabled" is done independently for the place where the exception is raised and the place where the exception is handled.

All calls to DBMS_TRACE.SET_PLSQL_TRACE and DBMS_TRACE.CLEAR_PLSQL_TRACE place a special trace record in the database. Therefore, it is always possible to determine when trace settings were changed.

Trace Control

As well as determining which items are collected, you can pause and resume the trace process. No information is gathered between the time that tracing is paused and the time that it is resumed. The constants TRACE_PAUSE and TRACE_RESUME are used to accomplish this. Trace records are generated to indicate that the trace was paused / resumed.

It is also possible to retain only the last 8,192 trace events of a run by using the constant TRACE_LIMIT. This allows tracing to be turned on without filling up the database. When tracing stops, the last 8,192 records are saved. The limit is approximate, since it is not checked on every trace record. At least the requested number of trace records will be generated; up to 1,000 additional records may be generated.

Summary of DBMS_TRACE Subprograms

Table 64–1 DBMS_TRACE Subprograms

Subprogram	Description
"SET_PLSQL_TRACE Procedure" on page 64-5	Starts tracing in the current session.
"CLEAR_PLSQL_TRACE Procedure" on page 64-6	Stops trace data dumping in session.
"PLSQL_TRACE_VERSION Procedure" on page 64-6	Gets the version number of the trace package.

SET_PLSQL_TRACE Procedure

This procedure enables PL / SQL trace data collection.

Syntax

```
DBMS_TRACE.SET_PLSQL_TRACE (
   trace_level INTEGER);
```

Parameter

Table 64–2 describes the parameter for the DBMS_TRACE.SET_PLSQL_TRACE syntax.

Table 64–2 SET_PLSQL_TRACE Procedure Parameters

Parameter	Description
trace_level	You must supply one or more of the constants as listed on page 64-2. By summing the constants, you can enable tracing of multiple PL/SQL language features simultaneously. The control constants "trace_pause", "trace_resume" and "trace_stop" should not be used in combination with other constants Also see "Collecting Trace Data" on page 64-3 for more information.

CLEAR_PLSQL_TRACE Procedure

This procedure disables trace data collection.

Syntax

```
DBMS_TRACE.CLEAR_PLSQL_TRACE;
```

PLSQL_TRACE_VERSION Procedure

This procedure gets the version number of the trace package. It returns the major and minor version number of the DBMS_TRACE package.

Syntax

```
DBMS_TRACE.PLSQL_TRACE_VERSION (
   major OUT BINARY_INTEGER,
   minor OUT BINARY_INTEGER);
```

Parameters

Table 64–3 describes the parameters for the DBMS_TRACE.PLSQL_TRACE_VERSION syntax.

Table 64–3 PLSQL_TRACE_VERSION Procedure Parameters

Parameter	Description
major	Major version number of DBMS_TRACE.
minor	Minor version number of DBMS_TRACE.

65

DBMS_TRANSACTION

This package provides access to SQL transaction statements from stored procedures.

See Also: *Oracle9i SQL Reference*

This chapter discusses the following topics:

- Requirements
- Summary of DBMS_TRANSACTION Subprograms

Requirements

This package runs with the privileges of calling user, rather than the package owner SYS.

Summary of DBMS_TRANSACTION Subprograms

Table 65–1 DBMS_TRANSACTION Subprograms

Subprogram
"READ_ONLY Procedure" on page 65-2
"READ_WRITE Procedure" on page 65-3
"ADVISE_ROLLBACK Procedure" on page 65-3
"ADVISE_NOTHING Procedure" on page 65-3
"ADVISE_COMMIT Procedure" on page 65-3
"USE_ROLLBACK_SEGMENT Procedure" on page 65-4
"COMMIT_COMMENT Procedure" on page 65-4
"COMMIT_FORCE Procedure" on page 65-4
"COMMIT Procedure" on page 65-5
"SAVEPOINT Procedure" on page 65-5
"ROLLBACK Procedure" on page 65-6
"ROLLBACK_SAVEPOINT Procedure" on page 65-6
"ROLLBACK_FORCE Procedure" on page 65-6
"BEGIN_DISCRETE_TRANSACTION Procedure" on page 65-7
"PURGE_MIXED Procedure" on page 65-7
"PURGE_LOST_DB_ENTRY Procedure" on page 65-8
"LOCAL_TRANSACTION_ID Function" on page 65-10
"STEP_ID Function" on page 65-11

READ_ONLY Procedure

This procedure is equivalent to following SQL statement:

```
SET TRANSACTION READ ONLY
```

Syntax

```
DBMS_TRANSACTION.READ_ONLY;
```

READ_WRITE Procedure

This procedure is equivalent to following SQL statement:

```
SET TRANSACTION READ WRITE
```

Syntax

```
DBMS_TRANSACTION.READ_WRITE;
```

ADVISE_ROLLBACK Procedure

This procedure is equivalent to following SQL statement:

```
ALTER SESSION ADVISE ROLLBACK
```

Syntax

```
DBMS_TRANSACTION.ADVISE_ROLLBACK;
```

ADVISE_NOTHING Procedure

This procedure is equivalent to following SQL statement:

```
ALTER SESSION ADVISE NOTHING
```

Syntax

```
DBMS_TRANSACTION.ADVISE_NOTHING;
```

ADVISE_COMMIT Procedure

This procedure is equivalent to following SQL statement:

```
ALTER SESSION ADVISE COMMIT
```

Syntax

```
DBMS_TRANSACTION.ADVISE_COMMIT;
```

USE_ROLLBACK_SEGMENT Procedure

This procedure is equivalent to following SQL statement:

```
SET TRANSACTION USE ROLLBACK SEGMENT <rb_seg_name>
```

Syntax

```
DBMS_TRANSACTION.USE_ROLLBACK_SEGMENT (
   rb_name VARCHAR2);
```

Parameters

Table 65–2 USE_ROLLBACK_SEGMENT Procedure Parameters

Parameter	Description
rb_name	Name of rollback segment to use.

COMMIT_COMMENT Procedure

This procedure is equivalent to following SQL statement:

```
COMMIT COMMENT <text>
```

Syntax

```
DBMS_TRANSACTION.COMMIT_COMMENT (
   cmnt VARCHAR2);
```

Parameters

Table 65–3 COMMIT_COMMENT Procedure Parameters

Parameter	Description
cmnt	Comment to associate with this commit.

COMMIT_FORCE Procedure

This procedure is equivalent to following SQL statement:

```
COMMIT FORCE <text>, <number>"
```

Syntax

```
DBMS_TRANSACTION.COMMIT_FORCE (
```

```
   xid VARCHAR2,
   scn VARCHAR2 DEFAULT NULL);
```

Parameters

Table 65–4 COMMIT_FORCE Procedure Parameters

Parameter	Description
xid	Local or global transaction ID.
scn	System change number.

COMMIT Procedure

This procedure is equivalent to following SQL statement:

```
COMMIT
```

Here for completeness. This is already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.COMMIT;
```

SAVEPOINT Procedure

This procedure is equivalent to following SQL statement:

```
SAVEPOINT <savepoint_name>
```

Here for completeness. This is already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.SAVEPOINT (
   savept VARCHAR2);
```

Parameters

Table 65–5 SAVEPOINT Procedure Parameters

Parameter	Description
savept	Savepoint identifier.

ROLLBACK Procedure

This procedure is equivalent to following SQL statement:

```
ROLLBACK
```

Here for completeness. This is already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.ROLLBACK;
```

ROLLBACK_SAVEPOINT Procedure

This procedure is equivalent to following SQL statement:

```
ROLLBACK TO SAVEPOINT <savepoint_name>
```

Here for completeness. This is already implemented as part of PL/SQL.

Syntax

```
DBMS_TRANSACTION.ROLLBACK_SAVEPOINT (
   savept VARCHAR2);
```

Parameters

Table 65–6 ROLLBACK_SAVEPOINT Procedure Parameters

Parameter	Description
savept	Savepoint identifier.

ROLLBACK_FORCE Procedure

This procedure is equivalent to following SQL statement:

```
ROLLBACK FORCE <text>
```

Syntax

```
DBMS_TRANSACTION.ROLLBACK_FORCE (
   xid VARCHAR2);
```

Parameters

Table 65–7 ROLLBACK_FORCE Procedure Parameters

Parameter	Description
xid	Local or global transaction ID.

BEGIN_DISCRETE_TRANSACTION Procedure

This procedure sets "discrete transaction mode" for this transaction.

Syntax

```
DBMS_TRANSACTION.BEGIN_DISCRETE_TRANSACTION;
```

Exceptions

Table 65–8 BEGIN_DISCRETE_TRANSACTION Procedure Exceptions

Exception	Description
ORA-08175	A transaction attempted an operation which cannot be performed as a discrete transaction. If this exception is encountered, then rollback and retry the transaction
ORA-08176	A transaction encountered data changed by an operation that does not generate rollback data: create index, direct load or discrete transaction. If this exception is encountered, then retry the operation that received the exception.

Example

```
DISCRETE_TRANSACTION_FAILED exception;
    pragma exception_init(DISCRETE_TRANSACTION_FAILED, -8175);
CONSISTENT_READ_FAILURE exception;
    pragma exception_init(CONSISTENT_READ_FAILURE, -8176);
```

PURGE_MIXED Procedure

When in-doubt transactions are forced to commit or rollback (instead of letting automatic recovery resolve their outcomes), there is a possibility that a transaction can have a mixed outcome: Some sites commit, and others rollback. Such

inconsistency cannot be resolved automatically by Oracle; however, Oracle flags entries in DBA_2PC_PENDING by setting the MIXED column to a value of 'yes'.

Oracle never automatically deletes information about a mixed outcome transaction. When the application or DBA is certain that all inconsistencies that might have arisen as a result of the mixed transaction have been resolved, this procedure can be used to delete the information about a given mixed outcome transaction.

Syntax

```
DBMS_TRANSACTION.PURGE_MIXED (
   xid VARCHAR2);
```

Parameters

Table 65–9 PURGE_MIXED Procedure Parameters

Parameter	Description
xid	Must be set to the value of the LOCAL_TRAN_ID column in the DBA_2PC_PENDING table.

PURGE_LOST_DB_ENTRY Procedure

When a failure occurs during commit processing, automatic recovery consistently resolves the results at all sites involved in the transaction. However, if the remote database is destroyed or recreated before recovery completes, then the entries used to control recovery in DBA_2PC_PENDING and associated tables are never removed, and recovery will periodically retry. Procedure PURGE_LOST_DB_ENTRY enables removal of such transactions from the local site.

Syntax

```
DBMS_TRANSACTION.PURGE_LOST_DB_ENTRY (
   xid VARCHAR2);
```

WARNING: PURGE_LOST_DB_ENTRY should *only* be used when the other database is lost or has been recreated. Any other use may leave the other database in an unrecoverable or inconsistent state.

Before automatic recovery runs, the transaction may show up in DBA_2PC_ PENDING as state "collecting", "committed", or "prepared". If the DBA has forced an

in-doubt transaction to have a particular result by using "commit force" or "rollback force", then states "forced commit" or "forced rollback" may also appear. Automatic recovery normally deletes entries in any of these states. The only exception is when recovery finds a forced transaction which is in a state inconsistent with other sites in the transaction; in this case, the entry is left in the table and the MIXED column has the value 'yes'.

However, under certain conditions, it may not be possible for automatic recovery to run. For example, a remote database may have been permanently lost. Even if it is recreated, it gets a new database ID, so that recovery cannot identify it (a possible symptom is ORA-02062). In this case, the DBA may use the procedure PURGE_LOST_DB_ENTRY to clean up the entries in any state other than "prepared". The DBA does not need to be in any particular hurry to resolve these entries, because they are not holding any database resources.

The following table indicates what the various states indicate about the transaction and what the DBA actions should be:

Table 65–10 PURGE_LOST_DB_ENTRY Procedure States

State of Column	State of Global Transaction	State of Local Transaction	Normal DBA Action	Alternative DBA Action
Collecting	Rolled back	Rolled back	None	PURGE_LOST_DB_ENTRY (See Note 1)
Committed	Committed	Committed	None	PURGE_LOST_DB_ENTRY (See Note 1)
Prepared	Unknown	Prepared	None	FORCE COMMIT or ROLLBACK
Forced commit	Unknown	Committed	None	PURGE_LOST_DB_ENTRY (See Note 1)
Forced rollback	Unknown	Rolled back	None	PURGE_LOST_DB_ENTRY (See Note 1)
Forced commit (mixed)	Mixed	Committed	(See Note 2)	
Forced rollback (mixed)	Mixed	Rolled back	(See Note 2)	

NOTE 1: Use only if significant reconfiguration has occurred so that automatic recovery cannot resolve the transaction. Examples are total loss of the remote database, reconfiguration in software resulting in loss of two-phase commit capability, or loss of information from an external transaction coordinator such as a TP monitor.

NOTE 2: Examine and take any manual action to remove inconsistencies; then use the procedure PURGE_MIXED.

Parameters

Table 65–11 PURGE_LOST_DB_ENTRY Procedure Parameters

Parameter	Description
xid	Must be set to the value of the LOCAL_TRAN_ID column in the DBA_2PC_PENDING table.

LOCAL_TRANSACTION_ID Function

This function returns the local (to instance) unique identifier for current transaction. It returns null if there is no current transaction.

Syntax

```
DBMS_TRANSACTION.LOCAL_TRANSACTION_ID (
   create_transaction BOOLEAN := FALSE)
  RETURN VARCHAR2;
```

Parameters

Table 65–12 LOCAL_TRANSACTION_ID Function Parameters

Parameter	Description
create_transaction	If true, then start a transaction if one is not currently active.

STEP_ID Function

This function returns local (to local transaction) unique positive integer that orders the DML operations of a transaction.

Syntax

```
DBMS_TRANSACTION.STEP_ID
   RETURN NUMBER;
```

66

DBMS_TRANSFORM

The DBMS_TRANSFORM package provides an interface to the message format transformation features of Oracle Advanced Queuing. See the *Oracle9i Application Developer's Guide - Advanced Queuing* for more on message format transformations.

This chapter discusses the following topics:

Summary of DBMS_TRANSFORM Subprograms

Table 66–1 DBMS_TRANSFORM Subprograms

Subprograms	Description
"CREATE_ TRANSFORMATION Procedure" on page 66-2	Creates a transformation that maps an object of the source type to an object of the destination type
"MODIFY_ TRANSFORMATION Procedure" on page 66-3	Modifies an existing transformation
"DROP_ TRANSFORMATION Procedure" on page 66-4	Drops the given transformation

CREATE_TRANSFORMATION Procedure

This procedure creates a transformation that maps an object of the source type to an object of the target type. The transformation expression can be a SQL expression or a PLSQL function. It must return an object of the target type.

Syntax

```
DBMS_TRANSFORM.CREATE_TRANSFORMATION (
    schema            VARCHAR2(30),
    name                 VARCHAR2(30),
    to_schema            VARCHAR2(30),
    to_name              VARCHAR2(30),
    from_schema          VARCHAR2(30),
    from_name            VARCHAR2(30),
```

You can also specify the transformation expression, which returns an object of the target type. If the target type is an ADT, the expression must be a function returning an object of the target type or a constructor expression for the target type. You can choose to not specify a transformation expression and specify a transformation per attribute of the target_type using MODIFY_ TRANSFORMATION.

```
    transformation    VARCHAR2(4000));
```

Parameters

Table 66–2 CREATE_TRANSFORMATION Procedure Parameters

Parameter	Description
schema	Specifies the schema of the transformation
name	Specifies the name of the transformation.
from_schema	Specifies the schema of the source type
from_name	Specifies the source type.
to_schema	Specifies the target type schema
to_type	Specifies the target type.
transformation	Specifies the transformation expression, returning an object of the target type.

MODIFY_TRANSFORMATION Procedure

This procedure modifies (or creates) the mapping for the specified attribute of the target type. The transformation expression must be a SQL expression or a PLSQL function returning the type of the specified attribute of the target type. An attribute number zero must be specified for a scalar target type. If the target type is an ADT, and the attribute number is zero, then the expression must be a PLSQL function returning an object of the target type or a constructor expression for the target type.

Syntax

```
DBMS_TRANSFORM.MODIFY_TRANSFORMATION (
    schema           VARCHAR2(30)
    name             VARCHAR2(30),
    attribute_number INTEGER,
    transformation   VARCHAR2(4000));
```

Parameters

Table 66–3 ADD_ATTRIBUTE_MAP Procedure Parameters

Parameter	Description
schema	Specifies the schema of the transformation
name	Specifies the name of the transformation.
attribute_number	Musts be zero for a scalar target type.

Table 66–3 ADD_ATTRIBUTE_MAP Procedure Parameters

Parameter	Description
transformation_expression	The transformation expression must be a SQL expression or a PLSQL function returning the type of the specified attribute of the target type.

DROP_TRANSFORMATION Procedure

This procedure drops the given transformation.

Syntax

```
DBMS_TRANSFORM.DROP_TRANSFORMATION (
    schema        VARCHAR2(30),
    name          VARCHAR2(30);
```

67

DBMS_TTS

This package checks if the transportable set is self-contained. All violations are inserted into a temporary table that can be selected from the view `TRANSPORT_SET_VIOLATIONS`.

Only users having the execute_catalog_role can execute this procedure. This role is initially only assigned to user SYS.

> **See Also:** *Oracle9i Database Administrator's Guide* and *Oracle9i Database Migration*

This chapter discusses the following topics:

Exceptions

```
ts_not_found  EXCEPTION;
PRAGMA exception_init(ts_not_found, -29304);
ts_not_found_num NUMBER := -29304;

invalid_ts_list  EXCEPTION;
PRAGMA exception_init(invalid_ts_list, -29346);
invalid_ts_list_num NUMBER := -29346;

sys_or_tmp_ts     EXCEPTION;
PRAGMA exception_init(sys_or_tmp_ts, -29351);
sys_or_tmp_ts_num NUMBER := -29351;
```

Summary of DBMS_TTS Subprograms

These two procedures are designed to be called by database administrators.

Table 67–1 DBMS_TTS Subprograms

Subprogram	Description
"TRANSPORT_SET_CHECK Procedure" on page 67-2	Checks if a set of tablespaces (to be transported) is self-contained.
"DOWNGRADE Procedure" on page 67-3	Downgrades transportable tablespace related data.

TRANSPORT_SET_CHECK Procedure

This procedure checks if a set of tablespaces (to be transported) is self-contained. After calling this procedure, the user may select from a view to see a list of violations, if there are any. If the view does not return any rows, then the set of tablespaces is self-contained. For example,

```
SQLPLUS> EXECUTE TRANSPORT_SET_CHECK('foo,bar', TRUE);
SQLPLUS> SELECT * FROM TRANSPORT_SET_VIOLATIONS;
```

Syntax

```
DBMS_TTS.TRANSPORT_SET_CHECK (
   ts_list          IN VARCHAR2,
   incl_constraints IN BOOLEAN DEFAULT,
   full_closure     IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 67–2 TRANSPORT_SET_CHECK Procedure Parameters

Parameter	Description
ts_list	List of tablespace, separated by comma.
incl_constraints	TRUE if you want to count in referential integrity constraints when examining if the set of tablespaces is self-contained. (The incl_constraints parameter is a default so that TRANSPORT_SET_CHECK will work if it is called with only the ts_list argument.)
full_closure	Indicates whether a full or partial dependency check is required. If TRUE, treats all IN and OUT pointers (dependencies) and captures them as violations if they are not self-contained in the transportable set. The parameter should be set to TRUE for TSPITR or if a strict version of transportable is desired. By default the parameter is set to false. It will only consider OUT pointers as violations.

DOWNGRADE Procedure

This procedure downgrades transportable tablespace related data.

Syntax

```
DBMS_TTS.DOWNGRADE;
```

68

DBMS_TYPES

The DBMS_TYPES package consists of constants, which represent the built-in and user-defined types. See the *Oracle interMedia User's Guide* for a complete discussion of types.

This chapter discusses the following topics:

- Constants for DBMS_TYPES

Constants for DBMS_TYPES

The following table lists the constants in the DBMS_TYPES package.

TYPECODE_DATE	A DATE type
TYPECODE_NUMBER	A NUMBER type
TYPECODE_RAW	A RAW type
TYPECODE_CHAR	A CHAR type
TYPECODE_VARCHAR2	A VARCHAR2 type
TYPECODE_VARCHAR	A VARCHAR type
TYPECODE_MLSLABEL	An MLSLABEL type
TYPECODE_BLOB	A BLOB type
TYPECODE_BFILE	A BFILE type
TYPECODE_CLOB	A CLOB type
TYPECODE_CFILE	A CFILE type
TYPECODE_TIMESTAMP	A TIMESTAMP type
TYPECODE_TIMESTAMP_TZ	A TIMESTAMP_TZ type
TYPECODE_TIMESTAMP_LTZ	A TIMESTAMP_LTZ type
TYPECODE_INTERVAL_YM	A INTERVAL_YM type
TYPECODE_INTERVAL_DS	An INTERVAL_DS type
TYPECODE_REF	A REF type
TYPECODE_OBJECT	An OBJECT type
TYPECODE_VARRAY	A VARRAY collection type
TYPECODE_TABLE	A nested table collection type
TYPECODE_NAMEDCOLLECTION	
TYPECODE_OPAQUE	An OPAQUE type
SUCCESS	
NO_DATA	

Exceptions

- INVALID_PARAMETERS

- INCORRECT_USAGE
- TYPE_MISMATCH

69

DBMS_UTILITY

This package provides various utility subprograms.

DBMS_UTILITY submits a job for each partition. It is the users responsibility to control the number of concurrent jobs by setting the INIT.ORA parameter JOB_QUEUE_PROCESSES correctly.There is minimal error checking for correct syntax. Any error is reported in SNP trace files.

This chapter discusses the following topics:

Requirements and Types for DBMS_UTILITY

Requirements

DBMS_UTILITY runs with the privileges of the calling user for the NAME_RESOLVE, COMPILE_SCHEMA, and ANALYZE_SCHEMA procedures. This is necessary so that the SQL works correctly.

This does not run as SYS. The privileges are checked via DBMS_DDL.

Types

```
type uncl_array IS TABLE OF VARCHAR2(227) INDEX BY BINARY_INTEGER;
```
Lists of "USER"."NAME"."COLUMN"@LINK should be stored here.

```
type name_array IS TABLE OF VARCHAR2(30) INDEX BY BINARY_INTEGER;
```
Lists of NAME should be stored here.

```
type dblink_array IS TABLE OF VARCHAR2(128) INDEX BY BINARY_INTEGER;
```
Lists of database links should be stored here.

```
TYPE index_table_type IS TABLE OF BINARY_INTEGER INDEX BY BINARY_INTEGER;
```
The order in which objects should be generated is returned here.

```
TYPE number_array IS TABLE OF NUMBER INDEX BY BINARY_INTEGER;
```
The order in which objects should be generated is returned here for users.

```
  TYPE instance_record IS RECORD (
       inst_number   NUMBER,
       inst_name     VARCHAR2(60));
  TYPE instance_table IS TABLE OF instance_record INDEX BY BINARY_INTEGER;
```
The list of active instance number and instance name.

The starting index of instance_table is 1; instance_table is dense.

Summary of DBMS_UTILITY Subprograms

Table 69–1 DBMS_UTILITY Subprograms **(Page 1 of 3)**

Subprogram	Description
"COMPILE_SCHEMA Procedure" on page 69-4	Compiles all procedures, functions, packages, and triggers in the specified schema.
"ANALYZE_SCHEMA Procedure" on page 69-5	Analyzes all the tables, clusters, and indexes in a schema.

Table 69–1 DBMS_UTILITY Subprograms **(Page 2 of 3)**

Subprogram	Description
"ANALYZE_DATABASE Procedure" on page 69-5	Analyzes all the tables, clusters, and indexes in a database.
"FORMAT_ERROR_STACK Function" on page 69-6	Formats the current error stack.
"FORMAT_CALL_STACK Function" on page 69-7	Formats the current call stack.
"IS_CLUSTER_DATABASE Function" on page 69-7	Finds out if this database is running in cluster database mode.
GET_TIME Function on page 69-7	Finds out the current time in 100th's of a second.
"GET_PARAMETER_VALUE Function" on page 69-8	Gets the value of specified init.ora parameter.
"NAME_RESOLVE Procedure" on page 69-9	Resolves the given name.
"NAME_TOKENIZE Procedure" on page 69-11	Calls the parser to parse the given name.
"COMMA_TO_TABLE Procedure" on page 69-11	Converts a comma-separated list of names into a PL/SQL table of names.
"TABLE_TO_COMMA Procedure" on page 69-12	Converts a PL/SQL table of names into a comma-separated list of names.
"PORT_STRING Function" on page 69-12	Returns a string that uniquely identifies the version of Oracle and the operating system.
"DB_VERSION Procedure" on page 69-13	Returns version information for the database.
"MAKE_DATA_BLOCK_ ADDRESS Function" on page 69-13	Creates a data block address given a file number and a block number.
"DATA_BLOCK_ADDRESS_FILE Function" on page 69-14	Gets the file number part of a data block address.
"DATA_BLOCK_ADDRESS_ BLOCK Function" on page 69-15	Gets the block number part of a data block address.
"GET_HASH_VALUE Function" on page 69-15	Computes a hash value for the given string.
"ANALYZE_PART_OBJECT Procedure" on page 69-16	

Table 69–1 DBMS_UTILITY Subprograms **(Page 3 of 3)**

Subprogram	Description
"EXEC_DDL_STATEMENT Procedure" on page 69-17	Executes the DDL statement in `parse_string`.
"CURRENT_INSTANCE Function" on page 69-18	Returns the current connected instance number.
ACTIVE_INSTANCES Procedure on page 69-18	

COMPILE_SCHEMA Procedure

This procedure compiles all procedures, functions, packages, and triggers in the specified schema. After calling this procedure, you should select from view `ALL_OBJECTS` for items with status of `INVALID` to see if all objects were successfully compiled.

To see the errors associated with `INVALID` objects, you may use the Enterprise Manager command:

```
SHOW ERRORS <type> <schema>.<name>
```

Syntax

```
DBMS_UTILITY.COMPILE_SCHEMA (
   schema VARCHAR2);
```

Parameters

Table 69–2 COMPILE_SCHEMA Procedure Parameters

Parameter	Description
schema	Name of the schema.

Exceptions

Table 69–3 COMPILE_SCHEMA Procedure Exceptions

Exception	Description
ORA-20000	Insufficient privileges for some object in this schema.

ANALYZE_SCHEMA Procedure

This procedure analyzes all the tables, clusters, and indexes in a schema.

Syntax

```
DBMS_UTILITY.ANALYZE_SCHEMA (
   schema           VARCHAR2,
   method           VARCHAR2,
   estimate_rows    NUMBER   DEFAULT NULL,
   estimate_percent NUMBER   DEFAULT NULL,
   method_opt       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 69–4 ANALYZE_SCHEMA Procedure Parameters

Parameter	Description
schema	Name of the schema.
method	One of ESTIMATE, COMPUTE or DELETE. If ESTIMATE, then either estimate_rows or estimate_percent must be non-zero.
estimate_rows	Number of rows to estimate.
estimate_percent	Percentage of rows to estimate. If estimate_rows is specified, then ignore this parameter.
method_opt	Method options of the following format: [FOR TABLE] [FOR ALL [INDEXED] COLUMNS] [SIZE n] [FOR ALL INDEXES]

Exceptions

Table 69–5 ANALYZE_SCHEMA Procedure Exceptions

Exception	Description
ORA-20000	Insufficient privileges for some object in this schema.

ANALYZE_DATABASE Procedure

This procedure analyzes all the tables, clusters, and indexes in a database.

Syntax

```
DBMS_UTILITY.ANALYZE_DATABASE (
   method           VARCHAR2,
   estimate_rows    NUMBER   DEFAULT NULL,
   estimate_percent NUMBER   DEFAULT NULL,
   method_opt       VARCHAR2 DEFAULT NULL);
```

Parameters

Table 69–6 ANALYZE_DATABASE Procedure Parameters

Parameter	Description
method	One of ESTIMATE, COMPUTE or DELETE. If ESTIMATE, then either estimate_rows or estimate_percent must be non-zero.
estimate_rows	Number of rows to estimate.
estimate_percent	Percentage of rows to estimate. If estimate_rows is specified, then ignore this parameter.
method_opt	Method options of the following format: [FOR TABLE] [FOR ALL [INDEXED] COLUMNS] [SIZE n] [FOR ALL INDEXES]

Exceptions

Table 69–7 ANALYZE_DATABASE Procedure Exceptions

Exception	Description
ORA-20000	Insufficient privileges for some object in this database.

FORMAT_ERROR_STACK Function

This function formats the current error stack. This can be used in exception handlers to look at the full error stack.

Syntax

```
DBMS_UTILITY.FORMAT_ERROR_STACK
  RETURN VARCHAR2;
```

Returns

This returns the error stack, up to 2000 bytes.

FORMAT_CALL_STACK Function

This function formats the current call stack. This can be used on any stored procedure or trigger to access the call stack. This can be useful for debugging.

Syntax

```
DBMS_UTILITY.FORMAT_CALL_STACK
  RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(format_call_stack,WNDS);
```

Returns

This returns the call stack, up to 2000 bytes.

IS_CLUSTER_DATABASE Function

This function finds out if this database is running in cluster database mode.

Syntax

```
DBMS_UTILITY.IS_CLUSTER_DATABASE
  RETURN BOOLEAN;
```

Returns

This returns TRUE if this instance was started in cluster database mode, FALSE otherwise.

GET_TIME Function

This function finds out the current time in 100th's of a second. It is primarily useful for determining elapsed time.

Syntax

```
DBMS_UTILITY.GET_TIME
  RETURN NUMBER;
```

Returns

Time is the number of 100th's of a second from some arbitrary epoch.

GET_PARAMETER_VALUE Function

This function gets the value of specified `init.ora` parameter.

Syntax

```
DBMS_UTILITY.GET_PARAMETER_VALUE (
   parnam IN     VARCHAR2,
   intval IN OUT BINARY_INTEGER,
   strval IN OUT VARCHAR2)
  RETURN BINARY_INTEGER;
```

Parameters

Table 69–8 GET_PARAMETER_VALUE Function Parameters

Parameter	Description
parnam	Parameter name.
intval	Value of an integer parameter or the value length of a string parameter.
strval	Value of a string parameter.

Returns

Table 69–9 GET_PARAMETER_VALUE Function Returns

Return	Description
partyp	Parameter type: 0 if parameter is an integer / boolean parameter 1 if parameter is a string / file parameter

Example

```
DECLARE
  parnam VARCHAR2(256);
  intval BINARY_INTEGER;
  strval VARCHAR2(256);
  partyp BINARY_INTEGER;
```

```
BEGIN
  partyp := dbms_utility.get_parameter_value('max_dump_file_size',
                                             intval, strval);
  dbms_output.put('parameter value is: ');
  IF partyp = 1 THEN
    dbms_output.put_line(strval);
  ELSE
    dbms_output.put_line(intval);
  END IF;
  IF partyp = 1 THEN
    dbms_output.put('parameter value length is: ');
    dbms_output.put_line(intval);
  END IF;
  dbms_output.put('parameter type is: ');
  IF partyp = 1 THEN
    dbms_output.put_line('string');
  ELSE
    dbms_output.put_line('integer');
  END IF;
END;
```

NAME_RESOLVE Procedure

This procedure resolves the given name, including synonym translation and authorization checking as necessary.

Syntax

```
DBMS_UTILITY.NAME_RESOLVE (
   name          IN  VARCHAR2,
   context       IN  NUMBER,
   schema        OUT VARCHAR2,
   part1         OUT VARCHAR2,
   part2         OUT VARCHAR2,
   dblink        OUT VARCHAR2,
   part1_type    OUT NUMBER,
   object_number OUT NUMBER);
```

Parameters

Table 69–10 NAME_RESOLVE Procedure Parameters

Parameter	Description
name	Name of the object. This can be of the form [[a.]b.]c[@d], where a, b, c are SQL identifier and d is a dblink. No syntax checking is performed on the dblink. If a dblink is specified, or if the name resolves to something with a dblink, then object is not resolved, but the schema, part1, part2 and dblink OUT parameters are filled in. a, b and c may be delimited identifiers, and may contain NLS characters (single and multi-byte).
context	Must be an integer between 0 and 8.
schema	Schema of the object: c. If no schema is specified in name, then the schema is determined by resolving the name.
part1	First part of the name. The type of this name is specified part1_type (synonym, procedure or package).
part2	If this is non-NULL, then this is a procedure name within the package indicated by part1.
dblink	If this is non-NULL, then a database link was either specified as part of name or name was a synonym which resolved to something with a database link. In this later case, part1_type indicates a synonym.
part1_type	Type of part1 is: 5 - synonym 7 - procedure (top level) 8 - function (top level) 9 - package If a synonym, then it means that name is a synonym that translates to something with a database link. In this case, if further name translation is desired, then you must call the DBMS_UTILITY.NAME_RESOLVE procedure on this remote node.

Exceptions

All errors are handled by raising exceptions. A wide variety of exceptions are possible, based on the various syntax error that are possible when specifying object names.

NAME_TOKENIZE Procedure

This procedure calls the parser to parse the given name as "a [. b [. c]][@ dblink]". It strips double quotes, or converts to uppercase if there are no quotes. It ignores comments of all sorts, and does no semantic analysis. Missing values are left as NULL.

Syntax

```
DBMS_UTILITY.NAME_TOKENIZE (
   name    IN  VARCHAR2,
   a       OUT VARCHAR2,
   b       OUT VARCHAR2,
   c       OUT VARCHAR2,
   dblink  OUT VARCHAR2,
   nextpos OUT BINARY_INTEGER);
```

Parameters

For each of a, b, c, dblink, tell where the following token starts in anext, bnext, cnext, dnext respectively.

COMMA_TO_TABLE Procedure

This procedure converts a comma-separated list of names into a PL/SQL table of names. This uses NAME_TOKENIZE to figure out what are names and what are commas.

Syntax

```
DBMS_UTILITY.COMMA_TO_TABLE (
   list   IN  VARCHAR2,
   tablen OUT BINARY_INTEGER,
   tab    OUT UNCL_ARRAY);
```

Parameters

Table 69–11 COMMA_TO_TABLE Procedure Parameters

Parameter	Description
list	Comma separated list of tables.
tablen	Number of tables in the PL/SQL table.
tab	PL/SQL table which contains list of table names.

Returns

A PL/SQL table is returned, with values 1..n and n+1 is null.

Usage Notes

The list must be a non-empty comma-separated list: Anything other than a comma-separated list is rejected. Commas inside double quotes do not count.

Entries in the comma-separated list cannot include multi-byte characters such as hyphens (-).

The values in tab are cut from the original list, with no transformations.

TABLE_TO_COMMA Procedure

This procedure converts a PL/SQL table of names into a comma-separated list of names. This takes a PL/SQL table, 1..n, terminated with n+1 null.

Syntax

```
DBMS_UTILITY.TABLE_TO_COMMA (
   tab    IN  UNCL_ARRAY,
   tablen OUT BINARY_INTEGER,
   list   OUT VARCHAR2);
```

Parameters

Table 69–12 TABLE_TO_COMMA Procedure Parameters

Parameter	Description
tab	PL/SQL table which contains list of table names.
tablen	Number of tables in the PL/SQL table.
list	Comma separated list of tables.

Returns

Returns a comma-separated list and the number of elements found in the table (n).

PORT_STRING Function

This function returns a string that identifies the operating system and the TWO TASK PROTOCOL version of the database. For example, "VAX/VMX-7.1.0.0"

The maximum length is port-specific.

Syntax

```
DBMS_UTILITY.PORT_STRING
   RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(port_string, WNDS, RNDS, WNPS, RNPS);
```

DB_VERSION Procedure

This procedure returns version information for the database.

Syntax

```
DBMS_UTILITY.DB_VERSION (
   version       OUT VARCHAR2,
   compatibility OUT VARCHAR2);
```

Parameters

Table 69–13 DB_VERSION Procedure Parameters

Parameter	Description
version	A string which represents the internal software version of the database (e.g., 7.1.0.0.0). The length of this string is variable and is determined by the database version.
compatibility	The compatibility setting of the database determined by the "compatible" `init.ora` parameter. If the parameter is not specified in the `init.ora` file, then `NULL` is returned.

MAKE_DATA_BLOCK_ADDRESS Function

This function creates a data block address given a file number and a block number. A data block address is the internal structure used to identify a block in the database. This function is useful when accessing certain fixed tables that contain data block addresses.

Syntax

```
DBMS_UTILITY.MAKE_DATA_BLOCK_ADDRESS (
   file  NUMBER,
   block NUMBER)
  RETURN NUMBER;
```

Parameters

Table 69–14 MAKE_DATA_BLOCK_ADDRESS Function Parameters

Parameter	Description
file	File that contains the block.
block	Offset of the block within the file in terms of block increments.

Pragmas

```
pragma restrict_references(make_data_block_address, WNDS, RNDS, WNPS, RNPS);
```

Returns

Table 69–15 MAKE_DATA_BLOCK_ADDRESS Function Returns

Returns	Description
dba	Data block address.

DATA_BLOCK_ADDRESS_FILE Function

This function gets the file number part of a data block address.

Syntax

```
DBMS_UTILITY.DATA_BLOCK_ADDRESS_FILE (
   dba NUMBER)
  RETURN NUMBER;
```

Parameters

Table 69–16 DATA_BLOCK_ADDRESS_FILE Function Parameters

Parameter	Description
dba	Data block address.

Pragmas

```
pragma restrict_references(data_block_address_file, WNDS, RNDS, WNPS, RNPS);
```

Returns

Table 69–17 DATA_BLOCK_ADDRESS_FILE Function Returns

Returns	Description
file	File that contains the block.

DATA_BLOCK_ADDRESS_BLOCK Function

This function gets the block number part of a data block address.

Syntax

```
DBMS_UTILITY.DATA_BLOCK_ADDRESS_BLOCK (
   dba NUMBER)
  RETURN NUMBER;
```

Parameters

Table 69–18 DATA_BLOCK_ADDRESS_BLOCK Function Parameters

Parameter	Description
dba	Data block address.

Pragmas

```
pragma restrict_references(data_block_address_block, WNDS, RNDS, WNPS, RNPS);
```

Returns

Table 69–19 DATA_BLOCK_ADDRESS_BLOCK Function Returns

Returns	Description
block	Block offset of the block.

GET_HASH_VALUE Function

This function computes a hash value for the given string.

Syntax

```
DBMS_UTILITY.GET_HASH_VALUE (
   name      VARCHAR2,
   base      NUMBER,
   hash_size NUMBER)
  RETURN NUMBER;
```

Parameters

Table 69–20 GET_HASH_VALUE Function Parameters

Parameter	Description
name	String to be hashed.
base	Base value for the returned hash value to start at.
hash_size	Desired size of the hash table.

Pragmas

```
pragma restrict_references(get_hash_value, WNDS, RNDS, WNPS, RNPS);
```

Returns

A hash value based on the input string. For example, to get a hash value on a string where the hash value should be between 1000 and 3047, use 1000 as the base value and 2048 as the `hash_size` value. Using a power of 2 for the `hash_size` parameter works best.

ANALYZE_PART_OBJECT Procedure

This procedure is equivalent to SQL:

```
"ANALYZE TABLE|INDEX [<schema>.]<object_name> PARTITION <pname> [<command_type>]
[<command_opt>] [<sample_clause>]
```

For each partition of the object, run in parallel using job queues.

Syntax

```
DBMS_UTILITY.ANALYZE_PART_OBJECT (
   schema        IN VARCHAR2 DEFAULT NULL,
   object_name   IN VARCHAR2 DEFAULT NULL,
   object_type   IN CHAR     DEFAULT 'T',
   command_type  IN CHAR     DEFAULT 'E',
```

```
   command_opt   IN VARCHAR2 DEFAULT NULL,
   sample_clause IN VARCHAR2 DEFAULT 'SAMPLE 5 PERCENT');
```

Parameters

Table 69–21 ANALYZE_PART_OBJECT Procedure Parameters

Parameter	Description
schema	Schema of the object_name.
object_name	Name of object to be analyzed, must be partitioned.
object_type	Type of object, must be T (table) or I (index).
command_type	Must be one of the following: C (compute statistics) E (estimate statistics) D (delete statistics) V (validate structure)
command_opt	Other options for the command type. For C, E it can be FOR table, FOR all LOCAL indexes, FOR all columns or combination of some of the 'for' options of analyze statistics (table). For V, it can be CASCADE when object_type is T.
sample_clause	The sample clause to use when command_type is 'E'.

EXEC_DDL_STATEMENT Procedure

This procedure executes the DDL statement in parse_string.

Syntax

```
DBMS_UTILITY.EXEC_DDL_STATEMENT (
   parse_string IN VARCHAR2);
```

Parameters

Table 69–22 EXEC_DDL_STATEMENT Procedure Parameters

Parameter	Description
parse_string	DDL statement to be executed.

CURRENT_INSTANCE Function

This function returns the current connected instance number. It returns NULL when connected instance is down.

Syntax

```
DBMS_UTILITY.CURRENT_INSTANCE
   RETURN NUMBER;
```

ACTIVE_INSTANCES Procedure

Syntax

```
DBMS_UTILITY.ACTIVE_INSTANCE (
   instance_table   OUT INSTANCE_TABLE,
   instance_count   OUT NUMBER);
```

Parameters

Table 69–23 ACTIVE_INSTANCES Procedure Parameters

Procedure	Description
instance_table	Contains a list of the active instance numbers and names. When no instance is up, the list is empty.
instance_count	Number of active instances.

70

DBMS_WM

This chapter describes how to use the DBMS_WM package, the programming interface to Oracle Database Workspace Manager (often referred to as Workspace Manager) to work with long transactions.

Workspace management refers to the ability of the database to hold different versions of the same record (that is, row) in one or more workspaces. Users of the database can then change these versions independently. For detailed conceptual and usage information about Workspace Manager, including descriptions of the types of procedures, see *Oracle9i Application Developer's Guide - Workspace Manager*. That manual also includes the detailed reference information found in this chapter.

This chapter discusses the following topics:

Summary of DBMS_WM Subprograms

Table 70–1 DBMS_WM Subprograms

Subprogram	Description
"AlterSavepoint Procedure" on page 70-5	Modifies the description of a savepoint.
"AlterWorkspace Procedure" on page 70-6	Modifies the description of a workspace.
"BeginResolve Procedure" on page 70-7	Starts a conflict resolution session.
"CommitResolve Procedure" on page 70-8	Ends a conflict resolution session and saves (makes permanent) any changes in the workspace since BeginResolve was executed.
"CompressWorkspace Procedure" on page 70-9	Deletes explicit savepoints in a workspace and minimizes the Workspace Manager metadata structures for the workspace.
"CompressWorkspaceTree Procedure" on page 70-11	Deletes explicit savepoints in a workspace and all its descendant workspaces. It also minimizes the Workspace Manager metadata structures for the affected workspaces, and eliminates any redundant data that might arise from the deletion of the savepoints.
"CopyForUpdate Procedure" on page 70-13	Allows LOB columns (BLOB or CLOB) in version-enabled tables to be modified.
"CreateSavepoint Procedure" on page 70-14	Creates a savepoint for the current version.
"CreateWorkspace Procedure" on page 70-16	Creates a new workspace in the database.
"DeleteSavepoint Procedure" on page 70-17	Deletes a savepoint.
"DisableVersioning Procedure" on page 70-19	Deletes all support structures that were created to enable the table to support versioned rows.
"EnableVersioning Procedure" on page 70-21	Creates the necessary structures to enable the table to support multiple versions of rows.
"FreezeWorkspace Procedure" on page 70-22	Disables changes in a workspace and prevents subsequent sessions from entering the workspace.
"GetConflictWorkspace Function" on page 70-24	Returns the name of the workspace on which the session has performed the SetConflictWorkspace procedure.

Table 70–1 DBMS_WM Subprograms (Cont.)

Subprogram	Description
"GetDiffVersions Function" on page 70-24	Returns the names of the (workspace, savepoint) pairs on which the session has performed the SetDiffVersions operation.
"GetLockMode Function" on page 70-25	Returns the locking mode, which determines whether or not access is enabled to versioned rows and corresponding rows in the parent workspace.
"GetMultiWorkspaces Function" on page 70-26	Returns the names of workspaces visible in the multiworkspace views for version-enabled tables.
"GetOpContext Function" on page 70-26	Returns the context of the current operation.
"GetPrivs Function" on page 70-27	Returns a comma-separated list of all privileges that the current user has for the specified workspace.
"GetWorkspace Function" on page 70-28	Returns the current workspace for the session.
"GotoDate Procedure" on page 70-29	Goes to a point at or near the specified date and time in the current workspace.
"GotoSavepoint Procedure" on page 70-30	Goes to the specified savepoint in the current workspace.
"GotoWorkspace Procedure" on page 70-31	Moves the current session to the specified workspace.
"GrantSystemPriv Procedure" on page 70-32	Grants system-level privileges (not restricted to a particular workspace) to users and roles. The `grant_option` parameter enables the grantee to then grant the specified privileges to other users and roles.
"GrantWorkspacePriv Procedure" on page 70-34	Grants workspace-level privileges to users and roles. The `grant_option` parameter enables the grantee to then grant the specified privileges to other users and roles.
"IsWorkspaceOccupied Function" on page 70-36	Checks whether or not a workspace has any active sessions.
"LockRows Procedure" on page 70-37	Controls access to versioned rows in a specified table and to corresponding rows in the parent workspace.
"MergeTable Procedure" on page 70-38	Applies changes to a table (all rows or as specified in the `WHERE` clause) in a workspace to its parent workspace.
"MergeWorkspace Procedure" on page 70-40	Applies all changes in a workspace to its parent workspace, and optionally removes the workspace.

Table 70–1 DBMS_WM Subprograms (Cont.)

Subprogram	Description
"RefreshTable Procedure" on page 70-41	Applies to a workspace all changes made to a table (all rows or as specified in the WHERE clause) in its parent workspace.
"RefreshWorkspace Procedure" on page 70-43	Applies to a workspace all changes made in its parent workspace.
"RemoveWorkspace Procedure" on page 70-44	Rolls back the data in the workspace and removes all support structures created for the workspace. The workspace ceases to exist.
"RemoveWorkspaceTree Procedure" on page 70-45	Removes the specified workspace and all its descendant workspaces. The data in the workspaces is rolled back and the workspace structure is removed.
"ResolveConflicts Procedure" on page 70-46	Resolves conflicts between workspaces.
"RevokeSystemPriv Procedure" on page 70-48	Revokes (removes) system-level privileges from users and roles.
"RevokeWorkspacePriv Procedure" on page 70-50	Revokes (removes) workspace-level privileges from users and roles for a specified workspace.
"RollbackResolve Procedure" on page 70-51	Quits a conflict resolution session and discards all changes in the workspace since BeginResolve was executed.
"RollbackTable Procedure" on page 70-52	Discards all changes made in the workspace to a specified table (all rows or as specified in the WHERE clause).
"RollbackToSP Procedure" on page 70-53	Discards all changes made after a specified savepoint in the workspace to all tables.
"RollbackWorkspace Procedure" on page 70-55	Discards all changes made in the workspace to all tables.
"SetConflictWorkspace Procedure" on page 70-56	Determine whether or not conflicts exist between a workspace and its parent.
"SetDiffVersions Procedure" on page 70-57	Finds differences in values in version-enabled tables for two savepoints and their common ancestor (base). It creates rows in the differences views describing these differences.
"SetLockingOFF Procedure" on page 70-59	Enables access to versioned rows and to corresponding rows in the parent workspace.
"SetLockingON Procedure" on page 70-60	Controls access to versioned rows and to corresponding rows in the previous version.
"SetMultiWorkspaces Procedure" on page 70-61	Makes the specified workspace or workspaces visible in the multiworkspace views for version-enabled tables.

Table 70–1 DBMS_WM Subprograms (Cont.)

Subprogram	Description
"SetWoOverwriteOFF Procedure" on page 70-62	Disables the VIEW_WO_OVERWRITE history option that had been enabled by the EnableVersioning or SetWoOverwriteON procedure, changing the option to VIEW_W_OVERWRITE (with overwrite).
"SetWoOverwriteON Procedure" on page 70-63	Enables the VIEW_WO_OVERWRITE history option that had been disabled by the SetWoOverwriteOFF procedure.
"SetWorkspaceLockModeOFF Procedure" on page 70-64	Enables access to versioned rows in the specified workspace and to corresponding rows in the parent workspace.
"SetWorkspaceLockModeON Procedure" on page 70-65	Sets the default mode for the row-level locking in the workspace.
"UnfreezeWorkspace Procedure" on page 70-66	Enables changes to a workspace, reversing the effect of FreezeWorkspace.
"UnlockRows Procedure" on page 70-67	Enables access to versioned rows in a specified table and to corresponding rows in the parent workspace.

Note: Most Workspace Manager subprograms are procedures, but a few are functions. Most functions have names starting with *Get* (such as GetConflictWorkspace Function and GetWorkspace Function).

In this chapter, the term *procedures* is often used to refer generally to both procedures and functions.

AlterSavepoint Procedure

This procedure modifies the description of a savepoint.

Syntax

```
DBMS_WM.AlterSavepoint(
   workspace      IN VARCHAR2,
   sp_name        IN VARCHAR2,
   sp_description IN VARCHAR2);
```

Parameters

Table 70–2 AlterSavepoint Procedure Parameters

Parameter	Description
workspace	Name of the workspace in which the savepoint was created. The name is case sensitive.
sp_name	Name of the savepoint. The name is case sensitive.
sp_description	Description of the savepoint.

Usage Notes

An exception is raised if the user is not the workspace owner or savepoint owner or does not have the WM_ADMIN_ROLE role.

Examples

The following example modifies the description of savepoint SP1 in the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.AlterSavepoint ('NEWWORKSPACE', 'SP1', 'First set of changes for
scenario');
```

AlterWorkspace Procedure

This procedure modifies the description of a workspace.

Syntax

```
DBMS_WM.AlterWorkspace(
   workspace             IN VARCHAR2,
   workspace_description  IN VARCHAR2);
```

Parameters

Table 70–3 AlterWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
workspace_description	Description of the workspace.

Usage Notes

An exception is raised if the user is not the workspace owner or does not have the WM_ADMIN_ROLE role.

Examples

The following example modifies the description of the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.AlterWorkspace ('NEWWORKSPACE', 'Testing proposed scenario B');
```

BeginResolve Procedure

This procedure starts a conflict resolution session.

Syntax

```
DBMS_WM.BeginResolve(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–4 BeginResolve Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.

Usage Notes

This procedure starts a conflict resolution session. While this procedure is executing, the workspace is frozen in 1WRITER mode.

After calling this procedure, you can execute ResolveConflicts Procedure as needed for various tables that have conflicts, and then call either CommitResolve Procedure or RollbackResolve Procedure. For more information about conflict resolution, see *Oracle9i Application Developer's Guide - Workspace Manager*.

An exception is raised if one or more of the following apply:

- There are one or more open regular transactions in workspace.
- The user executing BeginResolve Procedure does not have the privilege to access workspace and its parent workspace.

Examples

The following example starts a conflict resolution session in `Workspace1`.

```
EXECUTE  DBMS_WM.BeginResolve ('Workspace1');
```

CommitResolve Procedure

This procedure ends a conflict resolution session and saves (makes permanent) any changes in the workspace since BeginResolve Procedure was executed.

Syntax

```
DBMS_WM.CommitResolve(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–5 CommitResolve Procedure Parameters

Parameter	Description
`workspace`	Name of the workspace. The name is case sensitive.

Usage Notes

This procedure ends the current conflict resolution session (started by BeginResolve Procedure), and saves all changes in the workspace since the start of the conflict resolution session. Contrast this procedure with RollbackResolve Procedure, which discards all changes.

For more information about conflict resolution, see *Oracle9i Application Developer's Guide - Workspace Manager*.

An exception is raised if one or more of the following apply:

- There are one or more open regular transactions in `workspace`.
- The procedure was called by a user that does not have the `WM_ADMIN_ROLE` role or that did not execute the BeginResolve Procedure on `workspace`.

Examples

The following example ends the conflict resolution session in `Workspace1` and saves all changes.

```
EXECUTE  DBMS_WM.CommitResolve ('Workspace1');
```

CompressWorkspace Procedure

This procedure deletes explicit savepoints in a workspace and minimizes the Workspace Manager metadata structures for the workspace.

Syntax

```
DBMS_WM.CompressWorkspace(
   workspace                       IN VARCHAR2
   [, compress_view_wo_overwrite   IN BOOLEAN DEFAULT FALSE]
   [, firstSP                      IN VARCHAR2 DEFAULT NULL
   [, secondSP                     IN VARCHAR2 DEFAULT NULL] ]
   [, auto_commit                  IN BOOLEAN DEFAULT TRUE]);
```

or

```
DBMS_WM.CompressWorkspace(
   workspace                       IN VARCHAR2
   [, firstSP                      IN VARCHAR2 DEFAULT NULL
   [, secondSP                     IN VARCHAR2 DEFAULT NULL] ]
   [, auto_commit                  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–6 CompressWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
compress_view_wo_overwrite	A boolean value (TRUE or FALSE). TRUE causes history information between the affected savepoints to be deleted even if VIEW_WO_OVERWRITE was specified when versioning was enabled. FALSE (the default) causes history information (between the affected savepoints) for a table not to be deleted if VIEW_WO_OVERWRITE was specified when versioning was enabled. (If VIEW_WO_OVERWRITE was not specified for a table, history information for the table is deleted regardless of the parameter value.)

Table 70–6 CompressWorkspace Procedure Parameters (Cont.)

Parameter	Description
firstSP	First explicit savepoint. Savepoint names are case sensitive. If only workspace and firstSP are specified, all explicit savepoints between workspace creation and firstSP (but not including firstSP) are deleted. If workspace, firstSP, and secondSP are specified, all explicit savepoints from firstSP (and including firstSP if it is an explicit savepoint) to secondSP (but not including secondSP) are deleted. If only workspace is specified (no savepoints), all explicit savepoints in the workspace are deleted.
secondSP	Second explicit savepoint. All explicit savepoints from firstSP (and including firstSP if it is an explicit savepoint) to secondSP (but not including secondSP) are deleted. Savepoint names are case sensitive.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

You can compress a workspace when the explicit savepoints (all or some of them) in the workspace are no longer needed. The compression operation is useful for the following reasons:

- You can reuse savepoint names after they are deleted. (You cannot create a savepoint that has the same name as an existing savepoint.)
- Runtime performance for Workspace Manager operations is improved.
- Less disk storage is used for Workspace Manager structures.

While this procedure is executing, the current workspace is frozen in READ_ONLY mode.

A workspace cannot be compressed if there are any sessions with an open regular transaction, or if any user has executed a GotoDate Procedure operation or a GotoSavepoint Procedure operation specifying a savepoint in the workspace.

For information about VIEW_WO_OVERWRITE and other history options, see the information about the EnableVersioning Procedure.

An exception is raised if the user does not have the privilege to access and merge changes in workspace.

To compress a workspace and all its descendant workspaces, use the CompressWorkspaceTree Procedure.

Examples

The following example compresses NEWWORKSPACE.

```
EXECUTE DBMS_WM.CompressWorkspace ('NEWWORKSPACE');
```

The following example compresses NEWWORKSPACE, deleting all explicit savepoints between the creation of the workspace and the savepoint SP1.

```
EXECUTE DBMS_WM.CompressWorkspace ('NEWWORKSPACE', 'SP1');
```

The following example compresses NEWWORKSPACE, deleting the explicit savepoint SP1 and all explicit savepoints up to but not including SP2.

```
EXECUTE DBMS_WM.CompressWorkspace ('NEWWORKSPACE', 'SP1', 'SP2');
```

The following example compresses B_focus_1, accepts the default values for the firstSP and secondSP parameters (that is, deletes all explicit savepoints), and specifies FALSE for the auto_commit parameter.

```
EXECUTE DBMS_WM.CompressWorkspace ('B_focus_1', NULL, NULL, FALSE);
```

CompressWorkspaceTree Procedure

This procedure deletes explicit savepoints in a workspace and all its descendant workspaces. It also minimizes the Workspace Manager metadata structures for the affected workspaces, and eliminates any redundant data that might arise from the deletion of the savepoints.

Syntax

```
DBMS_WM.CompressWorkspaceTree(
   workspace                      IN VARCHAR2
   [, compress_view_wo_overwrite  IN BOOLEAN DEFAULT FALSE]
   [, auto_commit                 IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–7 CompressWorkspaceTree Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
compress_view_wo_overwrite	A boolean value (TRUE or FALSE). TRUE causes history information to be deleted even if VIEW_WO_OVERWRITE was specified when versioning was enabled. FALSE (the default) causes history information for a table not to be deleted if VIEW_WO_OVERWRITE was specified when versioning was enabled. (If VIEW_WO_OVERWRITE was not specified for a table, history information for the table is deleted regardless of the parameter value.)
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

You can compress a workspace and all its descendant workspaces when the explicit savepoints in the affected workspaces are no longer needed (for example, you will not need to go to or roll back to any of the savepoints).

The compression operation is useful for the following reasons:

- You can reuse savepoint names after they are deleted. (You cannot create a savepoint that has the same name as an existing savepoint.)
- Runtime performance for Workspace Manager operations is improved.
- Less disk storage is used for Workspace Manager structures.

A workspace cannot be compressed if there are any sessions with an open regular transaction, or if any user has executed a GotoDate Procedure operation or a GotoSavepoint Procedure operation specifying a savepoint in the workspace.

An exception is raised if the user does not have the privilege to access and merge changes in workspace.

If the CompressWorkspaceTree operation fails in any affected workspace, the entire operation is rolled back, and no workspaces are compressed.

To compress a single workspace (deleting all explicit savepoints or just some of them), use the CompressWorkspace Procedure.

Examples

The following example compresses NEWWORKSPACE and all its descendant workspaces.

```
EXECUTE DBMS_WM.CompressWorkspaceTree ('NEWWORKSPACE');
```

The following example compresses NEWWORKSPACE and all its descendant workspaces, accepts the default value for the compress_view_wo_overwrite parameter, and specifies FALSE for the auto_commit parameter.

```
EXECUTE DBMS_WM.CompressWorkspaceTree ('B_focus_1', NULL, FALSE);
```

CopyForUpdate Procedure

This procedure allows LOB columns (BLOB, CLOB, or NCLOB) in version-enabled tables to be modified. Use this procedure only if a version-enabled table has any LOB columns.

Syntax

```
DBMS_WM.CopyForUpdate(
   table_name       IN VARCHAR2,
   [, where_clause  IN VARCHAR2 DEFAULT '']);
```

Parameters

Table 70–8 CopyForUpdate Procedure Parameters

Parameter	Description
table_name	Name of the table containing one or more LOB columns. The name is not case sensitive.
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows affected. Example: 'department_id = 20' The WHERE clause cannot contain a subquery. If where_clause is not specified, all rows in table_name are affected.

Usage Notes

This procedure is intended for use only with version-enabled tables containing one or more LOB columns. The CopyForUpdate must be used because updates performed using the DBMS_LOB package do not fire INSTEAD OF triggers on the versioning views. Workspace Manager creates INSTEAD OF triggers on the versioning views to implement the copy-on-write semantics. (For non-LOB columns, you can directly perform the update operation, and the triggers work.)

See the following example.

Examples

The following example updates the SOURCE_CLOB column of TABLE1 for the document with DOC_ID = 1.

```
Declare
  clob_var
Begin
   /* This procedure copies the lob columns if necessary, i.e.,
      if the row with doc_id = 1 has not been versioned in the
      current version */
   vm.copyForUpdate('table1', 'doc_id = 1');

   select source_clob into clob_var
   from   table1
   where  doc_id = 1 for update;

   dbms_lob.write(clob_var,<amount>, <offset>, buff);

End;
```

CreateSavepoint Procedure

This procedure creates a savepoint for the current version.

Syntax

```
DBMS_WM.CreateSavepoint(
   workspace       IN VARCHAR2,
   savepoint_name  IN VARCHAR2
   [, description  IN VARCHAR2 DEFAULT NULL]
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–9 CreateSavepoint Procedure Parameters

Parameter	Description
workspace	Name of the workspace in which to create the savepoint. The name is case sensitive.
savepoint_name	Name of the savepoint to be created. The name is case sensitive.
description	Description of the savepoint to be created.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

There are no explicit privileges associated with savepoints; any user who can access a workspace can create a savepoint in the workspace.

This procedure can be performed while there are users in the workspace; a quiet point is not required.

While this procedure is executing, the current workspace is frozen in READ_ONLY mode.

An exception is raised if one or more of the following apply:

- The user is not in the latest version in the workspace (for example, if the user has called GotoDate Procedure).
- workspace does not exist.
- savepoint_name already exists.
- The user does not have the privilege to go to the specified workspace.

Examples

The following example creates a savepoint named Savepoint1 in the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.CreateSavepoint ('NEWWORKSPACE', 'Savepoint1');
```

CreateWorkspace Procedure

This procedure creates a new workspace in the database.

Syntax

```
DBMS_WM.CreateWorkspace(
   workspace       IN VARCHAR2
   [, isrefreshed  IN BOOLEAN DEFAULT FALSE]
   [, description  IN VARCHAR2 DEFAULT NULL]
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

or

```
DBMS_WM.CreateWorkspace(
   workspace       IN VARCHAR2,
   isrefreshed     IN BOOLEAN
   [, description  IN VARCHAR2 DEFAULT NULL]
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–10 CreateWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive, and it must be unique (no other workspace of the same name).
isrefreshed	A boolean value (TRUE or FALSE). TRUE causes the workspace to be continually refreshed. In a **continually refreshed workspace**, changes made in the parent workspace are automatically applied to the workspace after a merge or rollback operation in the parent workspace. That is, you do not need to call the RefreshWorkspace Procedure to apply the changes. A continually refreshed workspace must be created as a child of the LIVE workspace. FALSE causes the workspace not to be continually refreshed. To refresh the workspace, you must call the RefreshWorkspace Procedure. If you use the syntax without the isrefreshed parameter, the workspace is not continually refreshed.
description	Description of the workspace.

Table 70–10 CreateWorkspace Procedure Parameters (Cont.)

Parameter	Description
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

The new workspace is a child of the current workspace. If the session has not explicitly entered a workspace, it is in the LIVE database workspace, and the new workspace is a child of the LIVE workspace. For an explanation of database workspace hierarchy, see *Oracle9i Application Developer's Guide - Workspace Manager*.

An implicit savepoint is created in the current version of the current workspace. (The current version does not have to be the latest version in the current workspace.) For an explanation of savepoints (explicit and implicit), see *Oracle9i Application Developer's Guide - Workspace Manager*.

While this procedure is executing, the current workspace is frozen in READ_ONLY mode.

This procedure does not implicitly go to the workspace created. To go to the workspace, use the GotoWorkspace Procedure.

An exception is raised if one or more of the following apply:

- workspace already exists.
- The user does not have the privilege to create a workspace.

Examples

The following example creates a workspace named NEWWORKSPACE in the database.

```
EXECUTE DBMS_WM.CreateWorkspace ('NEWWORKSPACE');
```

DeleteSavepoint Procedure

This procedure deletes a savepoint.

Syntax

```
DBMS_WM.DeleteSavepoint(
   workspace                       IN VARCHAR2,
   savepoint_name                  IN VARCHAR2)
   [, compress_view_wo_overwrite   IN BOOLEAN DEFAULT FALSE]
   [, auto_commit                  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–11 DeleteSavepoint Procedure Parameters

Parameter	Description
workspace	Name of the workspace in which the savepoint was created. The name is case sensitive.
savepoint_name	Name of the savepoint to be deleted. The name is case sensitive.
compress_view_wo_overwrite	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

You can delete a savepoint when it is no longer needed (for example, you will not need to go to it or roll back to it).

Deleting a savepoint is useful for the following reasons:

- You can reuse a savepoint name after it is deleted. (You cannot create a savepoint that has the same name as an existing savepoint.)
- Runtime performance for Workspace Manager operations is improved.

- Less disk storage is used for Workspace Manager structures.

To delete a savepoint, you must have the WM_ADMIN_ROLE role or be the owner of the workspace or the savepoint.

This procedure cannot be executed if there are any sessions with an open regular transaction, or if any user has executed a GotoDate Procedure operation or a GotoSavepoint Procedure operation specifying a savepoint in the workspace.

An exception is raised if one or more of the following apply:

- The user is not in the latest version in the workspace (for example, if the user has called GotoDate Procedure).
- workspace does not exist.
- savepoint_name does not exist.
- The user does not have the privilege to go to the specified workspace.

Examples

The following example deletes a savepoint named Savepoint1 in the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.DeleteSavepoint ('NEWWORKSPACE', 'Savepoint1');
```

DisableVersioning Procedure

This procedure deletes all support structures that were created to enable the table to support versioned rows.

Syntax

```
DBMS_WM.DisableVersioning(
   table_name  IN VARCHAR2
   [, force    IN BOOLEAN DEFAULT FALSE]);
```

Parameters

Table 70–12 DisableVersioning Procedure Parameters

Parameter	Description
table_name	Name of the table. The name is not case sensitive.

Table 70–12 DisableVersioning Procedure Parameters (Cont.)

Parameter	Description
force	A boolean value (TRUE or FALSE). TRUE forces all data in workspaces other than LIVE to be discarded before versioning is disabled. FALSE (the default) prevents versioning from being disabled if table_name was modified in any workspace other than LIVE and if the workspace that modified table_name still exists.

Usage Notes

This procedure is used to reverse the effect of the EnableVersioning Procedure. It deletes the Workspace Manager infrastructure (support structures) for versioning of rows, but does not affect any user data in the LIVE workspace. The workspace hierarchy and any savepoints still exist, but all rows are the same as in the LIVE workspace. (If there are multiple versions in the LIVE workspace of a row in the table for which versioning is disabled, only the most recent version of the row is kept.)

The DisableVersioning operation fails if the force value is FALSE and any of the following apply:

- The table is being modified by any user in any workspace other than the LIVE workspace.
- There are versioned rows of the table in any workspace other than the LIVE workspace.

Only the owner of a table or a user with the WM_ADMIN_ROLE role can disable versioning on the table.

Tables that are version-enabled and users that own version-enabled tables cannot be deleted. You must first disable versioning on the relevant table or tables.

An exception is raised if the table is not version-enabled.

Examples

The following example disables the EMPLOYEE table for versioning.

```
EXECUTE DBMS_WM.DisableVersioning ('employee');
```

EnableVersioning Procedure

This procedure creates the necessary structures to enable the table to support multiple versions of rows.

Syntax

```
DBMS_WM.EnableVersioning(
   table_name  IN VARCHAR2
   [, hist     IN VARCHAR2 DEFAULT 'NONE']);
```

Parameters

Table 70–13 EnableVersioning Procedure Parameters

Parameter	Description
table_name	Name of the table. The length of a table name must not exceed 25 characters. The name is not case sensitive.
hist	History option, for tracking modifications to table_name. Must be one of the following values: NONE: No modifications to the table are tracked. (This is the default.) VIEW_W_OVERWRITE: The *with* overwrite (*W*_OVERWRITE) option: A view named <table_name>_HIST is created to contain history information, but it will show only the most recent modifications to the same version of the table. A history of modifications to the version is not maintained; that is, subsequent changes to a row in the same version overwrite earlier changes. (The CREATETIME column of the <table_name>_HIST view contains only the time of the most recent update.) VIEW_WO_OVERWRITE: The *without* overwrite (*WO*_OVERWRITE) option: A view named <table_name>_HIST is created to contain history information, and it will show all modifications to the same version of the table. A history of modifications to the version is maintained; that is, subsequent changes to a row in the same version do not overwrite earlier changes.

Usage Notes

The table that is being version-enabled must have a primary key defined.

Only the owner of a table can enable versioning on the table.

Tables that are version-enabled and users that own version-enabled tables cannot be deleted. You must first disable versioning on the relevant table or tables.

Tables owned by SYS cannot be version-enabled.

An exception is raised if the table is already version-enabled.

If the table is version-enabled with the VIEW_WO_OVERWRITE *hist* option specified, this option can later be disabled and re-enabled by calling the SetWoOverwriteOFF Procedure and SetWoOverwriteON Procedure. However, the VIEW_WO_OVERWRITE *hist* option can be overridden when a workspace is compressed by specifying the compress_view_wo_overwrite parameter as TRUE with the CompressWorkspace Procedure or CompressWorkspaceTree Procedure.

The history option affects the behavior of the GotoDate Procedure. See the Usage Notes for that procedure.

Current notes and restrictions include:

- If you have referential integrity constraints on version-enabled tables, note the considerations and restrictions in *Oracle9i Application Developer's Guide - Workspace Manager*.
- If you have triggers defined on version-enabled tables, note the considerations and restrictions in *Oracle9i Application Developer's Guide - Workspace Manager*.
- Constraints and privileges defined on the table are carried over to the version-enabled table.
- DDL operations are not allowed on version-enabled tables.
- Index-organized tables cannot be version-enabled.
- Object tables cannot be version-enabled.
- A table with one or more columns of LONG data type cannot be version-enabled.

Examples

The following example enables versioning on the EMPLOYEE table.

```
EXECUTE DBMS_WM.EnableVersioning('employee');
```

FreezeWorkspace Procedure

This procedure disables changes in a workspace and prevents subsequent sessions from entering the workspace.

Syntax

```
DBMS_WM.FreezeWorkspace(
   workspace        IN VARCHAR2
```

```
  [, freezemode    IN VARCHAR2 DEFAULT 'NO_ACCESS']
  [, freezewriter  IN VARCHAR2 DEFAULT NULL]
  [, force         IN BOOLEAN DEFAULT FALSE]);
```

Parameters

Table 70–14 FreezeWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
freezemode	Mode for the frozen workspace. Must be one of the following values: NO_ACCESS: No sessions are allowed in the workspace. (This is the default.) READ_ONLY: Sessions are allowed in the workspace, but no write operations (insert, update, delete) are allowed. 1WRITER: Sessions are allowed in the workspace, but only one user (see the freezewriter parameter) is allowed to perform write operations (insert, update, delete). WM_ONLY: Only Workspace Manager operations are permitted. No sessions can directly modify data values or perform queries involving table data; however, child workspaces can be merged into the workspace, and savepoints can be created in the workspace.
freezewriter	The user that is allowed to make changes in the workspace. Can be specified only if freezemode is 1WRITER. The default is USER (the current user).
force	A boolean value (TRUE or FALSE). TRUE forces the workspace to be frozen even if it is already frozen. For example, this value lets you freeze the workspace with a different freezemode parameter value without having first to call the UnfreezeWorkspace Procedure. FALSE (the default) prevents the workspace from being frozen if it is already frozen.

Usage Notes

The operation fails if any sessions are active in workspace (unless force is TRUE) and freezemode is NO_ACCESS.

If freezemode is READ_ONLY or 1WRITER, the workspace cannot be frozen if there is an active regular transaction.

Only the owner of the workspace or a user with WM_ADMIN_ROLE can freeze a workspace. There are no specific privileges associated with freezing a workspace.

The LIVE workspace can be frozen only if freezemode is READ_ONLY or 1WRITER.

To reverse the effect of FreezeWorkspace, use the UnfreezeWorkspace Procedure.

Examples

The following example freezes the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.FreezeWorkspace ('NEWWORKSPACE');
```

GetConflictWorkspace Function

This function returns the name of the workspace on which the session has performed the SetConflictWorkspace Procedure.

Syntax

```
DBMS_WM.GetConflictWorkspace
RETURN VARCHAR2;
```

Usage Notes

If the SetConflictWorkspace Procedure has not been executed, the name of the current workspace is returned.

Examples

The following example displays the name of the workspace on which the session has performed the SetConflictWorkspace Procedure.

```
SELECT DBMS_WM.GetConflictWorkspace FROM DUAL;

GETCONFLICTWORKSPACE
--------------------------------------------------------------------------------
B_focus_2
```

GetDiffVersions Function

This function returns the names of the (workspace, savepoint) pairs on which the session has performed the SetDiffVersions Procedure operation.

Syntax

```
DBMS_WM.GetDiffVersions
RETURN VARCHAR2;
```

Usage Notes

The returned string is in the format `'(WS1,SP1), (WS2,SP2)'`. This format, including the parentheses, is intended to help you if you later want to use parts of the returned string in a call to the SetDiffVersions Procedure.

Examples

The following example displays the names of the (workspace, savepoint) pairs on which the session has performed the SetDiffVersions Procedure operation.

```
SELECT DBMS_WM.GetDiffVersions FROM DUAL;

GETDIFFVERSIONS
--------------------------------------------------------------------------------
(B_focus_1, LATEST), (B_focus_2, LATEST)
```

GetLockMode Function

This function returns the locking mode, which determines whether or not access is enabled to versioned rows and corresponding rows in the previous version.

Syntax

```
DBMS_WM.GetLockMode
RETURN VARCHAR2;
```

Usage Notes

This function returns `E`, `S`, `C`, or `NULL`:

- For explanations of `E` (exclusive), `S` (shared), and `C` (carry-forward), see the description of the `lockmode` parameter of the SetLockingON Procedure.
- `NULL` indicates that locking is not in effect. (Calling the SetLockingOFF Procedure results in this setting.)

For an explanation of Workspace Manager locking, see *Oracle9i Application Developer's Guide - Workspace Manager*. See also the descriptions of the SetLockingON Procedure and SetLockingOFF Procedure.

Examples

The following example displays the locking mode in effect for the session.

```
SELECT DBMS_WM.GetLockMode FROM DUAL;

GETLOCKMODE
--------------------------------------------------------------------------------
C
```

GetMultiWorkspaces Function

This function returns the names of workspaces visible in the multiworkspace views for version-enabled tables.

Syntax

```
DBMS_WM.GetMultiWorkspaces
RETURN VARCHAR2;
```

Usage Notes

This procedure returns the names of workspaces visible in the multiworkspace views, which are described in *Oracle9i Application Developer's Guide - Workspace Manager*.

If no workspaces are visible in the multiworkspace views, `NULL` is returned. If more than one workspace name is returned, names are separated by a comma (for example: `workspace1,workspace2,workspace3`).

To make a workspace visible in the multiworkspace views, use the SetMultiWorkspaces Procedure.

Examples

The following example displays the names of workspaces visible in the multiworkspace views.

```
SELECT DBMS_WM.GetMultiWorkspaces FROM DUAL;
```

GetOpContext Function

This function returns the context of the current operation.

Syntax

```
DBMS_WM.GetOpContext (
RETURN VARCHAR2;
```

Usage Notes

This function returns one of the following values:

- DML: The current operation is driven by data manipulation language (DML) initiated by the user.
- MERGE_REMOVE: The current operation was initiated by a MergeWorkspace Procedure call with remove_workspace as TRUE or a MergeTable Procedure call with remove_data as TRUE.
- MERGE_NOREMOVE: The current operation was initiated by a MergeWorkspace Procedure call with remove_workspace as FALSE or a MergeTable Procedure call with remove_data as FALSE.

Examples

The following example displays the context of the current operation.

```
SELECT DBMS_WM.GetOpContext FROM DUAL;

GETOPCONTEXT
--------------------------------------------------------------------------------
DML
```

GetPrivs Function

This function returns a comma-separated list of all privileges that the current user has for the specified workspace.

Syntax

```
DBMS_WM.GetPrivs (
   workspace  VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 70–15 GetPrivs Function Parameters

Parameter	Description
workspace	Name of the workspace for which to return the list of privileges. The name is case sensitive.

Usage Notes

For information about Workspace Manager privileges, see *Oracle9i Application Developer's Guide - Workspace Manager*.

Examples

The following example displays the privileges that the current user has for the B_focus_2 workspace.

```
SELECT DBMS_WM.GetPrivs ('B_focus_2') FROM DUAL;

DBMS_WM.GETPRIVS('B_FOCUS_2')
--------------------------------------------------------------------------------
ACCESS,MERGE,CREATE,REMOVE,ROLLBACK
```

GetWorkspace Function

This function returns the current workspace for the session.

Syntax

```
DBMS_WM.GetWorkspace (
RETURN VARCHAR2;
```

Examples

The following example displays the workspace that the current user is in.

```
SELECT DBMS_WM.GetWorkspace FROM DUAL;

GETWORKSPACE
--------------------------------------------------------------------------------
B_focus_2
```

GotoDate Procedure

This procedure goes to a point at or near the specified date and time in the current workspace.

Syntax

```
DBMS_WM.GotoDate(
   in_date  IN DATE);
```

Parameters

Table 70–16 GotoDate Procedure Parameters

Parameter	Description
in_date	Date and time for the read-only view of the workspace. (See the Usage Notes for details.)

Usage Notes

You are presented a read-only view of the current workspace at or near the specified date and time. The exact time point depends on the history option for tracking modifications, as set by the EnableVersioning Procedure or modified by the SetWoOverwriteOFF Procedure or SetWoOverwriteON Procedure:

- NONE: The read-only view reflects the first savepoint after in_date.
- VIEW_W_OVERWRITE: The read-only view contents can vary depending on when updates were performed and if or when savepoints were created. The view reflects the data values in effect at in_date except for rows that have been modified *both* (1) between in_date and the most recent savepoint before in_date *and* (2) between in_date and the next savepoint after in_date; for these rows the view reflects the date in effect at the most recent savepoint *before* in_date. Therefore, be careful if you use this procedure when the VIEW_W_OVERWRITE option is enabled.
- VIEW_WO_OVERWRITE: The read-only view reflects the data values in effect at in_date.

For an explanation of the history options, see the description of the hist parameter for the EnableVersioning Procedure. The following example scenario shows the effects of the VIEW_W_OVERWRITE and VIEW_WO_OVERWRITE settings. Assume the following sequence of events:

1. The MANAGER_NAME value in a row is Adams.

2. Savepoint SP1 is created.
3. The MANAGER_NAME value is changed to Baxter.
4. The time point that will be specified as in_date (in step 7) occurs.
5. The MANAGER_NAME value is changed to Chang. (Thus, the value has been changed both before and after in_date since the first savepoint and before the second savepoint.)
6. Savepoint SP2 is created.
7. A GotoDate Procedure operation is executed, specifying the time point in step 4 as in_date.

In the preceding scenario:

- If the history option in effect is VIEW_W_OVERWRITE, the MANAGER_NAME value after step 7 is Adams.
- If the history option in effect is VIEW_WO_OVERWRITE, the MANAGER_NAME value after step 7 is Baxter.

The GotoDate procedure should be executed while users exist in the workspace. There are no explicit privileges associated with this procedure.

Examples

The following example goes to a point at or near midnight at the start of 30-Jun-2000, depending on the history option currently in effect.

```
EXECUTE DBMS_WM.GotoDate ('30-JUN-00');
```

GotoSavepoint Procedure

This procedure goes to the specified savepoint in the current workspace.

Syntax

```
DBMS_WM.GotoSavePoint(
   [savepoint_name  IN VARCHAR2 DEFAULT 'LATEST']);
```

Parameters

Table 70–17 GotoSavepoint Procedure Parameters

Parameter	Description
savepoint_name	Name of the savepoint. The name is case sensitive. If savepoint_name is not specified, the default is LATEST.

Usage Notes

You are presented a read-only view of the workspace at the time of savepoint creation. This procedure is useful for examining the workspace from different savepoints before performing a rollback to a specific savepoint by calling RollbackToSP Procedure to delete all rows from that savepoint forward.

This operation can be executed while users exist in the workspace. There are no explicit privileges associated with this operation.

If you do not want to roll back to the savepoint, you can call GotoSavepoint with a null parameter to go to the currently active version in the workspace. (This achieves the same result as calling GotoWorkspace Procedure and specifying the workspace.)

For more information about savepoints, including the LATEST savepoint, see *Oracle9i Application Developer's Guide - Workspace Manager*.

Examples

The following example goes to the savepoint named Savepoint1.

```
EXECUTE DBMS_WM.GotoSavepoint ('Savepoint1');
```

GotoWorkspace Procedure

This procedure moves the current session to the specified workspace.

Syntax

```
DBMS_WM.GotoWorkspace(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–18 GotoWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.

Usage Notes

After a user goes to a workspace, modifications to data can be made there.

To go to the live database, specify `workspace` as `LIVE`. Because many operations are prohibited when any users (including you) are in the workspace, it is often convenient to go to the `LIVE` workspace before performing operations on created workspaces.

An exception is raised if one or more of the following apply:

- `workspace` does not exist.
- The user does not have `ACCESS_WORKSPACE` privilege for `workspace`.
- `workspace` has been frozen to new users (see the FreezeWorkspace Procedure).

Examples

The following example includes the user in the `NEWWORKSPACE` workspace. The user will begin to work in the latest version in that workspace.

```
EXECUTE DBMS_WM.GotoWorkspace ('NEWWORKSPACE');
```

The following example includes the user in the `LIVE` database workspace. By default, when users connect to a database, they are placed in this workspace.

```
EXECUTE DBMS_WM.GotoWorkspace ('LIVE');
```

GrantSystemPriv Procedure

This procedure grants system-level privileges (not restricted to a particular workspace) to users and roles. The `grant_option` parameter enables the grantee to then grant the specified privileges to other users and roles.

Syntax

```
DBMS_WM.GrantSystemPriv(
   priv_types       IN VARCHAR2,
```

```
grantee          IN VARCHAR2
[, grant_option  IN VARCHAR2 DEFAULT 'NO']
[, auto_commit   IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–19 GrantSystemPriv Procedure Parameters

Parameter	Description
priv_types	A string of one or more keywords representing privileges. Use commas to separate privilege keywords. The available keywords are ACCESS_ANY_WORKSPACE, MERGE_ANY_WORKSPACE, CREATE_ANY_WORKSPACE, REMOVE_ANY_WORKSPACE, and ROLLBACK_ANY_WORKSPACE.
grantee	Name of the user (can be the PUBLIC user group) or role to which to grant priv_types.
grant_option	Specify YES to enable the grant option for grantee, or NO (the default) to disable the grant option for grantee. The grant option allows grantee to grant the privileges specified in priv_types to other users and roles.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

Contrast this procedure with GrantWorkspacePriv Procedure, which grants workspace-level Workspace Manager privileges with keywords that do not contain ANY and which has a workspace parameter.

If a user gets a privilege from more than one source and if any of those sources has the grant option for that privilege, the user has the grant option for the privilege. For example, assume that user SCOTT has been granted the ACCESS_ANY_WORKSPACE privilege with grant_option as NO, but that the PUBLIC user group has been granted the ACCESS_ANY_WORKSPACE privilege with grant_option as YES. Because user SCOTT is a member of PUBLIC, user SCOTT has the ACCESS_ANY_WORKSPACE privilege with the grant option.

The WM_ADMIN_ROLE role has all Workspace Manager privileges with the grant option. The WM_ADMIN_ROLE role is automatically given to the DBA role.

The ACCESS_WORKSPACE or ACCESS_ANY_WORKSPACE privilege is needed for all other Workspace Manager privileges.

To revoke system-level privileges, use the RevokeSystemPriv Procedure.

An exception is raised if one or more of the following apply:

- grantee is not a valid user or role in the database.
- You do not have the privilege to grant priv_types.

Examples

The following example enables user Smith to access any workspace in the database, but does not allow Smith to grant the ACCESS_ANY_WORKSPACE privilege to other users.

```
EXECUTE DBMS_WM.GrantSystemPriv ('ACCESS_ANY_WORKSPACE', 'Smith', 'NO');
```

GrantWorkspacePriv Procedure

This procedure grants workspace-level privileges to users and roles. The grant_option parameter enables the grantee to then grant the specified privileges to other users and roles.

Syntax

```
DBMS_WM.GrantWorkspacePriv(
   priv_types       IN VARCHAR2,
   workspace        IN VARCHAR2,
   grantee          IN VARCHAR2
   [, grant_option  IN VARCHAR2 DEFAULT 'NO']
   [, auto_commit   IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–20 GrantWorkspacePriv Procedure Parameters

Parameter	Description
priv_types	A string of one or more keywords representing privileges. Use commas to separate privilege keywords. The available keywords are ACCESS_WORKSPACE, MERGE_WORKSPACE, CREATE_WORKSPACE, REMOVE_WORKSPACE, and ROLLBACK_WORKSPACE.
workspace	Name of the workspace. The name is case sensitive.

Table 70–20 GrantWorkspacePriv Procedure Parameters (Cont.)

Parameter	Description
grantee	Name of the user (can be the PUBLIC user group) or role to which to grant priv_types.
grant_option	Specify YES to enable the grant option for grantee, or NO (the default) to disable the grant option for grantee. The grant option allows grantee to grant the privileges specified in priv_types on the workspace specified in workspace to other users and roles.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

Contrast this procedure with GrantSystemPriv Procedure, which grants system-level Workspace Manager privileges with keywords in the form *xxx*_ANY_WORKSPACE (ACCESS_ANY_WORKSPACE, MERGE_ANY_WORKSPACE, and so on).

If a user gets a privilege from more than one source and if any of those sources has the grant option for that privilege, the user has the grant option for the privilege. For example, assume that user SCOTT has been granted the ACCESS_WORKSPACE privilege with grant_option as NO, but that the PUBLIC user group has been granted the ACCESS_WORKSPACE privilege with grant_option as YES. Because user SCOTT is a member of PUBLIC, user SCOTT has the ACCESS_WORKSPACE privilege with the grant option.

The WM_ADMIN_ROLE role has all Workspace Manager privileges with the grant option. The WM_ADMIN_ROLE role is automatically given to the DBA role.

The ACCESS_WORKSPACE or ACCESS_ANY_WORKSPACE privilege is needed for all other Workspace Manager privileges.

To revoke workspace-level privileges, use the RevokeWorkspacePriv Procedure.

An exception is raised if one or more of the following apply:

- grantee is not a valid user or role in the database.
- You do not have the privilege to grant priv_types.

Examples

The following example enables user Smith to access the NEWWORKSPACE workspace and merge changes in that workspace, and allows Smith to grant the two specified privileges on NEWWORKSPACE to other users.

```
DBMS_WM.GrantWorkspacePriv ('ACCESS_WORKSPACE, MERGE_WORKSPACE', 'NEWWORKSPACE',
'Smith', 'YES');
```

IsWorkspaceOccupied Function

This function checks whether or not a workspace has any active sessions.

Syntax

```
DBMS_WM.IsWorkspaceOccupied(
   workspace  IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 70–21 IsWorkspaceOccupied Function Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.

Usage Notes

This function returns YES if the workspace has any active sessions and NO if the workspace has no active sessions.

An exception is raised if the LIVE workspace is specified or if the user does not have the privilege to access the workspace.

Examples

The following example checks if any sessions are active in the B_focus_2 workspace.

```
SELECT DBMS_WM.IsWorkspaceOccupied('B_focus_2') FROM DUAL;

DBMS_WM.ISWORKSPACEOCCUPIED('B_FOCUS_2')
--------------------------------------------------------------------------------
YES
```

LockRows Procedure

This procedure controls access to versioned rows in a specified table and to corresponding rows in the parent workspace.

Syntax

```
DBMS_WM.LockRows(
   workspace        IN VARCHAR2,
   table_name       IN VARCHAR2
   [, where_clause  IN VARCHAR2 DEFAULT '']
   [, lock_mode     IN VARCHAR2 DEFAULT 'E']);
```

Parameters

Table 70–22 LockRows Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The latest versions of rows visible from the workspace are locked. If a row has not been modified in this workspace, the locked version could be in an ancestor workspace. The name is case sensitive.
table_name	Name of the table in which rows are to be locked. The name is not case sensitive.
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows to be locked. Example: 'department_id = 20' Only primary key columns can be specified in the WHERE clause. The WHERE clause cannot contain a subquery. If where_clause is not specified, all rows in table_name are locked.
lock_mode	Mode with which to set the locks: E (exclusive) or S (shared). The default is E.

Usage Notes

This procedure affects Workspace Manager locking, which occurs in addition to any standard Oracle server locking. For an explanation of Workspace Manager locking, see *Oracle9i Application Developer's Guide - Workspace Manager*.

This procedure does not affect whether Workspace Manager locking is set on or off (determined by the SetLockingON Procedure and SetLockingOFF Procedure).

To unlock rows, use the UnlockRows Procedure.

Examples

The following example locks rows in the EMPLOYEES table where last_name = 'Smith' in the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.LockRows ('NEWWORKSPACE', 'employees', 'last_name = ''Smith''');
```

MergeTable Procedure

This procedure applies changes to a table (all rows or as specified in the WHERE clause) in a workspace to its parent workspace.

Syntax

```
DBMS_WM.MergeTable(
   workspace            IN VARCHAR2,
   table_id             IN VARCHAR2
   [, where_clause      IN VARCHAR2 DEFAULT '']
   [, create_savepoint  IN BOOLEAN DEFAULT FALSE]
   [, remove_data       IN BOOLEAN DEFAULT FALSE]
   [, auto_commit       IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–23 MergeTable Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
table_id	Name of the table containing rows to be merged into the parent workspace. The name is not case sensitive.
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows to be merged into the parent workspace. Example: 'department_id = 20' Only primary key columns can be specified in the WHERE clause. The WHERE clause cannot contain a subquery. If where_clause is not specified, all rows in table_name are merged.
create_savepoint	A boolean value (TRUE or FALSE). TRUE creates an implicit savepoint in the parent workspace before the merge operation. FALSE (the default) does not create an implicit savepoint in the parent workspace before the merge operation.

Table 70–23 MergeTable Procedure Parameters (Cont.)

Parameter	Description
remove_data	A boolean value (TRUE or FALSE). TRUE removes the data in the table (as specified by *where_clause*) in the child workspace after the merge operation, by rolling back to when the workspace was created. FALSE (the default) does not remove the data in the table in the child workspace after the merge operation; the table data in the child workspace is unchanged.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

All data that satisfies the where_clause in the version-enabled table table_name in workspace is applied to the parent workspace of workspace.

Any locks that are held by rows being merged are released.

If there are conflicts between the workspace being merged and its parent workspace, the merge operation fails and the user must manually resolve conflicts using the <table_name>_CONF view. (Conflict resolution is explained in *Oracle9i Application Developer's Guide - Workspace Manager*.)

A table cannot be merged in the LIVE workspace (because that workspace has no parent workspace).

A table cannot be merged or refreshed if there is an open regular transaction affecting the table.

An exception is raised if the user does not have access to table_id, or the MERGE_WORKSPACE privilege for workspace or the MERGE_ANY_WORKSPACE privilege.

Examples

The following example merges changes to the EMP table (in the USER3 schema) where last_name = 'Smith' in NEWWORKSPACE to its parent workspace.

```
EXECUTE DBMS_WM.MergeTable ('NEWWORKSPACE', 'user3.emp', 'last_name =
''Smith''');
```

MergeWorkspace Procedure

This procedure applies all changes in a workspace to its parent workspace, and optionally removes the workspace.

Syntax

```
DBMS_WM.MergeWorkspace(
   workspace            IN VARCHAR2
   [, create_savepoint  IN BOOLEAN DEFAULT FALSE]
   [, remove_workspace  IN BOOLEAN DEFAULT FALSE]
   [, auto_commit       IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–24 MergeWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
create_savepoint	A boolean value (TRUE or FALSE).
	TRUE creates an implicit savepoint in the parent workspace before the merge operation.
	FALSE (the default) does not create an implicit savepoint in the parent workspace before the merge operation.
remove_workspace	A boolean value (TRUE or FALSE).
	TRUE removes workspace after the merge operation.
	FALSE (the default) does not remove workspace after the merge operation; the workspace continues to exist.
auto_commit	A boolean value (TRUE or FALSE).
	TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes.
	FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

All data in all version-enabled tables in workspace is merged to the parent workspace of workspace, and workspace is removed if remove_workspace is TRUE.

While this procedure is executing, the current workspace is frozen in NO_ACCESS mode and the parent workspace is frozen in READ_ONLY mode.

If there are conflicts between the workspace being merged and its parent workspace, the merge operation fails and the user must manually resolve conflicts using the <table_name>_CONF view. (Conflict resolution is explained in *Oracle9i Application Developer's Guide - Workspace Manager*.)

If the remove_workspace parameter value is TRUE, the workspace to be merged must be a leaf workspace, that is, a workspace with no descendant workspaces. (For an explanation of workspace hierarchy, see *Oracle9i Application Developer's Guide - Workspace Manager*.)

An exception is raised if the user does not have the MERGE_WORKSPACE privilege for *workspace* or the MERGE_ANY_WORKSPACE privilege.

Examples

The following example merges changes in NEWWORKSPACE to its parent workspace and removes (by default) NEWWORKSPACE.

```
EXECUTE DBMS_WM.MergeWorkspace ('NEWWORKSPACE');
```

RefreshTable Procedure

This procedure applies to a workspace all changes made to a table (all rows or as specified in the WHERE clause) in its parent workspace.

Syntax

```
DBMS_WM.RefreshTable(
   workspace        IN VARCHAR2,
   table_id         IN VARCHAR2
   [, where_clause  IN VARCHAR2 DEFAULT '']
   [, auto_commit   IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–25 RefreshTable Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
table_id	Name of the savepoint. The name is case sensitive.
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows to be refreshed from the parent workspace. Example: 'department_id = 20'
	Only primary key columns can be specified in the WHERE clause. The WHERE clause cannot contain a subquery.
	If where_clause is not specified, all rows in table_name are refreshed.
auto_commit	A boolean value (TRUE or FALSE).
	TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes.
	FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

This procedure applies to workspace all changes in rows that satisfy the where_clause in the version-enabled table table_id in the parent workspace since the time when workspace was created or last refreshed.

If there are conflicts between the workspace being refreshed and its parent workspace, the refresh operation fails and the user must manually resolve conflicts using the <table_name>_CONF view. (Conflict resolution is explained in *Oracle9i Application Developer's Guide - Workspace Manager*.)

A table cannot be refreshed in the LIVE workspace (because that workspace has no parent workspace).

A table cannot be merged or refreshed if there is an open regular transaction affecting the table.

An exception is raised if the user does not have access to table_id, or the MERGE_WORKSPACE privilege for workspace or the MERGE_ANY_WORKSPACE privilege.

Examples

The following example refreshes NEWWORKSPACE by applying changes made to the EMPLOYEES table where last_name = 'Smith' in its parent workspace.

```
EXECUTE DBMS_WM.RefreshTable ('NEWWORKSPACE', 'employees', 'last_name =
''Smith''');
```

RefreshWorkspace Procedure

This procedure applies to a workspace all changes made in its parent workspace.

Syntax

```
DBMS_WM.RefreshWorkspace(
   workspace      IN VARCHAR2
   [, auto_commit IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–26 RefreshWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
auto_ commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

This procedure applies to workspace all changes made to version-enabled tables in the parent workspace since the time when workspace was created or last refreshed.

If there are conflicts between the workspace being refreshed and its parent workspace, the refresh operation fails and the user must manually resolve conflicts using the <table_name>_CONF view. (Conflict resolution is explained in *Oracle9i Application Developer's Guide - Workspace Manager*.)

The specified workspace and the parent workspace are frozen in READ_ONLY mode.

The LIVE workspace cannot be refreshed (because it has no parent workspace).

An exception is raised if the user does not have the MERGE_WORKSPACE privilege for workspace or the MERGE_ANY_WORKSPACE privilege.

Examples

The following example refreshes NEWWORKSPACE by applying changes made in its parent workspace.

```
EXECUTE DBMS_WM.RefreshWorkspace ('NEWWORKSPACE');
```

RemoveWorkspace Procedure

This procedure rolls back the data in the workspace and removes all support structures created for the workspace. The workspace ceases to exist.

Syntax

```
DBMS_WM.RemoveWorkspace(
   workspace       IN VARCHAR2
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–27 RemoveWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
auto_ commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

The RemoveWorkspace operation can only be performed on leaf workspaces (the bottom-most workspaces in a branch in the hierarchy). For an explanation of database workspace hierarchy, see *Oracle9i Application Developer's Guide - Workspace Manager*.

There must be no other users in the workspace being removed.

An exception is raised if the user does not have the REMOVE_WORKSPACE privilege for workspace or the REMOVE_ANY_WORKSPACE privilege.

Examples

The following example removes the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.RemoveWorkspace('NEWWORKSPACE');
```

RemoveWorkspaceTree Procedure

This procedure removes the specified workspace and all its descendant workspaces. The data in the workspaces is rolled back and the workspace structure is removed.

Syntax

```
DBMS_WM.RemoveWorkspaceTree(
   workspace       IN VARCHAR2
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–28 RemoveWorkspaceTree Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

The RemoveWorkspaceTree operation should be used with extreme caution, because it removes support structures and rolls back changes in a workspace and all its descendants down to the leaf workspace or workspaces.

There must be no other users in workspace or any of its descendant workspaces.

An exception is raised if the user does not have the REMOVE_WORKSPACE privilege for workspace or any of its descendant workspaces.

Examples

The following example removes the NEWWORKSPACE workspace and all its descendant workspaces.

```
EXECUTE DBMS_WM.RemoveWorkspaceTree('NEWWORKSPACE');
```

ResolveConflicts Procedure

This procedure resolves conflicts between workspaces.

Syntax

```
DBMS_WM.ResolveConflicts(
   workspace     IN VARCHAR2,
   table_name    IN VARCHAR2,
   where_clause  IN VARCHAR2,
   keep          IN VARCHAR2);
```

Parameters

Table 70–29 ResolveConflicts Procedure Parameters

Parameter	Description
workspace	Name of the workspace to check for conflicts with other workspaces. The name is case sensitive.
table_name	Name of the table to check for conflicts. The name is not case sensitive.
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows to be refreshed from the parent workspace. Example: 'department_id = 20' Only primary key columns can be specified in the WHERE clause. The WHERE clause cannot contain a subquery.

Table 70–29 ResolveConflicts Procedure Parameters (Cont.)

Parameter	Description
keep	Workspace in favor of which to resolve conflicts: PARENT, CHILD, or BASE. PARENT causes the parent workspace rows to be copied to the child workspace. CHILD does not cause the child workspace rows to be copied immediately to the parent workspace. However, the conflict is considered resolved, and the child workspace rows are copied to the parent workspace when the child workspace is merged. BASE causes the base rows to be copied to the child workspace but not to the parent workspace. However, the conflict is considered resolved; and when the child workspace is merged, the base rows are copied to the parent workspace.

Usage Notes

This procedure checks the condition identified by `table_name` and `where_clause`, and it finds any conflicts between row values in `workspace` and its parent workspace. This procedure resolves conflicts by using the row values in the parent or child workspace, as specified in the `keep` parameter; however, the conflict resolution is not actually merged until you commit the transaction (standard database commit operation) and call the CommitResolve Procedure to end the conflict resolution session. (For more information about conflict resolution, including an overall view of the process, see *Oracle9i Application Developer's Guide - Workspace Manager*.)

For example, assume that for Department 20 (`DEPARTMENT_ID = 20`), the `MANAGER_NAME` in the `LIVE` and `Workspace1` workspaces is `Tom`. Then the following operations occur:

1. The `manager_name` for Department 20 is changed in the `LIVE` database workspace from `Tom` to `Mary`.
2. The change is committed (a standard database commit operation).
3. The `manager_name` for Department 20 is changed in `Workspace1` from `Tom` to `Franco`.
4. MergeWorkspace Procedure is called to merge `Workspace1` changes to the `LIVE` workspace.

   At this point, however, a conflict exists with respect to `MANAGER_NAME` for Department 20 in `Workspace1` (`Franco`, which conflicts with `Mary` in the

LIVE workspace), and therefore the call to MergeWorkspace Procedure does not succeed.

5. ResolveConflicts is called with the following parameters: ('Workspace1', 'department', 'department_id = 20', 'child').

   After the MergeWorkspace Procedure operation in step 7, the MANAGER_NAME value will be Franco in both the Workspace1 and LIVE workspaces.

6. The change is committed (a standard database commit operation).

7. MergeWorkspace Procedure is called to merge Workspace1 changes to the LIVE workspace.

Examples

The following example resolves conflicts involving rows in the DEPARTMENT table in Workspace1 where DEPARTMENT_ID is 20, and uses the values in the child workspace to resolve all such conflicts. It then merges the results of the conflict resolution by first committing the transaction (standard commit) and then calling MergeWorkspace Procedure.

```
EXECUTE DBMS_WM.BeginResolve ('Workspace1');
EXECUTE  DBMS_WM.ResolveConflicts ('Workspace1', 'department', 'department_id =
20', 'child');
COMMIT;
EXECUTE DBMS_WM.CommitResolve ('Workspace1');
```

RevokeSystemPriv Procedure

This procedure revokes (removes) system-level privileges from users and roles.

Syntax

```
DBMS_WM.RevokeSystemPriv(
   priv_types      IN VARCHAR2,
   grantee         IN VARCHAR2
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–30 RevokeSystemPriv Procedure Parameters

Parameter	Description
priv_types	A string of one or more keywords representing privileges. Use commas to separate privilege keywords. The available keywords are ACCESS_ANY_WORKSPACE, MERGE_ANY_WORKSPACE, CREATE_ANY_WORKSPACE, REMOVE_ANY_WORKSPACE, and ROLLBACK_ANY_WORKSPACE.
grantee	Name of the user (can be the PUBLIC user group) or role from which to revoke priv_types.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

Contrast this procedure with RevokeWorkspacePriv Procedure, which revokes workspace-level Workspace Manager privileges with keywords in the form *xxx*_WORKSPACE (ACCESS_WORKSPACE, MERGE_WORKSPACE, and so on).

To grant system-level privileges, use the GrantSystemPriv Procedure.

An exception is raised if one or more of the following apply:

- grantee is not a valid user or role in the database.
- You do not have the privilege to revoke priv_types.

Examples

The following example disallows user Smith from accessing workspaces and merging changes in workspaces.

```
EXECUTE DBMS_WM.RevokeSystemPriv ('ACCESS_ANY_WORKSPACE, MERGE_ANY_WORKSPACE',
'Smith');
```

RevokeWorkspacePriv Procedure

This procedure revokes (removes) workspace-level privileges from users and roles for a specified workspace.

Syntax

```
DBMS_WM.RevokeWorkspacePriv(
   priv_types      IN VARCHAR2,
   workspace       IN VARCHAR2,
   grantee         IN VARCHAR2
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–31 RevokeWorkspacePriv Procedure Parameters

Parameter	Description
priv_types	A string of one or more keywords representing privileges. Use commas to separate privilege keywords. The available keywords are ACCESS_WORKSPACE, MERGE_WORKSPACE, CREATE_WORKSPACE, REMOVE_WORKSPACE, and ROLLBACK_WORKSPACE.
workspace	Name of the workspace. The name is case sensitive.
grantee	Name of the user (can be the PUBLIC user group) or role from which to revoke priv_types.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

Contrast this procedure with RevokeSystemPriv Procedure, which revokes system-level Workspace Manager privileges with keywords in the form *xxx*_ANY_WORKSPACE (ACCESS_ANY_WORKSPACE, MERGE_ANY_WORKSPACE, and so on).

To grant workspace-level privileges, use the GrantWorkspacePriv Procedure.

An exception is raised if one or more of the following apply:

- grantee is not a valid user or role in the database.

- You do not have the privilege to revoke `priv_types`.

Examples

The following example disallows user `Smith` from accessing the `NEWWORKSPACE` workspace and merging changes in that workspace.

```
EXECUTE DBMS_WM.RevokeWorkspacePriv ('ACCESS_WORKSPACE, MERGE_WORKSPACE',
'NEWWORKSPACE', 'Smith');
```

RollbackResolve Procedure

This procedure quits a conflict resolution session and discards all changes in the workspace since BeginResolve Procedure was executed.

Syntax

```
DBMS_WM.RollbackResolve(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–32 RollbackResolve Procedure Parameters

Parameter	Description
`workspace`	Name of the workspace. The name is case sensitive.

Usage Notes

This procedure quits the current conflict resolution session (started by BeginResolve Procedure), and discards all changes in the workspace since the start of the conflict resolution session. Contrast this procedure with CommitResolve Procedure, which saves all changes.

While the conflict resolution session is being rolled back, the workspace is frozen in `1WRITER` mode.

For more information about conflict resolution, see *Oracle9i Application Developer's Guide - Workspace Manager*.

An exception is raised if one or more of the following apply:

- There are one or more open regular transactions in `workspace`.

- The procedure was called by a user that does not have the WM_ADMIN_ROLE role or that did not execute the BeginResolve Procedure on workspace.

Examples

The following example quits the conflict resolution session in Workspace1 and discards all changes.

```
EXECUTE  DBMS_WM.RollbackResolve ('Workspace1');
```

RollbackTable Procedure

This procedure discards all changes made in the workspace to a specified table (all rows or as specified in the WHERE clause).

Syntax

```
DBMS_WM.RollbackTable(
   workspace        IN VARCHAR2,
   table_id         IN VARCHAR2,
   [, sp_name       IN VARCHAR2 DEFAULT '']
   [, where_clause  IN VARCHAR2 DEFAULT '']
   [, remove_locks  IN BOOLEAN DEFAULT TRUE]
   [, auto_commit   IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–33 RollbackTable Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
table_id	Name of the containing rows to be discarded. The name is not case sensitive.
sp_name	Name of the savepoint to which to roll back. The name is case sensitive. The default is to discard all changes (that is, ignore any savepoints).
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows to be discarded. Example: 'department_id = 20' Only primary key columns can be specified in the WHERE clause. The WHERE clause cannot contain a subquery. If where_clause is not specified, all rows all rows that meet the criteria of the other parameters are discarded.

Table 70–33 RollbackTable Procedure Parameters (Cont.)

Parameter	Description
remove_locks	A boolean value (TRUE or FALSE). TRUE (the default) releases those locks on rows in the parent workspace that satisfy the condition in where_clause and that were not versioned in the child workspace. This option has no effect if the table has been rolled back to a savepoint. FALSE does not release any locks in the parent workspace.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

You cannot roll back to a savepoint if any implicit savepoints have been created since the specified savepoint, unless you first merge or remove the descendant workspaces that caused the implicit savepoints to be created

An exception is raised if one or more of the following apply:

- workspace does not exist.
- You do not have the privilege to roll back *workspace* or any affected table.
- A regular transaction affecting table_id is active in workspace.

Examples

The following example rolls back all changes made to the EMP table (in the USER3 schema) in the NEWWORKSPACE workspace since that workspace was created.

```
EXECUTE DBMS_WM.RollbackTable ('NEWWORKSPACE', 'user3.emp');
```

RollbackToSP Procedure

This procedure discards all changes made after a specified savepoint in the workspace to all tables.

Syntax

```
DBMS_WM.RollbackToSP(
   workspace       IN VARCHAR2,
   savepoint_name  IN VARCHAR2
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–34 RollbackToSP Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
savepoint_name	Name of the savepoint to which to roll back changes. The name is case sensitive.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

While this procedure is executing, the workspace is frozen in NO_ACCESS mode.

Contrast this procedure with RollbackWorkspace Procedure, which rolls back all changes made since the creation of the workspace.

You cannot roll back to a savepoint if any implicit savepoints have been created since the specified savepoint, unless you first merge or remove the descendant workspaces that caused the implicit savepoints to be created.

An exception is raised if one or more of the following apply:

- workspace does not exist.
- savepoint_name does not exist.
- One or more implicit savepoints have been created in workspace after savepoint_name, and the descendant workspaces that caused the implicit savepoints to be created still exist.
- You do not have the privilege to roll back workspace or any affected table.

- Any sessions are active in workspace.

Examples

The following example rolls back any changes made in the NEWWORKSPACE workspace to all tables since the creation of Savepoint1.

```
EXECUTE DBMS_WM.RollbackToSP ('NEWWORKSPACE', 'Savepoint1');
```

RollbackWorkspace Procedure

This procedure discards all changes made in the workspace to all tables.

Syntax

```
DBMS_WM.RollbackWorkspace(
   workspace       IN VARCHAR2
   [, auto_commit  IN BOOLEAN DEFAULT TRUE]);
```

Parameters

Table 70–35 RollbackWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.
auto_commit	A boolean value (TRUE or FALSE). TRUE (the default) causes the operation to be executed as an autonomous regular transaction that will be committed when it finishes. FALSE causes the operation to be executed as part of the caller's open regular transaction (if one exists). If there is no open regular transaction, the operation is executed in a new regular transaction. In either case, the caller is responsible for committing the transaction.

Usage Notes

Only leaf workspaces can be rolled back. That is, a workspace cannot be rolled back if it has any descendant workspaces. (For an explanation of workspace hierarchy, see *Oracle9i Application Developer's Guide - Workspace Manager*.)

Contrast this procedure with RollbackToSP Procedure, which rolls back changes to a specified savepoint.

Like RemoveWorkspace Procedure, RollbackWorkspace deletes the data in the workspace; however, unlike RemoveWorkspace Procedure, RollbackWorkspace does not delete the Workspace Manager workspace structure.

While this procedure is executing, the specified workspace is frozen in NO_ACCESS mode.

An exception is raised if one or more of the following apply:

- workspace has any descendant workspaces.
- workspace does not exist.
- You do not have the privilege to roll back workspace or any affected table.
- Any sessions are active in workspace.

Examples

The following example rolls back any changes made in the NEWWORKSPACE workspace since that workspace was created.

```
EXECUTE DBMS_WM.RollbackWorkspace ('NEWWORKSPACE');
```

SetConflictWorkspace Procedure

This procedure determine whether or not conflicts exist between a workspace and its parent.

Syntax

```
DBMS_WM.SetConflictWorkspace(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–36 SetConflictWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.

Usage Notes

This procedure checks for any conflicts between workspace and its parent workspace, and it modifies the contents of the <table_name>_CONF views (explained in *Oracle9i Application Developer's Guide - Workspace Manager*.) as needed.

A SELECT operation from the <table_name>_CONF views for all tables modified in a workspace displays all rows in the workspace that are in conflict with the parent workspace. (To obtain a list of tables that may have been changed in the workspace, use the SQL statement SELECT * FROM ALL_VERSIONED_TABLES. The SQL statement SELECT * FROM <table_name>_CONF displays conflicts for <table_name> between the current workspace and its parent workspace.)

Any conflicts must be resolved before a workspace can be merged or refreshed. To resolve a conflict, you must use the ResolveConflicts Procedure (and then merge the result of the resolution by using the MergeWorkspace Procedure).

Examples

The following example checks for any conflicts between B_focus_2 and its parent workspace, and modifies the contents of the <table_name>_CONF views as needed.

```
EXECUTE DBMS_WM.SetConflictWorkspace ('B_focus_2');
```

SetDiffVersions Procedure

This procedure finds differences in values in version-enabled tables for two savepoints and their common ancestor (base). It modifies the contents of the differences views that describe these differences.

Syntax

```
DBMS_WM.SetDiffVersions(
   workspace1  IN VARCHAR2,
   workspace2  IN VARCHAR2);
```

or

```
DBMS_WM.SetDiffVersions(
   workspace1  IN VARCHAR2,
   savepoint1  IN VARCHAR2,
   workspace2  IN VARCHAR2,
   savepoint2  IN VARCHAR2);
```

Parameters

Table 70–37 SetDiffVersions Procedure Parameters

Parameter	Description
workspace1	Name of the first workspace to be checked for differences in version-enabled tables. The name is case sensitive.
savepoint1	Name of the savepoint in workspace1 for which values are to be checked. The name is case sensitive. If savepoint1 and savepoint2 are not specified, the rows in version-enabled tables for the LATEST savepoint in each workspace are checked.
workspace2	Name of the second workspace to be checked for differences in version-enabled tables. The name is case sensitive.
savepoint2	Name of the savepoint in workspace2 for which values are to be checked. The name is case sensitive.

Usage Notes

This procedure modifies the contents of the differences views (xxx_DIFF), which are described in *Oracle9i Application Developer's Guide - Workspace Manager*. Each call to the procedure populates one or more sets of three rows, each set consisting of:

- Values for the common ancestor
- Values for workspace1 (savepoint1 or LATEST savepoint values)
- Values for workspace2 (savepoint2 or LATEST savepoint values)

You can then select rows from the appropriate xxx_DIFF view or views to check comparable table values in the two savepoints and their common ancestor. The common ancestor (or "base") is identified as DiffBase in XXX_DIFF view rows.

Examples

The following example checks the differences in version-enabled tables for the B_focus_1 and B_focus_2 workspaces. (The output has been reformatted for readability.)

```
SQL> -- Add rows to "difference view" COLA_MARKETING_BUDGET_DIFF
SQL> EXECUTE DBMS_WM.SetDiffVersions ('B_focus_1', 'B_focus_2');

SQL> -- View the rows that were just added.
SQL> SELECT * from COLA_MARKETING_BUDGET_DIFF;
```

```
MKT_ID  MKT_NAME  MANAGER  BUDGET  WM_DIFFVER          WMCODE
------  --------  -------  ------  -----------         --------
   1    cola_a    Alvarez   2      DiffBase            NC
   1    cola_a    Alvarez   1.5    B_focus_1, LATEST   U
   1    cola_a    Alvarez   2      B_focus_2, LATEST   NC
   2    cola_b    Burton    2      DiffBase            NC
   2    cola_b    Beasley   3      B_focus_1, LATEST   U
   2    cola_b    Burton    2.5    B_focus_2, LATEST   U
   3    cola_c    Chen      1.5    DiffBase            NC
   3    cola_c    Chen      1      B_focus_1, LATEST   U
   3    cola_c    Chen      1.5    B_focus_2, LATEST   NC
   4    cola_d    Davis     3.5    DiffBase            NC
   4    cola_d    Davis     3      B_focus_1, LATEST   U
   4    cola_d    Davis     2.5    B_focus_2, LATEST   U

12 rows selected.
```

Oracle9i Application Developer's Guide - Workspace Manager explains how to interpret and use the information in the differences (xxx_DIFF) views.

SetLockingOFF Procedure

This procedure enables access to versioned rows and to corresponding rows in the parent workspace.

Syntax

```
DBMS_WM.SetLockingOFF();
```

Usage Notes

This procedure turns off Workspace Manager locking that had been set on by the SetLockingON Procedure. Existing locks applied by this session remain locked. All new changes by this session are not locked.

Examples

The following example sets locking off for the session.

```
EXECUTE DBMS_WM.SetLockingOFF;
```

SetLockingON Procedure

This procedure controls access to versioned rows and to corresponding rows in the previous version.

Syntax

```
DBMS_WM.SetLockingON(
   lockmode  IN VARCHAR2);
```

Parameters

Table 70–38 SetLockingON Procedure Parameters

Parameter	Description
lockmode	Locking mode. Must be E, S, or C.
	E (exclusive) mode locks the rows in the previous version and the corresponding rows in the current version; no other users in the workspace for either version can change any values.
	S (shared) mode locks the rows in the previous version and the corresponding rows in the current version; however, other users in the workspace for the current version (but no users in the workspace for the previous version) can change values in these rows.
	C (carry-forward) mode locks rows in the current workspace with the same locking mode as the corresponding rows in the previous version. (If a row is not locked in the previous version, its corresponding row in the current version is not locked.)

Usage Notes

This procedure affects Workspace Manager locking, which occurs in addition to any standard Oracle server locking. Workspace Manager locks can be used to prevent conflicts. When a user locks a row, the corresponding row in the parent workspace is also locked. Thus, when this workspace merges with the parent at merge time, it is guaranteed that this row will not have a conflict.

Exclusive locking prevents the use of *what-if* scenarios in which different values for one or more columns are tested. Thus, plan any testing of scenarios when exclusive locking is not in effect.

Locking is enabled at the user session level, and the locking mode stays in effect until any of the following occurs:

- The session goes to another workspace or connects to the database, in which case the locking mode is set to C (carry-forward) unless another locking mode has been specified using SetWorkspaceLockModeON Procedure.
- The session executes the SetLockingOFF Procedure.

The locks remain in effect for the duration of the workspace, unless unlocked by the UnlockRows Procedure. (Existing locks are not affected by the SetLockingOFF Procedure.)

There are no specific privileges associated with locking. Any session that can go to a workspace can set locking on.

Examples

The following example sets exclusive locking on for the session.

```
EXECUTE DBMS_WM.SetLockingON ('E');
```

All rows locked by this user remain locked until the workspace is merged or rolled back.

SetMultiWorkspaces Procedure

This procedure makes the specified workspace or workspaces visible in the multiworkspace views for version-enabled tables.

Syntax

```
DBMS_WM.SetMultiWorkspaces(
   workspaces  IN VARCHAR2);
```

Parameters

Table 70–39 SetMultiWorkspaces Procedure Parameters

Parameter	Description
workspaces	The workspace or workspaces for which information is to be added to the multiworkspace views. The workspace names are case sensitive. To specify more than one workspace (but no more than eight), use a comma to separate workspace names. For example: `'workspace1,workspace2'`

Usage Notes

This procedure adds rows to the multiworkspace views (xxx_MS). See *Oracle9i Application Developer's Guide - Workspace Manager* for information about the contents and uses of these views.

To see the names of workspaces visible in the multiworkspace views, use the GetMultiWorkspaces Function function.

An exception is raised if one or more of the following apply:

- The user does not have the privilege to go to one or more of the workspaces named in `workspaces`.
- A workspace named in `workspaces` is not valid.
- More than eight workspace names are specified in `workspaces`.

Examples

The following example adds information to the multiworkspace views for version-enabled tables in the `B_focus_1` workspace.

```
SQL> EXECUTE DBMS_WM.SetMultiWorkspaces ('B_focus_1');
```

SetWoOverwriteOFF Procedure

This procedure disables the `VIEW_WO_OVERWRITE` history option that had been enabled by the EnableVersioning Procedure or SetWoOverwriteON Procedure, changing the option to `VIEW_W_OVERWRITE` (*with overwrite*).

Syntax

```
DBMS_WM.SetWoOverwriteOFF();
```

Usage Notes

This procedure affects the recording of history information in the views named <*table_name*>_HIST by changing the `VIEW_WO_OVERWRITE` option to `VIEW_W_OVERWRITE`. That is, from this point forward, the views show only the most recent modifications to the same version of the table. A history of modifications to the version is not maintained; that is, subsequent changes to a row in the same version overwrite earlier changes.

This procedure affects only tables that were version-enabled with the *hist* parameter set to `VIEW_WO_OVERWRITE` in the call to the EnableVersioning Procedure.

The <*table_name*>_HIST views are described in *Oracle9i Application Developer's Guide - Workspace Manager*. The VIEW_WO_OVERWRITE and VIEW_W_OVERWRITE options are further described in the description of the EnableVersioning Procedure.

The history option affects the behavior of the GotoDate Procedure. See the Usage Notes for that procedure.

The result of the SetWoOverwriteOFF procedure remains in effect only for the duration of the current session. To reverse the effect of this procedure, use the SetWoOverwriteON Procedure.

Examples

The following example disables the VIEW_WO_OVERWRITE history option.

```
EXECUTE DBMS_WM.SetWoOverwriteOFF;
```

SetWoOverwriteON Procedure

This procedure enables the VIEW_WO_OVERWRITE history option that had been disabled by the SetWoOverwriteOFF Procedure.

Syntax

```
DBMS_WM.SetWoOverwriteON();
```

Usage Notes

This procedure affects the recording of history information in the views named <*table_name*>_HIST by changing the VIEW_W_OVERWRITE option to VIEW_WO_OVERWRITE (*without overwrite*). That is, from this point forward, the views show all modifications to the same version of the table. A history of modifications to the version is maintained; that is, subsequent changes to a row in the same version do not overwrite earlier changes.

This procedure affects only tables that were affected by a previous call to the SetWoOverwriteOFF Procedure.

The <*table_name*>_HIST views are described in *Oracle9i Application Developer's Guide - Workspace Manager*. The VIEW_WO_OVERWRITE and VIEW_W_OVERWRITE options are further described in the description of the EnableVersioning Procedure.

The VIEW_WO_OVERWRITE history option can be overridden when a workspace is compressed by specifying the compress_view_wo_overwrite parameter as TRUE with the CompressWorkspace Procedure or CompressWorkspaceTree Procedure.

The history option affects the behavior of the GotoDate Procedure. See the Usage Notes for that procedure.

To reverse the effect of this procedure, use the SetWoOverwriteOFF Procedure.

Examples

The following example enables the VIEW_WO_OVERWRITE history option.

```
EXECUTE DBMS_WM.SetWoOverwriteON;
```

SetWorkspaceLockModeOFF Procedure

This procedure enables access to versioned rows in the specified workspace and to corresponding rows in the parent workspace.

Syntax

```
DBMS_WM.SetWorkspaceLockModeOFF(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–40 SetWorkspaceLockModeOFF Procedure Parameters

Parameter	Description
workspace	Name of the workspace for which to set the locking mode off. The name is case sensitive.

Usage Notes

This procedure turns off Workspace Manager locking that had been set on by the SetWorkspaceLockModeON Procedure. Existing locks applied by this session remain locked. All new changes by this session or a subsequent session are not locked, unless the session turns locking on by executing the SetLockingON Procedure.

An exception is raised if any of the following occurs:

- The user does not have the WM_ADMIN_ROLE role or is not the owner of workspace.
- There are any open regular transactions in workspace.
- workspace is a continually refreshed workspace (see the description of the isrefreshed parameter of the CreateWorkspace Procedure).

Examples

The following example sets locking off for the workspace named NEWWORKSPACE.

```
EXECUTE DBMS_WM.SetWorkspaceLockModeOFF('NEWWORKSPACE');
```

SetWorkspaceLockModeON Procedure

This procedure sets the default mode for the row-level locking in the workspace.

Syntax

```
DBMS_WM.SetLockingON(
   workspace    IN VARCHAR2,
   lockmode     IN VARCHAR2
   [, override  IN BOOLEAN DEFAULT FALSE]);
```

Parameters

Table 70–41 SetWorkspaceLockModeON Procedure Parameters

Parameter	Description
workspace	Name of the workspace for which to set the locking mode. The name is case sensitive.
lockmode	Locking mode. Must be E, S, or C. E (exclusive) mode locks the rows in the parent workspace and the corresponding rows in the current workspace; no other users in either workspace can change any values. S (shared) mode locks the rows in the parent workspace and the corresponding rows in the current workspace; however, other users in the current workspace (but no users in the parent workspace) can change values in these rows. C (carry-forward) mode locks rows in the current workspace with the same locking mode as the corresponding rows in the parent workspace. (If a row is not locked in the parent workspace, its corresponding row in the child workspace is not locked.)
override	A boolean value (TRUE or FALSE) TRUE allows a session in the workspace to change the lockmode value by using the SetLockingON Procedure and SetLockingOFF Procedure. FALSE (the default) prevents a session in the workspace from changing the lockmode value.

Usage Notes

This procedure affects Workspace Manager locking, which occurs in addition to any standard Oracle server locking. Workspace Manager locks can be used to prevent conflicts. When a user locks a row, the corresponding row in the parent workspace is also locked. Thus, when this workspace merges with the parent at merge time, it is guaranteed that this row will not have a conflict.

Exclusive locking prevents the use of *what-if* scenarios in which different values for one or more columns are tested. Thus, plan any testing of scenarios when exclusive locking is not in effect.

If the override parameter value is `TRUE`, locking can also be enabled and disabled at the user session level with the SetLockingON Procedure and SetLockingOFF Procedure, respectively.

There are no specific privileges associated with locking. Any session that can go to a workspace can set locking on.

All new changes by this session or a subsequent session are locked, unless the session turns locking off by executing the SetLockingOFF Procedure.

An exception is raised if any of the following occurs:

- The user does not have the `WM_ADMIN_ROLE` role or is not the owner of `workspace`.
- There are any open regular transactions in `workspace`.
- `workspace` is a continually refreshed workspace (see the description of the `isrefreshed` parameter of the CreateWorkspace Procedure procedure).

Examples

The following example sets exclusive locking on for the workspace named `NEWWORKSPACE`.

```
EXECUTE DBMS_WM.SetWorkspaceLockModeON ('NEWWORKSPACE', 'E');
```

All locked rows remain locked until the workspace is merged or rolled back.

UnfreezeWorkspace Procedure

This procedure enables changes to a workspace, reversing the effect of FreezeWorkspace Procedure.

Syntax

```
DBMS_WM.UnfreezeWorkspace(
   workspace  IN VARCHAR2);
```

Parameters

Table 70–42 UnfreezeWorkspace Procedure Parameters

Parameter	Description
workspace	Name of the workspace. The name is case sensitive.

Usage Notes

The operation fails if any sessions are active in *workspace*.

Only the owner of the workspace or a user with WM_ADMIN_ROLE can unfreeze a workspace. There are no specific privileges associated with freezing a workspace.

Examples

The following example unfreezes the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.FreezeWorkspace ('NEWWORKSPACE');
```

UnlockRows Procedure

This procedure enables access to versioned rows in a specified table and to corresponding rows in the parent workspace.

Syntax

```
DBMS_WM.UnlockRows(
   workspace        IN VARCHAR2,
   table_name       IN VARCHAR2
   [, where_clause  IN VARCHAR2 DEFAULT '']
   [, all_or_user   IN VARCHAR2 DEFAULT 'USER']
   [, lock_mode     IN VARCHAR2 DEFAULT 'ES']);
```

Parameters

Table 70–43 UnlockRows Procedure Parameters

Parameter	Description
workspace	Name of the workspace: locked rows in this workspace and corresponding rows in the parent workspace will be unlocked, as specified in the remaining parameters. The name is case sensitive.
table_name	Name of the table in which rows are to be unlocked. The name is not case sensitive.
where_clause	The WHERE clause (excluding the WHERE keyword) identifying the rows to be unlocked. Example: 'department_id = 20' Only primary key columns can be specified in the WHERE clause. The WHERE clause cannot contain a subquery. If where_clause is not specified, all rows in table_name are made accessible.
all_or_user	Scope of the request: ALL or USER. ALL: All locks accessible by the user in the current workspace are considered. USER (default): Only locks owned by the user in the current workspace are considered.
lock_mode	Locking mode: E, S, or ES. E: Only exclusive mode locks are considered. S: Only shared mode locks are considered. ES (default): Both exclusive mode and shared mode locks are considered.

Usage Notes

This procedure affects Workspace Manager locking, which occurs in addition to any standard Oracle server locking. For an explanation of Workspace Manager locking, see *Oracle9i Application Developer's Guide - Workspace Manager*.

This procedure unlocks rows that had been previously locked (see the LockRows Procedure). It does not affect whether Workspace Manager locking is set on or off (determined by the SetLockingON Procedure and SetLockingOFF Procedure).

Examples

The following example unlocks the EMPLOYEES table where last_name = 'Smith' in the NEWWORKSPACE workspace.

```
EXECUTE DBMS_WM.UnlockRows ('employees', 'NEWWORKSPACE', 'last_name =
''Smith''');
```

71

DBMS_XMLGEN

DBMS_XMLGEN converts the results of a SQL query to a canonical XML format. The package takes an arbitrary SQL query as input, converts it to XML format, and returns the result as a CLOB.

This package is similar to the DBMS_XMLQUERY package, except that it is written in C and compiled into the kernel. This package can only be run on the database.

> **See Also:** *Oracle9i XML Reference* for more information on XML support and for an example of how to use DBMS_XMLGEN.

This chapter discusses the following topics:

Summary of DBMS_XMLGEN Subprograms

Table 71–1 DBMS_XMLGEN Subprograms

Subprogram	Description
"newContext Function" on page 71-3	Creates a new context handle from a passed-in SQL query. The context handle can be used for the rest of the functions.
"setRowTag Procedure" on page 71-3	Sets the name of the element enclosing each row of the result. The default tag is `ROW`.
"setRowSetTag Procedure" on page 71-4	Sets the name of the element enclosing the entire result. The default tag is `ROWSET`.
"getXML Procedure" on page 71-5	Appends the XML to the CLOB passed in. Use the `getNumRowsProcessed` function to figure out if any rows were appended.
"getXML Function" on page 71-5	Returns the XML as a CLOB.
"getNumRowsProcessed Function" on page 71-6	Gets the number of SQL rows that were processed in the last call to `getXML`.
"setMaxRows Procedure" on page 71-7	Sets the maximum number of rows to be fetched each time.
"setSkipRows Procedure" on page 71-8	Sets the number of rows to skip every time before generating the XML. The default is 0.
"setConvertSpecialChars Procedure" on page 71-8	Sets whether special characters such as `$,` which are non-XML characters, should be converted or not to their escaped representation. The default is to perform the conversion.
"useItemTagsForColl Procedure" on page 71-9	Forces the use of the collection column name appended with the `tag _ITEM` for collection elements. The default is to set the underlying object type name for the base element of the collection.
"restartQUERY Procedure" on page 71-10	Restarts the query to start fetching from the beginning.
"closeContext Procedure" on page 71-10	Closes the context and release all resources.

newContext Function

This function, given a query string, generates a new context handle to be used in subsequent functions.

Syntax

```
DBMS_XMLGEN.newContext (
    queryString  IN VARCHAR2)
RETURN ctxHandle;
```

Parameters

Table 71–2 shows the parameters of the `newContext` function.

Table 71–2 newContext Function Parameters

Parameter	Description
`queryString (IN)`	The query string, the result of which must be converted to XML.

Returns

The context handle.

Usage Notes

You must call this function first to obtain a handle that you can use in the `getXML()` and other functions to get XML back from the result.

setRowTag Procedure

This procedure sets the name of the element separating all the rows. The default name is `ROW`.

Syntax

```
DBMS_XMLGEN.setRowTag (
    ctx  IN ctxHandle,
    rowTag  IN VARCHAR2);
```

Parameters

Table 71–3 shows the parameters of the `setRowTag` procedure.

Table 71–3 setRowTag Procedure Parameters

Parameter	Description
ctx (IN)	The context handle obtained from the newContext call.
rowTag (IN)	The name of the ROW element. NULL indicates that you do not want the ROW element present.

Usage Notes

You can call this function to set the name of the ROW element if you do not want the default ROW name to appear. You can also set this to NULL to suppress the ROW element itself. However, an error is produced if both the row and the rowset are null and there is more than one column or row in the output.

setRowSetTag Procedure

This procedure sets the name of the root element of the document. The default name is ROWSET.

Syntax

```
DBMS_XMLGEN.setRowSetTag (
    ctx  IN ctxHandle,
    rowSetTag  IN VARCHAR2);
```

Parameters

Table 71–4 shows the parameters of the setRowSetTag procedure.

Table 71–4 setRowSetTag Procedure Parameters

Parameter	Description
ctx (IN)	The context handle obtained from the newContext call.
rowSetTag (IN)	The name of the document element. NULL indicates that you do not want the ROW element present.

Usage Notes

You can call this function to set the name of the document root element if you do not want the default ROWSET name in the output. You can also set this to NULL to suppress the printing of this element. However, an error is produced if both the row and the rowset are null and there is more than one column or row in the output.

getXML Procedure

This procedure gets the XML document by fetching the maximum number of rows specified. It appends the XML document to the CLOB passed in.

Syntax

```
DBMS_XMLGEN.getXML (
    ctx  IN ctxHandle,
    clobval  IN OUT NCOPY clob,
    dtdOrSchema  IN number := NONE)
RETURN boolean;
```

Parameters

Table 71–5 shows the parameters of the `getXML` procedure.

Table 71–5 getXML Procedure Parameters

Parameter	Description
`ctx (IN)`	The context handle obtained from the `newContext` call.
`clobval (IN/OUT)`	The clob to which the XML document is appended.
`dtdOrSchema (IN)`	The Boolean to indicate generation of either a DTD or a schema.

Usage Notes

Use this version of the `getXML` function if you want to avoid any extra CLOB copies, and you want to reuse the same CLOB for subsequent calls. This `getXML` call is more efficient than the `getXML` function, although this involves creating the LOB locator.

When the rows indicated by the `setSkipRows` call are skipped, the maximum number of rows as specified by the `setMaxRows` call (or the entire result if not specified) is fetched and converted to XML.

Use the `getNumRowsProcessed` function to check if any rows were retrieved.

getXML Function

This function generates the XML document and returns it as a CLOB.

Syntax

```
DBMS_XMLGEN.getXML (
    ctx  IN ctxHandle,
    dtdOrSchema  IN number := NONE)
RETURN clob;
```

Parameters

Table 71–6 shows the parameters for the getXML function.

Table 71–6 getXML Function Parameters

Parameter	Description
ctx (IN)	The context handle obtained from the newContext call.
dtdOrSchema (IN)	The Boolean to indicate generation of either a DTD or a schema.

Returns

A temporary CLOB containing the document.

Usage Notes

You must free the temporary CLOB obtained from this function using the DBMS_LOB.FREETEMPORARY call.

getNumRowsProcessed Function

This function gets the number of SQL rows processed when generating the XML using the getXML call. This count does not include the number of rows skipped before generating the XML.

Syntax

```
DBMS_XMLGEN.getNumRowsProcessed (
    ctx  IN ctxHandle)
RETURN NUMBER;
```

Parameters

Table 71–7 shows the parameters of the getNumRowsProcessed function

Table 71–7 getNumRowsProcessed Function Parameters

Parameter	Description
queryString (IN)	The query string, the result of which must be converted to XML.

Returns

The number of rows processed in the last call to getXML. This does not include the number of tows skipped.

Usage Notes

Use this function to determine the terminating condition if you are calling getXML in a loop. Note that getXML always generates an XML document, even if there are no rows present.

setMaxRows Procedure

This procedure sets the maximum number of rows to fetch from the SQL query result for every invokation of the getXML call.

Syntax

```
DBMS_XMLGEN.setMaxRows (
    ctx  IN ctxHandle,
    maxRows  IN NUMBER);
```

Parameters

Table 71–8 shows the parameters of the setMaxRows procedure.

Table 71–8 SET_MAX_ROWS Procedure

Parameter	Description
ctx (IN)	The context handle corresponding to the query executed.
maxRows (IN)	The maximum number of rows to get per call to getXML.

Usage Notes

Closes all resources associated with this handle. After closing the context, you cannot use the handle for any other DBMS_XMLGEN function call.

setSkipRows Procedure

This procedure skips a given number of rows before generating the XML output for every call to the `getXML` routine.

Syntax

```
DBMS_XMLGEN.setSkipRows (
    ctx  IN ctxHandle,
    skipRows  IN NUMBER);
```

Parameters

Table 71–9 shows the parameters of the `setSkipRows` procedure.

Table 71–9 setSkipRows Procedure Parameters

Parameter	Description
`ctxHandle (IN)`	The context handle corresponding to the query executed.
`skipRows (IN)`	The number of rows to skip per call to `getXML`.

Usage Notes

You can use the `skipRows` parameter when generating paginated results for stateless Web pages using this utility. For example, when generating the first page of XML or HTML data, you can set `skipRows` to zero. For the next set, you can set the `skipRows` to the number of rows that you got in the first case.

setConvertSpecialChars Procedure

This procedure sets whether or not special characters in the XML data must be converted into their escaped XML equivalent. For example, the < sign is converted to `<`. The default is to perform conversions.

Syntax

```
DBMS_XMLGEN.setConvertSpecialChars (
    ctx  IN ctxHandle,
    conv  IN boolean);
```

Parameters

Table 71–10 shows the parameters of the `setConvertSpecialChars` procedure.

Table 71–10 setConvertSpecialChars Procedure Parameters

Parameter	Description
ctx (IN)	The context handle to use.
conv (IN)	True indicates that conversion is needed.

Usage Notes

You can use this function to speed up XML processing whenever you are sure that the input data cannot contain any special characters such as <, >, ", ', which must be escaped. It is expensive to scan the character data to replace the special characters, particularly if it involves a lot of data. In cases where the data is XML-safe, you can call this function to improve performance.

useItemTagsForColl Procedure

This procedure sets the name of the collection elements. The default name for collection elements is the type name itself. Using this function, you can override the default to use the name of the column with the _ITEM tag appended to it.

Syntax

```
DBMS_XMLGEN.useItemTagsForColl (
    ctx  IN ctxHandle);
```

Parameters

Table 71–11 shows the parameters of the useItemTagsForColl procedure.

Table 71–11 useItemTagsForColl Procedure Parameters

Parameter	Description
ctx (IN)	The context handle.

Usage Notes

If you have a collection of NUMBER, the default tag name for the collection elements is NUMBER. Using this procedure, you can override this behavior and generate the collection column name with the _ITEM tag appended to it.

restartQUERY Procedure

This procedure restarts the query and generates the XML from the first row.

Syntax

```
DBMS_XMLGEN.restartQUERY (
    ctx  IN ctxHandle);
```

Parameters

Table 71–12 shows the parameters of the `restartQuery` procedure.

Table 71–12 restartQuery Procedure Parameters

Parameter	Description
`ctx (IN)`	The context handle corresponding to the current query.

Usage Notes

You can call this procedure to start executing the query again, without having to create a new context.

closeContext Procedure

This procedure closes a given context and releases all resources associated with it, including the SQL cursor and bind and define buffers.

Syntax

```
DBMS_XMLGEN.closeContext (
    ctx  IN ctxHandle);
```

Parameters

Table 71–13 shows the parameters of the `closeContext` procedure.

Table 71–13 closeContext Procedure Parameters

Parameter	Description
`ctx (IN)`	The context handle to close.

Usage Notes

Closes all resources associated with this handle. After this you cannot use the handle for any other `DBMS_XMLGEN` function call.

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DBMS_XMLQUERY

DBMS_XMLGEN is a built-in package in C. In general, use DBMS_XMLGEN instead of DBMS_XMLQUERY wherever possible. DBMS_XMLQUERY provides database-to-XMLType functionality.

See Also: *Oracle9i XML Reference* for more information

This chapter discusses the following topics:

Summary of DBMS_XMLQUERY Subprograms

Table 72–1 DBMS_XMLQUERY Subprograms

Subprogram	Description
"newContext Function" on page 72-3	Creates a query context and returns the context handle.
"newContext Function" on page 72-4	Creates a query context and returns the context handle.
"closeContext Procedure" on page 72-4	Closes or de-allocates a particular query context.
"setRowsetTag Procedure" on page 72-5	Sets the tag to be used to enclose the XML dataset.
"setRowTag Procedure" on page 72-5	Sets the tag to be used to enclose the XML element corresponding to a database record.
"setErrorTag Procedure" on page 72-6	Sets the tag to be used to enclose the XML error docs.
"setRowIdAttrName Procedure" on page 72-6	Sets the name of the id attribute of the row enclosing the tag.
"setRowIdAttrValue Procedure" on page 72-7	Specifies the scalar column whose value is to be assigned to the id attribute of the row enclosing the tag.
"setCollIdAttrName Procedure" on page 72-7	Sets the name of the id attribute of the separator tag of the collection element.
"useNullAttributeIndicator Procedure" on page 72-8	Specifies whether to use an XML attribute to indicate nullness, or to do it by omitting the particular entity in the XML document.
"setTagCase Procedure" on page 72-8	Specifies the case of the generated XML tags.
"setDateFormat Procedure" on page 72-9	Sets the format of the generated dates in the XML document.
"setMaxRows Procedure" on page 72-9	Sets the maximum number of rows to be converted to XML. By default, no maximum is set.
"setSkipRows Procedure" on page 72-10	Sets the number of rows to skip. By default, 0 rows are skipped.
"setStylesheetHeader Procedure" on page 72-10	Sets the stylesheet header (i.e. stylesheet processing instructions) in the generated XML document.

Table 72–1 DBMS_XMLQUERY Subprograms (Cont.)

Subprogram	Description
"setXSLT Procedure" on page 72-11	Registers a stylesheet to be applied to the generated XML.
"setXSLT Procedure" on page 72-12	Registers a stylesheet to be applied to the generated XML.
"setBindValue Procedure" on page 72-12	Sets a value for a particular bind name.
"setMetaHeader Procedure" on page 72-13	Sets the XML meta header.
"setDataHeader Procedure" on page 72-13	Sets the XML data header.
"setRaiseException Procedure" on page 72-14	Tells the XSU to throw the raised exceptions.
"setRaiseNoRowsException Procedure" on page 72-15	Tells the XSU whether or not to throw an `OracleXMLNoRowsException` when the XML document generated is empty.
"propagateOriginalException Procedure" on page 72-15	Tells the XSU that if an exception is raised, the XSU should throw that exception rather than wrapping it with an `OracleXMLSQLException.`
"getExceptionContent Procedure" on page 72-16	Returns the error code of the thrown exception and the error message (that is, the SQL error code).
"getDTD Function" on page 72-16	Generates the DTD based on the SQL query used to initialize the context.
"getDTD Procedure" on page 72-17	Generates the DTD based on the SQL query used to initialize the context.
"getXML Function" on page 72-17	Generates the XML document based on the SQL query used to initialize the context.
"getXML Procedure" on page 72-18	Generates the XML document based on the SQL query used to initialize the context.

newContext Function

This function creates a query context and returns the context handle.

Syntax

```
DBMS_XMLQUERY.newContext (
```

```
    sqlQuery  IN VARCHAR2);
```

Returns

The context handle.

Parameters

Table 72–2 shows the parameters of the `newContext` function.

Table 72–2 newContext Function Parameters

Parameter	Description
`sqlQuery (IN)`	SQL query, the results of which to convert to XML

newContext Function

This function creates a query context and returns the context handle.

Syntax

```
DBMS_XMLQUERY.newContext (
    sqlQuery  IN CLOB);
```

Returns

The context handle.

Parameters

Table 72–3 shows the parameters of the `newContext` function.

Table 72–3 newContext Function Parameters

Parameter	Description
`sqlQuery (IN)`	SQL query, the results of which to convert to XML.

closeContext Procedure

This procedure closes or de-allocates a particular query context.

Syntax

```
DBMS_XMLQUERY.closeContext (
    ctxHdl  IN ctxType);
```

Parameters

Table 72–4 shows parameters of the `closeContext` procedure.

Table 72–4 closeContext Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.

setRowsetTag Procedure

This procedure sets the tag to be used to enclose the XML dataset.

Syntax

```
DBMS_XMLQUERY.setRowsetTag (
    ctxHdl  IN ctxType,
    tag  IN VARCHAR2);
```

Parameters

Table 72–5 shows the parameters of the `setRowsetTag` procedure.

Table 72–5 setRowsetTag Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`tag (IN)`	The tag name

setRowTag Procedure

This procedure sets the tag to be used to enclose the XML element corresponding to a database record.

Syntax

```
DBMS_XMLQUERY.setRowTag (
    ctxHdl  IN ctxType,
    tag  IN VARCHAR2);
```

Parameters

Table 72–6 shows the parameters of the `setRowTag` procedure.

Table 72–6 setRowTag Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
tag (IN)	The tag name.

setErrorTag Procedure

This procedure sets the tag to be used to enclose the XML error docs.

Syntax

```
DBMS_XMLQUERY.setErrorTag (
    ctxHdl  IN ctxType,
    tag  IN VARCHAR2);
```

Parameters

Table 72–7 shows the parameters of the setErroTag procedure.

Table 72–7 setErrorTag Procedure Parameters

Parameters	Description
ctxHdl (IN)	The context handle.
tag (IN)	The tag name.

setRowIdAttrName Procedure

This procedure sets the name of the id attribute of the row enclosing the tag. Passing NULL or an empty string for the tag omits the row id attribute.

Syntax

```
DBMS_XMLQUERY.setRowIdAttrName (
    ctxHdl  IN ctxType,
    attrName  IN VARCHAR2);
```

Parameters

Table 72–8 shows the parameters of the setRowIdAttrName procedure.

Table 72–8 setRowIdAttrName Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
attrName (IN)	The attribute name.

setRowIdAttrValue Procedure

This procedure specifies the scalar column whose value is to be assigned to the id attribute of the row enclosing the tag. Passing NULL or an empty string for the colName results in the row id attribute being assigned the row count value (that is, 0, 1, 2, and so on).

Syntax

```
DBMS_XMLQUERY.setRowIdAttrValue (
    ctxHdl  IN ctxType,
    colName  IN VARCHAR2);
```

Parameters

Table 72–9 shows the parameters of the setRowIdAttrValue procedure.

Table 72–9 setRowIdAttrValue Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
colName (IN)	The column whose value is to be assigned to the row id attr.

setCollIdAttrName Procedure

This procedure sets the name of the id attribute of the separator tag of the collection element. Passing NULL or an empty string for the tag results omits the row id attribute.

Syntax

```
DBMS_XMLQUERY.setCollIdAttrName (
    ctxHdl  IN ctxType,
    attrName  IN VARCHAR2);
```

Parameters

Table 72–10 shows the parameters of the `setCollIdAttrName` procedure.

Table 72–10 setCollIdAttrName Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`attrName (IN)`	The attribute name.

useNullAttributeIndicator Procedure

This procedure specifies whether to use an XML attribute to indicate nullness, or to do it by omitting the particular entity in the XML document.

Syntax

```
DBMS_XMLQUERY.useNullAttributeIndicator (
    ctxHdl  IN ctxType,
    flag  IN BOOLEAN);
```

Parameters

Table 72–11 shows the parameters of the `useNullAttributeIndicator` procedure.

Table 72–11 useNullAttributeIndicator Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`flag (IN)`	Use attribute to indicate `NULL`?

setTagCase Procedure

This procedure specifies the case of the generated XML tags.

Syntax

```
DBMS_XMLQUERY.setTagCase (
    ctxHdl  IN ctxType,
    tCase  IN NUMBER);
```

Parameters

Table 72–12 shows the parameters of the `setTagCase` procedure.

Table 72–12 setTagCase Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`tCase (IN)`	The case of the tag (that is, 0-as Is, 1-lower, 2-upper).

setDateFormat Procedure

This procedure sets the format of the generated dates in the XML document. The syntax of the date format pattern (i.e. the date mask), should conform to the requirements of the `java.text.SimpleDateFormat` class. Setting the mask to `NULL` or an empty string results in the use of the default mask, `DEFAULT_DATE_FORMAT`.

Syntax

```
DBMS_XMLQUERY.setDateFormat (
    ctxHdl  IN ctxType,
    mask  IN VARCHAR2);
```

Parameters

Table 72–13 shows the parameters of the `setDateFormat` procedure.

Table 72–13 setDateFormat Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`mask (IN)`	The date mask.

setMaxRows Procedure

This procedure sets the maximum number of rows to be converted to XML. By default, no maximum is set.

Syntax

```
DBMS_XMLQUERY.setMaxRows (
    ctxHdl  IN ctxType,
```

```
    rows  IN NUMBER);
```

Parameters

Table 72–14 shows the parameters of the `setMaxRows` procedure.

Table 72–14 setMaxRows Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`rows (IN)`	The maximum number of rows to generate.

setSkipRows Procedure

This procedure sets the number of rows to skip. By default, 0 rows are skipped.

Syntax

```
DBMS_XMLQUERY.setSkipRows (
    ctxHdl  IN ctxType,
    rows  IN NUMBER);
```

Parameters

Table 72–15 shows the parameters of the `setSkipRows` procedure.

Table 72–15 setSkipRows Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`rows (IN)`	The number of rows to skip.

setStylesheetHeader Procedure

This procedure sets the stylesheet header (that is, stylesheet processing instructions) in the generated XML document.

Note: Passing NULL for the uri argument will unset the stylesheet header and the stylesheet type.

Syntax

```
DBMS_XMLQUERY.setStylesheetHeader (
    ctxHdl  IN ctxType,
    uri  IN VARCHAR2,
    type  IN VARCHAR2 := 'text/xsl');
```

Parameters

Table 72–16 shows the parameters of the setStylesheetHeader procedure.

Table 72–16 setStylesheetHeader Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
uri (IN)	The stylesheet URL.
type (IN)	The stylesheet type, which defaults to text/xsl.

setXSLT Procedure

This procedure registers a stylesheet to be applied to generated XML. If a stylesheet was already registered, it is replaced by the new one. To unregister the stylesheet, pass in a NULL for the uri argument.

Syntax

```
DBMS_XMLQUERY.setXSLT (
    ctxHdl  IN ctxType,
    uri  IN VARCHAR2,
    ref  IN VARCHAR2 := null);
```

Parameters

Table 72–17 shows the parameters of the setXSLT procedure.

Table 72–17 setXSLT Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
uri (IN)	The stylesheet URL.
ref (IN)	The URL for include, import, and external entities.

setXSLT Procedure

This procedure registers a stylesheet to be applied to generated XML. If a stylesheet was already registered, it is replaced by the new one. To unregister the stylesheet, pass in a NULL or an empty string for the stylesheet argument.

Syntax

```
DBMS_XMLQUERY.setXSLT (
    ctxHdl  IN ctxType,
    stylesheet  CLOB,
    ref  IN VARCHAR2 := null);
```

Parameters

Table 72–18 shows the parameters of the setXSLT procedure.

Table 72–18 setXSLT Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
stylesheet (IN)	The stylesheet.
ref (IN)	The URL for include, import, and external entities.

setBindValue Procedure

This procedure sets a value for a particular bind name.

Syntax

```
DBMS_XMLQUERY.setBindValue (
    ctxHdl  IN ctxType,
    bindName  IN VARCHAR2,
    bindValue  IN VARCHAR2);
```

Parameters

Table 72–19 shows the parameters of the `setBindValue` procedure.

Table 72–19 setBindValue Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`bindName (IN)`	The bind name.
`bindValue (IN)`	The bind value.

setMetaHeader Procedure

This procedure sets the XML meta header. When set, the header is inserted at the beginning of the metadata part (DTD or XMLSchema) of each XML document generated by this object. Note that the last meta header specified is the one that is used; furthermore, passing in `NULL` for the header parameter unsets the meta header.

Syntax

```
DBMS_XMLQUERY.setMetaHeader (
    ctxHdl  IN ctxType,
    header  IN CLOB := null);
```

Parameters

Table 72–20 shows the parameters of the `setMetaHeader` procedure.

Table 72–20 setMetaHeader Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`header (IN)`	The header.

setDataHeader Procedure

This procedure sets the XML data header. The data header is an XML entity that is appended at the beginning of the query-generated XML entity (that is, rowset). The two entities are enclosed by the tag specified via the `docTag` argument. Note that

the last data header specified is the one that is used; furthermore, passing in NULL for the header parameter unsets the data header.

Syntax

```
DBMS_XMLQUERY.setDataHeader (
    ctxHdl  IN ctxType,
    header  IN CLOB := null,
    tag  IN VARCHAR2 := null);
```

Parameters

Table 72–21 shows the parameters of the setDataHeader procedure.

Table 72–21 setDataHeader Procedure Parameters

Parameter	Description
ctzHdl (IN)	The context handle.
header (IN)	The header.
tag (IN)	The tag used to enclose the data header and the rowset.

setRaiseException Procedure

This procedure tells the XSU to throw the raised exceptions. If this call is not made or if false is passed to the flag argument, the XSU catches the SQL exceptions and generates an XML document from the exception message.

Syntax

```
DBMS_XMLQUERY.setRaiseException (
    ctxHdl  IN ctxType,
    flag  IN BOOLEAN);
```

Parameters

Table 72–22 shows the parameters of the setRaiseException procedure.

Table 72–22 setRaiseException Procedure Parameters

Parameter	Description
ctxhdl (IN)	The context handle.
flag (IN)	throw raised exceptions?

setRaiseNoRowsException Procedure

This procedure tells the XSU whether or not to throw an `OracleXMLNoRowsException` when the XML document generated is empty. By default, the exception is not thrown.

Syntax

```
DBMS_XMLQUERY.setRaiseNoRowsException (
    ctxHdl  IN ctxType,
    flag  IN BOOLEAN);
```

Parameters

Table 72–23 shows the parameters of the `setRaiseNoRowsException` procedure.

Table 72–23 setRaiseNoRowsException Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`flag (IN)`	throw OracleXMLNoRowsException if no data?

propagateOriginalException Procedure

This procedure tells the XSU that if an exception is raised, the XSU should throw the exception raised rather than wrapping it with an `OracleXMLSQLException`.

Syntax

```
DBMS_XMLQUERY.propagateOriginalException (
    ctxHdl  IN ctxType,
    flag  IN BOOLEAN)
```

Parameters

Table 72–24 shows the parameters of the `propagateOriginalException` procedure.

Table 72–24 propagateOriginalException Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`flag (IN)`	Propagates the original exception??

getExceptionContent Procedure

This procedure, via its arguments, returns the error code of the thrown exception and the error message (that is, the SQL error code). This is to get around the fact that the jvm throws an exception on top of whatever exception was raised, thus rendering PL/SQL unable to access the original exception.

Syntax

```
DBMS_XMLQUERY.getExceptionContent (
    ctxHdl  IN ctxType,
    errNo  OUT NUMBER,
    errMsg  OUT VARCHAR2);
```

Parameters

Table 72–25 shows the parameters of the `getExceptionContent` procedure.

Table 72–25 getExceptionContent Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`errNo (OUT)`	The error number.
`errMsg (OUT)`	The error message.

getDTD Function

This function generates the DTD based on the SQL query used to initialize the context.

Syntax

```
DBMS_XMLQUERY.getDTD (
    ctxHdl  IN ctxType,
    withVer  IN BOOLEAN := false);
```

Returns

The CLOB and the DTD.

Parameters

Table 72–26 shows the parameters of the `getDTD` function.

Table 72–26 getDTD Function Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
withVer (IN)	Generates the version information??

getDTD Procedure

This procedure generates the DTD based on the SQL query used to initialize the context.

Syntax

```
DBMS_XMLQUERY.getDTD (
    ctx  IN ctxType,
    xDoc  IN CLOB,
    withVer  IN BOOLEAN := false)
```

Parameters

Table 72–27 shows the parameters of the getDTD procedure.

Table 72–27 getDTD Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
xDoc (IN)	The LOB in which to write the generated XML document.
withVer (IN)	Generates the version information??

getXML Function

This function generates the XML document based on the SQL query used to initialize the context.

Syntax

```
DBMS_XMLQUERY.getXML (
    ctxHdl  IN ctxType,
    metaType  IN NUMBER := NONE)
```

Returns

The CLOB and the XML document.

Parameters

Table 72–28 shows the parameters of the `getXML` function.

Table 72–28 getXML Function Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`metaType (IN)`	The XML metadata type (that is, none or DTD).

getXML Procedure

This procedure generates the XML document based on the SQL query used to initialize the context.

Syntax

```
DBMS_XMLQUERY.getXML (
    ctxHdl  IN ctxType,
    xDoc  IN CLOB,
    metaType  IN NUMBER := NONE)
```

Parameters

Table 72–29 shows the parameters of the `getXML` procedure.

Table 72–29 getXML Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`xDoc (IN)`	The LOB in which to write the generated XML document.
`metaType (IN)`	The XML metadata type (I.e. none or DTD).

73

DBMS_XMLSAVE

DBMS_XMLSAVE provides XML to database-type functionality.

This chapter discusses the following topics:

Summary of DBMS_XMLSAVE Subprograms

Table 73–1 DBMS_XMLSAVE Subprograms

Subprogram	Description
"newContext Function" on page 73-3	Creates a save context and returns the context handle.
"closeContext Procedure" on page 73-3	Closes or de-allocates a particular save context.
"setRowTag Procedure" on page 73-4	Names the tag used in the XML document to enclose the XML elements corresponding to database records
"setIgnoreCase Procedure" on page 73-4	?
"setDateFormat Procedure" on page 73-5	Describes to the XSU the format of the dates in the XML document.
"setBatchSize Procedure" on page 73-5	Changes the batch size used during DML operations.
"setCommitBatch Procedure" on page 73-6	Sets the commit batch size.
"setUpdateColumn Procedure" on page 73-7	Adds a column to the update column list.
"clearUpdateColumnList Procedure" on page 73-7	Clears the update column list.
"setKeyColumn Procedure" on page 73-8	Adds a column to the key column list.
"clearKeyColumnList Procedure" on page 73-8	Clears the key column list.
"insertXML Function" on page 73-9	Inserts the XML document into the table specified at the context creation time.
"insertXML Function" on page 73-9	Inserts the XML document into the table specified at the context creation time.
"updateXML Function" on page 73-10	Updates the table specified at the context creation time with data from the XML document.
"updateXML Function" on page 73-10	Updates the table specified at the context creation time with data from the XML document.

Table 73–1 DBMS_XMLSAVE Subprograms (Cont.)

Subprogram	Description
"deleteXML Function" on page 73-11	Deletes records specified by data from the XML document, from the table specified at the context creation time.
"deleteXML Function" on page 73-11	Deletes records specified by data from the XML document, from the table specified at the context creation time.

newContext Function

This function creates a save context and returns the context handle.

Syntax

```
DBMS_XMLSAVE.newContext (
    targetTable  IN VARCHAR2);
```

Parameters

Table 73–2 shows the parameters of the `newContext` function.

Table 73–2 newContext Function Parameters

Parameter	Description
`targetTable (IN)`	The target table into which the XML document is loaded.

Returns

The context handle.

closeContext Procedure

This procedure closes or de-allocates a save context.

Syntax

```
DBMS_XMLSAVE.closeContext (
    ctxHdl  IN ctxType);
```

Parameters

Table 73–3 shows the parameters for the `closeContext` procedure.

Table 73–3 closeContext Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.

setRowTag Procedure

This procedure names the tag used in the XML document to enclose the XML elements corresponding to database records.

Syntax

```
DBMS_XMLSAVE.setRowTag (
    ctxHdl  IN ctxType,
    tag     IN VARCHAR2);
```

Parameters

Table 73–4 shows the parameters of the `setRowTag` procedure.

Table 73–4 setRowTag Procedure Parameters

Parameters	Description
ctxHdl (IN)	The context handle.
tag (IN)	The tag name.

setIgnoreCase Procedure

The XSU maps XML elements to database columns or attributes based on the element names (XML tags). The XSU mapping is case-insensitive.

Syntax

```
DBMS_XMLSAVE.setIgnoreCase (
    ctxHdl  IN ctxType,
    flag    IN NUMBER);
```

Parameters

Table 73–5 shows the parameters of the `setIgnoreCase` procedure.

Table 73–5 setIgnoreCase Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
flag (IN)	Tag case is ignored: 1=true, 0=false.

setDateFormat Procedure

This procedure describes the format of the dates in the XML document to the XSU . The syntax of the date format pattern (the date mask) should conform to the requirements of the `java.text.SimpleDateFormat` class. If you set the mask to `NULL` or an empty string, the default mask, `OracleXMLCore.DATE_FORMAT,` is used.

Syntax

```
DBMS_XMLSAVE.setDateFormat (
    ctxHdl  IN ctxType,
    mask    IN VARCHAR2);
```

Parameters

Table 73–6 shows the parameters of the `setDateFormat` procedure.

Table 73–6 setDateFormat Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`mask (IN)`	The date mask.

setBatchSize Procedure

This procedure changes the batch size used during DML operations. When performing inserts, updates, or deletes, batching the operations so that they are not executed as separate statements will result in performance gains. However, more memory is needed to buffer all the bind values. When batching is used, a commit occurs only after a batch is executed. Therefore, if one of the statements inside a batch fails, the whole batch is rolled back. If this behavior is unacceptable, set the batch size to 1.

Syntax

```
DBMS_XMLSAVE.setBatchSize (
    ctxHdl     IN ctxType,
    batchSize  IN NUMBER);
```

Parameters

Table 73–7 shows the parameters of the `setBatchSize` procedure.

Table 73–7 setBatchSize Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`batchSize (IN)`	The batch size.

setCommitBatch Procedure

This procedure sets the commit batch size. The commit batch size refers to the number of records inserted after which a commit should follow. Note that if the `commitBatch` is less than 1 or the session is in autocommit mode, the XSU does not make any explicit commits. By default the commit-batch size is 0.

Syntax

```
DBMS_XMLSAVE.setCommitBatch (
    ctxHdl     IN ctxType,
    batchSize  IN NUMBER);
```

Parameters

Table 73–8 shows the parameters of the `setCommitBatch` procedure.

Table 73–8 setCommitBatch Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`batchSize (IN)`	The commit batch size.

setUpdateColumn Procedure

This procedure adds a column to the update column list. In the case of an insert, the default is to insert values in all the columns in the table. In case of updates, the default is to update only the columns corresponding to the tags present in the ROW element of the XML document. When the update column list is specified, only the columns making up this list will be updated or inserted into.

Syntax

```
DBMS_XMLSAVE.setUpdateColumn (
    ctxHdl   IN ctxType,
    colName  IN VARCHAR2);
```

Parameters

Table 73–9 shows the parameters of the `setUpdateColumn` procedure.

Table 73–9 setUpdateColumn Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
colName (IN)	The column to be added to the update column list.

clearUpdateColumnList Procedure

This procedure clears the update column list.

Syntax

```
DBMS_XMLSAVE.clearUpdateColumnList (
    ctxHdl  IN ctxType);
```

Parameters

Table 73–10 shows the parameters of the `clearUpdateColumnList` procedure.

Table 73–10 clearUpdateColumnList Procedure Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.

See Also: setUpdateColumn Procedure on page 73-7.

setKeyColumn Procedure

This procedure adds a column to the key column list. For updates or deletes, the columns in the key column list make up the WHERE clause of the update or delete statement. The key column list must be specified before updates can be done. The key column list is optional for delete operations.

Syntax

```
DBMS_XMLSAVE.setKeyColumn (
    ctxHdl   IN ctxType,
    colName  IN VARCHAR2);
```

Parameters

Table 73–11 shows the parameters of the setKeyColumn procedure.

Table 73–11 setKeycolumn Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
colName (IN)	The column to be added to the key column list.

clearKeyColumnList Procedure

This procedure clears the key column list.

Syntax

```
DBMS_XMLSAVE.clearKeyColumnList (
    ctxHdl  IN ctxType);
```

Parameters

Table 73–12 shows the parameters of the clearKeyColumnList procedure.

Table 73–12 clearKeyColumnList Procedure Parameters

Parameter	Description
ctxHdl (IN)	The context handle.

See Also: setKeyColumn Procedure on page 73-8.

insertXML Function

This function inserts the XML document into the table specified at the context creation time.

```
DBMS_XMLSAVE.insertXML (
    ctxHdl  IN ctxType,
    xDoc  IN VARCHAR2);
```

Returns

The number of rows inserted.

Parameters

Table 73–13 shows the parameters of the `insertXML` function.

Table 73–13 insertXML Function Parameters

Parameter	Description
`ctxHdl (IN)`	The context handle.
`xDoc (IN)`	The string containing the XML document.

insertXML Function

This function inserts the XML document into the table specified at the context creation time.

Syntax

```
DBMS_XMLSAVE.insertXML (
    ctxHdl  IN ctxType,
    xDoc  IN CLOB);
```

Returns

The number of rows inserted.

Parameters

Table 73–14 shows the parameters of the `insertXML` function.

Table 73–14 insertXML Function Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
xDoc (IN)	The string containing the XML document.

updateXML Function

This function updates the table specified at the context creation time with data from the XML document.

Syntax

```
DBMS_XMLSAVE.updateXML (
    ctxHdl  IN ctxType,
    xDoc  IN VARCHAR2);
```

Returns

The number of rows updated.

Parameters

Table 73–15 shows the parameters of the updateXML function.

Table 73–15 updateXML Function Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
xDoc (IN)	The string containing the XML document.

updateXML Function

This function updates the table specified at the context creation time with data from the XML document.

Syntax

```
DBMS_XMLSAVE.updateXML (
    ctxHdl  IN ctxType,
    xDoc  IN CLOB);
```

Returns

The number of rows updated.

Parameters

Table 73–16 shows the parameters of the updateXML function.

Table 73–16 updateXML Function Parameters

Parameters	Description
ctxHdl (IN)	The context handle.
xDoc (IN)	The string containing the XML document.

deleteXML Function

This function deletes records specified by data from the XML document, from the table specified at the context creation time.

Syntax

```
DBMS_XMLSAVE.deleteXML (
    ctxHdl  IN ctxType,
    xDoc  IN VARCHAR2);
```

Returns

The number of rows deleted.

Parameters

Table 73–17 shows the parameters of the deleteXML function.

Table 73–17 deleteXML Function Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
xDoc (IN)	The string containing the XML document.

deleteXML Function

This function deletes records specified by data from the XML document, from the table specified at the context creation time.

Syntax

```
DBMS_XMLSAVE.deleteXML (
    ctxHdl  IN ctxType,
    xDoc  IN CLOB);
```

Returns

The number of rows deleted.

Parameters

Table 73–18 shows the parameters of the `deleteXML` function.

Table 73–18 deleteXMLFunction Parameters

Parameter	Description
ctxHdl (IN)	The context handle.
xDoc (IN)	The string containing the XML document.

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DEBUG_EXTPROC

The DEBUG_EXTPROC package enables you to start up the extproc agent within a session. This utility package can help you debug external procedures.

This chapter discusses the following topics:

- Requirements and Installation Notes for DEBUG_EXTPROC
- Using DEBUG_EXTPROC
- Summary of DBMS_EXTPROC Subprograms

Requirements and Installation Notes for DEBUG_EXTPROC

Requirements

Your Oracle account must have EXECUTE privileges on the package and CREATE LIBRARY privileges.

Note: DEBUG_EXTPROC works only on platforms with debuggers that can attach to a running process.

Installation Notes

To install the package, run the script DBGEXTP.SQL.

- Install/load this package in the Oracle USER where you want to debug the 'extproc' process.
- Ensure that you have execute privileges on package DEBUG_EXTPROC

```
SELECT SUBSTR(OBJECT_NAME, 1, 20)
FROM USER_OBJECTS
WHERE OBJECT_NAME = 'DEBUG_EXTPROC';
```

- You can install this package as any other user, as long as you have EXECUTE privileges on the package.

Using DEBUG_EXTPROC

Usage Assumptions

This assumes that the Listener has been appropriately configured to startup an external procedures 'extproc' agent.

This also assumes that you built your shared library with debug symbols to aid in the debugging process. Please check the C compiler manual pages for the appropriate C compiler switches to build the shared library with debug symbols.

Usage Notes

- Start a brand new oracle session through SQL*Plus or OCI program by connecting to ORACLE.
- Execute procedure DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT to startup the extproc agent in this session; e.g., execute DEBUG_EXTPROC.STARTUP_

EXTPROC_AGENT; Do not exit this session, because that terminates the extproc agent.

- Determine the PID of the extproc agent that was started up for this session.
- Using a debugger (e.g., gdb, dbx, or the native system debugger), load the extproc executable and attach to the running process.
- Set a breakpoint on function 'pextproc' and let the debugger continue with its execution.
- Now execute your external procedure in the same session where you first executed DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT
- Your debugger should now break in function 'pextproc'. At this point in time, the shared library referenced by your PL/SQL external function would have been loaded and the function resolved. Now set a breakpoint in your C function and let the debugger continue its execution.

Because PL/SQL loads the shared library at runtime, the debugger you use may or may not automatically be able to track the new symbols from the shared library. You may have to issue some debugger command to load the symbols (for example, 'share' in gdb)

- The debugger should now break in your C function. Its assumed that you had built the shared library with debugging symbols.
- Now proceed with your debugging.

Summary of DBMS_EXTPROC Subprograms

DEBUG_EXTPROC contains one subprogram: STARTUP_EXTPROC_AGENT procedure. This starts up the extproc agent process in the session

STARTUP_EXTPROC_AGENT Procedure

This procedure starts up the extproc agent process in the session.This enables you to get the PID of the executing process. This PID is needed to be able to attach to the running process using a debugger.

Syntax

```
DEBUG_EXTPROC.STARTUP_EXTPROC_AGENT;
```

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UTL_COLL

The UTL_COLL package lets PL/SQL programs use collection locators to query and update.

This chapter discusses the following topics:

- Summary of UTL_COLL Subprograms

Summary of UTL_COLL Subprograms

There is currently only one function supported in this package:IS_LOCATOR.

IS_LOCATOR Function

This function determines whether a collection item is actually a locator or not.

Syntax

```
UTL_COLL.IS_LOCATOR (
   collection IN ANY)
  RETURNS BOOLEAN;
```

Parameters

Table 75–1 IS_LOCATOR Function Parameters

Parameter	Description
collection	Nested table or varray item.

Returns

Table 75–2 IS_LOCATOR Function Returns

Return Value	Description
1	Collection item is indeed a locator.
0	Collection item is not a locator.

Pragmas

Asserts WNDS, WNPS and RNPS pragmas

Example

```
CREATE OR REPLACE TYPE list_t as TABLE OF VARCHAR2(20);
/

CREATE OR REPLACE TYPE phone_book_t AS OBJECT (
  pno  number,
  ph   list_t );
/
```

```
CREATE TABLE phone_book OF phone_book_t
      NESTED TABLE ph STORE AS nt_ph;
CREATE TABLE phone_book1 OF phone_book_t
      NESTED TABLE ph STORE AS nt_ph_1 RETURN LOCATOR;

INSERT INTO phone_book VALUES(1, list_t('650-633-5707','650-323-0953'));
INSERT INTO phone_book1 VALUES(1, list_t('415-555-1212'));

CREATE OR REPLACE PROCEDURE chk_coll IS
  plist list_t;
  plist1 list_t;
BEGIN
  SELECT ph INTO plist FROM phone_book WHERE pno=1;

  SELECT ph INTO plist1 FROM phone_book1 WHERE pno=1;

  IF (UTL_COLL.IS_LOCATOR(plist)) THEN
    DBMS_OUTPUT.PUT_LINE('plist is a locator');
  ELSE
    DBMS_OUTPUT.PUT_LINE('plist is not a locator');
  END IF;

  IF (UTL_COLL.IS_LOCATOR(plist1)) THEN
    DBMS_OUTPUT.PUT_LINE('plist1 is a locator');
  ELSE
    DBMS_OUTPUT.PUT_LINE('plist1 is not a locator');
  END IF;

END chk_coll;

SET SERVEROUTPUT ON
EXECUTE chk_coll;
```

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UTL_ENCODE

The UTL_ENCODE package provides functions that encode RAW data into a standard encoded format so that the data can be transported between hosts. You can use UTL_ENCODE functions to encode the body of email text. The package also contains the decode counterpart functions of the encode functions. The functions follow published standards for encoding to accommodate nonOracle utilities on the sending or receiving ends.

This chapter discusses the following topics:

Summary of UTL_ENCODE Subprograms

Table 76–1 UTL_ENCODE Subprograms

Subprogram	Description
"BASE64_ENCODE Function" on page 76-2	Encodes the binary representation of the RAW value into base 64 elements and returns it in the form of a RAW string
"BASE64_DECODE Function" on page 76-3	Reads the base 64-encoded RAW input string and decodes it to its original RAW value
"UUENCODE Function" on page 76-3	Reads the RAW input string and encodes it to the corresponding uuencode format string
"UUDECODE Function" on page 76-4	Reads the RAW uuencode format input string and decodes it to the corresponding RAW string
"QUOTED_PRINTABLE_ ENCODE Function" on page 76-5	Reads the RAW input string and encodes it to the corresponding quoted printable format string
"QUOTED_PRINTABLE_ DECODE Function" on page 76-6	Reads the varchar2 quoted printable format input string and decodes it to the corresponding RAW string

BASE64_ENCODE Function

This function encodes the binary representation of the RAW value into base 64 elements and returns it in the form of a RAW string.

Syntax

```
FUNCTION base64_encode(
   r IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(base64_encode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r is the RAW value to be encoded. There are no defaults or optional parameters.

Returns

Table 76–2 BASE64_ENCODE Function Returns

Return	Description
RAW	Contains the encoded base 64 elements

BASE64_DECODE Function

This function reads the base 64-encoded RAW input string and decodes it to its original RAW value.

Syntax

```
FUNCTION base64_decode(
   r IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(base64_decode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r is the RAW string containing base 64-encoded data. There are no defaults or optional parameters.

Returns

Table 76–3 BASE64_DECODE Function Returns

Return	Description
RAW	Contains the decoded string

UUENCODE Function

This function reads the RAW input string and encodes it to the corresponding uuencode format string. The output of this function is cumulative, in that it can be used to encode large data streams, by splitting the data stream into acceptably sized RAW values, encoded, and concatenated into a single encoded string. Also see "UUDECODE Function" on page 76-4.

Syntax

```
FUNCTION uuencode(
   r          IN RAW,
   type       IN PLS_INTEGER DEFAULT 1,
   filename   IN VARCHAR2 DEFAULT NULL,
   permission IN VARCHAR2 DEFAULT NULL) RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(uuencode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 76–4 UUENCODE Function Parameters

Parameter	Description
r	RAW string
type	Optional number parameter containing the type of uuencoded output. Options: complete—a defined PL/SQL constant with a value of 1. (default) header_piece middle_piece end_piece
filename	Optional varchar2 parameter containing the uuencode filename; the default is uuencode.txt
permission	Optional varchar2 parameter containing the permission mode; the default is 0 (a text string zero).

Returns

Table 76–5 UUENCODE Function Returns

Return	Description
RAW	Contains the uuencode format string

UUDECODE Function

This function reads the RAW uuencode format input string and decodes it to the corresponding RAW string. See "UUENCODE Function" on page 76-3 for discussion of the cumulative nature of UUENCODE and UUDECODE for data streams.

Syntax

```
FUNCTION uudecode(
   r IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(uudecode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r is the RAW string containing the uuencoded data string. There are no defaults or optional parameters.

Returns

Table 76–6 UUDECODE Function Returns

Return	Description
RAW	The decoded RAW string

QUOTED_PRINTABLE_ENCODE Function

This function reads the RAW input string and encodes it to the corresponding quoted printable format string.

Syntax

```
FUNCTION quoted_printable_encode(
   r IN RAW
  RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(quoted_printable_encode, WNDS, RNDS,WNPS, RNPS);
```

Parameters

r is the RAW string. There are no defaults or optional parameters.

Returns

Table 76–7 QUOTED_PRINTABLE_ENCODE Function Returns

Return	Description
RAW	Contains the quoted printable string

QUOTED_PRINTABLE_DECODE Function

This function reads the varchar2 quoted printable format input string and decodes it to the corresponding RAW string.

Syntax

```
FUNCTION quoted_printable_decode(
   r IN RAW
  RETURN RAW;
```

Pragmas

```
pragma RESTRICT_REFERENCES(quoted_printable_decode, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r is the RAW string containing a quoted printable data string. There are no defaults or optional parameters.

Returns

Table 76–8 QUOTED_PRINTABLE_DECODE Function Returns

Return	Description
RAW	The decoded string

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UTL_FILE

With the UTL_FILE package, your PL/SQL programs can read and write operating system text files. UTL_FILE provides a restricted version of operating system stream file I/O.

UTL_FILE I/O capabilities are similar to standard operating system stream file I/O (OPEN, GET, PUT, CLOSE) capabilities, but with some limitations. For example, you call the FOPEN function to return a file handle, which you use in subsequent calls to GET_LINE or PUT to perform stream I/O to a file. When file I/O is done, you call FCLOSE to complete any output and free resources associated with the file.

> **Note:** The UTL_FILE package is similar to the client-side TEXT_IO package currently provided by Oracle Procedure Builder. Restrictions for a server implementation require some API differences between UTL_FILE and TEXT_IO. In PL/SQL file I/O, errors are returned using PL/SQL exceptions.

This chapter discusses the following topics:

Security

The PL/SQL file I/O feature is available for both client-side and server-side PL/SQL. The client implementation (text I/O) is subject to normal operating system file permission checking. However, the server implementation may be running in a privileged mode, which requires a restriction on the directories that can be accessed. Accessible directories must be specified in the instance parameter initialization file (INIT.ORA).

Accessible directories for the UTL_FILE functions are specified in the initialization file using the UTL_FILE_DIR parameter. For example:

```
UTL_FILE_DIR = <directory name>
```

> **Note:** The directory specification is different on different platforms.

If the initialization file for the instance contains the line UTL_FILE_DIR = /usr/jsmith/my_app, then the directory /usr/jsmith/my_app is accessible to the FOPEN function. Note that a directory named /usr/jsmith/My_App would not be accessible on case-sensitive operating systems.

The parameter specification UTL_FILE_DIR = * should be used with caution. It turns off directory access checking and makes all directories accessible to the UTL_FILE functions.

> **Caution:** Oracle does not recommend that you use the * option in production systems. Also, do not include '.' (the current directory for UNIX) in the accessible directories list.
>
> To ensure security on file systems that enable symbolic links, users must not be allowed WRITE permission to directories accessible by PL/SQL file I/O functions. The symbolic links and PL/SQL file I/O could be used to circumvent normal operating system permission checking and allow users read/write access to directories to which they would not otherwise have access.

File Ownership and Protections

On UNIX systems, the owner of a file created by the FOPEN function is the owner of the shadow process running the instance. Normally, this owner is ORACLE. Files

created using FOPEN are always writable and readable using the UTL_FILE subprograms, but nonprivileged users who need to read these files outside of PL/SQL may need access from a system administrator.

Examples (UNIX-Specific)

If the parameter initialization file contains only:

```
UTL_FILE_DIR=/appl/gl/log
UTL_FILE_DIR=/appl/gl/out
```

Then the following file locations and filenames are valid:

```
FILE LOCATION            FILENAME
/appl/gl/log             L10324.log
/appl/gl/out             O10324.out
```

But the following file locations and filename are invalid:

```
FILE LOCATION            FILENAME
/appl/gl/log/backup      L10324.log          # subdirectory
/APPL/gl/log             L10324.log          # uppercase
/appl/gl/log             backup/L10324.log   # dir in name
/usr/tmp                 T10324.tmp          # not in INIT.ORA
```

Caution: There are no user-level file permissions. All file locations specified by the UTL_FILE_DIR parameters are valid for both reading and writing, for all users of the file I/O procedures. This can override operating system file permissions.

Types

```
TYPE file_type IS RECORD (id BINARY_INTEGER, datatype BINARY_INTEGER);
```

The contents of FILE_TYPE are private to the UTL_FILE package. You should not reference or change components of this record.

Exceptions

Table 77–1 UTL_FILE Package Exceptions

Exception Name	Description
INVALID_PATH	File location or filename was invalid.
INVALID_MODE	The open_mode parameter in FOPEN was invalid.
INVALID_FILEHANDLE	File handle was invalid.
INVALID_OPERATION	File could not be opened or operated on as requested.
READ_ERROR	Operating system error occurred during the read operation.
WRITE_ERROR	Operating system error occurred during the write operation.
INTERNAL_ERROR	Unspecified PL/SQL error.
CHARSETMISMATCH	A file is opened using FOPEN_NCHAR, but later I/O operations use nonchar functions such as PUTF or GET_LINE.

Procedures in UTL_FILE can also raise predefined PL/SQL exceptions such as NO_DATA_FOUND or VALUE_ERROR.

Summary of UTL_FILE Subprograms

Table 77–2 UTL_FILE Subprograms

Subprogram	Description
"FOPEN Function" on page 77-5	Opens a file for input or output with the default line size.
"FOPEN Function" on page 77-7	Opens a file with the maximum line size specified.
"FOPEN_NCHAR Function" on page 77-8	Opens a file in Unicode for input or output.
"FOPEN_NCHAR Function" on page 77-9	Opens a file in Unicode for input or output, with the maximum line size specified.
"IS_OPEN Function" on page 77-10	Determines if a file handle refers to an open file.
"FCLOSE Procedure" on page 77-11	Closes a file.

Table 77–2 UTL_FILE Subprograms (Cont.)

Subprogram	Description
"FCLOSE_ALL Procedure" on page 77-11	Closes all open file handles.
"GET_LINE Procedure" on page 77-12	Reads text from an open file.
"GET_LINE_NCHAR Procedure" on page 77-13	Reads text in Unicode from an open file.
"PUT Procedure" on page 77-13	Writes a string to a file.
"PUT_NCHAR Procedure" on page 77-14	Writes a Unicode string to a file.
"NEW_LINE Procedure" on page 77-15	Writes one or more operating system-specific line terminators to a file.
"PUT_LINE Procedure" on page 77-15	Writes a line to a file. This appends an operating system-specific line terminator.
"PUT_LINE_NCHAR Procedure" on page 77-16	Writes a Unicode line to a file.
"PUTF Procedure" on page 77-17	A PUT procedure with formatting.
"PUTF_NCHAR Procedure" on page 77-18	A PUT_NCHAR procedure with formatting. Writes a Unicode string to a file, with formatting.
"FFLUSH Procedure" on page 77-19	Physically writes all pending output to a file.

FOPEN Function

This function opens a file for input or output. The file location must be an accessible directory, as defined in the instance's initialization parameter UTL_FILE_DIR. The complete directory path must already exist; it is not created by FOPEN.

FOPEN returns a file handle, which must be used in all subsequent I/O operations on the file.

This version of FOPEN does not take a parameter for the maximum line size. Thus, the default (which is 1023 on most systems) is used. To specify a different maximum line size, use the other, overloaded version of "FOPEN Function" on page 77-7.

You can have a maximum of 50 files open simultaneously. See also "FOPEN_NCHAR Function" on page 77-8.

Syntax

```
UTL_FILE.FOPEN (
   location  IN VARCHAR2,
   filename  IN VARCHAR2,
   open_mode IN VARCHAR2)
  RETURN UTL_FILE.FILE_TYPE;
```

Parameters

Table 77–3 FOPEN Function Parameters

Parameters	Description
location	Operating system-specific string that specifies the directory in which to open the file.
filename	Name of the file, including extension (file type), without any directory path information. (Under the UNIX operating system, the filename cannot be terminated with a /).
open_mode	String that specifies how the file should be opened (either upper or lower case letters can be used). The supported values, and the UTL_FILE procedures that can be used with them are: r read text (GET_LINE) w write text (PUT, PUT_LINE, NEW_LINE, PUTF, FFLUSH) a append text (PUT, PUT_LINE, NEW_LINE, PUTF, FFLUSH)

Note: If you open a file that does not exist using the a value for open_mode, then the file is created in write (w) mode.

Returns

FOPEN returns a file handle, which must be passed to all subsequent procedures that operate on that file. The specific contents of the file handle are private to the UTL_FILE package, and individual components should not be referenced or changed by the UTL_FILE user.

Note: The file location and file name parameters are supplied to the FOPEN function as separate strings, so that the file location can be checked against the list of accessible directories as specified in the initialization file. Together, the file location and name must represent a legal filename on the system, and the directory must be accessible. A subdirectory of an accessible directory is not necessarily also accessible; it too must be specified using a complete path name in the initialization file.

Operating system-specific parameters, such as C-shell environment variables under UNIX, cannot be used in the file location or file name parameters.

Exceptions

```
INVALID_PATH
INVALID_MODE
INVALID_OPERATION
```

FOPEN Function

This function opens a file. With this version of FOPEN, you can specify the maximum line size. The other version of the "FOPEN Function" on page 77-5 uses the default line size. You can have a maximum of 50 files open simultaneously.

See also "FOPEN_NCHAR Function" on page 77-9.

Syntax

```
UTL_FILE.FOPEN (
   location     IN VARCHAR2,
   filename     IN VARCHAR2,
   open_mode    IN VARCHAR2,
   max_linesize IN BINARY_INTEGER)
  RETURN file_type;
```

Parameters

Table 77–4 FOPEN Function Parameters

Parameter	Description
location	Directory location of file.

Table 77–4 FOPEN Function Parameters

Parameter	Description
filename	File name (including extension).
open_mode	Open mode (r, w, a).
max_linesize	Maximum number of characters per line, including the newline character, for this file. (minimum value 1, maximum value 32767).

Returns

Table 77–5 FOPEN Function Returns

Return	Description
file_type	Handle to open file.

Exceptions

```
INVALID_PATH: File location or name was invalid.
INVALID_MODE: The open_mode string was invalid.
INVALID_OPERATION: File could not be opened as requested.
INVALID_MAXLINESIZE: Specified max_linesize is too large or too small.
```

FOPEN_NCHAR Function

This function opens a file in Unicode for input or output. With this function, you can read or write a text file in Unicode instead of in the database charset. See also "FOPEN Function" on page 77-5.

Syntax

```
UTL_FILE.FOPEN_NCHAR (
   location  IN VARCHAR2,
   filename  IN VARCHAR2,
   open_mode IN VARCHAR2)
  RETURN UTL_FILE.FILE_TYPE;
```

Parameters

Table 77–6 FOPEN_NCHAR Function Parameters

Parameters	Description
location	Operating system-specific string that specifies the directory in which to open the file.
filename	Name of the file, including extension (file type), without any directory path information. (Under the UNIX operating system, the filename cannot be terminated with a /).
open_mode	String that specifies how the file should be opened (either upper or lower case letters can be used). The supported values, and the UTL_FILE procedures that can be used with them are: r read text (GET_LINE_NCHAR) w write text (PUT_NCHAR, PUT_LINE_NCHAR, NEW_LINE_, PUTF_NCHAR, FFLUSH) a append text (PUT_NCHAR, PUT_LINE_NCHAR, NEW_LINE, PUTF_NCHAR, FFLUSH)

FOPEN_NCHAR Function

This function opens a file in Unicode for input or output, with the maximum line size specified. You can have a maximum of 50 files open simultaneously. With this function, you can read or write a text file in Unicode instead of in the database charset. See also FOPEN Function on page 77-7.

Syntax

```
UTL_FILE.FOPEN_NCHAR (
   location     IN VARCHAR2,
   filename     IN VARCHAR2,
   open_mode    IN VARCHAR2,
   max_linesize IN BINARY_INTEGER)
  RETURN file_type;
```

Parameters

Table 77–7 FOPEN_NCHAR Function Parameters

Parameter	Description
location	Directory location of file.
filename	File name (including extension).
open_mode	Open mode (r, w, a).
max_linesize	Maximum number of characters per line, including the newline character, for this file. (minimum value 1, maximum value 32767).

IS_OPEN Function

This function tests a file handle to see if it identifies an open file. IS_OPEN reports only whether a file handle represents a file that has been opened, but not yet closed. It does not guarantee that there will be no operating system errors when you attempt to use the file handle.

Syntax

```
UTL_FILE.IS_OPEN (
   file  IN FILE_TYPE)
  RETURN BOOLEAN;
```

Parameters

Table 77–8 IS_OPEN Function Parameters

Parameter	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call.

Returns

TRUE or FALSE

Exceptions

None.

FCLOSE Procedure

This procedure closes an open file identified by a file handle. If there is buffered data yet to be written when FCLOSE runs, then you may receive a WRITE_ERROR exception when closing a file.

Syntax

```
UTL_FILE.FCLOSE (
   file IN OUT FILE_TYPE);
```

Parameters

Table 77–9 FCLOSE Procedure Parameters

Parameter	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call.

Exceptions

```
WRITE_ERROR
INVALID_FILEHANDLE
```

FCLOSE_ALL Procedure

This procedure closes all open file handles for the session. This should be used as an emergency cleanup procedure, for example, when a PL/SQL program exits on an exception.

> **Note:** FCLOSE_ALL does not alter the state of the open file handles held by the user. This means that an IS_OPEN test on a file handle after an FCLOSE_ALL call still returns TRUE, even though the file has been closed. No further read or write operations can be performed on a file that was open before an FCLOSE_ALL.

Syntax

```
UTL_FILE.FCLOSE_ALL;
```

Parameters

None.

Exceptions

WRITE_ERROR

GET_LINE Procedure

This procedure reads text from the open file identified by the file handle and places the text in the output buffer parameter. Text is read up to, but not including, the line terminator, or up to the end of the file.

If the line does not fit in the buffer, then a VALUE_ERROR exception is raised. If no text was read due to end of file, then the NO_DATA_FOUND exception is raised.

Because the line terminator character is not read into the buffer, reading blank lines returns empty strings.

The maximum size of an input record is 1023 bytes, unless you specify a larger size in the overloaded version of FOPEN. See also "GET_LINE_NCHAR Procedure" on page 77-13.

Syntax

```
UTL_FILE.GET_LINE (
   file        IN  FILE_TYPE,
   buffer      OUT VARCHAR2);
```

Parameters

Table 77–10 GET_LINE Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN call. The file must be open for reading (mode r), otherwise an INVALID_OPERATION exception is raised.
buffer	Data buffer to receive the line read from the file.

Exceptions

INVALID_FILEHANDLE
INVALID_OPERATION
READ_ERROR
NO_DATA_FOUND
VALUE_ERROR

GET_LINE_NCHAR Procedure

This procedure reads text from the open file identified by the file handle and places the text in the output buffer parameter. With this function, you can read a text file in Unicode instead of in the database charset. See also "GET_LINE Procedure" on page 77-12.

Syntax

```
UTL_FILE.GET_LINE_NCHAR (
   file        IN  FILE_TYPE,
   buffer      OUT NVARCHAR2);
```

Parameters

Table 77–11 GET_LINE_NCHAR Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. The file must be open for reading (mode r). If the file is opened by FOPEN instead of FOPEN_NCHAR, a CHARSETMISMATCH exception is raised.
buffer	Data buffer to receive the line read from the file.

PUT Procedure

PUT writes the text string stored in the buffer parameter to the open file identified by the file handle. The file must be open for write operations. No line terminator is appended by PUT; use NEW_LINE to terminate the line or use PUT_LINE to write a complete line with a line terminator.

The maximum size of an input record is 1023 bytes, unless you specify a larger size in the overloaded version of FOPEN. See also "PUT_NCHAR Procedure" on page 77-14.

Syntax

```
UTL_FILE.PUT (
   file      IN FILE_TYPE,
   buffer    IN VARCHAR2);
```

Parameters

Table 77–12 PUT Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. The file must be open for reading (mode r). If the file is opened by FOPEN instead of FOPEN_NCHAR, a CHARSETMISMATCH exception is raised.
buffer	Buffer that contains the text to be written to the file. You must have opened the file using mode w or mode a; otherwise, an INVALID_OPERATION exception is raised.

Exceptions

```
INVALID_FILEHANDLE
INVALID_OPERATION
WRITE_ERROR
```

PUT_NCHAR Procedure

This procedure writes the text string stored in the buffer parameter to the open file identified by the file handle. With this function, you can write a text file in Unicode instead of in the database charset. See also "PUT Procedure" on page 77-13.

Syntax

```
UTL_FILE.PUT_INCHAR (
   file      IN FILE_TYPE,
   buffer    IN NVARCHAR2);
```

Parameters

Table 77–13 PUT_NCHAR Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. If the file is opened by FOPEN instead of FOPEN_NCHAR, a CHARSETMISMATCH exception is raised.
buffer	Buffer that contains the text to be written to the file. You must have opened the file using mode w or mode a; otherwise, an INVALID_OPERATION exception is raised.

NEW_LINE Procedure

This procedure writes one or more line terminators to the file identified by the input file handle. This procedure is separate from PUT because the line terminator is a platform-specific character or sequence of characters.

Syntax

```
UTL_FILE.NEW_LINE (
   file     IN FILE_TYPE,
   lines    IN NATURAL := 1);
```

Parameters

Table 77–14 NEW_LINE Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call.
lines	Number of line terminators to be written to the file.

Exceptions

```
INVALID_FILEHANDLE
INVALID_OPERATION
WRITE_ERROR
```

PUT_LINE Procedure

This procedure writes the text string stored in the buffer parameter to the open file identified by the file handle. The file must be open for write operations. PUT_LINE terminates the line with the platform-specific line terminator character or characters.

The maximum size for an output record is 1023 bytes, unless you specify a larger value using the overloaded version of FOPEN. See also "PUT_LINE_NCHAR Procedure" on page 77-16.

Syntax

```
UTL_FILE.PUT_LINE (
   file    IN FILE_TYPE,
   buffer  IN VARCHAR2);
```

Parameters

Table 77–15 PUT_LINE Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN call.
buffer	Text buffer that contains the lines to be written to the file.

Exceptions

```
INVALID_FILEHANDLE
INVALID_OPERATION
WRITE_ERROR
```

PUT_LINE_NCHAR Procedure

This procedure writes the text string stored in the buffer parameter to the open file identified by the file handle. With this function, you can write a text file in Unicode instead of in the database charset. See also "PUT_LINE Procedure" on page 77-15.

Syntax

```
UTL_FILE.PUT_LINE_NCHAR (
   file    IN FILE_TYPE,
   buffer  IN NVARCHAR2);
```

Parameters

Table 77–16 PUT_LINE_NCHAR Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. The file must be open for reading (mode r). If the file is opened by FOPEN instead of FOPEN_NCHAR, a CHARSETMISMATCH exception is raised.
buffer	Text buffer that contains the lines to be written to the file.

PUTF Procedure

This procedure is a formatted PUT procedure. It works like a limited printf(). The format string can contain any text, but the character sequences %s and \n have special meaning.

%s	Substitute this sequence with the string value of the next argument in the argument list.
\n	Substitute with the appropriate platform-specific line terminator.

See also PUTF_NCHAR Procedure on page 77-18.

Syntax

```
UTL_FILE.PUTF (
   file    IN FILE_TYPE,
   format  IN VARCHAR2,
   [arg1   IN VARCHAR2  DEFAULT NULL,
   . . .
   arg5    IN VARCHAR2  DEFAULT NULL]);
```

Parameters

Table 77–17 PUTF Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN call.
format	Format string that can contain text as well as the formatting characters \n and %s.
arg1..arg5	From one to five operational argument strings. Argument strings are substituted, in order, for the %s formatters in the format string. If there are more formatters in the format parameter string than there are arguments, then an empty string is substituted for each %s for which there is no argument.

Example

The following example writes the lines:

```
Hello, world!
I come from Zork with greetings for all earthlings.
```

```
my_world  varchar2(4) := 'Zork';
...
PUTF(my_handle, 'Hello, world!\nI come from %s with %s.\n',
                my_world,
                'greetings for all earthlings');
```

If there are more %S formatters in the format parameter than there are arguments, then an empty string is substituted for each %S for which there is no matching argument.

Exceptions

```
INVALID_FILEHANDLE
INVALID_OPERATION
WRITE_ERROR
```

PUTF_NCHAR Procedure

This procedure is a formatted PUT_NCHAR procedure. With this function, you can write a text file in Unicode instead of in the database charset. See also "PUTF Procedure" on page 77-17.

Syntax

```
UTL_FILE.PUTF_NCHAR (
   file    IN FILE_TYPE,
   format  IN NVARCHAR2,
   [arg1   IN NVARCHAR2  DEFAULT NULL,
   . . .
   arg5    IN NVARCHAR2  DEFAULT NULL]);
```

Parameters

Table 77–18 PUTF_NCHAR Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN_NCHAR call. The file must be open for reading (mode r). If the file is opened by FOPEN instead of FOPEN_NCHAR, a CHARSETMISMATCH exception is raised.
format	Format string that can contain text as well as the formatting characters \n and %s.

Table 77–18 PUTF_NCHAR Procedure Parameters

Parameters	Description
arg1..arg5	From one to five operational argument strings. Argument strings are substituted, in order, for the %s formatters in the format string. If there are more formatters in the format parameter string than there are arguments, then an empty string is substituted for each %s for which there is no argument.

FFLUSH Procedure

FFLUSH physically writes pending data to the file identified by the file handle. Normally, data being written to a file is buffered. The FFLUSH procedure forces the buffered data to be written to the file. The data must be terminated with a newline character.

Flushing is useful when the file must be read while still open. For example, debugging messages can be flushed to the file so that they can be read immediately.

Syntax

```
UTL_FILE.FFLUSH (
   file  IN FILE_TYPE);
invalid_maxlinesize  EXCEPTION;
```

Parameters

Table 77–19 FFLUSH Procedure Parameters

Parameters	Description
file	Active file handle returned by an FOPEN or FOPEN_NCHAR call.

Exceptions

```
INVALID_FILEHANDLE
INVALID_OPERATION
WRITE_ERROR
```

78

UTL_HTTP

The UTL_HTTP package makes Hypertext Transfer Protocol (HTTP) callouts from SQL and PL/SQL. You can use it to access data on the Internet over HTTP.

The package contains a set of APIs that enables users to write PL/SQL programs that communicate with Web (HTTP) servers. UTL_HTTP also contains a function that can be used in SQL queries. Besides HTTP, it also supports HTTP over the Secured Socket Layer protocol (SSL), also known as HTTPS, directly or via an HTTP proxy. Other Internet-related data-access protocols (such as the File Transfer Protocol (FTP) or the Gopher protocol) are also supported using an HTTP proxy server that supports those protocols.

When the package fetches data from a Web site using HTTPS, it requires Oracle Wallet Manager to set up an Oracle wallet. Non-HTTPS fetches do not require an Oracle wallet.

See Also:

- Chapter 84, "UTL_URL"
- Chapter 82, "UTL_SMTP"
- *Oracle Advanced Security Administrator's Guide* for more information on Wallet Manager

This chapter discusses the following topics:

UTL_HTTP Constants, Types and Flow

UTL_HTTP Constants

Table 78–1 lists the defined constants for UTL_HTTP.

Table 78–1 UTL_HTTP Constants

Constant and Syntax	Purpose
`HTTP_VERSION_1_0 CONSTANT VARCHAR2(10) := 'HTTP/1.0';`	Denotes HTTP version 1.0 that can be used in the function `begin_request`.
`HTTP_VERSION_1 CONSTANT VARCHAR2(10) := 'HTTP/1.1';`	Denotes HTTP version 1.1 that can be used in the function `begin_request`.
`DEFAULT_HTTP_PORT CONSTANT PLS_INTEGER := 80;`	The default TCP/IP port (80) at which a Web server or proxy server listens
`DEFAULT_HTTPS_PORT CONSTANT PLS_INTEGER := 443;`	The default TCP/IP port (443) at which an HTTPS Web server listens

The following denote all the HTTP 1.1 status codes:

```
HTTP_CONTINUE CONSTANT PLS_INTEGER := 100;

HTTP_SWITCHING_PROTOCOLS CONSTANT PLS_INTEGER := 101;

HTTP_OK CONSTANT PLS_INTEGER := 200;

HTTP_CREATED CONSTANT PLS_INTEGER := 201;

HTTP_ACCEPTED CONSTANT PLS_INTEGER := 202;

HTTP_NON_AUTHORITATIVE_INFO CONSTANT PLS_INTEGER := 203;

HTTP_NO_CONTENT CONSTANT PLS_INTEGER := 204;

HTTP_RESET_CONTENT CONSTANT PLS_INTEGER := 205;

HTTP_PARTIAL_CONTENT CONSTANT PLS_INTEGER := 206;

HTTP_MULTIPLE_CHOICES CONSTANT PLS_INTEGER := 300;

HTTP_MOVED_PERMANENTLY CONSTANT PLS_INTEGER := 301;

HTTP_FOUND CONSTANT PLS_INTEGER := 302;

HTTP_SEE_OTHER CONSTANT PLS_INTEGER := 303;

HTTP_NOT_MODIFIED CONSTANT PLS_INTEGER := 304;

HTTP_USE_PROXY CONSTANT PLS_INTEGER := 305;

HTTP_TEMPORARY_REDIRECT CONSTANT PLS_INTEGER := 307;
```

Table 78–1 UTL_HTTP Constants

Constant and Syntax	Purpose
`HTTP_BAD_REQUEST CONSTANT PLS_INTEGER := 400;`	
`HTTP_UNAUTHORIZED CONSTANT PLS_INTEGER := 401;`	
`HTTP_PAYMENT_REQUIRED CONSTANT PLS_INTEGER := 402;`	
`HTTP_FORBIDDEN CONSTANT PLS_INTEGER := 403;`	
`HTTP_NOT_FOUND CONSTANT PLS_INTEGER := 404;`	
`HTTP_NOT_ACCEPTABLE CONSTANT PLS_INTEGER := 406;`	
`HTTP_PROXY_AUTH_REQUIRED CONSTANT PLS_INTEGER := 407;`	
`HTTP_REQUEST_TIME_OUT CONSTANT PLS_INTEGER := 408;`	
`HTTP_CONFLICT CONSTANT PLS_INTEGER := 409;`	
`HTTP_GONE CONSTANT PLS_INTEGER := 410;`	
`HTTP_LENGTH_REQUIRED CONSTANT PLS_INTEGER := 411;`	
`HTTP_PRECONDITION_FAILED CONSTANT PLS_INTEGER := 412;`	
`HTTP_REQUEST_ENTITY_TOO_LARGE CONSTANT PLS_INTEGER := 413;`	
`HTTP_REQUEST_URI_TOO_LARGE CONSTANT PLS_INTEGER := 414;`	
`HTTP_UNSUPPORTED_MEDIA_TYPE CONSTANT PLS_INTEGER := 415;`	
`HTTP_REQ_RANGE_NOT_SATISFIABLE CONSTANT PLS_INTEGER := 416;`	
`HTTP_EXPECTATION_FAILED CONSTANT PLS_INTEGER := 417;`	
`HTTP_NOT_IMPLEMENTED CONSTANT PLS_INTEGER := 501;`	
`HTTP_BAD_GATEWAY CONSTANT PLS_INTEGER := 502;`	
`HTTP_SERVICE_UNAVAILABLE CONSTANT PLS_INTEGER := 503;`	
`HTTP_GATEWAY_TIME_OUT CONSTANT PLS_INTEGER := 504;`	
`HTTP_VERSION_NOT_SUPPORTED CONSTANT PLS_INTEGER := 505;`	

UTL_HTTP Types

Use the following types with UTL_HTTP.

REQ Type

Use this PL/SQL record type to represent an HTTP request.

Syntax

```
TYPE req IS RECORD (
    url  VARCHAR2(32767),
    method  VARCHAR2(64),
    http_version  VARCHAR2(64),
);
```

Parameters

Table 78–2 shows the parameters for the REQ type.

Table 78–2 REQ Type Parameters

Parameter	Description
`url`	The URL of the HTTP request. It is set after the request is created by `begin_request`.
`method`	The method to be performed on the resource identified by the URL. It is set after the request is created by `begin_request`.
`http_version`	The HTTP protocol version used to send the request. It is set after the request is created by `begin_request`.

Usage Notes

The information returned in `REQ` from the API `begin_request` is for read only. Changing the field values in the record has no effect on the request.

There are other fields in `REQ` record type whose names begin with the prefix `private_`. The fields are private and are intended for use by implementation of the `UTL_HTTP` package. You should not modify the fields.

RESP Type

This PL/SQL record type is used to represent an HTTP response.

Syntax

```
TYPE resp IS RECORD (
    status_code  PLS_INTEGER,
    reason_phrase  VARCHAR2(256),
    http_version  VARCHAR2(64),
);
```

Parameters

Table 78–3 shows the parameters for the RESP type.

Table 78–3 RESP Type Parameters

Parameter	Description
status_code	The status code returned by the Web server. It is a 3-digit integer that indicates the results of the HTTP request as handled by the Web server. It is set after the response is processed by get_response.
reason_phrase	The short textual message returned by the Web server that describe the status code. It gives a brief description of the results of the HTTP request as handled by the Web server. It is set after the response is processed by get_response.
http_version	The HTTP protocol version used in the HTTP response. It is set after the response is processed by get_response.

Usage Notes

The information returned in RESP from the API get_response is read-only. There are other fields in the RESP record type whose names begin with the prefix private_. The fields are private and are intended for use by implementation of the UTL_HTTP package. You should not modify the fields.

COOKIE and COOKIE_TABLE Types

The COOKIE type is the PL/SQL record type that represents an HTTP cookie. The COOKIE_TABLE type is a PL/SQL index-by-table type that represents a collection of HTTP cookies.

Syntax

```
TYPE cookie IS RECORD (
    name  VARCHAR2(256),
    value  VARCHAR2(1024),
    domain  VARCHAR2(256),
    expire  TIMESTAMP WITH TIME ZONE,
    path  VARCHAR2(1024),
    secure  BOOLEAN,
    version  PLS_INTEGER,
    comment  VARCHAR2(1024)
);
TYPE cookie_table IS TABLE OF cookie INDEX BY binary_integer;
```

Fields of COOKIE Record Type

Table 78–4 shows the fields for the COOKIE and COOKIE_TABLE record types.

Table 78–4 Fields of COOKIE and COOKIE_TABLE Type

Field	Description
name	The name of the HTTP cookie
value	The value of the cookie
domain	The domain for which the cookie is valid
expire	The time by which the cookie will expire
path	The subset of URLs to which the cookie applies
secure	Should the cookie be returned to the Web server using secured means only.
version	The version of the HTTP cookie specification the cookie conforms. This field is NULL for Netscape cookies.
comment	The comment that describes the intended use of the cookie. This field is NULL for Netscape cookies.

Usage Notes

PL/SQL programs do not usually examine or change the cookie information stored in the UTL_HTTP package. The cookies are maintained by the package transparently. They are maintained inside the UTL_HTTP package, and they last for the duration of the database session only. PL/SQL applications that require cookies to be maintained beyond the lifetime of a database session can read the cookies using get_cookies, store them persistently in a database table, and re-store the cookies back in the package using add_cookies in the next database session. All the fields in the cookie record, except for the comment field, must be stored. Do not alter the cookie information, which can result in an application error in the Web server or compromise the security of the PL/SQL and the Web server applications. See "Example: Retrieving and Restoring Cookies" on page 78-14.

CONNECTION Type

Use this PL/SQL record type to represent the remote hosts and TCP/IP ports of a network connection that is kept persistent after an HTTP request is completed, according to the HTTP 1.1 protocol specification. The persistent network connection may be reused by a subsequent HTTP request to the same host and port. The subsequent HTTP request may be completed faster because the network connection latency is avoided. connection_table is a PL/SQL table of connection.

For a direct HTTP persistent connection to a Web server, the host and port fields contain the host name and TCP/IP port number of the Web server. The proxy_

host and proxy_port fields are not set. For an HTTP persistent connection that was previously used to connect to a Web server using a proxy, the proxy_host and proxy_port fields contain the host name and TCP/IP port number of the proxy server. The host and port fields are not set, which indicates that the persistent connection, while connected to a proxy server, is not bound to any particular target Web server. An HTTP persistent connection to a proxy server can be used to access any target Web server that is using a proxy.

The ssl field indicates if Secured Socket Layer (SSL) is being used in an HTTP persistent connection. An HTTPS request is an HTTP request made over SSL. For an HTTPS (SSL) persistent connection connected using a proxy, the host and port fields contain the host name and TCP/IP port number of the target HTTPS Web server and the fields will always be set. An HTTPS persistent connection to an HTTPS Web server using a proxy server can only be reused to make another request to the same target Web server.

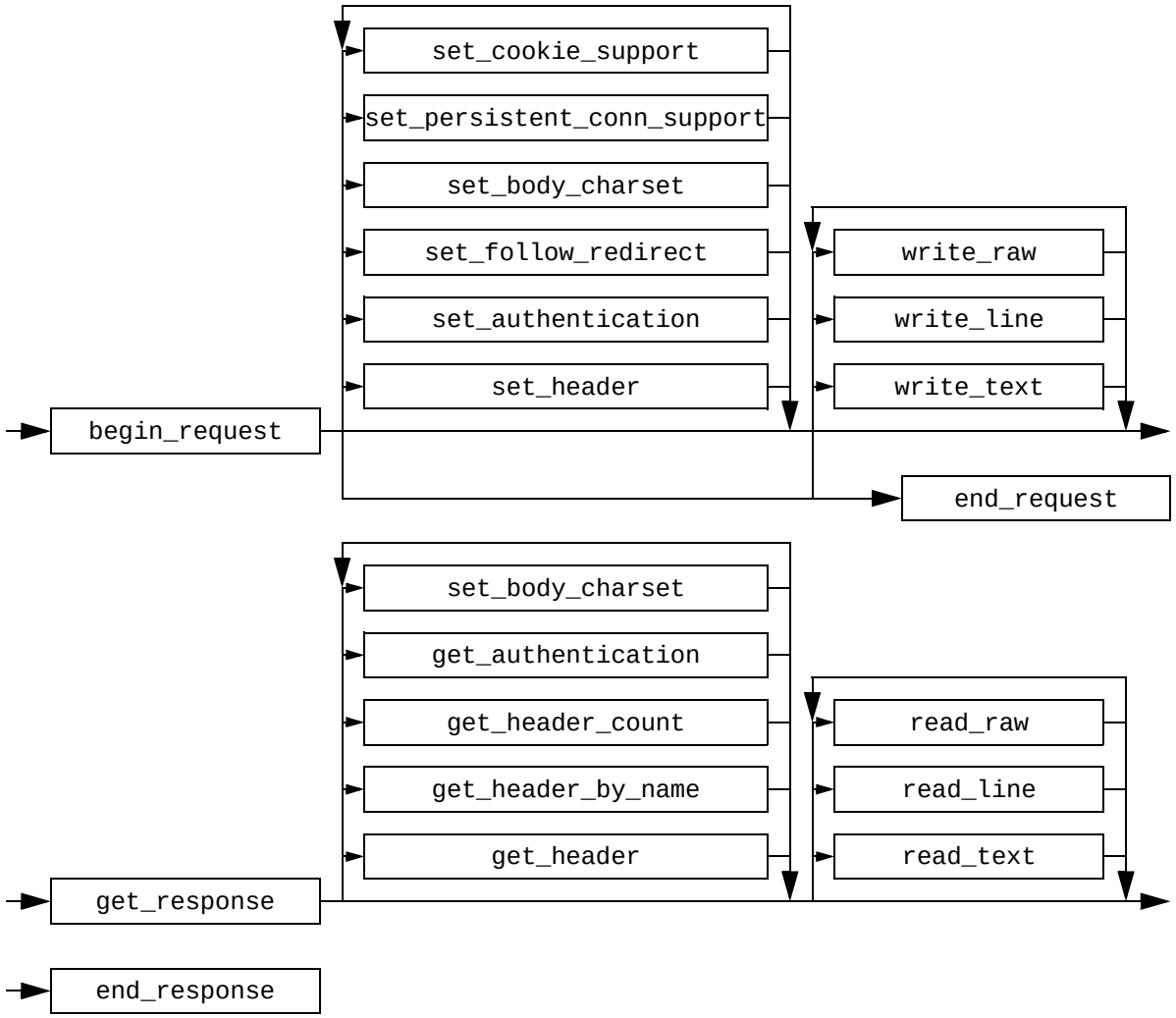
Syntax

```
TYPE connection IS RECORD (
    host  VARCHAR2(256),
    port  PLS_INTEGER,
    proxy_host  VARCHAR2(256),
    proxy_port  PLS_INTEGER,
    ssl  BOOLEAN
);
TYPE connection_table IS TABLE OF connection INDEX BY BINARY_INTEGER;
```

UTL_HTTP Flow

The UTL_HTTP package provides access to the HTTP protocol. The API must be called in the order shown, or an exception will be raised.

Figure 78–1 Flow of the Core UTL_HTTP Package



The following can be called at any time:

- Non-protocol APIs that manipulate cookies
  - `get_cookie_count`
  - `get_cookies`

    - add_cookies
    - clear_cookies
- Persistent connections
    - get_persistent_conn_count
    - get_persistent_conns
    - close_persistent_conn
    - close_persistent_conns
- APIs that manipulate attributes and configurations of the UTL_HTTP package in the current session
    - set_proxy
    - get_proxy
    - set_cookie_support
    - get_cookie_support
    - set_follow_redirect
    - get_follow_redirect
    - set_body_charset
    - get_body_charset
    - set_persistent_conn_support
    - get_persistent_conn_support
    - set_detailed_excp_support
    - get_detailed_excp_support
    - set_wallet
    - set_transfer_timeout
    - get_transfer_timeout
- APIs that retrieve the last detailed exception code and message UTL_HTTP package in the current session
    - get_detailed_sqlcode
    - get_detailed_sqlerrm

NOTE: Some of the request and response APIs bear the same name as the API that manipulates the attributes and configurations of the package in the current session. They are overloaded versions of the API that manipulate a request or a response.

UTL_HTTP Exceptions

Table 78–5 lists the exceptions that the UTL_HTTP package API can raise. By default, UTL_HTTP raises the exception request_failed when a request fails to execute. If the package is set to raise a detailed exception by set_detailed_excp_support, the rest of the exceptions will be raised directly (except for the exception end_of_body, which will be raised by read_text, read_line, and read_raw regardless of the setting).

Table 78–5 UTL_HTTP Exceptions

Exception	Error Code	Reason	Where Raised
request_failed	29273	The request fails to executes	Any HTTP request or response API when detailed_exception is disabled
bad_argument	29261	The argument passed to the API is bad	Any HTTP request or response API when detailed_exception is enabled
bad_url	29262	The requested URL is badly formed	begin_request, when detailed_exception is enabled
protocol_error	29263	An HTTP protocol error occurs when communicating with the Web server	set_header, get_response, read_raw, read_text, and read_line, when detailed_exception is enabled
unknown_scheme	29264	The scheme of the requested URL is unknown	begin_request and get_response, when detailed_exception is enabled
header_not_found	29265	The header is not found	get_header, get_header_by_name, when detailed_exception is enabled
end_of_body	29266	The end of HTTP response body is reached	read_raw, read_text, and read_line, when detailed_exception is enabled

Table 78–5 UTL_HTTP Exceptions

Exception	Error Code	Reason	Where Raised
illegal_call	29267	The call to UTL_HTTP is illegal at the current state of the HTTP request	set_header, set_authentication, and set_persistent_conn_support, when detailed_exception is enabled
http_client_error	29268	The response status code indicates that a client error has occurred (status code in 4xx range)	get_response, when detailed_exception is enabled
http_server_error	29269	The response status code indicates that a client error has occurred (status code in 5xx range)	get_response, when detailed_exception is enabled
too_many_requests	29270	Too many requests or responses are open	begin_request, when detailed_exception is enabled
partial_multibyte_exception	29275	No complete character is read and a partial multi-byte character is found at the end of the response body	read_text and read_line, when detailed_exception is enabled
transfer_timeout	29276	No data is read and a read timeout occurred	read_text and read_line, when detailed_exception is enabled

NOTE: The partial_multibyte_char and transfer_timeout exceptions are duplicates of the same exceptions defined in UTL_TCP. They are defined in this package so that the use of this package does not require the knowledge of the UTL_TCP. As those exceptions are duplicates, an exception handle that catches the partial_multibyte_char and transfer_timeout exceptions in this package also catch the exceptions in the UTL_TCP.

For REQUEST and REQUEST_PIECES(), the request_failed exception is raised when any exception occurs and detailed_exception is disabled.

UTL_HTTP Examples

The following examples demonstrate how to use UTL_HTTP.

Example: Using UTL_HTTP

```
SET serveroutput ON SIZE 40000

DECLARE
  req   utl_http.req;
  resp  utl_http.resp;
  value VARCHAR2(1024);
BEGIN

  utl_http.set_proxy('proxy.my-company.com', 'corp.my-company.com');

  req := utl_http.begin_request('http://www-hr.corp.my-company.com');
  utl_http.set_header(req, 'User-Agent', 'Mozilla/4.0');
  resp := utl_http.get_response(req);
  LOOP
    utl_http.read_line(resp, value, TRUE);
    dbms_output.put_line(value);
  END LOOP;
  utl_http.end_response(resp);
EXCEPTION
  WHEN utl_http.end_of_body THEN
    utl_http.end_response(resp);
END;
```

Example: Retrieving HTTP Response Headers

```
SET serveroutput ON SIZE 40000

DECLARE
  req   utl_http.req;
  resp  utl_http.resp;
  name  VARCHAR2(256);
  value VARCHAR2(1024);
BEGIN

  utl_http.set_proxy('proxy.my-company.com', 'corp.my-company.com');

  req := utl_http.begin_request('http://www-hr.corp.my-company.com');
  utl_http.set_header(req, 'User-Agent', 'Mozilla/4.0');
  resp := utl_http.get_response(req);

  dbms_output.put_line('HTTP response status code: ' || resp.status_code);
  dbms_output.put_line('HTTP response reason phrase: ' || resp.reason_phrase);

  FOR i IN 1..utl_http.get_header_count(resp) LOOP
```

```
    utl_http.get_header(resp, i, name, value);
    dbms_output.put_line(name || ': ' || value);
  END LOOP;
  utl_http.end_response(resp);
END;
```

Example: Handling HTTP Authentication

```
SET serveroutput ON SIZE 40000

CREATE OR REPLACE PROCEDURE get_page (url      IN VARCHAR2,
                                      username IN VARCHAR2 DEFAULT NULL,
                                      password IN VARCHAR2 DEFAULT NULL,
                                      realm    IN VARCHAR2 DEFAULT NULL) AS
  req       utl_http.req;
  resp      utl_http.resp;
  my_scheme VARCHAR2(256);
  my_realm  VARCHAR2(256);
  my_proxy  BOOLEAN;
BEGIN

  -- Turn off checking of status code. We will check it by ourselves.
  utl_http.http_response_error_check(FALSE);

  req := utl_http.begin_request(url);
  IF (username IS NOT NULL) THEN
    utl_http.set_authentication(req, username, password); -- Use HTTP Basic
Authen. Scheme
  END IF;

  resp := utl_http.get_response(req);
  IF (resp.status_code = utl_http.HTTP_UNAUTHORIZED) THEN
    utl_http.get_authentication(resp, my_scheme, my_realm, my_proxy);
    IF (my_proxy) THEN
       dbms_output.put_line('Web proxy server is protected.');
       dbms_output.put('Please supplied the required ' || my_scheme || '
authentication username/password for realm ' || my_realm || ' for the proxy
server.');
    ELSE
      dbms_output.put_line('Web page ' || url || ' is protected.');
      dbms_output.put('Please supplied the required ' || my_scheme || '
authentication username/password for realm ' || my_realm || ' for the Web
page.');
    END IF;
    utl_http.end_response(resp);
```

```
    RETURN;
  END IF;

  FOR i IN 1..utl_http.get_header_count(resp) LOOP
    utl_http.get_header(resp, i, name, value);
    dbms_output.put_line(name || ': ' || value);
  END LOOP;
  utl_http.end_response(resp);

END;
```

Example: Retrieving and Restoring Cookies

```
CREATE TABLE my_cookies (
    session_id  BINARY_INTEGER,
    name        VARCHAR2(256),
    value       VARCHAR2(1024),
    domain      VARCHAR2(256),
    expire      DATE,
    path        VARCHAR2(1024),
    secure      VARCHAR2(1),
    version     BINARY_INTEGER
);

CREATE SEQUENCE session_id;

SET serveroutput ON SIZE 40000

REM Retrieve cookies from UTL_HTTP

CREATE OR REPLACE FUNCTION save_cookies RETURN BINARY_INTEGER AS
  cookies        utl_http.cookie_table;
  my_session_id  BINARY_INTEGER;
  secure         VARCHAR2(1);
BEGIN

  /* assume that some cookies have been set in previous HTTP requests. */

  utl_http.get_cookies(cookies);
  select session_id.nextval into my_session_id from dual;

  FOR i in 1..cookies.count LOOP
    IF (cookies(i).secure) THEN
      secure := 'Y';
    ELSE
```

```
      secure := 'N';
    END IF;
    insert into my_cookies
    value (my_session_id, cookies(i).name, cookies(i).value, cookies(i).domain,
           cookies(i).expire, cookies(i).path, secure, cookies(i).version);
  END LOOP;

  RETURN my_session_id;

END;

REM Retrieve cookies from UTL_HTTP

CREATE OR REPLACE PROCEDURE restore_cookies (this_session_id IN BINARY_INTEGER)
AS
  cookies        utl_http.cookie_table;
  cookie         utl_http.cookie;
  i              PLS_INTEGER := 0;
  CORSOR c (c_session_id BINARY_INTEGER) IS
    SELECT * FROM my_cookies WHERE session_id = c_session_id;
BEGIN

  FOR r IN c(this_session_id) LOOP
    i := i + 1;
    cookie.name   := r.name;
    cookie.value  := r.value;
    cookie.domain := r.domain;
    cookie.expire := r.expire;
    cookie.path   := r.path;
    IF (r.secure = 'Y') THEN
      cookie.secure := TRUE;
    ELSE
      cookie.secure := FALSE;
    END IF;
    cookie.version := r.version;
    cookies(i) := cookie;
  END LOOP;

  utl_http.clear_cookies;
  utl_http.add_cookies(cookies);

END;
```

Summary of UTL_HTTP Subprograms

Table 78–6 UTL_HTTP Subprograms

Subprogram	Description
Simple HTTP fetches in a single call	
"REQUEST Function" on page 78-20	Returns up to the first 2000 bytes of the data retrieved from the given URL. This function can be used directly in SQL queries.
"REQUEST_PIECES Function" on page 78-22	Returns a PL / SQL table of 2000-byte pieces of the data retrieved from the given URL.
Session Settings	
"SET_PROXY Procedure" on page 78-26	Sets the proxy to be used for requests of HTTP or other protocols
"GET_PROXY Procedure" on page 78-27	Retrieves the current proxy settings
"SET_COOKIE_SUPPORT Procedure" on page 78-27	Sets whether or not future HTTP requests will support HTTP cookies; sets the maximum number of cookies maintained in the current database user session
"GET_COOKIE_SUPPORT Procedure" on page 78-28	Retrieves the current cookie support settings
"SET_FOLLOW_REDIRECT Procedure" on page 78-29	Sets the maximum number of times `UTL_HTTP` follows the HTTP redirect instruction in the HTTP responses to future requests in the `get_response` function
"GET_FOLLOW_REDIRECT Procedure" on page 78-30	Retrieves the follow-redirect setting in the current session
"SET_BODY_CHARSET Procedure" on page 78-30	Sets the default character set of the body of all future HTTP requests when the media type is `text` and the character set is not specified in the `Content-Type` header
"GET_BODY_CHARSET Procedure" on page 78-31	Retrieves the default character set of the body of all future HTTP requests
"SET_PERSISTENT_CONN_SUPPORT Procedure" on page 78-32	Sets whether or not future HTTP requests will support the HTTP 1.1 persistent connection; sets the maximum number of persistent connections maintained in the current database user session
"GET_PERSISTENT_CONN_SUPPORT Procedure" on page 78-34	Checks if the persistent connection support is enabled and gets the maximum number of persistent connections in the current session
"SET_RESPONSE_ERROR_CHECK Procedure" on page 78-35	Sets whether or not `get_response` raises an exception when the Web server returns a status code that indicates an error—a status code in the 4xx or 5xx ranges

Table 78–6 UTL_HTTP Subprograms (Cont.)

Subprogram	Description
"GET_RESPONSE_ERROR_CHECK Procedure" on page 78-36	Checks if the response error check is set or not
"SET_DETAILED_EXCP_SUPPORT Procedure" on page 78-36	Sets the UTL_HTTP package to raise a detailed exception
"GET_DETAILED_EXCP_SUPPORT Procedure" on page 78-37	Checks if the UTL_HTTP package will raise a detailed exception or not
"SET_WALLET Procedure" on page 78-37	Sets the Oracle Wallet used for all HTTP requests over Secured Socket Layer (SSL), that is, HTTPS
"SET_TRANSFER_TIMEOUT Procedure" on page 78-38	Sets the timeout value for UTL_HTTP to read the HTTP response from the Web server or proxy server
"GET_TRANSFER_TIMEOUT Procedure" on page 78-39	Retrieves the current network transfer timeout value
HTTP Requests	
"BEGIN_REQUEST Function" on page 78-39	Begins a new HTTP request. UTL_HTTP establishes the network connection to the target Web server or the proxy server and sends the HTTP request line.
"SET_HEADER Procedure" on page 78-40	Sets an HTTP request header. The request header is sent to the Web server as soon as it is set.
"SET_AUTHENTICATION Procedure" on page 78-41	Sets HTTP authentication information in the HTTP request header. The Web server needs this information to authorize the request.
"SET_COOKIE_SUPPPORT Procedure" on page 78-42	Enables or disables support for the HTTP cookies in the request.
"SET_FOLLOW_REDIRECT Procedure" on page 78-43	Sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP response to this request in the GET_RESPONSE function.
"SET_BODY_CHARSET Procedure" on page 78-44	Sets the character set of the request body when the media type is `text` but the character set is not specified in the `Content-Type` header.

Table 78–6 UTL_HTTP Subprograms (Cont.)

Subprogram	Description
"SET_PERSISTENT_CONN_SUPPORT Procedure" on page 78-45	Enables or disables support for the HTTP 1.1 persistent-connection in the request.
"WRITE_TEXT Procedure" on page 78-47	Writes some text data in the HTTP request body.
"WRITE_LINE Procedure" on page 78-48	Writes a text line in the HTTP request body and ends the line with new-line characters (CRLF as defined in UTL_TCP).
"WRITE_RAW Procedure" on page 78-50	Writes some binary data in the HTTP request body.
"END_REQUEST Procedure" on page 78-51	Ends the HTTP request.
HTTP Responses	
"GET_RESPONSE Function" on page 78-51	Reads the HTTP response. When the function returns, the status line and the HTTP response headers have been read and processed.
"GET_HEADER_COUNT Function" on page 78-52	Returns the number of HTTP response headers returned in the response.
"GET_HEADER Procedure" on page 78-52	Returns the n^{th} HTTP response header name and value returned in the response.
"GET_HEADER_BY_NAME Procedure" on page 78-53	Returns the HTTP response header value returned in the response given the name of the header.
"GET_AUTHENTICATION Procedure" on page 78-54	Retrieves the HTTP authentication information needed for the request to be accepted by the Web server as indicated in the HTTP response header.
"SET_BODY_CHARSET Procedure" on page 78-55	Sets the character set of the response body when the media type is "text" but the character set is not specified in the "Content-Type" header.
"READ_TEXT Procedure" on page 78-56	Reads the HTTP response body in text form and returns the output in the caller-supplied buffer.
"READ_LINE Procedure" on page 78-57	Reads the HTTP response body in text form until the end of line is reached and returns the output in the caller-supplied buffer.

Table 78–6 UTL_HTTP Subprograms (Cont.)

Subprogram	Description
"READ_RAW Procedure" on page 78-58	Reads the HTTP response body in binary form and returns the output in the caller-supplied buffer.
"END_RESPONSE Procedure" on page 78-59	Ends the HTTP response. It completes the HTTP request and response.
HTTP Cookies	
"GET_COOKIE_COUNT Function" on page 78-60	Returns the number of cookies currently maintained by the UTL_HTTP package set by all Web servers.
"GET_COOKIES Function" on page 78-60	Returns all the cookies currently maintained by the UTL_HTTP package set by all Web servers.
"ADD_COOKIES Procedure" on page 78-60	Adds the cookies maintained by UTL_HTTP.
"CLEAR_COOKIES Procedure" on page 78-61	Clears all cookies maintained by the UTL_HTTP package.
HTTP Persistent Connections	
"GET_PERSISTENT_CONN_COUNT Function" on page 78-61	Returns the number of network connections currently kept persistent by the UTL_HTTP package to the Web servers.
"GET_PERSISTENT_CONNS Procedure" on page 78-62	Returns all the network connections currently kept persistent by the UTL_HTTP package to the Web servers.
"CLOSE_PERSISTENT_CONN Procedure" on page 78-62	Closes an HTTP persistent connection maintained by the UTL_HTTP package in the current database session.
"CLOSE_PERSISTENT_CONNS Procedure" on page 78-63	Closes a group of HTTP persistent connections maintained by the UTL_HTTP package in the current database session.
Error Conditions	
"GET_DETAILED_SQLCODE Function" on page 78-64	Retrieves the detailed SQLCODE of the last exception raised.
"GET_DETAILED_SQLERRM Function" on page 78-65	Retrieves the detailed SQLERRM of the last exception raised.

Simple HTTP Fetches

REQUEST and REQUEST_PIECES take a string universal resource locator (URL), contact that site, and return the data (typically HTML) obtained from that site.

You should not expect REQUEST or REQUEST_PIECES to succeed in contacting a URL unless you can contact that URL by using a browser on the same machine (and with the same privileges, environment variables, etc.)

If REQUEST or REQUEST_PIECES fails (for example, if it raises an exception, or if it returns an HTML-formatted error message, but you believe that the URL argument is correct), then try contacting that same URL with a browser to verify network availability from your machine. You may have a proxy server set in your browser that needs to be set with each REQUEST or REQUEST_PIECES call using the optional proxy parameter.

Note: UTL_HTTP can also use environment variables to specify its proxy behavior. For example, on UNIX, setting the environment variable http_proxy to a URL uses that service as the proxy server for HTTP requests. Setting the environment variable no_proxy to a domain name does not use the HTTP proxy server for URLs in that domain. When the UTL_HTTP package is executed in the Oracle database server, the environment variables are the ones that are set when the database instance is started.

REQUEST Function

This function returns up to the first 2000 bytes of data retrieved from the given URL. This function can be used directly in SQL queries.

Syntax

```
UTL_HTTP.REQUEST (
    url              IN VARCHAR2,
    proxy            IN VARCHAR2 DEFAULT NULL),
    wallet_path      IN VARCHAR2 DEFAULT NULL,
    wallet_password  IN VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references (request, wnds, rnds, wnps, rnps);
```

Parameters

Table 78–7 shows the parameters for the REQUEST function.

Table 78–7 REQUEST Function Parameters

Parameter	Description
url	Universal resource locator.
proxy	(Optional) Specifies a proxy server to use when making the HTTP request. See set_proxy for the full format of the proxy setting.
wallet_path	(Optional) Specifies a client-side wallet. The client-side wallet contains the list of trusted certificate authorities required for HTTPS request. The format of wallet_path on a PC is, for example, file:c:\WINNT\Profiles\<username>\WALLETS, and in Unix is, for example, file:/home/<username>/wallets When the UTL_HTTP package is executed in the Oracle database server, the wallet is accessed from the database server. Therefore, the wallet path must be accessible from the database server. See set_wallet for a description on how to set up an Oracle wallet. Non-HTTPS requests do not require an Oracle wallet.
wallet_password	(Optional) Specifies the password required to open the wallet.

Returns

The return type is a string of length 2000 or less, which contains up to the first 2000 bytes of the HTML result returned from the HTTP request to the argument URL.

Exceptions

```
INIT_FAILED
REQUEST_FAILED
```

Usage Notes

The URL passed as an argument to this function is not examined for illegal characters, for example, spaces, per the URL specification RFC 2396. The caller should escape those characters with the UTL_URL package. See the comments of the package for the list of legal characters in URLs. Note that URLs should consist of US-ASCII characters only. The use of non-US-ASCII characters in a URL is generally unsafe.

Please see the documentation of the function set_wallet on the use of an Oracle wallet, which is required for accessing HTTPS Web servers.

Unless response error check is turned on, this function does not raise an exception when a 4xx or 5xx response is received from the Web server. Instead, it returns the formatted error message from the Web server:

```
<HTML>
<HEAD>
<TITLE>Error Message</TITLE>
</HEAD>
<BODY>
<H1>Fatal Error 500</H1>
Can't Access Document:  http://home.nothing.comm.
<P>
<B>Reason:</B> Can't locate remote host:  home.nothing.comm.
<P>
<P><HR>
<ADDRESS><A HREF="http://www.w3.org">
CERN-HTTPD3.0A</A></ADDRESS>
</BODY>
</HTML>
```

Example

```
SQLPLUS> SELECT utl_http.request('http://www.my-company.com/') FROM dual;
UTL_HTTP.REQUEST('HTTP://WWW.MY-COMPANY.COM/')
<html>
<head><title>My Company Home Page</title>
<!--changed Jan. 16, 19
1 row selected.
```

If you are behind a firewall, include the `proxy` parameter. For example, from within the Oracle firewall, where there might be a proxy server named `www-proxy.my-company.com`:

```
SQLPLUS> SELECT
utl_http.request('http://www.my-company.com', 'www-proxy.us.my-company.com')
FROM dual;
```

REQUEST_PIECES Function

This function returns a PL/SQL table of 2000-byte pieces of the data retrieved from the given URL.

Syntax

```
type html_pieces is table of varchar2(2000) index by binary_integer;

UTL_HTTP.REQUEST_PIECES (
    url             IN VARCHAR2,
    max_pieces      IN NATURAL DEFAULT 32767,
    proxy           IN VARCHAR2 DEFAULT NULL,
    wallet_path     IN VARCHAR2 DEFAULT NULL,
    wallet_password IN VARCHAR2 DEFAULT NULL)
RETURN html_pieces;
```

Pragmas

```
pragma restrict_references (request_pieces, wnds, rnds, wnps, rnps);
```

Parameters

Table 78–8 shows the parameters for the REQUEST_PIECES function.

Table 78–8 REQUEST_PIECES Function Parameters

Parameter	Description
url	Universal resource locator.
max_pieces	(Optional) The maximum number of pieces (each 2000 characters in length, except for the last, which may be shorter), that REQUEST_PIECES should return. If provided, then that argument should be a positive integer.
proxy	(Optional) Specifies a proxy server to use when making the HTTP request. See set_proxy for the full format of the proxy setting.
wallet_path	(Optional) Specifies a client-side wallet. The client-side wallet contains the list of trusted certificate authorities required for HTTPS request. The format of wallet_path is 'file:/<local-dir-for-client-side-wallet>'. The format of wallet_path on a PC is, for example, file:c:\WINNT\Profiles\<username>\WALLETS, and in Unix is, for example, file:/home/<username>/wallets. When the UTL_HTTP package is executed in the Oracle database server, the wallet is accessed from the database server. Therefore, the wallet path must be accessible from the database server. See set_wallet for the description on how to set up an Oracle wallet. Non-HTTPS requests do not require an Oracle wallet.

Table 78–8 REQUEST_PIECES Function Parameters

Parameter	Description
wallet_password	(Optional) Specifies the password required to open the wallet.

Returns

REQUEST_PIECES returns a PL/SQL table of type UTL_HTTP.HTML_PIECES. Each element of that PL/SQL table is a string of maximum length 2000. The elements of the PL/SQL table returned by REQUEST_PIECES are successive pieces of the data obtained from the HTTP request to that URL.

Exceptions

INIT_FAILED
REQUEST_FAILED

Usage Notes

The URL passed as an argument to this function will not be examined for illegal characters, for example, spaces, per the URL specification RFC 2396. The caller should escape those characters with the UTL_URL package. See the comments of the package for the list of legal characters in URLs. Note that URLs should consist of US-ASCII characters only. The use of non-US-ASCII characters in a URL is generally unsafe.

Each entry of the PL/SQL table (the "pieces") returned by this function may not be filled to their fullest capacity. The function may start filling the data in the next piece before the previous "piece" is totally full.

Please see the documentation of the function set_wallet on the use of an Oracle wallet, which is required for accessing HTTPS Web servers.

Unless response error check is turned on, this function does not raise an exception when a 4xx or 5xx response is received from the Web server. Instead, it returns the formatted error message from the Web server:

```
<HTML>
<HEAD>
<TITLE>Error Message</TITLE>
</HEAD>
<BODY>
<H1>Fatal Error 500</H1>
Can't Access Document:  http://home.nothing.comm.
<P>
```

```
<B>Reason:</B> Can't locate remote host:  home.nothing.comm.
<P>
<P><HR>
<ADDRESS><A HREF="http://www.w3.org">
CERN-HTTPD3.0A</A></ADDRESS>
</BODY>
</HTML>
```

Example

```
SET SERVEROUTPUT ON


DECLARE
    x   utl_http.html_pieces;
    len PLS_INTEGER;
BEGIN
    x := utl_http.request_pieces('http://www.oracle.com/', 100);
    dbms_output.put_line(x.count || ' pieces were retrieved.');
    dbms_output.put_line('with total length ');
    IF x.count < 1 THEN
        dbms_output.put_line('0');
  ELSE
    len := 0;
    FOR i in 1..x.count LOOP
        len := len + length(x(i));
    END LOOP;
    dbms_output.put_line(i);
  END IF;
END;
/
-- Output
Statement processed.
4 pieces were retrieved.
with total length
7687
```

Session Settings

Session settings manipulate the configuration and default behavior of UTL_HTTP when HTTP requests are executed within a database user session. When a request is created, it inherits the default settings of the HTTP cookie support, follow-redirect, body character set, persistent-connection support, and transfer timeout of the current session. Those settings can be changed later by calling the request API.

When a response is created for a request, it inherits those settings from the request. Only the body character set can be changed later by calling the response API.

SET_PROXY Procedure

This procedure sets the proxy to be used for requests of the HTTP or other protocols, excluding those for hosts that belong to the domain specified in no_proxy_domains. The proxy may include an optional TCP/IP port number at which the proxy server listens. The syntax is [http://]host[:port][/], for example, www-proxy.my-company.com:80. If the port is not specified for the proxy, port 80 is assumed. no_proxy_domains is a comma-, semi-colon-, or space-separated list of domains or hosts for which HTTP requests should be sent directly to the destination HTTP server instead of going through a proxy server. Optionally, a port number can be specified for each domain or host. If the port number is specified, the no-proxy restriction is only applied to the request at the port of the particular domain or host, for example, corp.my-company.com, eng.my-company.com:80. When no_proxy_domains is NULL and the proxy is set, all requests go through the proxy. When the proxy is not set, UTL_HTTP sends requests to the target Web servers directly.

Syntax

```
UTL_HTTP.set_proxy (
    proxy            IN VARCHAR2,
    no_proxy_domains  IN VARCHAR2);
```

Parameters

Table 78–9 shows the parameters for the SET_PROXY procedure.

Table 78–9 SET_PROXY Procedure Parameters

Parameter	Description
proxy (IN)	The proxy (host and an optional port number) to be used by the UTL_HTTP package
no_proxy_domains (IN)	The list of hosts and domains for which no proxy should be used for all requests.

Usage Notes

If proxy settings are set when the database server instance is started, the proxy settings in the environment variables http_proxy and no_proxy are assumed. Proxy settings set by this procedure override the initial settings.

GET_PROXY Procedure

This procedure retrieves the current proxy settings.

Syntax

```
UTL_HTTP.get_proxy (
    proxy            OUT NOCOPY VARCHAR2,
    no_proxy_domains  OUT NOCOPY VARCHAR2);
```

Parameters

Table 78–10 shows the parameters for the GET_PROXY procedure.

Table 78–10 GET_PROXY Procedure Parameters

Parameter	Description
proxy (OUT)	The proxy (host and an optional port number) currently used by the UTL_HTTP package
no_proxy_domains (OUT)	The list of hosts and domains for which no proxy is used for all requests.

SET_COOKIE_SUPPORT Procedure

This procedure sets:

- Whether or not future HTTP requests will support HTTP cookies
- The maximum number of cookies maintained in the current database user session

If cookie support is enabled for an HTTP request, all cookies saved in the current session and applicable to the request are returned to the Web server in the request, in accordance with HTTP cookie specification standards. Cookies that are set in response to the request are saved in the current session for return to the Web server in subsequent requests, if cookie support is enabled for those requests. If cookie support is disabled for an HTTP request, no cookies will be returned to the Web server in the request and the cookies set in the response to the request are not saved in the current session, although the Set-Cookie HTTP headers can still be retrieved from the response.

Cookie support is enabled by default for all HTTP requests in a database user session. The default setting of the cookie support (enabled vs. disabled) affects only the future requests and has no effect on the existing ones. After your request is

created, the cookie support setting may be changed by using the other `set_cookie_support` procedure that operates on a request.

The default maximum number of cookies saved in the current session is 20 per site and 300 total.

Syntax

```
UTL_HTTP.set_cookie_support (
       enable  IN BOOLEAN,
       max_cookies  IN PLS_INTEGER DEFAULT 300,
       max_cookies_per_site  IN PLS_INTEGER DEFAULT 20);
```

Parameters

Table 78–11 shows the parameters for the `SET_COOKIE_SUPPORT` procedure.

Table 78–11 SET_COOKIE SUPPORT Procedure Parameters

Parameter	Description
`enable (IN)`	Sets whether future HTTP requests should support HTTP cookies (`TRUE`) or not (`FALSE`)
`max_cookies (IN)`	Sets the maximum total number of cookies maintained in the current session
`max_cookies_per_site (IN)`	Sets the maximum number of cookies maintained in the current session per each Web site

Usage Notes

If you lower the maximum total number of cookies or the maximum number of cookies per each Web site, the oldest cookies will be purged first to reduce the number of cookies to the lowered maximum. HTTP cookies saved in the current session last for the duration of the database session only; there is no persistent storage for the cookies. Cookies saved in the current session are not cleared if you disable cookie support.

See "UTL_HTTP Examples" on page 78-11 for how to use `get_cookies` and `add_cookies` to retrieve, save, and restore cookies.

GET_COOKIE_SUPPORT Procedure

This procedure retrieves the current cookie support settings.

Syntax

```
UTL_HTTP.get_cookie_support (
    enable  OUT BOOLEAN,
    max_cookies  OUT PLS_INTEGER,
    max_cookies_per_site  OUT PLS_INTEGER);
```

Parameters

Table 78–12 shows the parameters for the GET_COOKIE_SUPPORT procedure.

Table 78–12 GET_COOKIE SUPPORT Procedure Parameters

Parameter	Description
enable (OUT)	Indicates whether future HTTP requests should support HTTP cookies (TRUE) or not (FALSE)
max_cookies (OUT)	Indicates the maximum total number of cookies maintained in the current session
max_cookies_per_site (OUT)	Indicates the maximum number of cookies maintained in the current session per each Web site

SET_FOLLOW_REDIRECT Procedure

This procedure sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP responses to future requests in the get_response function.

If max_redirects is set to a positive number, get_response will automatically follow the redirected URL for the HTTP response status code 301, 302, and 307 for the HTTP HEAD and GET methods, and 303 for all HTTP methods, and retry the HTTP request (the request method will be changed to HTTP GET for the status code 303) at the new location. It follows the redirection until the final, non-redirect location is reached, or an error occurs, or the maximum number of redirections has been reached (to prevent an infinite loop). The URL and method fields in the REQ record will be updated to the last redirected URL and the method used to access the URL. Set the maximum number of redirects to zero to disable automatic redirection.

The default maximum number of redirections in a database user session is 3. The default value affects only future requests and has no effect on existing requests.

After a request is created, the maximum number of redirections can be changed by using the other set_follow_redirect procedure that operates on a request.

Syntax

```
UTL_HTTP.set_follow_redirect (
    max_redirects  IN PLS_INTEGER DEFAULT 3);
```

Parameters

Table 78–13 shows the parameters for the SET_FOLLOW_REDIRECT procedure.

Table 78–13 SET_FOLLOW_REDIRECT Procedure Parameters

Parameter	Description
max_redirects (IN)	The maximum number of redirections. Set to zero to disable redirection

Usage Notes

While it is set not to follow redirect automatically in the current session, it is possible to specify individual HTTP requests to follow redirect instructions the function follow_redirect and vice versa.

GET_FOLLOW_REDIRECT Procedure

This procedure retrieves the follow-redirect setting in the current session.

Syntax

```
UTL_HTTP.get_follow_redirect (
    max_redirects  OUT PLS_INTEGER);
```

Parameters

Table 78–14 shows the parameters for the GET_FOLLOW_REDIRECT procedure.

Table 78–14 GET_FOLLOW_REDIRECT Procedure Parameters

Parameter	Description
max_redirects (OUT)	The maximum number of redirections for all future HTTP requests.

SET_BODY_CHARSET Procedure

This procedure sets the default character set of the body of all future HTTP requests when the media type is text and the character set is not specified in the

Content-Type header. Following the HTTP protocol standard specification, if the media type of a request or a response is text, but the character set information is missing in the Content-Type header, the character set of the request or response body should default to ISO-8859-1. A response created for a request inherits the default body character set of the request instead of the body character set of the current session.

The default body character set is ISO-8859-1 in a database user session. The default body character set setting affects only future requests and has no effect on existing requests.

After a request is created, the body character set can be changed by using the other set_body_charset procedure that operates on a request.

Syntax

```
UTL_HTTP.set_body_charset (
    charset  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 78–15 shows the parameters for the SET_BODY_CHARSET procedure.

Table 78–15 SET_BODY_CHARSET Procedure Parameters

Parameter	Description
charset (IN)	The default character set of the request body. The character set can be in Oracle or Internet Assigned Numbers Authority (IANA) naming convention. If charset is NULL, the database character set is assumed.

GET_BODY_CHARSET Procedure

This procedure retrieves the default character set of the body of all future HTTP requests.

Syntax

```
UTL_HTTP.get_body_charset (
    charset  OUT NOCOPY VARCHAR2);
```

Parameters

Table 78–16 shows the parameters for the GET_BODY_CHARSET procedure.

Table 78–16 GET_BODY_CHARSET Procedure Parameters

Parameter	Description
charset (OUT)	The default character set of the body of all future HTTP requests

SET_PERSISTENT_CONN_SUPPORT Procedure

This procedure sets:

- Whether or not future HTTP requests will support the HTTP 1.1 persistent connection
- The maximum number of persistent connections maintained in the current database user session

If persistent-connection support is enabled for an HTTP request, the package keeps the network connections to a Web server or the proxy server open in the package after the request is completed. A subsequent request to the same server can use the HTTP 1.1 persistent connection. With persistent connection support, subsequent HTTP requests can be completed faster because network connection latency is avoided. If the persistent-connection support is disabled for a request, the package will send the HTTP header `Connection: close` automatically in the HTTP request and close the network connection when the request is completed. This setting has no effect on HTTP requests that follows HTTP 1.0 protocol, for which the network connections will always be closed after the requests are completed.

When a request is made, the package always attempts to reuse an existing persistent connection to the target Web server (or proxy server) if one is available. If none is available, a new network connection will be initiated. The persistent-connection support setting for a request affects only whether the network connection should be closed after a request completes.

Persistent-connection support is disabled for all HTTP requests in a database user session by default. The default maximum number of persistent connections saved in the current session is zero. The default setting of the persistent-connection support (enabled vs. disabled) affects only future requests and has no effect on existing requests.

After a request is created, the persistent-connection support setting can be changed by using the other `set_persistent_conn_support` procedure that operates on a request.

While the use of persistent connections in `UTL_HTTP` can reduce the time it takes to fetch multiple Web pages from the same server, it consumes system resources

(network connections) in the database server. Excessive use of persistent connections can reduce the scalability of the database server when too many network connections are kept open in the database server. Network connections should be kept open only if they will be used immediately by subsequent requests and should be closed when they are no longer needed. You should normally disable persistent connection support in the session and enable persistent connections in individual HTTP requests, as shown in "Example: Using SET_PERSISTENT_CONN_SUPPORT" on page 78-33.

Syntax

```
UTL_HTTP.set_persistent_conn_support (
    enable  IN BOOLEAN,
    max_conns  IN PLS_INTEGER DEFAULT 0);
```

Parameters

Table 78–17 shows the parameters for the SET_PERSISTENT_CONN_SUPPORT procedure.

Table 78–17 SET_PERSISTENT_CONN_SUPPORT Procedure Parameters

Parameter	Description
enable (IN)	Enables (set to TRUE) or disables (set to FALSE) persistent connection support
max_conns (IN)	Sets the maximum number of persistent connections maintained in the current session.

Usage Notes

The default value of the maximum number of persistent connections in a database session is zero. To truly enable persistent connections, you must also set the maximum number of persistent connections to a positive value or no connections will be kept persistent.

Example: Using SET_PERSISTENT_CONN_SUPPORT

```
DECLARE
  TYPE vc2_table IS TABLE OF VARCHAR2(256) INDEX BY binary_integer;
  paths vc2_table;

  PROCEDURE fetch_pages(paths IN vc2_table) AS
    url_prefix VARCHAR2(256) := 'http://www.my-company.com/';
```

```
    req   utl_http.req;
    resp  utl_http.resp;
    data  VARCHAR2(1024);
  BEGIN
    FOR i IN 1..paths.count LOOP
      req := utl_http.begin_request(url_prefix || paths(i));

      -- Use persistent connection except for the last request
      IF (i < paths.count) THEN
        utl_http.set_persistent_conn_support(req, TRUE);
      END IF;

      resp := utl_http.get_response(req);

      BEGIN
        LOOP
          utl_http.read_text(resp, data);
          -- do something with the data
        END LOOP;
      EXCEPTION
        WHEN utl_http.end_of_body THEN
          NULL;
      END;
      utl_http.end_response(resp);
    END LOOP;
  END;

BEGIN
  utl_http.set_persistent_conn_support(FALSE, 1);
  paths(1) := '...';
  paths(2) := '...';
  ...
  fetch_pages(paths);
END;
```

GET_PERSISTENT_CONN_SUPPORT Procedure

This procedure checks:

- If the persistent connection support is enabled
- Gets the maximum number of persistent connections in the current session

Syntax

```
UTL_HTTP.get_persistent_conn_support (
```

```
    enable  OUT BOOLEAN,
    max_conns  OUT PLS_INTEGER);
```

Parameters

Table 78–18 shows the parameters for the GET_PERSISTENT_CONN_SUPPORT procedure.

Table 78–18 GET_PERSISTENT_CONN_SUPPORT Procedure Parameters

Parameter	Description
enable (OUT)	TRUE if persistent connection support is enabled; otherwise FALSE
max_conns (OUT)	the maximum number of persistent connections maintained in the current session.

SET_RESPONSE_ERROR_CHECK Procedure

This procedure sets whether or not get_response raises an exception when the Web server returns a status code that indicates an error—a status code in the 4xx or 5xx ranges. For example, when the requested URL is not found in the destination Web server, a 404 (document not found) response status code is returned. If the status code indicates an error—a 4xx or 5xx code—and this procedure is enabled, get_response will raise the HTTP_CLIENT_ERROR or HTTP_SERVER_ERROR exception. If SET_RESPONSE_ERROR_CHECK is set to FALSE, get_response will not raise an exception when the status code indicates an error. Response error check is turned off by default.

Syntax

```
UTL_HTTP.set_response_error_check (
    enable  IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 78–19 shows the parameters for the SET_RESPONSE_ERROR_CHECK procedure.

Table 78–19 SET_RESPONSE_ERROR_CHECK Procedure Parameters

Parameter	Description
enable (IN)	TRUE to check for response errors; otherwise FALSE

Usage Notes

The `get_response` function can raise other exceptions when SET_RESPONSE_ERROR_CHECK is set to FALSE.

GET_RESPONSE_ERROR_CHECK Procedure

This procedure checks if the response error check is set or not.

Syntax

```
UTL_HTTP.get_response_error_check (
    enable  OUT BOOLEAN);
```

Parameters

Table 78–20 shows the parameters for the GET_RESPONSE_ERROR_CHECK procedure.

Table 78–20 GET_RESPONSE_ERROR_CHECK Procedure Parameters

Parameter	Description
enable (OUT)	TRUE if the response error check is set; otherwise FALSE

SET_DETAILED_EXCP_SUPPORT Procedure

This procedure sets the UTL_HTTP package to raise a detailed exception. By default, UTL_HTTP raises the `request_failed` exception when an HTTP request fails. Use GET_DETAILED_SQLCODE and GET_DETAILED_SQLEERM for more detailed information about the error.

Syntax

```
UTL_HTTP.set_detailed_excp_support (
    enable  IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 78–21 shows the parameters for the SET_DETAILED_EXCP_SUPPORT procedure.

Table 78–21 SET_DETAILED_EXCP_SUPPORT Procedure Parameters

Parameter	Description
enable (IN)	Asks UTL_HTTP to raise a detailed exception directly if set to TRUE; otherwise FALSE

GET_DETAILED_EXCP_SUPPORT Procedure

This procedure checks if the UTL_HTTP package will raise a detailed exception or not.

Syntax

```
UTL_HTTP.get_detailed_excp_support (
    enable  OUT BOOLEAN);
```

Parameters

Table 78–22 shows the parameters for the GET_DETAILED_EXCP_SUPPORT procedure.

Table 78–22 GET_DETAILED_EXCP_SUPPORT Procedure Parameters

Parameter	Description
enable (OUT)	TRUE if UTL_HTTP raises a detailed exception; otherwise FALSE

SET_WALLET Procedure

This procedure sets the Oracle wallet used for all HTTP requests over Secured Socket Layer (SSL), namely HTTPS. When the UTL_HTTP package communicates with an HTTP server over SSL, the HTTP server presents its digital certificate, which is signed by a certificate authority, to the UTL_HTTP package for identification purpose. The Oracle wallet contains the list of certificate authorities that are trusted by the user of the UTL_HTTP package. An Oracle wallet is required to make an HTTPS request.

To set up an Oracle wallet, use the Oracle Wallet Manager to create a wallet. In order for the HTTPS request to succeed, the certificate authority that signs the certificate of the remote HTTPS Web server must be one trust point set in the wallet. When a wallet is created, it is populated with a set of well-known certificate authorities as trust points. If the certificate authority that signs the certificate of the remote HTTPS Web server is not among the trust points, or the certificate authority

has new root certificates, you should obtain the root certificate of that certificate authority and install it as a trust point in the wallet using Oracle Wallet Manager. See Oracle Advanced Security Administrator's Guide for more information on Wallet Manager.

Syntax

```
UTL_HTTP.set_wallet (
    path      IN VARCHAR2,
    password  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 78–23 shows the parameters for the SET_WALLET procedure.

Table 78–23 SET_WALLET Procedure Parameters

Parameter	Description
path (IN)	The directory path that contains the Oracle wallet. The format is file:<directory-path>.
	The format of wallet_path on a PC is, for example, file:c:\WINNT\Profiles\<username>\WALLETS, and in Unix is, for example, file:/home/<username>/wallets. When the UTL_HTTP package is executed in the Oracle database server, the wallet is accessed from the database server. Therefore, the wallet path must be accessible from the database server.
password (IN)	The password needed to open the wallet. A second copy of a wallet in a wallet directory that may be opened without a password. That second copy of the wallet is read-only. If the password is NULL, the UTL_HTTP package will open the second, read-only copy of the wallet instead.

SET_TRANSFER_TIMEOUT Procedure

Sets the default timeout value for all future HTTP requests that the UTL_HTTP package should attempt while reading the HTTP response from the Web server or proxy server. This timeout value may be used to avoid the PL/SQL programs from being blocked by busy Web servers or heavy network traffic while retrieving Web pages from the Web servers. The default value of the timeout is 60 seconds.

Syntax

```
UTL_HTTP.set_transfer_timeout (
    timeout  IN PLS_INTEGER DEFAULT 60);
```

Parameters

Table 78–24 shows the parameters for the SET_TRANSFER_TIMEOUT procedure.

Table 78–24 SET_TRANSFER_TIMEOUT Procedure Parameters

Parameter	Description
TIMEOUT (IN)	The network transfer timeout value in seconds.

GET_TRANSFER_TIMEOUT Procedure

This procedure retrieves the default timeout value for all future HTTP requests.

Syntax

```
UTL_HTTP.get_transfer_timeout (
    timeout  OUT PLS_INTEGER);
```

Parameters

Table 78–25 shows the parameters for the GET_TRANSFER_TIMEOUT procedure.

Table 78–25 GET_TRANSFER_TIMEOUT Procedure Parameters

Parameter	Description
TIMEOUT (OUT)	The network transfer timeout value in seconds.

HTTP Requests

The following APIs begin an HTTP request, manipulate attributes, and send the request information to the Web server. When a request is created, it inherits the default settings of the HTTP cookie support, follow-redirect, body character set, persistent-connection support, and transfer timeout of the current session. The settings can be changed by calling the request API.

BEGIN_REQUEST Function

This functions begins a new HTTP request. UTL_HTTP establishes the network connection to the target Web server or the proxy server and sends the HTTP request line. The PL/SQL program continues the request by calling some other API to complete the request.

Syntax

```
UTL_HTTP.begin_request (
    url  IN VARCHAR2,
    method  IN VARCHAR2 DEFAULT 'GET',
    http_version  IN VARCHAR2 DEFAULT NULL)
RETURN req;
```

Parameters

Table 78–26 shows the parameters for the BEGIN_REQUEST function.

Table 78–26 BEGIN_REQUEST Function Parameters

Parameter	Description
url (IN)	The URL of the HTTP request
method (IN)	The method performed on the resource identified by the URL
http_version (IN)	The HTTP protocol version that sends the request. The format of the protocol version is HTTP/major-version.minor-version, where major-version and minor-version are positive numbers. If this parameter is set to NULL, UTL_HTTP uses the latest HTTP protocol version that it supports to send the request. The latest version that the package supports is 1.1 and it can be upgraded to a later version. The default is NULL.

Usage Notes

The URL passed as an argument to this function is not examined for illegal characters, such as spaces, according to URL specification RFC 2396. You should escape those characters with the UTL_URL package to return illegal and reserved characters. URLs should consist of US-ASCII characters only. See Chapter 84, "UTL_URL" for a list of legal characters in URLs. Note that URLs should consist of US-ASCII characters only. The use of non-US-ASCII characters in a URL is generally unsafe.

An Oracle wallet must be set before accessing Web servers over HTTPS. See the set_wallet procedure on how to set up an Oracle wallet.

SET_HEADER Procedure

This procedure sets an HTTP request header. The request header is sent to the Web server as soon as it is set.

Syntax

```
UTL_HTTP.set_header (
    r  IN OUT NOCOPY req,
    name  IN VARCHAR2,
    value  IN VARCHAR2);
```

Parameters

Table 78–26 shows the parameters for the SET_HEADER procedure.

Table 78–27 SET_HEADER Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
name (IN)	The name of the HTTP request header
value (IN)	The value of the HTTP request header

Usage Notes

Multiple HTTP headers with the same name are allowed in the HTTP protocol standard. Therefore, setting a header does not replace a prior header with the same name.

If the request is made using HTTP 1.1, UTL_HTTP sets the Host header automatically for you.

When you set the Content-Type header with this procedure, UTL_HTTP looks for the character set information in the header value. If the character set information is present, it is set as the character set of the request body. It can be overridden later by using the set_body_charset procedure.

When you set the Transfer-Encoding header with the value chunked, UTL_HTTP automatically encodes the request body written by the write_text, write_line and write_raw procedures. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format.

SET_AUTHENTICATION Procedure

This procedure sets HTTP authentication information in the HTTP request header. The Web server needs this information to authorize the request.

Syntax

```
UTL_HTTP.set_authentication(
    r  IN OUT NOCOPY req,
    username  IN VARCHAR2,
    password  IN VARCHAR2,
    scheme    IN VARCHAR2 DEFAULT 'Basic',
    for_proxy IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 78–28 shows the parameters for the SET_AUTHENTICATION procedure.

Table 78–28 SET_AUTHENTICATION Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
username (IN)	The username for the HTTP authentication
password (IN)	The password for the HTTP authentication
scheme (IN)	The HTTP authentication scheme. The default, BASIC, denotes the HTTP Basic Authentication scheme.
for_proxy (IN)	Identifies if the HTTP authentication information is for access to the HTTP proxy server instead of the Web server. Default is FALSE.

Usage Notes

Only the HTTP Basic Authentication scheme is supported.

SET_COOKIE_SUPPPORT Procedure

This procedure enables or disables support for the HTTP cookies in the request. If cookie support is enabled for an HTTP request, all cookies saved in the current session and applicable to the request are returned to the Web server in the request in accordance with HTTP cookie specification standards. Cookies set in the response to the request are saved in the current session for return to the Web server in the subsequent requests if cookie support is enabled for those requests. If the cookie support is disabled for an HTTP request, no cookies are returned to the Web server in the request and the cookies set in the response to the request are not saved in the current session, although the Set-Cookie HTTP headers can still be retrieved from the response.

Use this procedure to change the cookie support setting a request inherits from the session default setting.

Syntax

```
UTL_HTTP.set_cookie_support(
    r  IN OUT NOCOPY req,
    enable  IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 78–28 shows the parameters for the SET_COOKIE_SUPPPORT procedure.

Table 78–29 SET_COOKIE_SUPPORT Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
enable (IN)	Set enable to TRUE to enable HTTP cookie support; FALSE to disable

Usage Notes

HTTP cookies saved in the current session will last only for the duration of the database session; there is no persistent storage for the cookies. See "UTL_HTTP Examples" on page 78-11 for how to use get_cookies and add_cookies to retrieve, save, and restore cookies.

SET_FOLLOW_REDIRECT Procedure

This procedure sets the maximum number of times UTL_HTTP follows the HTTP redirect instruction in the HTTP response to this request in the GET_RESPONSE function.

If max_redirects is set to a positive number, GET_RESPONSE will automatically follow the redirected URL for the HTTP response status code 301, 302, and 307 for the HTTP HEAD and GET methods, and 303 for all HTTP methods, and retry the HTTP request (the request method will be changed to HTTP GET for the status code 303) at the new location. It follows the redirection until the final, non-redirect location is reached, or an error occurs, or the maximum number of redirections has been reached (to prevent an infinite loop). The url and method fields in the REQ record are updated to the last redirected URL and the method used to access the URL. Set the maximum number of redirects to zero to disable automatic redirection.

Use this procedure to change the maximum number of redirections a request inherits from the session default setting.

Syntax

```
UTL_HTTP.set_follow_redirect(
    r  IN OUT NOCOPY req,
    max_redirects  IN PLS_INTEGER DEFAULT 3);
```

Parameters

Table 78–30 shows the parameters for the SET_FOLLOW_REDIRECT procedure.

Table 78–30 SET_FOLLOW_REDIRECT Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
max_redirects (IN)	The maximum number of redirects. Set to zero to disable redirects.

Usage Notes

The SET_FOLLOW_REDIRECT procedure must be called before GET_RESPONSE for any redirection to take effect.

SET_BODY_CHARSET Procedure

This procedure sets the character set of the request body when the media type is text but the character set is not specified in the Content-Type header. Per the HTTP protocol standard specification, if the media type of a request or a response is "text" but the character set information is missing in the "Content-Type" header, the character set of the request or response body should default to "ISO-8859-1".

Use this procedure to change the default body character set a request inherits from the session default setting.

Syntax

```
UTL_HTTP.set_body_charset(
    r  IN OUT NOCOPY req,
    charset  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 78–30 shows the parameters for the SET_BODY_CHARSET procedure.

Table 78–31 SET_BODY_CHARSET Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
charset (IN)	The default character set of the request body. The character set can be in Oracle or Internet Assigned Numbers Authority (IANA) naming convention. If charset is NULL, the database character set is assumed.

SET_PERSISTENT_CONN_SUPPORT Procedure

This procedure enables or disables support for the HTTP 1.1 persistent-connection in the request.

If the persistent-connection support is enabled for an HTTP request, the package will keep the network connections to a Web server or the proxy server open in the package after the request is completed properly for a subsequent request to the same server to reuse per HTTP 1.1 protocol specification. With the persistent connection support, subsequent HTTP requests may be completed faster because the network connection latency is avoided. If the persistent-connection support is disabled for a request, the package will always send the HTTP header "Connection: close" automatically in the HTTP request and close the network connection when the request is completed. This setting has no effect on HTTP requests that follows HTTP 1.0 protocol, for which the network connections will always be closed after the requests are completed.

When a request is being made, the package attempts to reuse an existing persistent connection to the target Web server (or proxy server) if one is available. If none is available, a new network connection will be initiated. The persistent-connection support setting for a request affects only whether the network connection should be closed after a request completes.

Use this procedure to change the persistent-connection support setting a request inherits from the session default setting.

Users should note that while the use of persistent connections in UTL_HTTP may reduce the time it takes to fetch multiple Web pages from the same server, it consumes precious system resources (network connections) in the database server. Also, excessive use of persistent connections may reduce the scalability of the database server when too many network connections are kept open in the database

server. Network connections should be kept open only if they will be used immediately by subsequent requests and should be closed immediately when they are no longer needed. Set the default persistent connection support as disabled in the session, and enable persistent connection in individual HTTP requests as shown in "Example: Using SET_PERSISTENT_CONN_SUPPORT in HTTP Requests" on page 78-46.

Syntax

```
UTL_HTTP.set_persistent_conn_support(
    r  IN OUT NOCOPY req,
    enable  IN BOOLEAN DEFAULT FALSE);
```

Parameters

Table 78–32 shows the parameters for the SET_PERSISTENT_CONN_SUPPORT procedure.

Table 78–32 SET_PERSISTENT_CONN_SUPPORT Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
enable (IN)	TRUE to keep the network connection persistent. FALSE otherwise.

Usage Notes

The default value of the maximum number of persistent connections in a database session is zero. To truly enable persistent connections, you must also set the maximum number of persistent connections to a positive value or no connections will be kept persistent.

Example: Using SET_PERSISTENT_CONN_SUPPORT in HTTP Requests

```
DECLARE
  TYPE vc2_table IS TABLE OF VARCHAR2(256) INDEX BY binary_integer;
  paths vc2_table;

UTL_HTTP.fetch_pages(paths IN vc2_table) AS
    url_prefix VARCHAR2(256) := 'http://www.my-company.com/';
    req   utl_http.req;
    resp  utl_http.resp;
    data  VARCHAR2(1024);
  BEGIN
```

```
    FOR i IN 1..paths.count LOOP
      req := utl_http.begin_request(url_prefix || paths(i));

      -- Use persistent connection except for the last request
      IF (i < paths.count) THEN
        utl_http.set_persistent_conn_support(req, TRUE);
      END IF;

      resp := utl_http.get_response(req);

      BEGIN
        LOOP
          utl_http.read_text(resp, data);
          -- do something with the data
        END LOOP;
      EXCEPTION
        WHEN utl_http.end_of_body THEN
          NULL;
      END;
      utl_http.end_response(resp);
    END LOOP;
  END;

BEGIN
  utl_http.set_persistent_conn_support(FALSE, 1);
  paths(1) := '...';
  paths(2) := '...';
  ...
  fetch_pages(paths);
END;
```

WRITE_TEXT Procedure

This procedure writes some text data in the HTTP request body. As soon as some data is sent as the HTTP request body, the HTTP request headers section is completed. Text data is automatically converted from the database character set to the request body character set.

Syntax

```
UTL_HTTP.write_text(
    r  IN OUT NOCOPY req,
    data  IN VARCHAR2);
```

Parameters

Table 78–33 shows the parameters for the WRITE_TEXT procedure.

Table 78–33 WRITE_TEXT Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
data (IN)	The text data to send in the HTTP request body

Usage Notes

An HTTP client must always let the remote Web server know the length of the request body it is sending. If the amount of data is known beforehand, you can set the Content-Length header in the request, where the length of the content is measured in bytes instead of characters. If the length of the request body is not known beforehand, you can send the request body using the HTTP 1.1 chunked transfer-encoding format. The request body is sent in chunks, where the length of each chunk is sent before the chunk is sent. UTL_HTTP performs chunked transfer-encoding on the request body transparently when the Transfer-Encoding: chunked header is set. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format. See the set_header procedure for details.

If you send the Content-Length header, you should note that the length specified in the header should be the byte-length of the textual request body after it is converted from the database character set to the request body character set. When either one of the two character sets is a multi-byte character set, the precise byte-length of the request body in the request body character set cannot be known beforehand. In this case, you can perform the character set conversion explicitly, determine the byte-length of the results, send the Content-Length header, and the results using the write_raw procedure to avoid the automatic character set conversion. Or, if the remove Web server or CGI programs allow, you can send the request body using the HTTP 1.1 chunked transfer-encoding format, where UTL_HTTP handles the length of the chunks transparently.

WRITE_LINE Procedure

This procedure writes a text line in the HTTP request body and ends the line with new-line characters (CRLF as defined in UTL_TCP). As soon as some data is sent as the HTTP request body, the HTTP request headers section is completed. Text data is

automatically converted from the database character set to the request body character set.

Syntax

```
UTL_HTTP.write_line(
    r  IN OUT NOCOPY req,
    data  IN VARCHAR2);
```

Parameters

Table 78–34 shows the parameters for the WRITE_LINE procedure.

Table 78–34 WRITE_LINE Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
data (IN)	The text line to send in the HTTP request body

Usage Notes

An HTTP client must always let the remote Web server know the length of the request body it is sending. If the amount of data is known beforehand, you can set the Content-Length header in the request, where the length of the content is measured in bytes instead of characters. If the length of the request body is not known beforehand, you can send the request body using the HTTP 1.1 chunked transfer-encoding format. The request body is sent in chunks, where the length of each chunk is sent before the chunk is sent. The UTL_HTTP package performs chunked transfer-encoding on the request body transparently when the Transfer-Encoding: chunked header is set. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format. See the set_header procedure for details.

If you send the Content-Length header, you should note that the length specified in the header should be the byte-length of the textual request body after it is converted from the database character set to the request body character set. When either one of the two character sets is a multi-byte character set, the precise byte-length of the request body in the request body character set cannot be known beforehand. In this case, you can perform the character set conversion explicitly, determine the byte-length of the results, send the Content-Length header, and the results using the write_raw procedure to avoid the automatic character set conversion. Or, if the remove Web server or CGI programs allow, you can send the request body using

the HTTP 1.1 chunked transfer-encoding format, where UTL_HTTP handles the length of the chunks transparently.

WRITE_RAW Procedure

This procedure writes some binary data in the HTTP request body. As soon as some data is sent as the HTTP request body, the HTTP request headers section is completed.

Syntax

```
UTL_HTTP.write_raw(
    r  IN OUT NOCOPY req,
    data  IN RAW);
```

Parameters

Table 78–35 shows the parameters for the WRITE_RAW procedure.

Table 78–35 WRITE_RAW Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request
data (IN)	The binary data to send in the HTTP request body

Usage Notes

An HTTP client must always let the remote Web server know the length of the request body it is sending. If the amount of data is known beforehand, you can set the Content-Length header in the request, where the length of the content is measured in bytes instead of characters. If the length of the request body is not known beforehand, you can send the request body using the HTTP 1.1 chunked transfer-encoding format. The request body is sent in chunks, where the length of each chunk is sent before the chunk is sent. UTL_HTTP performs chunked transfer-encoding on the request body transparently when the Transfer-Encoding: chunked header is set. Note that some HTTP-1.1-based Web servers or CGI programs do not support or accept the request body encoding in the HTTP 1.1 chunked transfer-encoding format. See the set_header procedure for details.

END_REQUEST Procedure

This procedure ends the HTTP request. To terminate the HTTP request without completing the request and waiting for the response, the program can call this procedure. Otherwise, the program should go through the normal sequence of beginning a request, getting the response, and closing the response. The network connection will always be closed and will not be reused.

Syntax

```
UTL_HTTP.end_request (
    r  IN OUT NOCOPY req);
```

Parameters

Table 78–36 shows the parameters for the END_REQUEST procedure.

Table 78–36 END_REQUEST Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP request

HTTP Responses

The following APIs manipulate an HTTP response obtained from GET_RESPONSE and receive response information from the Web server. When a response is created for a request, it inherits settings of the HTTP cookie support, follow-redirect, body character set, persistent-connection support, and transfer timeout from the request. Only the body character set can be changed by calling the response API.

GET_RESPONSE Function

This function reads the HTTP response. When the function returns, the status line and the HTTP response headers have been read and processed. The status code, reason phrase, and the HTTP protocol version are stored in the response record. This function completes the HTTP headers section.

Syntax

```
UTL_HTTP.get_response (
    r  IN OUT NOCOPY req)
RETURN resp;
```

Parameters

Table 78–37 shows the parameters for the GET_RESPONSE procedure.

Table 78–37 GET_RESPONSE Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response

GET_HEADER_COUNT Function

This function returns the number of HTTP response headers returned in the response.

Syntax

```
UTL_HTTP.get_header_count (
    r  IN OUT NOCOPY resp)
RETURN PLS_INTEGER;
```

Parameters

Table 78–38 shows the parameters for the GET_HEADER_COUNT function.

Table 78–38 GET_HEADER_COUNT Function Parameters

Parameter	Description
r (IN/OUT)	The HTTP response

Usage Notes

If the response body returned by the remote Web server is encoded in chunked transfer encoding format, the trailer headers that are returned at the end of the response body will be added to the response, and the response header count will be updated. You can retrieve the additional headers after the end of the response body is reached and before you end the response.

GET_HEADER Procedure

This procedure returns the n^{th} HTTP response header name and value returned in the response.

Syntax

```
UTL_HTTP.get_header (
    r  IN OUT NOCOPY resp,
    n  IN PLS_INTEGER,
    name  OUT NOCOPY VARCHAR2,
    value  OUT NOCOPY VARCHAR2);
```

Parameters

Table 78–39 shows the parameters for the GET_HEADER procedure.

Table 78–39 GET_HEADER Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.
n (IN)	The n^{th} header to return.
name (OUT)	The name of the HTTP response header.
value (OUT)	The value of the HTTP response header.

Usage Notes

If the response body returned by the remote Web server is encoded in chunked transfer encoding format, the trailer headers that are returned at the end of the response body will be added to the response, and the response header count will be updated. You can retrieve the additional headers after the end of the response body is reached and before you end the response.

GET_HEADER_BY_NAME Procedure

This procedure returns the HTTP response header value returned in the response given the name of the header.

Syntax

```
UTL_HTTP.get_header_by_name(
    r  IN OUT NOCOPY resp,
    name  IN VARCHAR2,
    value  OUT NOCOPY VARCHAR2,
    n  IN PLS_INTEGER DEFAULT 1);
```

Parameters

Table 78–40 shows the parameters for the GET_HEADER_BY_NAME procedure.

Table 78–40 GET_HEADER_BY_NAME Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response
n (IN)	The n^{th} occurrence of an HTTP response header by the specified name to return. The default is 1.
name (IN)	The name of the HTTP response header for which the value is to return
value (OUT)	The value of the HTTP response header.

Usage Notes

If the response body returned by the remote Web server is encoded in chunked transfer encoding format, the trailer headers that are returned at the end of the response body will be added to the response, and the response header count will be updated. You can retrieve the additional headers after the end of the response body is reached and before you end the response.

GET_AUTHENTICATION Procedure

This procedure retrieves the HTTP authentication information needed for the request to be accepted by the Web server as indicated in the HTTP response header.

Syntax

```
UTL_HTTP.get_authentication(
    r  IN OUT NOCOPY resp,
    scheme  OUT VARCHAR2,
    realm  OUT VARCHAR2,
    for_proxy  IN BOOLEAN  DEFAULT FALSE);
```

Parameters

Table 78–41 shows the parameters for the GET_AUTHENTICATION procedure.

Table 78–41 GET_AUTHENTICATION Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.
scheme (OUT)	The scheme for the required HTTP authentication
realm (OUT)	The realm for the required HTTP authentication
for_proxy (IN)	Returns the HTTP authentication information required for the access to the HTTP proxy server instead of the Web server? Default is FALSE.

Usage Notes

When a Web client is unaware that a document is protected, at least two HTTP requests are required for the document to be retrieved. In the first HTTP request, the Web client makes the request without supplying required authentication information; so the request is denied. The Web client can determine the authentication information required for the request to be authorized by calling `get_authentication`. The Web client makes the second request and supplies the required authentication information with `set_authorization`. If the authentication information can be verified by the Web server, the request will succeed and the requested document is returned. Before making the request, if the Web client knows that authentication information is required, it can supply the required authentication information in the first request, thus saving an extra request.

SET_BODY_CHARSET Procedure

This procedure sets the character set of the response body when the media type is "text" but the character set is not specified in the "Content-Type" header. Per the HTTP protocol standard specification, if the media type of a request or a response is "text" but the character set information is missing in the "Content-Type" header, the character set of the request or response body should default to "ISO-8859-1".

Use this procedure to change the default body character set a response inherits from the request.

Syntax

```
UTL_HTTP.set_body_charset(
    r  IN OUT NOCOPY resp,
    charset  IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 78–42 shows the parameters for the SET_BODY_CHARSET procedure.

Table 78–42 SET_BODY_CHARSET Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.
charset (IN)	The default character set of the response body. The character set can be in Oracle or Internet Assigned Numbers Authority (IANA) naming convention. If charset is NULL, the database character set is assumed.

READ_TEXT Procedure

This procedure reads the HTTP response body in text form and returns the output in the caller-supplied buffer. The end_of_body exception will be raised if the end of the HTTP response body is reached. Text data is automatically converted from the response body character set to the database character set.

Syntax

```
UTL_HTTP.read_text(
    r  IN OUT NOCOPY resp,
    data  OUT NOCOPY VARCHAR2,
    len  IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 78–43 shows the parameters for the READ_TEXT procedure.

Table 78–43 READ_TEXT Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.
data (OUT)	The HTTP response body in text form
len (IN)	The maximum number of characters of data to read. If len is NULL, this procedure will read as much input as possible to fill the buffer allocated in data. The actual amount of data returned may be less than that specified if little data is available before the end of the HTTP response body is reached or the transfer_timeout amount of time has elapsed. The default is NULL.

Usage Notes

The UTL_HTTP package supports HTTP 1.1 chunked transfer-encoding. When the response body is returned in chunked transfer-encoding format as indicated in the response header, the package automatically decodes the chunks and returns the response body in de-chunked format.

If transfer timeout is set in the request of this response, read_text waits for each data packet to be ready to read until timeout occurs. If it occurs, this procedure stops reading and returns all the data read successfully. If no data is read successfully, the transfer_timeout exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multi-byte character is found at the end of the response body, read_text stops reading and returns all the complete multi-byte characters read successfully. If no complete character is read successfully, the partial_multibyte_char exception is raised. The exception can be handled and the bytes of that partial multi-byte character can be read as binary by the read_raw procedure. If a partial multi-byte character is seen in the middle of the response body because the remaining bytes of the character have not arrived and read timeout occurs, the transfer_timeout exception is raised instead. The exception can be handled and the read operation can be retried later.

READ_LINE Procedure

This procedure reads the HTTP response body in text form until the end of line is reached and returns the output in the caller-supplied buffer. The end of line is as defined in the function read_line of UTL_TCP. The end_of_body exception will be raised if the end of the HTTP response body is reached. Text data is automatically converted from the response body character set to the database character set.

Syntax

```
UTL_HTTP.read_line(
    r  IN OUT NOCOPY resp,
    data  OUT NOCOPY  VARCHAR2,
    remove_crlf  IN  BOOLEAN DEFAULT FALSE);
```

Parameters

Table 78–44 shows the parameters for the READ_LINE procedure.

Table 78–44 READ_LINE Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.
data (OUT)	The HTTP response body in text form
remove_crlf (IN)	Removes the newline characters if set to TRUE

Usage Notes

The UTL_HTTP package supports HTTP 1.1 chunked transfer-encoding. When the response body is returned in chunked transfer-encoding format as indicated in the response header, the package automatically decodes the chunks and returns the response body in de-chunked format.

If transfer timeout is set in the request of this response, read_line waits for each data packet to be ready to read until timeout occurs. If it occurs, this procedure stops reading and returns all the data read successfully. If no data is read successfully, the transfer_timeout exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multi-byte character is found at the end of the response body, read_line stops reading and returns all the complete multi-byte characters read successfully. If no complete character is read successfully, the partial_multibyte_char exception is raised. The exception can be handled and the bytes of that partial multi-byte character can be read as binary by the read_raw procedure. If a partial multi-byte character is seen in the middle of the response body because the remaining bytes of the character have not arrived and read timeout occurs, the transfer_timeout exception is raised instead. The exception can be handled and the read operation can be retried later.

READ_RAW Procedure

This procedure reads the HTTP response body in binary form and returns the output in the caller-supplied buffer. The end_of_body exception will be raised if the end of the HTTP response body is reached.

Syntax

```
UTL_HTTP.read_raw(
    r  IN OUT NOCOPY resp,
    data  OUT NOCOPY RAW,
    len  IN PLS_INTEGER DEFAULT NULL);
```

Parameters

Table 78–45 shows the parameters for the READ_RAW procedure.

Table 78–45 READ_RAW Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.
data (OUT)	The HTTP response body in binary form
len (IN)	The number of bytes of data to read. If len is NULL, this procedure will read as much input as possible to fill the buffer allocated in data. The actual amount of data returned may be less than that specified if not much data is available before the end of the HTTP response body is reached or the transfer_timeout amount of time has elapsed. The default is NULL

Usage Notes

The UTL_HTTP package supports HTTP 1.1 chunked transfer-encoding. When the response body is returned in chunked transfer-encoding format as indicated in the response header, the package automatically decodes the chunks and returns the response body in de-chunked format.

If transfer timeout is set in the request of this response, read_raw waits for each data packet to be ready to read until timeout occurs. If it occurs, read_raw stops reading and returns all the data read successfully. If no data is read successfully, the transfer_timeout exception is raised. The exception can be handled and the read operation can be retried later.

END_RESPONSE Procedure

This procedure ends the HTTP response. It completes the HTTP request and response. Unless HTTP 1.1 persistent connection is used in this request, the network connection is also closed.

Syntax

```
UTL_HTTP.end_response (
    r  IN OUT NOCOPY resp);
```

Parameters

Table 78–46 shows the parameters for the END_RESPONSE procedure.

Table 78–46 END_RESPONSE Procedure Parameters

Parameter	Description
r (IN/OUT)	The HTTP response.

HTTP Cookies

Use the following APIs to manipulate HTTP cookies.

GET_COOKIE_COUNT Function

This function returns the number of cookies currently maintained by the UTL_HTTP package set by all Web servers.

Syntax

```
UTL_HTTP.get_cookie_count
RETURN PLS_INTEGER;
```

GET_COOKIES Function

This function returns all the cookies currently maintained by the UTL_HTTP package set by all Web servers.

Syntax

```
UTL_HTTP.get_cookies (
    cookies  IN OUT NOCOPY cookie_table);
```

Parameters

Table 78–47 shows the parameters for the GET_COOKIES procedure.

Table 78–47 GET_COOKIES Procedure Parameters

Parameter	Description
cookies (IN/OUT)	The cookies returned

ADD_COOKIES Procedure

This procedure adds the cookies maintained by UTL_HTTP.

Syntax

```
UTL_HTTP.add_cookies (
    cookies  IN cookie_table);
```

Parameters

Table 78–48 shows the parameters for the ADD_COOKIES procedure.

Table 78–48 ADD_COOKIES Procedure Parameters

Parameter	Description
cookies (IN/OUT)	The cookies to be added

Usage Notes

The cookies that the package currently maintains are not cleared before new cookies are added.

CLEAR_COOKIES Procedure

This procedure clears all cookies maintained by the UTL_HTTP package.

Syntax

```
UTL_HTTP.clear_cookies;
```

HTTP Persistent Connections

Use the following functions to manipulate persistent connections.

GET_PERSISTENT_CONN_COUNT Function

This function returns the number of network connections currently kept persistent by the UTL_HTTP package to the Web servers.

Syntax

```
UTL_HTTP.get_persistent_conn_count
RETURN PLS_integer;
```

Usage Notes

Connections to the same Web server at different TCP/IP ports are counted individually. The host names of the Web servers are identified as specified in the URL of the original HTTP requests. Therefore, fully qualified host names with domain names will be counted differently from the host names without domain names.

GET_PERSISTENT_CONNS Procedure

This procedure returns all the network connections currently kept persistent by the UTL_HTTP package to the Web servers.

Syntax

```
UTL_HTTP.get_persistent_conns (
    connections  IN OUT NOCOPY connection_table);
```

Parameters

Table 78–49 shows the parameters for the GET_PERSISTENT_CONNS procedure.

Table 78–49 GET_PERSISTENT_CONNS Procedure Parameters

Parameter	Description
connections (IN/OUT)	The network connections kept persistent

Usage Notes

Connections to the same Web server at different TCP/IP ports are counted individually. The host names of the Web servers are identified as specified in the URL of the original HTTP requests. Therefore, fully qualified host names with domain names will be counted differently from the host names without domain names.

CLOSE_PERSISTENT_CONN Procedure

This procedure closes an HTTP persistent connection maintained by the UTL_HTTP package in the current database session.

Syntax

```
UTL_HTTP.close_persistent_conn (
    conn  IN connection);
```

Parameters

Table 78–50 shows the parameters for the CLOSE_PERSISTENT_CONN procedure.

Table 78–50 CLOSE_PERSISTENT_CONN Procedure Parameters

Parameter	Description
conn (IN)	The HTTP persistent connection to close

CLOSE_PERSISTENT_CONNS Procedure

This procedure closes a group of HTTP persistent connections maintained by the UTL_HTTP package in the current database session. This procedure uses a pattern-match approach to decide which persistent connections to close.

To close a group of HTTP persistent connection that share a common property (for example, all connections to a particular host, or all SSL connections), set the particular parameters and leave the rest of the parameters NULL. If a particular parameter is set to NULL when this procedure is called, that parameter will not be used to decide which connections to close.

For example, the following call to the procedure closes all persistent connections to foobar:

```
utl_http.close_persistent_conns(host => 'foobar');
```

And the following call to the procedure closes all persistent connections via the proxy www-proxy at TCP/IP port 80:

```
utl_http.close_persistent_conns(proxy_host => 'foobar',
                                proxy_port => 80);
```

And the following call to the procedure closes all persistent connections:

```
utl_http.close_persistent_conns;
```

Syntax

```
UTL_HTTP.close_persistent_conns (
    host  IN VARCHAR2 DEFAULT NULL,
    port  IN PLS_INTEGER DEFAULT NULL,
    proxy_host  IN VARCHAR2 DEFAULT NULL,
    proxy_port IN PLS_INTEGER DEFAULT NULL,
    ssl  IN BOOLEAN DEFAULT NULL);
```

Parameters

Table 78–51 shows the parameters for the CLOSE_PERSISTENT_CONNS procedure.

Table 78–51 CLOSE_PERSISTENT_CONNS Procedure Parameters

Parameter	Description
host (IN)	The host for which persistent connections are to be closed
port (IN)	The port number for which persistent connections are to be closed
proxy_host (IN)	The proxy host for which persistent connections are to be closed
proxy_port (IN)	The proxy port for which persistent connections are to be closed
ssl (IN)	Close persistent SSL connection

Usage Notes

Connections to the same Web server at different TCP/IP ports are counted individually. The host names of the Web servers are identified as specified in the URL of the original HTTP requests. Therefore, fully qualified host names with domain names will be counted differently from the host names without domain names.

Note that the use of a NULL value in a parameter when this procedure is called means that the caller does not care about its value when the package decides which persistent connection to close. If you want a NULL value in a parameter to match only a NULL value of the parameter of a persistent connection (which is when you want to close a specific persistent connection), you should use the close_persistent_conn procedure that closes a specific persistent connection.

Error Conditions

The following APIs retrieve error information.

GET_DETAILED_SQLCODE Function

This function retrieves the detailed SQLCODE of the last exception raised.

Syntax

```
UTL_HTTP.get_detailed_sqlcode
```

```
RETURN PLS_INTEGER;
```

GET_DETAILED_SQLERRM Function

This function retrieves the detailed SQLERRM of the last exception raised.

Syntax

```
UTL_HTTP.get_detailed_sqlerrm
RETURN VARCHAR2;
```

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UTL_INADDR

UTL_INADDR provides a PL/SQL procedures to support internet addressing. It provides an API to retrieve host names and IP addresses of local and remote hosts.

This chapter discusses the following topics:

- Exceptions
- Summary of UTL_INADDR Subprograms

Exceptions

The exception raised by the Internet Address package appears in Table 79–1.

Table 79–1 Exception from Internet Address Package

Exception	Description
UNKNOWN_HOST	The host is unknown.

Summary of UTL_INADDR Subprograms

Table 79–2 UTL_INADDR Subprograms

Subprogram	Description
"get_host_name Function" on page 79-2	Retrieves the name of the local or remote host given its IP address.
"get_host_address Function" on page 79-3	Retrieves the IP address of the local or remote host given its name.

get_host_name Function

This function retrieves the name of the local or remote host given its IP address.

Syntax

```
UTL_INADDR.GET_HOST_NAME (
    ip  IN VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 79–3 get_host_name Function Parameters

Parameter	Description
ip	The IP address of the host used to determine its host name. If ip is not NULL, the official name of the host with its domain name is returned. If this is NULL, the name of the local host is returned and the name does not contain the domain to which the local host belongs.

Returns

The name of the local or remote host of the specified IP address.

Exceptions

`unknown_host`. The specified IP address is unknown.

get_host_address Function

This function retrieves the IP address of a host.

Syntax

```
UTL_INADDR.GET_HOST_ADDRESS (
    host  IN VARCHAR2 DEFAULT NULL)
RETURN VARCHAR2;
```

Parameters

Table 79–4 get_host_address Function Parameters

Parameter	Description
`host (IN)`	The name of the host to retrieve the IP address. If host is `NULL`, this function returns the IP address of the local host.

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UTL_RAW

The UTL_RAW package provides SQL functions for manipulating RAW datatypes. This package is necessary because normal SQL functions do not operate on RAWs, and PL/SQL does not allow overloading between a RAW and a CHAR datatype. UTL_RAW also includes subprograms that convert various COBOL number formats to, and from, RAWs.

UTL_RAW is not specific to the database environment, and it may actually be used in other environments as it exists here. For this reason, the prefix UTL has been given to the package, instead of DBMS.

This chapter discusses the following topics:

Usage Notes

UTL_RAW allows a RAW "record" to be composed of many elements. By using the RAW datatype, character set conversion will not be performed, keeping the RAW in its original format when being transferred through remote procedure calls.

With the RAW functions, you can manipulate binary data that was previously limited to the hextoraw and rawtohex functions.

Summary of UTL_RAW Subprograms

Table 80–1 UTL_RAW Subprograms

Subprogram	Description
"CAST_FROM_BINARY_ INTEGER Function" on page 80-3	Returns the binary representation of a BINARY_INTEGER (in RAW).
"CAST_FROM_NUMBER Function" on page 80-4	Returns the binary representation of a NUMBER (in RAW).
"CAST_TO_BINARY_ INTEGER Function" on page 80-4	Casts the binary representation of a BINARY_INTEGER (in RAW) into a BINARY_INTEGER
"CAST_TO_NUMBER Function" on page 80-5	Casts the binary representation of a NUMBER (in RAW) into a NUMBER. If include_length is TRUE, the first byte of r encodes the number of bytes in r (
"CAST_TO_RAW Function" on page 80-5	Converts a VARCHAR2 represented using n data bytes into a RAW with n data bytes.
"CAST_TO_VARCHAR2 Function" on page 80-6	Converts a RAW represented using n data bytes into VARCHAR2 with n data bytes.
"CONCAT Function" on page 80-7	Concatenates up to 12 RAWs into a single RAW.
"LENGTH Function" on page 80-8	Returns the length in bytes of a RAW r.
"SUBSTR Function" on page 80-9	Returns len bytes, starting at pos from RAW r.
"TRANSLATE Function" on page 80-10	Translates the bytes in the input RAW r according to the bytes in the translation RAWs from_set and to_set.
"TRANSLITERATE Function" on page 80-12	Converts the bytes in the input RAW r according to the bytes in the transliteration RAWs from_set and to_set.

Table 80–1 UTL_RAW Subprograms (Cont.)

Subprogram	Description
"OVERLAY Function" on page 80-14	Overlays the specified portion of target RAW with overlay RAW, starting from byte position pos of target and proceding for len bytes.
"COPIES Function" on page 80-15	Returns n copies of r concatenated together.
"XRANGE Function" on page 80-16	Returns a RAW containing all valid 1-byte encodings in succession, beginning with the value start_byte and ending with the value end_byte.
"REVERSE Function" on page 80-17	Reverses a byte sequence in RAW r from end to end.
"COMPARE Function" on page 80-18	Compares RAW r1 against RAW r2.
"CONVERT Function" on page 80-19	Converts RAW r from character set from_charset to character set to_charset and returns the resulting RAW.
"BIT_AND Function" on page 80-20	Performs bitwise logical "and" of the values in RAW r1 with RAW r2 and returns the "anded" result RAW.
"BIT_OR Function" on page 80-21	Performs bitwise logical "or" of the values in RAW r1 with RAW r2 and returns the "or'd" result RAW.
"BIT_XOR Function" on page 80-22	Performs bitwise logical "exclusive or" of the values in RAW r1 with RAW r2 and returns the "xor'd" result RAW.
"BIT_COMPLEMENT Function" on page 80-23	Performs bitwise logical "complement" of the values in RAW r and returns the "complement'ed" result RAW.

CAST_FROM_BINARY_INTEGER Function

This function returns the binary representation of a BINARY_INTEGER (in RAW).

Syntax

```
UTL_RAW.CAST_FROM_BINARY_INTEGER (n IN BINARY_INTEGER, endianess in PLS_INTEGER
DEFAULT BIG_ENDIAN) RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_from_binary_integer, WNDS, RNDS, WNPS, RNPS);
```

Parameters

n, the BINARY_INTEGER value

endianess, a PLS_INTEGER representing big-endian or little-endian architecture. The default is big-endian.

Returns

The binary representation of the BINARY_INTEGER value.

CAST_FROM_NUMBER Function

This function returns the binary representation of a NUMBER (in RAW). If include_length is TRUE, the first byte of the RAW returned encodes the number of valid bytes in the number (not including the length byte), and the result is padded to a fixed length of 22 bytes with arbitrary data. If include_length is FALSE, the RAW returned is variable length, with a maximum length of 21 bytes.

Syntax

```
UTL_RAW.CAST_FROM_NUMBER (n IN NUMBER, include_length IN
BOOLEAN) RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_from_number, WNDS, RNDS, WNPS, RNPS);
```

Parameters

n, the NUMBER value

Returns

The binary representation of the NUMBER value.

CAST_TO_BINARY_INTEGER Function

This function casts the binary representation of a BINARY_INTEGER (in RAW) into a BINARY_INTEGER.

Syntax

```
UTL_RAW.CAST_TO_BINARY_INTEGER (r IN RAW, endianess in PLS_INTEGER DEFAULT BIG_
ENDIAN) RETURN BINARY_INTEGER;
```

Pragmas

```
pragma restrict_references(cast_to_binary_integer, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r, the binary representation of a BINARY_INTEGER

endianess, a PLS_INTEGER representing big-endian or little-endian architecture. The default is big-endian.

Returns

The BINARY_INTEGER value

CAST_TO_NUMBER Function

This function casts the binary representation of a NUMBER (in RAW) into a NUMBER. If include_length is TRUE, the first byte of r encodes the number of bytes in r (not including the length byte) which are valid, up to a maximum of 21 bytes plus the length byte.

Syntax

```
UTL_RAW.CAST_TO_NUMBER (r IN RAW, include_length IN BOOLEAN) RETURN NUMBER;
```

Pragmas

```
pragma restrict_references(cast_to_number, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r, the binary representation of a NUMBER

Returns

The NUMBER value.

CAST_TO_RAW Function

This function converts a VARCHAR2 represented using n data bytes into a RAW with n data bytes. The data is not modified in any way; only its datatype is recast to a RAW datatype.

Syntax

```
UTL_RAW.CAST_TO_RAW (
   c IN VARCHAR2)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(cast_to_raw, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–2 CAST_TO_RAW Function Parameters

Parameter	Description
c	VARCHAR2 to be changed to a RAW.

Returns

Table 80–3 CAST_TO_RAW Function Returns

Return	Description
RAW	Containing the same data as the input VARCHAR2 and equal byte length as the input VARCHAR2 and without a leading length field.
NULL	If c input parameter was NULL.

CAST_TO_VARCHAR2 Function

This function converts a RAW represented using n data bytes into VARCHAR2 with n data bytes.

> **Note:** When casting to a VARCHAR2, the current NLS character set is used for the characters within that VARCHAR2.

Syntax

```
UTL_RAW.CAST_TO_VARCHAR2 (
   r IN RAW)
  RETURN VARCHAR2;
```

Pragmas

```
pragma restrict_references(cast_to_varchar2, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–4 CAST_TO_VARCHAR2 Function Parameters

Parameter	Description
r	RAW (without leading length field) to be changed to a VARCHAR2).

Returns

Table 80–5 CAST_TO_VARCHAR2 Function Returns

Return	Description
VARCHAR2	Containing having the same data as the input RAW.
NULL	If r input parameter was NULL.

CONCAT Function

This function concatenates up to 12 RAWs into a single RAW. If the concatenated size exceeds 32K, then an error is returned

Syntax

```
UTL_RAW.CONCAT (
   r1  IN RAW DEFAULT NULL,
   r2  IN RAW DEFAULT NULL,
   r3  IN RAW DEFAULT NULL,
   r4  IN RAW DEFAULT NULL,
   r5  IN RAW DEFAULT NULL,
   r6  IN RAW DEFAULT NULL,
   r7  IN RAW DEFAULT NULL,
   r8  IN RAW DEFAULT NULL,
   r9  IN RAW DEFAULT NULL,
   r10 IN RAW DEFAULT NULL,
   r11 IN RAW DEFAULT NULL,
   r12 IN RAW DEFAULT NULL)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(concat, WNDS, RNDS, WNPS, RNPS);
```

Parameters

r1....r12 are the RAW items to concatenate.

Returns

Table 80–6 CONCAT Function Returns

Return	Description
RAW	Containing the items concatenated.

Errors

There is an error if the sum of the lengths of the inputs exceeds the maximum allowable length for a RAW, which is 32767 bytes.

LENGTH Function

This function returns the length in bytes of a RAW r.

Syntax

```
UTL_RAW.LENGTH (
   r IN RAW)
  RETURN NUMBER;
```

Pragmas

```
pragma restrict_references(length, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–7 LENGTH Function Parameters

Parameter	Description
r	The RAW byte stream to be measured.

Returns

Table 80–8 LENGTH Function Returns

Return	Description
NUMBER	Equal to the current length of the RAW.

SUBSTR Function

This function returns len bytes, starting at pos from RAW r.

Syntax

```
UTL_RAW.SUBSTR (
   r   IN RAW,
   pos IN BINARY_INTEGER,
   len IN BINARY_INTEGER DEFAULT NULL)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(substr, WNDS, RNDS, WNPS, RNPS);
```

Parameters

If pos is positive, then SUBSTR counts from the beginning of r to find the first byte. If pos is negative, then SUBSTR counts backwards from the end of the r. The value pos cannot be 0.

If len is omitted, then SUBSTR returns all bytes to the end of r. The value len cannot be less than 1.

Table 80–9 SUBSTR Function Parameters

Parameter	Description
r	The RAW byte-string from which a portion is extracted.
pos	The byte position in r at which to begin extraction.
len	The number of bytes from pos to extract from r (optional).

Defaults and Optional Parameters

Table 80–10 SUBSTR Function Exceptions

Optional Parameter	Description
len	Position pos through to the end of r.

Returns

Table 80–11 SUBSTR Function Returns

Return	Description
portion of r	Beginning at pos for len bytes long.
NULL	R input parameter was NULL.

Errors

Table 80–12 SUBSTR Function Errors

Error	Description
VALUE_ERROR	Either pos = 0 or len < 0

TRANSLATE Function

This function translates the bytes in the input RAW r according to the bytes in the translation RAWs from_set and to_set. If a byte in r has a matching byte in from_set, then it is replaced by the byte in the corresponding position in to_set, or deleted.

Bytes in r, but undefined in from_set, are copied to the result. Only the first (leftmost) occurrence of a byte in from_set is used. Subsequent duplicates are not scanned and are ignored. If to_set is shorter than from_set, then the extra from_set bytes have no translation correspondence and any bytes in r matching.

Note: Difference from TRANSLITERATE:

- Translation RAWs have no defaults.

- r bytes undefined in the to_set translation RAW are deleted.

- Result RAW may be shorter than input RAW r.

Syntax

```
UTL_RAW.TRANSLATE (
   r        IN RAW,
   from_set IN RAW,
   to_set   IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(translate, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–13 TRANSLATE Function Parameters

Parameter	Description
r	RAW source byte-string to be translated.
from_set	RAW byte-codes to be translated, if present in r.
to_set	RAW byte-codes to which corresponding from_str bytes are translated.

Returns

Table 80–14 TRANSLATE Function Returns

Return	Description
RAW	Translated byte-string.

Errors

Table 80–15 TRANSLATE Function Errors

Error	Description
VALUE_ERROR	Either: - r is NULL and / or has 0 length - from_set is NULL and / or has 0 length - to_set is NULL and / or has 0 length

TRANSLITERATE Function

This function converts the bytes in the input RAW r according to the bytes in the transliteration RAWs from_set and to_set. Successive bytes in r are looked up in the from_set, and, if not found, copied unaltered to the result RAW. If found, then they are replaced in the result RAW by either corresponding bytes in the to_set, or the pad byte when no correspondence exists.

Bytes in r, but undefined in from_set, are copied to the result. Only the first (leftmost) occurrence of a byte in from_set is used. Subsequent duplicates are not scanned and are ignored. The result RAW is always the same length as r.

If the to_set is shorter than the from_set, then the pad byte is placed in the result RAW when a selected from_set byte has no corresponding to_set byte (as if the to_set were extended to the same length as the from_set with pad bytes).

Note: Difference from TRANSLATE:

- r bytes undefined in to_set are padded.

- Result RAW is always same length as input RAW r.

Syntax

```
UTL_RAW.TRANSLITERATE (
   r        IN RAW,
   to_set   IN RAW DEFAULT NULL,
   from_set IN RAW DEFAULT NULL,
   pad      IN RAW DEFAULT NULL)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(transliterate, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–16 TRANSLITERATE Function Parameters

Parameter	Description
r	RAW input byte-string to be converted.
from_set	RAW byte-codes to be converted, if present in r (any length).
to_set	RAW byte-codes to which corresponding from_set bytes are converted (any length).
pad	1 byte used when to-set is shorter than the from_set.

Defaults and Optional Parameters

Table 80–17 TRANSLITERATE Function Optional Parameters

Optional Parameter	Description
from_set	x'00 through x'ff.
to_set	To the NULL string and effectively extended with pad to the length of from_set as necessary.
pad	x'00'.

Returns

Table 80–18 TRANSLITERATE Function Returns

Return	Description
RAW	Converted byte-string.

Errors

Table 80–19 TRANSLITERATE Function Errors

Error	Description
VALUE_ERROR	R is NULL and / or has 0 length.

OVERLAY Function

This function overlays the specified portion of target RAW with overlay RAW, starting from byte position pos of target and proceeding for len bytes.

If overlay has less than len bytes, then it is extended to len bytes using the pad byte. If overlay exceeds len bytes, then the extra bytes in overlay are ignored. If len bytes beginning at position pos of target exceeds the length of target, then target is extended to contain the entire length of overlay.

len, if specified, must be greater than, or equal to, 0. pos, if specified, must be greater than, or equal to, 1. If pos exceeds the length of target, then target is padded with pad bytes to position pos, and target is further extended with overlay bytes.

Syntax

```
UTL_RAW.OVERLAY (
   overlay_str IN RAW,
   target      IN RAW,
   pos         IN BINARY_INTEGER DEFAULT 1,
   len         IN BINARY_INTEGER DEFAULT NULL,
   pad         IN RAW            DEFAULT NULL)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(overlay, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–20 OVERLAY Function Parameters

Parameters	Description
overlay_str	Byte-string used to overlay target.
target	Byte-string which is to be overlayed.
pos	Position in target (numbered from 1) to start overlay.
len	The number of target bytes to overlay.
pad	Pad byte used when overlay len exceeds overlay length or pos exceeds target length.

Defaults and Optional Parameters

Table 80–21 OVERLAY Function Optional Parameters

Optional Parameter	Description
pos	1
len	To the length of overlay
pad	x'00'

Returns

Table 80–22 OVERLAY Function Returns

Return	Description
RAW	The target byte_string overlayed as specified.

Errors

Table 80–23 OVERLAY Function Errors

Error	Description
VALUE_ERROR	Either: - Overlay is NULL and / or has 0 length - Target is missing or undefined - Length of target exceeds maximum length of a RAW - len < 0 - pos < 1

COPIES Function

This function returns n copies of r concatenated together.

Syntax

```
UTL_RAW.COPIES (
   r IN RAW,
   n IN NUMBER)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(copies, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–24 COPIES Function Parameters

Parameters	Description
r	RAW to be copied
n	Number of times to copy the RAW (must be positive).

Returns

This returns the RAW copied n times.

Errors

Table 80–25 COPIES Function Errors

Error	Description
VALUE_ERROR	Either: - r is missing, NULL and / or 0 length - n < 1 - Length of result exceeds maximum length of a RAW

XRANGE Function

This function returns a RAW containing all valid 1-byte encodings in succession, beginning with the value start_byte and ending with the value end_byte. If start_byte is greater than end_byte, then the succession of resulting bytes begins with start_byte, wraps through 'FF'x to '00'x, and ends at end_byte. If specified, start_byte and end_byte must be single byte RAWs.

Syntax

```
UTL_RAW.XRANGE (
   start_byte IN RAW DEFAULT NULL,
   end_byte   IN RAW DEFAULT NULL)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(xrange, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–26 XRANGE Function Parameters

Parameters	Description
start_byte	Beginning byte-code value of resulting sequence.
end_byte	Ending byte-code value of resulting sequence.

Defaults and Optional Parameters

```
start_byte - x'00'
start_byte - x'00'
end_byte   - x'FF'
```

Returns

Table 80–27 XRANGE Function Returns

Return	Description
RAW	Containing succession of 1-byte hexadecimal encodings.

REVERSE Function

This function reverses a byte sequence in RAW r from end to end. For example, x'0102F3' would be reversed to x'F30201', and 'xyz' would be reversed to 'zyx'.The result length is the same as the input RAW length.

Syntax

```
UTL_RAW.REVERSE (
   r IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(reverse, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–28 REVERSE Function Parameters

Parameter	Description
r	RAW to reverse.

Returns

Table 80–29 REVERSE Function Returns

Return	Description
RAW	Containing the "reverse" of r.

Errors

Table 80–30 REVERSE Function Errors

Error	Description
VALUE_ERROR	R is NULL and / or has 0 length.

COMPARE Function

This function compares RAW r1 against RAW r2. If r1 and r2 differ in length, then the shorter RAW is extended on the right with pad if necessary.

Syntax

```
UTL_RAW.COMPARE (
   r1  IN RAW,
   r2  IN RAW,
   pad IN RAW DEFAULT NULL)
  RETURN NUMBER;
```

Pragmas

```
pragma restrict_references(compare, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–31 COMPARE Function Parameters

Parameter	Description
r1	1st RAW to be compared, may be NULL and / or 0 length.
r2	2nd RAW to be compared, may be NULL and / or 0 length.
pad	Byte to extend whichever of r1 or r2 is shorter.

Defaults and optional parameters

pad - x'00'

Returns

Table 80–32 COMPARE Function Returns

Return	Description
NUMBER	Equals 0 if RAW byte strings are both NULL or identical; or, Equals position (numbered from 1) of the first mismatched byte.

CONVERT Function

This function converts RAW r from character set from_charset to character set to_charset and returns the resulting RAW.

Both from_charset and to_charset must be supported character sets defined to the Oracle server.

Syntax

```
UTL_RAW.CONVERT (
   r            IN RAW,
   to_charset   IN VARCHAR2,
   from_charset IN VARCHAR2)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(convert, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–33 CONVERT Function Parameters

Parameter	Description
r	RAW byte-string to be converted.
to_charset	Name of NLS character set to which r is converted.
from_charset	Name of NLS character set in which r is supplied.

Returns

Table 80–34 CONVERT Function Returns

Return	Description
RAW	Byte string r converted according to the specified character sets.

Errors

Table 80–35 CONVERT Function Errors

Error	Description
VALUE_ERROR	Either: - r missing, NULL, and / or 0 length - from_charset or to_charset missing, NULL, and / or 0 length - from_charset or to_charset names invalid or unsupported

BIT_AND Function

This function performs bitwise logical "and" of the values in RAW r1 with RAW r2 and returns the "anded" result RAW.

If r1 and r2 differ in length, the and operation is terminated after the last byte of the shorter of the two RAWs, and the unprocessed portion of the longer RAW is appended to the partial result. The result length equals the longer of the two input RAWs.

Syntax

```
UTL_RAW.BIT_AND (
   r1 IN RAW,
```

```
   r2 IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_and, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–36 BIT_AND Function Parameters

Parameter	Description
r1	RAW to "and" with r2.
r2	RAW to "and" with r1.

Returns

Table 80–37 BIT_AND Function Returns

Return	Description
RAW	Containing the "and" of r1 and r2.
NULL	Either r1 or r2 input parameter was NULL.

BIT_OR Function

This function performs bitwise logical "or" of the values in RAW r1 with RAW r2 and returns the or'd result RAW.

If r1 and r2 differ in length, then the "or" operation is terminated after the last byte of the shorter of the two RAWs, and the unprocessed portion of the longer RAW is appended to the partial result. The result length equals the longer of the two input RAWs.

Syntax

```
UTL_RAW.BIT_OR (
   r1 IN RAW,
   r2 IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_or, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–38 BIT_OR Function Parameters

Parameters	Description
r1	RAW to "or" with r2.
r2	RAW to "or" with r1.

Returns

Table 80–39 BIT_OR Function Returns

Return	Description
RAW	Containing the "or" of r1 and r2.
NULL	Either r1 or r2 input parameter was NULL.

BIT_XOR Function

This function performs bitwise logical "exclusive or" of the values in RAW r1 with RAW r2 and returns the xor'd result RAW.

If r1 and r2 differ in length, then the "xor" operation is terminated after the last byte of the shorter of the two RAWs, and the unprocessed portion of the longer RAW is appended to the partial result. The result length equals the longer of the two input RAWs.

Syntax

```
UTL_RAW.BIT_XOR (
   r1 IN RAW,
   r2 IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_xor, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–40 BIT_XOR Function Parameters

Parameter	Description
r1	RAW to "xor" with r2.
r2	RAW to "xor" with r1.

Returns

Table 80–41 BIT_XOR Function Returns

Return	Description
RAW	Containing the "xor" of r1 and r2.
NULL	If either r1 or r2 input parameter was NULL.

BIT_COMPLEMENT Function

This function performs bitwise logical "complement" of the values in RAW r and returns the complement'ed result RAW. The result length equals the input RAW r length.

Syntax

```
UTL_RAW.BIT_COMPLEMENT (
   r IN RAW)
  RETURN RAW;
```

Pragmas

```
pragma restrict_references(bit_complement, WNDS, RNDS, WNPS, RNPS);
```

Parameters

Table 80–42 BIT_COMPLEMENT Function Parameters

Parameter	Description
r	RAW to perform "complement" operation.

Returns

Table 80–43 BIT_COMPLEMENT Function Returns

Return	Description
RAW	The "complement" of r1.
NULL	If r input parameter was NULL.

81

UTL_REF

Oracle8*i* supports user-defined composite type or object type. Any instance of an object type is called an object. An object type can be used as the type of a column or as the type of a table.

In an object table, each row of the table stores an object. You can uniquely identify an object in an object table with an object identifier.

A reference is a persistent pointer to an object, and each reference can contain an object identifier. The reference can be an attribute of an object type, or it can be stored in a column of a table. Given a reference, an object can be retrieved.

The UTL_REF package provides PL/SQL procedures to support reference-based operations. Unlike SQL, UTL_REF procedures enable you to write generic type methods without knowing the object table name.

This chapter discusses the following topics:

Requirements

The procedural option is needed to use this package. This package must be created under SYS (connect internal). Operations provided by this package are performed under the current calling user, not under the package owner SYS.

Datatypes, Exceptions, and Security for UTL_REF

Datatypes

An object type is a composite datatype defined by the user or supplied as a library type. You can create the object type `employee_type` using the following syntax:

```
CREATE TYPE employee_type AS OBJECT (
    name    VARCHAR2(20),
    id      NUMBER,

    member function GET_ID
        (name VARCHAR2)
       RETURN MEMBER);
```

The object type `employee_type` is a user-defined type that contains two attributes, `name` and `id`, and a member function, `GET_ID`().

You can create an object table using the following SQL syntax:

```
CREATE TABLE employee_table OF employee_type;
```

Exceptions

Exceptions can be returned during execution of `UTL_REF` functions for various reasons. For example, the following scenarios would result in exceptions:

- The object selected does not exist. This could be because either:
  1. The object has been deleted, or the given reference is dangling (invalid).
  2. The object table was dropped or does not exist.
- The object cannot be modified or locked in a serializable transaction. The object was modified by another transaction after the serializable transaction started.
- You do not have the privilege to select or modify the object. The caller of the `UTL_REF` subprogram must have the proper privilege on the object that is being selected or modified.

Table 81–1 UTL_REF Exceptions

Exceptions	Description
`errnum == 942`	Insufficient privileges.
`errnum == 1031`	Insufficient privileges.
`errnum == 8177`	Unable to serialize, if in a serializable transaction.
`errnum == 60`	Deadlock detected.
`errnum == 1403`	No data found (if the REF is null, etc.).

The UTL_REF package does not define any named exceptions. You may define exception handling blocks to catch specific exceptions and to handle them appropriately.

Security

You can use the UTL_REF package from stored PL/SQL procedures/packages on the server, as well as from client/side PL/SQL code.

When invoked from PL/SQL procedures/packages on the server, UTL_REF verifies that the invoker has the appropriate privileges to access the object pointed to by the REF.

> **Note:** This is in contrast to PL/SQL packages/procedures on the server which operate with definer's privileges, where the package owner must have the appropriate privileges to perform the desired operations.

Thus, if UTL_REF is defined under user SYS, and user A invokes UTL_REF.SELECT to select an object from a reference, then user A (the invoker) requires the privileges to check.

When invoked from client-side PL/SQL code, UTL_REF operates with the privileges of the client session under which the PL/SQL execution is being done.

Summary of UTL_REF Subprograms

Table 81–2 UTL_REF Subprograms

Subprogram	Description
"SELECT_OBJECT Procedure" on page 81-4	Selects an object given a reference.
"LOCK_OBJECT Procedure" on page 81-5	Locks an object given a reference.
"UPDATE_OBJECT Procedure" on page 81-6	Updates an object given a reference.
"DELETE_OBJECT Procedure" on page 81-6	Deletes an object given a reference.

SELECT_OBJECT Procedure

This procedure selects an object given its reference. The selected object is retrieved from the database and its value is put into the PL/SQL variable 'object'. The semantic of this subprogram is similar to the following SQL statement:

```
SELECT VALUE(t)
INTO object
FROM object_table t
WHERE REF(t) = reference;
```

Unlike the above SQL statement, this subprogram does not require you to specify the object table name where the object resides.

Syntax

```
UTL_REF.SELECT_OBJECT (
   reference IN REF "<typename>",
   object    IN OUT "<typename>");
```

Parameters

Table 81–3 SELECT_OBJECT Procedure Parameters

Parameter	Description
reference	Reference to the object to select or retrieve.
object	The PL/SQL variable that stores the selected object; this variable should be of the same object type as the referenced object.

Exceptions

May be raised.

LOCK_OBJECT Procedure

This procedure locks an object given a reference. In addition, this procedure lets the program select the locked object. The semantic of this subprogram is similar to the following SQL statement:

```
SELECT VALUE(t)
  INTO object
  FROM object_table t
  WHERE REF(t) = reference
  FOR UPDATE;
```

Unlike the above SQL statement, this subprogram does not require you to specify the object table name where the object resides. It is not necessary to lock an object before updating / deleting it.

Syntax

```
UTL_REF.LOCK_OBJECT (
   reference IN REF "<typename>");

UTL_REF.LOCK_OBJECT (
   reference IN REF "<typename>",
   object    IN OUT "<typename>");
```

Parameters

Table 81–4 LOCK_OBJECT Procedure Parameters

Parameter	Description
reference	Reference of the object to lock.
object	The PL / SQL variable that stores the locked object. This variable should be of the same object type as the locked object.

Exceptions

May be raised.

UPDATE_OBJECT Procedure

This procedure updates an object given a reference. The referenced object is updated with the value contained in the PL/SQL variable 'object'. The semantic of this subprogram is similar to the following SQL statement:

```
UPDATE object_table t
SET VALUE(t) = object
WHERE REF(t) = reference;
```

Unlike the above SQL statement, this subprogram does not require you to specify the object table name where the object resides.

Syntax

```
UTL_REF.UPDATE_OBJECT (
   reference IN REF "<typename>",
   object    IN     "<typename>");
```

Parameters

Table 81–5 UPDATE_OBJECT Procedure Parameters

Parameter	Description
reference	Reference of the object to update.
object	The PL/SQL variable that contains the new value of the object. This variable should be of the same object type as the object to update.

Exceptions

May be raised.

DELETE_OBJECT Procedure

This procedure deletes an object given a reference. The semantic of this subprogram is similar to the following SQL statement:

```
DELETE FROM object_table
WHERE REF(t) = reference;
```

Unlike the above SQL statement, this subprogram does not require you to specify the object table name where the object resides.

Syntax

```
UTL_REF.DELETE_OBJECT (
   reference IN REF "<typename>");
```

Parameters

Table 81–6 DELETE_OBJECT Procedure Parameters

Parameter	Description
reference	Reference of the object to delete.

Exceptions

May be raised.

Example

The following example illustrates usage of the UTL_REF package to implement this scenario: if an employee of a company changes their address, their manager should be notified.

... declarations of Address_t and others...

```
CREATE OR REPLACE TYPE Person_t (
    name    VARCHAR2(64),
    gender  CHAR(1),
    address Address_t,
    MEMBER PROCEDURE setAddress(addr IN Address_t)
);

CREATE OR REPLACE TYPE BODY Person_t (
    MEMBER PROCEDURE setAddress(addr IN Address_t) IS
    BEGIN
        address := addr;
    END;
);

CREATE OR REPLACE TYPE Employee_t (
```

Under Person_t: Simulate implementation of inheritance using a REF to Person_t and delegation of setAddress to it.

```
    thePerson  REF Person_t,
    empno      NUMBER(5),
```

```
    deptREF    Department_t,
    mgrREF     Employee_t,
    reminders  StringArray_t,
    MEMBER PROCEDURE setAddress(addr IN Address_t),
    MEMBER procedure addReminder(reminder VARCHAR2);
);

CREATE TYPE BODY Employee_t (
    MEMBER PROCEDURE setAddress(addr IN Address_t) IS
        myMgr Employee_t;
        meAsPerson Person_t;
    BEGIN
```

Update the address by delegating the responsibility to `thePerson`. Lock the Person object from the reference, and also select it:

```
        UTL_REF.LOCK_OBJECT(thePerson, meAsPerson);
        meAsPerson.setAddress(addr);
```

Delegate to `thePerson`:

```
        UTL_REF.UPDATE_OBJECT(thePerson, meAsPerson);
        if mgr is NOT NULL THEN
```

Give the manager a reminder:

```
            UTL_REF.LOCK_OBJECT(mgr);
            UTL_REF.SELECT_OBJECT(mgr, myMgr);
            myMgr.addReminder
            ('Update address in the employee directory for' ||
            thePerson.name || ', new address: ' || addr.asString);
            UTL_REF.UPDATE_OBJECT(mgr, myMgr);
        END IF;
    EXCEPTION
        WHEN OTHERS THEN
        errnum := SQLCODE;
        errmsg := SUBSTR(SQLERRM, 1, 200);
```

82

UTL_SMTP

UTL_SMTP is designed for sending e-mail over Simple Mail Transfer Protocol (SMTP). It does not have the functionality to implement an SMTP server for mail clients to send e-mail using SMTP.

Many interfaces to the SMTP package appear as both a function and a procedure. The functional form returns the reply from the server for processing by the client. The procedural form discards the reply but raises an exception if the reply indicates a transient (400-range reply code) or permanent error (500-range reply code).

Note that the original SMTP protocol communicates using 7-bit ASCII. Using UTL_SMTP, all text data (in other words, those in VARCHAR2) will be converted to US7ASCII before it is sent over the wire to the server. Some implementations of SMTP servers that support SMTP extension 8BITMIME [RFC1652] support full 8-bit communication between client and server.

The body of the DATA command may be transferred in full 8 bits, but the rest of the SMTP command and response should be in 7 bits. When the target SMTP server supports 8BITMIME extension, users of multibyte databases may convert their non-US7ASCII, multibyte VARCHAR2 data to RAW and use the write_raw_data() API to send multibyte data using 8-bit MIME encoding.

Also, note that UTL_SMTP provides API for SMTP communication as specified in RFC821. The package does not provide API to format the content of the message according to RFC 822 (for example, setting the subject of an electronic mail). It is the user's responsibility to format the message appropriately.

This chapter discusses the following topics:

- Example
- Exceptions, Limitations, and Reply Codes

- Summary of UTL_SMTP Subprograms

Note : RFC documents are "Request for Comments" documents that describe proposed standards for public review on the Internet. For the actual RFC documents, please refer to:

`http://www.ietf.org/rfc/`

Example

The following example illustrates how UTL_SMTP is used by an application to send e-mail. The application connects to an SMTP server at port 25 and sends a simple text message.

```
UTL_SMTP.send_mail (
    sender      IN VARCHAR2,
    recipient   IN VARCHAR2,
    message     IN VARCHAR2)
IS
    mailhost    VARCHAR2(30) := 'mailhost.mydomain.com';
    mail_conn   utl_smtp.connection;
BEGIN
    mail_conn := utl_smtp.open_connection(mailhost, 25);
    utl_smtp.helo(mail_conn, mailhost);
    utl_smtp.mail(mail_conn, sender);
    utl_smtp.rcpt(mail_conn, recipient);
    utl_smtp.data(mail_conn, message);
    utl_smtp.quit(mail_conn);
EXCEPTION
    WHEN OTHERS THEN
        -- Handle the error
END;
```

Exceptions, Limitations, and Reply Codes

Exceptions

Table 82–1 lists the exceptions that can be raised by the API of the UTL_SMTP package. The network error is transferred to a reply code of 421- service not available.

Table 82–1 UTL_SMTP Exceptions

Exception	Description
INVALID_OPERATION	Raised when an invalid operation is made. In other words, calling API other than write_data(), write_raw_data() or close_data() after open_data() is called, or calling write_data(), write_raw_data() or close_data() without first calling open_data().
TRANSIENT_ERROR	Raised when receiving a reply code in 400 range.
PERMANENT_ERROR	Raised when receiving a reply code in 500 range.

Limitations

No limitation or range-checking is imposed by the API. However, you should be aware of the following size limitations on various elements of SMTP. Sending data that exceed these limits may result in errors returned by the server.

Table 82–2 SMTP Size Limitation

Element	Size Limitation
user	The maximum total length of a user name is 64 characters.
domain	The maximum total length of a domain name or number is 64 characters.
path	The maximum total length of a reverse-path or forward-path is 256 characters (including the punctuation and element separators).
command line	The maximum total length of a command line including the command word and the <CRLF> is 512 characters.
reply line	The maximum total length of a reply line including the reply code and the <CRLF> is 512 characters.
text line	The maximum total length of a text line including the <CRLF> is 1000 characters (but not counting the leading dot duplicated for transparency).
recipients buffer	The maximum total number of recipients that must be buffered is 100 recipients.

Reply Codes

The following is a list of the SMTP reply codes.

Table 82–3 SMTP Reply Codes

Reply Code	Meaning
211	System status, or system help reply
214	Help message [Information on how to use the receiver or the meaning of a particular non-standard command; this reply is useful only to the human user]
220	<domain> Service ready
221	<domain> Service closing transmission channel
250	Requested mail action okay, completed
251	User not local; will forward to <forward-path>

Table 82–3 SMTP Reply Codes

Reply Code	Meaning
252	OK, pending messages for node <node> started. Cannot VRFY user (e.g., info is not local), but will take message for this user and attempt delivery.
253	OK, <messages> pending messages for node <node> started
354	Start mail input; end with <CRLF>.<CRLF>
355	Octet-offset is the transaction offset
421	<domain> Service not available, closing transmission channel (This may be a reply to any command if the service knows it must shut down.)
450	Requested mail action not taken: mailbox unavailable [for example, mailbox busy]
451	Requested action aborted: local error in processing
452	Requested action not taken: insufficient system storage
453	You have no mail.
454	TLS not available due to temporary reason. Encryption required for requested authentication mechanism.
458	Unable to queue messages for node <node>
459	Node <node> not allowed: reason
500	Syntax error, command unrecognized (This may include errors such as command line too long.)
501	Syntax error in parameters or arguments
502	Command not implemented
503	Bad sequence of commands
504	Command parameter not implemented
521	<Machine> does not accept mail.
530	Must issue a STARTTLS command first. Encryption required for requested authentication mechanism.
534	Authentication mechanism is too weak.
538	Encryption required for requested authentication mechanism.
550	Requested action not taken: mailbox unavailable [for example, mailbox not found, no access]

Table 82–3 SMTP Reply Codes

Reply Code	Meaning
551	User not local; please try <forward-path>
552	Requested mail action aborted: exceeded storage allocation
553	Requested action not taken: mailbox name not allowed [for example, mailbox syntax incorrect]
554	Transaction failed

Summary of UTL_SMTP Subprograms

Table 82–4 UTL_SMTP Subprograms

Subprogram	Description
"connection Record Type" on page 82-7	This is a PL/SQL record type used to represent a SMTP connection.
"reply, replies Record Types" on page 82-8	PL/SQL record types used to represent an SMTP reply line.
"open_connection Function" on page 82-9	Opens a connection to an SMTP server.
"command(), command_replies() Functions" on page 82-10	Performs a generic SMTP command.
"helo Function" on page 82-10	Performs initial handshaking with SMTP server after connecting.
"ehlo Function" on page 82-11	Performs initial handshaking with SMTP server after connecting, with extended information returned.
"mail Function" on page 82-12	Initiates a mail transaction with the server. The destination is a mailbox.
"rcpt Function" on page 82-13	Specifies the recipient of an e-mail message.
"data Function" on page 82-14	Specifies the body of an e-mail message.
"open_data(), write_data(), write_raw_data(), close_data() Functions" on page 82-15	Provide more fine-grain control to the data() API.

Table 82–4 UTL_SMTP Subprograms (Cont.)

Subprogram	Description
"rset Function" on page 82-17	Aborts the current mail transaction.
"vrfy Function" on page 82-18	Verifies the validity of a destination e-mail address.
"noop() Function" on page 82-18	The null command.
"quit Function" on page 82-19	Terminates an SMTP session and disconnects from the server.

connection Record Type

This is a PL/SQL record type used to represent an SMTP connection.

Syntax

```
TYPE connection IS RECORD (
    host              VARCHAR2(255),      -- remote host name
    port              PLS_INTEGER,        -- remote port number
    tx_timeout        PLS_INTEGER,        -- Transfer time-out (in seconds)
    private_tcp_con   utl_tcp.connection, -- private, for implementation use
    private_state     PLS_INTEGER         -- private, for implementation use
);
```

Fields

Table 82–5 connection Record Type Fields

Field	Description
`host`	The name of the remote host when connection is established. `NULL` when no connection is established.
`port`	The port number of the remote SMTP server connected. `NULL` when no connection is established.
`tx_timeout`	The time in seconds that the `UTL_SMTP` package waits before giving up in a read or write operation in this connection. In read operations, this package gives up if no data is available for reading immediately. In write operations, this package gives up if the output buffer is full and no data is to be sent into the network without being blocked. `0` indicates not to wait at all. `NULL` indicates to wait forever.

Table 82–5 connection Record Type Fields

Field	Description
private_tcp_con	Private, for implementation use only. You should not modify this field.
private_state	Private, for implementation use only. You should not modify this field.

Usage Notes

The read-only fields in a connection record are used to return information about the SMTP connection after the connection is successfully made with open_connection(). Changing the values of these fields has no effect on the connection. The fields private_xxx are for implementation use only. You should not modify these fields.

reply, replies Record Types

These are PL/SQL record types used to represent an SMTP reply line. Each SMTP reply line consists of a reply code followed by a text message. While a single reply line is expected for most SMTP commands, some SMTP commands expect multiple reply lines. For those situations, a PL/SQL table of reply records is used to represent multiple reply lines.

Syntax

```
TYPE reply IS RECORD (
  code    PLS_INTEGER,       -- 3-digit reply code
  text    VARCHAR2(508)      -- text message
);
TYPE replies IS TABLE OF reply INDEX BY BINARY_INTEGER;   -- multiple reply
lines
```

Fields

Table 82–6 reply, replies Record Type Fields

Field	Description
code	The 3-digit reply code.
text	The text message of the reply.

open_connection Function

This function opens a connection to an SMTP server.

Syntax

```
UTL_SMTP.OPEN_CONNECTION (
    host        IN  VARCHAR2,
    port        IN  PLS_INTEGER DEFAULT 25,
    c           OUT connection,
    tx_timeout  IN  PLS_INTEGER DEFAULT NULL)
RETURN reply;
UTL_SMTP.OPEN_+CONNECTION (
    host        IN  VARCHAR2,
    port        IN  PLS_INTEGER DEFAULT 25,
    tx_timeout  IN  PLS_INTEGER DEFAULT NULL)
RETURN connection;
```

Parameters

Table 82–7 open_connection Function Parameters

Parameter	Description
`host (IN)`	The name of the SMTP server host
`port (IN)`	The port number on which SMTP server is listening (usually 25).
`tx_timeout (IN)`	The time in seconds that the `UTL_SMTP` package waits before giving up in a read or write operation in this connection. In read operations, this package gives up if no data is available for reading immediately. In write operations, this package gives up if the output buffer is full and no data is to be sent into the network without being blocked. `0` indicates not to wait at all. `NULL` indicates to wait forever.

Usage Notes

The expected response from the server is a message beginning with status code 220.

The version of `open_connection()` API that returns `utl_smtp.connection` record is actually the procedure version of `open_connection` that checks the reply code returned by an SMTP server when the connection is first established.

A timeout on the write operations feature is not supported in the current release of this package.

command(), command_replies() Functions

These functions perform generic SMTP commands.

Syntax

```
UTL_SMTP.COMMAND (
    c    IN connection,
    cmd  IN VARCHAR2,
    arg  IN VARCHAR2 DEFAULT NULL)
RETURN reply;
UTL_SMTP.COMMAND (
    c    IN connection,
    cmd  IN VARCHAR2,
    arg  IN ARCHAR2 DEFAULT NULL);
UTL_SMTP.COMMAND_REPLIES (
    c    IN connection,
    cmd  IN VARCHAR2,
    arg  IN VARCHAR2 DEFAULT NULL)
RETURN replies;
```

Parameters

Table 82–8 command (), command_replies () Function Parameters

Parameter	Description
c (IN)	The SMTP connection.
cmd (IN)	The SMTP command to send to the server.
arg (IN)	The optional argument to the SMTP argument. A space will be inserted between cmd and arg.

Usage Notes

These are the APIs used to invoke generic SMTP commands. Use command() if only a single reply line is expected. Use command_replies() if multiple reply lines are expected (in other words, EXPN or HELP).

For command(), if multiple reply lines are returned from the SMTP server, it returns the last reply line only.

helo Function

This function performs initial handshaking with SMTP server after connecting.

Syntax

```
UTL_SMTP.HELO (
    c  IN NOCOPY connection, domain IN NOCOPY)
RETURN reply;
UTL_SMTP.HELO (
    c  IN NOCOPY connection, domain IN NOCOPY);
```

Parameters

Table 82–9 helo Function Parameters

Parameter	Description
`c (IN NOCOPY)`	The SMTP connection.
`domain (IN NOCOPY)`	The domain name of the local (sending) host. Used for identification purposes.

Usage Notes

RFC 821 specifies that the client must identify itself to the server after connecting. This routine performs that identification. The connection must have been opened via a call to `open_connection()` before calling this routine.

The expected response from the server is a message beginning with status code 250.

Related Functions

`ehlo()`

ehlo Function

This function performs initial handshaking with SMTP server after connecting, with extended information returned.

Syntax

```
UTL_SMTP.EHLO (
    c       IN OUT NOCOPY connection,
    domain  IN NOCOPY)
RETURN replies;
UTL_SMTP.EHLO (
    c       IN OUT NOCOPY connection,
    domain  IN NOCOPY);
```

Parameters

Table 82–10 ehlo Function Parameters

Parameter	Description
c (IN NOCOPY)	The SMTP connection.
domain (IN NOCOPY)	The domain name of the local (sending) host. Used for identification purposes.

Usage Notes

The ehlo() interface is identical to helo(), except that it allows the server to return more descriptive information about its configuration. [RFC1869] specifies the format of the information returned, which the PL/SQL application can retrieve using the functional form of this call. For compatibility with helo(), each line of text returned by the server begins with status code 250.

Related Functions

helo()

mail Function

This function initiates a mail transaction with the server. The destination is a mailbox.

Syntax

```
UTL_SMTP.MAIL (
   c           IN OUT NOCOPY connection,
   sender      IN OUT NOCOPY,
   parameters  IN OUT NOCOPY)
RETURN reply;
UTL_SMTP.MAIL (
   c           IN OUT NOCOPY connection,
   sender      IN OUT NOCOPY,
   parameters  IN OUT NOCOPY);
```

Parameters

Table 82–11 Mail Function Parameters

Parameter	Description
`c (IN NOCOPY)`	The SMTP connection.
`sender (IN OUT NOCOPY)`	The e-mail address of the user sending the message.
`parameters (IN OUT NOCOPY)`	The additional parameters to MAIL command as defined in Section 6 of [RFC1869]. It should follow the format of "XXX=XXX (XXX=XXX ....)".

Usage Notes

This command does not send the message; it simply begins its preparation. It must be followed by calls to `rcpt()` and `data()` to complete the transaction. The connection to the SMTP server must be open and a `helo()` or `ehlo()` command must have already been sent.

The expected response from the server is a message beginning with status code 250.

rcpt Function

This function specifies the recipient of an e-mail message.

Syntax

```
UTL_SMTP.RCPT (
    c           IN OUT NOCOPY connection,
    recipient   IN OUT NOCOPY,
    parameters  IN OUT NOCOPY)
RETURN reply;
UTL_SMTP.RCPT (
    c           IN OUT NOCOPY connection
    recipient   IN OUT NOCOPY,
    parameters  IN OUT NOCOPY);
```

Table 82–12 rcpt Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The SMTP connection.

Table 82–12 rcpt Function Parameters

Parameter	Description
`recipient (IN OUT NOCOPY)`	The e-mail address of the user to which the message is being sent.
`parameters (IN OUT NOCOPY)`	The additional parameters to RCPT command as defined in Section 6 of [RFC1869]. It should follow the format of "XXX=XXX (XXX=XXX ....)".

Usage Notes

To send a message to multiple recipients, call this routine multiple times. Each invocation schedules delivery to a single e-mail address. The message transaction must have been begun by a prior call to `mail()`, and the connection to the mail server must have been opened and initialized by prior calls to `open_connection()` and `helo()` or `ehlo()`, respectively.

The expected response from the server is a message beginning with status code 250 or 251.

data Function

This function specifies the body of an e-mail message.

Syntax

```
UTL_SMTP.DATA (
    c     IN OUT NOCOPY connection
    body  IN OUT NOCOPY)
RETURN reply;
UTL_SMTP.DATA (
    c     IN OUT NOCOPY connection
    body  IN OUT NOCOPY);
```

Parameters

Table 82–13 data Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The SMTP Connection.
`body (IN OUT NOCOPY)`	The text of the message to be sent, including headers, in [RFC822] format.

Usage Notes

The application must ensure that the contents of the body parameter conform to the MIME(RFC822) specification. The `data()` routine will terminate the message with a <CR><LF>.<CR><LF> sequence (a single period at the beginning of a line), as required by RFC821. It will also translate any sequence of <CR><LF>.<CR><LF> (single period) in body to <CR><LF>..<CR><LF> (double period). This conversion provides the transparency as described in Section 4.5.2 of RFC821.

The `data()` call should be called only after `open_connection()`, `helo() / ehlo()`, `mail()` and `rcpt()` have been called. The connection to the SMTP server must be open, and a mail transaction must be active when this routine is called.

The expected response from the server is a message beginning with status code 250. The 354 response received from the initial DATA command will not be returned to the caller.

open_data(), write_data(), write_raw_data(), close_data() Functions

These APIs provide more fine-grain control to the `data()` API; in other words, to the SMTP DATA operation. `open_data()` sends the DATA command. After that, `write_data()` and `write_raw_data()` write a portion of the e-mail message. A repeat call to `write_data()` and `write_raw_data()` appends data to the e-mail message. The `close_data()` call ends the e-mail message by sending the sequence <CR><LF>.<CR><LF> (a single period at the beginning of a line).

Syntax

```
UTL_SMTP.OPEN_DATA (
    c     IN OUT NOCOPY connection)
RETURN reply;
UTL_SMTP.OPEN_DATA (
    c     IN OUT NOCOPY connection);
UTL_SMTP.WRITE_DATA (
    c     IN OUT NOCOPY connection,
    data  IN OUT NOCOPY);
UTL_SMTP.WRITE_RAW_DATA (
    c     IN OUT NOCOPY connection
    data  IN OUT NOCOPY);
UTL_SMTP.CLOSE_DATA (
    c     IN OUT NOCOPY connection)
RETURN reply;
UTL_SMTP.CLOSE_DATA (
```

```
    c     IN OUT NOCOPY connection);
```

Parameters

Table 82–14 open_data(), write_data(), write_raw_data(), close_data() Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The SMTP connection.
`data (IN OUT NOCOPY)`	The portion of the text of the message to be sent, including headers, in [RFC822] format.

Usage Notes

The calls to `open_data()`, `write_data()`, `write_raw_data()` and `close_data()` must be made in the right order. A program calls `open_data()` to send the `DATA` command to the SMTP server. After that, it can call `write_data()` or `write_raw_data()` repeatedly to send the actual data. The data is terminated by calling `close_data()`. After `open_data()` is called, the only APIs that can be called are `write_data()`, `write_raw_data()`, or `close_data()`. A call to other APIs will result in an `INVALID_OPERATION` exception being raised.

The application must ensure that the contents of the body parameter conform to the MIME(RFC822) specification. The `data()` routine will terminate the message with a `<CR><LF>.<CR><LF>` sequence (a single period at the beginning of a line), as required by RFC821. It will also translate any sequence of `<CR><LF>.<CR><LF>` (single period) in the body to `<CR><LF>..<CR><LF>` (double period). This conversion provides the transparency as described in Section 4.5.2 of RFC821.

Notice that this conversion is not bullet-proof. Consider this code fragment:

```
utl_smtp.write_data('some message.' || chr(13) || chr(10));
utl_smtp.write_data('.' || chr(13) || chr(10));
```

Since the sequence `<CR><LF>.<CR><LF>` is split between two calls to `write_data()`, the implementation of `write_data()` will not detect the presence of the data-terminator sequence, and therefore, will not perform the translation. It will be the responsibility of the user to handle such a situation, or it may result in premature termination of the message data.

`XXX_data()` should be called only after `open_connection()`, `helo()`/`ehlo()`, `mail()`, and `rcpt()` have been called. The connection to the SMTP

server must be open and a mail transaction must be active when this routine is called.

Note that there is no function form of `write_data()` because the SMTP server does not respond until the data-terminator is sent during the call to `close_data()`.

Text (VARCHAR2) data sent using `write_data()` API is converted to US7ASCII before it is sent. If the text contains multibyte characters, each multibyte character in the text that cannot be converted to US7ASCII is replaced by a '?' character. If 8BITMIME extension is negotiated with the SMTP server using the `EHLO()` API, multibyte VARCHAR2 data can be sent by first converting the text to RAW using the UTL_RAW package, and then sending the RAW data using `write_raw_data()`.

rset Function

This function aborts the current mail transaction.

Syntax

```
UTL_SMTP.RSET (
    c  IN OUT NOCOPY connection)
RETURN reply;
UTL_SMTP.RSET (
    c  IN OUT NOCOPY connection);
```

Parameters

Table 82–15 rset Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The SMTP connection.

Usage Notes

This command allows the client to abandon a mail message it was in the process of composing. No mail will be sent. The client can call `rset()` at any time after the connection to the SMTP server has been opened via `open_connection()`. The server will always respond to RSET with a message beginning with status code 250.

Related Functions

`quit()`

vrfy Function

This function verifies the validity of a destination e-mail address.

Syntax

```
UTL_SMTP.VRFY (
    c          IN OUT NOCOPY connection
    recipient  IN OUT NOCOPY)
RETURN reply;
```

Parameters

Table 82–16 vrfy Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The SMTP connection.
`recipient (IN OUT NOCOPY)`	The e-mail address to be verified.

Usage Notes

The server attempts to resolve the destination address `recipient`. If successful, it returns the recipient's full name and fully qualified mailbox path. The connection to the server must have already been established via `open_connection()` and `helo()` / `ehlo()` before making this request.

Successful verification returns one or more lines beginning with status code 250 or 251.

Related Functions

`expn()`

noop() Function

The null command.

Syntax

```
UTL_SMTP.NOOP (
    c  IN OUT NOCOPY connection)
RETURN VARCHAR2;
UTL_SMTP.NOOP (
```

```
    c  IN OUT NOCOPY connection);
```

Parameter

Table 82–17 noop Function Parameters

Parameter	Description
c (IN OUT NOCOPY)	The SMTP connection.

Usage Notes

This command has no effect except to elicit a successful reply from the server. It can be issued at any time after the connection to the server has been established with `open_connection()`. The `noop()` command can be used to verify that the server is still connected and is listening properly.

This command will always reply with a single line beginning with status code 250.

quit Function

This function terminates an SMTP session and disconnects from the server.

Syntax

```
UTL_SMTP.QUIT (
    c  IN OUT NOCOPY connection)
RETURN VARCHAR2;
UTL_SMTP.QUIT (
    c  IN OUT NOCOPY connection);
```

Parameter

Table 82–18 quit Function Parameters

Parameter	Description
c (IN OUT NOCOPY)	The SMTP connection.

Usage Notes

The `quit()` command informs the SMTP server of the client's intent to terminate the session. It then closes the connection established by `open_connection()`, which must have been called before executing this command. If a mail transaction is

in progress when `quit()` is issued, it is abandoned in the same manner as `rset()`.

The function form of this command returns a single line beginning with the status code 221 on successful termination. In all cases, the connection to the SMTP server is closed. The fields `remote_host` and `remote_port` of `c` are reset.

Related Functions

`rset()`

83

UTL_TCP

With the UTL_TCP package and its procedures and functions, PL/SQL applications can communicate with external TCP/IP-based servers using TCP/IP. Because many Internet application protocols are based on TCP/IP, this package is useful to PL/SQL applications that use Internet protocols.

The UTL_TCP package provides TCP/IP client-side access functionality in PL/SQL. The API provided in the package only allows connections to be initiated by the PL/SQL program. It does not allow the PL/SQL program to accept connections initiated from outside of the program.

This chapter discusses the following topics:

Exceptions

The exceptions raised by the TCP/IP package are listed in Table 83–1.

Table 83–1 TCP/IP Exceptions

Exception	Description
BUFFER_TOO_SMALL	Buffer is too small for input that requires look-ahead.
END_OF_INPUT	Raised when no more data is available to read from the connection.
NETWORK_ERROR	Generic network error.
BAD_ARGUMENT	Bad argument passed in an API call (for example, a negative buffer size).
TRANSFER_TIMEOUT	No data is read and a read time-out occurred.
PARTIAL_MULTIBYTE_CHAR	No complete character is read and a partial multi-byte character is found at the end of the input.

Example

The following code example illustrates how the TCP/IP package can be used to retrieve a Web page over HTTP. It connects to a Web server listening at port 80 (standard port for HTTP) and requests the root document.

```
DECLARE
  c  utl_tcp.connection;  -- TCP/IP connection to the Web server
  ret_val pls_integer;
BEGIN
  c := utl_tcp.open_connection(remote_host => 'www.acme.com',
                               remote_port =>  80,
                               charset     => 'US7ASCII');  -- open connection
  ret_val := utl_tcp.write_line(c, 'GET / HTTP/1.0');    -- send HTTP request
  ret_val := utl_tcp.write_line(c);
  BEGIN
    LOOP
      dbms_output.put_line(utl_tcp.get_line(c, TRUE));  -- read result
    END LOOP;
  EXCEPTION
    WHEN utl_tcp.end_of_input THEN
      NULL; -- end of input
  END;
  utl_tcp.close_connection(c);
END;
```

The following code example illustrates how the TCP/IP package might be used by an application to send email. The application connects to an SMTP server at port 25 and sends a simple text message.

```
PROCEDURE send_mail (sender    IN VARCHAR2,
                     recipient IN VARCHAR2,
                    message   IN VARCHAR2)
IS
    mailhost   VARCHAR2(30) := 'mailhost.mydomain.com';
    smtp_error  EXCEPTION;
    mail_conn   utl_tcp.connection;
    PROCEDURE smtp_command(command IN VARCHAR2,
                           ok      IN VARCHAR2 DEFAULT '250')
    IS
        response varchar2(3);
        len pls_integer;
    BEGIN
        len := utl_tcp.write_line(mail_conn, command);
        response := substr(utl_tcp.get_line(mail_conn), 1, 3);
        IF (response <> ok) THEN
            RAISE smtp_error;
        END IF;
    END;

BEGIN
    mail_conn := utl_tcp.open_connection(remote_host => mailhost,
                                         remote_port => 25,
                                         charset     => 'US7ASCII');
    smtp_command('HELO ' || mailhost);
    smtp_command('MAIL FROM: ' || sender);
    smtp_command('RCPT TO: ' || recipient);
    smtp_command('DATA', '354');
    smtp_command(message);
    smtp_command('QUIT', '221');
    utl_tcp.close_connection(mail_conn);
EXCEPTION
    WHEN OTHERS THEN
        -- Handle the error
END;
```

Summary of UTL_TCP Subprograms

Table 83–2 UTL_TCP Subprograms

Subprogram	Description
"connection" on page 83-4	A PL/SQL record type used to represent a TCP/IP connection.
"CRLF" on page 83-6	The character sequence carriage-return line-feed. It is the newline sequence commonly used many communication standards.
"open_connection Function" on page 83-6	Opens a TCP/IP connection to a specified service.
"available Function" on page 83-9	Determines the number of bytes available for reading from a TCP/IP connection.
"read_raw Function" on page 83-10	Receives binary data from a service on an open connection.
"write_raw Function" on page 83-11	Transmits a binary message to a service on an open connection.
"read_text Function" on page 83-12	Receives text data from a service on an open connection.
"write_text Function" on page 83-14	Transmits a text message to a service on an open connection.
"read_line Function" on page 83-15	Receives a text line from a service on an open connection.
"write_line Function" on page 83-16	Transmits a text line to a service on an open connection.
"get_raw(), get_text(), get_line() Functions" on page 83-17	Convenient forms of the read functions, which return the data read instead of the amount of data read.
"flush Procedure" on page 83-18	Transmits all data in the output buffer, if a buffer is used, to the server immediately.
"close_connection Procedure" on page 83-18	Closes an open TCP/IP connection.
"close_all_connections Procedure" on page 83-19	Closes all open TCP/IP connections.

connection

This is a PL/SQL record type used to represent a TCP/IP connection.

Syntax

```
TYPE connection IS RECORD (
    remote_host    VARCHAR2(255), -- remote host name
    remote_port    PLS_INTEGER,   -- remote port number
    local_host     VARCHAR2(255), -- local host name
    local_port     PLS_INTEGER,   -- local port number
    charset        VARCHAR2(30),  -- character set for on-the-wire communication
    newline        VARCHAR2(2),   -- newline character sequence
    tx_timeout     PLS_INTEGER,   -- transfer time-out value (in seconds)
    private_sd     PLS_INTEGER,   -- for internal use
    );
```

Fields

Table 83–3 connection Record Type Fields

Field	Description
`remote_host`	The name of the remote host when connection is established. NULL when no connection is established.
`remote_port`	The port number of the remote host connected. NULL when no connection is established.
`local_host`	The name of the local host used to establish the connection. NULL when no connection is established.
`local_port`	The port number of the local host used to establish the connection. NULL when no connection is established.
`charset`	The on-the-wire character set. Since text messages in the database may be encoded in a character set that is different from the one expected on the wire (i.e. the character set specified by the communication protocol, or the one stipulated by the other end of the communication), text messages in the database will be converted to and from the on-the-wire character set as they are sent and received on the network.
`newline`	The newline character sequence. This newline character sequence is appended to the text line sent by write_line() API.
`tx_timeout`	A time in seconds that the UTL_TCP package waits before giving up in a read or write operation in this connection. In read operations, this package gives up if no data is available for reading immediately. In write operations, this package gives up if the output buffer is full and no data is to be sent in the network without being blocked. Zero (0) indicates not to wait at all. NULL indicates to wait forever.

Usage Notes

The fields in a connection record are used to return information about the connection, which is often made using `open_connection()`. Changing the values of those fields has no effect on the connection. The fields `private_XXXX` are for implementation use only. You should not modify the values.

In the current release of the `UTL_TCP` package, the parameters `local_host` and `local_port` are ignored when `open_connection` makes a TCP/IP connection. It does not attempt to use the specified local host and port number when the connection is made. The `local_host` and `local_port` fields will not be set in the connection record returned by the function.

Time-out on write operations is not supported in the current release of the `UTL_TCP` package.

CRLF

The character sequence carriage-return line-feed. It is the newline sequence commonly used many communication standards.

Syntax

```
CRLF varchar2(10);
```

Usage Notes

This package variable defines the newline character sequence commonly used in many Internet protocols. This is the default value of the newline character sequence for `write_line()`, specified when a connection is opened. While such protocols use `<CR><LF>` to denote a new line, some implementations may choose to use just line-feed to denote a new line. In such cases, users can specify a different newline character sequence when a connection is opened.

This CRLF package variable is intended to be a constant that denotes the carriage-return line-feed character sequence. Do not modify its value. Modification may result in errors in other PL/SQL applications.

open_connection Function

This function opens a TCP/IP connection to a specified service.

Syntax

```
UTL_TCP.OPEN_CONNECTION  (remote_host      IN VARCHAR2,
```

```
remote_port      IN PLS_INTEGER,
local_host       IN VARCHAR2 DEFAULT NULL,
local_port       IN PLS_INTEGER DEFAULT NULL,
in_buffer_size   IN PLS_INTEGER DEFAULT NULL,
out_buffer_size  IN PLS_INTEGER DEFAULT NULL,
charset          IN VARCHAR2 DEFAULT NULL,
newline          IN VARCHAR2 DEFAULT CRLF,
tx_timeout       IN PLS_INTEGER DEFAULT NULL)
RETURN connection;
```

Parameters

Table 83–4 open_connection Function Parameters

Parameter	Description
`remote_host (IN)`	The name of the host providing the service. When `remote_host` is NULL, it connects to the local host.
`remote_port (IN)`	The port number on which the service is listening for connections.
`local_host (IN)`	The name of the host providing the service. NULL means don't care.
`local_port (IN)`	The port number on which the service is listening for connections. NULL means don't care.
`in_buffer_size (IN)`	The size of input buffer. The use of an input buffer can speed up execution performance in receiving data from the server. The appropriate size of the buffer depends on the flow of data between the client and the server, and the network condition. A 0 value means no buffer should be used. A NULL value means the caller does not care if a buffer is used or not. The maximum size of the input buffer is 32767 bytes.
`out_buffer_size (IN)`	The size of output buffer. The use of an output buffer can speed up execution performance in sending data to the server. The appropriate size of buffer depends on the flow of data between the client and the server, and the network condition. A 0 value means no buffer should be used. A NULL value means the caller does not care if a buffer is used or not. The maximum size of the output buffer is 32767 bytes.

Table 83–4 open_connection Function Parameters

Parameter	Description
`charset (IN)`	The on-the-wire character set. Since text messages in the database may be encoded in a character set that is different from the one expected on the wire (i.e. the character set specified by the communication protocol, or the one stipulated by the other end of the communication), text messages in the database will be converted to and from the on-the-wire character set as they are sent and received on the network using `read_text(), read_line(), write_text()` and `write_line()`. Set this parameter to NULL when no conversion is needed.
`newline (IN)`	The newline character sequence. This newline character sequence is appended to the text line sent by `write_line()` API.
`tx_timeout`	A time in seconds that the `UTL_TCP` package should wait before giving up in a read or write operations in this connection. In read operations, this package gives up if no data is available for reading immediately. In write operations, this package gives up if the output buffer is full and no data is to be sent in the network without being blocked. Zero (0) indicates not to wait at all. NULL indicates to wait forever.

Usage Notes

Note that connections opened by this UTL_TCP package can remain open and be passed from one database call to another in MTS configuration. However, the connection must be closed explicitly. The connection will remain open when the PL/SQL record variable that stores the connection goes out-of-scope in the PL/SQL program. Failing to close unwanted connections may result in unnecessary tying up of local and remote system resources.

The parameters local_host and local_port are ignored currently when open_connection makes a TCP/IP connection. It does not attempt to use the specified local host and port number when the connection is made.

In the current release of the `UTL_TCP` package, the parameters `local_host` and `local_port` are ignored when `open_connection` makes a TCP/IP connection. It does not attempt to use the specified local host and port number when the connection is made. The `local_host` and `local_port` fields will not be set in the connection record returned by the function.

Time-out on write operations is not supported in the current release of the UTL_TCP package.

Related Functions

`close_connection(), close_all_connections()`

available Function

This function determines the number of bytes available for reading from a TCP/IP connection. It is the number of bytes that can be read immediately without blocking. Determines if data is ready to be read from the connection.

Syntax

```
UTL_TCP.AVAILABLE (
    c        IN OUT NOCOPY connection,
    timeout  IN PLS_INTEGER DEFAULT 0)
RETURN PLS_INTEGER;
```

Parameters

Table 83–5 available Function Parameters

Parameter	Description
c (IN OUT NOCOPY)	The TCP connection to determine the amount of data that is available to be read from.
timeout	A time in seconds to wait before giving up and reporting that no data is available. Zero (0) indicates not to wait at all. NULL indicates to wait forever.

Usage Notes

The connection must have already been opened via a call to `open_connection()`. Users may use this API to determine if data is available to be read before calling the read API so that the program will not be blocked because data is not ready to be read from the input.

The number of bytes available for reading returned by this function may less than than what is actually available. On some platforms, this function may only return 1, to indicate that some data is available. If you are concerned about the portability of your application, assume that this function returns a positive value when data is available for reading, and 0 when no data is available. The following example illustrates using this function in a portable manner:

```
DECLARE
   c   utl_tcp.connection
```

```
   data VARCHAR2(256);
   len  PLS_INTEGER;
BEGIN
   c := utl_tcp.open_connection(...);
   LOOP
      IF (utl_tcp.available(c) > 0) THEN
         len := utl_tcp.read_text(c, data, 256);
      ELSE
         ---do some other things
        . . . .
      END IF
   END LOOP;
END;
```

Related Functions

`read_raw(), read_text(), read_line()`

read_raw Function

This function receives binary data from a service on an open connection.

Syntax

```
UTL_TCP.READ_RAW (c     IN OUT NOCOPY connection,
                  data  IN OUT NOCOPY RAW,
                  len   IN            PLS_INTEGER DEFAULT 1,
                  peek  IN            BOOLEAN     DEFAULT FALSE)
                                      RETURN PLS_INTEGER;
```

Parameters

Table 83–6 read_raw Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The TCP connection to receive data from.
`data (IN OUT COPY)`	The data received.
`len (IN)`	The number of bytes of data to receive.

Table 83–6 read_raw Function Parameters

Parameter	Description
peek (IN)	Normally, users want to read the data and remove it from the input queue, i.e. consuming it. In some situations, users may just want to look ahead at the data, i.e. peeking it, without removing it from the input queue so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and an input buffer must be set up when the connection is opened. The amount of data that can be peeked (i.e. read but kept in the input queue) must be less the size of input buffer.
return value	The actual number of bytes of data received.

Usage Notes

The connection must have already been opened via a call to open_connection(). This function does not return until the specified number of characters have been read, or the end of input has been reached.

If transfer time-out is set when the connection is opened, this function waits for each data packet to be ready to read until time-out occurs. If it occurs, this function stops reading and returns all the data read successfully. If no data is read successfully, the transfer_timeout exception is raised. The exception can be handled and the read operation can be retried later.

Related Functions

read_text(), read_line(), available()

write_raw Function

This function transmits a binary message to a service on an open connection.

Syntax

```
UTL_TCP.WRITE_RAW (c    IN OUT NOCOPY connection,
                   data IN            RAW,
                   len  IN            PLS_INTEGER DEFAULT NULL)
                                      RETURN PLS_INTEGER;
```

Table 83–7 write_raw Function Parameters

Parameter	Description
c (IN OUT NOCOPY)	The TCP connection to send data to.
data (IN)	The buffer containing the data to be sent.
len (IN)	The number of bytes of data to transmit. When len is NULL, the whole length of data is written. The actual amount of data written may be less because of network condition.
return value	The actual number of bytes of data transmitted.

Usage Notes

The connection must have already been opened via a call to open_connection().

Related Functions

write_text(), write_line(), flush()

read_text Function

This function receives text data from a service on an open connection.

Syntax

```
UTL_TCP.READ_TEXT (c    IN OUT NOCOPY connection,
                   data IN OUT NOCOPY VARCHAR2,
                   len  IN            PLS_INTEGER DEFAULT 1,
                   peek IN            BOOLEAN     DEFAULT FALSE) RETURN PLS_
INTEGER;
```

Table 83–8 read_text Function Parameters

Parameter	Description
c (IN OUT NOCOPY)	The TCP connection to receive data from.
data (IN OUT NOCOPY)	The data received.
len (IN)	The number of characters of data to receive.

Table 83–8 read_text Function Parameters

Parameter	Description
peek (IN)	Normally, users want to read the data and remove it from the input queue, i.e. consuming it. In some situations, users may just want to look ahead at the data, i.e. peeking it, without removing it from the input queue so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and an input buffer must be set up when the connection is opened. The amount of data that can be peeked (i.e. read but kept in the input queue) must be less the size of input buffer.
return value	The actual number of characters of data received.

Usage Notes

The connection must have already been opened via a call to open_connection(). This function does not return until the specified number of characters has been read, or the end of input has been reached. Text messages will be converted from the on-the-wire character set, specified when the connection was opened, to the database character set before they are returned to the caller.

Unless explicitly overridden, the size of a VARCHAR2 buffer is specified in terms of bytes, while the parameter len refers to the maximum number of characters to be read. When the database character set is multi-byte, where a single character may consist of more than 1 byte, you should ensure that the buffer can hold the maximum of characters. In general, the size of the VARCHAR2 buffer should equal the number of characters to be read, multiplied by the maximum number of bytes of a character of the database character set.

If transfer time-out is set when the connection is opened, this function waits for each data packet to be ready to read until time-out occurs. If it occurs, this function stops reading and returns all the data read successfully. If no data is read successfully, the transfer_timeout exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multi-byte character is found at the end of input, this function stops reading and returns all the complete multi-byte characters read successfully. If no complete character is read successfully, the partial_multibyte_char exception is raised. The exception can be handled and the bytes of that partial multi-byte character can be read as binary by the read_raw function. If a partial multi-byte character is seen in the middle of the input because the remaining bytes of the character have not arrived and read time-out occurs, the transfer_timeout

exception is raised instead. The exception can be handled and the read operation can be retried later.

Related Functions

`read_raw(), read_line(), available()`

write_text Function

This function transmits a text message to a service on an open connection.

Syntax

```
UTL_TCP.WRITE_TEXT (c    IN OUT NOCOPY connection,
                    data IN            VARCHAR2,
                    len  IN            PLS_INTEGER DEFAULT NULL)
                                       RETURN PLS_INTEGER;
```

Table 83–9 write_text Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The TCP connection to send data to.
`data (IN)`	The buffer containing the data to be sent.
`len (IN)`	The number of characters of data to transmit. When len is NULL, the whole length of data is written. The actual amount of data written may be less because of network condition.
`return value`	The actual number of characters of data transmitted.

Usage Notes

The connection must have already been opened via a call to *open_connection()*. Text messages will be converted to the on-the-wire character set, specified when the connection was opened, before they are transmitted on the wire.

Related Functions

`write_raw(), write_line(), flush()`

read_line Function

This function receives a text line from a service on an open connection. A line is terminated by a line-feed, a carriage-return or a carriage-return followed by a line-feed.

Syntax

```
UTL_TCP.READ_LINE (c           IN OUT NOCOPY connection,
                   data        IN OUT NOCOPY VARCHAR2,
                   remove_crlf IN            BOOLEAN DEFAULT FALSE,
                   peek        IN            BOOLEAN DEFAULT FALSE)
                                             RETURN PLS_INTEGER;
```

Table 83–10 read_line Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The TCP connection to receive data from.
`data (IN OUT NOCOPY)`	The data received.
`remove_crlf (IN)`	If TRUE, the trailing CR/LF character(s) are removed from the received message.
`peek (IN)`	Normally, users want to read the data and remove it from the input queue, i.e. consuming it. In some situations, users may just want to look ahead at the data, i.e. peeking it, without removing it from the input queue so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and an input buffer must be set up when the connection is opened. The amount of data that can be peeked (i.e. read but kept in the input queue) must be less the size of input buffer.
`return value`	The actual number of characters of data received.

Usage Notes

The connection must have already been opened via a call to *open_connection()*. This function does not return until the end-of-line have been reached, or the end of input has been reached. Text messages will be converted from the on-the-wire character set, specified when the connection was opened, to the database character set before they are returned to the caller.

If transfer time-out is set when the connection is opened, this function waits for each data packet to be ready to read until time-out occurs. If it occurs, this function stops reading and returns all the data read successfully. If no data is read

successfully, the `transfer_timeout` exception is raised. The exception can be handled and the read operation can be retried later.

If a partial multi-byte character is found at the end of input, this function stops reading and returns all the complete multi-byte characters read successfully. If no complete character is read successfully, the `partial_multibyte_char` exception is raised. The exception can be handled and the bytes of that partial multi-byte character can be read as binary by the `read_raw` function. If a partial multi-byte character is seen in the middle of the input because the remaining bytes of the character have not arrived and read time-out occurs, the `transfer_timeout` exception is raised instead. The exception can be handled and the read operation can be retried later.

Related Functions

`read_raw(), read_text(), available()`

write_line Function

This function transmits a text line to a service on an open connection. The newline character sequence will be appended to the message before it is transmitted.

Syntax

```
UTL_TCP.WRITE_LINE (c    IN OUT NOCOPY connection,
                    data IN            VARCHAR2 DEFAULT NULL)
                                       RETURN PLS_INTEGER;
```

Table 83–11 write_line Function Parameters

Parameter	Description
`c (IN OUT NOCOPY)`	The TCP connection to send data to.
`data (IN)`	The buffer containing the data to be sent.
`return value`	The actual number of characters of data transmitted.

Usage Notes

The connection must have already been opened via a call to *open_connection()*. Text messages will be converted to the on-the-wire character set, specified when the connection was opened, before they are transmitted on the wire.

Related Functions

`write_raw(), write_text(), flush()`

get_raw(), get_text(), get_line() Functions

Convenient forms of the read functions, which return the data read instead of the amount of data read.

Syntax

```
UTL_TCP.GET_RAW (c     IN OUT NOCOPY connection,
                 len   IN            PLS_INTEGER DEFAULT 1,
                 peek  IN            BOOLEAN     DEFAULT FALSE) RETURN RAW;
UTL_TCP.GET_TEXT (c    IN OUT NOCOPY connection,
                  len  IN            PLS_INTEGER DEFAULT 1,
                  peek IN            BOOLEAN     DEFAULT FALSE) RETURN VARCHAR2;
UTL_TCP.GET_LINE (c           IN OUT NOCOPY connection,
                  remove_crlf IN            BOOLEAN DEFAULT false,
                  peek        IN            BOOLEAN DEFAULT FALSE) RETURN
VARCHAR2;
```

Table 83–12 get_raw(), get_text(), and get_line() Function Parameters

Parameter	Description
c (IN OUT NOCOPY)	The TCP connection to receive data from.
len (IN)	The number of bytes (or characters for VARCHAR2) of data to receive. Default is 1.
peek (IN)	Normally, users want to read the data and remove it from the input queue, i.e. consuming it. In some situations, users may just want to look ahead at the data, i.e. peeking it, without removing it from the input queue so that it is still available for reading (or even peeking) in the next call. To keep the data in the input queue, set this flag to TRUE and an input buffer must be set up when the connection is opened. The amount of data that can be peeked (i.e. read but kept in the input queue) must be less the size of input buffer.
remove_crlf (IN)	If TRUE, the trailing CR/LF character(s) are removed from the received message.

Usage Notes

The connection must have already been opened via a call to *open_connection()*.

For all the get_* APIs described in this section, see the corresponding read_* API for the read time-out issue. For get_text and get_line, see the corresponding read_* API for character set conversion, buffer size, and multi-byte character issues.

Related Functions

read_raw(), read_text(), read_line()

flush Procedure

This procedure transmits all data in the output buffer, if a buffer is used, to the server immediately.

Syntax

```
UTL_TCP.FLUSH (c IN OUT NOCOPY connection);
```

Parameters

Table 83–13 flush Procedure Parameters

Parameter	Description
c (IN OUT NOCOPY)	The TCP connection to send data to.

Usage Notes

The connection must have already been opened via a call to *open_connection()*.

Related Functions

write_raw(), write_text(), write_line()

close_connection Procedure

This procedure closes an open TCP/IP connection.

Syntax

```
UTL_TCP.close_CLOSE_CONNECTION (c IN OUT NOCOPY connection);
```

Parameters

Table 83–14 close_connection Procedure Parameters

Parameter	Description
c (IN OUT NOCOPY)	The TCP connection to close.

Usage Notes

Connection must have been opened by a previous call to open_connection(). The fields remote_host, remote_port, local_host, local_port and charset of c will be reset after the connection is closed.

An open connection must be closed explicitly. An open connection will remain open when the PL/SQL record variable that stores the connection goes out-of-scope in the PL/SQL program. Failing to close unwanted connections may result in unnecessary tying up of local and remote system resources.

close_all_connections Procedure

This procedure closes all open TCP/IP connections.

Syntax

```
UTL_TCP.CLOSE_ALL_CONNECTIONS;
```

Usage Notes

This call is provided to close all connections before a PL/SQL program avoid dangling connections.

Related Functions

open_connection(), close_connection()

84

UTL_URL

The UTL_URL package has two functions: ESCAPE and UNESCAPE.

See Also: Chapter 78, "UTL_HTTP"

This chapter discusses the following topics:

- Introduction to the UTL_URL Package
- UTL_URL Exceptions
- Summary of UTL_URL Subprograms

Introduction to the UTL_URL Package

A Uniform Resource Locator (URL) is a string that identifies a Web resource, such as a page or a picture. A URL allows you to easily access such resources by way of the HyperText Transfer Protocol (HTTP). For example, the URL for Oracle's Web site is:

```
http://www.oracle.com
```

Normally, a URL contains English alphabetic characters, digits, and punctuation symbols. These characters are known the u*nreserved characters*. Any other characters in URLs, including multi-byte characters or binary octet codes, must be escaped to be accurately processed by Web browsers or Web servers. Some punctuation characters, such as dollar sign ($), question mark (?), colon (:), and equals sign (=), are reserved as delimiters in a URL. They are known as the *reserved characters*. To literally process these characters, instead of treating them as delimiters, they must be escaped.

The unreserved characters are:

- A through Z, a through z, and 0 through 9
- Hyphen (-), underscore (_), period (.), exclamation point (!), tilde (~), asterisk (*), accent (’), left parenthesis (( ), right parenthesis ( ))

The reserved characters are:

- Semi-colon (;) slash (/), question mark (?), colon (:), at sign (@), ampersand (&), equals sign (=), plus sign (+), dollar sign ($), and comma (,)

The UTL_URL package has two functions that provide escape and unescape mechanisms for URL characters. Use the escape function to escape a URL before the URL is used fetch a Web page by way of the UTL_HTTP package. Use the unescape function to unescape an escaped URL before information is extracted from the URL.

For more information, refer to the Request For Comments (RFC) document RFC2396. Note that this URL escape and unescape mechanism is different from the x-www-form-urlencoded encoding mechanism described in the HTML specification:

```
http://www.w3.org/TR/html
```

In fact, x-www-form-urlencoded encoding can be implemented using the UTL_URL.escape function as follows:

```
CREATE OR REPLACE FUNCTION form_urlencode (
    v IN VARCHAR2)
```

```
RETURN VARCHAR2 AS
BEGIN
  RETURN utl_url.escape(replace(v, ' ', '+'), TRUE);
END;
```

UTL_URL Exceptions

Table 84–1 lists the exceptions that can be raised when the UTL_URL package API is invoked.

Table 84–1 UTL_URL Exceptions

Exception	Error Code	Reason
bad_url	29262	The URL contains badly formed escape code sequences
bad_fixed_width_charset	29274	Fixed-width multibyte character set is not allowed as a URL character set.

Summary of UTL_URL Subprograms

Table 84–2 UTL_URL Package Subprograms

Subprogram	Description
"ESCAPE Function" on page 84-3	Returns a URL with illegal characters (and optionally reserved characters) escaped using the %2-digit-hex-code format
"UNESCAPE Function" on page 84-5	Unescapes the escape character sequences to their original forms in a URL. Convert the %XX escape character sequences to the original characters

ESCAPE Function

This function returns a URL with illegal characters (and optionally reserved characters) escaped using the %2-digit-hex-code format.

Syntax

```
FUNCTION escape (
   url                  IN VARCHAR2,
   escape_reserved_chars IN BOOLEAN  DEFAULT FALSE,
   url_charset          IN VARCHAR2 DEFAULT
                                    utl_http.body_charset)
```

```
RETURN VARCHAR2;
```

Parameters

Table 84–3 shows the parameters for the ESCAPE function.

Table 84–3 ESCAPE Function Parameters

Parameter	Description
url (IN)	The original URL
escape_reserved_chars (IN)	Indicates whether the URL reserved characters should be escaped. If set to TRUE, both the reserved and illegal URL characters are escaped. Otherwise, only the illegal URL characters are escaped. The default value is FALSE.
url_charset (IN)	When escaping a character (single-byte or multi-byte), what is the target character set that character should be converted to before the character is escaped in %hex-code format? If url_charset is NULL, the database charset is assumed and no character set conversion will occur. The default value is the current default body character set of the UTL_HTTP package, whose default value is ISO-8859-1. The character set can be named in Internet Assigned Numbers Authority (IANA) or Oracle naming convention.

Usage Notes

Use this function to escape URLs that contain illegal characters as defined in the URL specification RFC 2396. The legal characters in URLs are:

- A through Z, a through z, and 0 through 9
- Hyphen (-), underscore (_), period (.), exclamation point (!), tilde (~), asterisk (*), accent (’), left parenthesis (( ), right parenthesis ( ))

The reserved characters consist of:

- Semi-colon (;) slash (/), question mark (?), colon (:), at sign (@), ampersand (&), equals sign (=), plus sign (+), dollar sign ($), and comma (,)

Many of the reserved characters are used as delimiters in the URL. You should escape characters beyond those listed here by using escape_url. Also, to use the reserved characters in the name-value pairs of the query string of a URL, those characters must be escaped separately. An escape_url cannot recognize the need to escape those characters because once inside a URL, those characters become indistinguishable from the actual delimiters. For example, to pass a name-value pair

`$logon=scott/tiger` into the query string of a URL, escape the `$` and `/` separately as `%24logon=scott%2Ftiger` and use it in the URL.

Normally, you will escape the entire URL, which contains the reserved characters (delimiters) that should not be escaped. For example:

```
utl_url.escape('http://www.acme.com/a url with space.html')
```

Returns:

```
http://foo.com/a%20url%20with%20space.html
```

In other situations, you may want to send a query string with a value that contains reserved characters. In that case, escape only the value fully (with `escape_reserved_chars` set to `TRUE`) and then concatenate it with the rest of the URL. For example:

```
url := 'http://www.acme.com/search?check=' || utl_url.escape
('Is the use of the "$" sign okay?', TRUE);
```

This expression escapes the question mark (?), dollar sign ($), and space characters in `'Is the use of the "$" sign okay?'` but not the ? after `search` in the URL that denotes the use of a query string.

The Web server that you intend to fetch Web pages from may use a character set that is different from that of your database. In that case, specify the url_charset as the Web server character set so that the characters that need to be escaped are escaped in the target character set. For example, a user of an EBCDIC database who wants to access an ASCII Web server should escape the URL using `US7ASCII` so that a space is escaped as `%20` (hex code of a space in ASCII) instead of `%40` (hex code of a space in EBCDIC).

This function does not validate a URL for the proper URL format.

UNESCAPE Function

This function unescapes the escape character sequences to its original form in a URL, to convert the `%XX` escape character sequences to the original characters.

Syntax

```
FUNCTION unescape(
   url            IN VARCHAR2,
   url_charset IN VARCHAR2 DEFAULT utl_http.body_charset)
                  RETURN VARCHAR2;
```

Parameters

Table 84–3 shows the parameters for the UNESCAPE function.

Table 84–4 UNESCAPE Function Parameters

Parameter	Description
`url (IN)`	The URL to unescape
`url_charset (IN)`	After a character is unescaped, the character is assumed to be in the `source_charset` character set and it will be converted from the `source_charset` to the database character set before the URL is returned. If `source_charset` is `NULL`, the database charset is assumed and no character set conversion occurred. The default value is the current default body character set of the `UTL_HTTP` package, whose default value is "ISO-8859-1". The character set can be named in Internet Assigned Numbers Authority (IANA) or Oracle naming convention.

Usage Notes

The Web server that you receive the URL from may use a character set that is different from that of your database. In that case, specify the url_charset as the Web server character set so that the characters that need to be unescaped are unescaped in the source character set. For example, a user of an EBCDIC database who receives a URL from an ASCII Web server should unescape the URL using `US7ASCII` so that `%20` is unescaped as a space (0x20 is the hex code of a space in ASCII) instead of a `?` (because 0x20 is not a valid character in EBCDIC).

This function does not validate a URL for the proper URL format.

85

ANYDATA TYPE

An ANYDATA contains an instance of a given type, plus a description of the type. In this sense, an ANYDATA is self-describing. An ANYDATA can be persistently stored in the database.

Persistent storage of ANYDATA instances whose type contains embedded LOBs is not supported yet.

This chapter discusses the following topics:

Construction

There are 2 ways to construct an AnyData. The `Convert*()` calls enable construction of the AnyData in its entirety with a single call. They serve as explicit CAST functions from any type in the Oracle ORDBMS to AnyData.

```
STATIC FUNCTION ConvertNumber(num IN NUMBER) RETURN AnyData,
STATIC FUNCTION ConvertDate(dat IN DATE) RETURN AnyData,
STATIC FUNCTION ConvertChar(c IN CHAR) RETURN AnyData,
STATIC FUNCTION ConvertVarchar(c IN VARCHAR) RETURN AnyData,
STATIC FUNCTION ConvertVarchar2(c IN VARCHAR2) RETURN AnyData,
STATIC FUNCTION ConvertRaw(r IN RAW) RETURN AnyData,
STATIC FUNCTION ConvertBlob(b IN BLOB) RETURN AnyData,
STATIC FUNCTION ConvertClob(c IN CLOB) RETURN AnyData,
STATIC FUNCTION ConvertBfile(b IN BFILE) RETURN AnyData,
STATIC FUNCTION ConvertObject(obj IN "<object_type>") RETURN AnyData,
STATIC FUNCTION ConvertRef(rf IN REF "<object_type>") RETURN AnyData,
STATIC FUNCTION ConvertCollection(col IN "<COLLECTION_1>") RETURN AnyData,
```

Summary of ANYDATA Subprograms

Table 85–1 ANYDATA Subprograms

Subprogram	Description
"BEGINCREATE Static Procedure" on page 85-3	Begins creation process on a new AnyData.
"PIECEWISE Member Procedure" on page 85-4	Sets the MODE of access of the current data value to be an attribute at a time (if the data value is of TYPECODE_OBJECT).
"SET Member Procedures" on page 85-4	Sets the current data value.
"ENDCREATE Member Procedure" on page 85-6	Ends creation of an AnyData.
"GETTYPENAME Member Function" on page 85-7	Get the fully qualified type name for the AnyData.
"GETTYPE Member Function" on page 85-7	Gets the Type of the AnyData.
"GET Member Functions" on page 85-8	Gets the current data value (which should be of appropriate type).

The second way to construct an AnyData is a piece by piece approach. The `BeginCreate()` call begins the construction process and `EndCreate()` call finishes the construction process. In between these two calls, the individual attributes of an object type or the elements of a collection can be set using `Set*()` calls. For piece by piece access of the attributes of objects and elements of collections, the `PieceWise()` call should be invoked prior to `Get*()` calls.

Note: The AnyData has to be constructed or accessed sequentially starting from its first attribute (or collection element). The `BeginCreate()` call automatically begins the construction in a piece-wise mode. There is no need to call `PieceWise()` immediately after `BeginCreate()`. `EndCreate()` should be called to finish the construction process (before which any access calls can be made).

BEGINCREATE Static Procedure

This procedure begins the creation process on a new AnyData.

Syntax

```
STATIC PROCEDURE BeginCreate(
   dtype          IN OUT NOCOPY AnyType,
   adata          OUT NOCOPY AnyData);
```

Parameters

Table 85–2 BEGINCREATE Procedure Parameters

Parameter	Description
dtype	The type of the AnyData. (Should correspond to OCI_ TYPECODE_OBJECT or a Collection typecode.)
adata	AnyData being constructed.

Exception

DBMS_TYPES.invalid_parameters: dtype is invalid (not fully constructed, etc.)

Usage Notes

There is NO NEED to call `PieceWise()` immediately after this call. Automatically, the construction process begins in a piece-wise manner.

PIECEWISE Member Procedure

This procedure sets the MODE of access of the current data value to be an attribute at a time (if the data value is of TYPECODE_OBJECT).

It sets the MODE of access of the data value to be a collection element at a time (if the data value is of collection type). Once this call has been made, subsequent calls to `Set*()` and `Get*()` will sequentially obtain individual attributes or collection elements.

Syntax

```
MEMBER PROCEDURE PieceWise(
   self         IN OUT NOCOPY AnyData);
```

Parameter

Table 85–3 BEGINCREATE Procedure Parameters

Parameter	Description
self	The current data value.

Exceptions

- DBMS_TYPES.invalid_parameters
- DBMS_TYPES.incorrect_usage: On incorrect usage.

Usage Notes

The current data value must be of an OBJECT or COLLECTION type before this call can be made.

Piece-wise construction and access of nested attributes that are of object or collection types is not supported.

SET Member Procedures

Sets the current data value.

This is a list of procedures that should be called depending on the type of the current data value. The type of the data value should be the type of the attribute at the current position during the piece-wise construction process.

Syntax

```
MEMBER PROCEDURE SetNumber(
   self         IN OUT NOCOPY AnyData,
   num          IN NUMBER,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetDate(
   self         IN OUT NOCOPY AnyData,
   dat          IN DATE,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetChar(
   self         IN OUT NOCOPY AnyData,
   c            IN CHAR,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetVarchar(
   self         IN OUT NOCOPY AnyData,
   c            IN VARCHAR,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetVarchar2(
   self         IN OUT NOCOPY AnyData,
   c            IN VARCHAR2,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetRaw(
   self         IN OUT NOCOPY AnyData,
   r            IN RAW,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetBlob(
   self         IN OUT NOCOPY AnyData,
   b            IN BLOB,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetClob(
   self         IN OUT NOCOPY AnyData,
   c            IN CLOB,
   last_elem    IN boolean DEFAULT FALSE)'
MEMBER PROCEDURE SetBfile(
   self         IN OUT NOCOPY AnyData,
   b            IN BFILE,
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetObject(
   self         IN OUT NOCOPY AnyData,
   obj          IN "<object_type>",
   last_elem    IN boolean DEFAULT FALSE);
MEMBER PROCEDURE SetRef(
   self         IN OUT NOCOPY AnyData,
   rf           IN REF "<object_type>",
```

```
   last_elem   IN boolean DEFAULT FALSE),
MEMBER PROCEDURE SetCollection(
   self        IN OUT NOCOPY AnyData,
   col         IN "<collectyion_type>",
   last_elem   IN boolean DEFAULT FALSE);
```

Parameters

Table 85–4 SET*() Procedure Parameters

Parameter	Description
self	An AnyData.
num	The number, etc., that is to be set.
last_elem	Relevant only if AnyData represents a collection. Set to TRUE if it is the last element of the collection, FALSE otherwise.

Exceptions

- DBMS_TYPES.invalid_parameters: Invalid Parameters (if it is not appropriate to add a number at this point in the creation process).
- DBMS_TYPES.incorrect_usage: Incorrect usage.
- DBMS_TYPES.type_mismatch: When the expected type is different from the passed in type.

Usage Notes

When `BeginCreate()` is called, construction has already begun in a piece-wise fashion. Subsequent calls to `Set*()` will set the successive attribute values.

If the AnyData is a standalone collection, the `Set*()` call will set the successive collection elements.

ENDCREATE Member Procedure

This procedure ends creation of an AnyData. Other creation functions cannot be called after this call.

Syntax

```
MEMBER PROCEDURE EndCreate(
```

```
   self         IN OUT NOCOPY AnyData);
```

Parameter

Table 85–5 ENDCREATE Procedure Parameter

Parameter	Description
self	An AnyData.

GETTYPENAME Member Function

This function gets the fully qualified type name for the AnyData.

If the AnyData is based on a built-in type, this function will return NUMBER etc.

If it is based on a user defined type, this function will return <schema_ name>.<type_name>. for example, SCOTT.FOO.

If it is based on a transient anonymous type, this function will return NULL.

Syntax

```
MEMBER FUNCTION GetTypeName(
   self         IN AnyData)
   RETURN       VARCHAR2;
```

Parameter

Table 85–6 GETTYPENAME Function Parameter

Parameter	Description
self	An AnyData.

Returns

Type name of the AnyData.

GETTYPE Member Function

This function gets the typecode of the AnyData.

Syntax

```
MEMBER FUNCTION GetType(
```

```
   self          IN AnyData,
   typ           OUT NOCOPY AnyType)
   RETURN        PLS_INTEGER;
```

Parameters

Table 85–7 GETTYPE Function Parameter

Parameter	Description
self	An AnyData.
typ	The AnyType corresponding to the AnyData. May be NULL if it does not represent a user-defined type.

Returns

The typecode corresponding to the type of the AnyData.

GET Member Functions

These functions get the current data value (which should be of appropriate type).

The type of the current data value depends on the MODE with which we are accessing (depending on whether we have invoked the `PieceWise()` call).

If `PieceWise()` has NOT been called, we are accessing the AnyData in its entirety and the type of the data value should match the type of the AnyData.

If `PieceWise()` has been called, we are accessing the AnyData piece-wise. The type of the data value should match the type of the attribute (or collection element) at the current position.

Syntax

```
MEMBER FUNCTION GetNumber(
   self          IN AnyData,
   num           OUT NOCOPY NUMBER)
   RETURN        PLS_INTEGER;
  MEMBER FUNCTION GetDate(
   self          IN AnyData,
   dat           OUT NOCOPY DATE)
   RETURN        PLS_INTEGER;
MEMBER FUNCTION GetChar(
   self          IN AnyData,
   c             OUT NOCOPY CHAR)
```

```
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetVarchar(
   self         IN AnyData,
   c            OUT NOCOPY VARCHAR)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetVarchar2(
   self         IN AnyData,
   c            OUT NOCOPY VARCHAR2)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetRaw(
   self         IN AnyData,
   r            OUT NOCOPY RAW)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetBlob(
   self         IN AnyData,
   b            OUT NOCOPY BLOB)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetClob(
   self         IN AnyData,
   c            OUT NOCOPY CLOB)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetBfile(
   self         IN AnyData,
   b            OUT NOCOPY BFILE)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetObject(
   self         IN AnyData,
   obj          OUT NOCOPY "<object_type>")
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetRef(
   self         IN AnyData,
   rf           OUT NOCOPY REF "<object_type>")
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetCollection(
   self         IN AnyData,
   col          OUT NOCOPY "<collection_type>")
   RETURN       PLS_INTEGER;
```

Parameters

Table 85–8 GET* Function Parameter

Parameter	Description
self	An AnyData.

Table 85–8 GET Function Parameter*

Parameter	Description
num	The number, etc., to be obtained.

Returns

DBMS_TYPES.SUCCESS or DBMS_TYPES.NO_DATA

The return value is relevant only if `PieceWise()` has been already called (for a collection). In such a case, DBMS_TYPES.NO_DATA signifies the end of the collection when all elements have been accessed.

Exceptions

DBMS_TYPES.type_mismatch: When the expected type is different from the passed in type.

DBMS_TYPES.invalid_parameters: Invalid Parameters (if it is not appropriate to add a number at this point in the creation process).

DBMS_TYPES.incorrect_usage: Incorrect usage.

86

ANYDATASET TYPE

An ANYDATASET type contains a description of a given type plus a set of data instances of that type. An ANYDATASET can be persistently stored in the database if desired, or it can be used as interface parameters to communicate self-descriptive sets of data, all of which belong to a certain type.

This chapter discusses the following topics:

Construction

The AnyDataSet needs to be constructed value by value, sequentially.

For each data instance (of the type of the AnyDataSet), the `AddInstance()` function must be invoked. This adds a new data instance to the AnyDataSet. Subsequently, `Set*()` can be called to set each value in its entirety.

The MODE of construction / access can be changed to attribute / collection element wise by making calls to `PieceWise()`.

- If the type of the AnyDataSet is TYPECODE_OBJECT, individual attributes will be set with subsequent `Set*()` calls. Likewise on access.
- If the type of the current data value is a collection type individual collection elements will be set with subsequent `Set*()` calls. Likewise on access. This call is very similar to `AnyData.PieceWise()` call defined for the type AnyData.

Note that there is no support for piece-wise construction and access of nested (not top level) attributes that are of object types or collection types.

`EndCreate()` should be called to finish the construction process (before which no access calls can be made).

Summary of ANYDATASET Subprograms

Table 86–1 ANYDATASET Subprograms

Subprogram	Description
BEGINCREATE Static Procedure on page 86-3	The AnyDataSet needs to be constructed value by value, sequentially.
BEGINCREATE Static Procedure on page 86-3	Creates a new AnyDataSet which can be used to create a set of data values of the given ANYTYPE.
ADDINSTANCE Member Procedure on page 86-4	Adds a new data instance to an AnyDataSet.
PIECEWISE Member Procedure on page 86-4	Sets the MODE of construction, access of the data value to be an attribute at a time (if the data value is of TYPECODE_OBJECT).
SET* Member Procedures on page 86-5	Sets the current data value.
ENDCREATE Member Procedure on page 86-7	Ends Creation of a AnyDataSet. Other creation functions cannot be called after this call.

Table 86–1 ANYDATASET Subprograms

Subprogram	Description
GETTYPENAME Member Function on page 86-7	Gets the AnyType describing the type of the data instances in an AnyDataSet.
GETTYPE Member Function on page 86-8	Gets the current data value (which should be of appropriate type).
GETINSTANCE Member Function on page 86-9	Gets the next instance in an AnyDataSet.
GET* Member Functions on page 86-9	Gets the current data value (which should be of appropriate type).
GETCOUNT Member Function on page 86-11	Gets the number of data instances in an AnyDataSet.

BEGINCREATE Static Procedure

This procedure creates a new AnyDataSet which can be used to create a set of data values of the given ANYTYPE.

Syntax

```
STATIC PROCEDURE BeginCreate(
   typecode     IN PLS_INTEGER,
   rtype        IN OUT NOCOPY AnyType,
   aset         OUT NOCOPY AnyDataSet);
```

Parameters

Table 86–2 BEGINCREATE Procedure Parameter

Parameter	Description
typecode	The typecode for the type of the AnyDataSet.
dtype	The type of the data values. This parameter is a must for user-defined types like TYPECODE_OBJECT, Collection typecodes, etc.
aset	The AnyDataSet being constructed.

Exceptions

DBMS_TYPES.invalid_parameters: dtype is invalid (not fully constructed, etc.)

ADDINSTANCE Member Procedure

This procedure adds a new data instance to an AnyDataSet.

Syntax

```
MEMBER PROCEDURE AddInstance(
   self          IN OUT NOCOPY AnyDataSet);
```

Parameters

Table 86–3 ADDINSTANCE Procedure Parameter

Parameter	Description
self	The AnyDataSet being constructed.

Exceptions

```
DBMS_TYPES.invalid_parameters: Invalid parameters.
DBMS_TYPES.incorrect_usage: On incorrect usage.
```

Usage Notes

The data instances have to be added sequentially. The previous data instance must be fully constructed (or set to NULL) before a new one can be added.

This call DOES NOT automatically set the mode of construction to be piece-wise. The user has to explicitly call `PieceWise()` if a piece-wise construction of the instance is intended.

PIECEWISE Member Procedure

This procedure sets the MODE of construction, access of the data value to be an attribute at a time (if the data value is of TYPECODE_OBJECT).

It sets the MODE of construction, access of the data value to be a collection element at a time (if the data value is of a collection TYPE). Once this call has been made, subsequent `Set*()` and `Get*()` calls will sequentially obtain individual attributes or collection elements.

Syntax

```
MEMBER PROCEDURE PieceWise(
   self         IN OUT NOCOPY AnyDataSet);
```

Parameters

Table 86–4 PIECEWISE Procedure Parameter

Parameter	Description
self	The AnyDataSet being constructed.

Exceptions

```
DBMS_TYPES.invalid_parameters
DBMS_TYPES.incorrect_usage: On incorrect usage.
```

Usage Notes

The current data value must be of an object or collectyon type before this call can be made. There is no support for piece-wise construction or access of embedded object type attributes or nested collections.

SET* Member Procedures

This procedure sets the current data value.

The type of the current data value depends on the MODE with which we are constructing (depending on how we have invoked the `PieceWise()` call). The type of the current data should be the type of the AnyDataSet if `PieceWise()` has NOT been called. The type should be the type of the attribute at the current position if `PieceWise()` has been called.

Syntax

```
MEMBER PROCEDURE SetNumber(
   self              IN OUT NOCOPY AnyDataSet,
   num               IN NUMBER,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetDate(
   self              IN OUT NOCOPY AnyDataSet,
   dat               IN DATE,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetChar(
   self              IN OUT NOCOPY AnyDataSet,
   c                 IN CHAR,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetVarchar(
   self              IN OUT NOCOPY AnyDataSet,
```

```
   c                IN VARCHAR,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetVarchar2(
   self             IN OUT NOCOPY AnyDataSet,
   c                IN VARCHAR2,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetRaw(
   self             IN OUT NOCOPY AnyDataSet,
   r                IN RAW,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetBlob(
   self             IN OUT NOCOPY AnyDataSet,
   b                IN BLOB,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetClob(
   self             IN OUT NOCOPY AnyDataSet,
   c                IN CLOB,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetBfile(
   self             IN OUT NOCOPY AnyDataSet,
   b                IN BFILE,
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetObject(
   self             IN OUT NOCOPY AnyDataSet,
   obj              IN "<object_type>",
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetRef(
   self             IN OUT NOCOPY AnyDataSet,
   rf               IN REF "<object_type>",
   last_elem boolean DEFAULT FALSE);
MEMBER PROCEDURE SetCollection(
   self             IN OUT NOCOPY AnyDataSet,
   col              IN "<collection_type>",
   last_elem boolean DEFAULT FALSE);
```

Parameters

Table 86–5 SET* Procedure Parameters

Parameter	Description
self	The AnyDataSet being accessed.
num	The number, etc., that is to be set.

Table 86–5 SET Procedure Parameters*

Parameter	Description
last_elem	Relevant only if `PieceWise()` has been already called (for a collection). Set to TRUE if it is the last element of the collection, FALSE otherwise.

Exceptions

- DBMS_TYPES.invalid_parameters: Invalid parameters (if it is not appropriate to add a number at this point in the creation process).
- DBMS_TYPES.incorrect_usage: Incorrect usage.
- DBMS_TYPES.type_mismatch: When the expected type is different from the passed in type.

ENDCREATE Member Procedure

This procedure ends Creation of a AnyDataSet. Other creation functions cannot be called after this call.

Syntax

```
MEMBER PROCEDURE EndCreate(
   self              IN OUT NOCOPY AnyDataSet);
```

Parameters

Table 86–6 ENDCREATE Procedure Parameter

Parameter	Description
self	The AnyDataSet being constructed.

GETTYPENAME Member Function

This procedure gets the fully qualified type name for the AnyDataSet.

If the AnyDataSet is based on a built-in, this function will return NUMBER etc.

If it is based on a user defined type, this function will return <schema_ name>.<type_name>. e.g. SCOTT.FOO.

If it is based on a transient anonymous type, this function will return NULL.

Syntax

```
MEMBER FUNCTION GetTypeName(
   self           IN AnyDataSet)
   RETURN         VARCHAR2;
```

Parameter

Table 86–7 GETTYPENAME Function Parameter

Parameter	Description
self	The AnyDataSet being constructed.

Returns

Type name of the AnyDataSet.

GETTYPE Member Function

Gets the AnyType describing the type of the data instances in an AnyDataSet.

Syntax

```
MEMBER FUNCTION GetType(
   self           IN AnyDataSet,
   typ            OUT NOCOPY AnyType)
   RETURN         PLS_INTEGER;
```

Parameters

Table 86–8 GETTYPE Function Parameter

Parameter	Description
self	The AnyDataSet.
typ	The AnyType corresponding to the AnyData. May be NULL if it does not represent a user-defined function.

Returns

The typecode corresponding to the type of the AnyData.

GETINSTANCE Member Function

This function gets the next instance in an AnyDataSet. Only sequential access to the instances in an AnyDataSet is allowed. After this function has been called, the `Get*()` functions can be invoked on the AnyDataSet to access the current instance. If `PieceWise()` is called before doing the `Get*()` calls, the individual attributes (or collection elements) can be accessed.

It is an error to invoke this function before the AnyDataSet is fully created.

Syntax

```
MEMBER FUNCTION GetInstance(
   self           IN OUT NOCOPY AnyDataSet)
   RETURN         PLS_INTEGER;
```

Parameters

Table 86–9 GETINSTANCE Function Parameter

Parameter	Description
self	The AnyDataSet being accessed.

Returns

DBMS_TYPES.SUCCESS or DBMS_TYPES.NO_DATA

DBMS_TYPES.NO_DATA signifies the end of the AnyDataSet (all instances have been accessed).

Usage Notes

This function should be called even before accessing the first instance.

GET* Member Functions

These functions get the current data value (which should be of appropriate type).

The type of the current data value depends on the MODE with which you are accessing it (depending on how we have invoked the `PieceWise()` call). If `PieceWise()` has NOT been called, we are accessing the instance in its entirety and the type of the data value should match the type of the AnyDataSet.

If `PieceWise()` has been called, we are accessing the instance piece-wise. The type of the data value should match the type of the attribute (or collection element) at the current position.

Syntax

```
MEMBER FUNCTION GetNumber(
   self         IN AnyDataSet,
   num          OUT NOCOPY NUMBER)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetDate(
   self         IN AnyDataSet,
   dat          OUT NOCOPY DATE)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetChar(
   self         IN AnyDataSet,
   c            OUT NOCOPY CHAR)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetVarchar(
   self         IN AnyDataSet,
   c            OUT NOCOPY VARCHAR)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetVarchar2(
   self         IN AnyDataSet,
   c            OUT NOCOPY VARCHAR2)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetRaw(
   self         IN AnyDataSet,
   r            OUT NOCOPY RAW)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetBlob(
   self         IN AnyDataSet,
   b            OUT NOCOPY BLOB)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetClob(
   self         IN AnyDataSet,
   c            OUT NOCOPY CLOB)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetBfile(
   self         IN AnyDataSet,
   b            OUT NOCOPY BFILE)
   RETURN       PLS_INTEGER;
MEMBER FUNCTION GetObject(
   self         IN AnyDataSet,
   obj          OUT NOCOPY "<object_type>")
```

```
   RETURN      PLS_INTEGER;
MEMBER FUNCTION GetRef(
   self        IN AnyDataSet,
   rf          OUT NOCOPY REF "<object_type>")
   RETURN      PLS_INTEGER;
MEMBER FUNCTION GetCollection(
   self        IN AnyDataSet,
   col         OUT NOCOPY "<collection_type>")
   RETURN      PLS_INTEGER;
```

Parameters

Table 86–10 GET Procedure Parameters*

Parameter	Description
self	The AnyDataSet being accessed.
num	The number, etc., that is to be obtained.

Returns

DBMS_TYPES.SUCCESS or DBMS_TYPES.NO_DATA

The return value is relevant only if `PieceWise()` has been already called (for a collection). In such a case, DBMS_TYPES.NO_DATA signifies the end of the collection when all elements have been accessed.

Exceptions

DBMS_TYPES.invalid_parameters: Invalid Parameters (if it is not appropriate to add a number at this point in the creation process).

DBMS_TYPES.incorrect_usage: Incorrect usage

DBMS_TYPES.type_mismatch: When the expected type is different from the passed in type.

GETCOUNT Member Function

This function gets the number of data instances in an AnyDataSet.

Syntax

```
MEMBER FUNCTION GetCount(
   self        IN AnyDataSet)
```

```
RETURN      PLS_INTEGER;
```

Parameter

Table 86–11 GETCOUNT Function Parameter

Parameter	Description
self	The AnyDataSet being accessed.

Returns

The number of data instances.

87

ANYTYPE TYPE

An ANYTYPE can contain a type description of any persistent SQL type, named or unnamed, including object types and collection types. It can also be used to construct new transient type descriptions.

New persistent types can only be created using the CREATE TYPE statement. Only new transient types can be constructed using the ANYTYPE interfaces.

Thios chapter discusses the following:

- Summary of ANYTYPE Subprograms

Summary of ANYTYPE Subprograms

Table 87–1 ANYTYPE Subprograms

Subprogram	Description
"BEGINCREATE Static Procedure" on page 87-2	Creates a new instance of ANYTYPE which can be used to create a transient type description.
"SETINFO Member Procedure" on page 87-3	Sets any additional information required for constructing a COLLECTION or builtin type.
"ADDATTR Member Procedure" on page 87-4	Adds an attribute to an ANYTYPE (of typecode DBMS_TYPES.TYPECODE_OBJECT).
"ENDCREATE Member Procedure" on page 87-5	Ends creation of a transient AnyType. Other creation functions cannot be called after this call.
"GETPERSISTENT Static Function" on page 87-6	Returns an AnyType corresponding to a persistent type created earlier using the CREATE TYPE SQL statement.
"GETINFO Member Function" on page 87-6	Gets the type information for the AnyType.
"GETATTRELEMINFO Member Function" on page 87-8	Gets the type information for an attribute of the type (if it is of TYPECODE_OBJECT). Gets the type information for a collection's element type if the *self* parameter is of a collection type.

BEGINCREATE Static Procedure

This procxedure creates a new instance of ANYTYPE which can be used to create a transient type description.

Syntax

```
STATIC PROCEDURE BEGINCREATE(
   typecode       IN PLS_INTEGER,
   atype          OUT NOCOPY AnyType);
```

Parameters

Table 87–2 BEGINCREATE Procedure Parameters

Parameter	Description
typecode	Use a constant from DBMS_TYPES package. Typecodes for user-defined type: can be DBMS_TYPES.TYPECODE_OBJECT DBMS_TYPES.TYPECODE_VARRAY or DBMS_TYPES.TYPECODE_TABLE Typecodes for builtin types: DBMS_TYPES.TYPECODE_NUMBER etc.
atype	AnyType for a transient type

SETINFO Member Procedure

This procedure sets any additional information required for constructing a COLLECTION or builtin type.

Syntax

```
MEMBER PROCEDURE SetInfo(
   self          IN OUT NOCOPY AnyType,
   prec          IN PLS_INTEGER,
   scale         IN PLS_INTEGER,
   len           IN PLS_INTEGER,
   csid          IN PLS_INTEGER,
   csfrm         IN PLS_INTEGER,
   atype         IN ANYTYPE DEFAULT NULL,
   elem_tc       IN PLS_INTEGER DEFAULT NULL,
   elem_count    IN PLS_INTEGER DEFAULT 0);
```

Parameters

Table 87–3 SETINFO Procedure Parameters

Parameter	Description
self	The transient ANYTYPE that is being constructed.
prec, scale (OPTIONAL)	Required if typecode represents a NUMBER. Give precision and scale. Ignored otherwise.

Table 87–3 SETINFO Procedure Parameters

Parameter	Description
len (OPTIONAL)	Required if typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Gives length.
csid, csfrm (OPTIONAL)	Required if typecode represents types requiring character information such as CHAR, VARCHAR, VARCHAR2, or CFILE.
atype (OPTIONAL)	Required if collection element typecode is a user-defined type such as TYPECODE_OBJECT, etc. It is also required for a built-in type that needs user-defined type information such as TYPECODE_REF. This parameter is not needed otherwise.
The Following Parameters Are Required For Collection Types:	
elem_tc	Must be of the collection element's typecode (from DBMS_ TYPES package).
elem_count	Pass 0 for elem_count if the self represents a nested table (TYPECODE_TABLE). Otherwise pass the collection count if *self* represents a VARRAY.

Exceptions

- DBMS_TYPES.invalid_parameter: Invalid Parameters (typecode, typeinfo)
- DBMS_TYPES.incorrect_usage: Incorrect usage (cannot call after calling `EndCreate()`, etc.)

Usage Notes

It is an error to call this function on an AnyType that represents a persistent user defined type.

ADDATTR Member Procedure

This procedure adds an attribute to an AnyType (of typecode DBMS_ TYPES.TYPECODE_OBJECT).

Syntax

```
MEMBER PROCEDURE AddAttr(
   self          IN OUT NOCOPY AnyType,
   aname         IN VARCHAR2,
   typecode      IN PLS_INTEGER,
   prec          IN PLS_INTEGER,
```

```
   scale         IN PLS_INTEGER,
   len           IN PLS_INTEGER,
   csid          IN PLS_INTEGER,
   csfrm         IN PLS_INTEGER,
   attr_type     IN ANYTYPE DEFAULT NULL);
```

Parameters

Table 87–4 ADDATTR Procedure Parameters

Parameter	Description
self	The transient AnyType that is being constructed. Must be of type DBMS_TYPES.TYPECODE_OBJECT.
aname (OPTIONAL)	Attribute's name. Could be NULL.
typecode	Attribute's typecode. Can be built-in or user-defined typecode (from DBMS_TYPES package).
prec, scale (OPTIONAL)	Required if typecode represents a NUMBER. Give precision and scale. Ignored otherwise.
len (OPTIONAL)	Required if typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Give length.
csid, csfrm (OPTIONAL)	Required if typecode represents a type requiring character information, such as CHAR, VARCHAR, VARCHAR2, CFILE.
attr_type (OPTIONAL)	AnyType corresponding to a user-defined type. This parameter is required if the attribute is a user defined type.

Exceptions

- DBMS_TYPES.invalid_parameters: Invalid Parameters (typecode, typeinfo)
- DBMS_TYPES.incorrect_usage: Incorrect usage (cannot call after calling EndCreate(), etc.)

ENDCREATE Member Procedure

This procedure ends creation of a transient AnyType. Other creation functions cannot be called after this call.

Syntax

```
MEMBER PROCEDURE EndCreate(
   self           IN OUT NOCOPY AnyType);
```

Parameter

Table 87–5 ENDCREATE Procedure Parameter

Parameter	Description
self	The transient AnyType that is being constructed.

GETPERSISTENT Static Function

This procedure returns an AnyType corresponding to a persistent type created earlier using the CREATE TYPE SQL statement.

Syntax

```
STATIC FUNCTION GetPersistent(
   schema_name      IN VARCHAR2,
   type_name        IN VARCHAR2,
   version          IN VARCHAR2 DEFAULT NULL)
   RETURN           AnyType;
```

Parameters

Table 87–6 GETPERSISTENT Function Parameters

Parameter	Description
schema_name	Schema name of the type.
type_name	Type name.
version	Type version.

Returns

An AnyType corresponding to a persistent type created earlier using the CREATE TYPE SQL statement.

GETINFO Member Function

This function gets the type information for the AnyType.

Syntax

```
MEMBER FUNCTION GetInfo (
   self        IN AnyType,
```

```
prec        OUT PLS_INTEGER,
scale       OUT PLS_INTEGER,
len         OUT PLS_INTEGER,
csid        OUT PLS_INTEGER,
csfrm       OUT PLS_INTEGER,
schema_name OUT VARCHAR2,
type_name   OUT VARCHAR2,
version     OUT varchar2,
count       OUT PLS_INTEGER)
RETURN      PLS_INTEGER;
```

Parameters

Table 87–7 GETINFO Function Parameters

Parameter	Description
self	The AnyType.
prec, scale	If typecode represents a number. Gives precision and scale. Ignored otherwise.
len	If typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Gives length.
csid, csfrm	If typecode represents a type requiring character information such as: CHAR, VARCHAR, VARCHAR2, CFILE.
schema_name, type_name, version	Type's schema (if persistent), typename and version.
count	If *self* is a VARRAY, this gives the VARRAY count. If self is of TYPECODE_OBJECT, this gives the number of attributes.

Returns

The typecode of *self*.

Exceptions

- DBMS_TYPES.invalid_parameters: Invalid Parameters (position is beyond bounds or the AnyType is not properly Constructed).

GETATTRELEMINFO Member Function

This function gets the type information for an attribute of the type (if it is of TYPECODE_OBJECT). Gets the type information for a collection's element type if the *self* parameter is of a collection type.

Syntax

```
MEMBER FUNCTION GetAttrElemInfo (
   self           IN AnyType,
   pos            IN PLS_INTEGER,
   prec           OUT PLS_INTEGER,
   scale          OUT PLS_INTEGER,
   len            OUT PLS_INTEGER,
   csid           OUT PLS_INTEGER,
   csfrm          OUT PLS_INTEGER,
   attr_elt_type  OUT ANYTYPE
   aname          OUT VARRCHAR2)
   RETURN         PLS_INTEGER;
```

Parameters

Table 87–8 GETATTRELEMINFO Function Parameters

Parameter	Description
self	The AnyType.
pos	If self is of TYPECODE_OBJECT, this gives the attribute position (starting at 1). It is ignored otherwise.
prec, scale	If attribute / collection element typecode represents a NUMBER. Gives precision and scale. Ignored otherwise.
len	If typecode represents a RAW, CHAR, VARCHAR, or VARCHAR2 type. Gives length.
csid, csfrm	If typecode represents a type requiring character information such as: CHAR, VARCHAR, VARCHAR2, CFILE. Gives character set ID, character set form.
attr_elt_type	IF attribute / collection element typecode represents a user-defined type, this returns the AnyType corresponding to it. User can subsequently describe the *attr_elt_type*.
aname	Attribute name (if it is an attribute of an object type, NULL otherwise).

Returns

The typecode of the attribute or collection element.

Exceptions

- DBMS_TYPES.invalid_parameters: Invalid Parameters (position is beyond bounds or the AnyType is not properly constructed).

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