Introducing Sybase® SQL Server™ for Windows NT

Sybase SQL Server Release 11.0.x

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About This Book

This book, *Introducing Sybase SQL Server for Windows NT*, provides an overview of SQL Server for Windows NT™, a set of Sybase® products for developing and deploying relational database applications on desktop platforms.

Audience

Read this guide before you install and begin using SQL Server to establish a foundation for using the product. This guide is for system administrators, managers, or anyone who will be involved in setting up or using SQL Server for Windows NT or who wants to understand how the product set fits together. This guide assumes no technical knowledge of the Sybase products.

How to Use This Guide

This guide includes the following chapters:

- Chapter 1, "Overview of SQL Server for Windows NT," introduces relational database management systems and client/server architecture. It also describes each of the products in the SQL Server for Windows NT set of products.
- Chapter 2, "Terms and Concepts," defines some of the basic terminology necessary for understanding discussions about using SQL Server.
- Chapter 3, "Using SQL Server," provides a brief introduction to some of the most common tasks a user performs with a new SQL Server for Windows NT.

Related Documents

The *Read Me First* card included in your product package lists the products included with your SQL Server for Windows NT products. It also provides a road map for locating the related Sybase documentation available to you. *Installing Sybase SQL Server for Windows NT* lists the version numbers of the included products.

Conventions

This manual uses the following style conventions:

- Within text, the names of files, directories, and database objects appear in italics:

  \ data \ master.dat

- Examples showing the use of Transact-SQL commands are printed like this:

  ```
  select titles, pub_id
      from titles
  ```

- The names of utilities, procedures, commands, and scripts appear in the following font:

  sp_revokelogin

- Terms that you can find in the glossary appear in the following font:

  global variable

1 Overview of SQL Server for Windows NT

SQL Server for Windows NT is an integrated set of software products for developing and deploying relational database applications. It consists of a high-performance relational database management system (RDBMS), which runs database servers, and a collection of applications and libraries, which run on database clients. This arrangement, consisting of servers accessed by multiple clients over a network, forms the basis for Sybase's **client/server architecture**.

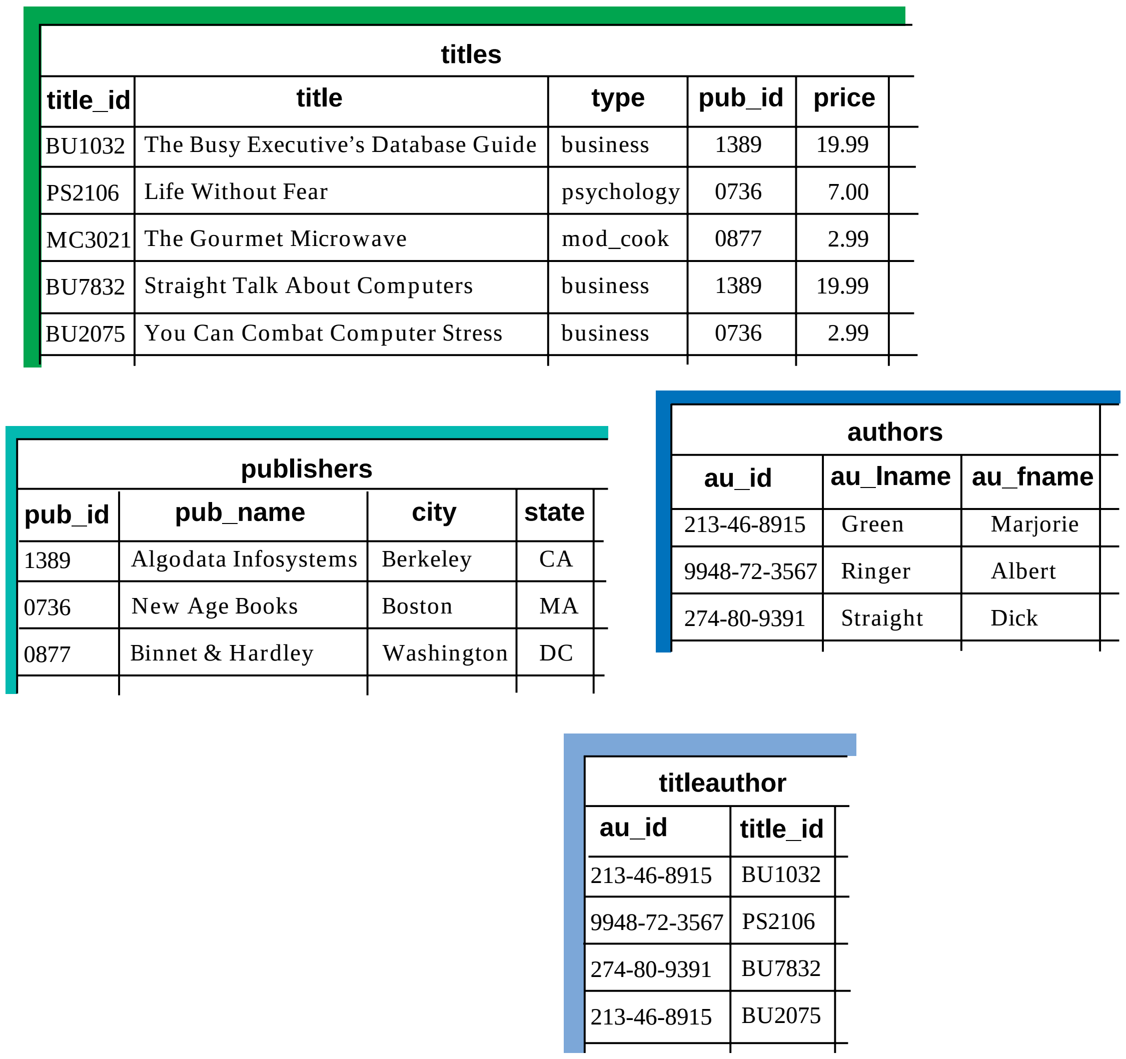
This chapter provides an overview of the following topics:

Relational Database Management Systems

A **relational database management system** (**RDBMS**) is a system for storing and retrieving data in which the data is represented in two-dimensional **tables**. In early relational systems, tables were called relations. A relational database consists of a collection of tables that store interrelated data.

Tables

Figure 1-1 shows portions of tables that you might create in a relational database storing related data about books— called *titles, authors*, *publishers*, and *titleauthor.*



titles

title_id	title	type	pub_id	price
BU1032	The Busy Executive's Database Guide	business	1389	19.99
PS2106	Life Without Fear	psychology	0736	7.00
MC3021	The Gourmet Microwave	mod_cook	0877	2.99
BU7832	Straight Talk About Computers	business	1389	19.99
BU2075	You Can Combat Computer Stress	business	0736	2.99

publishers

pub_id	pub_name	city	state
1389	Algodata Infosystems	Berkeley	CA
0736	New Age Books	Boston	MA
0877	Binnet & Hardley	Washington	DC

authors

au_id	au_lname	au_fname
213-46-8915	Green	Marjorie
9948-72-3567	Ringer	Albert
274-80-9391	Straight	Dick

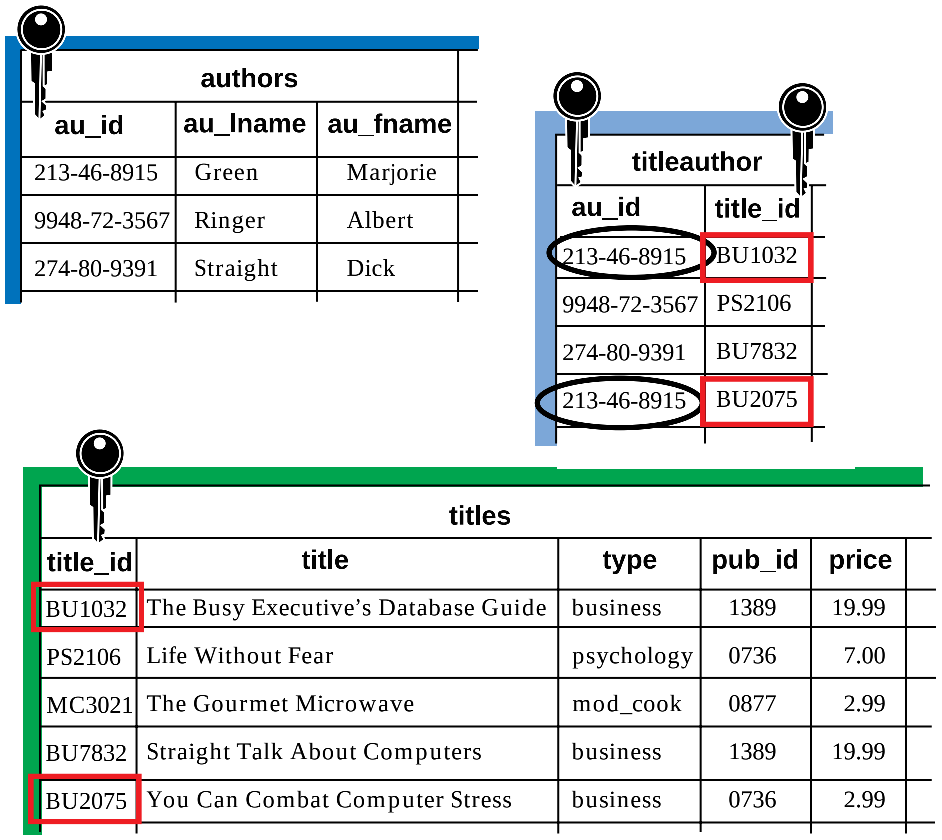
titleauthor

au_id	title_id
213-46-8915	BU1032
9948-72-3567	PS2106
274-80-9391	BU7832
213-46-8915	BU2075

Figure 1-1: Tables in a database

Each table in the database holds information about different things—books, publishers, and authors. But some information in each table overlaps with information in another table—by design. Columns that appear in more than one table and that link the tables together are called **keys**. Keys, which are discussed in more detail in "Key" on page 2-2, allow you to retrieve information that is distributed over multiple tables.

For example, you might want information about books published by Marjorie Greene, which spans the *authors* and the *titles* tables. Figure 1-2 shows the key columns for our sample databases and how they allow you to retrieve the correct data from the tables.



authors

au_id	au_lname	au_fname
213-46-8915	Green	Marjorie
9948-72-3567	Ringer	Albert
274-80-9391	Straight	Dick

titleauthor

au_id	title_id
213-46-8915	BU1032
9948-72-3567	PS2106
274-80-9391	BU7832
213-46-8915	BU2075

titles

title_id	title	type	pub_id	price
BU1032	The Busy Executive’s Database Guide	business	1389	19.99
PS2106	Life Without Fear	psychology	0736	7.00
MC3021	The Gourmet Microwave	mod_cook	0877	2.99
BU7832	Straight Talk About Computers	business	1389	19.99
BU2075	You Can Combat Computer Stress	business	0736	2.99

Figure 1-2: Retrieving data across tables using key columns

One advantage of relational databases is that they allow you to set up multiple tables, a structure that eliminates redundancy and possible inconsistencies caused by that redundancy. For example, both the sales and accounts payable departments might enter and look up information about publishers. In a relational database, the information about publishers only needs to be entered once, in a table that both departments can access.

Defining how tables represent a body of information, determining how the data should be distributed among the tables, and deciding what keys are needed to define the relationships are the subjects of **logical design**. Sound database design is the key factor in realizing SQL Server’s performance potential and makes your database easy to maintain and update. Many excellent books are available on this subject. *The Practical SQL Handbook* (Bowman, Emerson, and Damovsky, Addison-Wesley, 1993) offers a clear introduction to logical database design, and it specifically relates the issues to a SQL Server context. (See “Designing Databases” on page 3-4.)

SQL

SQL (Structured Query Language) is the foundation for entering data in and retrieving data from the server. SQL is the database language designed for the RDBMS model, which makes it easy to set up, use, and maintain a relational database. This is in contrast to database systems in previous computing models, which required large IS departments to be involved in data requests. An excellent reference for learning SQL is the *LAN Times Guide to SQL* (Groff and Weinberg, Osborne McGraw-Hill, 1994).

End users need not learn SQL in order to access data, however—in most systems, purchased or developed GUI client software does the job of translating user requests into SQL. Software called application programming interfaces (APIs) or libraries installed on the clients allow applications to communicate with the RDBMS.

Sybase's enhanced version of SQL is called **Transact-SQL** (see "Transact-SQL" on page 2-6).

Auxiliary Facilities of SQL Server's RDBMS

In addition to storing and retrieving data, SQL Server provides a number of auxiliary facilities for managing the relational databases. These include programs for starting and stopping the server, for backing up and restoring data, for copying data between a database and a file system, for authenticating users of the server and the databases, for managing the physical devices on which the data is stored, for displaying system messages in different languages, for storing and preprocessing a reusable procedure or set of procedures, and so forth. Together with the basic storage and retrieval capabilities, these facilities make up SQL Server's relational database management system.

Client/Server Architecture

In a Sybase SQL Server environment, the databases and the RDBMS software reside on one or more servers, where multiple clients can access them concurrently over a network. Applications that access and manipulate the shared data, as well as the libraries that allow the applications to communicate with the RDBMS, reside on the clients. Figure 1-3 illustrates the Sybase client / server configuration.

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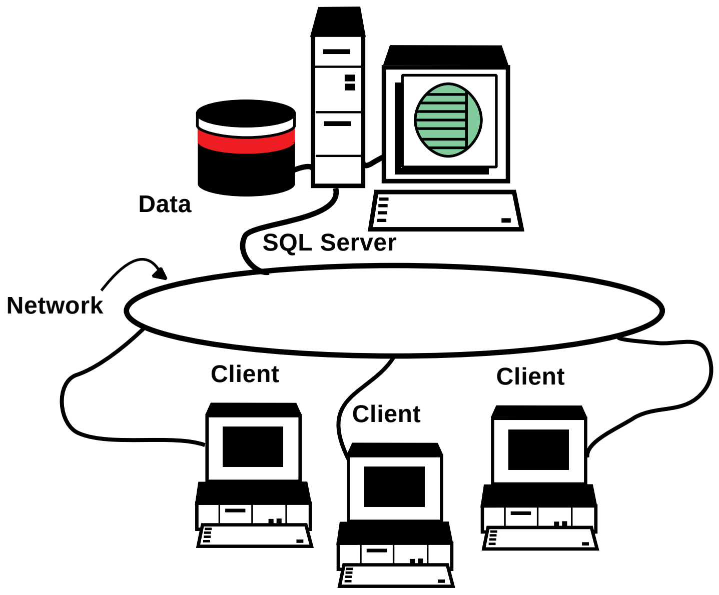


Figure 1-3: A Sybase client/server environment

The basic client / server relationship is one in which client applications request services from servers, and servers return results to client applications. A typical request for service in a client / server RDBMS is for the client to request that the server retrieve or modify the data that it is storing. A typical result is confirmation by the server that the request was successfully or unsuccessfully carried out, followed by the requested data. Figure 1-4 illustrates a basic client / server interaction.

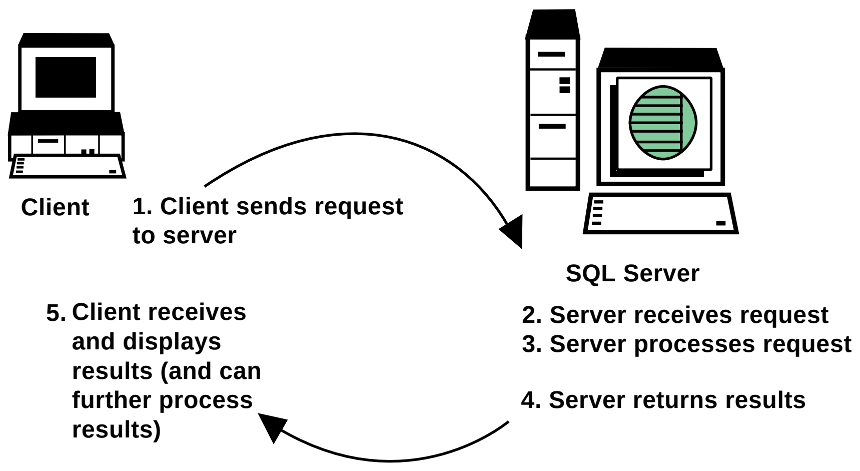

Client
1. Client sends request to server
SQL Server
2. Server receives request
3. Server processes request
4. Server returns results
5. Client receives and displays results (and can further process results)

Figure 1-4: Basic client/server interaction

Division of Tasks

A client/server model provides the best performance for data sharing among a large number of PCs and workstations because clients and servers share the work—each performs the work it can do most efficiently. The server handles activities related directly to the maintenance and retrieval of shared data, while other tasks, such as displaying returned data or interpreting requests from users, are off-loaded to the clients. Figure 1-5 represents how the tasks are divided.

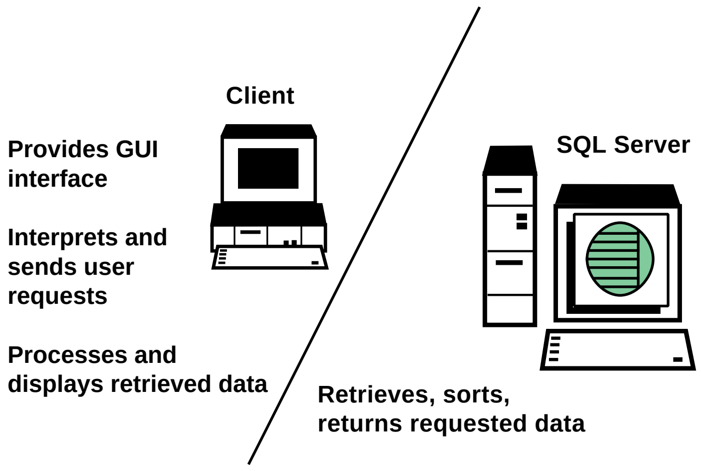

Client
Provides GUI interface
Interprets and sends user requests
Processes and displays retrieved data
SQL Server
Retrieves, sorts, returns requested data

Figure 1-5: Division of tasks

Distributed Computing

The ability to distribute data among multiple servers provides a structure for distributed computing environments in which control is not centralized at a single data source or geographic location. Clients can access the data they need from any server.

Figure 1-6 shows a non-centralized, distributed computing configuration in which data is distributed over several sites and each site houses a different subset of the data.

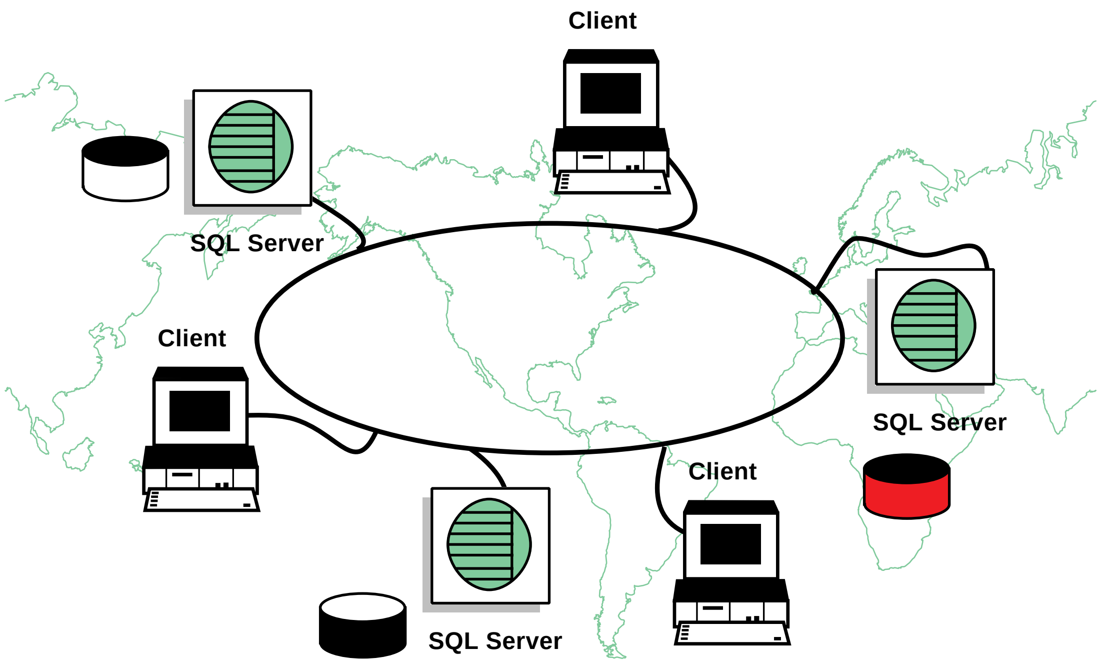


Figure 1-6: Distributed client/server environment

Some organizations want each site to have a complete copy of the entire data set for two reasons, among others: to improve the time it takes to access the data, and to eliminate downtime in the case of one server's failure. Data **replication** offers a solution to these organizations.

Replication Server®, a Sybase product you can purchase separately, can be integrated with your SQL Server for Windows NT setup. Replication Server replicates peer-to-peer data replication across a distributed environment, to and from heterogeneous hardware and data sources. All clients have equally fast and reliable access to all data.

Components of SQL Server for Windows NT

As the section “Client / Server Architecture” on page 1-4, described, the basic client / server RDBMS model consists of the database server and third-party or developed client software that communicates with the database server over a network. The integrated set of products in SQL Server for Windows NT also includes software for backing up, monitoring, administering SQL Server as well as client libraries that enable applications to communicate with the server

You install some of the SQL Server for Windows NT software on the server and some on the client. If you are running SQL Server on an Intel-based machine, you can install the client software on your server, if you like. It is convenient to be able to run some of the client administrative tools and utilities from the server desktop.

In addition, on the server you create files for use as **database devices**, files dedicated to storing data. You use the Transact-SQL **disk init** command to initialize the devices.

On the client you will most likely install (in addition to the client components of SQL Server) **development tools** such as PowerBuilder that help you build applications that access SQL Server, the applications themselves, and / or third-party software.

Figure 1-7 shows an overview of the client and server components of your SQL Server system. You may want to install client components tagged with an asterisk on either the server or the client, or both. The sections “Server Components” on page 1-9 and “Client Components” on page 1-10 describe each of the components in more detail.

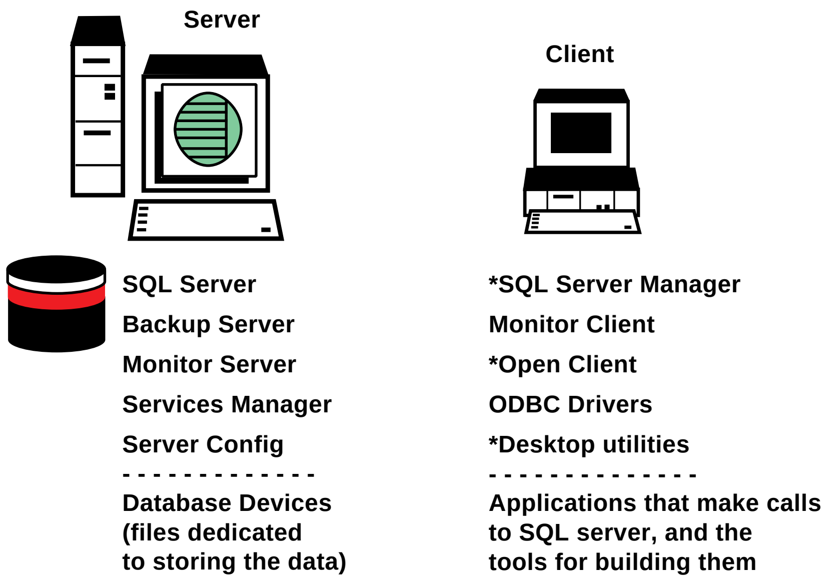


Figure 1-7: Overview of SQL Server for Windows NT components

Server Components

The following SQL Server for Windows NT components reside on the server:

- **SQL Server**

  SQL Server is Sybase's high-performance RDBMS. You can get a technical overview of SQL Server release 11.0.x from the product description and the white papers accessible from the Sybase home page on the World Wide Web at the following address:

  http://www.sybase.com

  Also ask your sales representative for more information. There are also several excellent books about SQL Server available from Sybase Press as well as from third-party publishers.

  SQL Server also includes several utilities, which are described in *SQL Server Utilities Programs* for your platform.

- **Backup Server™**

  Backup Server is a server application that runs concurrently with SQL Server to perform high-speed on-line database **dumps** and **loads**. Backup Server is automatically installed when you install SQL Server.

- **Server Components of SQL Server Monitor Server™**

  Monitor Server and **Monitor Historical Server** are the server components of a client/server application called SQL Server Monitor Server, which allows you to capture, display, and evaluate SQL Server performance data and to tune SQL Server performance. Monitor Server captures performance data from SQL Server's shared memory; Monitor Historical Server writes the data to files for off-line analysis. You must install Monitor Server on the same machine as the SQL Server that you want to monitor. Monitor Historical Server performs best when installed on a different machine from the SQL Server being monitored.

- **Services Manager**

  Services Manager is a Windows utility that allows you to start, pause, and stop a Sybase server.

- **Server Config**

  Server Config facilitates configuration of SQL Server immediately after installation. See "Configuring SQL Server" on page 3-2 for a discussion of these post-installation tasks.

Client Components

When you install client products on a PC, a program window is created. This program window, shown in Figure 1-8 for NT clients and in Figure 1-9 for Windows clients, shows many (but not all) of the client components.

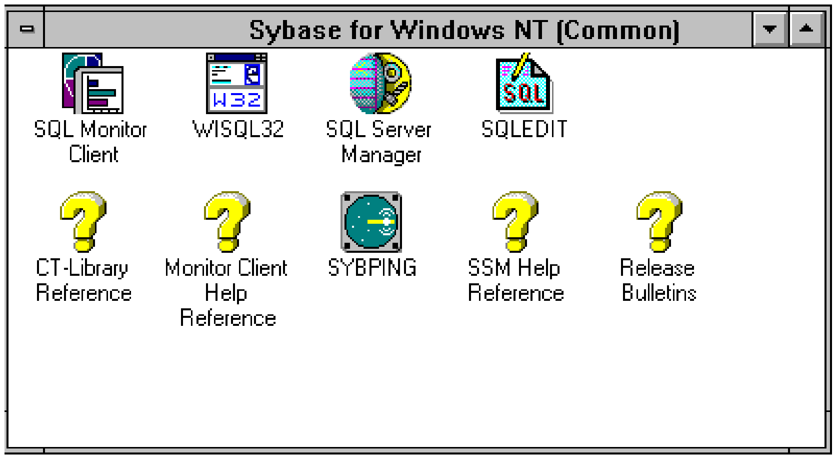


Figure 1-8: The Sybase Program window on the NT client desktop

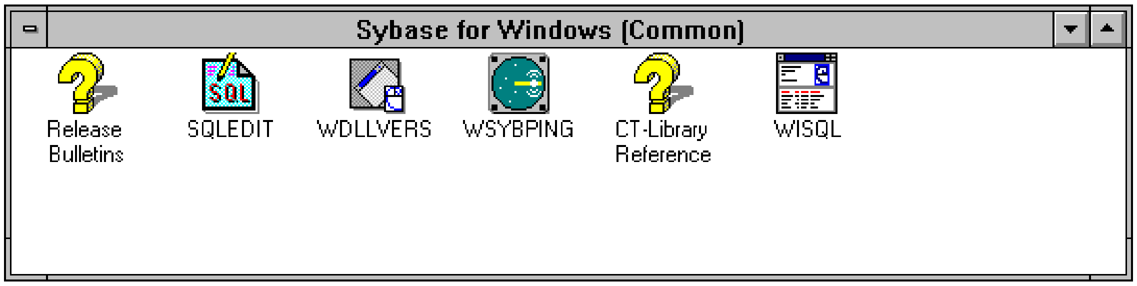


Figure 1-9: The Sybase Program window on the Windows client desktop

The following SQL Server for Windows NT components are client components:

- **SQL Server Manager™**

  SQL Server Manager is a graphical **system administration** and **database administration** tool for SQL Server. Its powerful collection of features make exacting administrative tasks easy to perform. Figure 1-10 shows the SQL Server Manager user interface.

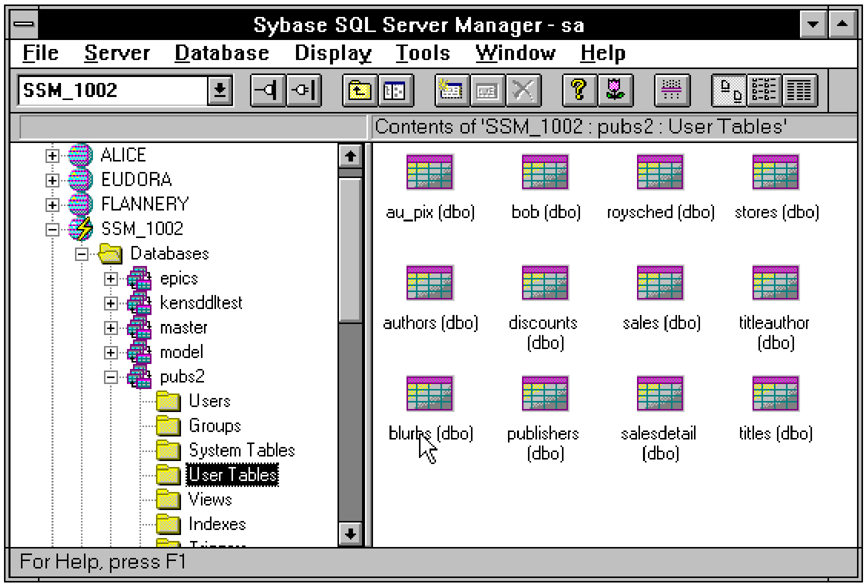


Figure 1-10: The SQL Server Manager user interface

SQL Server Manager helps with the following typical system or database administrator's tasks:

- Managing SQL Servers, including connecting to, disconnecting from, configuring, and stopping servers; and troubleshooting SQL Server problems
- Managing **data caches**
- Managing SQL Server physical resources
- Managing databases, including creating, deleting, backing up, and restoring databases
- Managing access, including creating and deleting SQL Server **logins**, creating and deleting database users and user **groups**, administering Sybase **roles**, and managing object and command **permissions**

• **Monitor Client**

This client application gathers data collected by Monitor Server and presents it to the user through a graphical user interface. Monitor Client makes it easy to view SQL Server performance data and tune SQL Server performance parameters. Monitor Client also includes Monitor Client Library, which provides a programmatic interface to Monitor Server.

• **Open Client™**

Open Client contains APIs that enable client applications to interface with SQL Server. These APIs are Client-Library™, DB-Library™, and CS-Library. Client applications that you purchase or develop, as well as application development tools such as PowerBuilder® and Infomaker, require that these Open Client libraries be installed so that they can communicate with SQL Server.

CS-Library contains a collection of utility routines used by all client applications. Client-Library and DB-Library contain a collection of routines that are specific to the programming language being used in an application. Client-Library is an extension of the older DB-Library that accommodates new features supported by SQL Server release 10 and later; DB-Library supports pre-system 10 features. For more information, consult the documentation in the Open Client/Server™ collection of SyBooks™ (see “Sybase Documentation” on page 1-13 for more information).

Open Client includes Net-Library™, a library containing network protocol services that support connections between client applications and SQL Server.

Open Client also includes the following utilities:

- **isql** – an interactive query processor that lets you send commands to the RDBMS from the command line on the client.
- **bcp** – a program that copies data from a database to an **operating system file** and vice-versa.
- **defncopy** – a program that copies definitions of **database objects** that you create from a database to an operating system file and vice-versa.

- **Desktop Utilities**

  Icons for frequently used utilities appear on the desktop. These include:

  - **sqledit** – an editor for creating and modifying the network configuration files.You can also call **sqledit** from SQL Server Manager.
  - **sybping** (Windows NT) or **wsybping** (Windows) – utilities for testing network connections between client PCs and the server.
  - **wdllvers** (Windows only) – a utility for examining Sybase and Windows Dynamic Link Libraries (**DLLs**) loaded into memory.

- **Open Database Connectivity (ODBC) Drivers**

  ODBC is the API developed by Microsoft to allow clients to connect to heterogeneous RDBMSs. You will install and use the appropriate ODBC driver, which resides on the client, only if you are developing or running third-party client applications that require access to SQL Server through Microsoft's ODBC interface.

Sybase Documentation

Except for the books included in the SQL Server for Windows NT package, all the product documentation is contained in an online library called SyBooks, which is included on the product media.You can install SyBooks on a single server, where users can access it over the network, or you can install it on individual clients if they have enough disk space.

If you have Internet access and a web browser, you can also access SyBooks from the World Wide Web. Search for "SyBooks" on the Sybase home page to access SyBooks-on-the-Web.

You also have the option to order all the documentation in the SyBooks collection in printed form. Refer to the product ID numbers listed on the SyBooks content list included in the product package.

See “Document Orders” on the first page following the title page of this guide for specific ordering information.

2 Terms and Concepts

Before you delve too deeply into SQL Server and SQL Server documentation, familiarize yourself with some of the terminology that you will frequently encounter as you explore the Sybase family of relational database products.

Chapter 1 defined some terms, including **client/server architecture**, **relational database**,**relational database management system**, and **table**.

This chapter describes some additional terms and concepts that relate to SQL Server, including:

Database Object

The term **database object** refers to the components of a relational database. The primary database object is the **table**. This section describes other database objects: **rows** and **columns**, **defaults**, **views**, **indexes**, **rules**, **triggers**, and **stored procedures**.

Row and Column

A table contains information about an entity. For example, a table might contain information about authors. A **row**, or record, describes one instance of that entity—a person, a company, a sale, or some other thing. In our example, it describes one particular author. A **column**, or field, describes an attribute of that entity, such as name, size, color, price, etc. The example shown in Figure 2-1 shows columns that represent the author's first or last name. In early relational systems, columns were called attributes.

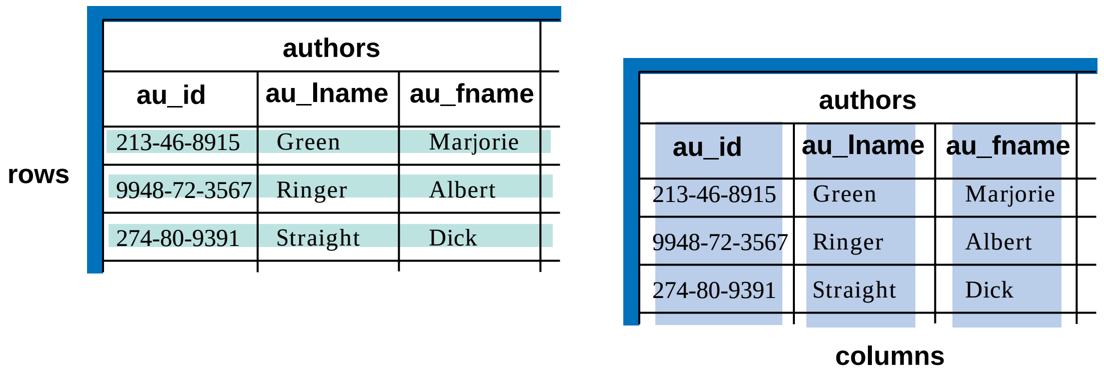
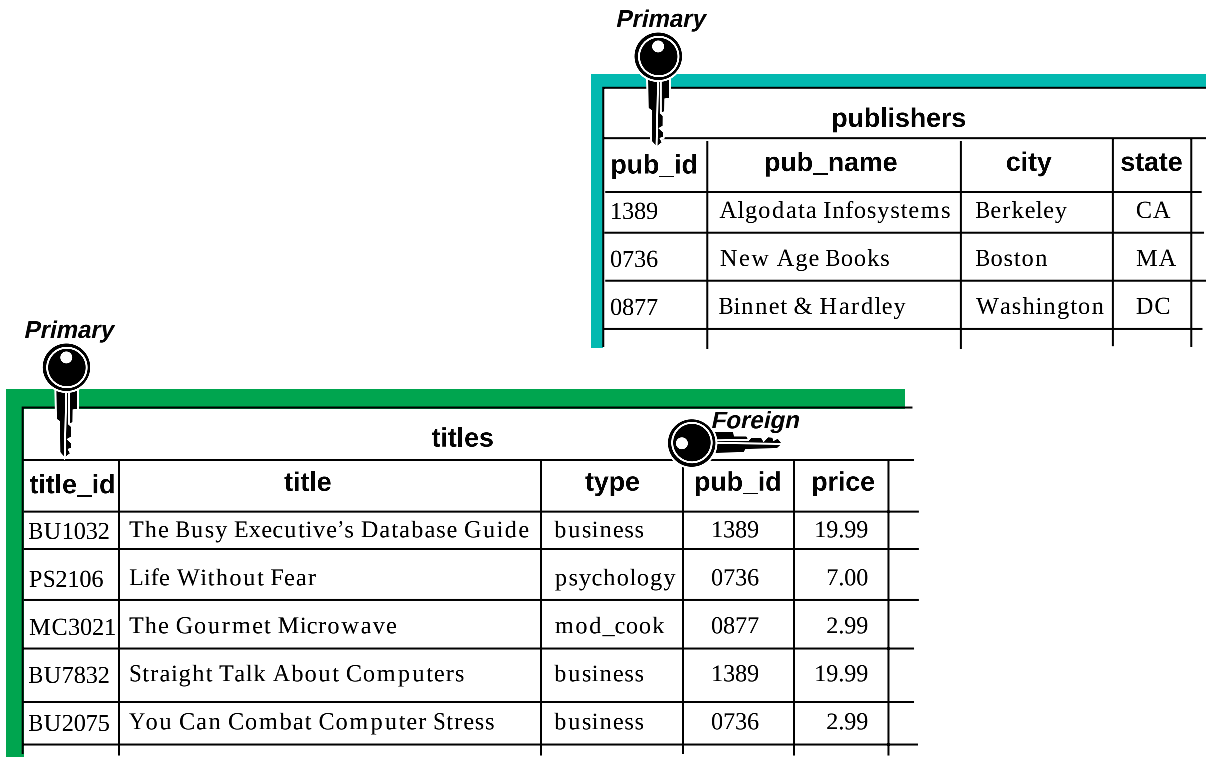


Figure 2-1: Rows and columns in a table

Key

In some cases, a column does not describe a real-world attribute but instead is a **key** column that serves a logical function, (as introduced in "Tables" on page 1-1). A **primary key** uniquely identifies a row in a table. A **foreign key** relates a row in one table to a row in another table by matching its value to the value of the other table's primary key.

The sample shown in Chapter 1 and repeated in Figure 2-2 shows three key columns. The *pub_id* column in the *publishers* table is a primary key that provides a unique identifier for every row in the *publishers* table—there are no duplicated *pub_id* values. In the *titles* table, however, the *pub_id* column is a foreign key that relates the information about a book in the *titles* table to information about that book's publisher in the *publishers* table. In the *titles* table, there may be *pub_ids* that appear more than once, because a publisher probably publishes more than one book.



publishers

pub_id	pub_name	city	state
1389	Algodata Infosystems	Berkeley	CA
0736	New Age Books	Boston	MA
0877	Binnet & Hardley	Washington	DC

titles

title_id	title	type	pub_id	price
BU1032	The Busy Executive's Database Guide	business	1389	19.99
PS2106	Life Without Fear	psychology	0736	7.00
MC3021	The Gourmet Microwave	mod_cook	0877	2.99
BU7832	Straight Talk About Computers	business	1389	19.99
BU2075	You Can Combat Computer Stress	business	0736	2.99

Figure 2-2: Primary and foreign key columns

You must enforce **referential integrity** for foreign keys; foreign key data must be kept consistent with the primary keys to which they refer. An easy way to do this is with **triggers** (see "Trigger" on page 2-6). You can also enforce referential integrity with **constraints**.

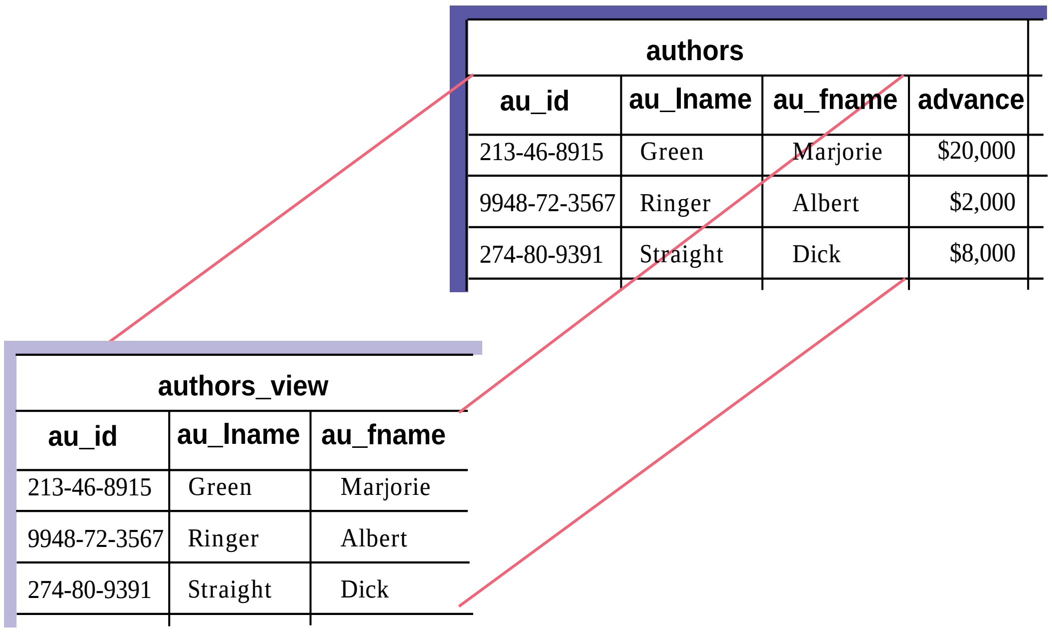
Default

A **default** is the value that SQL Server assigns to a column when a row is added to a table specifying no particular value for that column. You have the option of specifying a default for a column when you create a table. For example, for a column that identifies the price of a published book, you can define "UNDECIDED" as the default value until a price is assigned to the book.

View

A **view** is a virtual table, composed of specific columns and / or rows from one or more tables or other views. A view is virtual because it has no physical existence in the database.

You can use a view to simplify and customize a user's perception of a database. For example, sales clerks might need to access some data about authors, but they should not have access to confidential information about an author's royalty advances. You could create a view that customizes the way that sales clerks can access the database. Figure 2-3 gives an idea of how a view can select information from a table or tables.



authors

au_id	au_lname	au_fname	advance
213-46-8915	Green	Marjorie	$20,000
9948-72-3567	Ringer	Albert	$2,000
274-80-9391	Straight	Dick	$8,000

authors_view

au_id	au_lname	au_fname
213-46-8915	Green	Marjorie
9948-72-3567	Ringer	Albert
274-80-9391	Straight	Dick

Figure 2-3: A view

Different views can present combinations of data from various tables in different ways, independently of the table structure in which the data is stored. In some cases data can be directly updated through a view, in other cases a view is read-only.

Index

An **index** is a database object that helps SQL Server locate data. Indexes speed up data retrieval by pointing SQL Server to the location of a table column's data on disk.

Conceptually, an index in a database is like an index in a book. In a book, the index relates each indexed term to the page or pages on which that word appears. In a database, the index relates each indexed column value to the **page**, or physical location, at which the row of data containing the indexed value is stored. See Figure 2-4.

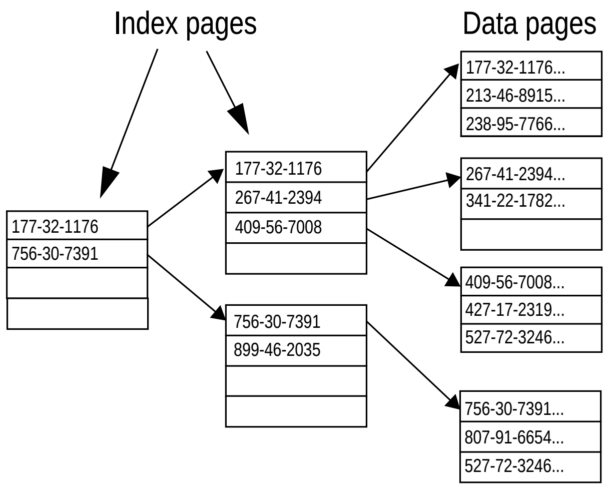


Figure 2-4: A simplified index schematic

Indexes are an important physical design element for high performance. The *Performance and Tuning Guide* explains in detail how indexes work and how to create indexes that improve performance.

Rule

A **rule** defines and enforces what data may be entered for a particular table column or user-defined datatype. For example, you could define a rule that requires that all the values in the *title_id* column in the *titles* table begin with two uppercase letters followed by four digits. Or you could define a rule that all values of the *money* datatype be less than $1,000,000.

Stored Procedure

A **stored procedure** is a set of one or more commands stored in a database. A stored procedure is partially processed before it is stored, so it executes faster than if you executed its constituent commands individually.

A stored procedure is invoked by its name. The caller can pass **parameters** to and receive results from the stored procedure. You can create and name your own stored procedures to execute specific database queries and perform other database tasks. For example, you might create a stored procedure that returns the names of all authors whose books have sold more than the number of books that you specify as a parameter at the time you call the procedure.

You can also use a set of stored procedures supplied by Sybase to help you accomplish numerous administrative tasks. These Sybase-supplied stored procedures are called **system procedures** and are automatically installed when you install SQL Server. The system procedures are described in the *SQL Server Reference Manual*.

Trigger

A **trigger** is a special stored procedure you can create that automatically fires whenever a user updates, deletes, or inserts data, depending on how you define the trigger. You associate a trigger with a table or columns within a table.

For example, some organizations keep duplicate data to improve retrieval speed for **decision support** queries. They can define triggers to automatically duplicate data after an update, deletion, and insertion. Managers can query duplicated decision support data without slowing down the data entry system. Another common use of a trigger is to implement some aspects of **referential integrity**.

Transact-SQL

Transact-SQL® is Sybase's enhanced version of SQL and is the language that you, or the client application you are running, uses to communicate requests to the RDBMS. Some of the enhancements that Transact-SQL offers, such as **stored procedures**, **control-of-flow language**, and **error handling** allow SQL Server to be a truly programmable database server.

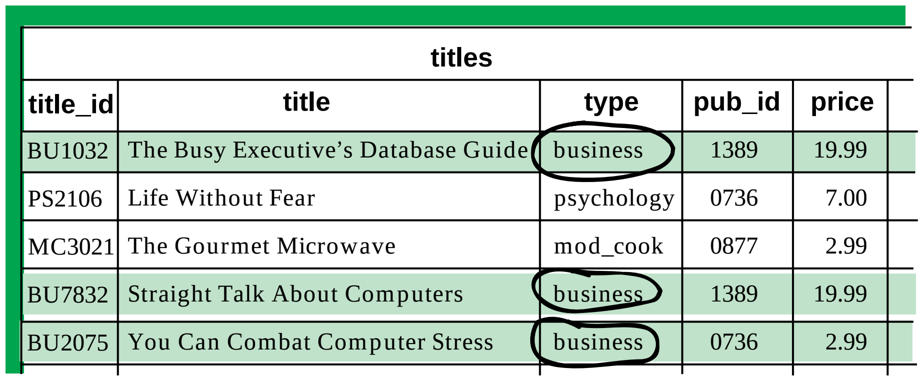
Queries

The "Q" in "SQL" stands for **query**. You query or retrieve data from a database with Transact-SQL's workhorse **select** command. The basic query operations in a relational system are **selection**, **projection**, and **join**. The **select** command implements all of them.

The following sections present some simplified scenarios of retrieving data from a database using the **select** command and show the actual SQL statements you would use to accomplish the queries. The purpose of these statements is merely to familiarize you with what Transact-SQL looks like, not teach you SQL. For detailed instruction in how to use Transact-SQL, consult the *Transact-SQL User's Guide,* which is part of your user documentation.

Selection

A **selection** (also called restriction) is a subset of the rows in a table, based on some conditions. Figure 2-5 shows an example of selecting the rows for books of the type "business" from the *titles* table.



titles

title_id	title	type	pub_id	price
BU1032	The Busy Executive's Database Guide	business	1389	19.99
PS2106	Life Without Fear	psychology	0736	7.00
MC3021	The Gourmet Microwave	mod_cook	0877	2.99
BU7832	Straight Talk About Computers	business	1389	19.99
BU2075	You Can Combat Computer Stress	business	0736	2.99

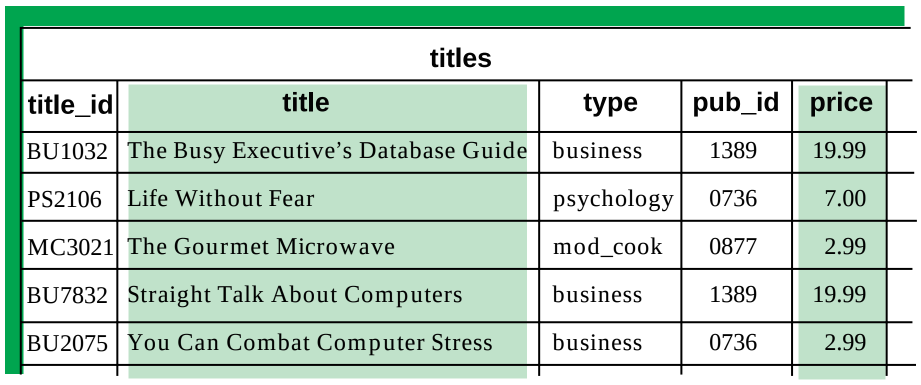
Figure 2-5: Selection

The actual Transact-SQL **select** command that retrieves the highlighted rows is:

```
select *
    from titles
    where type like "business"
```

Projection

A **projection** is a subset of the columns in a table. Figure 2-6 shows a sample projection in which you want look only at the title and price of all books in the *titles* table.



titles

title_id	title	type	pub_id	price
BU1032	The Busy Executive’s Database Guide	business	1389	19.99
PS2106	Life Without Fear	psychology	0736	7.00
MC3021	The Gourmet Microwave	mod_cook	0877	2.99
BU7832	Straight Talk About Computers	business	1389	19.99
BU2075	You Can Combat Computer Stress	business	0736	2.99

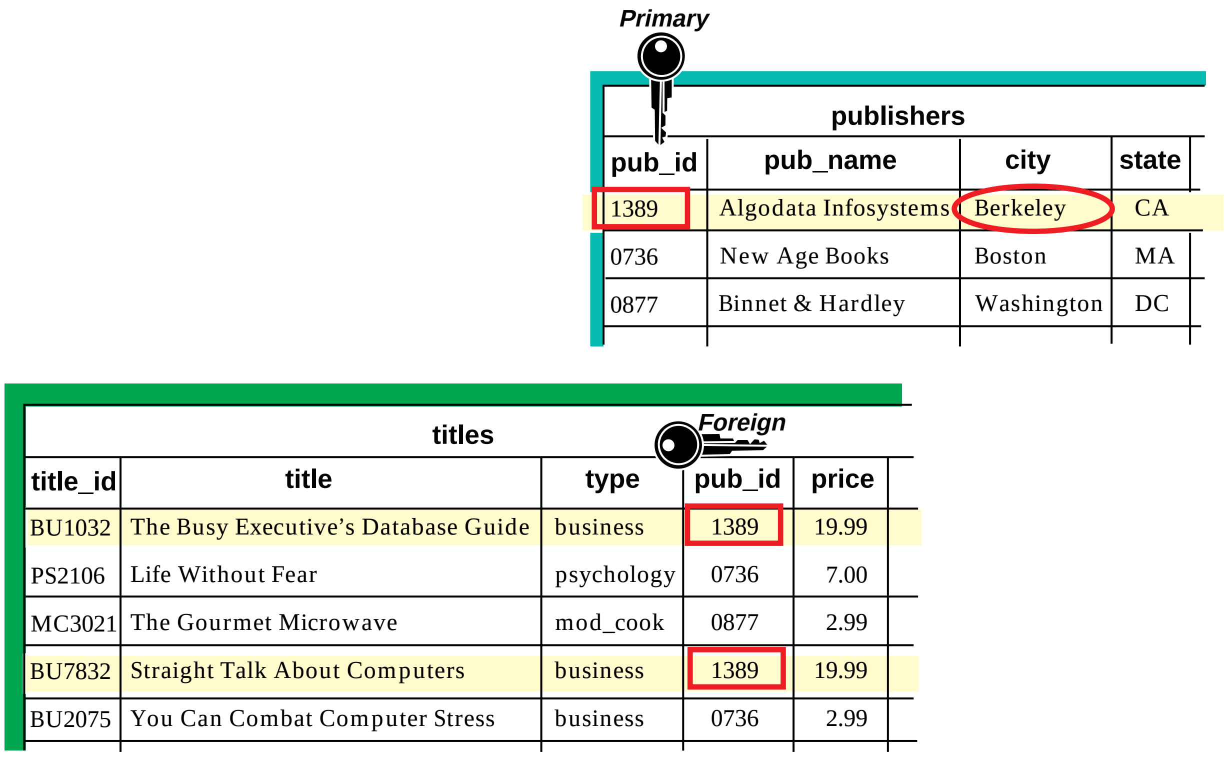
Figure 2-6: Projection

The actual Transact-SQL **select** command that retrieves the highlighted columns is:

```
select titles, pub_id
    from titles
```

Join

A **join** links the rows in two or more tables by comparing the values in key columns and concatenating rows that have matching values. For example, you might want to select data from the relevant tables showing information about Berkeley publishers and the type and titles of books they published. Figure 2-7 shows the join.



publishers

pub_id	pub_name	city	state
1389	Algodata Infosystems	Berkeley	CA
0736	New Age Books	Boston	MA
0877	Binnet & Hardley	Washington	DC

titles

title_id	title	type	pub_id	price
BU1032	The Busy Executive’s Database Guide	business	1389	19.99
PS2106	Life Without Fear	psychology	0736	7.00
MC3021	The Gourmet Microwave	mod_cook	0877	2.99
BU7832	Straight Talk About Computers	business	1389	19.99
BU2075	You Can Combat Computer Stress	business	0736	2.99

Figure 2-7: A join

The actual SQL **select** statement that returns the highlighted data from the two tables is:

```
select *
    from publishers, titles
    where publishers.pub_id = titles.pub_id
    and city = “Berkeley
```

Other Commands

You can do more with SQL than just query, however. Transact-SQL includes other commands to create tables and views, such as **create table** and **create view**. It also includes commands to modify tables (the **insert**, **update**, and **delete** commands), and commands to perform many other database tasks discussed in this guide.

Transact-SQL offers extensions to the standard library of SQL commands. We have already looked at one powerful extension, in “Stored Procedure” on page 2-5. Another is control-of-flow language, which is Transact-SQL’s programming-like constructs that control the flow of execution of Transact-SQL statements. When combined with Transact-SQL's sophisticated error handling techniques, including the ability to capture a **return status** and get reports from **global variables**, they make SQL Server a fully programmable database server.

The Transact-SQL commands are described in the *SQL Server Reference Manual*. For in-depth discussions of how to use many of the Transact-SQL commands, see the *Transact-SQL User's Guide*.

Presenting Transact-SQL to the RDBMS

There are several ways to present Transact-SQL commands to the RDBMS. One way is to use Sybase's interactive query parser, **isql**. You can invoke **isql** at the operating system command line and then enter Transact-SQL commands at the **isql** prompt.

End users typically do not use SQL itself but access the databases using specialized client applications. The client applications send Transact-SQL commands to the RDBMS by passing them as parameters to Open Client library routines (see "Building or Buying the Client" on page 3-9).

System Database

There are two kinds of databases: **system databases** and **user databases**. User databases are databases that you create to store and manage your enterprise's data. System databases are databases that the system creates to manage the system.

The *master* database is a system database that is installed with every SQL Server. It stores information about all the user databases and other system databases and their associated devices.

The *sybsystemprocs* database is the database that stores all the system procedures provided by Sybase.

The *model* database is a system database that SQL Server uses as a template for creating user databases. You can customize the default *model* database that Sybase provides to include your own database objects. For example, if you have created some special stored procedures that you want to be included in all the user databases that are subsequently created, you could accomplish this by creating the procedures in the *model* database.

The *tempdb* database is a system database that SQL Server uses to provide temporary working storage for objects that it creates in the process of executing queries.

The *sybsecurity* database is an optional system database that you can install if you want to use SQL Server's audit system. For information about the audit system and the *sybsecurity* database, see the *Security Administration Guide.*

The *sybsyntax* system database is an optional system database that stores the syntax for all the Transact-SQL commands, Sybase system procedures, SQL Server utilities, and some Open Client routines. Although the syntax for these facilities is available in the Sybase documentation, if you want to be able to access the syntax quickly on-line using the **sp_syntax** system procedure, you must install the *sybsyntax* database.

The *pubs2* database is an optional sample user database that is used in most of the examples appearing in Sybase documentation. If you want to try out some of the examples that appear in the documentation, install the *pubs2* database as described in the configuration guide for your platform. The objects in *pubs2* are described in the *SQL Server Reference Supplement*.

For more information about the system databases, see the *System Administration Guide.*

Database Device

A **database device** stores SQL Server databases. It can be a disk or portion of a disk or, sometimes, an operating system file.

The system and user databases reside on database devices connected to the server. The *master* database must be installed on a device called the master device, which is automatically created at install time. The other system databases and the user databases should be created on other devices.

Part of the process of installing SQL Server consists of preparing the database devices. This procedure is explained in detail in either the installation guide or the configuration guide, depending on the platform for which you have purchased SQL Server.

System Table

Every user database contains a set of **system tables**, which are special tables used by the system to manage data and the system. The *master* database contains some special system tables not appearing in other databases that keep track of SQL Server as a whole. In other relational database products, what Sybase calls the system tables may be called the data dictionary or the system catalogs.

SQL Server for Windows NT includes a poster illustrating the contents of and relationships among the system tables. The *SQL Server Reference Supplement* also describes each system table in detail.

Although you can query the system tables directly to retrieve information about the system, such as the names of all the user databases on the server or all the user accounts on the server, it is usually simpler to use the appropriate system procedure. The system procedures are designed to retrieve the information that a user or system administrator is likely to need, and they save you the trouble of having to formulate complex queries and become familiar with the details of the system tables on your own.

Permission

A **permission**, sometimes called a privilege, is the authority to perform an action on a certain database object. SQL Server permissions are similar to permissions at the operating system level, but SQL Server maintains its own permissions for each user, apart from those conferred by the operating system. Examples of SQL Server permissions are permission to select data from a table, to modify data in a table, to execute a particular stored procedure, or to create databases or tables.

The SQL Server System Administrator or the owner of a particular database is responsible for setting up and maintaining permissions for various users, or groups of users, for SQL Server or a particular database.

Utility Programs

SQL Server utility programs perform RDBMS tasks, but you start them from the operating system rather than through **isql** or a similar program.

isql itself is a utility. Another example of a utility is **bcp**, which copies bulk data from an operating system file to a database table and vice-versa. See *SQL Server Utilities Programs* for your platform for information on the Sybase utilities.

Transaction Log

The **transaction log** is a special system table that SQL Server maintains for each database to record modifications to the data in the database tables. If you experience a system failure while data is being modified, SQL Server uses the transaction log to recover the data and restore the database to the state it was in before the failure occurred. Although the log is a part of the database, it should be stored on a separate device to reduce the likelihood of a physical disk error damaging both a database and the associated transaction log.

System Administration

The term **system administration** refers to an assortment of tasks including, but not limited to, managing SQL Server's physical storage, creating and backing up databases, creating user accounts, granting permissions, and running diagnostic and repair functions.

The user responsible for system administration is the SQL Server **System Administrator**, who may or may not be the same individual or individuals who are system administrators for the server machine's operating system. For SQL Server, the System Administrator can log in to SQL Server as the special, predefined user "**sa**" and knows the system administrator password. The "sa" account has special privileges not held by normal users. The system administrator can grant other users permission to perform certain system administration tasks.

SQL Server Manager allows you to execute the most common system administration tasks through a graphical interface. Some tasks must be executed using Transact-SQL commands or SQL Server utilities directly. See the *SQL Server Manager User's Guid*e for information about SQL Server Manager and the *System Administration Guide* and the *Performance and Tuning Guide* for complete information about SQL Server system administration.

3 Using SQL Server

This chapter briefly describes common tasks that a user performs with a new SQL Server. Its gives a general idea of how to begin using this product, and is not an exhaustive discussion.

This chapter covers the following topics:

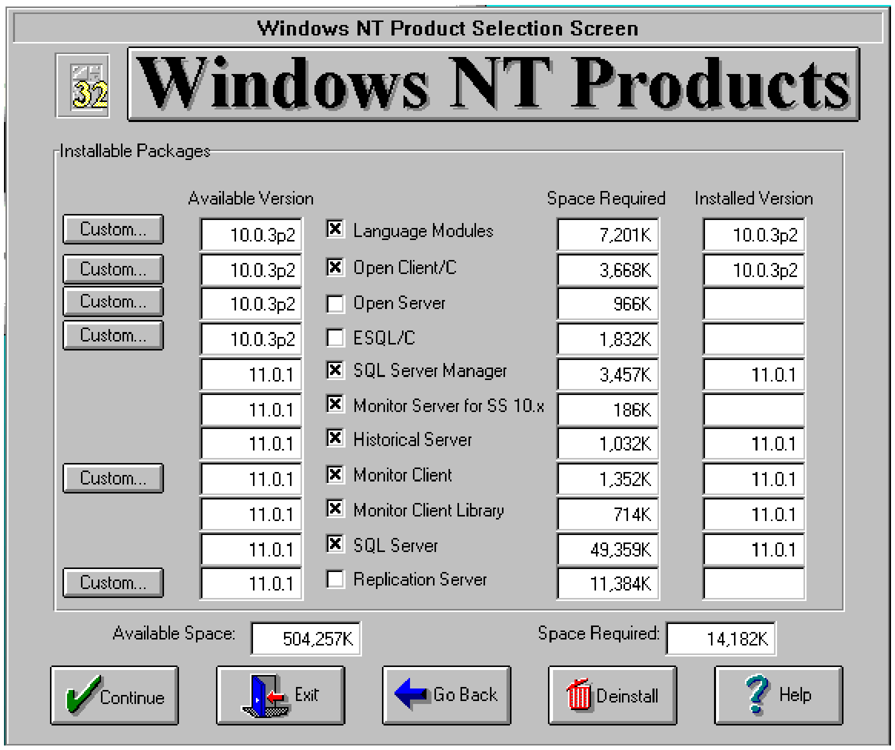
For complete technical information about SQL Server, see the online documentation in SyBooks. You can also consult some of the excellent books available from Sybase Press, such as *Understanding Sybase System 11: A Hands-On Approach.*

Installing SQL Server

You need to install SQL Server and the other server components on the server machine, and the client components on one or more client machines. On both servers and clients, you install the software into a Sybase installation directory that you can designate. You should also install SyBooks to have access to the online documentation.

If you have an earlier release of SQL Server already installed, you may need to upgrade your existing databases before you can access them with the newly installed release.

The installation program, shown in Figure 3-1, makes it easy to choose the components you want to install on your server and client.



	Available Version		Space Required	Installed Version
Custom...	10.0.3p2	☒ Language Modules	7,201K	10.0.3p2
Custom...	10.0.3p2	☒ Open Client/C	3,668K	10.0.3p2
Custom...	10.0.3p2	☐ Open Server	966K	
Custom...	10.0.3p2	☐ ESQL/C	1,832K	
	11.0.1	☒ SQL Server Manager	3,457K	11.0.1
	11.0.1	☒ Monitor Server for SS 10.x	186K	
	11.0.1	☒ Historical Server	1,032K	11.0.1
Custom...	11.0.1	☒ Monitor Client	1,352K	11.0.1
	11.0.1	☒ Monitor Client Library	714K	11.0.1
	11.0.1	☒ SQL Server	49,359K	11.0.1
Custom...	11.0.1	☐ Replication Server	11,384K	

Available Space: 504,257K Space Required: 14,182K

Figure 3-1: The installation screen for NT server and client products

To install the software, follow the instructions in the installation guide and release bulletin for your platform. The installation guide is a book packaged with the software media.

SyBooks installation instructions are contained in the Postscript file *sybinst.ps* in the */release* directory on the media and can be printed directly to a Postscript printer prior to installing any software.

Configuring SQL Server

Configuration of SQL Server falls into two categories: post-installation configuration and maintenance configuration.

When you install SQL Server, the installation program sets configuration parameters to default values. After installing, you need to configure SQL Server for your installation. This involves:

- Setting up client / server network connections
- Specifying the location of the **error log**
- Localizing the language, **character set**, and **sort order**

- Setting certain operating system values
- Setting the **System Administrator** ("sa") password
- Setting up **auditing**, if desired

You can easily configure SQL Server with the Server Config utility that appears on the desktop after you install SQL Server for Windows NT. Figure 3-2 shows the main menu of Server Config and the tasks it helps you accomplish.

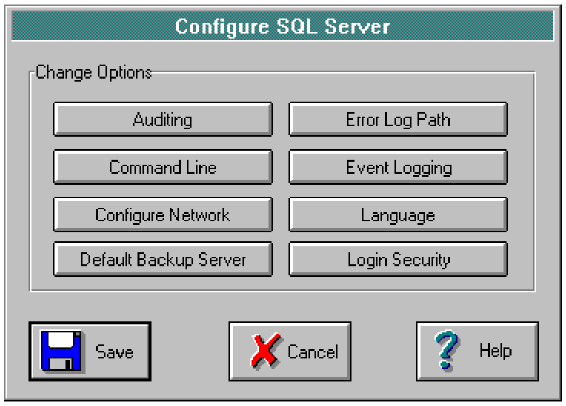


Figure 3-2: Configuring SQL Server from the Server Config utility

See the configuration guide for your platform for detailed information about performing these post-installation configuration tasks. The configuration guide is a book packaged with the software media.

Maintenance configuration is concerned more with fine-tuning memory and disk storage. See the *System Administration Guide* for information about ongoing SQL Server configuration.

To configure SQL Server from a Windows client with a graphical interface, use SQL Server Manager's configuration facility to set configuration parameters and configure network connections. Choose Configuration from the SQL Server Manager's Server menu.

Those who prefer a command line interface can set configuration parameters by invoking the **sp_configure** system procedure from **isql**. System procedures are fully documented in the *System Administration Guide*.

Designing Databases

There are two stages of database design: **logical design** and **physical design.** In logical design, you define the entities that will be represented by tables in the database, choose the attributes of those entities (which will be represented by columns in the table), and determine how the entities are interrelated through the designation of primary and foreign keys.

Logical design can be accomplished independently of the particular relational database vendor that your organization chooses to supply its software. Logical design should rely heavily on input from the intended users of the databases, not just database and software experts. Ideally, you will have completed the logical design of your user databases before you purchase and install SQL Server.

In the physical design stage, you map the logical design to the Transact-SQL data definition commands that will actually create the databases on the server. These are commands like **create database**, **create table**, **create view**, **create rule**, and so on. You can produce a physical design manually or, if the databases are large and complex, you can use one of the many database design software tools on the market, such as S-Designor™.

Creating Databases

The output of the physical design effort is a collection of Transact-SQL commands that create databases and, within the databases, database objects. To create the databases, you execute these create commands on the server.

An easy way to create databases and database objects is to use the database management tool SQL Server Manager. You specify information about the database you want to create in the SQL Server Manager command dialog box. Figure 3-3 shows the create database dialog box, which appears when you choose Create Database from the Server menu.

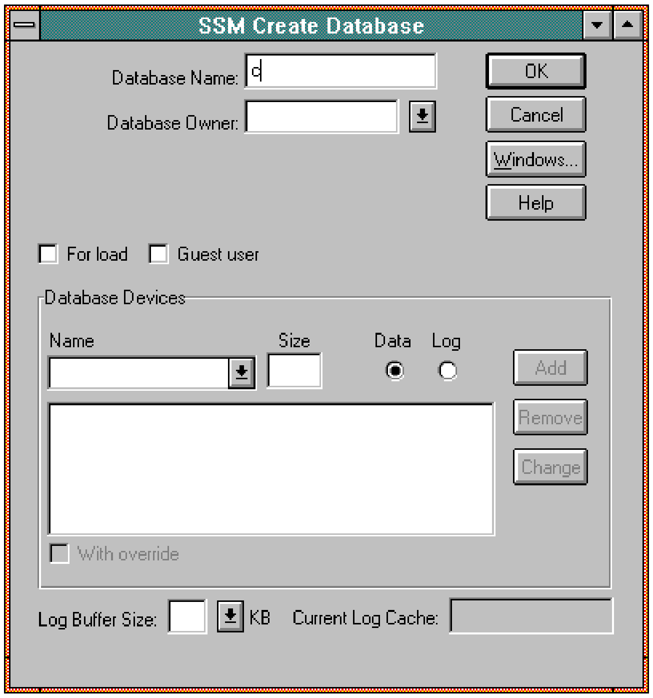


Figure 3-3: One of SQL Server Manager's command dialog boxes

It is also possible, of course, to create databases at the **isql** command line using the Transact-SQL create commands. Since most databases consist of several tables, if you use the command line method it is a good idea to save the original data definition commands in a script file that can be run to re-create consistent images of the database as many times as necessary.

Loading Data

After the database tables have been created, you can fill them with data. You may have to insert the data manually using either the Transact-SQL **insert** command or a client application that has been written to input the data. In many cases, however, the data already exists either in another vendor's database system or in **operating system files**.

If the data is in a file, or can be converted to a file, you can copy it into a database table using the **bcp** bulk copy utility. See the utilities guide for your platform for information on how to use **bcp**.

If the data is in a Sybase database from an earlier release, the original tables may be accessible after they have upgraded. See the description of the upgrade process in the installation guide to determine if the databases are upgradable.

Creating Indexes

If you are going to load a large amount of initial data into a table after creating it, it is best to create the table indexes after you load the data, because indexes slow performance in commands that insert data. This is because, for every row added to the table, a row must also be added to the index. However, well-chosen indexes greatly improve performance on commands that retrieve data, so it is advisable to create indexes on tables that are frequently queried.

When you create an index on a table, you have to decide on which table column or combination of columns the index will be based. You also have to decide what type of index to create and whether it should be unique. See the description of the **create index** command in the *SQL Server Reference Manual* and the chapter on indexes on the *Performance and Tuning Guide* to learn about selecting useful indexes.

You can create indexes using the SQL Server Manager command dialog boxes or at the **isql** command line using the Transact-SQL **create index** command.

Backing Up Data

After you input data and create indexes on the tables, you should back up the databases so that you can restore them in the event of a system failure. You should continue to back up data at regular intervals. How often you back up a database depends on how frequently the data is updated and how costly it would be for you to lose it.

Databases that are constantly being modified need to be backed up frequently, while databases containing relatively static data can be backed up less often. You should regularly back up production databases, but you can usually be less diligent about backing up databases used for test and development purposes if you can afford to lose their most recent data.

If you experience a **media failure**, you can restore the data from the most recent backups using SQL Server's **restore** facility.

You do not have to shut down SQL Server to back up or restore a database. Backup Server makes it possible to perform online backup and restore operations while SQL Server is running.

You can back up and restore databases and their transaction logs using the SQL Server Manager **backup** and **restore** command dialog boxes or at the **isql** command line using the Transact-SQL **dump** and **load** commands.

See the *System Administration Guide* for information about developing a backup plan and about backing up and restoring both user and system databases.

Assigning Logins, Users, and Permissions

SQL Server security is based on a three-tiered system that separates server access, database access, and data access.

To be able to connect to a server, a person must have a **login** on the server. A login does not automatically give the person permission to access data or create database objects, just to connect. It consists of a login name and a password. To give others access to a server, the Sybase system administrator (called the **System Administrator**) creates logins using either the SQL Server Manager **create login command** dialog box or the **sp_addlogin** system procedure from **isql**.

To be able to connect to a database, a person must be made a user and have a database **user ID**. The database username may or may not be the same as the person's login name. The System Administrator or the **Database Owner** (the person who created the database or was given ownership by the database creator) create database users. You can create users with either the SQL Server Manager **create user** command dialog box or the **sp_adduser** system procedure from **isql**.

In addition to individual users, the System Administrator or Database Owner can create a **group** of database users in SQL Server. The group is identified by a group name and provides a convenient way to grant and revoke permissions to more than one user in a single statement. For example, you can define a "managers" group or a "payroll" group, assign users to the group, and assign the same privileges to all the users in the group by assigning the privileges to the group as a whole. There is also a system-defined group named "all," of which all database users are members.

You can create a group using the SQL Server Manager **create group** command dialog box or the **sp_addgroup** system procedure from **isql**. When you add a user to the database, you can designate the groups that the user is a member of as one of the options in the **sp_adduser** system procedure or SQL Server Manager **create user** command dialog box.

Having a login and username gives an individual access to a server and a database, but it does not give automatic permission to select data from tables or views, modify data in tables, or execute stored procedures. To give a user permission to access a database object, the System Administrator or the owner of the database object (the user who created the object) must explicitly grant the user, or a group in which the user is a member, permission to access that object. They can grant and deny various permissions to other users to use specific database objects with either the SQL Server Manager or the Transact-SQL **grant** and **revoke** commands from **isql**.

Querying and Modifying Data

Most activity between a user and SQL Server involves either querying the data or modifying the data. Querying the data is discussed in "Queries" on page 2-6.

Modifications

Modifying data means one of the following:

- Adding a new row to a table (the **insert** command)
- Deleting a row from a table (the **delete** command)
- Changing the value of one or more columns in a row (the **update** command)

Transactions

If you are executing multiple data modification commands on the same or related data, you can execute them together in a single **transaction**. A transaction consists of multiple Transact-SQL commands, enclosed between begin and end delimiters, that are executed as an atomic command rather than as separate commands. The tables affected by the transaction are locked so that other users cannot make changes that affect the work being accomplished during the transaction. The transaction as a whole is either entirely committed or entirely uncommitted, ensuring that if the system fails in the middle of an operation, the database is not left in an inconsistent state.

The classic example of a transaction is one that removes money from your savings account (**delete**) and adds it to your checking account (**insert**). You would want to perform the **delete** and the **insert** in a single transaction, so that if the system failed after the **delete** but before the **insert**, the record of the funds would not be lost. If such a failure occurred, the transaction would be rolled back by SQL Server's recovery program and the database would appear as though the **delete** had never been executed.

Stored Procedures

If you find that there are commands, or sets of commands, that users will perform frequently, you should consider creating a **stored procedure**. Even for a single command, a stored procedure usually executes faster because the stored procedure stores the command in a partially processed form. Also, you can control access more securely by giving users permission only to execute the stored procedure without giving them permission to access to all the objects referenced by the commands in the stored procedure. Consult the *Transact-SQL User's Guide* for more information on creating stored procedures.

Building or Buying the Client

You have a number of options for establishing a client interface through which SQL Server users can access data. You can purchase one of many third-party applications, or you can build your own.

If your organization is very small and your information needs are very simple, you may be able to manage by using a set of Transact-SQL statements and creating some stored procedures. Users could perform queries through an **isql** client and direct the results of a query to a file.

If your needs are more complex and you want to provide a customized interface to users who may not know anything about relational databases or Transact-SQL, you can purchase a client application that has been designed for a particular purpose and runs against a SQL Server database from a third-party software company or a VAR (Value Added Reseller). Look for the "Industry Solutions" page in the "Partners and Solutions" section of Sybase's web site for up-to-date news and reference information about industry-specific applications that run against SQL Server.

If you cannot find a commercial application that meets your needs, you can build a customized, user-friendly client application with a **development tool** such as PowerBuilder. With such a tool you can create GUI applications that send Transact-SQL commands to access and manipulate SQL Server data. After building your application, you deploy it on the client where it is linked with the Open Client libraries. Typically these tools have their own simplified programming APIs and a graphical interface for program development. Figure 3-4 shows the PowerBuilder development window.

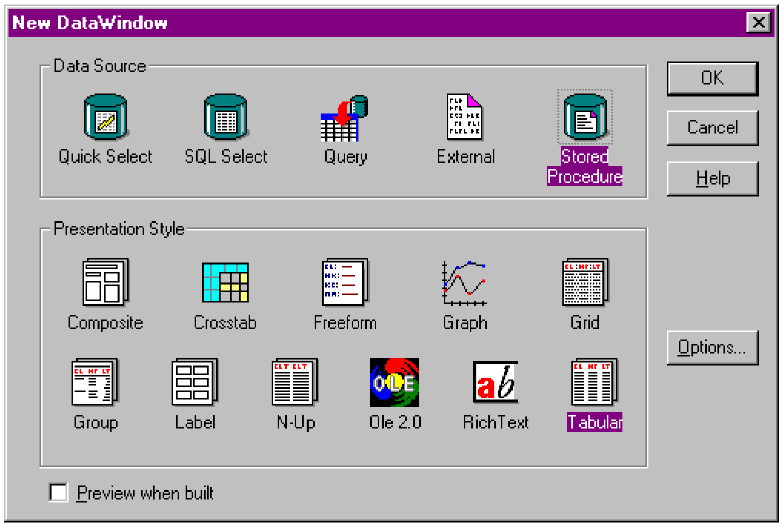


Figure 3-4: PowerBuilder development window

You can also design client applications from scratch using a traditional procedural programming language, such as the C, C++, or COBOL. This method usually requires more time and more skilled software engineers than are needed to develop an application using a development tool.

The advantage of the second approach is that the applications are generally smaller, and in some cases possibly faster because the executable does not have the overhead of the tool. These programs make direct calls to the Open Client library routines to communicate with SQL Server. See the Open Client documentation in the Open Client/Server SyBooks collection for complete information about coding with the Open Client libraries.

Monitoring and Tuning Performance

After a production database is established, you may want to examine some performance statistics and adjust some performance parameters to tune the system for high **performance**.

The easiest way to monitor SQL Server performance is with SQL Server Monitor. Monitor Client provides an overall picture of performance with a graphical view of overall performance parameters. It also gives specific details about performance with numeric measurements of cache usage, network traffic, **device I/O**, and **locking** activity, which are all discussed in the *Performance and Tuning Guide*.

Most of your actual tuning efforts ought to address the amount of time it takes for SQL Server to respond to queries. You can achieve high performance by starting out with a well designed database that includes strategic indexes and by learning to work with the SQL Server query **optimizer**, a SQL Server feature that analyzes queries and database objects and selects the appropriate query plan based on how much time it will take to execute. For more information, see the *Performance and Tuning Guide*.

Glossary

APIs

Application Program Interfaces, subroutines that allow client applications to interface with SQL Server. Also known as **libraries**.

application-building tool

See **development tool**.

argument

A value supplied to a function or procedure that is required to evaluate the function.

auditing

Recording security-related system activity that can be used to detect penetration of the system and misuse of system resources.

backup

A copy of a database or transaction log, used to recover from a **media failure**.

business rules

The rules to which the data in a database must conform.

cache

See **data cache**.

character set

A set of specific (usually standardized) characters with an encoding scheme that uniquely defines each character. ASCII and ISO 8859-1 (Latin 1) are two common character sets.

client

The user's side of a client/server arrangement; can refer to the software making the calls to the server or to the machine running the client software.

client/server architecture

A computer system architecture in which clients request a service and a server provides that service. Each machine can then specialize in the tasks it is best suited for.

clustered index

An **index** in which the physical order and the logical (indexed) order is the same. A table can have only one clustered index.

column

A data value that describes one characteristic of an **entity**. Also called a **field**.

command

An instruction that specifies an operation to be performed by the computer. Each command or SQL statement begins with a keyword, such as **insert**, that names the basic operation performed.

constraint

A rule applied to a database object that ensures that all entries in the database object to which it applies satisfy a particular condition. For example, a column may have a constraint requiring that all values in the column be unique.

control-of-flow language

Transact-SQL's programming-like constructs (such as **if**, **else**, **while**, **goto** label) that control the flow of execution of Transact SQL statements.

data cache

Also referred to as named cache or cache. A cache is an area of memory within SQL Server that contains the in-memory images of database **pages** and the data structures required to manage the pages.

data definition

The process of setting up databases and creating database objects such as tables, indexes, rules, defaults, procedures, triggers, and views.

data dictionary

The system tables that contain descriptions of the **database objects** and how they are structured.

data integrity

The correctness and completeness of data within a database.

data modification

Adding, deleting, or changing information in the database with the **insert**, **delete**, and **update** commands.

data retrieval

Requesting data from the database and receiving the results. Also called a **query**.

database

A set of related data tables and other database objects that are organized and presented to serve a specific purpose.

database administration

The tasks involved in maintaining, designing, implementing changes to, tuning, and expanding a database. *See also* **system administration**.

database device

See **device**.

database object

One of the components of a database: **table**, **view**, **index**, **stored procedure**, **trigger**, **column**, **default**, or **rule**.

Database Owner

The user who creates a database. A Database Owner has control over all the database objects in that database. The login name for the Database Owner is ‘‘dbo’’.

datatype

Specifies what kind of information each column will hold, and how the data will be stored. Datatypes include *char*, *int*, *money*, and so on. Users can construct their own datatypes based on the SQL Server system datatypes.

dbo

In a user’s own database, SQL Server recognizes the user as “dbo.” A **Database Owner** logs into SQL Server using his or her assigned login name and password.

decision support

Data used to help managers make business decisions. Usually involves a lot of queries as opposed to updates.

default

The option chosen by the system when no other option is specified.

default database

The database that a user connects with when he or she logs in.

development tool

Software such as PowerBuilder that helps you build specialized GUI applications for accessing SQL Server databases.

device

Any piece of disk (such as a partition) or a file in the file system that you specially prepare and that is used to store databases and their objects.

device I/O

Reads or writes to or from a database device.

disk initialization

The process of preparing a database device or file for SQL Server use. Once the device is initialized, it can be used for storing databases and database objects. The command used to initialize a database device is **disk init**.

DLLs

Dynamic Link Libraries, software used by Microsoft Windows and IBM OS/2 to provide services to applications.

dump

To make a backup of an entire database, including both the data and the **transaction log**, which you accomplish with the **dump database** command. Also, the data that results from this action.

entity

The basic unit described by tables in a relational database. Identifying them is the first step in the **logical design**.

error handling

Techniques available to Transact-SQL programmers for basing code on and displaying errors and error messages.

error log

A file that stores severe error messages and results about the startup and recovery of databases on a server being started up.

error message

A message that SQL Server issues, usually to the user’s terminal, when it detects an error condition.

field

A data value that describes one characteristic of an **entity**. Also called a **column**.

foreign key

A key column in a table that logically depends on a **primary key** column in another table. Also, a column (or combination of columns) whose values are required to match a primary key in some other table.

global variable

System-defined variables that SQL Server updates on an ongoing basis. For example, *@@error* contains the last error number generated by the system.

group

Uniquely named set of users assigned a set of permissions for the objects and operations within a database.

guest

Default user in the *model* database that allows any user with valid SQL Server login can use that database, with limited privileges.

index

A database object that consists of key values from the data tables, and pointers to the pages that contain those values. Indexes speed up access to data rows by pointing SQL Server to the location of a table column's data on disk.

integrity rules

Rules that describe how data will be kept accurate and consistent in the relational model.

join

A basic operation in a relational system that links the rows in two or more tables by comparing the values in specified columns.

key

A field used to identify a record, often used as the **index** field for a table.

key value

Any value that is indexed.

keyword

A word or phrase that is reserved for exclusive use by Transact-SQL. Also known as a reserved word.

libraries

See **APIs**.

load

To restore data stored in a backup created during a **dump**.

local variables

User-defined variables defined with a **declare** statement.

locking

The process of restricting access to resources in a multi-user environment to maintain security and prevent concurrent access problems. SQL Server automatically applies locks to tables or **pages**.

logical design

Defining the tables, relations, and keys of a relational database. Distinguished from **physical design**.

logical key

The primary, foreign, or common **key** definitions in a database design that define the relationship between tables in the database. Logical keys are not necessarily the same as the **physical key**s (the keys used to create indexes) on the table.

logical read

The process of accessing a data or index page already in memory to satisfy a query. Compare to **physical read**.

login

The name a user uses to log onto SQL Server. A login is valid if SQL Server has an entry for that user in the system table *syslogins*.

Master Database

Controls the user databases and the operation of SQL Server for Windows NT as a whole. Known as *master*, it keeps track of such things as user accounts, ongoing processes, and system error messages.

master table

A table that contains data on which data in another table logically depends. The detail table typically has a foreign key that joins to the primary key of the master table.

media failure

A media failure occurs when the information on a medium (typically a hard disk drive) becomes unusable.

message number

The number that uniquely identifies an error message.

model database

A template for new user databases. The installation process creates *model* when SQL Server is installed. Each time the **create database** command is issued, SQL Server makes a copy of *model* and extends it to the size requested, if necessary.

nested queries

select statements that contain one or more subqueries.

nonclustered index

An **index** that stores key values and pointers to data.

normalization rules

The standard rules of database design in a relational database management system.

null

Having no explicitly assigned value. NULL is not equivalent to zero, or to blank. A value of NULL is not considered to be greater than, less than, or equivalent to any other value, including another value of NULL.

object permissions

Permissions that regulate the use of certain commands (data modification commands, plus **select**, **truncate table** and **execute**) to specific tables, views or columns.

objects

See **database object**.

ODBC

The Open Database Connectivity (ODBC) interface, defined by Microsoft Corporation, a standard interface to database management systems in the Windows and Windows NT environments.

operating system

A group of programs that translates your commands to the computer, so that you can perform such tasks as creating files, running programs, and printing documents.

operating system file

Collection of data named and recognized by the operating system. SQL Server data is not stored in so-called operating system files but can be exported to operating system files using bulk copy.

optimizer

SQL Server code that analyzes queries and database objects and selects the appropriate query plan. It estimates the cost of each permutation of table accesses in terms of how much processing and disk writing time it will take.

page

A 2K block of data that is the minimal unit that can be read from or written to disk.

parameter

An **argument** to a **stored procedure**.

performance

The speed with which SQL Server processes queries and returns results. Performance is affected by several factors.

permission

The authority to perform certain actions on certain database objects or to run certain commands.

physical design

Mapping the **logical design** to the Transact-SQL data definition commands that actually create the databases on the server.

physical key

A column name, or set of column names, used in a **create index** statement to define an index on a table. Physical keys on a table are not necessarily the same as the **logical keys**.

physical read

A disk I/O to access a data, index, or log page. SQL Server for Windows NT estimates physical reads and logical reads when optimizing queries. See **logical read**.

primary key

The column or columns whose values uniquely identify a row in a table.

privilege

The authority to perform certain actions on certain database objects or to run certain commands. Synonymous with **permission**.

projection

One of the basic query operations in a relational system. A projection is a subset of the columns in a table.

query

1. A request for the retrieval of data with a **select** statement.

2. Any SQL statement that manipulates data.

query plan

The ordered set of steps required to carry out a query, complete with the access methods chosen for each table.

recovery

The process of rebuilding one or more databases from database dumps and log dumps.

referential integrity

The rules governing data consistency, specifically the relationships among the primary keys and foreign keys of different tables. SQL Server addresses referential integrity with user-defined **triggers** and with referential integrity **constraints**.

relational database

A collection of tables that stored interrelated data.

relational database management system

RDBMS, a system for storing and retrieving data from two-dimensional tables in which **SQL** use is standard.

relationship

Describes how entities are related. A basic step in logical design of a database is to identify the relationships between the entities you have identified.

remote procedure calls

A **stored procedure** executed on a different SQL Server from the server the user is logged into.

replication

For databases, a process by which the changes to data in one database (including creation, updating, and deletion of records) are also applied to the corresponding records in other database.

restriction

A subset of the rows in a table. Also called a **selection**, it is one of the basic query operations in a relational system.

return status

A value that indicates that the procedure completed successfully or indicates the reason for failure.

roles

Provide individual accountability for users performing system administration and security-related tasks in SQL Server. The **System Administrator**, System Security Officer, and Operator roles can be granted to individual server login accounts.

rollback transaction

A Transact-SQL statement used with a user-defined **transaction** (before a **commit transaction** has been received) that cancels the transaction and undoes any changes that were made to the database.

row

A set of related **columns** that describes a specific entity. Also called a record.

rule

A specification that controls what data may be entered in a particular column, or in a column of a particular user-defined datatype.

sa

The login name for the Sybase **System Administrator**.

savepoint

A marker that the user puts inside a user-defined **transaction**. The user can later use the **rollback transaction** command with the savepoint name to cancel any commands up to the savepoint, or **commit transaction** to actually complete the commands.

selection

A subset of the rows in a table. Also called a **restriction**, it is one of the basic query operations in a relational system.

server user ID

The ID number by which a user is known to SQL Server.

sort order

Used by SQL Server to determine the order in which to sort character data.

SQL

Structured Query Language (SQL), the language used to communicate with a relational database and that is the subject of standards set by several standards bodies.

SQL Server

The server in Sybase's client / server architecture. SQL Server manages multiple databases and multiple users, keeps track of the actual location of data on disks, maintains mapping of logical data description to physical data storage, and maintains data and procedure caches in memory.

statement

A statement begins with a **keyword** that names the basic operation or command to be performed.

stored procedure

A collection of SQL statements and optional control-of-flow statements stored under a name. SQL Server-supplied stored procedures are called **system procedures**.

subquery

A **select** statement that is nested inside another **select**, **insert**, **update** or **delete** statement, or inside another subquery.

system administration

An assortment of tasks including but not limited to managing SQL Server's physical storage, creating and backing up databases, creating user accounts, granting permissions, and running diagnostic and repair functions. *See also* **database administration**.

System Administrator

A user authorized to handle SQL Server system administration, including creating user accounts, assigning permissions, and creating new databases.

system databases

The databases on a newly installed SQL Server: *master*, which controls user databases and the operation of the SQL Server; *tempdb*, used for temporary tables; *model*, used as a template to create new user databases; and *sybsystemprocs*, which stores the system procedures. Distinguished from **user databases**.

system procedures

Stored procedures that SQL Server supplies for use in system administration. These procedures are provided as shortcuts for retrieving information from the system tables, or mechanisms for accomplishing database administration and other tasks that involve updating system tables.

system table

One of the data dictionary tables. The system tables keep track of information about the SQL Server for Windows NT as a whole and about each user database. The *master* database contains some system tables that are not in user databases.

table

A collection of **rows** (records) that have associated **columns** (fields). The logical equivalent of a database file.

temporary database

The database in SQL Server called *tempdb* that provides a storage area for temporary tables and other temporary working storage needs.

throughput

The volume of work completed in a given time period. It is usually measured in transactions per second (TPS).

Transact-SQL

The SQL dialect used in Sybase SQL Server.

transaction

A grouping of a series of Transact-SQL statements so that they are treated as a single unit of work. Either all statements in the group are executed or no statements are executed. The tables queried during the transaction are locked until the transaction is complete.

transaction log

A **system table** (*syslogs*) in which all changes to the database are recorded.

trigger

A special form of **stored procedure** that goes into effect when a user gives a change command such as **insert**, **delete**, or **update** to a specified table or column. Triggers are often used to enforce referential integrity.

unique indexes

Indexes that do not permit any two rows in the specified columns to have the same value. SQL Server checks for duplicate values when you create the index (if data already exists) and each time data is added.

update

An addition, deletion, or change to data, involving the **insert**, **delete**, **truncate table**, or **update** statements.

user database

Database created by a user, distinguished from **system databases**.

user-defined datatype

A definition of the type of data a column can contain that is created by the user. These **datatypes** are defined in terms of the existing system datatypes. Rules and defaults can be bound to user-defined datatypes (but not to system datatypes).

user ID

The ID number by which a user is known in a specific database. Distinct from **server user ID**.

variable

An entity that is assigned a value. SQL Server has two kinds of variables, called **local variables** and **global variables**.

view

A named **select** statement that is stored in the database as an object. It allows users to “view” a subset of rows or columns from one or more tables.

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