SGS-THOMSON MICROELECTRONICS

T9000 INQUEST
IMS D4390, D7390

T9000 debugging and performance analysis tools

PRODUCT INFORMATION

FEATURES

- Supports T9000 ANSI C and T9000 occam 2 Toolsets.

Interactive and post-mortem debugging:–

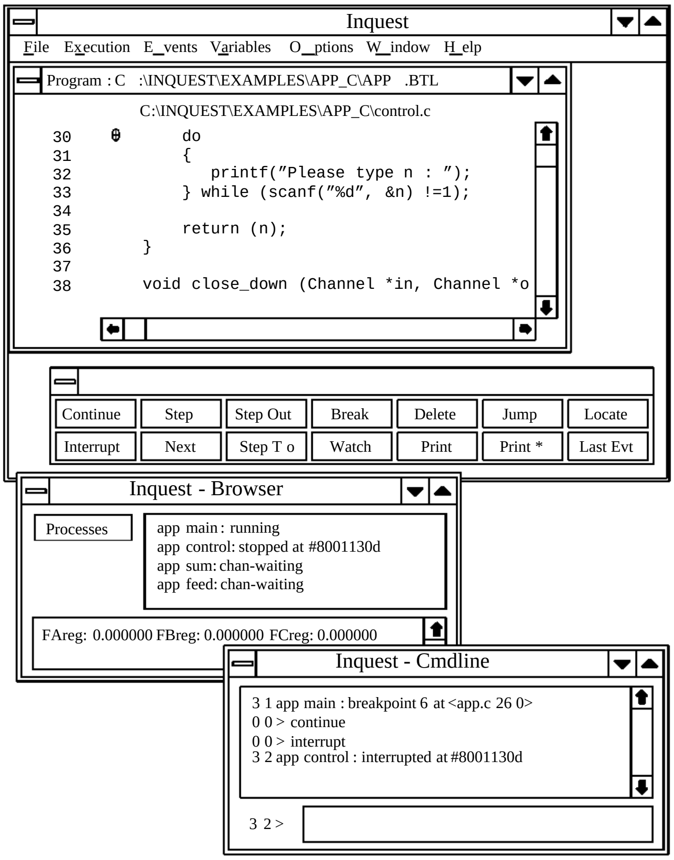
- Windowing interface using X Windows and OSF/Motif on Sun workstations or Microsoft Windows on PCs.
- Programmable command language.
- Source code or assembly code view of a thread.
- Stack trace-back facility.
- Variable and memory display facility.
- Expression interpreter.

Interactive debugging:–

- Process and thread break points.
- Single stepping of threads.
- Read/Write/Access watch point capability.
- Facilities to interrupt and find threads.

Performance analysis tools:–

- Analysis of time spent in each function.
- Analysis of processor idle time and high priority time.
- Analysis of processor utilization.



DESCRIPTION

The *T9000 INQUEST* development environment package provides additional tools for developers using the T9000 ANSI C Toolset or T9000 occam 2 Toolset for IMS T9000 transputer networks hosted by Sun-4 workstations or PCs.

An *interactive and post-mortem windowing debugger* provides single stepping, breakpoints, watchpoints and many other features for debugging sequential and parallel programs running on single or multiple transputer networks.

An *execution profiler* gives a post-mortem statistical analysis of the total execution time used by each function in a program. A *transputer network utilization monitor* shows graphically when each processor in a network was busy and when it was idle.

Contents

1 Product overview

This document contains product information for the T9000 INQUEST package.

The T9000 INQUEST package provides three additional tools for developers using the IMS Dx394 T9000 ANSI C Toolset or IMS Dx395 T9000 occam 2 Toolset for IMS T9000 transputer networks.

The debugger supplied in the INQUEST package supports source-level and low-level debugging of multi-process and multi-processor programs. A graphical user interface, with multiple windows, simplifies use of this sophisticated tool. The debugger provides single stepping, breakpoints, watchpoints and many other features for debugging sequential and parallel programs running on single or multiple IMS T9000 networks.

The INQUEST debugger has three debugging modes:

- interactive debugging, i.e. monitoring the application as it executes on the target processor;
- post-mortem debugging on the target processor when the application has stopped;
- post-mortem debugging on the host from a dump file.

An execution profiler gives a post-mortem statistical analysis of the total execution time used by each function in a program. A transputer network utilization monitor shows graphically when each IMS T9000 processor in a network was busy and when it was idle.

The IMS Dx390 T9000 INQUEST package operates in a host-target transputer development environment. The debugger runs on the host computer from which the IMS T9000 network has been loaded. If the host is a Sun 4 then the target network is accessed using the IMS B300 Ethernet to Transputer Gateway product. If the host is a PC then the target network is accessed using the IMS B108 PC HTRAM add-in Motherboard or compatible product or the IMS B300 Ethernet to Transputer Gateway product.

1.1 Applications

- Single- and multi-processor embedded systems.
- Massively parallel applications.
- Evaluation of concurrent algorithms.
- Scientific programming.

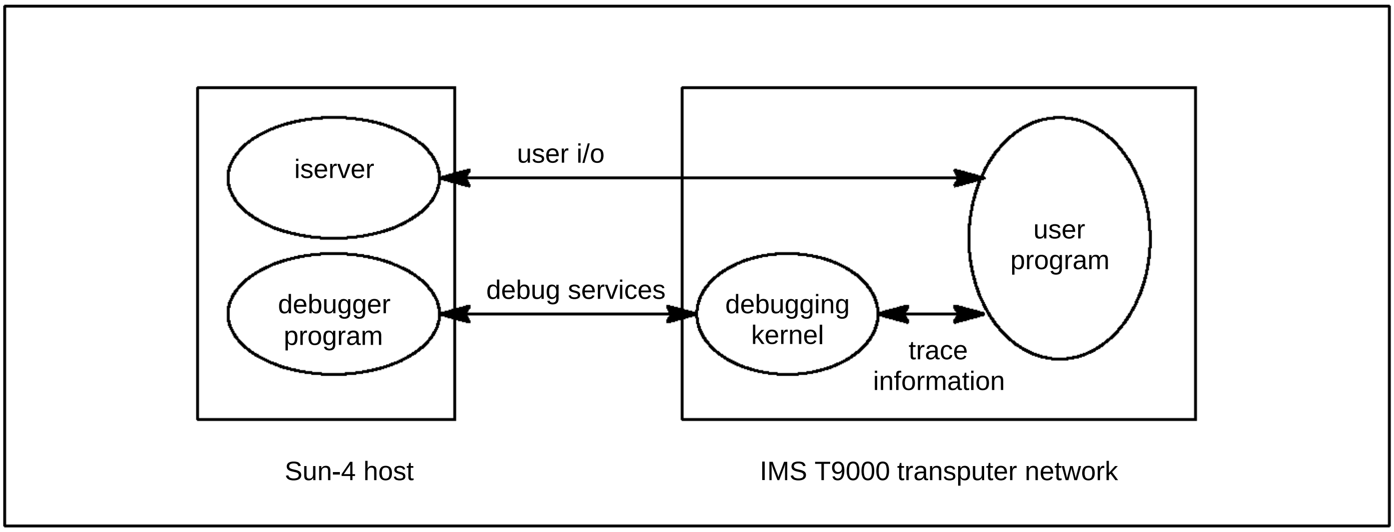


Figure 1 Debugger architecture

2 Interactive debugging

The INQUEST debugger can debug T9000 ANSI C and occam programs either interactively or post-mortem. A user interface displays source code or disassembled code and enables the user to interact with the debugger by means of buttons and menus, mouse and keyboard. The interface is built using the X Window System and OSF/Motif for Sun-4s or Microsoft Windows for PCs.

The interactive debugger consists of a host-based symbolic debugger and transputer-resident distributed debugging kernels that are configured into the application program on one or more processors, as shown in Figure 1.

A user interface displays source code or disassembled code and enables the user to interact with the debugger by means of buttons and menus, mouse and keyboard. The user interface is built using the X Window System and OSF/Motif on Sun hosts or Microsoft Windows 3.1 on PC hosts.

The program being debugged may consist of any number of parallel threads of execution, some of which may be running while others are stopped or being single stepped. The host debugger program is asynchronous and holds a copy of the last stopped state of each thread, so values may be inspected by the host while the user program is running on the transputer network. Multiple debugging windows may be opened to view different parts of the program simultaneously.

The interactive debugger provides the following features:–

- A break point facility that can be used on particular threads of execution.
- A single stepping facility that allows a thread of execution to be single stepped at the source level or at the assembly code level.
- A watch point facility that enables the program to be stopped when variables are to be written to or read from.
- A facility to find the threads of execution of a program and set break points on them.
- A stack trace facility.
- A facility to monitor the creation of threads of execution.
- Commands to print the values of variables and display memory.
- A simple interpreter to enable C and occam structured variables to be displayed.
- A programmable command language that allows complex break points and watch points to be set and enables debugging scripts to be generated.
- A source and object browser to select a process, a thread and source code.

2.1 Post-mortem debugging

The post-mortem debugger provides the following features:–

- A source and object browser to select a process, a thread and source code.
- Commands to print the values of variables and display memory.
- A simple interpreter to display structured data.

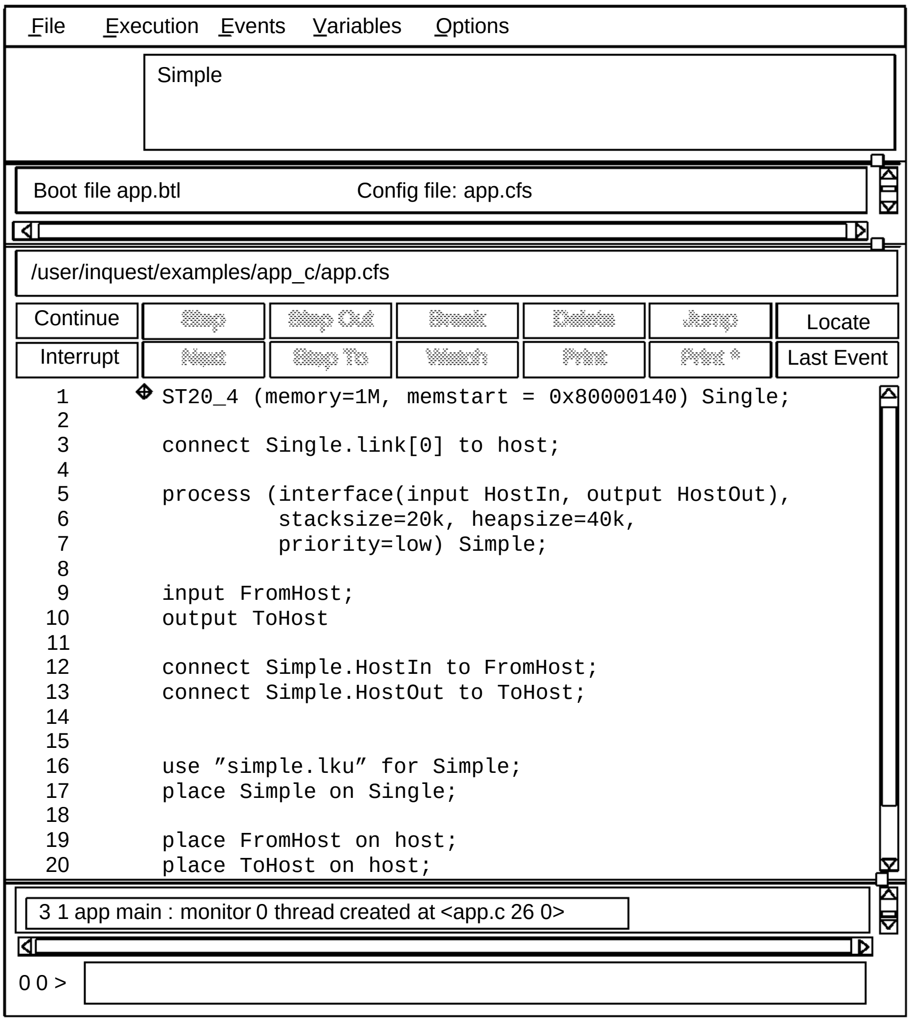


Figure 2 The X-Windows debugger display using ANSI C

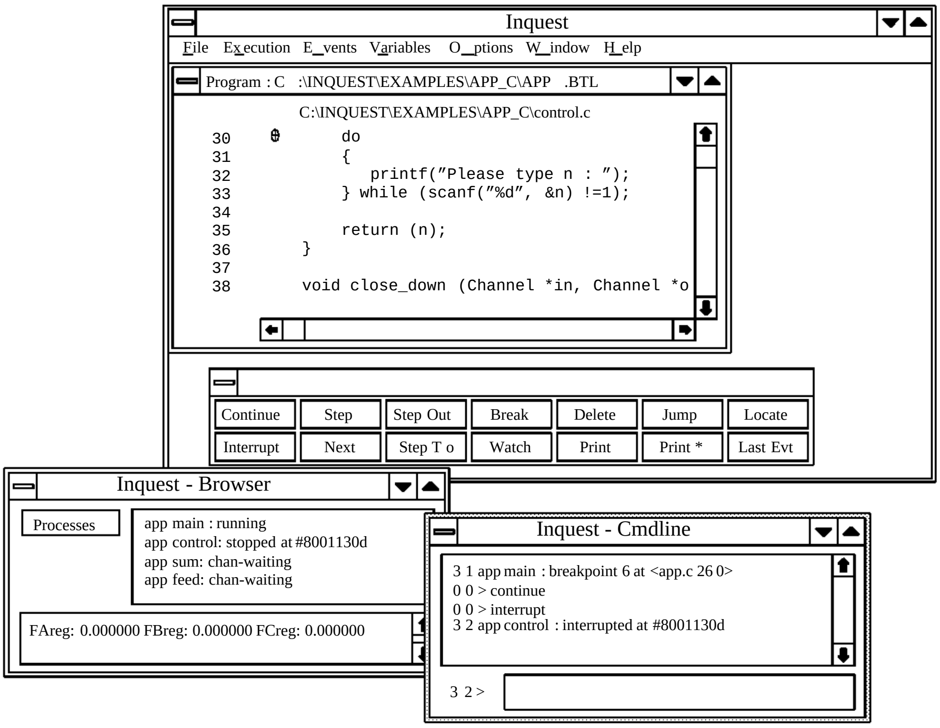


Figure 3 The debugger display using ANSI C under Microsoft Windows

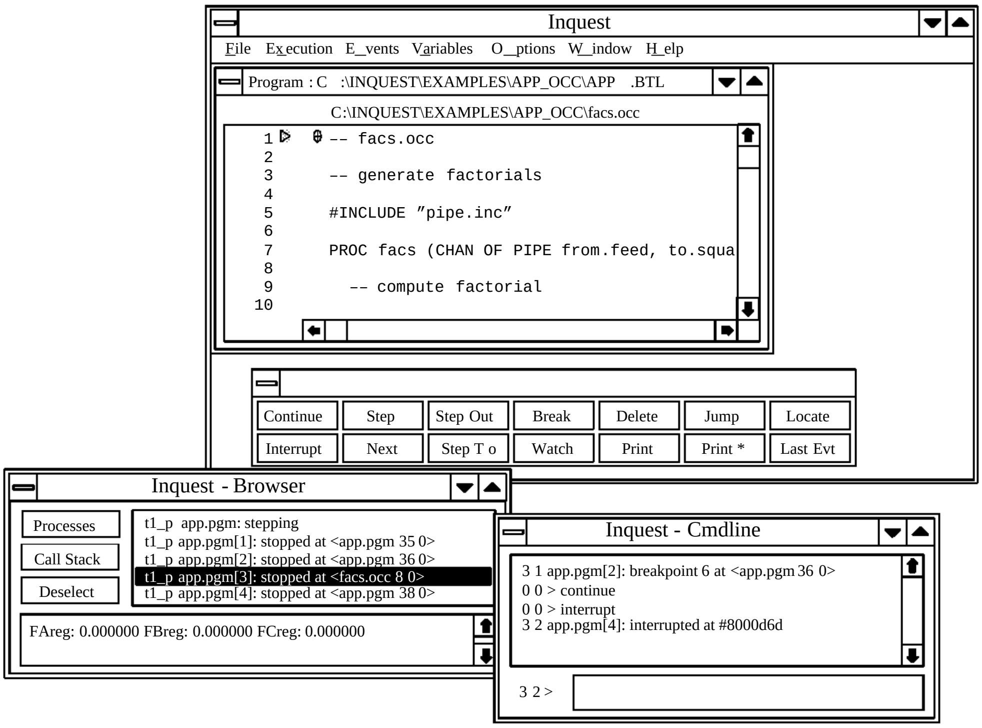


Figure 4 The debugger display using occam under Microsoft Windows

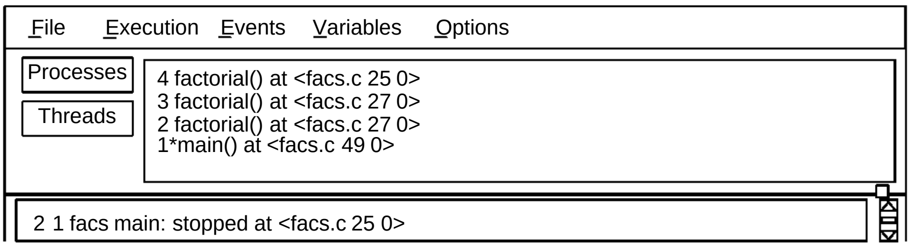


Figure 5 An X-Windows stack trace

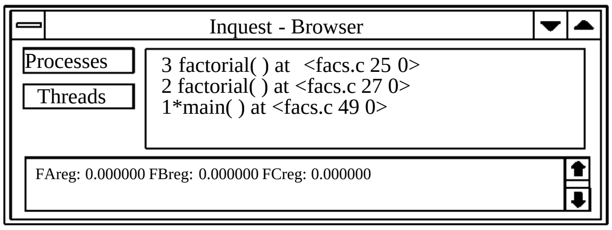


Figure 6 A Microsoft Windows stack trace

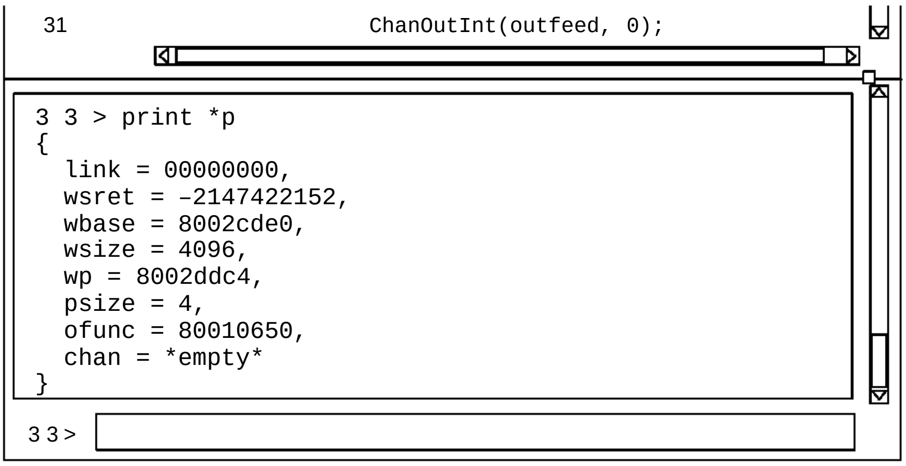


Figure 7 Displaying a structured variable under X-Windows

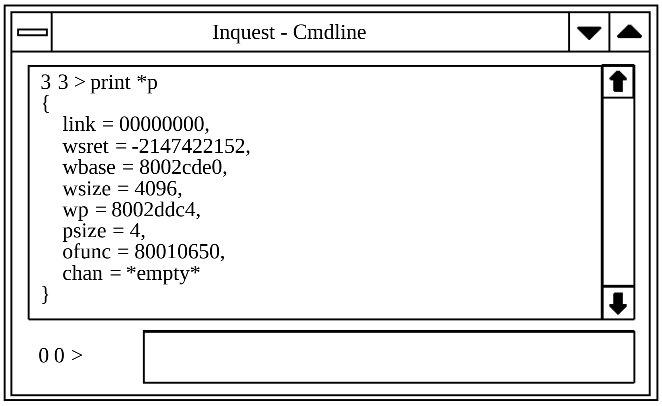


Figure 8 Displaying a structured variable under Microsoft Windows

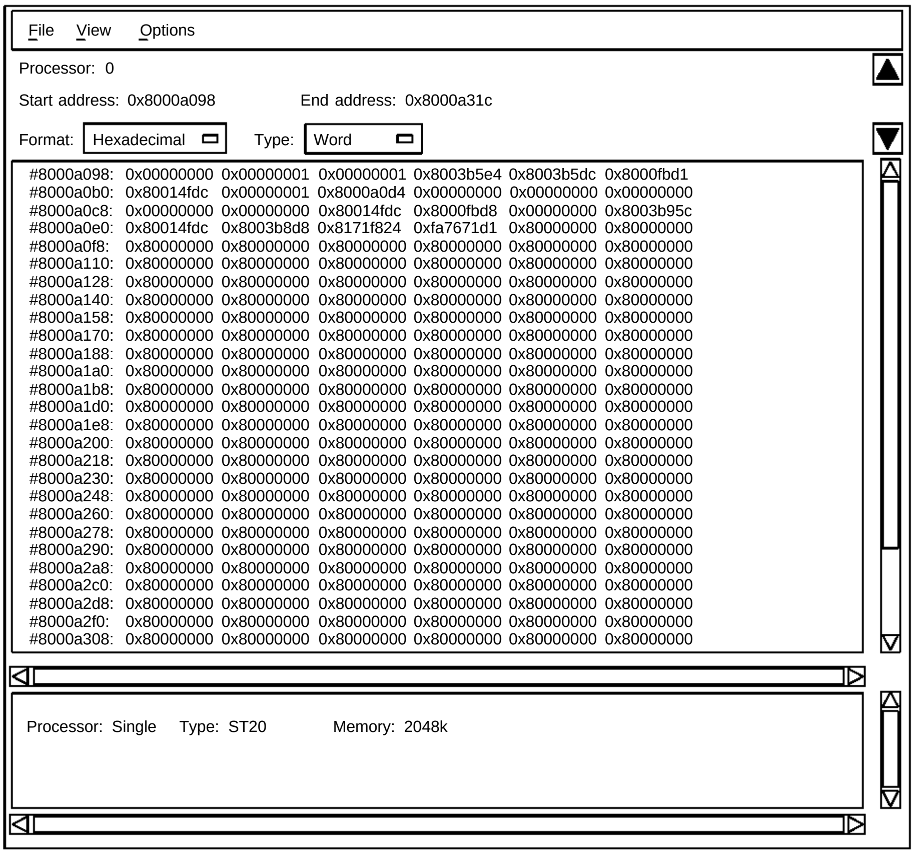


Figure 9 Displaying memory contents under X-Windows

3 Performance analysis tools

The performance analysis tools comprise an execution profiler and a network utilization monitor. With these tools the execution of the user program is monitored by a distributed profiling kernel. The monitoring data is stored locally to each processor, so the profiling tools have little execution overhead on the application. After the program has completed execution, the monitoring data is extracted from the processors and is analyzed to provide displays on the program execution.

3.1 Execution profiler

The execution profiler gives an analysis of the total time spent executing each function on each processor.

It provides the following information on program execution:–

- The percentage time spent executing each low priority function.
- The percentage time spent executing at high priority.
- The percentage idle time of each processor in the network.
- The percentage time spent executing each configuration process.

```
Processor ”Root”
Idle time 35.3% (19516)
High time 0.1% (37)
Wptr Misses 0
Iptr Misses 0
Resolution 4

-----------------------------------------------------------------------------
Process ”ex” (99.9% processor) (35.666s)
Stack 100.0% (35666)    Heap 0.0% (0)    Static 0.0% (0)
Function Name                                | Process | Processor |Samples
-----------------------------------------------------------------------------
libc.lib/getc                                |    11.4 |      11.4 |4081
cc/pp.c/pp_rdch0                             |    10.1 |      10.1 |3605
cc/bind.c/globalize_memo                     |     6.9 |       6.9 |2467
cc/pp.c/pp_process                           |     4.3 |       4.3 |1525
cc/pp.c/pp_rdch3                             |     4.2 |       4.2 |1497
cc/pp.c/pp_rdch2                             |     3.9 |       3.9 |1380
cc/pp.c/pp_rdch1                             |     3.8 |       3.8 |1354
cc/pp.c/pp_rdch                              |     3.5 |       3.5 |1252
cc/pp.c/pp_nextchar                          |     3.3 |       3.3 |1189
cc/pp.c/pp_checkid                           |     3.2 |       3.2 |1150
cc/lex.c/next_basic_sym                      |     2.7 |       2.7 |979
libc.lib/strcmp                              |     2.3 |       2.3 |812
libc.lib/DummySemWait                        |     2.2 |       2.2 |784
libc.lib/sub_vfprintf                        |     1.7 |       1.7 |617
```

Figure 10   Example output from the execution profiler

3.2 Utilization monitor

The utilization monitor shows in graphical form the utilization of each processor over the time of the program execution. This is displayed in the form of an interactive program using X Window Systems and OSF/Motif that displays a chart of processor execution against time.

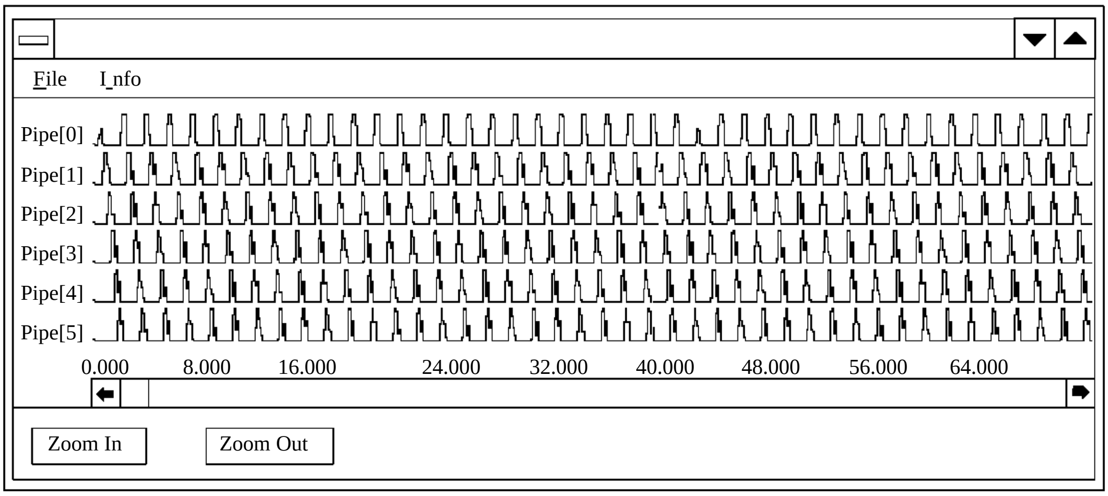


Figure 11   Example display from the utilization monitor

4 Product components

4.1 Tools

`inquest` – debugger

`iprof` – Execution profiler

`imon` – Utilization Monitor

4.2 Documentation

INQUEST Debugger Tutorial

INQUEST User and Reference Manual

Delivery Manual

5 Product variants

5.1 Sun-4 product

- IMS D4390 T9000 INQUEST

5.2 Operating requirements

The IMS D4390 T9000 INQUEST package will run on

- A Sun-4 workstation or server with 1/4 inch tape drive capable of reading QIC-24 format;
- An X Window System server (X11R4 or later) such as an X terminal or SPARCstation running OpenWindows 3;
- SunOS 4.1.3 or Solaris 2.4 or compatible;
- 9 Mbytes of free disk space.

The IMS D4390 Sun 4 T9000 INQUEST is designed to operate in conjunction with:

- IMS D4394 T9000 ANSI C Toolset or IMS D4395 T9000 occam 2 Toolset software or both, and
- an IMS B103 Ethernet to DS-Link Interface board, and
- IMS S4397a Network Interface software.

5.3 Distribution media

Sun-4 software is distributed on DC300A data cartridges 60 Mbyte, QIC-24, in tar format.

5.4 PC product

- IMS D7390 T9000 INQUEST

5.5 Operating requirements

The IMS D7390 PC T9000 INQUEST software will run on an IBM 386 PC or IBM 486 PC or compatible, running MS-DOS 5.0 or compatible. To support the graphical user interface, the environment must include Microsoft Windows 3.1.

The IMS D7390 PC T9000 INQUEST is designed to operate in conjunction with:

- the IMS D7394 T9000 ANSI C Toolset or IMS D7395 T9000 occam 2 Toolset software or both, and
- an IMS B108 PC HTRAM Motherboard or an IMS B103 Ethernet to DS-Link Interface board, and
- IMS S7397a Network Interface software.

5.6 Distribution media

PC software is distributed on 3.5 inch high density (1.44 Mbyte) diskettes.

6 Problem reporting and field support

HTRAMs and transputer toolkit development products are supported world-wide through SGS-THOMSON Sales Offices, Regional Technology Centers, and authorized distributors.

7 Ordering information

Description	Order number
PC T9000 INQUEST.	IMS D7390
Sun 4 T9000 INQUEST.	IMS D4390