Operator's Guide

HP 9000 V2500 Server

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Notice

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Preface

The *Operator's Guide HP 9000 V2500 Server* documents the information necessary to operate and monitor HP V-Class servers. This book is not intended to be a tutorial but a reference for system administrators, system operators, and system managers.

Notational conventions

This section describes notational conventions used in this book.

bold monospace	In command examples, **bold monospace** identifies input that must be typed exactly as shown.
monospace	In paragraph text, monospace identifies command names, system calls, and data structures and types. In command examples, monospace identifies command output, including error messages.
italic	In paragraph text, *italic* identifies titles of documents. In command syntax diagrams, *italic* identifies variables that you must provide. The following command example uses brackets to indicate that the variable *output_file* is optional: command *input_file* [*output_file*]
Brackets ([ ])	In command examples, square brackets designate optional entries.
Curly brackets ({}), Pipe (|)	In command syntax diagrams, text surrounded by curly brackets indicates a choice. The choices available are shown inside the curly brackets and separated by the pipe sign (|). The following command example indicates that you can enter either a or b: command {a | b}

Horizontal ellipses (...)	In command examples, horizontal ellipses show repetition of the preceding items.
Vertical ellipses	Vertical ellipses show that lines of code have been left out of an example.
Keycap	**Keycap** indicates the keyboard keys you must press to execute the command example.

NOTE A note highlights important supplemental information.

CAUTION **Cautions highlight procedures or information necessary to avoid injury to personnel. The warning should tell the reader exactly what will result from what actions and how to avoid them.**

WARNING **A warning highlights procedures or information necessary to avoid damage to equipment, damage to software, loss of data, or invalid test results.**

Safety and regulatory information

For your protection, this product has been tested to various national and international regulations and standards. The scope of this regulatory testing includes electrical/mechanical safety, radio frequency interference, ergonomics, acoustics, and hazardous materials.Where required, approvals obtained from third-party test agencies are shown on the product label.

Safety in material handling

CAUTION **Do not lift the node manually. To avoid physical injury you must use a mechanical lifting device.**

USA radio frequency interference FCC Notice

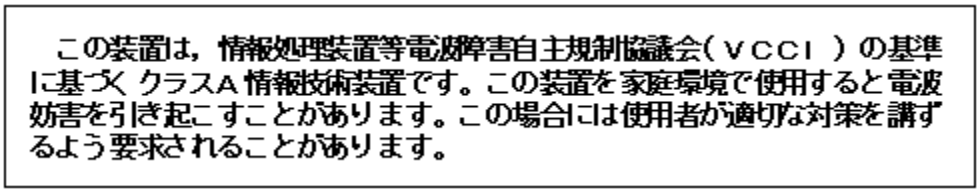
The Federal Communications Commission (in CFR Part 15) has specified that the following notice be brought to the attention of the users of this product.

NOTE This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The user is cautioned that changes or modifications not expressly approved by Hewlett-Packard could result in the equipment being noncompliant with FCC Class A requirements and void the user's authority to operate the equipment.

Japanese radio frequency interference VCCI

Figure 1 Japanese radio frequency notice



This equipment is a Class A category (Information Technology Equipment to be used in commercial and /or industrial areas) and conforms to the standards set by the Voluntary Control Council for Interference by Information Technology Equipment aimed at preventing radio interference in commercial and/or industrial areas.

Consequently, when used in a residential area or in an adjacent area thereto, radio interference may be caused to radios and TV receivers, etc. Read the instructions for correct handling.

EMI statement (European Union only)

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Digital apparatus statement (Canada)

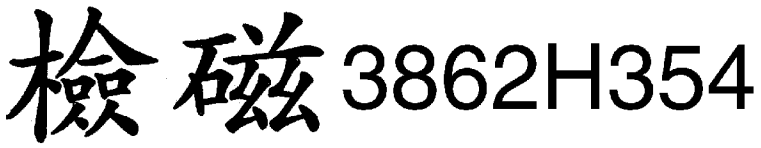
This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

BCIQ (Taiwan)

This product has been reviewed, evaluated by GesTek Taiwan and is fully compliant to CNS 13438 (CISPR 22: 1993) Class A.

Figure 2 BCIQ (Taiwan)



Acoustics (Germany)

Laermangabe (Schalldruckpregel LpA) gemessen am fiktiver Arbeitsplatz bei normalem Betrieb nach DIN 45635, Teil 19: LpA = 65.3 dB.

Acoustic Noise (A-weighted Sound Pressure Level LpA) measured at the bystander position, normal operation, to ISO 7779: LpA = 65.3 dB.

IT power system

This product has not been evaluated for connection to an IT power system (an AC distribution system having no direct connection to earth according to IEC 950).

High leakage current

CAUTION **High leakage current. Ground (earth) connection essential before connecting the supply.**

Attention Forts courants de peretes. Connection a une borne de terre est essentielle avant tout raccord electrique.

Achtung Hoher ableitstrom. Vor inbetreiebnahme schutzleiterverbindung herstellen.

Installation conditions (U.S.)

See installation instructions before connecting to the supply.

Voir la notice d'installation avant de raccorder au réseau.

CAUTION **Please note the following conditions of installation:**

An insulated earthing conductor that is identical in size, insulation material, and thickness to the earthed and unearthed branch-circuit supply conductors except that it is green with or without one or more yellow stripes is to be installed as part of the branch circuit that supplies the unit or system. The earthing conductor described is to be connected to earth that the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set.

The attachment-plug receptacles in the vicinity of the unit or system are all to be of an earthing type, and the earthing conductors serving these receptacles are to be connected to earth at the service equipment.

CAUTION **For supply connections, use wires suitable for at least 60 ˚C.**

Utillser des fils convenant à une température de 60 ˚C pour les connexions d'allmenation.

Fuse cautions

CAUTION **Disconnect power before changing fuse.**

Attention Coupier le courant avant de remplacer le fusible.

CAUTION **For continued protection against risk of fire, replace fuses only with same type and rating.**

Attention Pour ne pas compromettre la protection contre les risques d'incendle, remplacer par un fusible de même type et de mêmes caractéristiques nominales.

1 Overview

This chapter introduces V-Class system components including a brief overview of V2500 server hardware resources. It also provides some basic details about HP-UX use.

The V2500 model of V-Class server may include from 2 to 32 processors, from 512 MBytes to 32 GBytes of memory, and up to 28 PCI I/O cards per cabinet.

Each V-Class system also includes a dedicated workstation connected to the server: the teststation. The teststation is used for server booting, monitoring, and other operations. Details on using the teststation are provided in Chapter 3, “Teststation”.

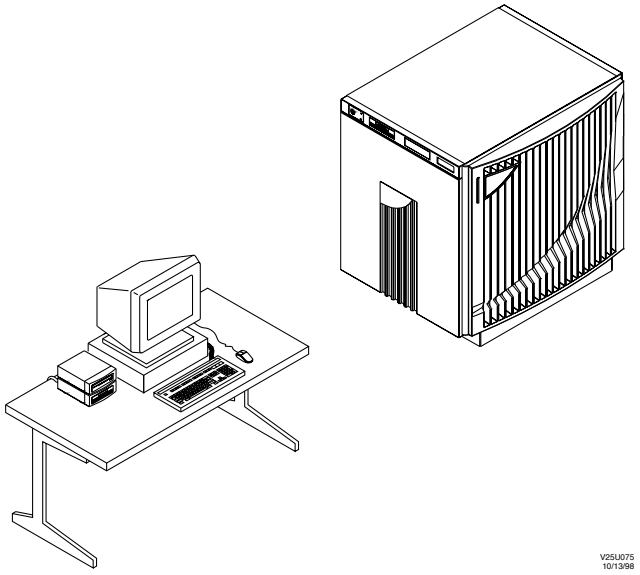
One new feature of the HP V2500 server is its Scalable Computing Architecture (SCA) design, that allows multiple V2500 cabinets to be connected to form a single HP-UX system.

This book covers only the currently supported single-cabinet configurations and features; future editions will address multiple-cabinet support and operations.

V-Class system components

Each V-Class system includes two main components: a V-Class server and a teststation dedicated to supporting the server, as shown below in Figure 3.

Figure 3 V-Class server components: cabinet and teststation



All V-Class server resources, such as processors, memory, disks, power, etc., are contained in the V-Class cabinet. The teststation has software that allows the resources in a V-Class cabinet to be monitored. The V-Class server and the teststation run separate instances, and different versions, of the HP-UX operating system.

The teststation

The teststation connects to the V-Class cabinet via the server's utilities board. Key operations supported by the teststation include booting, configuring, and monitoring the server, as well as diagnostics operations. The teststation is used when installing or upgrading V-Class firmware.

HP-UX V10.20 runs on the teststation, and additional files and utility software are provided in the directory `/spp`. All V2500-related files that are stored on the teststation can be found in this directory, including log files.

The default user account for teststation operations is `sppuser`, with a home directory of `/users/sppuser`.

See Chapter 3, “Teststation,” for more detailed information on the teststation.

V-Class server architecture

This section describes the functional components of the HP V-Class server, as shown in Figure 6 on page 6.

Each V2500 cabinet contains CPU, memory, and I/O resources, as well as interconnecting components and a utilities board. These are described in the following sections.

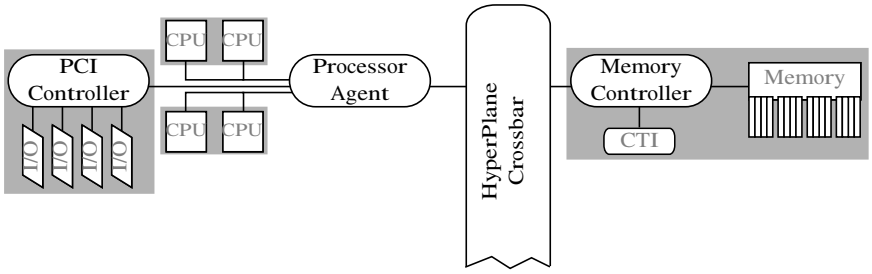
Interconnecting hardware

The V2500 server has a powerful set of interconnecting hardware components that allow the server's CPUs, memory, and I/O components to operate with minimal interruptions or contentions for resources.

The processor agents serve as a bus connection for a subset of the system's CPUs. Memory controllers provide cache-coherent access to a large, shared memory. PCI controllers are the connections for PCI I/O cards. CTI controllers are an SCA feature used only in multiple-cabinet servers.

The primary interconnecting component of the V-Class server is its HyperPlane Crossbar, which provides connections from CPUs and I/O to memory. An overview of V2500 components and their throughput capacities is shown below in Figure 4.

Figure 4 **V2500 interconnecting components and throughput capacities**



PCI Controllers

- 240 MBytes/sec bi-directional per controller
- 1.9 GBytes/sec peak aggregate per V2500 cabinet

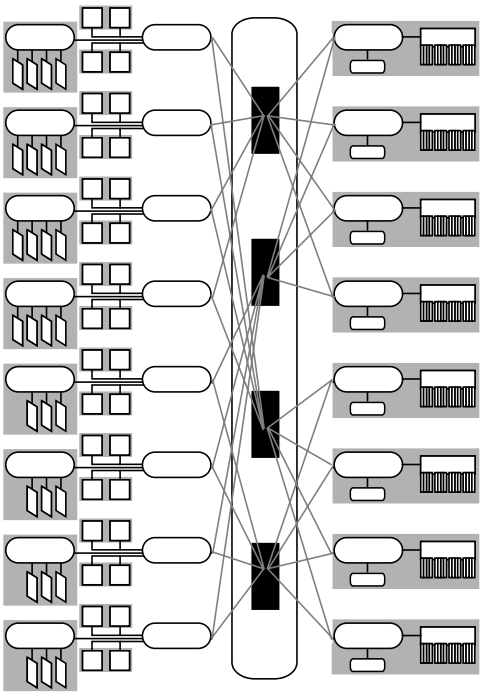
HyperPlane Crossbar

- 960 MBytes/sec bi-directional per port
- 15.36 GBytes/sec memory bandwidth per V2500 cabinet

The V2500 HyperPlane Crossbar is a non-blocking 8x8 crossbar that provides a central connection among the system's processor agents, memory controllers, and PCI controllers.

As Figure 5 shows, the crossbar has four Exemplar Routing Access Controllers (ERACs), each of which connects to four processor agents and four memory controllers. All memory controllers and processor agents connect to two separate ERACs, thus making the entire system's memory addressable by all processors and I/O devices in the system.

Figure 5 **V2500 HyperPlane Crossbar connections**

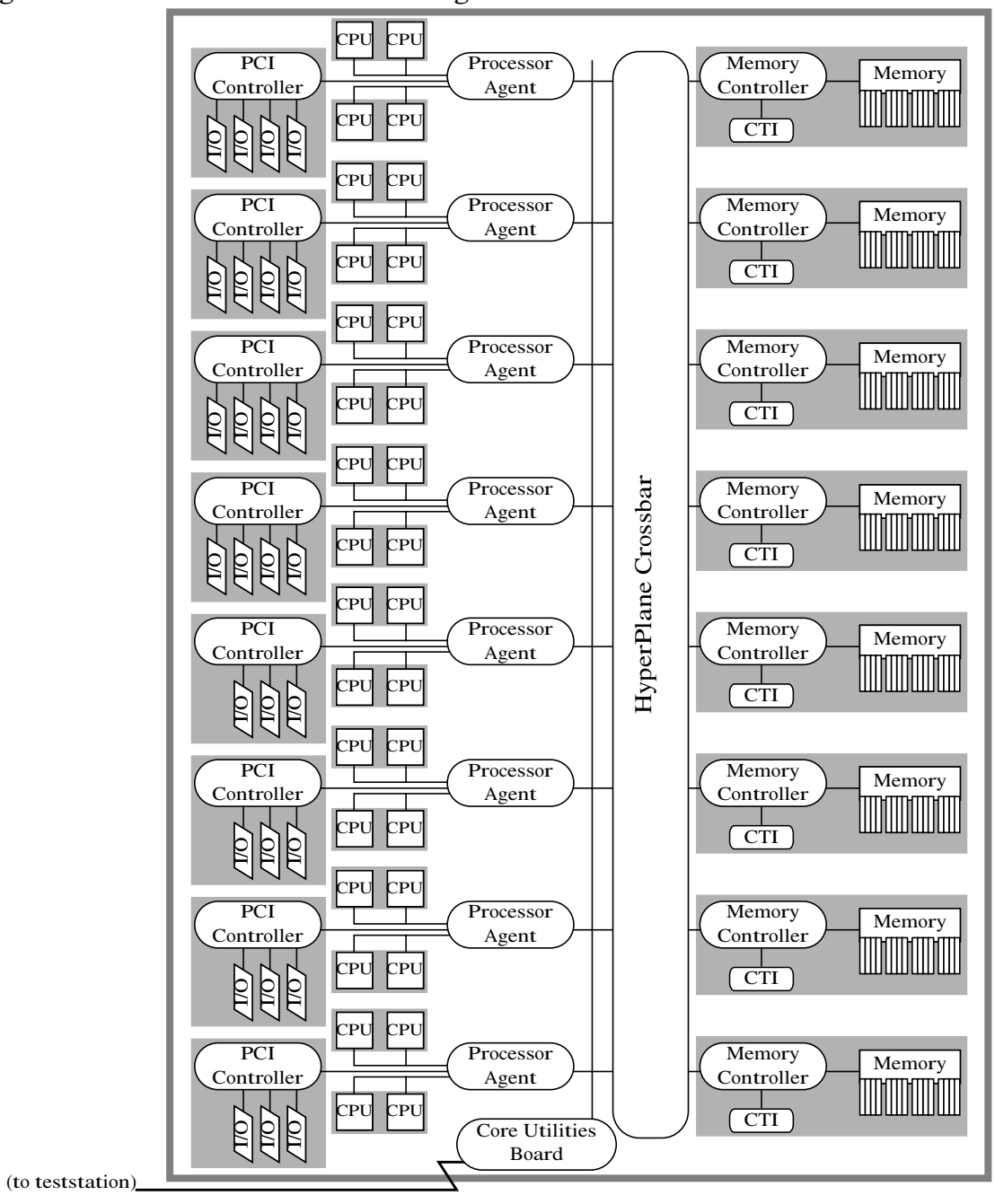


Each ERAC has 16 ports, four send and four receive on each side, which may operate simultaneously.

V2500 block diagram

The following figure shows a functional overview of the V2500 server hardware. A fully configured V2500 cabinet is pictured, though partial configurations are supported, as described in "V2500 cabinet configurations" on page 10. For details on the components shown in Figure 6 on page 6, refer to the sections that follow.

Figure 6 Functional block diagram of a V2500 server



Core Utilities Board

The utilities board provides boot, diagnostics, and console connections from the V-Class cabinet to the teststation, as well as system clock, system LCD, and other functionality. It also stores the boot firmware and boot-time variable settings in non-volatile memory. For details on firmware use and configuration refer to Chapter 4, “Firmware (OBP and PDC)”.

Processors

Each V2500 cabinet may contain from 2 to 32 HP PA-8500 processors. The PA-8500 is a 64-bit, 440-MHz processor. Each processor board contains one or two processors, with up to two processor boards connecting to each of the eight processor agents per cabinet.

The PA-8500 processor is based on version 2.0 of Hewlett-Packard’s Reduced Instruction Set Computer (RISC) processor architecture.

NOTE

The PA-RISC architecture is presented in the *PA-RISC 2.0 Architecture* reference manual. Please refer to that document for detailed information about processor features. This Operator’s Guide does not duplicate information in that manual.

Other models of V-Class servers, including V2200 and V2250 servers, use Hewlett-Packard’s PA-8200 processor. Upgrading these other models of servers to a V2500 involves upgrading the processor, among other components.

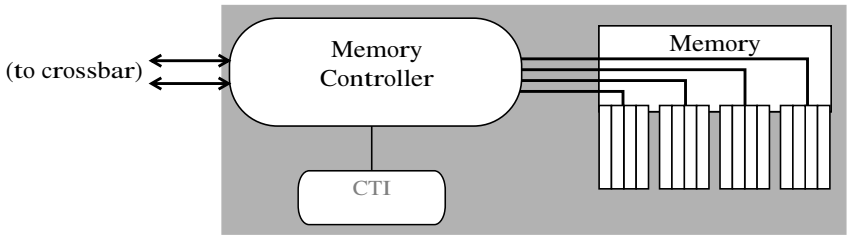
Memory

A maximum of 32 GBytes of memory may be installed per V2500 cabinet. The V-Class server has a Symmetric Multi-Processing (SMP) design, that gives all processors equal access to all memory an a uniform latency for memory accesses.

Each memory board includes a memory access controller, memory DIMMs, and a CTI controller.

The CTI controller is not used in single-cabinet servers but is present for future system expansion. CTI controllers are a feature of HP’s SCA and are used for connecting cabinets in multiple-cabinet servers.

Figure 7 Detailed view of V2500 memory board



Through the memory access controllers, each memory board provides separate read and write access to the memory DIMMs. Up to 16 DIMMs may be installed per board, providing up to 256-way memory interleaving per cabinet when all memory boards are fully populated.

Slots for DIMMs on each memory board are grouped in four quadrants. Each quadrant, as Figure 7 shows, has a separate connection to the memory controller. All quadrants should have the same memory configuration; this also provides good performance by interleaving memory within a memory board.

Memory also is interleaved across memory controllers, allowing separate controllers and separate parts of the V2500 crossbar to simultaneously access memory on different controllers. See Figure 5 on page 5 for details.

If planning for future expansion to a multiple-cabinet server configuration, use 88-bit DIMMs and configure the V2500 server to be one-fourth, one-half, or fully populated with DIMMs. Single-cabinet servers can also use 80-bit DIMMs and may be filled to three-fourths memory capacity (3 DIMMs in every quadrant).

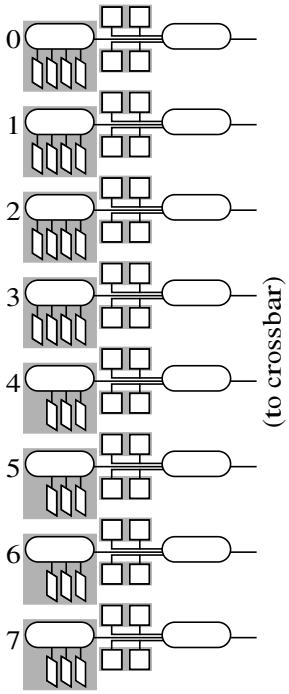
Input/Output

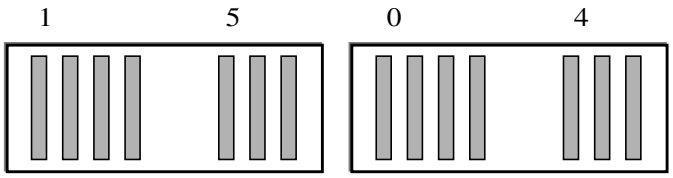
Up to 28 PCI I/O cards may be connected to a V2500 cabinet via the 64-bit PCI chassis. Each PCI controller has connections for either three or four PCI cards.

Each of the I/O ports is capable of direct memory access (DMA), which eliminates processor involvement during data transfers, and streamlines data transfer for large disk blocks and high-speed network connections.

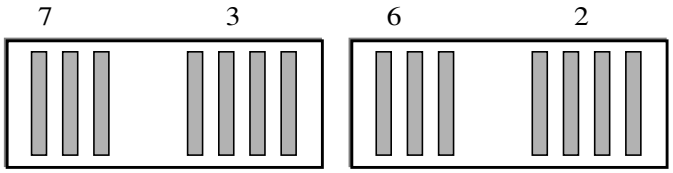
PCI controllers are numbered from 0 to 7, and are accessible from either the top-left or the bottom-right sides of the V2500 cabinet, as shown in Figure 8 on page 9.

Figure 8 Numbering and locations of V2500 PCI I/O





Top left PCI card cage, as viewed from the left side of the V2500 cabinet.



Bottom right PCI card cage, as viewed from the right side of the V2500 cabinet.

The following I/O cards are supported on HP V2500 servers:

- ATM
- FDDI
- Fibre Channel
- FWD SCSI-2
- HyperFabric
- Token Ring
- Ultra2 SCSI
- 10/100Base-T
- 100 Base-Fx
- 1000 BaseSX GB
- X.25

V2500 cabinet configurations

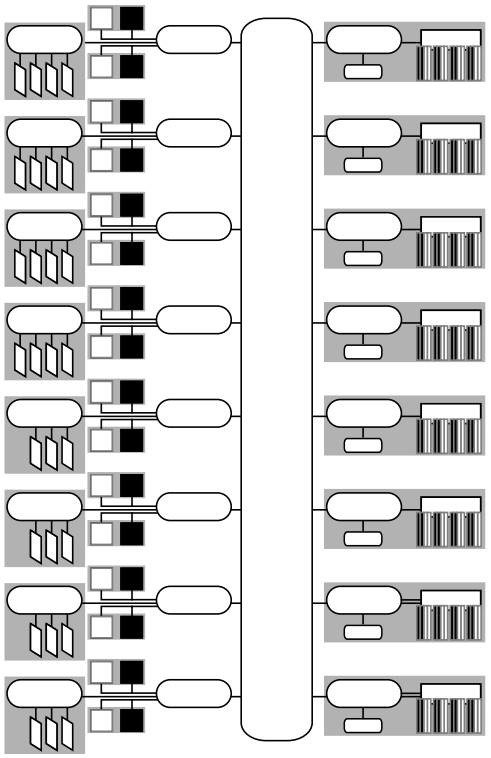
This section shows two sample V2500 cabinet configurations: a 16-processor system and an 8-processor system, filled to one-half and one-fourth memory capacity, respectively.

For information on performance implications of the configurations shown in Figure 9, refer to “V-Class server architecture” on page 4.

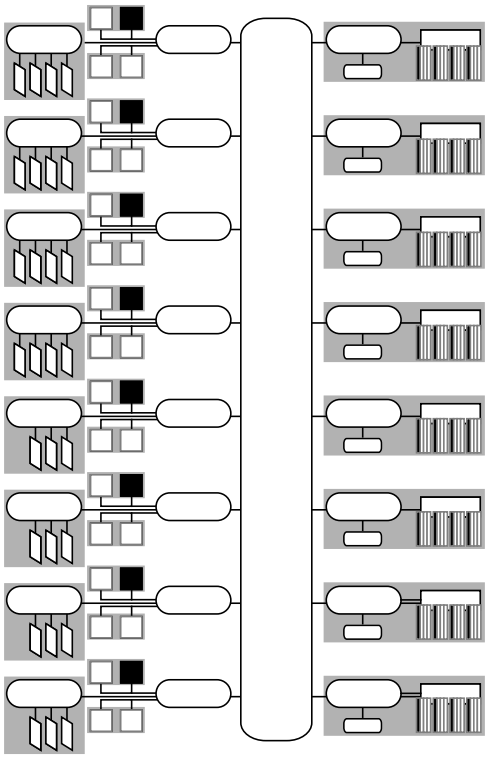
V2500 servers may contain up to 32 processors and 32 GBytes of memory. Additional server configuration and ordering information is available from the following Web site.

```
http://eproducts.hp.com/
```

Figure 9 Sample V2500 cabinet configurations



V2500 cabinet with 16 processors and 16 GBytes of memory, using 256MByte DIMMs.



V2500 cabinet with 8 processors and 8 GBytes of memory, using 256MByte DIMMs.

HP-UX operating system

As mentioned earlier, different versions of the HP-UX operating system run on a V-Class server and its teststation. This section covers issues related to using HP-UX V11.0 on V-Class servers. See Chapter 3 for teststation details.

V-Class servers run HP-UX V11.0, and in general HP-UX administration tasks are performed as on other HP servers. One difference is that V-Class servers run the HP-UX kernel only in 64-bit mode. This facilitates addressing the larger memory capacity available on the V2500. However, both 32-bit and 64-bit applications may be run simultaneously on the server.

Displaying system information

This section gives brief information on the `model`, `top`, and `ioscan` HP-UX commands. More HP-UX information is available from the following Web site.

```
http://docs.hp.com/
```

The `model` command prints the hardware series and model for the machine it is issued on. On V2500 servers it displays information as shown in the command example below.

```
# model
9000/800/V2500
```

See the *model*(1) man page for more information.

The `top` command displays information on the top processes on the system and lists CPU utilization data for the system's processors. Because V-Class servers can have many processors, it may be preferable to issue `top -h` when using this command. The `-h` option suppresses printing individual lines of processor information, instead printing only a one-line system average. This makes room on the screen for showing the active processes running on the system. See the *top*(1) man page for more information.

The `ioscan` utility scans the system's hardware and lists all hardware found, including processors, memory, I/O devices, and interface cards. On V-Class servers, `ioscan` also reports PCI controllers (beginning at

hardware paths 0–7, as present) and the core utility controller and its connections to the teststation (beginning at hardware path 15). See the *ioscan*(1M) man page for more information.

Configuring HP-UX for V-Class servers

HP-UX V11.0 provides several tuned parameter sets useful on HP V-Class servers. Configuring HP-UX with these parameter sets can improve the V-Class server's performance when using it for different purposes, such as scientific, data processing, or mixed interactive use.

Use the SAM utility (`/usr/sbin/sam`) to configure an HP-UX kernel for HP V-Class servers. To do so, select Kernel Configuration, then the Configurable Parameters subarea, and apply the tuned parameter set for your type of server use via the Actions menu.

HP-UX kernel configurations are provided for the following types of V-Class server use:

- Scientific and technical use—Servers running applications that have very large data sets and may have long processing times. Examples include NASTRAN, Abaqus, mechanical and electrical design applications, and fluid dynamics applications.

  The "V-Class Technical Server" tuned parameter set provides HP-UX kernel parameter settings for running such workloads on HP V-Class servers.

- Dedicated commercial data processing use—Servers whose use is restricted for online transaction processing (OLTP), running Oracle, and running other data processing workloads. These systems provide limited, if any, interactive user access.

  The "OLTP/Database Server System" tuned parameter set provides a good HP-UX configuration for using HP V-Class servers for dedicated commercial data processing.

- Mixed interactive and data processing use—Servers used for interactive user log-ins, and for running OLTP/data processing workloads and miscellaneous other applications.

  The "OLTP/Database Monolithic System" tuned parameter set is appropriate for mixed-use V-Class servers.

These tuned parameter sets are available from the SAM utility's Configurable Parameters subarea, as described above, and are stored as files in the following directory.

```
/usr/sam/lib/kc/tuned
```

Refer to the SAM online help for examples and details on using kernel parameters.

Process and thread scheduling

HP-UX V11.0 includes support for kernel threads and provides a "gang scheduling" feature for managing how threads belonging to the same process are executed.

The HP-UX gang scheduler permits a set of MPI processes, or multiple threads from a single process, to be scheduled concurrently as a group.

Gang scheduling is enabled and disabled by setting the `MP_GANG` environment variable to `ON` or `OFF`.

The gang scheduling feature can significantly improve parallel application performance in loaded timeshare environments that are oversubscribed. Oversubscription occurs when the total number of runnable parallel threads, runnable MPI processes, and other runnable processes exceeds the number of processors in the system.

Gang scheduling also permits low-latency interactions among threads in shared-memory parallel applications.

Only applications using the HP-UX V11.0 MPI or pthread libraries can be gang scheduled. Because HP compiler parallelism is primarily built on the pthread library, programs compiled with HP compilers can benefit from gang scheduling.

See the *gang_sched*(7) man page for more information.

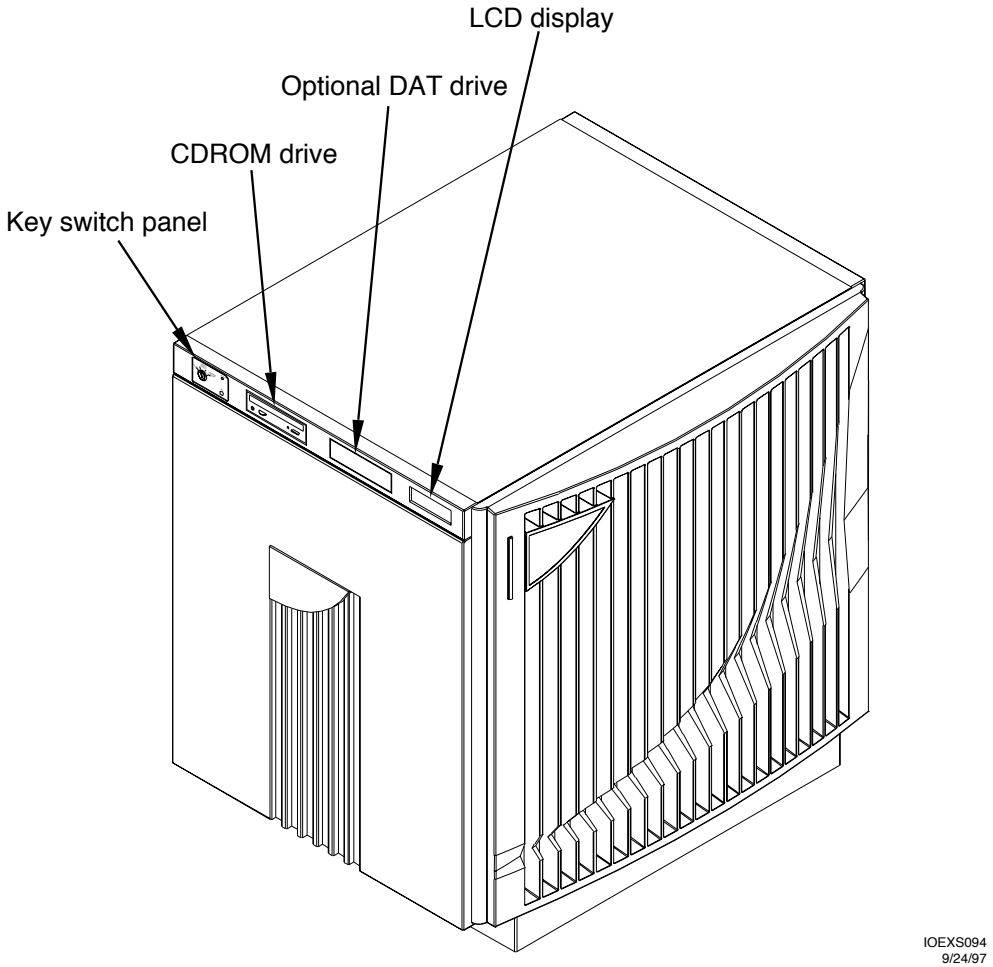
2 Indicators, switches, and displays

This section describes indicators, switches, and displays of the HP 9000 V2500 server.

Operator panel

The operator panel is located on the top left side of the server and contains the key switch panel, CDROM drive, optional DAT tape drive, and the LCD display. Figure 10 shows the location of the operator panel and its components.

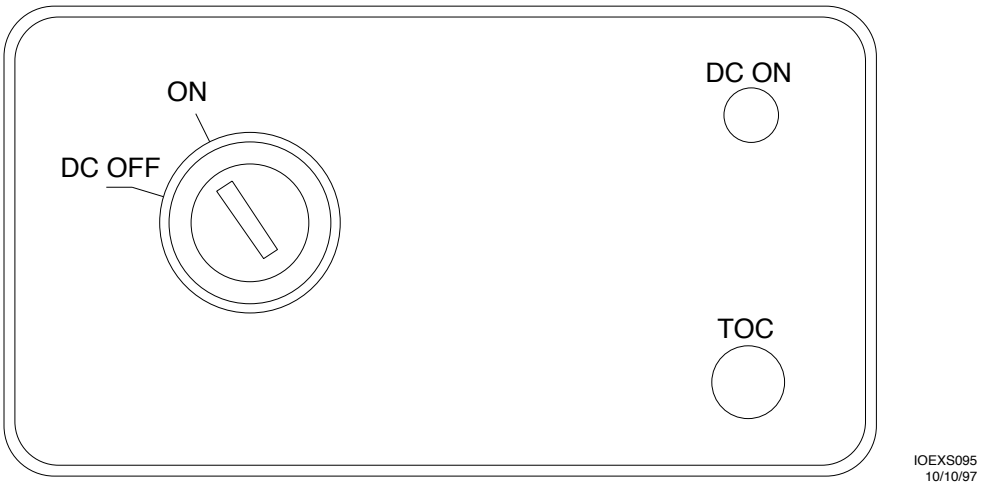
Figure 10 Operator panel



Key switch panel

The key switch panel is located on the left of the operator panel, as shown in Figure 10 on page 16. The key switch panel contains a two position key switch, a DC ON LED, and a TOC (Transfer Of Control) button, as shown in Figure 11.

Figure 11 Key switch panel



Key switch

The key switch has four positions. Placing the key switch in any position other than DC OFF powers up the V-Class server.

- DC OFF

  DC power is not applied to the system. Placing the key switch in this position is the normal method for turning off power to the system.

- ON

  DC power is applied to the system. POST (Power On Self Test) begins executing and brings up the system from an indeterminate state and then calls OBP.

DC ON LED

This LED indicates that DC power has been applied to the system.

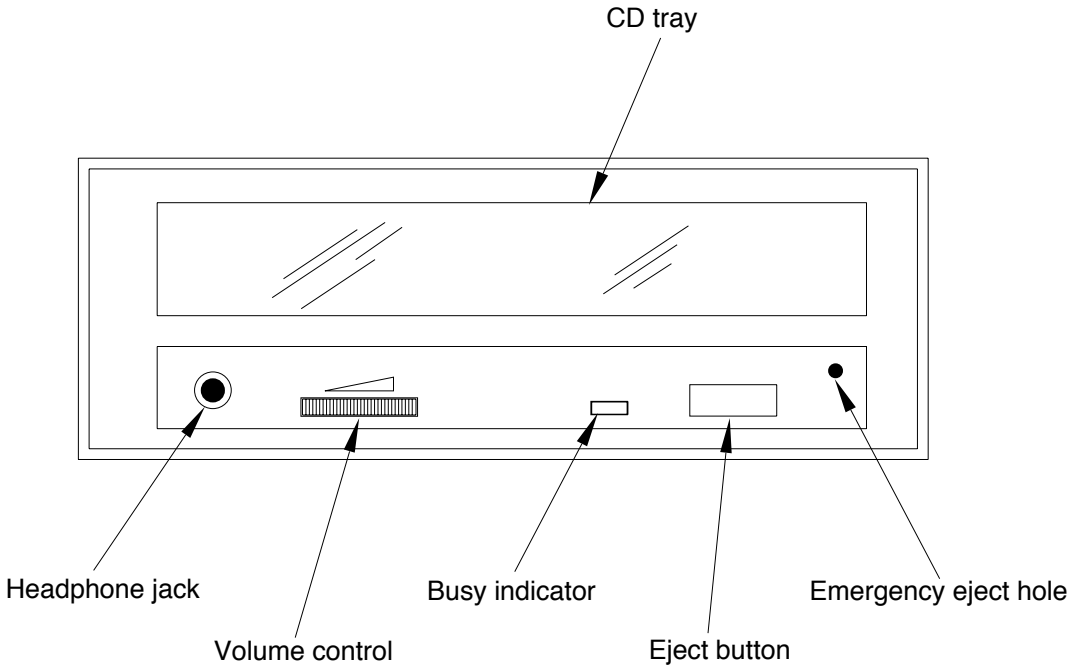
TOC

The TOC (Transfer Of Control) button is a recessed switch that resets the system.

CDROM drive

The CDROM drive is located on the left of the operator panel, as shown in Figure 10 on page 16. Figure 12 shows the CDROM drive front panel in detail.

Figure 12 **CDROM drive**



Busy indicator

The busy indicator LED flashes to indicate that a read operation is occurring.

CAUTION

Do not push the eject button while this LED is flashing. If you do, the operation in progress is aborted, and the CDROM is ejected, possibly causing a loss of data.

Eject button

Push the eject button to open the CD tray to remove CDROMs from the drive.

Emergency eject

Insert a paper clip into the emergency eject hole to open a jammed CD tray.

Optional DAT drive

The DAT drive is located on the right of the operator panel, as shown in Figure 10 on page 16. The DAT drive front panel contains two indicator LEDs and an eject button, as shown in Figure 13.

Figure 13 DDS-3 DAT drive front panel

LEDs

The two LEDs provide operating information for normal as well as error conditions. Table 1 shows the meaning of the different LED patterns.

Table 1 Indicator LED operation

Tape (Activity) LED (green)	Clean (Attention) LED (amber)	Meaning
Flashing slowly	Off	A load or unload of a cartridge is in progress.
Flashing rapidly	Off	A cartridge is loaded and a read or write is in progress.
On	Off	A cartridge is loaded.

Tape (Activity) LED (green)	Clean (Attention) LED (amber)	Meaning
Any	Flashing slowly	Media caution signal. Indicates that a cartridge is near the end of its life or that the heads need cleaning.
Any	On	Fault
Flashing slowly	Off	Power-on (starts with two steady lights)

Eject button

Push the eject button to remove cartridges from the tape drive. The drive performs the following Unload sequence:

1. The tape is rewound to Beginning of Partition (BOP) for Partition 0.
2. If the tape is write-enable, the copy of the Tape log is written back to tape.
3. The tape is then rewound to Beginning of Media (BOM), unthreaded from the mechanism, and ejected.

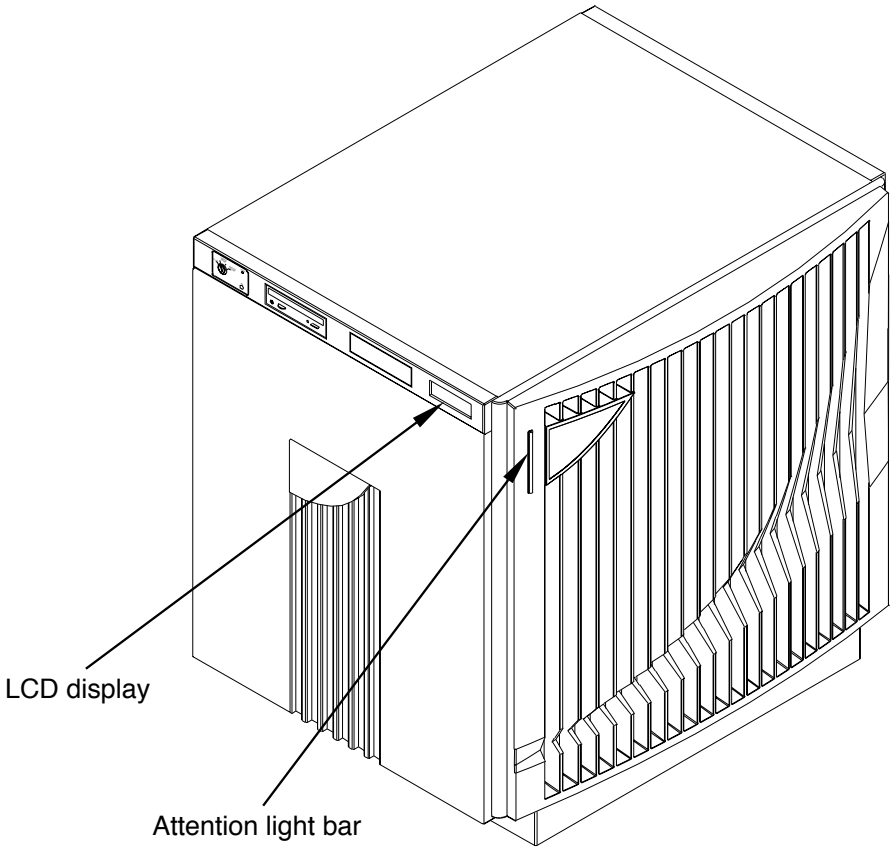
CAUTION

Do not push the eject button while the LED is flashing. If you do, the operation in progress is aborted and the cartridge is ejected, possibly causing a loss of data.

System Displays

The V-Class servers provide two means of displaying status and error reporting: an LCD and an Attention light bar.

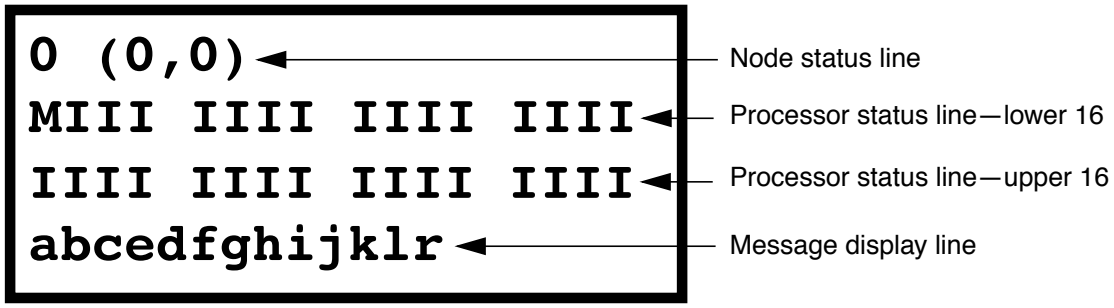
Figure 14 System displays



LCD (Liquid Crystal Display)

The LCD display is located on the right of the operator panel, as shown in Figure 14 on page 23. The LCD is a 20-character by 4-line liquid crystal display. Figure 15 shows the display and indicates what each line on the display means.

Figure 15 Front panel LCD



When the operator panel key switch is turned on, the LCD powers up, but is initially blank.

Power-On Self Test (POST) takes about 20 seconds to start displaying output to the LCD. POST is described in the *HP Diagnostics Guide: V2500 Servers*. The following explains the output shown in Figure 15:

Node status line

The Node Status Line shows the node ID in both decimal and X, Y topology formats.

Processor status line

The processor status line shows the current run state for each processor in the node. Table 2 shows the initialization step code definitions and Table 3 shows the run-time status codes. The M in the first processor status line stands for the monarch processor.

Table 2 Processor initialization steps

Step	Description
0	Processor internal diagnostic register initialization
1	Processor early data cache initialization.
2	Processor stack SRAM test.(optional)
3	Processor stack SRAM initialization.
4	Processor BIST-based instruction cache initialization.
5	Processor BIST-based data cache initialization
6	Processor internal register final initialization.
7	Processor basic instruction set testing. (optional)
8	Processor basic instruction cache testing. (optional)
9	Processor basic data cache testing. (optional)
a	Processor basic TLB testing (optional)
b	Processor post-selftest internal register cleanup. (optional)

Table 3 Processor run-time status codes

Status	Description
R	RUN: Performing system initialization operations.
I	IDLE: Processor is in an idle loop, awaiting a command.
M	MONARCH: The main POST initialization processor.
H	HPMC: processor has detected a high priority machine check (HPMC).
T	TOC: processor has detected a transfer of control (TOC).
S	SOFT_RESET: processor has detected a soft RESET.
D	DEAD: processor has failed initialization or selftest.

Status	Description
d	DECONFIG: processor has been deconfigured by POST or the user.
-	EMPTY: Empty processor slot.
?	UNKNOWN: processor slot status in unknown.

Message display line

The message display line shows the POST initialization progress. This is updated by the monarch processor. The system console also shows detail for some of these steps. Table 4 shows the code definitions.

Table 4 Message display line

Message display code	Description
a	Utilities board (SCUB) hardware initialization.
b	Processor initialization/selftest rendezvous.
c	Utilities board (SCUB) SRAM test. (optional)
d	Utilities board (SCUB) SRAM initialization.
e	Reading Node ID and serial number.
f	Verifying non-volatile RAM (NVRAM) data structures.
g	Probing system hardware (ASICs).
h	Initializing system hardware (ASICs).
i	Probing processors.
j	Initialing, and optionally testing, remaining SCUB SRAM.
k	Probing main memory.
l	Initializing main memory.
r	Enabling system error hardware.

Attention light bar

The Attention light bar is located at the top left corner on the front of the V2500 server as shown in Figure 14 on page 23. This light bar displays system status in three ways:

- Off—system powered down
- Steady on—system powered up
- Flashing—error condition

A flashing attention light can indicate a wide variety of problems. Contact the Hewlett-Packard Response Center should this occur.

3 Teststation

This chapter provides information about the Hewlett-Packard workstation that serves as a teststation for the V-Class server.

Teststation functionality

The teststation is connected directly to the V-Class server via a dedicated LAN connection as well as a special RS-232 serial connection. Together the LAN and the serial connection provide control, status, and HPMC error information to the teststation where operators and CEs may view status.

A teststation is required to enable service personnel to verify and troubleshoot the V-Class system.

Several functions of the teststation include:

- V-Class console
- Running diagnostics
- Updating of Utility Board firmware
- Logging of environmental and system level events
- Configuration of hardware and boot parameters
- Booting the Operating System

Teststation logons

Two UNIX user accounts are created on the teststation during the HP-UX 10.20 operating system installation process.

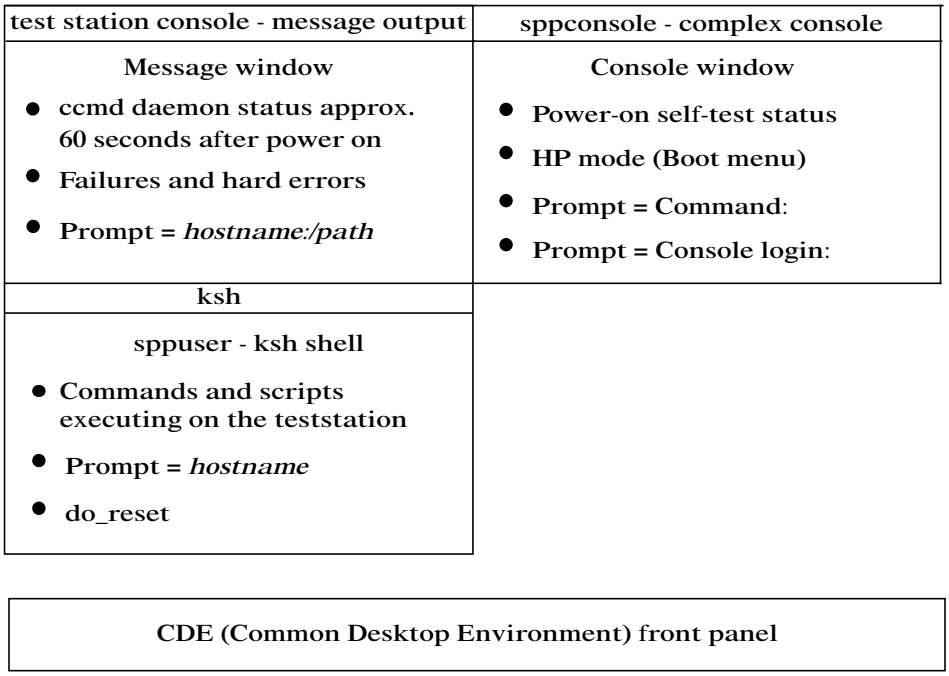
sppuser	This user is the normal logon for the teststation during system operation, verification, and troubleshooting. Default password: spp user Please note the space between spp and user.
root	This user has the ability to modify and configure every parameter on the teststation.

NOTE If the passwords to these accounts are changed by the customer, the new passwords must be supplied to the Hewlett-Packard Customer Engineer (CE) upon request.

Teststation sppuser windows

When the sppuser is logged on to the teststation, the windows appear in the configuration shown in Figure 16.

Figure 16 Teststation sppuser windows



Message window (test station console - message output)

The message window (TOP LEFT) displays status messages about the V-Class server. Do not enter commands in this window.

This window displays status from the `ccmd` daemon running on the teststation.

Hard error logger also displays status in this window.

Console window (sppconsole - complex console)

This is the main console window (TOP RIGHT) for the V-Class server. All POST (Power-On Self-Test) status is displayed here. The user can type commands while in HP mode (boot menu) to boot and configure the node. See Chapter 4, “Firmware (OBP and PDC)” for more information about HP mode (boot menu). HP service personnel can also enter a special mode called forth mode (OBP) to perform special configuration commands.

ksh shell windows (ksh)

The ksh window (LOWER LEFT) are local shell windows on the teststation. The user may enter commands into this windows which invoke scripts or functions on the V-Class server.

Some commands like the `do_reset` command are scripts that begin execution on the teststation and then control the V-Class server.

Using the CDE (Common Desktop environment) Root Menu

The teststation uses the CDE Workspace Manager to control the X windows on your screen. The Root Menu is Workspace Manager's main menu. The options on the Root Menu affect your entire display. From the Root Menu, you can select menu items to create new windows, initiate diagnostic tools, and perform other tasks.

To select a command from the Root Menu:

Step 1. Press and hold down right mouse button over the root window. The root window is any part of your display that is not covered by a window. The Root Menu appears.

Step 2. Move the mouse pointer over an option. The option becomes boxed.

Step 3. Release the mouse button to select the option.

The Root Menu options include:

Teststation Utilities

- **V-Class Complex**: ***name***—Opens this submenu for the node/complex. If more than one node/complex has been configured multiple V-Class Complexes will be available by name.
  - **Console**—Creates a new console window for a list of available node/complexes.
  - **Shells**—Choose between sppdsh, ksh, tcsh, csh, and sh shells.
  - **Diagnostic Tools**—Performs a `do_reset`, or invoke `cxtest`, `est`, or `xconfig`.
- **ksh**—Creates a new ksh window on the screen.
- **consolebar**—Creates GUI console select bar on the screen.
- **ts_config**—Configures the teststation console, system monitoring, and diagnostic capabilities. Runs as superuser.
- **ts_config (root)**—Configures the teststation console, system monitoring, and diagnostic capabilities. Runs as root, requires the password, and allows reconfiguration of nodes.
- **Test station console**—Creates a new console window on the screen.

- **xsecure**—Use this tool to disable modem and LAN activity.
- **shell menu**—Lists several shell options for new windows including the csh.
- **X tools**—Lists several X tools including the load average display and xlock (screen lock/saver).

Workspace Actions

- **Shuffle up**—Moves the bottom window in a stack of windows to the top.
- **Shuffle down**—Moves the top window in a stack of windows to the bottom.
- **Refresh all**—Refreshes the entire X display.
- **Restart Workspace Manager**—Stops and restarts the Workspace Manager.
- **logout**—Closes all open windows and stops Workspace Manager.

Creating new console windows

Console windows can also be created using the `sppconsole`, `startcon`, and `xterm` commands from the teststation; see Table 5 for details.

Table 5 **Commands for creating console windows**

Teststation command	Description
`/spp/scripts/sppconsole`	The `sppconsole` script provides an HP-UX console interface in the current teststation window.
`/usr/bin/X11/xterm`	Creates a teststation login window.
`/usr/bin/X11/xterm -C`	Creates a teststation console window.

Using the console

The console serves as the communication device for theV-Class server. Virtual consoles are also used to monitor specific operations, like a system software crash dump.

Tasks covered in this section include:

- Starting the console
- Accessing the console remotely
- Accessing system logs

Starting the console

The console server program automatically starts the console on the teststation when you log on as sppuser. If the console dies or stops running, restart it from the teststation using one of the following methods:

Using the Root Menu

To restart the console using the Root Menu complete the following steps:

Step 1. Press and hold down the right mouse button over the root window. The root window is any part of the display that is not covered by a window. The Root Menu appears.

Step 2. Select the desired V-Class complex. The menu displays.

Step 3. Select console menu. The menu displays.

Step 4. Select Node 0/complex. The new console window displays.

Using the `sppconsole` command

To restart the console using the `sppconsole` command complete the following steps:

Step 1. Select a shell window by placing the mouse pointer in the window.

Step 2. If more than one V-Class complex is connected to the teststaion, use the `set_complex` command to select the desired complex. Enter:

set_complex

An output similar to the following will be displayed. Enter the desired complex from the list provided.

```
COMPLEX_NAME = [Select from hal, colossus] hal
```

Step 3. Start the console. Enter:

sppconsole

The new sppconsole window displays.

Logging out

To restart the console by logging out of the teststation and logging back on again complete the following steps:

Step 1. Press and hold down the right mouse button over the root window. The root window is any part of the display that is not covered by a window. The Root Menu appears.

Step 2. Select logout. The teststation closes all open windows and returns a HP-UX login prompt.

Step 3. Log into the teststation as sppuser. The new sppconsole window displays.

Accessing the console remotely

Use the sppconsole command to access the console from a system other than the teststation. Using control sequences with this command allows the user to watch or to assume control of the console window.

Table 6 sppconsole commands

Command	Description
^Ecf	Force control of the console interface.
^Ecs	Relinquish control of the interface and return to spy mode.
^Ecw	Display a list of other users connected to the console.
^Ec?	List the console escape command sequences.
^Ec.	Exit the console program.

NOTE

^E is the **Ctrl** and **e** keys pressed simultaneously. The **e** does not have to be an uppercase **E**.

Example: Performing a ^E command

To execute the **^Ecf** command complete the following steps:

1. Press the **Cntrl** key and the **e** key simultaneously.
2. Release the **Cntrl** key and the **e** key.
3. Press the **c** key.
4. Press the **f** key.

Watching the console remotely

Any user can display the console via a remote login to the teststation, so it is possible to have many different processes watching the console at the same time. This is sometimes referred to as "spy mode". Only one window can actually control the console; see "Controlling the console remotely" on page 41 for more information.

To monitor the console from a system other than the teststation, complete the following steps:

Step 1. Remotely log in to the teststation as sppuser (default password: spp user) with the following command:

`rlogin` *hostname*

```
login: sppuser
Password: spp user
```

Step 2. Access the system console with the following command:

`sppconsole`

At this point the console is in "spy mode", meaning the user can only monitor what is going on at the system console. If commands are entered the following message is displayed:

```
[read-only -- use '^Ecf' to attach, '^Ec?' for help]
```

Display a list of other console users

Step 1. Display a list of other users connected to the console with the following command:

CTRL-`Ecw`

Step 2. Exit the session with the following command:

CTRL-`Ec.`

The period is part of the command.

Controlling the console remotely

System maintenance or diagnostics can be performed remotely by assuming control of the console from a remote terminal. Upon gaining control of the console, the user has write access to that window.

Only one window can be active at a time.

To assume control of the console, complete the following steps:

Step 1. Remotely log in to the teststation as sppuser (default password: spp user) with the following command:

`rlogin` *hostname*

```
login: sppuser
Password: spp user
```

Step 2. Access the system console with the following command:

`sppconsole`

At this point the console is in "spy mode", meaning the user can only monitor what is going on at the system console. If commands are entered the following message is displayed:

```
[read-only -- use '^Ecf' to attach, '^Ec?' for help]
```

Step 3. Assume control of the console by attaching to it with the following command:

CTRL-Ecf

Step 4. You can relinquish control of the console and return to spy mode with the following command:

CTRL-Ecs

Step 5. Exit the session with the following command:

CTRL-Ec.

Changing a console's connection

Once the console is started as a watch or a control connection, the connection type can be changed with escape characters.

To change a watch window to an active console window, enter:

CTRL-Ecf

To change an active console window to a watch window, enter:

CTRL-Ecs

Accessing system logs

Monitor system status via two logs, `event_log` and `consolelogX` (where `X` is the node_id), located in `/spp/data/`*`complex_name`* on the teststation.

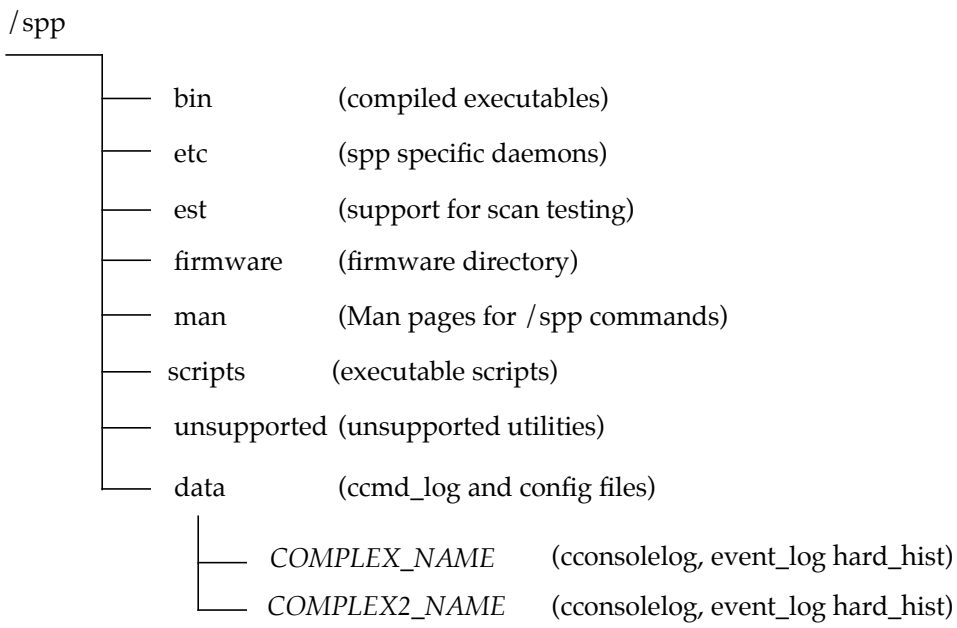
The `event_log` file periodically logs system status. Once the file reaches 1 MB, the system compresses it to `event_log.old.Z` and creates a new `event_log` file.

The `consolelogX` files grow without bounds. These need to be periodically checked by the system administrator.

Teststation file system

The /spp directory located on the workstation's local disk (HP-UX version 10.20) contains all the necessary files necessary for the workstation to function as the V-Class server's teststation.

Figure 17 **Teststation file system**



/spp/etc

The /spp/etc directory contains many of the unique daemons which run on the teststation. These daemons provide services in the management of the V-Class node. Two daemons that are always running on the teststation are:

`ccmd`	A daemon that maintains a database of information about the V2500 hardware. It also monitors the system and reports any significant changes in system status.
`conserver`	The console-server that directs RS-232 console traffic from the Utility Board to the upper right console window on the teststation.

/spp/bin

In the /spp/bin directory you will find specific commands and daemons used to manage a V-Class node. The most frequently used commands are:

`est`	The command (Exemplar Scan Testing) to initiate scan testing.
`do_reset`	The command executed on the teststation to reset the V-Class node remotely.
`sppdsh`	An enhanced version of the Korn Shell (ksh) with all of the functionality of ksh, as well as new commands that are suited to a diagnostic environment.
`event_logger`	Responsible for logging events such as HPMC (High Priority Machine Checks).

/spp/scripts

The /spp/scripts directory contains scripts that perform a variety of functions.

`dcm`	Dump Configuration Manager.
`hard_logger`	The hard error logger, HP Machine Check (HPMC) data collection script.
`sppconsole`	The console utility.

/spp/data/*COMPLEX_NAME*

The /spp/data/*COMPLEX_NAME* directory contains:

`node_0.cfg`	Configuration file with scan rings and configured hardware. This file describes all the ASIC chips populated in a V-Class node and also defines the scan

	rings which are used by the est (Exemplar Scan Test) utility. This file is a very useful troubleshooting tool for tracking scan ring failures to devices.
`consolelog`	A file containing all the console activity on the system.
`est`	The scan testing log.
`hard_hist`	Log of all hard failure information. Logs the output of all suspected ASIC (Application Specific Integrated Circuits). This file may be useful in troubleshooting intermittent ASIC failures.
`event_log`	Log of all event information. A read only file which captures information generated by the `ccmd` daemon.

/spp/firmware

The /spp/firmware directory is where firmware files are loaded temporarily before they are moved to the Utility Board (SCUB).

/spp/est

The est directory contains files used during scan testing.

/spp/man

The /spp/man directory contains the man (manual) pages and many of the teststation specific commands.

4 Firmware (OBP and PDC)

This chapter discusses the boot sequence and the commands available from the boot menu.

Boot sequence

OpenBoot PROM (OBP) and SPP Processor Dependent Code (SPP_PDC) make up the firmware on HP V-Class servers that makes it possible to boot HP-UX.

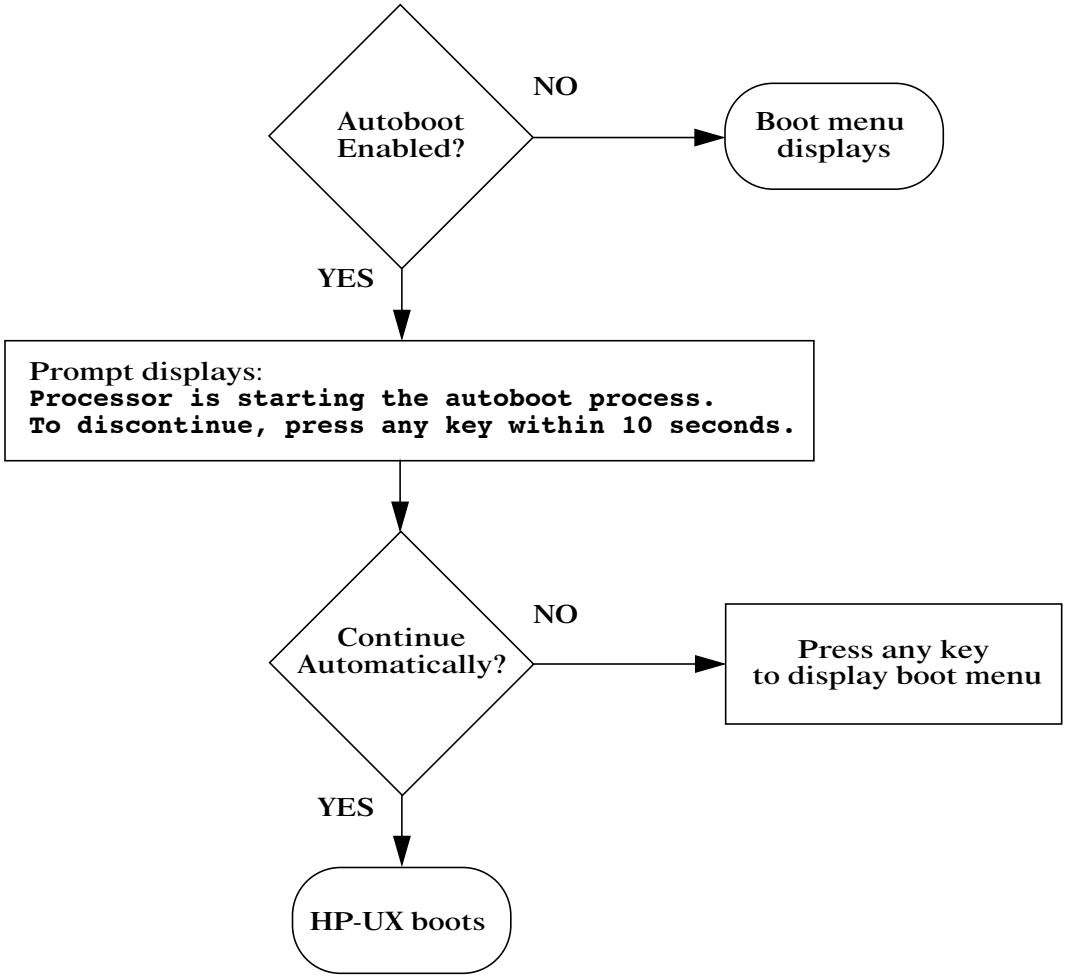
Once a machine powers on, the firmware controls the system until the operating system (OS) executes. If the system encounters an error any time during the boot process, it stops processing and goes to HP mode boot menu. See “HP mode boot menu” on page 52 for more information.

When the operator powers on or resets the machine, the following process occurs:

1. Power-On Self Test (POST) runs. POST is described in the *HP Diagnostics Guide: V2500 Servers*.
2. OBP probes all the devices.
3. OBP loads SPP_PDC in RAM.
4. OBP starts the HP-UX loader, which in turns calls SPP_PDC to set up CPU's, memory, and I/O devices in a way that HP-UX understands.
5. The next action depends on whether Autoboot is enabled.
    1. If autoboot is enabled, the operating system boots unless the user presses a key within 10 seconds.
    2. If autoboot is disabled or if the user presses a key within 10 seconds, the boot menu is displayed.

Figure 18 on page 49 illustrates the initialization and start-up process.

Figure 18 Boot process



Boot process output

The following output illustrates what typically displays on the console as the system starts up:

```
Stingray POST, Revision 0.6.1.0 1998/08/20 11:04:54 LAB #0006
Probing CPUs: PB0L_A PB0R_A PB1R_A PB1L_A PB2L_A PB2R_A PB3R_A PB3L_A PB4L_A PB4
R_A PB5R_A PB5L_A PB6L_A PB6R_A PB7R_A PB7L_A PB0L_B PB0R_B PB1R_B PB1L_B PB2L_B
 PB2R_B PB3R_B PB3L_B PB4L_B PB4R_B PB5R_B PB5L_B PB6L_B PB6R_B PB7R_B PB7L_B
 Probing Main Memory: MB0L MB1L MB2R MB3R MB4L MB5L MB6R MB7R
 Initializing Main Memory:
   Parallel memory initialization in progress
     r0         r1         r2         r3
    PB1R_B MB0L [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB1R_A MB1L [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB2L_A MB2R [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB3R_A MB3R [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB4L_A MB4L [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB5R_A MB5L [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB6L_A MB6R [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
    PB7R_A MB7R [|||| |||||[|||| |||||[|||| |||||[|||| |||||]
Building Main Memory Map:
Booting OBP
OBP Power-On Boot on [0:B]
--------------------------------------------------------------------------------
    PDC Firmware Version Information
PDC_ENTRY version 4.1.0.7
     POST Revision: 0.6.1.0
       OBP Fieldtest Release 4.1.0.7, compiled 98/07/01 15:37:10  (2)
SPP_PDC Fieldtest 1.4.0.12 (07/02/98 00:49:28)
--------------------------------------------------------------------------------
Proc type   Proc#   Proc Rev  Speed     State   Dcache   Icache   I-prefetch
----------  -----   --------  -------  -------  -------  -------  ----------
HP,PA85000  0       1.0       440 MHz  Active   1024 KB  512 KB   Off
```

```
HP,PA85000  1       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  2       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  3       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  4       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  5       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  6       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  7       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  8       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  9       1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  10      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  11      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  12      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  13      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  14      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  15      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  16      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  17      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  18      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  19      1.0       440 MHz  ff
HP,PA85000  26      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  27      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  28      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  29      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  30      1.0       440 MHz  Active   1024 KB  512 KB   Off
HP,PA85000  31      1.0       440 MHz  Active   1024 KB  512 KB   Off
32768 MB memory installed        0  MB CTI cache configured (total, all nodes)
Primary boot path   = 0/0/0.6.0
Alternate boot path = 15/3 NFS 15.99.111.99:/spp/os
Console path        = 15/1
Keyboard path       = 15/1
 [*** Manufacturing (or Debug) Permissions ON ***]
System is HP9000/800/V2500 series
Autoboot and Autosearch flags are both OFF or we are in HP core mode.
Processor is entering manual boot mode.
```

HP mode boot menu

In some instances, the boot menu displays; otherwise the operating system boots and the system is ready for use. The boot menu displays when one of the following occurs:

- The system encounters a problem while booting
- Autoboot is disabled
- The operator interrupts the boot process

```
Command                          Description

-------                          -----------

AUto [BOot|SEArch ON|OFF]        Display or set the specified flag
BOot [PRI|ALT|<path> <args>]     Boot from a specified path
BootTimer [time]                 Display or set boot delay time
CLEARPIM                         Clear PIM storage
CPUconfig [<proc>] [ON|OFF]      Configure/Deconfigure Processor
DEfault                          Set the system to defined values
DIsplay                          Display this menu
ForthMode                        Switch to the Forth OBP interface
IO                               List the I/O devices in the system
LS [<path>|flash]                List the boot or flash volume
OS [hpux|sppux]                  Display/Select Operating System
PASSword                         Set the Forth password
PAth [PRI|ALT|CON] [<path>]      Display or modify a path
PDT [CLEAR|DEBUG]                Display/clear Non-Volatile PDT state
PIM_info [cpu#] [HPMC|TOC|LPMC]  Display PIM of current or any CPU
RESET [hard|debug]               Force a reset of the system
RESTrict [ON|OFF]                Display/Select restricted access to Forth
SCSI [INIT|RATE] [bus slot val]  List/Set SCSI controller parms
SEArch [<path>]                  Search for boot devices
SECure [ON|OFF]                  Display or set secure boot mode
TIme [cn:yr:mo:dy:hr:mn[:ss]]    Display or set the real-time clock
VErsion                          Display the firmware versions
Command:
```

At this point, the user can either enter any command on the menu or continue the boot process. To continue booting, enter the following command:

```
Command: boot
```

Commands and options are case-insensitive (auto = AUTO). Each command has a shortcut, which is the minimum letters that can be entered to execute the command. For example, to execute the search command, enter **SEA**, **SEAR**, **SEARC**, or **SEARCH**. This shortcut is indicated by capital letters in Table 7 and in the rest of this chapter.

Table 7 lists the commands available from the `Command:` prompt.

Table 7 Boot menu commands

Command	Description
`AUto [BOot|SEArch ON|OFF]`	Displays or sets the Autoboot or Search flag. If Autoboot is on, the system boots automatically after reset. If AutoSearch is on, the system searches for and displays all I/O devices that the system can boot from.
`BOot [PRI|ALT|`*path args*`]`	Initiates the boot sequence. A default or specified path to the boot device can be used.
`BootTimer [time]`	Displays or sets a delay time for the system to wait for external mass storage devices to come online.
`CLEARPIM`	Clears (zeros) Processor Internal Memory (PIM) storage after a system crash. CAUTION: this command can delete important troubleshooting information; do not enter the CLEARPIM command unless directed to.
`CPUconfig [proc] [ON|OFF]`	Displays or sets the configuration of processors.
`DEfault`	Sets the system environment variables to defined values and changes certain HP variables so that HP-UX can boot.
`DIsplay`	Displays this menu.
`ForthMode`	Switches to the Forth OBP interface. For use by service personnel only.
`IO`	Displays all I/O devices in the system whose SCSI controller cards are enabled.
`LS [`*path*`|flash]`	Displays the LIF contents (boot or flash volume) of a device.
`OS [hpux|sppux]`	Displays or sets which OS is going to boot—HP-UX or SPP-UX. For V-Class, this should be set to HP-UX.

Command	Description
`PASSword`	Defines the password used to control access to ForthMode. Same as UNIX `password` command.
`PAth [PRI|ALT|CON] [`*path*`]`	Displays or sets primary, alternate, console, and keyboard hardware paths. Keyboard path cannot be modified.
`PDT [CLEAR|DEBUG]`	Displays or clears Page Deallocation Table (PDT) information. For use by service personnel only.
`PIM_info [cpu#] [HPMC|TOC|LPMC]`	Displays Processor Internal Memory (PIM) information for current or any CPU.
`RESET [hard|debug]`	Resets the system state.
`RESTrict [ON|OFF]`	Displays or sets restricted access to Forth mode.
`SCSI [INIT|RATE] [bus slot val]`	Displays or sets SCSI controller initiator ID or transfer rate.
`SEArch [`*path*`]`	Displays pathnames for devices with bootable media in the system.
`SECure [ON|OFF]`	Displays or sets secure boot mode. If secure mode is set, the boot process cannot be interrupted. Only useful if autoboot is on; the system will autosearch and autoboot.
`TIme [cn:yr:mo:dy:hr:mn[:ss]]`	Displays or sets the realtime clock.
`VErsion`	Displays the internal firmware versions.

Enabling Autoboot

`AUto` displays or sets the Autoboot or Search flag, which sets the way a system will behave after powering on. If Autoboot is ON, the system boots automatically after reset. If AutoSearch is ON and Autoboot is OFF, the system searches for and displays all I/O devices that the system can boot from. Changes to a flag take effect after a system reset or power-on. The default value for both Autoboot and Autosearch is OFF.

Syntax

`AUto [BOot | SEArch] [ON / OFF]`

- Used alone, this command displays the current status of the Autoboot and Autosearch flags.
- `BOot` - If ON, the OS is automatically loaded from the primary boot path after a power-up or reset. Otherwise, the system displays the boot menu and waits for interactive boot commands. During an autoboot, the process pauses for 10 seconds to allow the operator to stop the boot process.
- `SEArch` - If ON, the system searches for all I/O devices that it can boot from and displays a list. Usually disabled because the search can be time-consuming.
- `ON` enables the indicated feature.
- `OFF` disables the indicated feature.

Examples

au This command displays the status of the Autoboot and Autosearch flags.

```
Autoboot:ON
Autosearch:ON
```

au bo This command displays the current setting of the Autoboot flag.

```
Autoboot:ON
```

au bo on This command sets the Autoboot flag ON.

```
Autoboot:ON
```

HElp command

The help command displays help information for the specified command or redisplays the boot menu.

Syntax

HElp [*command*]

Used alone, HElp displays the boot menu. Specifying *command* displays the syntax and description of the named command.

Examples

The following example illustrate use of this command:

help au This command displays information for the auto command.

```
AUto[BOot|SEArch] [ON|OFF] Display or set the specified flag

AUto boot on                    Enable  auto boot on next boot.
AUto boot off                   Disable auto boot on next boot.
AUto search on                  Enable  auto search on next boot.
AUto search off                 Disable auto search on next boot.

Auto search enables the automatic search of a boot device.
Auto boot enables the autoboot sequence.
```

5 Starting and stopping HP-UX

This chapter provides information about starting and stopping HP-UX:

Starting your HP 9000 V-Class Server

Bringing the V-Class server to a usable state involves two systems and their hardware and software. This section provides a brief overview of the process; for complete instructions, see *Managing Systems and Workgroups*.

A V-Class server consists of two systems:

- Teststation
  - Boots the V-Class server
  - Monitors the V-Class server for hardware errors
  - Debugs a hung system
  - Runs HP-UX
- V-Class node
  - Hosts OpenBoot PROM (OBP) software
  - Runs HP-UX

The boot procedure differs according to the value of the Autoboot flag. See “Enabling Autoboot” on page 55 for information on how to set Autoboot. After you power-up your V-Class server, if Autoboot is set to:

- `ON`, OBP automatically starts HP-UX. (Press the **ESC** key within 10 seconds to interrupt the boot process and enter bootmenu commands.)
- `OFF`, the user must:
  - Start OBP at the teststation's HP-UX prompt by entering the following command:

    `do_reset`
  - Start the V-Class server using default values at OBP's default prompt by entering the following command:

    `boot`

Starting HP-UX

Start up, or boot, HP-UX after the operating system has been completely shut down or partially shut down to perform system administration tasks. This section provides a brief overview of the process; for complete instructions, see *Managing Systems and Workgroups*. This section describes:

- Starting HP-UX
- Reviewing the state of the file system
- Restarting HP-UX

Power-On Sequence

Turn on the teststation power and allow it to boot before powering on the V-Class server's nodes. This allows the teststation to be used to monitor and control the V-Class server as it boots is used.

The following is the sequence for powering on an HP V-Class server and its teststation:

Step One Turn on the teststation and allow it to boot HP-UX.

Step Two Turn on the node.

If the node is already powered on before the teststation booted, the node can be reset from the teststation after it boots, using the `do_reset` command.

HP-UX boot process

The process begins when you power up the V-Class server. OBP probes the hardware, provides a complete and accurate description of all available hardware, and boots the operating system.

OBP then passes control to the `/sbin/init` process, which sequentially executes the contents of `/etc/inittab`. The `inittab` file executes the `/sbin/bcheckrc` and `/sbin/rc` scripts to check the file system and initialize the system.

The operating system continues to boot and displays additional information about the system. After the boot process completes, an HP-UX login prompt appears in the sppconsole window.

Reviewing the state of the file system

During the start-up process, the `/sbin/bcheckrc` script executes `/usr/sbin/fsclean`. This command determines the shut down status of the system and returns three possibilities:

1. Proper file system shut down

   The startup process continues, and the following message is displayed:

```
/usr/sbin/fsclean:/dev/dsk/0s0(root device) ok file system is OK, not running
fsck
```

2. Improper file system shut down

   The start-up process is interrupted:

```
/usr/sbin/fsclean:/dev/dsk/0s0 not ok run fsck FILE SYSTEM(S) NOT PROPERLY
SHUTDOWN, BEGINNING FILE SYSTEM REPAIR.
```

   At this point, the system runs `/usr/sbin/fsck` in a mode that corrects certain inconsistencies in the file systems without your intervention and without removing data. The `fsck` command does one of the following:

   - Repairs and reboots the system, incorporating the changes
   - Prompts the userto run the `fsck` command manually. If `fsck` needs to be run manually, see the fsck(1m) manpage

3. Other errors detected

   An error message displays (for example, unable to open a specified device file), the start-up process ends, and the problem will have to be solved before proceeding.

Restarting HP-UX

To restart the system after a reboot or hang, bring the system to single-user state. Characteristics of the single-user state include:

- The only access to the system is through the sppconsole
- The only processes running on the system are the:
  - Shell on the console
  - Background daemon processes started by `/sbin/rc`
  - Processes that the root user invokes

Restarting HP-UX from single-user mode

Complete the following steps to restart your system:

Step 1. Select the sppconsole window on the teststation or assume control remotely. See "Accessing the console remotely" on page 39.

Step 2. Log in as root.

Step 3. Reboot the system with the `reboot` command. Enter:

```
reboot
```

Restarting HP-UX from multiuser mode

Complete the following steps to restart your system:

Step 1. Select the sppconsole window on the teststation or assume control remotely. See "Accessing the console remotely" on page 39.

Step 2. Log in as root.

Step 3. Change to the root directory. Enter:

```
cd /
```

Step 4. Bring the system to single-user state with the `shutdown` command. Enter:

```
shutdown
```

Step 5. Reboot the system with the `reboot` command. Enter:

```
reboot
```

Stopping HP-UX

This section provides a brief overview of the process; for complete instructions, see *Managing Systems and Workgroups*.

Typically, the system is shut down to:

- Put it in single-user state so that the system can be updated or to check file systems.
- Turn it off in order to perform a task such as installing a new disk drive.

CAUTION Never stop the system by turning off the power. Stopping the system improperly can corrupt the file system. Use the `shutdown` command.

Shutdown considerations

Only the system administrator or a designated superuser can shut down the system.

The `/sbin/shutdown` command:

- Warns all users to log out of the system within a grace period you specify
- Halts daemons
- Kills unauthorized processes
- Unmounts file systems
- Puts the system in single-user mode
- Writes the contents of the I/O buffers to a disk

CAUTION Do not run `shutdown` from a remote system via `rlogin` if a network service is used. The shutdown process logs the user out prematurely and returns control to the console. Run `shutdown` from the sppconsole window on the teststation.

See the shutdown(1M) man page for a complete description of the shutdown process and available options.

Rebooting or shutting down the system

To reboot or shut down the V-Class server, perform the following steps:

Step 1. Select the sppconsole window on the teststation. See "Teststation sppuser windows" on page 31.

Step 2. Log in as root.

Step 3. Change to the root directory. Enter:

```
cd /
```

Step 4. Shut down the system using the `shutdown` command. Enter:

```
shutdown
```

Progress messages detailing system shutdown activities print to the terminal. Upon reaching run-level 0, the system:

- Restarts in single-user mode
- Displays the root prompt

Step 5. Bring the system to a complete stop with the `reboot` command. Enter:

```
reboot -h
```

CAUTION Turn power off to the node only after the words `CPU halted` have been displayed in the sppconsole window.

6 Recovering from failures

This chapter provides detailed information on recovering from HP-UX system interruptions.

Usually, the first indication of a problem is that the system does not respond to user input. This lack of response indicates either a performance problem or system interruption.

Performance problems are generally characterized by:

- The system responds to one or more programs/users but not all, or sluggishly to others
- The system seems to be very slow

System interruptions usually result in a total loss of CPU resources for all users/programs due to a:

- System hang
- System panic
- HPMC

Collecting information

Providing the Response Center with a complete and accurate symptom description is important in solving any problem. The V-Class server's teststation automatically records information on environmental and system level events in several log files. See "Teststation file system" on page 43 for more information about these files.

Use the following procedure to collect troubleshooting information:

Step 1. If an error message is displayed on the system console, record it.

Step 2. Record the information displayed on the system LCD. See "LCD (Liquid Crystal Display)" on page 24 for more information.

Step 3. Record any relevant information contained in the log files in the /spp/data/*complex* directory on the teststation:

- event_log
  Main log file
- hard_hist
  Filtered output from the hard_logger, appended after each error

Step 4. Record any relevant information contained in the syslog.log file in the /var/adm/syslog directory on the system disk. Access to this log file may require rebooting the system if it has hung or crashed.

Performance problems

Performance problems are generally perceived as:

- Sluggish response at the operating system prompt
- Slow program execution
- Some users/programs unable to get a response

Use the following procedure to troubleshoot a performance problem:

Step 1. At the console window of the teststation, use one or both of the following commands to check for active processes making heavy use of system resources:

- `ps`
- `top`

See *Managing Systems and Workgroups* and the `ps` and `top` man pages for more information about options and usage.

Step 2. Enter a **Ctrl-C** from the terminal exhibiting the problem to abort an executing command.

Step 3. Check another terminal to verify that the problem is not just a console hang.

Step 4. Contact the Hewlett-Packard Customer Response Center.

System hangs

System hangs are characterized by users unable to access the system, although the LCD display and attention light may not indicate a problem exists. The system console may or may not be hung.

Use the following procedure to troubleshoot a system hang:

Step 1. Press **Enter** at a terminal several times and wait for a response.

Step 2. Press **Ctrl-C** at a terminal to abort an executing command.

Step 3. Check another terminal to verify that the problem is not just a console hang.

Step 4. At the console window of the teststation, use one or both of the following utilities to communicate with the server:

- `ping`
- `telnet`

See the `ping` and `telnet` man pages for more information about options and usage.

Step 5. If possible, wait about 15 minutes to see if the computer is really hung or if it has a performance problem. With some performance problems, a computer may not respond to user input for 15 minutes or longer.

Step 6. If the computer is really hung, reset the server by issuing a `do_reset` command from the console window of the teststation.

`do_reset` *[node] [level]*

node	node to reset. Default is all nodes connected to the teststation.	
level	level to reset. There are four:	
	1	Jtag controller—core utility board reset, hard reset, clear option bits and send messages to `ccmd`. (default)
	2	Jtag controller—core utility board reset and system soft reset

3	Jtag controller—core utility board reset
4	TOC reset. Used to produce a crash dump

Step 7. Save the core dump file and contact the HP Response Center to have the core dump file analyzed. Refer to the service contract for the phone number of the Hewlett-Packard Response Center. See “Fast dump” on page 79 for more information.

System panics

A system panic is the result of HP-UX encountering a condition that it is unable to respond to and halting execution.

System panics are rare and are not always the result of a catastrophe. They may occur on bootup, if the system was previously shut down improperly. Sometimes they occur as a result of hardware failure.

Recovering from a system panic can be as simple as rebooting the system. At worst, it may involve reinstalling HP-UX and restoring any files that were lost or corrupted. If the system panic was caused by a hardware failure such as a disk head crash, repairs have to be made before reinstalling HP-UX or restoring lost files.

NOTE It is important to maintain an up-to-date backup of the files on the system so that data can be recovered in the event of a disk head crash or similar situation. How frequently the backups are updated depends on how much data one can afford to be lose. For information on how to back up data, refer to *Managing Systems and Workgroups*.

After HP-UX experiences a system panic, the system:

- May display an HPMC tombstone on the console if panic was caused by an HPMC. A tombstone is a list of register values used for troubleshooting.
- May attempt to save a core file (an image of physical memory) to the dump device (by default this is the primary swap device).
- Attempts to reboot.
- Usually displays a panic message on the console. A panic message consists of several lines of text starting with the heading System Panic.
- May attempt to copy the core file to the file system (by default, to the directory /tmp/syscore) if HP-UX can reboot.

Use the following procedure to troubleshoot a system panic:

Step 1. If an HPMC tombstone appears on the console, copy or print out the “Machine Check Parameters” field, and all information that follows them.

Step 2. Record the panic message displayed on the system console. Look for text on the console that contains terms like:

- System Panic
- HPMC
- Privilege Violation
- Data Segmentation Fault
- Instruction Segmentation Fault

Step 3. Categorize the panic message. The panic message describes why HP-UX panicked. Sometimes panic messages refer to internal structures of HP-UX (or its file systems) and the cause might not be obvious.

The wording of the panic message should allow the problem to be classified into one of the following areas:

- Peripheral problem
- Server or I/O card problem
- File system problem
- LAN communication problem
- Logical Volume Manager (LVM) related problem
- Other

Peripheral problem

Use the following procedure to troubleshoot an apparent peripheral hardware failure:

Step 1. Check to ensure the device is powered on and online.

CAUTION Do not connect or disconnect cables or power off or on SCSI devices while the V-Class server is powered on. Doing so could lead to corruption of disk data.

Step 2. Check the device's error display. If an error is displayed:

1. Record the error message or display.

2. Take the device offline.
3. Power down the device.
4. If it is a disk drive, wait for the disk to stop spinning.
5. Power up the device.
6. Place the device back online.

Step 3. Check to ensure the device address or ID is correct.

Step 4. Check cable and terminator connections.

Step 5. If the system does not reboot by itself, reboot the computer by issuing the `reset` command in the console window or `do_reset` command at the ksh-shell window. For more information about rebooting the system see "Rebooting the system" on page 77.

Step 6. If the problem reappears on the device there may be an interface card or system problem. See "Interface card and system problem".

If the problem reappears, it might be necessary to have the problem fixed by Hewlett-Packard service personnel.

Interface card and system problem

Use the following procedure if a hardware failure appears to be associated with an interface card or with the an internal component of the system:

Step 1. If an HPMC tombstone is displayed, record it.

Step 2. Record the information displayed on the LCD. See "LCD (Liquid Crystal Display)" on page 24 for more information.

Step 3. Record any relevant information contained in the following log files in the /spp/data/*COMPLEX* directory on the teststation:

- `event_log`
  Main log file
- `hard_hist`
  Filtered output from the hard_logger, appended after each error
- `consolelog`
  Complete log of all input/output from the sppconsole window

Step 4. If the system does not reboot by itself, reboot the computer by issuing the `reset` command in the console window or `do_reset` command at the ksh-shell window. For more information about rebooting the system see "Rebooting the system" on page 77.

If the problem reappears, it might be necessary to have the problem fixed by Hewlett-Packard service personnel.

File system problem

If the panic message indicates a problem with one of the file systems, reboot the system and run the file system checker `fsck` to check and correct the problem. Follow all directions that fsck displays. Especially when the root file system (the one with the / directory) has problems, it is important to use the `-n` option to the `reboot` command, right after fsck completes. `fsck` is normally run automatically at boot time. See "Rebooting the system" on page 77.

LAN communication problem

Use the following procedure if the panic messages indicate a problem with LAN communication:

Step 1. Check LAN cable and media access unit (MAU) connections.

Step 2. Ensure that all vampire taps are tightly connected to their respective cables.

Step 3. Ensure that the LAN is properly terminated. Each end of the LAN cable must have a 50-ohm terminator attached. Do not connect the system directly to the end of a LAN cable.

If the problem reappears or if the hardware failure appears to be associated with a LAN card or an internal component of the V-Class server, it might be necessary to have the problem fixed by Hewlett-Packard service personnel.

Logical Volume Manager (LVM) related problem

If the size of a logical volume that contains a file system is reduced such that the logical volume is smaller than the file system within it, the file system will be corrupted. When an attempt is made to access a part of the truncated file system that is beyond the new boundary of the logical volume a system panic will often result.

The problem might not show up immediately. It will occur when the truncated part of the file system is overwritten by something else (such as a new logical volume or the extension of a logical volume in the same volume group as the truncated file system).

For more information on LVM, see *Managing Systems and Workgroups*.

Recovery from other situations

When a problem appears with something other than that has previously been discussed or the problem can not be classified, proceed to "Rebooting the system" on page 77. Be sure to record the exact text of the panic message be recorded for future troubleshooting purposes. See "Collecting information" on page 68 for further information.

Rebooting the system

Once a problem has been corrected, reset and reboot the system.

Step 1. Reset the V-Class node using one of four different methods:

- Power cycle the V-Class node by turning the key switch to the DC OFF position then back to the On position. See "Key switch panel" on page 17 for more information.
- Press the key switch panel TOC button.
- Type `reset` into console window (if in menu or fourth mode only).
- `do_reset` executed from one of the teststation ksh windows.

There may be differences in the boot up displays/activities as compared with the normal boot up sequence.

The system may have saved a system core file to disk. See "Abnormal system shutdowns" on page 79.

Step 2. If the system panicked due to a corrupted file system, fsck will report the errors and any corrections it makes. If fsck terminates and requests to be run manually, refer to *Managing Systems and Workgroups* for further instructions. If the problems were associated with the root file system, fsck will ask the operator to reboot the system when it finishes. Use the command:

```
reboot -n
```

The `-n` option tells reboot not to sync the file system before rebooting. Since fsck has made all the corrections on disk, this will not undo the changes by writing over them with the still corrupt memory buffers.

Monitoring the system after a system panic

If the system successfully reboots, there is a good chance that it can resume normal operations. Many system panics are isolated events, unlikely to reoccur.

Check applications to be sure that they are running properly and monitor the system closely for the next 24 hours. For a short while, backups may be done more frequently than normal until confidence in the system has been restored.

Abnormal system shutdowns

Abnormal systems shutdowns (often referred to as system crashes) can occur for many reasons. In some cases, the cause of the crash can be easily determined. In some extreme cases, however, it may be necessary to analyze a snapshot (called a core dump or simply dump) of the computer's memory in order to determine the cause of the crash. This may require the services of the Hewlett-Packard Response Center.

V-Class servers using HP-UX Release 11.0 or greater employ a more efficient dump mechanism than other HP servers using previous releases of HP-UX. This mechanism is called *fast dump*.

Fast dump

When a system crashes, the operator can now choose whether or not to dump, and if so, whether the dump should contain the relevant subset of memory or all memory (without operator interaction).

By default fast dump selectively dumps only the parts of memory that are expected to be useful in debugging. It improves system availability in terms of both the time and space needed to dump and analyze a large memory system.

The following commands allow the operator to configure, save, and manipulate the fast core dump:

- `crashconf`—Configures the destination and contents of a crash dump without rebooting. See the crashconf(1M) man page for more information.
- `savecrash`—Runs at boot time and saves any information that may be overwritten by normal system activity. See the savecrash(1M) man page for more information.
- `crashutil`—Saves or manipulates the crash dump (if desired). It can format the dump snapshot so that it can be read by the older commands. See the crashutil(1M) man page for more information.

Installations that used to call `savecore` in any way other than by the HP-supplied, unmodified `/sbin/init.d/savecore` script need to be updated to use `savecrash` and/or `crashutil`.

The on-disk and file system formats of a crash dump have changed with HP-UX 11.0.

`libcrash`(3) is a new library provided to allow programmatic access to a crash dump. supports all past and current crash dump formats. By using `libcrash`(3) under certain configurations, crash dumps no longer need to be copied into the file system before they can be debugged. See the `libcrash`(3) man page for more information.

Overview of the dump and save cycle

When the system crashes, HP-UX saves the image of physical memory or certain portions of it to predefined locations called dump devices. When the operator next reboots the system, a special utility copies the memory image from the dump devices to the HP-UX file system area. Once copied, the memory image can be analyzed with a debugger or saved to tape for later analysis.

Prior to HP-UX 11.0, dump devices had to be defined in the kernel configuration, and they still can be using Release 11.0. Beginning with Release 11.0, however, a new more-flexible method for defining dump devices is available using `crashconf`.

Beginning with HP-UX Release 11.0, there are three places where dump devices are configured:

1. In the kernel (same as releases prior to Release 11.0)
2. During system initialization when the initialization script for `crashconf` runs (and reads entries from the `/etc/fstab` file)
3. During runtime, by the operator or administrator manually running the `/sbin/crashconf` command.

Crash dump destination and contents

Defining the contents and destination of the crash dump are two important factors to consider when preparing for the dump. The destination and contents are configurable without rebooting, using the `crashconf` interface. See the crashconf(1M) man page for more information.

In order to capture the memory image of the system when a crash occurs, the image storage location(s) must be defined in advance. They can be on local disk devices or logical volumes.

It is important to have sufficient space to capture the part of memory that contains the instruction or data that caused the crash. More than one dump device can be defined so that if the first one fills up, the next one continues dumping until the dump is complete or no more defined space is available. To ensure enough dump space, define a dump area that is at least as big as the computer's physical memory plus 1 Mbyte.

Setting the amount of memory dumped and the classes of the memory pages determines the size of the dump. The content can be configured while the system is running and changed without rebooting the system. The larger the size of the system's physical memory, the longer it takes to dump it to disk (and the more disk space it consumes).

Configuration criteria

There are three main criteria to consider when making decisions regarding how to configure system dumps. The criteria are:

- System recovery time—Get the system back up as soon as possible
- Crash information integrity—Capture the correct information
- Disk space needs—Conserve available disk space

System recovery time

To get the system back up and running as soon as possible, consider the following factors:

- Dump level
- Compressed save vs. noncompressed save
- Using a device for both paging and dumping
- Partial save

These factors are discussed in the following sections.

Dump level

With HP-UX 11.0 the operator can select three levels of core dumps: no dump, selective dump, or full dump.

Selective dump causes only the selected memory pages to get dumped (see the crashconf(1M) man page for more information).

NOTE

In some specific cases, HP-UX will override the selective dump and request a full dump. The operator is given ten seconds to override HP-UX and continue with a selective dump.

The fewer pages dumped to disk (and on reboot, copy to the HP-UX file system area), the faster the system can be back up and running. Therefore, avoid using the full dump option.

When defining dump devices, whether in a kernel build or at run time, the operator can list which classes of memory *must always get dumped*, and which classes of memory *should not be dumped*. If both of these "lists" are left empty, HP-UX decides which parts of memory should be dumped based on what type of error occurred. In nearly all cases, leaving the lists empty is preferred.

NOTE Even if a full dump has not been defined (in the kernel or at run time), the definitions can be overridden (within a ten second window) and a request for a full dump after a system crash can be performed. Likewise, if the cause of the crash is known, a request to not dump can be performed as well.

Compressed save vs. noncompressed save

System dumps can be so large that they tax the HP-UX file system area.

The boot time utility, `savecrash`, can be configured (by editing the file `/etc/rc.config.d/savecrash`) to compress or not compress the data as it copies the memory image from the dump devices to the HP-UX file system area during the reboot process. This effects system recovery time in that data compression takes longer. Therefore, if there is enough disk space and the fastest system recovery is required, configure `savecrash` to not compress the data. See the savecrash(1M) man pages for more information.

Using a device for both paging and dumping

It is possible to use a specific device for both paging (swapping) and as a dump device. If system recovery time is critical, do not configure the primary paging device as a dump device.

When the primary paging device is not used as one of the dump devices or after the crash image on the primary paging device has been saved, by default, `savecrash` runs in the background. This reduces system boot time by running the system with only the primary paging device.

Another advantage to keeping paging and dump devices separate is that paging does not overwrite the information stored on a dump device, no matter how long the system has been up or how much activity has taken place. Disabling `savecrash` processing at boot time (by editing the file `/etc/rc.config.d/savecrash`) reduces system recovery time. After the system recovery, run `savecrash` manually to copy the memory image from the dump area to the HP-UX file system area.

Partial save

If a memory dump resides partially on dedicated dump devices and partially on devices that are also used for paging, only those pages that are endangered by paging activity can be saved.

Pages residing on the dedicated dump devices can remain there. It is possible to analyze memory dumps directly from the dedicated dump devices using a debugger that supports this feature. If, however, there is

a need to send the memory dump to someone else for analysis, move the pages on the dedicated dump devices to the HP-UX file system area. Then use a utility such as `tar` to bundle them for shipment. To do that, use the command `/usr/sbin/crashutil` instead of `savecrash` to complete the copy.

Crash information integrity

This section discusses how to make sure the part of memory that contains the instruction or piece of data that caused the crash is captured. The factors that must be considered are:

- Full dump vs. selective dump
- Dump definitions built into the kernel vs. defined at runtime
- Using a device for both paging and as a dump device

Full dump vs. selective dump

The only way to guarantee capturing the specific instruction or data that caused the crash is to capture everything. This means selecting a full dump of memory.

Be aware, however, that this can be costly in terms of time and disk space. A large amount of time and disk space is needed to dump the entire contents of memory in a system with a large memory configuration or to copy a large memory image to the HP-UX file system area during the reboot process.

The amount of dump area should at least be equal to the amount of memory in the system; depending on a number of factors, additional disk space greater than the amount of physical memory in the system may be needed

Dump definitions built into the kernel vs. defined at runtime

There are three places to define which devices are to be used as dump devices:

1. During kernel configuration
2. At boot time (entries defined in the `/etc/fstab` file)
3. At run time (using the `/sbin/crashconf` command)

Definitions at each of these places add to or replace any previous definitions from other sources. However, consider the following situation:

Example

A system called appserver has 1-Gbyte of physical memory. If the dump devices for this system are defined with a total of 256-Mbytes of space in the kernel file and an additional 768-Mbytes of disk space in the `/etc/fstab` file, there would be enough dump space to hold the entire memory image (a full dump).

If the crash occurs, however, before `/etc/fstab` is processed, only the amount of dump space already configured is available at the time of the crash; in this example, it is 256-Mbytes of space.

Define enough dump space in the kernel configuration if it is critical to capture every byte of memory in all instances, including the early stages of the boot process.

NOTE

This example is presented for completeness. The actual amount of time between the point where kernel dump devices are activated and the point where runtime dump devices are activated is very small (a few seconds), so the window of vulnerability for this situation is practically nonexistent.

Using a device for both paging and as a dump device

It is possible to use a specific device for both paging purposes and as a dump device. If, however, crash dump integrity is critical, this is not recommended.

If `savecrash` determines that a dump device is already enabled for paging and that paging activity has already taken place on that device, a warning message indicates that the dump may be invalid. If a dump device has not already been enabled for paging, `savecrash` prevents paging from being enabled to the device by creating the file `/etc/savecore.LCK`. `swapon` does not enable the device for paging if the device is locked in `/etc/savecore.LCK`.

Systems configured with small amounts of memory and using only the primary swap device as a dump device might not be able to preserve the dump (copy it to the HP-UX file system area) before paging activity destroys the data in the dump area. Larger memory systems are less likely to need paging (swap) space during start-up and are therefore less likely to destroy a memory dump on the primary paging device before it can be copied.

Disk space needs

This section discusses how to manage limited disk resources on the system for the post-crash dump and/or the post-reboot save of the memory image. The factors to consider are:

- Dump level
- Compressed save vs. noncompressed save
- Partial save (savecrash -p)

Dump level

There are three levels of core dumps: full dump. selective dump, and no dump. The fewer pages required to dump, the less space is required to hold them. Therefore, a full dump is not recommended. If disk space is really at a premium, one option is no dump at all.

A third option is called a selective dump. HP-UX 11.0 can determine which pages of memory are the most critical for a given type of crash, and save only those pages. Choosing this option can save a lot of disk space on the dump devices and again later on the HP-UX file system area. For instructions on how to do this see “Defining dump devices” on page 88.

Compressed save vs. noncompressed save

Regardless of whether a full or selective dump is chosen, whatever is saved on the dump devices needs to be copied to the HP-UX file system area before it can be used.

NOTE

With HP-UX 11.0, it is possible to analyze a crash dump directly from dump devices using a debugger that supports this feature. If, however, there is a need to save it to tape or send it to someone, copy the memory image to the HP-UX file system area first.

If there is a disk space shortage in the HP-UX file system area (as opposed to dump devices), the operator can elect to have `savecrash` (the boot time utility that does the copy) compress the data as it makes the copy.

Partial save (savecrash -p)

If the system has plenty of dump device space but is limited in HP-UX file system space, consider using the `-p` option for the `savecrash` command. This option copies only those pages on dump devices that are endangered by paging activity (i.e. pages on the devices used for both paging and as dump devices). Pages that are on dedicated dump devices remain there.

To configure this option into the boot process, edit the file `/etc/rc.config/savecrash` and comment out the line that sets the environment variable `SAVE_PART=1`.

Defining dump devices

When defining dump devices, it is important to accurately determine the amount of space needed to hold the dump without wasting disk space. To save a full dump, the amount of dump space needed is equal to the size of the system's physical memory.

For selective dumps, the size of dump space varies, depending on the classes of memory be saved. To determine amount of space needed, perform the following procedure:

Step 1. When the system is running with a typical workload, enter the following command:

```
/sbin/crashconf -v
```

The following typical output appears:

```
CLASS          PAGES  INCLUDED IN DUMP  DESCRIPTION
--------  ----------  ----------------  -------------------------------------

UNUSED           2036  no,  by default   unused pages
USERPG           6984  no,  by default   user process pages
BCACHE          15884  no,  by default   buffer cache pages
KCODE            1656  no,  by default   kernel code pages
USTACK            153  yes, by default   user process stacks
FSDATA            133  yes, by default   file system metadata
KDDATA           2860  yes, by default   kernel dynamic data
KSDATA           3062  yes, by default   kernel static data


Total pages on system:             32768
Total pages included in dump:       6208


DEVICE        OFFSET(kB)   SIZE (kB)  LOGICAL VOL.  NAME
------------  ----------  ----------  ------------  -------------------------
31:0x00d000        52064      262144   64:0x000002  /dev/vg00/lvol2
                          ----------
                             262144
```

Step 2. Multiply the number of pages listed in "`Total pages included in dump`" by the page size (4-Kbytes) and add 25% for a margin of safety. In the above example, the calculation would be:

```
(6208 x 4 Kbytes) x 1.25 = approx. 30 Mbytes
```

Kernel dump device definitions

Capturing dumps for crashes that occur during early stages of the boot process requires sufficient dump space in the kernel configuration.

Using SAM to configure dump devices into the kernel

The easiest way to configure dump devices is to use SAM. A screen for dump device definition is located in the Kernel Configuration area. After changing the dump device definitions, a new kernel must be built and the system rebooted using the new kernel file to make the changes take effect. To configure dump devices into the kernel, perform the following procedure:

Step 1. Run SAM and select the Kernel Configuration Area

Step 2. From the Kernel Configuration Area, select the Dump Devices area

A list of dump devices configured into the next kernel built by SAM is displayed. This is the list of pending dump devices.

Step 3. Use the SAM action menu to add, remove, or modify devices or logical volumes.

NOTE The order of the devices in the list is important. Devices are used in reverse order from the way they appear in the list. The last device in the list is as the first dump device.

Step 4. Follow the SAM procedure for building a new kernel.

Step 5. Boot the system from the new kernel file to activate the new dump device definitions.

Using HP-UX commands to configure dump devices into the kernel

The `system` file can be edited and the `config` program used to build the new kernel. For details see *Managing Systems and Workgroups*. Perform the following procedure to configure dump devices into the kernel using HP-UX commands:

Step 1. Edit the `system` file (the file that `config` uses to build the new kernel). This is usually the file `/stand/system` but it can be another file if that is preferred.

Dump to Hardware Device—For each hardware dump device to be configured into the kernel, add a dump statement in the area of the file designated "`* Kernel Device info`" immediately prior to any tunable parameter definitions. For example:

```
dump 2/0/1.5.0

dump 56/52.3.0
```

Dump to Logical Volume—For logical volumes, it is not necessary to define each volume used as a dump device. For dumping to logical volumes, the logical volumes must meet all of the following requirements:

- Each logical volume to be used as a dump device must be part of the root volume group (vg00). For details on configuring logical volumes as kernel dump devices, see the lvlnboot (1M) manpage.
- The logical volumes must be contiguous (no disk striping or bad-block reallocation is permitted for dump logical volumes).

- The logical volume cannot be used for file system storage, because the whole logical volume is used.

To use logical volumes for dump devices (no matter how many logical volumes are required), include the following dump statement in the system file:

```
dump lvol
```

Configuring No Dump Devices—To configure a kernel with no dump device, use the following dump statement in the system file:

```
dump none
```

To configured the kernel for no dump device, the above statement (**`dump none`**) must be used.

NOTE Omitting dump statements altogether from the `system` file results in a kernel that uses the primary paging device (swap device) as the dump device.

Step 2. Once the `system` file has been edited, build a new kernel file using the `config` command.

Step 3. Save the existing kernel file (probably `/stand/vmunix`) to a safe place (such as `/stand/vmunix.safe`) in case the new kernel file can not be booted.

Step 4. Boot the system from the new kernel file to activate the new dump device definitions.

Runtime dump device definitions

If there is not a concern about capturing a dump that occurs during the earliest stages of the boot process, replace or supplement any kernel dump device definitions while the system is booting or running. There are two ways to do this:

1. Using `crashconf` to read dump entries in the `/etc/fstab` file (using `crashconf`'s `-a` option)
2. Using arguments to the `crashconf` command, directly specifying the devices to be configured

The /etc/fstab file

Define entries in the `fstab` file to activate dump devices during the HP-UX initialization (boot) process or when `crashconf` reads the file. The format of a dump entry for `/etc/fstab` looks like the following:

devicefile_name `/ dump defaults 0 0`

Examples:

```
/dev/dsk/c0t3d0 / dump defaults 0 0
/dev/vg00/lvol2 / dump defaults 0 0
/dev/vg01/lvol1 / dump defaults 0 0
```

Define one entry for each device or logical volume to be used as a dump device.

NOTE Unlike dump device definitions built into the kernel, with run time dump definitions the logical volumes from volume groups other than the root volume group can be used.

The crashconf command

Use the `/sbin/crashconf` command to add to, remove, or redefine dump devices. The following are two ways to do this:

- Reread the `/etc/fstab` file using the `crashconf -a` option
- Use device arguments with `crashconf` to configure the devices

With either method, use the `crashconf -r` option to specify that new definitions replace, rather than add to, any previous dump device definitions.

Examples:

To have `crashconf` read the `/etc/fstab` file (thereby adding any listed dump devices to the currently active list of dump devices), enter the following command:

```
/sbin/crashconf -a
```

To have `crashconf` read the `/etc/fstab` file (thereby replacing the currently active list of dump devices with those defined in `fstab), enter the following`:

```
/sbin/crashconf -ar
```

To have `crashconf` add the devices represented by the block device files `/dev/dsk/c0t1d0` and `/dev/dsk/c1t4d0` to the dump device list, enter the following:

```
/sbin/crashconf /dev/dsk/c0t1d0/dev/dsk/c1t4d0
```

To have `crashconf` replace any existing dump device definitions with the logical volume `/dev/vg00/lvol3` and the device represented by block device file `/dev/dsk/c0t1d0`, enter the following:

```
/sbin/crashconf -r /dev/vg00/lvol3 /dev/dsk/c0t1d0
```

Dump order

The order that devices dump after a system crash is important when using the primary paging device along with other devices as a dump device.

Regardless of how the list of currently active dump devices was built (from a kernel build, from the `/etc/fstab` file, from use of the `crashconf` command, or any combination of the these) dump devices are used (dumped to) in the reverse order from which they were defined. The last dump device in the list is the first one used, and the first device in the list is the last one used.

Place devices that are used for both paging and dumping early in the list of dump devices so that other dump devices are used first and overwriting of dump information due to paging activity is minimized.

What happens when the system crashes?

This section discusses the unlikely event of a V-Class system crash. A system panic means that HP-UX encountered a condition that it could not to handle. Sometimes the cause of the crash is apparent, but many times an in-depth analysis is required. HP-UX is equipped with a dump procedure to capture the contents of memory at the time of the crash.

Operator override options

When the system crashes, the system console displays a panic message similar to the following:

```
*** A system crash has occurred.  (See the above messages for details.)
*** The system is now preparing to dump physical memory to disk, for use
*** in debugging the crash.


*** The dump will be a SELECTIVE dump:  21 of 128 megabytes.

*** To change this dump type, press any key within 10 seconds.


*** Select one of the following dump types, by pressing the corresponding key:
N) There will be NO DUMP performed.
S) The dump will be a SELECTIVE dump:  21 of 128 megabytes.
F) The dump will be a FULL dump of 128 megabytes.
O) The dump will be an OLD-FORMAT dump of 128 megabytes.
*** Enter your selection now.
```

The operator can override any dump device definitions by entering N (for no dump) at the system console within the 10-second override period.

If disk space is limited, but the operator feels that a dump is important, the operator can enter S (for selective dump) regardless of the currently defined dump level.

The dump

After the operator overrides the current dump level, or the 10-second override period expires, HP-UX writes the physical memory contents to the dump devices until one of the following conditions is true:

- The entire contents of memory are dumped (if a full dump was configured or requested by the operator).
- The entire contents of selected memory pages are dumped (if a selective dump was configured or requested by the operator).
- Configured dump device space is exhausted

Depending on the amount of memory being dumped, this process can take from a few seconds to hours.

NOTE

During the dump, status messages on the system console indicate the progress. Interrupt the dump at any time by pressing the **ESC** key. However, if a dump is interrupted, all information is lost.

Following the dump, the system attempts to reboot.

The reboot

When dumping of physical memory pages is complete, the system attempts to reboot (if the Autoboot is set). For information on the Autoboot flag, see "Enabling Autoboot" on page 55.

savecrash processing

During the boot process, a process called `savecrash` can be used that copies (and optionally compresses) the memory image stored on the dump devices to the HP-UX file system area.

Dual-mode devices (dump / swap)

By default, `savecrash` performs its copy during the boot process. Disable this operation by editing the file: `/etc/rc.config.d/savecrash` and setting the `SAVECRASH` environment variable to a value of zero. This is generally safe to do if the dump devices are not also being used as paging devices.

CAUTION If using devices for both paging and dumping, do not disable savecrash boot processing. Loss of the dumped memory image to subsequent system paging activity can occur.

What to do after the system has rebooted?

After the system reboots, make sure that the physical memory image dumped to the dump devices is copied to the HP-UX file system area then either package and send it in for analysis or analyze it using a debugger.

NOTE With HP-UX 11.0, it is possible to analyze a crash dump directly from dump devices. If, however, it needs to be saved to a tape or sent to someone, first copy the memory image to the HP-UX file system area.

Unless specifically disabled during reboot, the `savecrash` utility copies the memory image during the reboot process. The default HP-UX directory for the memory image in is `/var/adm/crash`. Specify a different location by editing the file `/etc/rc.config.d/savecrash` and setting the environment variable called `SAVECRASH_DIR` to the name of the directory the dumps are to be located.

Using crashutil to complete the saving of a dump

If devices are being used for both paging (swapping) and dumping, it is very important to not disable `savecrash` processing at boot time. If this is done, there is a chance that the memory image in the dump area will be overwritten by normal paging activity. If, however, there are separate dump and paging devices (no single device used for both purposes), copying the memory image to the HP-UX file system area can be delayed in order to speed up the boot process. To do this, edit the file `/etc/rc.config.d/savecrash` and set the environment variable called `SAVECRASH=0`.

If copying the physical memory image from the dump devices to the HP-UX file system area has been delayed, run `savecrash` manually to do the copy when the system is running. Confirm that enough space to hold the copy in the HP-UX file system area has been configured before doing so.

If a partial save is being done, the only pages copied to the HP-UX file system area during the boot process are those that were on paging devices. Pages residing on dedicated dump devices are still there. A partial save can be selected by leaving the `SAVECRASH` environment set to 1 and setting the environment variable `SAVE_PART=1` in `/etc/rc.config.d/savecrash`. To copy the remaining pages to the HP-UX file system area when the system is running again, use the command `crashutil`. See the crashutil(1M) manpage for details.

Example

```
/usr/sbin/crashutil -v CRASHDIR /var/adm/crash/crash.0
```

Crash dump format conversion

Use `crashutil` to convert the file format when analyzing a crash dump on a computer running a different version of HP-UX than the V-Class server, or if the debugging tool does not recognize the specific format of the saved file.

The basic format of the `crashutil` command to do a conversion is:

`/usr/sbin/crashutil -v` *version source* [*destination*]

version	Designates the version of the destination format.
source	Designates the pathname of the crash dump to be converted.
destination	Designates the pathname where the converted file will be written. If no *destination* is specified the *source* will be overwritten.

See the crashutil(1M) manpage for more information.

Analyzing crash dumps

Analyzing crash dumps is not a trivial task. It requires intimate knowledge of HP-UX internals and the use of debuggers. It is beyond the scope of this document to cover the actual analysis process. Contact the Hewlett-Packard representative for help in analyzing a crash dump.

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