HP 9000 A-Class Servers: A500/A400

System Architecture and Design Guide

This technical white paper describes the design goals and system architecture of the HP 9000 A-Class servers.

May 2000

Table of Contents

1. Introduction 1
Overview of the A-Class A500/A400 Server 1
Features 2
The HP 9000 Enterprise Server Product Line 3
Operating System Support & Binary Compatibility 3

2. Architecture 5
Low-Latency Memory Access 6
Minimum and Maximum Memory Configurations 6
I/O Subsystem Design 7
Speeds and Feeds 8
Booting over I/O 8
Scalability 8

3. Industrial Design and Packaging 9
Racking in HP Cabinets 9
Racking in Third Party Cabinets 9
Standalone/Deskside Configuration 9

4. High Availability 10
Hot-Plug Disk Drives 10
Main Memory—Advanced ECC and Parity 10
Dynamic Processor Deallocation 10
Dynamic Processor Resilience 11
Other High Availability Features 11

5. Manageability 12
LED Front-Panel 12
Event Monitoring Service (EMS) 12
Extended Fault Management System 13
Console Options 14
For More Information 15

1. Introduction

Overview of the A-Class A500/A400 Server

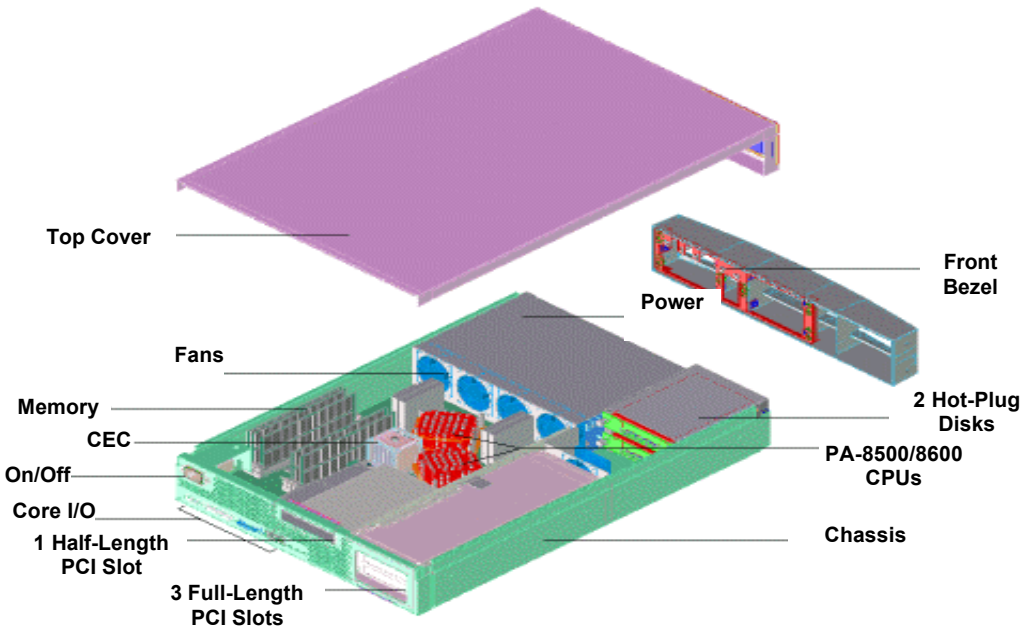
The A500 and A400 are new entry-level servers that will serve in the space currently supported by the A180, and A180C. These new servers also present a compelling value proposition for customers currently using D-Class and R-Class servers.

The new A-Class systems were designed to meet the needs of the Internet and application service provider markets. Fulfilling the market's need for faster, smaller servers, the A500 delivers industry-leading symmetric multiprocessing (SMP) performance with up to two PA-8500 or PA-8600 processors in a 2-EIA-unit chassis. The two processors, coupled with 8GB of main memory and 4 PCI slots, deliver a balanced system with leadership price/performance in SPECweb and other performance benchmarks. The A400 is a one-way 440MHz PA-8500 server with half the I/O and one-quarter the memory capacity of the two-processor A500 server. With the ability to upgrade to PA-8700 processors and an in-chassis upgrade from the A400 to the A500, the A-Class offers unmatched investment protection.

In addition, the A-Class offers high-availability features normally found only in larger, more expensive servers. Features such as hot-plug disks, memory scrubbing and page deallocation, dynamic processor deallocation and resilience, independent PCI buses, failure avoidance and notification capability, and MC/ServiceGuard support are all standard on both the A500 and the A400.

All of these features are packed into a compact, 2-EIA-unit package -- that's only three and one-half inches high! With up to twenty servers and 40 processors in a 2-meter cabinet, the A-Class offers industry-leading performance density and availability. For those customers who don't need a cabinet, the A-Class can be securely stacked up to six servers high right on the floor. There is also a pedestal stand that allows customers to use a single A-Class in a stand-alone vertical position.

Figure 1.1 Internal View of A-Class Components



Features

Figure 1.1 reveals the location of major components, as well as the mechanical and architectural features of the A-Class. The A-Class is partitioned into two main electrical assemblies—the system board and the I/O backplane, and into four main volumes—system, I/O, disk, and power.

The front of the server consists of the disk and power volumes. Two hot-plug Ultra2 SCSI disk bays are accessible behind a hinged door on the left-front of the server. The power system, made up of a single 600W power supply extends across the rest of the front volume. The main fan system is located at the rear of the power system.

The rear of the server houses the main system volume, as well as the removable I/O card bay. The system volume contains the system board, which houses up to two CPUs, eight DIMM memory slots, the core I/O, the extended fault management system, and one of the four available PCI I/O slots. The removable I/O card bay, at the left rear of the server, houses the three additional PCI I/O slots.

A500 Features At-a-Glance

- 1 or 2 440 MHz PA-8500 or 550 MHz PA-8600 64-bit CPUs
- Up to 8GB of memory
- 4 PCI I/O slots (66 MHz × 64-bit) with adaptive signaling
- 4 independent PCI buses for the I/O slots and core I/O
- 2 hot-plug disk drives on 2 independent controllers
- 1.8GB/s system bus bandwidth
- 1.9GB/s I/O bus bandwidth
- 1.8GB/s memory bus bandwidth
- HP-UX 11 operating system
- Linux for PA-RISC (when available)
- High-density 2-EIA-unit, 3.5-inch rackmount or stand-alone package
- MC/ServiceGuard support
- Out-of-box support for non-HP racks

A400 Features At-a-Glance

- 1 440MHz PA-8500 64-bit CPU
- Up to 2GB of memory
- 2 PCI I/O slots (66 MHz x 64-bit) with adaptive signaling
- 3 independent PCI buses for the I/O slots and core I/O
- 2 hot-plug disk drives
- In-box upgrade to A500
- 1.8GB/s system bus bandwidth
- 1.3GB/s I/O bus bandwidth
- 1.8GB/s memory bus bandwidth
- HP-UX 11 operating system
- Linux for PA-RISC (when available)
- High-density 2-EIA-unit, 3.5-inch rackmount or stand-alone package
- MC/ServiceGuard support
- Out-of-box support for non-HP racks

The HP 9000 Enterprise Server Product Line

The A500 and A400 are the newest members of the Business Critical Proven HP 9000 Enterprise Server product line from Hewlett-Packard. The HP 9000 family is #1 among UNIX® servers for reliability, scalability, availability, performance, and price/performance. This robust product line addresses the major computing challenges customers face today in Internet infrastructure, content distribution, electronic commerce, online transaction processing, enterprise resource planning, supply chain management, and technical applications.

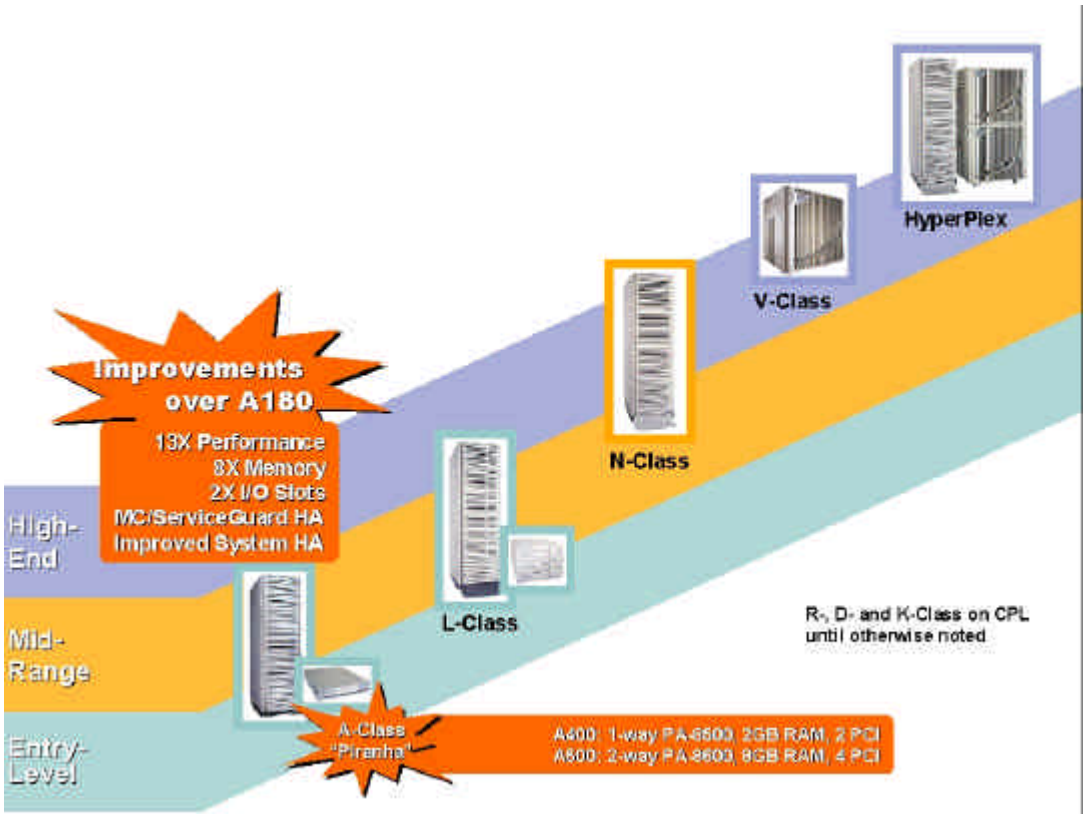
At the entry-level, affordable A- and L-Class servers effortlessly handle Internet workloads and enterprise-size applications. Both platforms also add leadership price/performance and include bundled Internet software solutions.

In the midrange, the N-Class delivers the high-performance, compact Internet-era UNIX server platform that today's IS executives are demanding. With up to 8 PA-8600 processors, the N-Class provides the robust performance and scalability needed for the most demanding workloads.

With exceptional OLTP performance, availability, scalability, and manageability, the HP 9000 V-Class has become the pacesetter for high-end computing. HP's HyperPlex platform assures peak UNIX application performance and Internet-critical high availability to help you meet the rigorous demands of e-services and systems consolidation, as well as large-scale, highly complex technical modeling and simulations.

All HP 9000 Enterprise Servers provide excellent investment protection with a smooth transition path to future PA-RISC and/or IA-64 architectures. So whether your business requires cutting-edge e-services, systems consolidation, or a host of other solutions, our power-packed HP 9000 servers are business-critical proven and ready to meet the challenge—today and tomorrow.

Figure 1.2 The Industry's Most Scalable Range of UNIX Servers



Operating System Support & Binary Compatibility

The A-Class server supports the 64-bit HP-UX 11 operating system. With HP-UX 11, HP maintains its long-standing tradition of providing the industry's best record of investment protection. HP-UX provides forward binary compatibility, in which a fully-bound application developed on an earlier version of HP-UX will run smoothly on HP-UX 11. Thus, current 32-bit and 64-bit applications can run without requiring recompilation. Additionally, HP-UX provides binary compatibility with the future IA-64 family of processors, facilitating the migration path to the next generation of server architectures.

Major features of HP-UX 11 include:

- **Performance and Scalability**
  - Optimized memory page sizing
  - Kernel threads
  - Network File System PV3
  - 64-bit Journaled File System
  - Dynamic Kernel Tuning*
- **Enhanced Internet Infrastructure**
  - Java Runtime
  - Java JIT compiler
  - Common Internet File System (CIFS) for secure HP-UX/Windows interoperability
  - Bundled, Industry-leading web server software
  - Bundled search engine capability*
  - E-speak dynamic brokering software
  - LDAP directory services*
- **Manageability**
  - HP WebQoS for service-level management
  - Event monitoring service
  - System Administration Manager (SAM) & Service Control Manager
  - Dynamic Patching*
- **Security**
  - Praesidium IPSec/9000 encryption
  - Common Data Security Architecture (CDSA)

*Note: Asterisked items will be available soon.

The A-Class Server will also support the PA-RISC version of Linux when it becomes available later this year. HP expects Linux to play a key role in certain applications, such as Internet infrastructure, technical computing, and university research. The PA-RISC version of Linux will provide Linux/HP-UX API compatibility. Therefore, customers have the opportunity to move Linux-developed applications to the mission-critical HP-UX environment if they desire.

2. Architecture

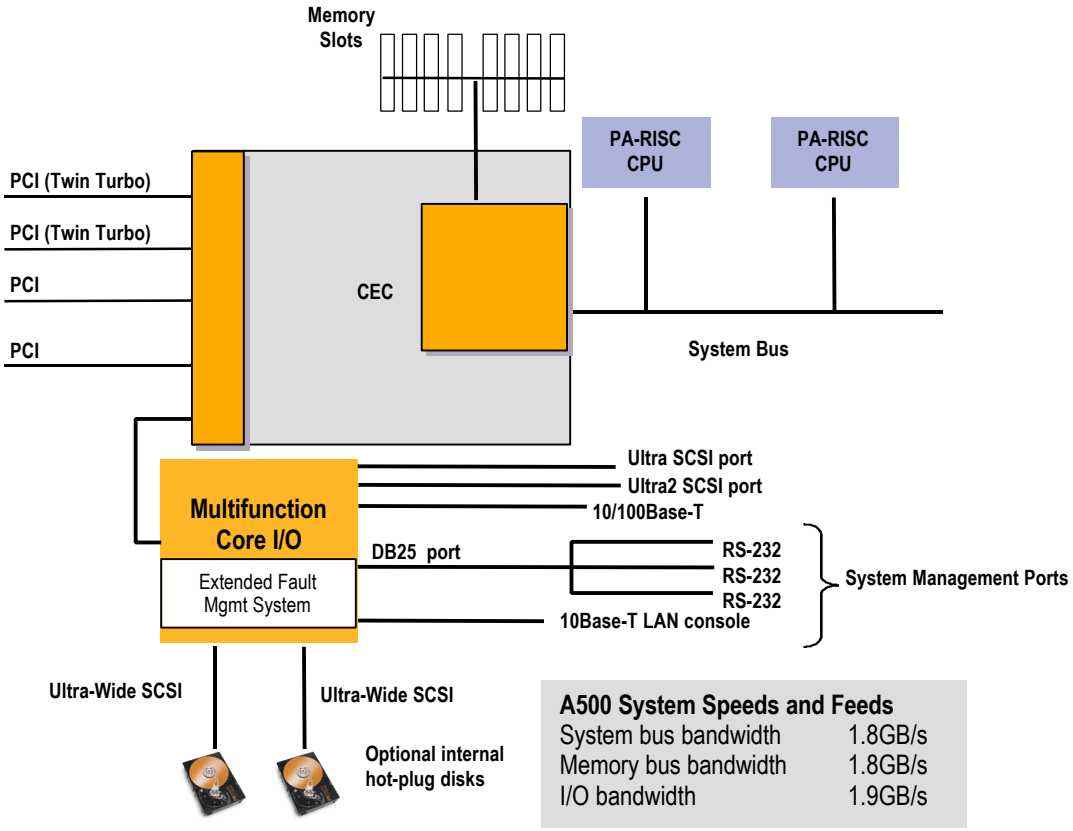
Figure 2.1 shows the relationship of the A500 main blocks and the buses that connect them. Processors, memory, and I/O are interconnected via an integrated high-speed core electronics complex (CEC). This CEC was specifically designed for the A-Class to provide no-compromise features and performance at a low-end price point, as well as to offer important form factor benefits. Integrated within the CEC chip are the memory and I/O controllers, with several peripheral ASICs to control and drive the specific I/O and memory buses.

The integrated design contributes to a significant reduction in the A-Class memory latency over that found in the A180, D-Class, and K-Class systems. The memory controller supports two sets of integrated 4-slot memory arrays, providing a total of eight DIMM slots. With current DIMM availability, the A500 can be configured with a minimum of 128MB and a maximum of 8GB of SDRAM memory.

A single CPU bus connects the CEC with up to two PA-RISC processors. This bus runs at 111 MHz and provides 1.8GB/s of bandwidth. The I/O controller in the A-Class provides seven 250MB/s data channels distributed over the I/O slots and the core I/O. Please see page 7 for a detailed description of the I/O architecture.

The A400 architecture is similar to the A500. However, only one processor and only two PCI I/O slots are available. Also, the system allows a maximum of 2GB of memory (one-fourth of the A500) spread over the 8 DIMM slots.

Figure 2.1 A500 Architecture



Low Latency Memory Access

The A-Class provides memory capacity of 8GB at first release, with an upgrade to 16GB expected during the life of the product. The large memory capacity provides superior application performance as large data sets can be loaded entirely into memory, minimizing the need for I/O and disk operations.

The A-Class has eight memory slots distributed across two integrated memory arrays. The memory arrays are connected to the CEC through a low-latency/high-bandwidth 1.8GB/s bus. This low-latency bus can supply the CPUs with requested data in a fraction of the time of competitive systems and previous generation HP servers like D-Class, A180, and K-Class.

To decrease memory latency and improve performance, the memory address lines are buffered three times: once on the system board to drive each memory carrier, once on the memory carrier to drive banks of DIMMs, and again on each DIMM before driving the memory components.

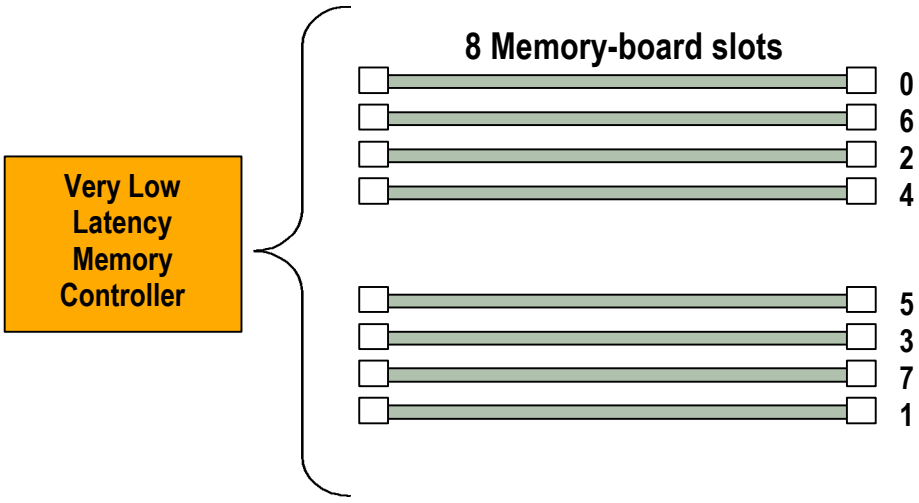
Minimum and Maximum Memory Configurations

The A-Class uses state-of-the-art SyncDRAM technology, which can be ordered in single-DIMM modules (128MB) or in two-DIMM board pairs (256MB, 512MB, 1GB, and 2GB). The memory provides advanced error correcting code.

The A500 minimum memory is 128MB, configured as a single 128MB DIMM. All other DIMM sizes must be added in pairs. Additionally, all memory slots must be filled in a specific sequence that is clearly labeled on the A-Class system board (see Figure 2.2). At first release, the A500's maximum memory consists of eight 1GB DIMMs (ordered as four 2GB board pairs). If growth is planned for the system, higher density modules should be used in order to minimize future slot constraints.

The A400 minimum memory is 128MB, shipped as a standard part of every A400 system. The A400 also supports the 256MB, 512MB, and 1GB memory options. Although the A400 has eight memory slots, it only supports 2GB of total memory – DIMM purchases should be planned accordingly. To reach higher memory capacities, it may be necessary to remove the bundled 128MB DIMM.

Figure 2.2 A500/A400 Memory Slots (showing loading order of DIMM modules)



I/O Subsystem Design

The A500 contains seven I/O channels, each providing 250MB/s of peak bandwidth. The channels are laid-out to support two "Twin-Turbo" PCI slots, two shared PCI slots, and the core I/O.

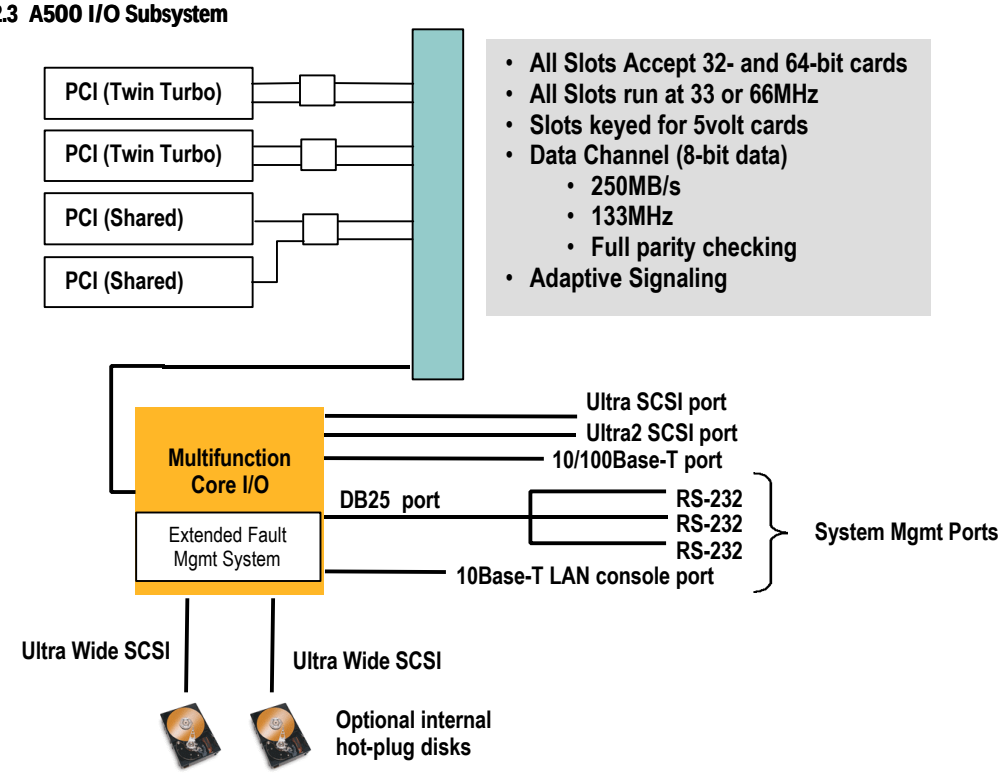
The term "Turbo" refers to a PCI slot that has a dedicated I/O channel. The A500 has two "*Twin*-Turbo" slots, each with *two* dedicated channels. The dedicated, independent channels provide both performance and availability advantages. The "Twin-Turbo" slots, labeled slots 1 and 2 on the chassis, each provide 500MB/s of peak bandwidth. The independent design prevents slow cards from affecting the performance of a fast card. Independence also provides error containment. For example, if a card hangs in slot 1, cards in slots 2-4 will still function properly. The "Twin-Turbo" slots should be reserved for the highest performing cards, such as multi-port cards, RAID controllers.

Slots 3 and 4 share two I/O channels. If only one of these two slots is occupied, that slot will operate in "Twin-Turbo" mode, with 500 MB/s of dedicated bandwidth. If both slots are occupied, the I/O controller arbitrates the activity between them, providing 500 MB/s of shared bandwidth.

The seventh and final I/O channel provides 250 MB/s of dedicated bandwidth to the core I/O. The core I/O consists of two internal hot-plug disks, an Ultra2 SCSI connection, an Ultra SCSI connection, a 10/100BT LAN port, a 10BT LAN console port, and three RS-232 serial ports multiplexed from a single DB25 connection.

All of the I/O slots in the A-Class can accept 64 bit PCI cards. The A-Class uses HP-developed adaptive signaling technology to automatically detect a card's performance features. The data width (64-bit or 32-bit) and the speed (66 MHz or 33 MHz) of the card is automatically detected to ensure that the card runs at the optimal level. One exception is the two shared-slots. If one of the two shared-slots contains a 66MHz card and one contains a 33MHz card, then both slots will run at 33MHz.

Figure 2.3 A500 I/O Subsystem



The A400 has the same I/O features as the A500 except for the number of PCI slots. The A400 has both "Twin-Turbo" slots active. However, the two shared-slots are not operable.

Booting over I/O

The A500 and A400 can boot from the internal disks, from the core external SCSI connections, or from any of the four I/O slots. Additionally, the system can be booted over the 10/100BT LAN connection as part of the HP-UX ignite process. Please refer to the HP9000 Server Configuration Guide for a list of I/O cards that support boot.

Speeds and Feeds

Tables 2.1 and 2.2 show the theoretical maximum bandwidth for various system buses.

Table 2.1 A500 Maximum Bus Bandwidths

	# of Buses (or Controllers)	Maximum Bus Bandwidth	Aggregate Bus Bandwidth
Twin-Turbo PCI slots	2	500 MB/s	1.0 GB/s
Shared PCI slots	1	500 MB/s	500 MB/s
Core I/O	1	250 MB/s	250 MB/s
I/O subsystem	1 (controller)	1.9 GB/s	1.9 GB/s
Memory subsystem	1	1.8 GB/s	1.8 GB/s
CPU buses	1	1.8 GB/s	1.8 GB/s

Table 2.2 A400 Maximum Bus Bandwidths

	# of Buses (or Controllers)	Maximum Bus Bandwidth	Aggregate Bus Bandwidth
Twin-Turbo PCI slots	2	500 MB/s	1.0 GB/s
Shared PCI slots	0	0	0
Core I/O	1	250 MB/s	250 MB/s
I/O subsystem	1 (controller)	1.3 GB/s	1.3 GB/s
Memory subsystem	1	1.8 GB/s	1.8 GB/s
CPU buses	1	1.8 GB/s	1.8 GB/s

Scalability

The A-Class is designed without tradeoffs in CPU, memory, internal storage, or I/O expandability to offer the best scalability of any 1U or 2U server in its class.

- **CPU upgrades.** With its entry-level configuration of one 440MHz CPU and its upgrade path to a second 440MHz or 550MHz processor, the A-Class offers great flexibility to cover a wide range of performance points. The A-Class was also designed to accommodate the next generation of PA-RISC processor, the PA-8700.
- **Memory upgrades.** With 8 available slots, the A-Class ranges from a minimum of 128MB to a maximum of 8GB of main memory at first release. With the addition of 2GB DIMMs, the total memory capacity will increase to 16GB over the product's lifetime.
- **Internal Storage.** The A-Class supports up to two internal, low-profile hot-plug disk drives. At first release, the disk capacities are 9GB, 18GB, and 36GB, for a maximum of 72GB of internal storage. Future releases of low-profile disk drives will further increase capacity.
- **A400 to A500 Upgrade.** An A400 can be fully upgraded to an A500 via an in-the-box firmware change.

3. Industrial Design and Packaging

The A-Class has been designed to fit into environments ranging from data center to utility closet to desktop. The industrial design is coordinated with other HP servers and peripherals for a consistent appearance.

Racking in HP Cabinets

The A-Class system is designed to provide unprecedented performance density that easily adapts to different environments. At 2 EIA units (1 EIA unit= 1.75 inches), up to twenty A-Class servers can be installed into a single 2-meter HP cabinet. With the high cost of computer room floor space, the A-Class's small footprint dramatically lowers total cost of ownership.

The A-Class was designed for and tested in HP System/E cabinets (A490xA). HP cabinets are the best option for customers who want to ensure that their rack environments offer the utmost in safety, ease of service, factory integration, and HP field support.

The A-Class field and factory rack kits contain advanced, high availability slider rails. These rails were designed to allow easy service access to the system. The A-Class system can be completely serviced without removing it from the rack, thus allowing side-by-side racks of systems to be completely supported without sacrificing floor space for side access to the system.

Racking in Third Party Cabinets

For customers who choose to use non-HP cabinets, the A-Class provides simple options for installation and HP field support. The A-Class field rack kit contains an adjustable mounting bracket that fits onto the A-Class high availability slider rails. This bracket telescopes to mounting depths of 28-31.25 inches, allowing the A-Class to be mounted in most four-post, third party cabinets.

Once an A-Class server is mounted in a third-party cabinet, it must meet some simple criteria to ensure that HP field personnel can fully support the rack environment:

- **Anti-Tip**. The rack/cabinet must be solidly anchored to the floor both front and rear. This is usually accomplished by anti-tip feet or by direct bolting to the floor.
- **Air Flow.** The A-Class uses front to back airflow to cool the unit. Thus a cabinet cannot have a solid front or rear door. Solid doors may have to be removed or changed to an open perforation pattern.
- **Cable Strain Relief.** A proper method of strain relief must be used. This may force the elimination of the rear door in some cases.
- **Front & Rear Access**. For proper cooling and ease of service access, HP recommends 32" of unobstructed floor space in the front and rear of rack installations. This recommendation applies to both HP and third party racks and cabinets.

Standalone/Desktop Configuration

The A-Class is also available in a standalone, or a stackable configuration when a cabinet is not desired. The standalone A-Class is ideal for an office environment, under a desk, or on a shelf. A pedestal stand is included to secure the server in a vertical position if desired. Additionally, up to six A-Class systems can be stacked directly on the floor. A stacking brace is available to secure the stacked systems and to maintain safety requirements.

Table 3.1 A-Class Dimensions

	Length	Width	Height	Max. Weight
Racked	25" (28" w/ Bezel)	19"	3.75" (2U)	50 pounds
Standalone	25" (28" w/ Bezel)	17"	3.44"	45 pounds

Note: A few extra inches of length may be needed to manage cables in the rear of the server

4. High Availability

The A-Class has numerous high availability features that are unmatched in its class. Standard features on every A-Class include hot-plug disks, memory scrubbing and page deallocation, dynamic processor deallocation and resilience, independent PCI slots, failure avoidance and notification capability, and MC/ServiceGuard support.

Hot-Plug Disk Drives

The A-Class supports up to two hot-plug, Ultra2 SCSI disks accessible from the front of the server. These disks can be removed and inserted while the A-Class continues to operate.

Two dual-channel SCSI controllers manage the two internal hot-plug disks. For added availability, disks are on separate channels as well as separate SCSI controllers. Hence on systems running mirror disk/UX, a SCSI controller, SCSI channel, or root disk could fail and the A-Class would continue to run properly. Furthermore, each of the internal disks can be mirrored to external storage connected on a separate channel and controller.

The A-Class contains circuitry to properly control the disk's power and reset during the hot-plug operation. Either SAM (System Administration Manager) or online diagnostic software (MESA) can be utilized to effectively de-configure and re-configure the disk. Both of these tools are available as a standard feature of the HP-UX operating environment.

Main Memory—Advanced ECC and Parity

Data stored in the A-Class's main memory is protected by error correction code (ECC) and address/control parity. The A-Class ECC design provides memory scrubbing and page deallocation functionality that will tolerate single-bit SDRAM failures without requiring DIMM replacement.

The data controllers generate ECC bits and store these ECC bits with the data in the DIMMs. The 256MB and 512MB DIMMs use x4 SDRAMs to store each bit of a word, including its ECC bits, in a different SDRAM within the DIMM pair. The 128MB DIMMS use x8 SDRAMs. When reading the data back, the data controllers are able to detect and correct single-bit data errors. Double-bit errors cannot be corrected. Double-bit data errors are highly unlikely because the data and ECC bits are stored one-bit-per-SDRAM and multiple SDRAMs would have to be involved in the error. Hence, a single SDRAM could fail within each DIMM pair and the system would still function.

The system also detects address and control parity errors to prevent data corruption from reading or writing to the wrong location in main memory. The address controller and each address buffer generate address and control parity. Each address buffer detects address and control parity problems and reports it back to the address controller. There are three levels of address buffers as the address lines fan out. These address buffers are located on the system board, on each memory carrier, and on each DIMM.

Dynamic Processor Deallocation

Incorporated into HP's version 11 of HP-UX, this feature provides the ability to take a processor out of service while the system is running and without interrupting applications. Once a processor is deallocated, the HP-UX operating system will immediately transfer all application processes that are currently scheduled on that processor to other active processors. If the processor has been assigned to handle interrupts for any I/O drivers, it will continue to do so while it is deallocated.

Dynamic Processor Resilience

PA-RISC processors have the ability to detect and correct single-bit cache errors. Th event monitoring service (EMS) monitors the rate of correctable errors in each processor's on-board cache. These errors are manifested as Low Priority Machine Checks (LPMCs). While occasional correctable errors are to be expected in the on-board cache, too many of these errors in a short period of time indicate an increased likelihood that a non-correctable cache error could occur. The EMS LPMC monitor will continuously monitor the rate at which LPMCs are occurring and dynamically deallocate a processor, using the dynamic processor deallocation facility. This technology is referred to as Dynamic Processor Resilience.

Other High Availability Features

- **Independent PCI slots**. Two of the four A500 PCI slots are on independent PCI buses. Cards in independent slots are unaffected by failures in other cards. In the A400, both of the available slots are on independent buses.
- **Failure Avoidance and Notification.** The A-Class has several features that monitor system features, take corrective actions when necessary, and notify administrators if pre-defined thresholds are reached. Please refer to Section 5 for more information on the manageability features.
- **MC/ServiceGuard Support.** Both the A500 and A400 support MC/ServiceGuard for high availability clustering solutions. MC/ServiceGuard software and support is not included with the A-Class server. It must be ordered as an additional feature.
- **Instant Capacity on Demand (ICOD)**. At this time, the A-Class is not available with ICOD.

5. Manageability

The A-Class simplifies system management though several methods, including the LED front-panel, the event monitoring service, and the extended fault management system. Additionally, the A-Class provides multiple console options to meet both local and remote administrative needs.

LED Front-Panel

The LEDs on the front-panel are the best way for an operator to get simple, fast, server management information. Each LED, which is clearly labeled on both the plastic front bezel as well as the metal chassis, can convey information by its color (green, yellow, or red) and/or by flashing. The five LEDs and a description of some key messages are as follows:

- **Run** – Green: normal system operation; Flashing Green: system operating, no OS code
- **Attention** – Flashing Yellow: non-critical operator intervention required
- **Fault** – Red: critical operator intervention required; Flashing Red: unexpected reboot, system recovered
- **Remote** – Yellow: remote console enabled via modem
- **Power** – Green: system power on; Flashing Green: system in standby mode

Event Monitoring Service (EMS)

HP EMS is a system monitoring application designed to facilitate remote/centralized real-time monitoring and error detection for HP products in the enterprise environment. This framework provides centralized management of hardware devices such as the A-Class server and system resources, and it provides immediate notification of hardware failures and system status. HP EMS can receive data on unusual activity, add information on the problem's source, and provide recommendations on problem resolution.

HP EMS consists of a set of system and network monitors within a monitoring environment. This monitoring framework has an easy-to-use interface and provides a mechanism for monitoring resources, registering monitoring requests, and sending notification when resources reach user-defined critical values EMS monitors are available for a variety of hardware, including disks, disk arrays, network adapters, memory, and network switches.

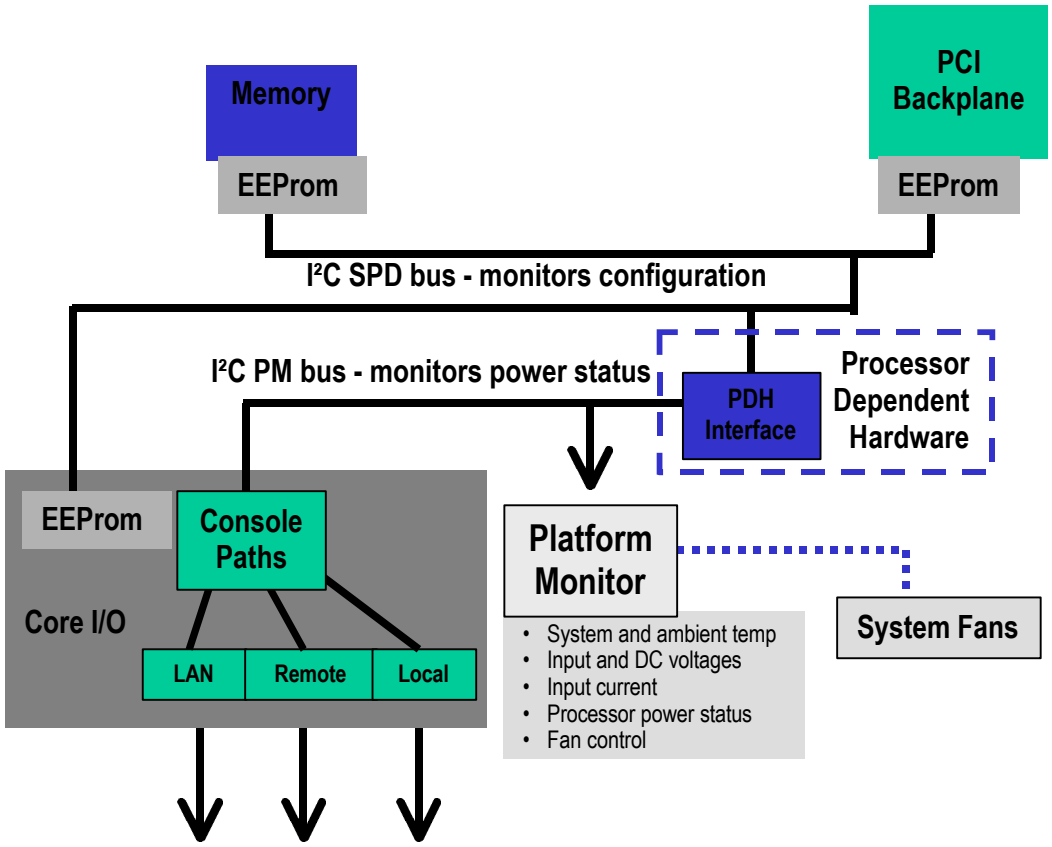
How it works:

1. A hardware event monitor detects abnormal behavior in one of the hardware resources (devices) it is monitoring.
2. The hardware event monitor creates the appropriate event message, which includes suggested corrective action, and passes it to the Event Monitoring Service (EMS).
3. EMS sends the event message to the system administrator using the notification method specified in the monitoring request (for example: e-mail, telephone page, message to the console, entry in a system log).
4. The system administrator (or Hewlett-Packard service provider) receives the messages, corrects the problem, and returns the hardware to its normal operating condition.
5. Events can also be passed to MC/ServiceGuard. If desired, MC/ServiceGuard can failover to a redundant hardware resource.

Extended Fault Management System

The A-Class employs an innovative fault management system that aids administration and problem diagnosis. This hardware-based system is entirely independent of the operating system, allowing administrators to diagnose problems even in the unlikely event that the system is unable to execute code. The Service Processor allows system power to be remotely turned on or off, and it has battery backup that allows diagnosis even if the main system power has failed. The Service Processor interfaces to key system components via an I^2C bus to continually monitor the status of system fans, temperature, and power supplies.

Figure 5.1 Extended Fault Management System Architecture



Major features of the Extended Fault Management System include:

- System console redirection
- Console mirroring
- Configuration of system for automatic restart
- Viewing history log of system events
- Viewing history log of console activity
- Setting inactivity timeout thresholds
- Remote system control
- Telnet capability to other server Extended Fault Management Systems
- Power control—remote power on and off
- Viewing system status logs
- Configuration of virtual front panel display

- Event notification to system console, e-mail, pager, and/or HP Response Centers
- Auto system restart
- Virtual front panel display
- Power consumption, power supply status, and temperature monitoring
- External ambient air temperature
- Fan operation
- Password security (same level as UNIX)

Console Options

The A-Class supports multiple management console options, including the HP Secure Web Console, LAN console, ASCII terminals, and remote/modem connections.

Secure Web Console

The HP Secure Web Console allows remote server management from a PC or workstation running a web browser. At first release, the A-Class Web Console is a PCI card solution (part # A5858A). This card can be ordered for a nominal charge with the initial server order – the card cannot be ordered as a standalone accessory at a later date. There is also an external Secure Web Console solution (part # J3591A) for customers who don't want to fill an I/O slot. Later in the A-Class lifetime, the Web Console will be integrated into the system's core electronics, freeing an I/O slot.

Major features of the Secure Web Console include:

- Secure system management over a corporate Intranet
- Mirrored access—up to four operators can simultaneously share the same screen and keyboard
- Security—built-in password encryption, data scrambling, and Java™ download protection
- Universal browser-based support for Netscape v.3.0+ and Microsoft Internet Explorer v.3.0+ Web browsers
- Easy updates of web console software over the network
- Support for HTTP, FTP, TFTP, and other key Internet standards

LAN Console

The A-Class also provides a LAN console interface using industry-standard telnet connections. Like the web console, the LAN console can be used remotely for managing many systems from a single control center. The telnet interface allows scripts to be used to vastly simplify multiple system management. Password protection provides a high level of security to control access to the LAN console, ensuring that only authorized personnel perform system management.

ASCII Terminals

The A-Class provides an RS-232 port to use for ASCII terminal console connections. Any VT100-capable terminal or emulator can be used as a local system console.

Remote Console via Modem Connection

The A-Class provides an RS-232 modem port that can be used for dial-up remote management. This feature is particularly helpful for obtaining help from HP service experts. Security is ensured by having to explicitly enable remote console access, which is protected with a password, and via dial-back phone verification.

For More Information

HP product information and technical documentation is available online at **www.eproducts.hp.com**.

In addition, configuration tools and pricing information allow registered users to place orders online. For registration, please contact your Hewlett-Packard sales representative.

Contact any of our worldwide sales offices or HP Channel Partners (in the U.S., call 1-800-637-7740) or visit our HP 9000 A-Class Enterprise Servers Web site at **http://www.hp.com/go/a-class**.