



## hp server rp5405



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## **introduction to the hp server 05 series**

Today's business environment is changing in a fundamental way. Despite significant competitive pressures, businesses must increasingly stretch their IT budgets further. For many IT managers, this has created a challenging situation—whether to purchase systems that offer enterprise-level availability and functionality—or buy more economical systems that sacrifice functionality and reliability. Regardless of the decision, many businesses find themselves making an uncomfortable trade-off between functionality and price. As the organization's reliance on its IT infrastructure increases, the importance of this trade-off decision can literally be a matter of business survival.

The hp 05 series servers address this new business reality by offering your business the ability to deliver top-line results without compromising on the bottom line. Designed for workgroup applications; front-end applications (such as caching, firewall, and workload balancing); and Web, application, and small database serving, 05 series systems offer the right performance while delivering the high availability and manageability features you've come to expect from HP servers.

### **enterprise-class high availability**

The 05 series servers from HP allow you to stretch your budget dollars further while offering enterprise-class high availability that no one else can match. Standard high availability features on all 05 series servers include dynamic processor resilience, full error-checking and -correcting (ECC) protection, and HP's Event Monitoring Service (EMS) which provides proactive fault avoidance, detection, and notification. The 05 series product family also supports a wide range of high-availability software solutions to keep your business running, including industry-leading HP MC/Serviceguard.

### **industry-leading functionality**

The 05 series products offer unparalleled opportunity to manage your server resources. Integrated features, such as HP Secure Web Console, give you the capability for full remote management, including centralized single-system and multi-system configuration. Other industry-leading capabilities include HP-UX Workload Manager (WLM), which allows various workloads to be managed to meet the service-level objectives of your business. And select 05 series models, including the HP Server rp5405, offer dynamic virtual partitioning, which allows you to run multiple workloads on different instances of HP-UX, ensuring complete software fault isolation.

### **easy ordering and deployment**

Designed for ease of ordering and deployment, the 05 series product line has a full range of standardized configurations with the flexibility to meet immediate business requirements. Pre-configured with high-powered PA-RISC processors and offering a choice of four pre-integrated and tested HP-UX 11i operating environments, 05 series servers can be put to work to rapidly address business demands. 05 series systems also offer industry-leading form factors that allow multiple servers to be racked in the data center, preserving valuable floor space and lowering operating costs.

# introduction to the rp5405

## overview and illustration

The new HP Server rp5405 was designed to meet the price/performance needs of the enterprise data center, the remote office deployment, and the IP-based service provider market. Fulfilling the need for faster, full-featured, economical servers, the rp5405 delivers industry-leading symmetric multiprocessing (SMP) performance, with up to four PA-8700 processors in a 7-EIA-unit chassis. The four processors, coupled with 16 GB of main memory and ten PCI slots, deliver a balanced system with outstanding price/performance and performance density.

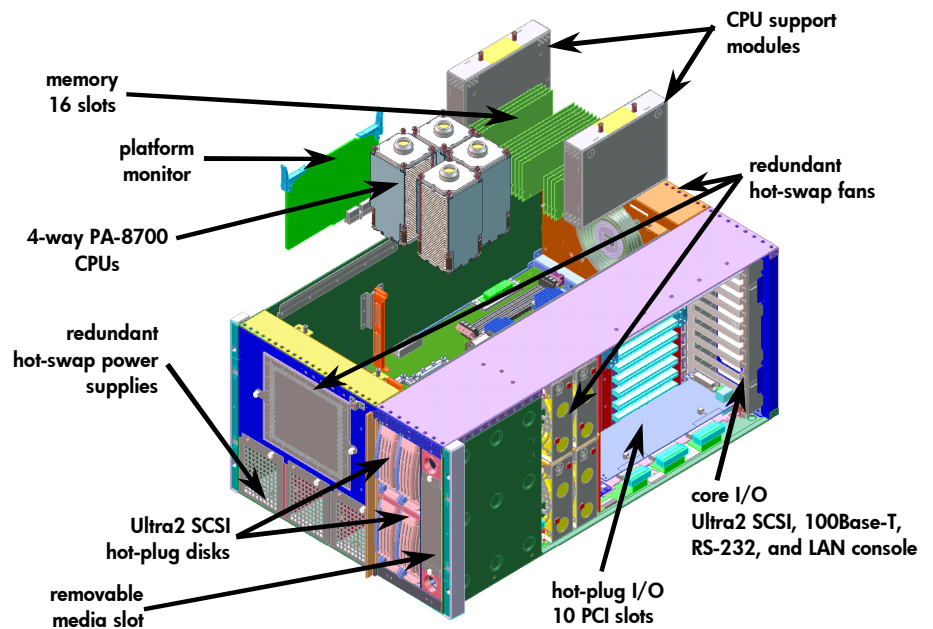
**Figure 1** reveals the location of major components, as well as the mechanical and architectural features of the HP Server rp5405. The server is partitioned into two main electrical assemblies—the system board and the I/O backplane—and into three main volumes—processor and memory, I/O and disk, and power.

Looking at the front face, three hot-swap power supply bays are located in the lower left corner. To the right, a peripheral bay provides space for four hot-plug disks and one removable media device (either DVD-ROM or DDS-3). Directly above the power supply bays is the first of eight hot-swap cooling fans.

The right side of the system houses the I/O card bay. There are ten PCI I/O slots available. Two pairs of fans located here provide cooling for the I/O bay as well as the peripheral bay.

The opening at the top provides access to the system board, which supports the four CPUs, sixteen dual inline memory module (DIMM) slots, two processor support modules, and the platform monitor board. The core I/O is located at the rear of the system.

**figure 1. hp server rp5405 front view**



### **rp5405 features at-a-glance**

- 2-way or 4-way PA-8700 processors
- 650 MHz CPU speed
- High-performance “stretch” core electronics complex (leveraged from HP midrange servers)
- Intel® Itanium® 2 processor upgradable
- Up to 16 GB of memory
- 10 PCI I/O slots (8 hot-plug, 2 non-hot-plug; all are 66 MHz × 64-bit)
- 9 independent PCI buses for I/O slots
- N+1 power and cooling
- 4 hot-plug disk drives
- Removable media bay: DVD-ROM or DDS-3
- 4.3 GB/s system bus bandwidth
- 3.2 GB/s I/O bus bandwidth
- 4.3 GB/s memory bus bandwidth
- 64-bit HP-UX 11.0 and 11i
- High-density 7-EIA-unit, 19-inch rackmount or pedestal package

### **superior operating system**

The rp5405 runs the industry-leading, award-winning HP-UX 11i operating environment. HP-UX addresses the major computing challenges that customers face today in online transaction processing (OLTP), enterprise resource planning (ERP), supply chain management (SCM), server consolidation, telco billing applications, high-performance technical computing, and customer relationship management (CRM). HP-UX is also ideal for use in business intelligence systems and in Internet, scientific, and technical applications. This mainframe-class, 64-bit operating system enjoys the industry’s greatest support from independent software vendors, allowing a choice of more than 15,000 applications—including native 64-bit versions of all major databases and leading ERP applications.

### **Intel Itanium Processor Family ready**

The rp5405 is upgradable to the Itanium 2-based HP Server rx5670. This upgrade is done in-chassis, by a swap of the internal electronics.

The Intel Itanium Processor Family is based on Explicitly Parallel Instruction Computing (EPIC), a new architecture technology invented by HP Labs. The EPIC architecture breaks through the sequential nature of today’s RISC and CISC processor architectures by allowing the software to communicate explicitly to the processor when operations can be done in parallel. EPIC serves as the enabler for future high-performance chips by providing explicit parallelism, massive resources, and inherent scalability not available with conventional RISC architectures. Increased performance is realized by reducing the number of branches and branch mispredicts and by reducing the effects of memory-to-processor latency.

For the vast majority of users, the transition to the Intel Itanium Processor Family will be simple and seamless. For customers who require additional assistance, HP provides transition services around the world to help make this upgrade as smooth as possible. HP can provide assistance every step of the way, from assessment and design to verification and deployment.

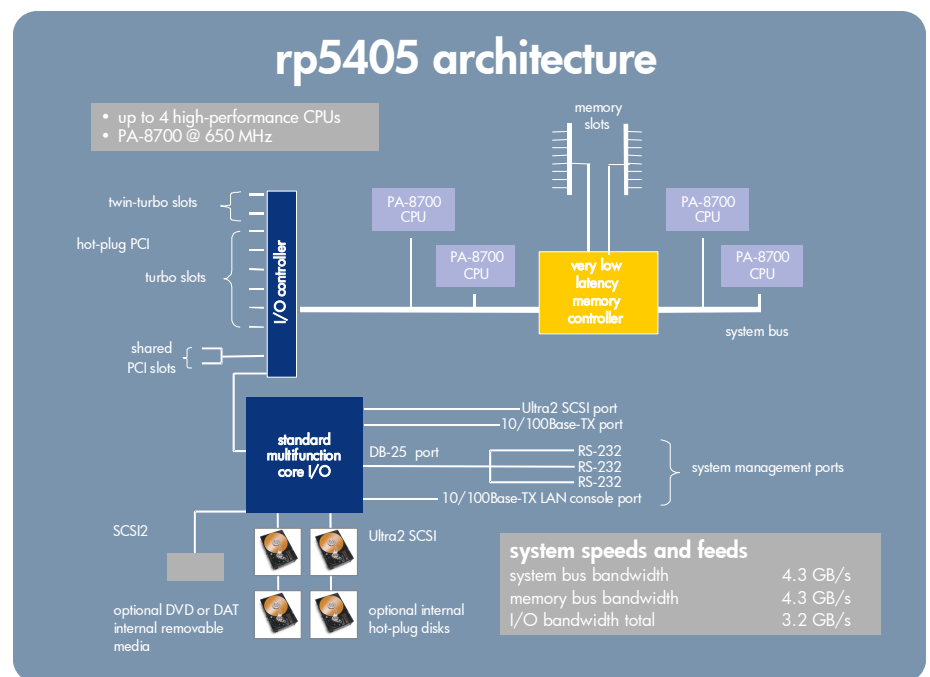
For more information on Itanium-based computers, please see <http://www.hp.com/go/Itanium>

## architecture

**Figure 2** shows the relationship of the rp5405 main blocks to the buses that connect them. The rp5405 uses the “stretch” high-performance core electronics complex (CEC), which is also used in midrange-class hp servers. This CEC, specifically designed for demanding Internet workloads, brings unprecedented levels of bandwidth and performance to the 4-way entry-level market.

Two front-side buses, both running at 133 MHz, provide 4.3 GB/s of bandwidth to four PA-8700 processors. The low-latency memory controller provides 4.3 GB/s of memory bandwidth to two 8-slot memory extenders. The I/O controller provides twelve 250 MB/s data channels, for an aggregate bandwidth of 3.2 GB/s distributed among the 10 PCI slots and multi-function core I/O.

**figure 2. hp server rp5405 architecture**



## low-latency memory access

The rp5405 supports one or two 8-memory-slot carrier boards, for a maximum of 16 memory slots. The memory is connected to the core electronics complex (CEC) through a low-latency/high-bandwidth bus. With approximately half the latency of HP’s previous generation K-Class server, the rp5405 can supply the CPU with requested data in a fraction of the time of competitive systems.

The rp5405 uses state-of-the-art synchronous dynamic random access memory (SDRAM) technology, available in 256 MB, 512 MB, 1 GB, and 2 GB DIMM pairs, all with advanced error-checking and -correcting (ECC) protection to detect and correct single-bit errors. The rp5405 supports up to 16 GB of total system memory.

The rp5405 CEC supports memory chip spare. This high-availability technology detects and corrects multiple-bit errors on memory DIMMs. With chip spare, any single DRAM chip can fail and the system will continue to operate normally. Chip spare is not supported on the 256 MB DIMM pair; it is, however, enabled and supported with 512 MB, 1 GB, and 2 GB DIMM pairs.

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.

**speeds and feeds**

**Table 1** shows the theoretical maximum bandwidth for various system buses. Theoretical maximum bandwidth is defined as the bus width multiplied by the frequency and number of buses.

**table 1. maximum bandwidth for rp5405 system buses**

	<b># of buses (or controllers)</b>	<b>maximum bus bandwidth</b>	<b>aggregate bus bandwidth</b>
<b>twin-turbo PCI slots</b>	2	500 MB/s	1 GB/s
<b>turbo PCI slots</b>	6	250 MB/s	1.5 GB/s
<b>shared PCI slots</b>	1	250 MB/s	250 MB/s
<b>core I/O</b>	1	250 MB/s	250 MB/s
<b>I/O subsystem</b>	1 (controller)	3.2 GB/s	3.2 GB/s
<b>memory subsystem</b>	2	2.15 GB/s	4.3 GB/s
<b>CPU buses</b>	2	2.15 GB/s	4.3 GB/s

## I/O subsystem design

The rp5405 contains ten PCI I/O slots. The top eight slots have hot-plug capabilities under HP-UX 11i. The eight hot-plug slots all have independent I/O channels. This independent design prevents slow cards from affecting the performance of a fast card. Not only does independence provide great performance, but it also provides error containment. For example, if a card hangs in slot 9, cards in slots 0–8 will still function properly. The first two hot-plug slots are twin-turbo slots, meaning they each have two dedicated 250 MB/s channels or a total of 500 MB/s per slot. These two slots should be reserved for the highest performing I/O cards, such as Fibre Channel, Gigabit Ethernet, or Hyperfabric controllers. The remaining six hot-plug slots are turbo slots, each with a single 250 MB/s channel.

In addition to the eight hot-plug slots, the rp5405 has two shared PCI slots. These slots share a single 250 MB/s channel.

All ten of the rp5405 I/O slots use HP-developed adaptive signaling technology to automatically match an I/O card's appropriate speed and data width. Therefore, all slots will accept 64- or 32-bit cards running at either 33 MHz or 66 MHz.

Figure 3 and Table 2 summarize the PCI slot architecture for the rp5405.

**figure 3. hp server rp5405 I/O subsystem**

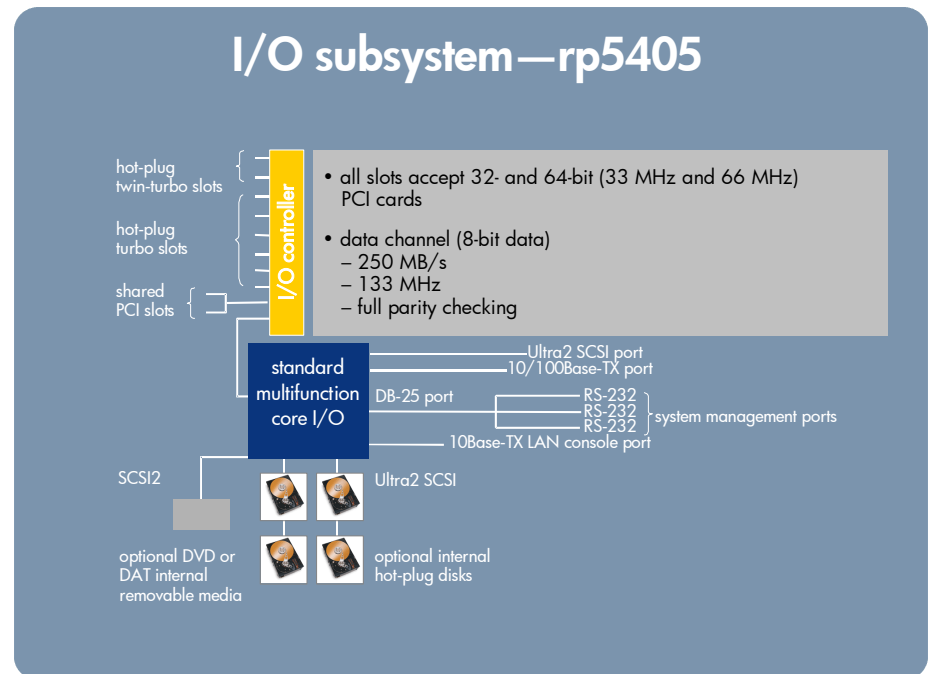




table 2. hp server rp5405 PCI I/O

	number of slots	hot plug	bandwidth per channel	bus width	signaling speed	slot keying	adaptive signaling
<b>twin turbo</b>	2	yes	500 MB/s	64 bits	66 and 33 MHz	5 volts	yes
<b>turbo</b>	6	yes	250 MB/s	64 bits	66 and 33 MHz	5 volts	yes
<b>shared</b>	2	no	250 MB/s	64 bits	33 MHz	5 volts	yes

## internal removable media

The rp5405 contains a single removable media bay that can accommodate either a DVD-ROM or DDS-3. The media bay is supported by one of two SCSI controllers located within the core I/O.

A dedicated single-ended (SE) SCSI channel connects the media bay to the controller. The removable media bay does not support hot-plug capability. The DVD-ROM drive provides access to 650 MB of data from one disk. The DVD-ROM drive provides enhanced features while preserving backward read compatibility with the CD-ROM. Data transfer rates of up to 6.75 MB/s are achieved with the DVD format; 4.8 MB/s can be achieved with the CD format.

The DDS-3 drive offered with the rp5405 provides storage capacity of up to 12 GB on a single tape. This drive can store up to 7.2 GB of data per hour, and automatic read-after-write verification helps to ensure the integrity of stored data. Read-write backward compatibility with DDS-1 and DDS-2 allows continued use of archive tapes.

## scalability

The rp5405 is designed without tradeoffs in CPU, memory, internal storage, or I/O expandability to offer the best scalability in the market.

- **CPU upgrades**—With an entry-level configuration of two CPUs and expandability up to four CPUs, the rp5405 offers great flexibility to cover a wide range of performance points. The rp5405 features the 650 MHz PA-8700 CPU.
- **memory upgrades**—The rp5405 memory subsystem is also designed for scalability. With 16 available slots, the servers range from a minimum of 4 GB to a maximum of 16 GB of main memory.
- **internal storage**—The rp5405 supports up to four internal hot-plug disk drives, which can be either half-height or low-profile form factors. Current disk offerings include 18, 36, and 73 GB Ultra160 disk drives. The maximum internal storage is 292 GB, via four 73 GB drives.

## rp5405 industrial design and packaging

### racking density

The rp5405 has been designed to fit into environments ranging from data centers to deskside. The industrial design is coordinated with other HP servers and peripherals for a consistent appearance.

The rp5405 is designed to provide unprecedented performance density that easily adapts to different environments. At 7 EIA units (1 EIA unit = 1.75 inches), up to five servers can be installed into a single 2-meter HP cabinet. With the high cost of computer room floor space, this small footprint dramatically lowers total cost of ownership.

The rp5405 is supported in A490xA and A189xA cabinets. When using the high availability slider rail, bolt-on anti-tip feet are required. When using the slider in A189xA cabinets, ballasts are required.

The rp5405 is also supported in a variety of third-party, non-HP racks and cabinets. Please refer to the HP-UX Servers Configuration Guide for the latest list of qualified third-party racks for the rp5400 series.

Note—dimensions for rack configuration:

H = 12.25 inches (311 mm)

D = 30.5 inches (775 mm)

W = 19 inches (482 mm)

### high-availability slider rails

There are two rail options, static or slider, available for racking the rp5405 into an HP cabinet. The high-availability (HA) slider rails were designed to allow easy service access to the system, as well as to enable the hot-plug capability of the I/O slots and the hot-swap of four fans in the side cavity. With the HA slider rail, the rp5405 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. The slider rails also contribute to a 100% improvement in “mean time to repair” over D- and K-Class servers. The high-availability slider rails are highly recommended.

Note—the slider mechanism occupies 1 EIA unit of rack space. When used with the rp5405, the combination will occupy 8 EIA units of rack space.

Static rails do not consume EIA space within the cabinet, therefore leaving more EIA space for peripherals. However, using static rails prohibits hot-plug of the I/O cards and hot-swap of the I/O bay fans.

### cabinet spacing requirements

The rp5405 requires a minimum of 24 inches (61 cm) of free space in both the front and rear of the cabinet for proper ventilation. During product installation and servicing, a total of 32 inches (82 cm) of free space is needed at the front of the cabinet.

The depth of HP A490xA cabinets is 39 inches (99 cm). Therefore, a minimum of 87 inches (221 cm) of total space is needed for each cabinet during normal operation. An additional 8 inches (21 cm) is needed during installation and servicing.

## **standalone/deskside configuration**

The rp5405 is also available in a standalone configuration when a cabinet is not desired. The standalone system is ideal for an office environment, under a desk, or on a shelf. The standalone configuration utilizes the same internal chassis and front plastic bezel as the racked version. However, a sheet metal cover, base, and casters are added for functionality and aesthetics. Casters can be removed when not desired.

Note—dimensions for standalone/deskside configuration:

H = 14.5 inches (368 mm)

D = 30.5 inches (775 mm)

W = 19 inches (482 mm)

## **high availability**

The rp5405 has numerous high availability features that are unmatched in the entry-level server market—features such as redundant hot-swap fans and power, hot-plug I/O and disks, memory scrubbing and page deallocation, memory chip spare, independent PCI slots, failure avoidance and notification capability, and MC/Serviceguard support. These features improve the availability level of the total system and are introduced in this section.

## **redundant, hot-swap power supplies**

HP power supplies have a long history of excellent reliability, and the redundant power supply option increases HP's commitment to even higher reliability and availability.

The rp5405 power subsystem holds a maximum of three hot-swap power supplies. These supplies are located in the very front of the server. Each supply is capable of sustaining 930 watts of output. The server comes standard with two power supplies. A third supply can be added for N+1 redundancy. The rp5405 comes standard with two power supplies; a third supply can be ordered for N+1 redundancy. Each power supply has its own power cord, which provides protection against losing the power from a single cord or breaker. To maximize availability, the power cords should be plugged into separate breakers whenever possible.

Because of the hot-swap capability, in the event of a power supply failure, the faulty supply can be removed and replaced without notifying the system. This, of course, is assuming that an N+1 condition exists.

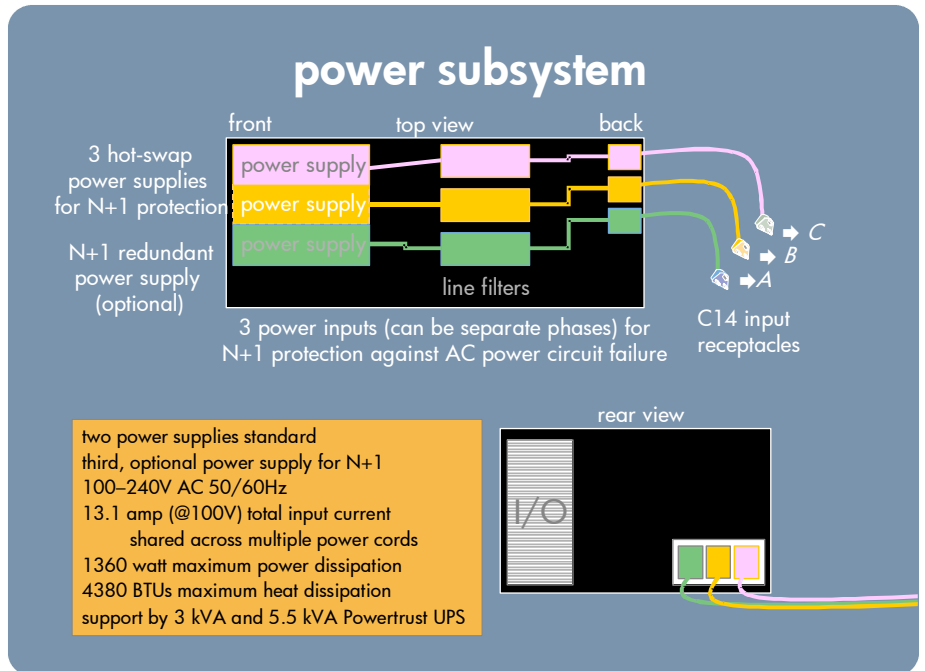
Exchanging a power supply in a running system involves opening the hinged, front plastic bezel. The failed power supply is easily identified and removed. The power supply is exchanged with a good one and the door is then closed to finish the process. The system will log a management code to indicate that redundancy is re-enabled. It is that simple.

There is another advantage for those customers with rigorous preventive maintenance programs. While the server continues to operate, the power supplies can be removed one-at-a-time and dust buildup can be vacuumed using proper electrostatic discharge (ESD) procedures.

## redundant power input protection

**Figure 4** contains a diagram of the rp5405 power subsystem. This section explains how customers can utilize these capabilities to achieve different levels of power input protection.

**figure 4. power subsystem**



The server has three AC input line cords to reduce single points of failure. Each line cord supplies power to one of the three internal power supplies. The system is designed to operate on nominal 100–240 VAC and 50- or 60-Hz power without line-select switches. Each power supply can draw up to 930 watts. Because the servers will continue to operate with two of the three supplies functioning, many possibilities exist for the customer to configure the AC input depending on the level of protection desired. If the site has very stable AC power, all three line cords could be plugged into the same power grid. For additional protection, a single uninterruptible power supply (UPS) could be utilized to supply power to all three cords if primary AC power should fail.

- The next higher level of protection is to have three branch AC circuits, one for each AC input. This reduces the dependency on single-point breaker failures and common wiring. Additional protection for this configuration would utilize three smaller UPSs.
- The highest level of protection is three electrical utilities that each supply a branch circuit. This approach is expensive but does greatly reduce single points of failure. Large sites with many systems may find this configuration cost-effective. For the ultimate protection of large sites, install a large UPS on each branch circuit.

## **redundant, hot-swap cooling**

The rp5405 contains eight hot-swappable fans to cool system components. The eight cooling fans (1 front-access, 4 side-access, 3 rear-access) are arranged in an N+1 configuration so any fan can fail and not impact system uptime. In the event of a fan failure, the faulty fan can simply be removed and replaced while the server continues to run. The design pairs the fans together. If one fan fails, the other speeds up to ensure adequate system cooling.

In addition, the server monitors ambient temperature and the power consumed within the box to determine the desired fan speed. By sensing the tachometer outputs from each fan, the actual speed is determined. Digital phase locked-loop (DPLL) circuitry is used to individually adjust the speed of each fan to the desired common speed.

These smart algorithms reduce unnecessary fan noise, power consumption, and wear while producing a very clear indication of a working, cooling subsystem. In the unlikely event of a fan failure, it will drop out-of-lock with the DPLL. The server signals a fan failure via chassis codes to the console and will light an LED on the failed fan assembly.

There is another advantage for those customers with rigorous preventive maintenance programs. While the server continues to operate, the fans can be removed one-at-a-time and dust buildup can be vacuumed using proper ESD procedures.

## **main memory—advanced ECC and parity**

Data stored in the main memory is protected by error checking and correcting (ECC) and address/control parity. The ECC design provides memory scrubbing and page de-allocation functionality that will tolerate typical hard 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 256 MB, 512 MB, and 1 GB DIMMs use x4 SDRAMs to store each bit of a word, including its ECC bits, in a different SDRAM within the DIMM pair. 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 and on each memory carrier on each DIMM.

## memory chip spare technology

Chip spare is the ability of the system to continue to run in the face of any single- or multi-bit chip error on a DRAM. DRAMs are basically N+1 per memory word. This functionality is essential in the design of reliable memory systems. Systems without chip spare functionality are doomed to fail at an alarming rate when compared to HP servers deploying chip spare.

The 256 MB DIMM pair (product A5554A) does not support chip spare. To ensure maximum memory availability, users should add 512 MB, 1 GB, or 2 GB memory modules only.

## hot-plug disk drives

The rp5405 has four embedded SCSI disks accessible from the front of the server. These disks can be removed and inserted while the server continues to operate. This operation is called hot-plug, and it is different from hot-swap.

During both hot-plug and hot-swap operations, the power remains on and the system continues to function. However, hot-swap means that the assembly can be removed, added, or replaced without informing the system. Hot-plug requires the assembly to be deconfigured before removal and reconfigured before the system can utilize the newly inserted assembly. Because disks have unique information stored on them, hot-plug methods are used. Fans and power supplies are hot-swap assemblies.

Two dual-channel SCSI controllers manage the four internal hot-plug disks. For added availability, disk pairs are on separate channels as well as separate SCSI controllers. Thus, with disk mirroring, a SCSI controller, SCSI channel, or root disk could fail and the server would continue to run properly.

The rp5405 contains circuitry to properly control the disk's power and reset during the hot-plug operation. Either system administration manager (SAM) or the MESA suite of online diagnostic software can be utilized to effectively deconfigure and reconfigure the disk.

Another advantage for those customers with rigorous security programs is the ability to completely remove and isolate disks in a disaster- and theft-safe environment.

## hot-plug PCI I/O slots

The ability to hot-plug PCI cards offers excellent flexibility for adding, reconfiguring, and maintaining I/O functions while the system continues operations. No reboot is required.

The I/O card bay is located at the right rear of the chassis. The I/O bay supports up to 10 PCI cards. Access to the I/O bay in rackmounted systems utilizing the high-availability slider rail is achieved by sliding the server forward. Special features on the chassis, along with custom rack rails, allow the unit to move safely and smoothly during online service with all cables still attached. Once the system is slid into the service position, the I/O bay cover can be removed to gain side access to the PCI cards. In the standalone configuration, the outer shell is removed to gain access to the I/O bay.

The rp5405 has ten PCI I/O slots, and eight of those slots are hot-plug capable. Each hot-plug slot supports 64-bit × 66 MHz PCI cards running at full speed and is connected to the I/O controller via an independent channel. This independent design prevents slow cards from affecting the performance of a fast card. Not only does independence provide great performance, but it also provides error containment. For example, if a card hangs in slot 10, cards in all other slots will still function properly. The highest-performing cards should always be placed in these independent slots.

The PCI cards are spaced on a 0.9-inch pitch to allow for special hot-plug features and increased PCI reliability. Extra airflow holes between bulkheads more than double PCI airflow. Between the PCI slots, I/O card separators prevent electrical shorting and exposure to hazardous energy during hot-plug installation and removal. Locking features are designed into the main chassis to eliminate the need for individual PC board bulkhead screws, thus removing a potential electrical safety hazard.

Hot-plugging I/O cards have both hardware and software components. The hardware requirements are met by the electronics on the I/O backplanes and by mechanical design in the I/O cardcage. Bus idling, slot-to-slot electromechanical isolation, per-slot power and reset control, and visual indicators are all components of the total hot-plug hardware solution. With associated software, any card located in a hot-pluggable PCI slot can be removed, replaced, or added without power cycling, rebooting the system, or impacting the operation of other I/O transactions.

Please note that software support for hot-plug I/O is available in HP-UX 11i, but not in HP-UX 11.0.

## **dynamic processor de-allocation and resilience**

Every rp5405 has the capability for Dynamic Processor De-allocation and Resilience. Incorporated into HP-UX 11 is the capability to take a processor out of service while the system is running, without interruption to applications. This technology is referred to as Dynamic Processor De-allocation. Once a processor is de-allocated, the HP-UX operating system will migrate all application processes that are currently scheduled on that processor to other active processors. Note that if the processor has been assigned to handle interrupts for any I/O drivers, it will continue to do so while it is de-allocated.

The rp5405's PA-RISC processors have the ability to detect and correct single-bit cache errors. The embedded 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 De-allocation facility. This technology is referred to as Dynamic Processor Resilience.

## manageability and support

### LED event notification

The rp5405 has many features to minimize the effort required to manage one system or an entire computer room. The server simplifies system management in several aspects: event notification, automatic error handling, power monitoring, and user interface to system management.

For an operator who is physically present, the simplest and easiest way to check system status is by quickly glancing at the status LEDs on the front of the system. The five LEDs each have a specific meaning:

- Power—power is present and on, and power supplies are functioning properly
- Remote—remote console is enabled
- Run—system is up and running
- Attention—occurrence of a non-catastrophic event (for example: failure of an N+1 component)
- Fault—occurrence of a catastrophic system event

In addition to the five specific meanings of the LEDs, related system status is encoded based on whether the LED is solid or flashing. Examples include unexpected reboot system recovered, operating system not running, and operator intervention required.

### event monitoring service

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 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.

How it works:

- A hardware event monitor detects abnormal behavior in one of the hardware resources (devices) it is monitoring.
- The hardware event monitor creates the appropriate event message, which includes suggested corrective action, and passes it to the EMS.
- EMS sends the event message to the system administrator using the notification method specified in the monitoring request (for example: e-mail, message to the console, entry in a system log).

The system administrator (or HP service provider) receives the message, corrects the problem, and returns the hardware to its normal operating condition.

- If the peripheral status monitor (PSM) has been properly configured, events are also processed by the PSM. The PSM changes the device status to DOWN if the event is serious enough. The change in device status is passed to EMS, which in turn alerts MC/Serviceguard. The DOWN status will cause MC/Serviceguard to failover any package associated with the failed hardware resource.



The monitors can also poll hardware, disks, clusters, network interfaces, and system resources and send information to the framework. An “event” can be simply defined as something you want to know about—for example, a disk failure or file space dropping below a predefined level.

The primary EMS benefits include:

- Enables efficient and effective system monitoring within a single, comprehensive framework
- Delivers the ability to tailor the monitoring system to fit specific needs
- Provides a wide variety of notification methods through multiple protocols (SNMP traps, TCP, UDP, OPC messaging)
- Provides immediate alerts if a component fails, enabling proactive replacement
- Integrates with HP MC/Serviceguard and Serviceguard OPS Edition to provide a complete high-availability solution

## **extended fault management system**

The rp5405 employs a dedicated processor to aid system management and diagnosis. The extended fault management system can diagnose a system failure even in the unlikely event that the system is unable to execute code. It allows system power to be remotely turned on or off, and it has battery backup that even allows diagnosis of power failures. The system interfaces with key components via an inter-integrated circuit (I<sup>2</sup>C) bus to continually monitor the status of system fans, temperature, and power supplies; it signals the operator if any significant system events occur.

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
- 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
- Password security (same level as UNIX®)

## system platform monitor

Closely integrated with the extended fault management system is the system platform monitor. The system platform monitor controls and monitors system power and cooling. Aspects controlled and monitored by the system platform monitor are:

- Power supply status and temperature
- System supply voltages—including remote system power on and off
- Total system power consumption
- Individual Processor Support Module status
- External ambient air temperature
- Individual fan speed and status

Various temperatures are monitored to control the system fans, provide thermal warnings, and prevent permanent damage from overheating by graceful shutdown if the temperature is too high. (Note that the system fans are run only as fast as necessary to keep the system cool. The fans are kept in sync with each other, turning at exactly the same rate. This intelligent fan control allows the server to generate as little noise as possible while maintaining an optimum operating environment to maximize reliability.)

The power monitor senses the presence of power supplies and the power consumption of system components to determine if the system is in an N or N+1 power configuration; it can determine:

- Number of bulk power supplies
- Number of CPUs
- Amount of memory present
- Number and power consumption of each installed PCI I/O card

System configuration and health is tracked by the system platform monitor and passed via a dedicated I<sup>2</sup>C bus to the fault management processor. This information can be processed as follows: simply displayed on the system console, logged to an event file, or used to trigger an alert based on a specific threshold (system temperature, fan status, or power supply status, for example).

## **built-in Web console**

The rp5405 has integrated Web console functionality which allows management of many systems from a single Internet browser. The Web console is embedded into the fault management processor and can be accessed through the core 10/100Base-TX management LAN. The external HP Secure Web Console box that shipped with older-generation HP servers is no longer needed. The Secure Web Console allows an Internet browser to be used as a system console, giving total system access to authorized system administrators anywhere, just as if they were at an ASCII console. A high level of password protection is used to control access to the Web console.

Major features of Secure Web Console include:

- System management over the Internet or intranet
- Mirrored access—up to four operators can simultaneously share the same screen and keyboard
- SSL encryption
- 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
- Easy installation—just connect the console port to a LAN; there is no client software to install
- Support for HTTP, FTP, TFTP, and other key Internet standards

## **LAN console**

The server 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 consoles**

For users who wish to locally administer their systems, the rp5405 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 access**

As with previous HP server systems, an RS-232 interface for a remote console is useful for obtaining help from HP service experts. Customers need only add a modem to allow remote access via phone; security is ensured by having to explicitly enable remote console access, which is protected with a password, and via dial-back phone verification.

## **self-diagnosis**

Many features have been designed into the server to maximize system uptime. There are several aspects to maximizing uptime: eliminating common single points of failure, allowing the system to continue running after some errors, and allowing quick identification and servicing of hardware faults if they do occur.

Besides using traditional diagnostic software, the server also continuously monitors system health with the platform monitor. Knowing a failure has occurred that reduces N+1 protection is important. It is important to minimize the risk of downtime by replacing a failed component as soon as possible to get back to the safety of an N+1 configuration.

The rp5405 has extensive firmware-based self-tests. These diagnostics are evoked on power-up or reset. The self-tests check for correct system operation prior to booting the operating system. The firmware diagnostics first check the processors, then processor caches and memory, and finally I/O devices. Testing complexity increases as more of the system is proven good and more pieces of the system can be relied upon to increase test coverage on the remaining parts. Self-test failures are reported to the system console and the support processor, along with failure specifics and recommended corrective action.

## online and offline diagnostics

The rp5405 also offers traditional online and offline diagnostics to validate system health and provide extensive system fault coverage.

With online diagnostics, the system is tested while the operating system and applications continue to run. This allows basic testing of system components that are not currently being used, or it allows testing in situations where the testing does not prevent continued use of the operating system and applications.

Offline diagnostics provide increased coverage of system components for improved fault isolation and intensive system testing before returning to production.

## ordering information

The HP Server rp5405 can be ordered with two pre-integrated configurations. These configurations were chosen to allow ease of ordering and rapid deployment. Anything not included in the standard configuration can be ordered as a standalone accessory, including HP-UX operating environments. Standalone accessories will not be factory-integrated.

### hp server rp5405 standard configurations

hp server rp5405	A7117A	A7118A
<b>CPU</b>	2 x PA-8700 650 MHz	4 x PA-8700 650 MHz
<b>processor support module</b>	1	2
<b>memory carrier boards (A6155A)</b>	1	2
<b>memory</b>	4 GB (8 x 512 MB DIMMs)— 1 full memory carrier board	16 GB (16 x 1 GB DIMMs)— 2 full memory carrier boards
<b>disk</b>	2 x 36 GB 10K	2 x 36 GB 10K
<b>power supplies</b>	2—must order additional power supply (A5527A) for N+1 redundancy	2—must order additional power supply (A5527A) for N+1 redundancy

## for more information

HP product information and technical documentation is available online at:

<http://www.hp.com/go/rp5405>

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