

HP Integrity rx2800 i2 Server

Achieve high performance with the leading mission-critical rackmount server

Technical white paper

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Executive summary

The HP Integrity rx2800 i2 Server is a cost-effective, high-capacity 2U rack-mount platform that provides 8-core scalability in 3x less compute density without sacrificing reliability, availability, and serviceability (RAS). With Integrity rx2800 i2 Server, HP continues the tradition of delivering servers that provide flexible capacity, secured availability, and simplified management to customers while meeting customers' goal of keeping costs in check. At the same time satisfying the increasing and often varying demands of their technology operations.

The overarching goal of the HP Integrity rx2800 i2 Server is to deliver efficient, powerful systems that can be deployed in multiple environments and applications through a balanced system design. The HP Integrity rx2800 i2 Server provides higher levels of availability and scalability and increased internal expansion and performance.

The HP Integrity rx2800 i2 Server incorporates new, powerful quad-core Intel® Itanium® processors that draw less power per core than previous Intel Itanium processors. HP system designers have also engineered these servers to use new memory (DDR3) and hard disks (2.5-inch Serial Attached SCSI [SAS] drives) that require less power while providing increased performance. The result is efficient and more powerful servers.

The HP Integrity rx2800 i2 Server has mission-critical availability and scalability and supports Dynamic Processor Resiliency (DPR), which is the ability to take a failed processor offline without taking down the entire system. The server supports new advanced RAS features such as Intel Cache Safe technology, advanced machine check architecture, and error checking and correction (ECC) on all major structures on the processor. It also has double DRAM data correction (which reduces DIMM replacements by 17 times over single chip spare and is 1,200 times better than single-bit ECC), and proactive hardware memory scrubbing.

The HP Integrity rx2800 i2 Server supports up to 96 GB (192 GB when 8 GB DIMMs becomes available) of main memory, eight internal hard disk drives, four integrated 1 GbE LAN ports, and six high bandwidth I/O expansion slots. Compared to the previous generation, HP Integrity rx2800 i2 Server has expanded memory, networking, I/O expansion, and disk capacity while maintaining the same 2U footprint. In other words, rx2800 i2 does more for less.

If you are considering upgrading to a next-generation server, this paper is intended to highlight some of the features and capabilities of the HP Integrity rx2800 i2 Server to aid in your evaluation.

Specifications for the HP Integrity rx2800 i2 Server

The HP Integrity rx2800 i2 is a symmetrical multiprocessing (SMP) server that supports up to two high-performance 64-bit Itanium processors. The server offers yet another level of entry-class value by providing flexibility and 8-core scalability in 3x less compute density without sacrificing RAS. At only 3.5 inches (89 mm) the HP Integrity rx2800 i2 Server supports two dual-core or two quad-core Intel Itanium processors, can be configured with up to 96 GB¹ of RAM, supports eight 2.5-inch hot-pluggable SAS disk drives, and offers a choice of I/O expansion riser cards.

The HP Integrity rx2800 i2 Server also includes extensive availability and management features, which makes it ideal for deployment in mission-critical data centers or computation-intensive server farms. Features such as hot-swappable redundant power and fans, double DRAM data correction, an Integrity Integrated Lights-Out 3 (iLO 3) management processor, dynamic processor resiliency and de-allocation, advanced ECC protected DDR3 memory, and high-availability clustering support makes the HP Integrity rx2800 i2 ideal for nearly any computing environment.

¹ Maximum memory of 192 GB will be supported with 8 GB DIMMs post initial shipment.

HP Integrity rx2800 i2 Server also provides operating systems flexibility by offering the following 64-bit operating systems:

- HP-UX 11i V3
- OpenVMS v8.4²
- Microsoft® Windows® Server 2008 R2³

The server can be installed in a rack or in a stand-alone pedestal configuration, along with a host of choices from the full range of HP storage peripherals and I/O adapters.

Figure 1: The HP Integrity rx2800 i2 can be installed in a rack or as a stand-alone unit.



Product specifications

- Central processor
 - One or two dual-core series 9300 Intel® Itanium® processors at 1.6 GHz
 - One or two quad-core series 9300 Intel® Itanium® processors at 1.33 GHz or 1.6 GHz
 - Floating point coprocessor included in all processors
- Cache
 - Level 1 Cache: 32 KB per core; 16 KB instruction/16 KB data
 - Level 2 Cache: 512 KB instruction/256 KB data per core
 - Level 3 Cache: 10 MB/5 MB per core (1.6 GHz dual-core processor)
 - Level 3 Cache: 16 MB/4 MB per core (1.33 GHz quad-core processor)
 - Level 3 Cache: 20 MB/5 MB per core (1.6 GHz quad-core processor)
- All processors support
 - Single-bit cache error correction
 - 50-bit physical addressing
 - 64-bit virtual addressing
 - 4 GB maximum page size
 - Error protection on all major data structures
 - Intel Hyper-Threading
 - Intel Advanced Thermal Management (Foxton/VFM)
 - Intel Cache Safe Technology

² Will be supported post initial shipment.

³ Will be supported post initial shipment.

- Main memory
 - Twenty four DDR3 DIMMs operating at 800 MT/s
 - 4 GB to 96 GB maximum (with 4 GB DIMMs) DDR3 memory in 24 DIMM slots (DIMMs must be installed in pairs). Maximum memory will increase with future support of 8 GB and 16 GB DIMMs
 - Double DRAM data correction is not supported with 2 GB DIMMs
- Choice of form factors
 - Rack mount
 - Stand-alone (vertical mount)
- I/O expansion slots: two I/O risers provide up to 6 PCI-E Gen2 slots, each riser has two riser card options
 - 3-Slot Riser Card: Two half-length/full-height x4 speed/x8 connector slots, and one full-length/full-height x8 speed/x16 connector slot
 - 2-Slot Riser Card: One full-length/full-height x8 speed/x16 connector slot, and one half-length/full-height x8 speed/x16 connector slot
- Hot-plug disk drives (eight bays for 2.5-inch SAS disks)
 - 2,400 GB maximum internal storage with 300 GB SAS disk drives. Future support of up to 600 GB SAS disk drives will increase the maximum internal storage to 4,800 GB
 - An embedded Smart Array P410i 6 GB SAS RAID Controller provides 8 ports, 1 port per SAS disk, for point-to-point connection from the controller to the disk. This means that each disk has its own 6 GB link. The SAS RAID Controller can be configured in either host bus adapter (HBA) mode or in RAID mode. In HBA mode the disks are used as raw devices rather than being configured as a RAID volume
 - When the controller is configured in RAID mode, the maximum of eight disks can be configured for RAID 0, 10, 5, 50, 60, and ADG RAID 0 requires one drive, RAID 10 requires two identical HDDs, RAID 5 requires at least three identical HDDs, and RAID 60 requires at least four identical HDDs. An optional SAS 512 MB Cache and Super Cap kit (AM252A) is available for all RAID options; it is required for RAID 60 and ADG⁴. RAID 60 and ADG requires Advanced Park license
 - HP MirrorDisk/UX is available for software mirroring on all HDDs in HP-UX-based systems
 - Available disk sizes⁵: 72 GB, 146 GB, and 300 GB
- Removable media
 - One slimline media bay for optical media drives
 - Choice of DVD-ROM or DVD+RW drive
- Core I/O interconnect ports
 - Four 10/100/1000Base-TX LAN (automatic speed sensing, RJ-45 connector, Wake-On-LAN capability)
 - HP Internal 8-Port Smart Array SAS Controller, which supports up to eight internal 2.5-inch SAS disks
 - One general-purpose RS-232 serial port
 - Five USB Series A ports (USB 1.1 compatible); two front, two rear ports, and one internal
 - Two VGA ports; one front and one rear

⁴ Will be supported post initial shipment.

⁵ 450 GB and 600 GB post initial release.

- HP Integrity Integrated Lights Out 3 (iLO 3) Management Processor Functionality
 - Dedicated 10/100/1000Base-TX LAN port for LAN console and embedded web console access
 - One RS-232 serial port for local console
 - Password protected console ports
 - Console mirroring between all local, modem, LAN, and web consoles
 - Remote power up and power down control
 - Event notification to system console. Provides connectivity, information, and support for HP-UX tools, such as STM and EMS, to notify by email, pager, and/or HP Response Centers
 - Interface to system monitoring and diagnostic hardware via an internal IC bus
 - Secure Sockets Layer security on web console
 - iLO 3 Advanced Pack (included with every rx2800 i2 Server): Provides additional remote management capabilities, including LDAP directory services, Virtual Media (CD, DVD, and ISO image) for HP-UX, Windows, and Linux and Integrated Remote Console (Virtual Keyboard, Video, and Mouse) for Windows
 - The RN50 integrated chip provides basic graphic capabilities. One VGA port is supported with optional connection from front or rear of the system
- Power and cooling
 - Standard: One hot-swappable power supply (800 W at 90 V to 132 V AC input/1200 W at 180 V to 264 V AC input)
 - Optional: Second hot-swappable power supply (800 W at 90 V to 132 V AC input/1200 W at 180 V to 264 V AC input) for N+N redundancy
 - Fully redundant system fans, which are data center environment aware with rotation speed based on environmental factors including temperature of air inside and outside chassis
 - “Sea of Sensors” same as ProLiant G6 and G7 products
 - Thermal Sensors on every DIMM and, IOH, processor
 - Altitude sensor
 - Inlet and outlet air temperature sensor
- Power requirements
 - Input current: 100 V to 127 V, 10A/200 V to 240 V, 7A (auto-ranging)
 - Line frequency: 47 Hz to 63 Hz

Physical and environmental specifications

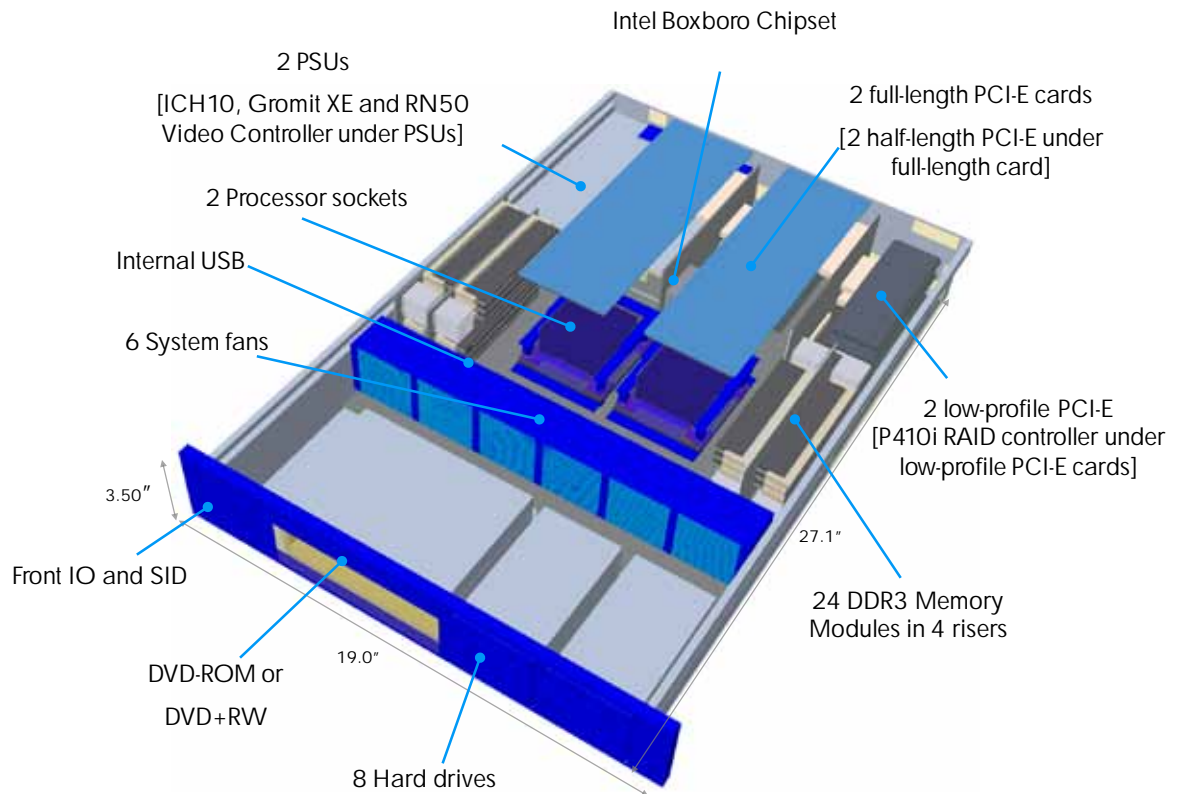
- Altitude
 - Operating: 3,000 m (10,000 ft) maximum
 - Storage: 4,600 m (15,000 ft) maximum

- Temperature
 - Operating: +41 °F to +95 °F (+5 °C to +35 °C)
 - Non-operating: -40 °F to +158 °F (-40 °C to +70 °C)
- Humidity
 - Operating: 15% to 80% relative (non-condensing)
 - Storage: 90% relative (non-condensing) at +65 °C
- Acoustics (operator/bystander) at 25 °C
 - Maximum configuration for rack-mount form factor (disk active): 7.1 Bels LwA
 - Maximum configuration for pedestal form factor (disk active): 6.0 Bels LwA or less
- Physical dimensions in rack orientation
 - Height: 86 mm (3.4 inches)/2U
 - Width: 482 mm (19 inches)
 - Depth: 692 mm (27.25 inches)
- Physical dimensions in stand-alone, vertical orientation
 - Height: 512 mm (20.2 inches)
 - Width: 275 mm with the feet (10.8 inches with the feet)
 - Depth: 710 mm (28.0 inches)
- Net weight
 - Minimum rack-mount configuration: 21 kg (46.2 lb)
 - Maximum rack-mount configuration: 30 kg (75 lb)
 - Minimum stand-alone configuration: 34 kg (75.0 lb)
 - Maximum stand-alone configuration: 43 kg (94.8 lb)

Mechanical design and packaging

The view shown in Figure 2 reveals the location of major components and the mechanical and architectural features of the HP Integrity rx2800 i2 Server. The system is partitioned into a system board (including processors and core I/O), the memory expansion board, and the I/O expansion board.

Figure 2: Major components of the HP Integrity rx2800 i2 Server



The HP Integrity rx2800 i2 Server occupies 2U or 86 mm (3.4 inches) of rack height, is 482 mm (19 inches) wide, EIA rack compatible, and meets or exceeds all regulatory and safety requirements, including HP environmental tests.

All external cabling enters and exits from the rear of the enclosure. A cable-management arm manages the cable routing. When the server is installed in a rack, services access to the system is enhanced by using chassis slides. The system status indicator and a power switch are on the front of the enclosure, and each individual customer replaceable unit (CRU) has its own set of status indicators located on a Systems Insight Display (SID) panel on the front bezel.

Eight 2.5-inch SAS hot-pluggable hard disk drives, which are arranged horizontally on the right side, are conveniently accessible from the front of the system. A system-power LED, health LEDs, and a locator LED are located next to the Systems Insight Display panel. The power button and the unique identifier (UID) button are located on the front panel. Also, to the left of the front panel above the fan grill, is a slimline DVD drive bay.

Six N+1 redundant, hot-swappable fan pack assemblies cool the HP Integrity rx2800 i2 Server. They are serviced from the top of the chassis by simply removing the cover panel. The replacement operation must be completed within a specified amount of time. The server fans provide excellent cooling by pulling cool air from the front of the unit, enabling the air to flow over internal system components, and then discharging heated air out of the back of the server. The system can sustain one fan failure while continuing to cool the system.⁶

The processors and memory modules are serviced from the top of the chassis as well. The HP Integrity rx2800 i2 Server supports four memory risers with each riser supporting up to six DDR3 memory DIMMs.

The HP Integrity rx2800 i2 Server is designed to provide high availability with 1+1 power redundancy. The redundant N+N hot-swappable power supplies are serviced from the rear (as viewed from the back) of the chassis. To further enhance availability, each power supply has its own dedicated power feed or line cord. Cords can be plugged into separate power grids for maximum level of power protection. The power supplies are power factor corrected.

Architectural Overview of the HP Integrity rx2800 i2 Server

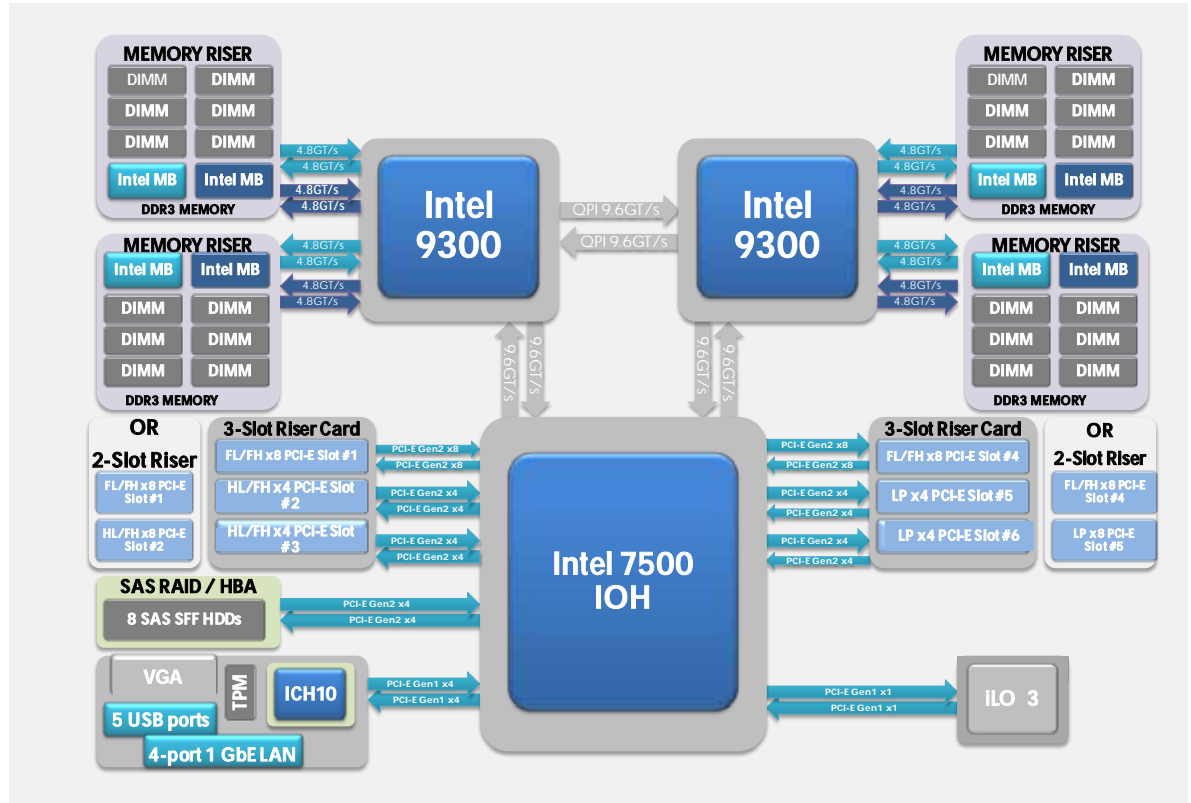
As shown in Figure 3, the HP Integrity rx2800 i2 Server supports one or two dual-core or quad-core Intel Itanium 9300 series processor modules. The two processors are linked together by a full width Intel QuickPath Interconnect (QPI) links providing 19.2 GB/s of bandwidth. Each processor module contains two memory controllers, with an aggregate bandwidth of 28.8 GB/s, and supports up to 12 DDR3 memory DIMMs resulting in up to 24 memory DIMMs in total for the HP Integrity rx2800 i2 Server.

The I/O subsystem is composed of integrated multi-function Core I/O and two I/O riser expansion slots. Each I/O expansion slot supports a 3-Slot Riser Card and a 2-Slot Riser Card. The 3-Slot Riser Card is provisioned with one x8 and two x4 Gen2 PCI-E links. The 2-Slot Riser Card is provisioned with two x8 Gen2 PCI-E links. Thus, HP Integrity rx2800 i2 can support up to 6 PCI-E Gen2 slots with each x8 Gen2 slots providing a raw total aggregate bandwidth of 10 GB/s and each x4 Gen2 slots providing a raw aggregate bandwidth of 5 GB/s (send and receive).

The HP Integrity rx2800 i2 supports up to eight internal Serial Attached SCSI (SAS) 2.5-inch hot-pluggable small form factor hard disk drives. An internal 8-port host bus adapter provides 8 ports, 1 port per SAS disk, for point-to-point connection from the adapter to the disk. This means that each disk has its own 6 GB link. The manageability subsystem also resides on the server, and the server also provides serial, USB, and VGA ports on the front of the server for service and support.

⁶ Redundant fan option does not apply to Office Friendly Version of Integrity rx2800 i2.

Figure 3: The HP Integrity rx2800 i2 Server architecture diagram.



The Quad-Core Intel Itanium Processor

The quad-core Intel Itanium 9300 series processor is the world's first 2 billion transistor microprocessor. Significant improvements in Itanium 9300 series processor include doubling the number of processing cores to 4, significant increase in bandwidth, greater physical memory capacity, and next-generation reliability, availability, serviceability (RAS), and manageability features.

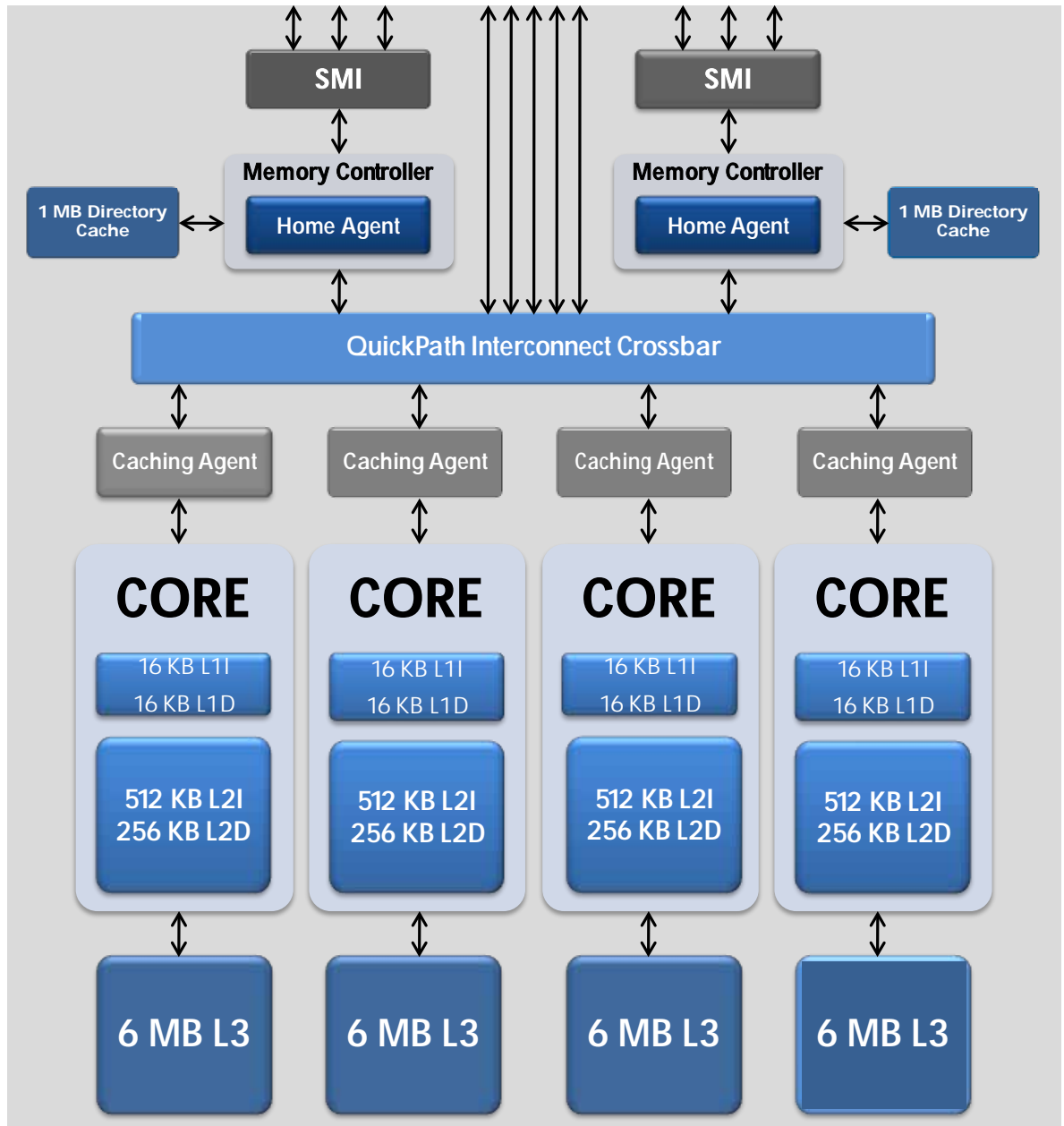
Each Itanium 9300 series processor module can host up to four processing cores, contains two memory controllers with an aggregate bandwidth of 28.8 GB/s, and features Intel QuickPath Interconnect technology to boost bandwidth between processors, memory, and I/O subsystems.

Multilevel caches

Intel Itanium 9300 series processor has a three level cache hierarchy as shown in Figure 4 below.

- An on-core 32 KB Level 1 (L1) cache split into 16 KB for instruction and 16 KB for data. The L1 cache can deliver six instructions every clock cycle.
- The on-core Level 2 (L2) cache is organized as 512 KB instruction and 256 KB data caches.
- Each processor core features up to 6 MB Level 3 (L3) cache. All L3 caches amount to a total of up to 24 MB per processor socket.
- Each memory controller also features a 1 MB directory cache.

Figure 4: Intel Itanium 9300 series processor hierarchy diagram.



Hyper-Threading

With four multi-threaded cores, each Itanium 9300 series processor can execute up to eight simultaneous software threads. Thread management has improved compared to previous Itanium generations. Earlier thread switching occurred when a thread was stalled due to a high-latency event such as waiting for data from main memory. Itanium 9300 series processor supports switching for medium latency events and for spin-lock loops. This and other enhancements to thread switching logic help to boost core utilization. This feature improves application response time and overall system throughput.

Turbo Boost technology

Intel Turbo Boost technology allows low activity factor workloads (such as workloads that are not heavily floating point including TPC-C/TPC-H to run at a faster clock speed). Turbo Boost is engaged by default. It automatically increases the clock frequency and voltage of active cores operating below power and thermal design points determined by the processor. Turbo Boost technology is operating-system independent, which means that Advanced Configuration and Power Interface-aware (ACPI) operating systems require no changes to support it.

Integrated Memory Controllers and Scalable Memory Interconnect

Communication channels between the processor cores and main memory have been dramatically improved. Each processor has two integrated memory controllers that provide peak memory bandwidth up to 34 GB/s, which is up to six times the bandwidth of the previous generation processor. The Scalable Memory Interconnect (SMI) connects to the Intel Scalable Memory Buffers to support larger physical memory configurations. The memory subsystem supports up to eight times more memory than previous generations using DDR3 memory components.

Enhanced Instructions-Level Parallelism

Instructions-level parallelism (ILP) refers to the ability to process multiple instructions on each software thread. Itanium 9300 series processor disperses instructions to 11 functional units, via a six-instruction wide and eight-stage deep pipeline. To minimize threads from stalling the pipeline, the processor supports zero-cycle load-use penalties and zero-cycle branch re-steers plus extensive bypasses.

QuickPath Interconnect architecture

Each QuickPath Interconnect (QPI) consists of two unidirectional links that operate simultaneously in opposite directions using differential signaling. Unlike a typical serial bus, the QPIs transmit data packets in parallel across multiple lanes, and packets are broken into multiple parallel transfers. Each link is comprised of twenty 1-bit lanes. Maximum of 16 bits (2 bytes) are used to transfer data while error correction functionality uses the remaining 4 bits. The link allows a maximum of 9.6 GB/s data transfer in each direction, for a total bandwidth of 19.2 GB/s. If an application requests data from the memory of another processor, the QPI uses high-bandwidth inter-processor communication to retrieve the data.

Thermal logic technologies

Itanium 9300 series processor provides enhanced power and thermal management features. Enhanced demand-based switching (DBS), where voltage and frequency are modulated, enables better energy efficiency. Voltage and frequency settings are adjusted dynamically to provide best performance without exceeding maximum power. Performance is improved by monitoring 120 events in each core and adjusting the core voltage and frequency every 6 μ s (micro-seconds). This function can be used in conjunction with DBS to optimize performance versus power.

Processor RAS improvements

Itanium 9300 series processor extends the mainframe-class reliability, availability, and serviceability features from previous Itanium processors. The Itanium 9300 series processor incorporates extensive capabilities for detecting, correcting, and reporting processor soft and hard errors.

Major core structure improvements include:

- **Soft Errors:** High energy particles striking a processor may cause a logic gate to switch state, resulting in a soft error. Itanium 9300 series processor circuit topologies were designed to improve resistance to soft errors in latches by up to 100 times from any regular latch. Registers are less susceptible than standard registers to soft errors.
- **Error Correction Code or Parity:** All major structures on the Itanium 9300 series processor are protected via ECC or parity error protection.
- **Intel Cache Safe Technology:** Heuristics are used to monitor the number of errors per cache index and map out bad cache lines. Cache data is also automatically scrubbed to correct single bit errors. Itanium 9300 series processors protect the second and third-level cache arrays. Previous Itanium processors only protected the third-level cache.
- **Advanced Machine Check Architecture (AMCA):** This enables coordinated error handling across the hardware, firmware, and operating systems. The coordinated handling greatly reduces the likelihood of data corruption. It also improves the reliability of the system since firmware and OS participate on the system recovery, from otherwise uncorrectable errors.

Memory RAS features

Extensive RAS features are integrated to detect and correct errors on the memory subsystem.

- **DRAM ECC:** By using memory DIMMs whose base DRAM x4 bits wide, the subsystem corrects single (SDDC) and double device data correction (DDDC). This means that the memory subsystem can map out two failed devices and continue correcting single bit errors. There is no performance penalty for mapping out the devices.
- **Memory Scrubbing:** Accumulated memory DIMM errors can result in multi-bit errors that cannot be corrected and can result in data corruption. Memory scrubbing finds memory errors before they accumulate. Corrected data is rewritten back to the appropriate memory location.
- **SMI Memory Channel Protection:** Cyclic Redundancy Check is used to detect errors in the Scalable Memory Interconnect channels. Upon errors, the transactions are retried several times. If required, the channel could be re-initialized on the fly. Upon problem persistence, the affected memory channel is mapped out.

Intel QuickPath Interconnect RAS features

Extensive RAS features are integrated to detect and correct errors on the memory subsystem.

- **Error Detection and Correction:** Cyclic Redundancy Check (CRC) is used to detect errors—transactions can be retried multiple times, the channel can be physically reset on the fly by the link layer, and bad lanes can be failed over.
- **Lane Failover:** During operation, failed lanes would cause CRCs that would trigger an “on the fly” link retraining where the bad lane is mapped. Operations are resumed with a reduced width link. Although mapping out lanes may affect the performance by reducing a full-width link to half or half-width to quarter-width, it does enable uninterrupted operation and protection against most multi-bit hard errors.

Embedded Server Management and Integrity iLO 3

The Integrity Integrated Lights-Out 3 (iLO 3) management processor provides the highest level of system management and high-availability monitoring. The processor provides remote interface to manage system resources, diagnose the health of the system, and facilitate system repair. System administrators can interact with the iLO 3 management processor on a dedicated, out-of-band (independent of the main system data paths) communication link that can be accessed through RS-232 serial port or a 10/100/1000Base-TX management LAN.

The Integrity iLO 3 management processor reduces or eliminates the need for the system administrator to be physically present at the system to perform tasks such as diagnostics, system management, or even hard resets. The management processor has its own battery backup, so it can be accessed even in the unlikely event that the main system power is out and the operating system has stopped functioning.

The Integrity iLO 3 management enables the following features and more:

- Faster (compared to iLO 2) processor
- 3x virtual media performance
- Out-of-band manageability and system firmware update
- System management over the Internet or Intranet (web console)
- System console direction
- Console mirroring
- System configuration for automatic restart
- Viewing history log of system events and console activity
- Remote system control
- Remote power cycle
- Viewing system status
- Virtual media (CD, DVD, ISO images)
- SSH
- LDAP

- Configuration of manageability and console security
- Virtual keyboard, video, and mouse
- Event notification to system console, email, pager, and HP Response Centers
- System health management: Fans, power supplies, temperature, and voltages
- Hardware and data protection: Automatic clean operating system shutdown on critical events, secure storage of system configuration parameters, and protection of system flash ROM

High-Availability Features

The HP Integrity rx2800 i2 Server is designed to be an integral part of a mission-critical environment, delivering up to 99.999% availability, depending on the specific solution configuration. Delivering these levels of uptime requires a strong base of single-system high availability (SSHA) in the hardware. The HP Integrity rx2800 i2 Server has redundancy and resiliency built-in from the ground, starting from the chassis infrastructure, through the I/O, and continuing through the memory and processor subsystems.

The server's strong single-system high availability is further bolstered by the HP Event Monitoring Service (EMS). And for the highest uptime, the HP Integrity rx2800 i2 can be configured as an integral part of a high-availability cluster, using clustering software such as HP Serviceguard.

High-availability chassis infrastructure

System fans in HP Integrity rx2800 i2 provide excellent cooling by pulling cool air from the front of the unit, enabling the air to flow over internal system components, and then discharge heated air out of the back of the server. The fans are easily accessible and provide N+1 redundancy.

The server provides high-availability with the N+N redundant power option. The HP Integrity rx2800 i2 Server comes standard with one hot-swappable power supply, and an optional supply can be ordered for 1+1 redundancy. To further enhance availability, each power supply has its own dedicated power feed or line cord. Cords can be plugged into separate power grids for maximum level of power protection.

Hot-pluggable disk drives

The HP Integrity rx2800 i2 Server supports up to eight hot-pluggable, 2.5-inch SAS disk drives. All disks are accessible from the front of the system and can be removed (hot plugged) while the server runs. These disks are managed by an integrated HP P410i SAS RAID controller.

The SAS RAID Controller can be configured in either HBA mode or in RAID mode. In HBA mode the disks are used as raw devices rather than being configured as RAID volume. The disks can be configured to support internal RAID 0, 10, 50, 60, and ADG. RAID 0 requires one drive, RAID 10 requires two identical HDDs, RAID 5 requires at least three identical HDDs, and RAID 60 requires at least four identical HDDs. An optional 512 MB Cache and Super Cap kit is available for all RAID options; it is required for RAID 6.

HP MirrorDisk/UX is available for software mirroring on all HDDs in HP-UX-based systems. HP Volume Shadowing Level 1 is supported in OpenVMS-based systems.

ECC and double chip spare memory

The memory system for the HP Integrity rx2800 i2 Server uses error-correcting code to correct single-bit errors and sparing technology to protect against multi-bit errors. Double DRAM data correction is only supported for 4 GB and larger DIMMs (x4 DRAM).

Chip sparing enables an entire SDRAM chip on a DIMM to be bypassed in the event that a multi-bit error is detected on that SDRAM. Double DRAM data correction extends this protection to two devices. Memory must be installed in pairs (groups of two DIMMs) with each memory pair consisting of DIMMs of the same capacity/density, same organization, same number of ranks, and same speed. Memory options come in DIMM pairs for the HP Integrity rx2800 i2 Server. Double chip sparing is not supported on 2 GB DIMMs, and Double DRAM data correction is disabled whenever any 2 GB DIMMs are installed in the system.

Due to the provision of the double chip spare feature, the HP Integrity rx2800 i2 Server is completely resilient to all single DRAM failures, regardless of the number of bits involved in the fault condition. This feature virtually eliminates memory failures as a source of system errors.

DRAM sparing reduces scheduled and unscheduled downtime, reducing DIMM replacements by up to 17 times over single chip spare and is 1,200 times better than standard single-bit ECC. Some other vendors deal with multi-bit SDRAM failures by accepting that they will occur. That is, they use a scheme that supports only failure detection, not failure correction.

HP believes that this condition is unacceptable and is dangerous for servers in business-critical environments. In fact, server systems that employ failure detection but not correction are at high risk of failure resulting from memory problems.

Processor high-availability Features

HP Integrity rx2800 i2 Server supports the Intel Cache Safe technology; the ability of the processor to remove bad cache lines from use automatically. In the server, the L1 and L2 cache have full single-bit ECC and double-bit error detection. Additionally, all the instruction and data paths also have single-bit ECC capabilities.

The HP Integrity rx2800 i2 Server employs Dynamic Processor Resiliency (DPR). DPR is the ability of the processor to be de-allocated on the next boot when flagged to do so by firmware. With DPR, any processor generating correctable cache errors at a rate deemed unacceptable is de-allocated from use by the system. This feature helps protect against a processor degrading to the point at which it could cause system crashes. When excessive errors are reported against a processor, the processor is deactivated (that is, the operating system will not schedule any new processes on it). The system firmware remembers the processor serial number and the time when this action was taken. From then on, at each poll interval, the system monitor determines whether the processor has been replaced (by comparing the serial numbers). When the processor is replaced, its history is reset. If the system is rebooted before the offending processor is replaced, the monitor generates a warning message and immediately de-allocates the processor.

HP Integrity rx2800 i2 Server also supports Automatic Process Recovery (APR). With APR, the operating system can individually kill a process rather than bring down the system. For example, when a parity error is detected in the processor, the error is isolated to the affected process, rather than crashing the entire system.

Comprehensive error logs

All system events are stored in the system event log (SEL) in nonvolatile memory. In addition, system firmware creates activity and forward progress logs (FPLs) in nonvolatile memory. In all but the most extreme situations, that is, in more than 95% of cases, the information in these logs is sufficient enough to diagnose system failures to a single replaceable part. The SEL and FPLs are available to iLO (and therefore also available remotely) and to system-level tools, leading to quick and accurate diagnosis.

Fault management throughout the lifecycle

Fault management is the overall HP strategy to provide a complete value chain for detection, notification, and repair of system problems. Fault management starts during the design phase, when hardware and operating system designers include capabilities and instrumentation points that provide the ability to detect and isolate system anomalies. Monitors are created to poll for system health information or to asynchronously respond to instrumentation points that have been designed into the system to report problems or faults.

Fault management also involves implementing several methods for maintaining historical event information, allowing preservation of information for analysis or trending. Faults that generate errors and warnings are automatically logged to syslog, while notes and audit information are copied to an event log. Other options are available for preserving historical information as well.

Fault management provides immediate alerts of problems (and even potential problems) as soon as they are detected so that the system administrator can take corrective action. In some cases, fault monitors are actually smart enough to repair faults or prevent them from occurring.

Fault management uses the philosophy of proactive (as opposed to reactive) management of problems. Fault management provides highly accurate fault diagnosis the first time, even as the problem occurs, and initiates or enables fast corrective action. Fault management results in a substantial decrease in unplanned downtime.

Power Management features

Power Monitoring

An integrated power meter in HP Integrity rx2800 i2 Server analyzes actual server power use. Power monitoring will allow a system manager to analyze current power usage and heat generation with an option to keep up to 24 hours of historical usage data in a convenient graphical format that shows peak, minimum, and averages. This feature enables customers to monitor power usage patterns and measure against power and thermal limitations. Insight Control power management and iLO can be used to access the power meter information. This is provided for any operating system (OS).

Operating System Power Regulation

Power Regulation enables customers to plan for power and cooling. With this feature, customers can optimize power consumption based on workloads, power loads, or utility pricing. HP-UX 11i v3 can realize a power savings of up to 45 percent of processor power on a system with the **pwr_idle_ctl** command. The command determines how aggressive the OS will be in keeping a processor idle once it has become idle. Some power states have been optimized to save power with practically no performance penalty. Active processors can save up to 40 percent with the **pstatectl** command. Active processors can be given a dynamic power state, which can change performance states to match processor performance (and power consumption) with utilization requirements. A static control mode is also available, which allows a processor's performance state to be set and maintained at a tunable value.

HP Dynamic Power Capping

Future enhancements to Integrity rx2800 i2 will enable Dynamic Power Capping. Dynamic Power Capping allows customers to apply a power budget to an individual server or a group of servers. This feature helps customer address overprovisioning and optimize for density and performance. Dynamic Power Capping can bring a server experiencing a sudden increase in workload back under its power cap in less than one-half second. This fast response prevents any surge in power demand that could cause a typical data center circuit breaker to trip. Dynamic Power Capping prevents tripping circuit breakers that have a specified trip time of three seconds or longer at 50 °C and 150 percent overload.

Data Security Technology with Trusted Platform Module

The Trusted Platform Module (TPM) is a hardware-based system security feature that can securely store information such as passwords and encryption keys to authenticate the platform. Administrators can also use TPM to store platform measurements that help ensure that the platform remains trustworthy. The Integrity rx2800 i2 Server supports an optional TPM v1.2. HP-UX Trusted Computing Services (HP-UX TCS) provides software support for the TPM when running HP-UX 11i v3. By providing a low-cost embedded security chip option, HP has established a foundation for strong protection of sensitive information—including cryptographic keys.

Built around industry standards, the Trusted Platform Module provides a basis for key storage by securely generating and storing cryptographic keys. HP-UX 11i TCS takes this step further by providing necessary infrastructure for managing the TPM, as well as integrating it into select features such as HP-UX Encrypted Volumes and Files Systems (EVFS).

Using HP-UX TCS to make the unattended boot capability of EVFS more secure is an important example of how HP-UX TCS can be integrated with other applications to enhance security. For more information see the "Protecting EVFS Keys with HP-UX TCS" chapter in the "HP-UX Trusted Computing Services Administrators Guide" available in the HP-UX Trusted Computing Services section at: <http://docs.hp.com/en/internet.html>

Conclusion

The HP Integrity rx2800 i2 Server uses one or two dual-core or quad-core Intel Itanium processors and up to 96 GB of memory. The server offers cutting-edge, 64-bit power along with excellent price/performance. The server provides 8-core scalability, expanded memory, I/O, and disk capacity in 2U footprint.

For technical computing and for commercial IT environments, the HP Integrity rx2800 i2 Server provides a unique combination of scalability, virtualization, and availability enabling you to optimize your business outcomes while decreasing costs and reducing risk.

For more information

To know how HP Integrity rx2800 i2 Server can help you enhance your business outcome while decreasing costs and reducing risks, visit: www.hp.com/go/integrity

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4AA0-7916ENW, Created October 2010

