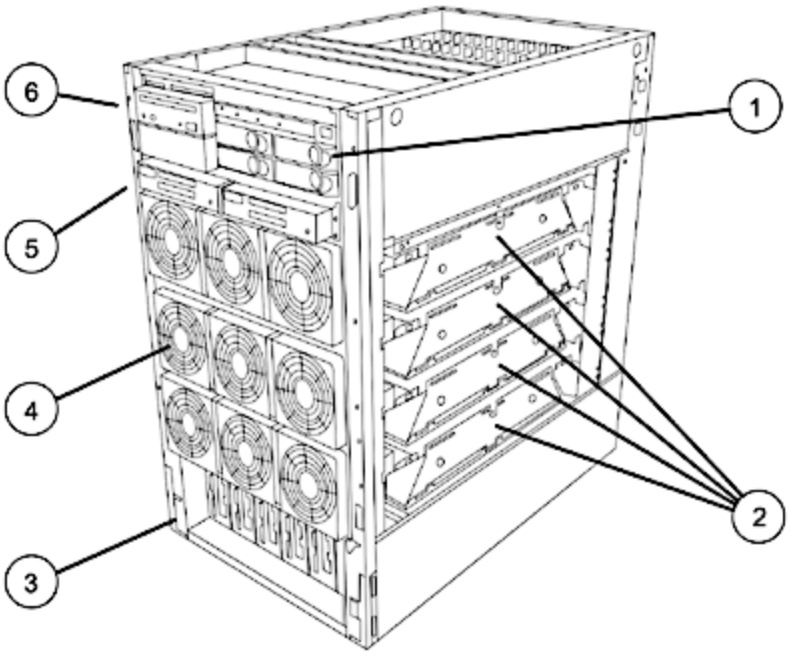
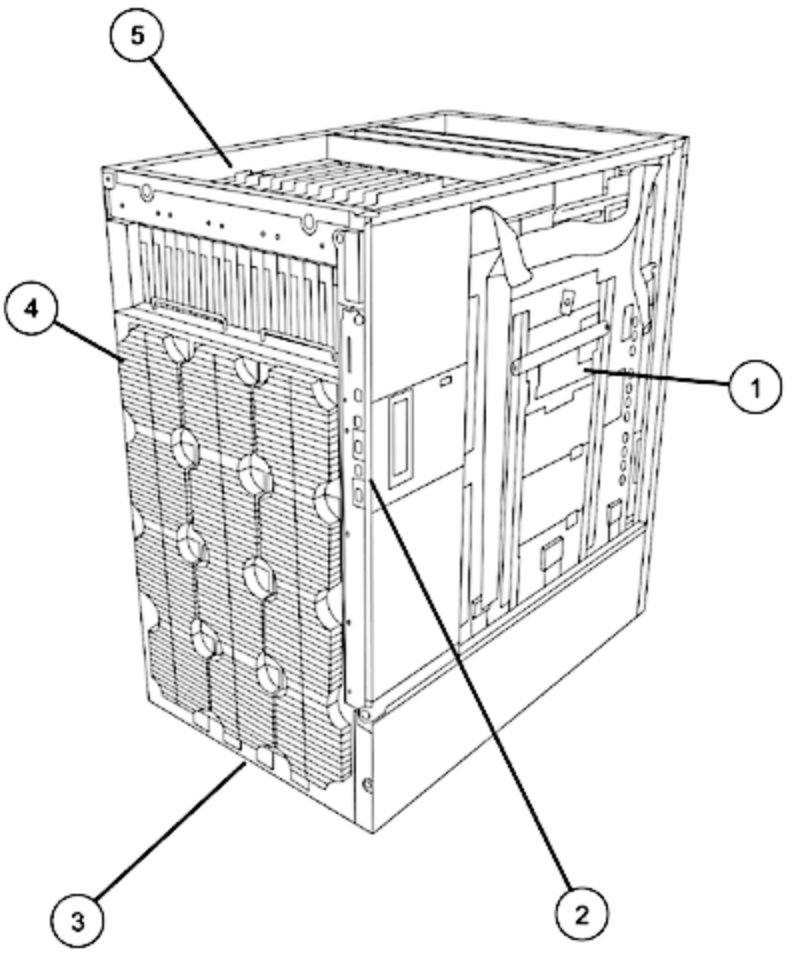
Overview

HP Integrity rx8640 Server System Overview-Front View



1. Hot plug disks
2. Cell boards
3. Redundant hot-swap power
4. Redundant hot-swap fans
5. PCI power supplies
6. Removable media - DVD/DAT

Integrity rx8640 Server System Overview-Rear View



1. System backbone
2. Core I/O
3. 2N redundant power inputs
4. Hot-swap redundant fans
5. Hot-plug PCI slots

Overview

At A Glance

rx8640 Server Product Number (base)

AB297A

Standard System Features

- HP UX 11i v2 and HP UX 11i v3 operating system
- Microsoft Windows Server 2008
- Linux RHEL AS 5 and AS 4 and SLES 10 SP 1. Mad9M rx8640 configuration not supported.
- OpenVMS V8.3-1H1 or higher (for Montvale). Mad9M rx8640 configurations not supported.
- External Ultra320 SCSI channel
- Two Internal Ultra320 SCSI channels, one channel to each internal disk
- 1 GbE LAN ports
- Management Processor technology with Integrated LAN console
- Rackmountable into HP 19 inch cabinets (factory or field integration)
- Rackmountable into some 3rd party cabinets
- Two hardware partitions (nPartitions)
- Four hardware partitions when configured with the Server Expansion Unit
- Factory integration of processors, memory, disk drives, removable media drives, and I/O cards
- HP site planning and installation
- One year warranty with same business day on site service response
- Owner's Guide and General Usage media set

HP Integrity rx8640 Server Flexible Advantage Starter (FAST) Base Systems

The **F**lexible **A**dvantage **ST**arter base systems for the HP Integrity rx8640 Server allow for faster configurations due to the semi configured base system bundles. Configurations built from FAST base systems will have substantially lower prices than systems built from the parts.

HP Integrity rx8640 Server FAST bundles

Product Number[1]	Number of Intel dual core Itanium processors	Number of Cell Boards in bundle	Number of Core I/O Cards in bundle	Number of Power Supplies in bundle
AB443A	4 (4P/8C)	1	1	3
AB444A	8 (8P/16C)	2	1	4
AB446A	16 (16P/32C)	4	1	6

[1] Includes base chassis and power supplies

Standard Features

Minimum System

- One active core in an Intel Dual core Itanium (1P/2C) processor
- One processor per cell board (Dual core Itanium requires one active core per cell board)
- One cell board
- 4GB memory module (1 pair of 2GB DIMMs)
- One core I/O
- One internal DVD drive for OpenVMS and Windows
- Two power cords
- 8 hot plug 33 /66 /133 /266 MHz 64 bit PCI X slots or 8 mix of hot plug 64 bit PCI X and PCIe x8 IO slots with adaptive signaling technology

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Maximum Server Capacities

- Sixteen (16) Intel Dual core Itanium (16P/32C) processors
- Four (4) processors per cell board
- Four (4) cell boards
- 512GB memory (32 pairs of 8 GB DIMMs)
- Four power cords, providing 2N power and dual grid support
- Four internal hot plug LVD SCSI disks
- Two removable media drives-DVD or DAT
- Sixteen PCI expansion cards

Maximum capacities when configured with the Server Expansion Unit 2 (SEU 2):

- Four core I/O cards
- Eight internal hot plug LVD SCSI disks
- Four removable media drives-DVD or DAT
- 32 hot plug 33 /66 /133 /266 MHz 64 bit PCI X slots or 32 mix of hot plug 64 bit PCI X and PCIe x8 IO slots with adaptive signaling technology

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Standard System Features

- HP UX 11i v3 and HP UX 11i v2 operating system
- Microsoft Windows Server 2008
- Linux RHEL AS 5 and AS 4 and SLES 10 SP 1. Mad9M rx8640 configuration not supported.
- OpenVMS V8.3 1H1 or higher (for 91X0N processors Montvale). Mad9M rx8640 configurations not supported.
- External Ultra320 SCSI channel
- Two Internal Ultra320 SCSI channels, one channel to each internal disk
- 1 GbE LAN ports
- Management Processor technology with Integrated LAN console
- Rackmountable into HP 19 inch cabinets (factory or field integration)
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- Two hardware partitions (nPartitions)
- Four hardware partitions when configured with the Server Expansion Unit
- Factory integration of processors, memory, disk drives, removable media drives, and I/O cards
- HP site planning and installation
- One year warranty with same business day on site service response
- Owner's Guide and General Usage media set

Standard Features

High Availability	• N+1 Hot swap cooling • Redundant and hot swap power supplies • Cell Hot plug (implemented as dynamic nPars in HP UX 11i v3) • Hot plug disks • 2N power inputs • On line memory page deallocation • ECC protected DDR II memory • Full parity protection of data and address buses • On chip processor cache with ECC protection • Memory double chip spare • Dynamic Processor resilience and deallocation (processor deallocation on failure) • On line addition and replacement of PCI I/O cards • UPS power management • Four independent UltraSCSI buses to internal disks for mirroring across disks and controllers • Journal file system (HP UX) • Auto reboot • On line diagnostics and system health monitor • Microsoft Cluster Services for Windows Server 2008 • HP StorageWorks Software for HP Integrity Servers running Windows Server 2008. Includes Cluster Extension XP and EVA, Continuous Access, Business Copy and SQL Server Fast Recovery • HP OpenVMS Cluster Software
Security	• Separate console LAN port for system management • Password protection on console port • Disablement of remote console ports
Internet Server Functions	• Internet server (inetd) • Domain name server • Routing (OSPF, BIND, RIP, EGP, HELLO, gateD) • Network Time Protocol
Client Configuration Services	• Automatic configuration for printers, PCs, workstations, and X terminals (DHCP, Bootp, tftp, rbootp)
Optional Web Services	• Netscape Communication Server • Netscape Navigator
Email	• Mail, MailX, ELM • Sendmail, MIME, SMTP, ESMTP
Remote Access Services	• Telnet, ftp, anonymous ftp server

Configuration

Configuration

The HP Integrity rx8640 Server is a symmetrical multiprocessing (SMP) server supporting up to sixteen high performance Intel dual core Itanium processors (90X0 series or 91X0N series). The server supports HP's advanced sx2000 chip set. The rx8640 can be configured as a single SMP server or divided into up to four smaller, hardware partitioned (nPars), logical servers.

Cell Boards

A minimum of one and a maximum of four cells can be ordered in HP Integrity rx8640 Servers. Each cell can be purchased with up to four active Intel dual core Itanium processors (90X0 series or 91X0N series) or in combination with Instant Capacity processors. The rx8640 can support a mix of 90X0 and 91X0N series processors; however, within a single cell, all processors must be identical.

The HP Integrity rx8640 and HP Integrity rx7640 (8 processor) servers share the same cell board. The rp8400/rp8420/rx8620 cell boards cannot be carried forward to the rx8640 server.

Cell Details

- 4 processor slots (supporting up to eight processor cores with dual core)
- HP sx2000 cell controller
- 16 DDR-2 Memory DIMM slots
- DC-DC Power converters
- Manageability and Processor Dependent Hardware Circuitry

Cell Board Configuration Rules

- Cell boards are ordered individually
- Minimum: 1 cell board; Maximum: 4 cell boards
- Cell slots 0 or 1 must be loaded first
- Recommended Cell board loading order: 0,1,2,3

Cell Board and Processor Mixing Rules

- Cannot Mix Montecito processors with Mad9M on same cell board
- Cannot Mix Montecito processors with Mad9M in same partition
- Cannot Mix Montecito processors with Montvale processors on same cell
- Cannot Mix Montecito processors with Montvale processors in same partition
- Cannot Mix Montecito 1.4GHZ with Montecito 1.6GHZ on same cell board or in the same partition
- Cannot Mix Montecito 12MB with Montecito 18MB or 24MB on same cell board or in same partition
- Cannot Mix Montecito 18MB with Montecito 12MB or 24MB on same cell board or in same partition
- Cannot Mix Montecito 24MB with Montecito 12MB or 18MB on same cell board or in same partition
- Cannot Mix Montvale 1.4GHZ with Montvale 1.6GHZ on same cell board or in the same partition
- Cannot Mix Montvale 12MB with Montvale 18MB or 24MB on same cell board or in same partition
- Cannot Mix Montvale 18MB with Montvale 12MB or 24MB on same cell board or in same partition
- Cannot Mix Montvale 24MB with Montvale 12MB or 18MB on same cell board or in same partition

NOTE: If slower speed processor is installed on cell (1.4 with 1.6) the slowest speed will be used

Configuration

Intel Dual-Core Itanium Details

Intel Dual-Core Itanium Details

- 1.6-GHz
- Level 3 cache: 24 MB
- Level 2 cache: 1 MB instr + 256 KB data
- Level 3 cache: 16 KB instr + 16 KB data
- Single-bit cache error correction
- 44-bit physical addressing
- 64-bit virtual addressing
- 4-GB maximum page size
- Intel Itanium 9150N (Montvale)

- 1.6 GHz
- Level 3 cache: 24 MB
- Level 2 cache: 1 MB instr + 256 KB data
- Level 3 cache: 16 KB instr + 16 KB data
- Single bit cache error correction
- 44 bit physical addressing
- 64 bit virtual addressing
- 4 GB maximum page size
- Intel Itanium 9050 (Montecito)

- 1.6 GHz
- Level 3 cache: 18 MB
- Level 2 cache: 1 MB instr + 256 KB data
- Level 3 cache: 16 KB instr + 16 KB data
- Single-bit cache error correction
- 44-bit physical addressing
- 64-bit virtual addressing
- 4-GB maximum page size
- Intel Itanium 9140N (Montvale)

- 1.6 GHz
- Level 3 cache: 18 MB
- Level 2 cache: 1 MB instr + 256 KB data
- Level 3 cache: 16 KB instr + 16 KB data
- Single bit cache error correction
- 44 bit physical addressing
- 64 bit virtual addressing
- 4 GB maximum page size
- Intel Itanium 9040 (Montecito)

- 1.4 GHz
- Level 3 cache: 12 MB
- Level 2 cache: 1 MB instr + 256 KB data
- Level 3 cache: 16 KB instr + 16 KB data
- Single-bit cache error correction
- 44-bit physical addressing
- 64-bit virtual addressing
- 4-GB maximum page size
- Intel Itanium 9120N (Montvale)

- 1.4 GHz
- Level 3 cache: 12 MB
- Level 2 cache: 1 MB instr + 256 KB data
- Level 3 cache: 16 KB instr + 16 KB data
- Single bit cache error correction
- 44 bit physical addressing
- 64 bit virtual addressing
- 4 GB maximum page size
- Intel Itanium 9020 (Montecito)

Processor Configuration Rules

- The Intel dual core Itanium processor consists of 2 processor cores. You may order and upgrade the dual core Itanium processor in increments of one core (the second core in a processor being iCAP).
- There must be one active processor core (the other being iCAP) for dual core Itanium processors on each cell board.
- On each cell board, processors must be installed in the following sequence 0, 2, 1, 3.
- HP Integrity rx8620 1.6 GHz 6 MB Level 3 cache processors may be carried forward to rx8640 servers.
- Intel single core Itanium processors and Intel dual core Itanium processors can be mixed in the same chassis as long as they are in separate hard partitions (requires the same chipset sx1000 or sx2000).

Memory Configuration

The memory DIMMs used in the HP Integrity rx8640 Server are custom designed by HP and are sold in pairs or as bundles. Each DIMM contains DDR II memory chips qualified to run at 267/533 MHz, with full ECC protection. DIMM sizes of 2 GB, 4 GB, and 8 GB are supported. HP 9000 rp8400/rp8420/rx8620 memory modules cannot be carried forward to the rx8640 server. Each HP Integrity rx8640 Server cell board supports up to 16 DIMM slots and 17 GB/s of peak memory bandwidth.

HP Integrity rx8640 Memory DIMMs

Memory Module size (pairs)	**rx8640 Product Number**	**HP Integrity rx8640 Server Maximum Capacity Using single DIMM Size**	**Single DIMM Size**
4 GB (2 x 2GB)	AB454A	128 GB	2048 MB
8 GB (2 x 4GB)	AB455A	256 GB	4096 MB
16 GB (2 x 8GB)	AB456A	512GB	8192 MB
Bundle size	**rx8640 Product Number**	**Equivalent Memory Module**	**Single DIMM SIze**
128 GB (16 x 4GB)	AH411A	Qty 16 of AB455A	4096 MB
128 GB (8 x 8GB)	AH412A	Qty 8 of AB456A	8192 MB
256 GB (32 x 4GB)	AH413A	Qty 32 of AB455A)	4096 MB
256 GB (16 x 8GB)	AH414A	Qty 16 of AB456A	8192 MB

Configuration

Memory Loading Rules

- Memory must be installed in pairs - modules (2 DIMMs of equal density)
- Memory modules (pairs of DIMMS) are available in three densities: 4 GB (2×2048MB DIMMs), 8 GB (2×4096MB DIMMs), and 16 GB (2×8192MB DIMMs).
- Memory bundle product numbers consist of DIMMS already qualified in the memory modules
- DIMM pairs must be loaded in slot order
- Minimum memory is 2 GB per cell
- Maximum memory per system is 512 GB-using 32 16 GB memory modules (8GB pairs) per system.
- Larger DIMMs must be loaded first across a cell, followed by progressively smaller DIMM sizes.
- On each cell board, Memory pairs must be installed in the following order: (0A, 0B), (1A, 1B), (2A, 2B), (3A, 3B), (4A, 4B), (5A, 5B), (6A, 6B), (7A, 7B)
- DIMM mixing other than recommended configurations is supported as long as the memory loading rules are followed

rx8640 Recommended Memory Configurations

Desired Memory per Cell (GBs)	Number of DIMMs			Quad Echelon							
	2 GB	4 GB	8 GB	2	1	3	0	2	1	3	0
				OA, OB	1A, 1B	2A, 2B	3A, 3B	4A, 4B	5A, 5B	6A, 6B	7A, 7B
4	2			2 GB							
8	4			2 GB	2 GB						
16	8			2 GB	2 GB	2 GB	2 GB				
32	16			2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB
48	8	8		4 GB	4 GB	4 GB	4 GB	2 GB	2 GB	2 GB	2 GB
64		16		4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB
96		8	8	8 GB	8 GB	8 GB	8 GB	4 GB	4 GB	4 GB	4 GB
128			16	8 GB	8 GB	8 GB	8 GB	8 GB	8 GB	8 GB	8 GB

Performance Tuning Guidelines

- For best performance, a cell should be configured with a multiple of 8 DIMMs or four pairs (although the server will execute properly with an odd number of pairs). It takes 8 DIMMs to populate both memory buses. Populating only one of the two memory buses on a cell board will deliver only half the peak memory bandwidth.
- Load memory equally across the available cell boards.

Memory Latencies

There are two types of memory latencies within the HP Integrity rx8640 Server:

1. Memory latency within the cell refers to the case where an application either runs on a partition that consists of a single cell or uses cell local memory.
2. Memory latency between cell refers to the case where the partition consists of two or more cell and cell interleaved memory is used. For example, for an rx8640 server with four cells in the partition, 25% of the addresses are to memory on the same cell as the requesting processor, and the other 75% of the addresses are to memory on the other three cells.

The HP Integrity rx8640 Server memory latency depends on the number of processors in the partition. Assuming that memory accesses are equally distributed across all cell boards and memory controllers within the partition, the average idle memory latency (load to use) is as shown below:

Number of processors	Average Memory Latency
4-processor	185 ns
8-processor	249 ns
16-processor	334 ns

Configuration

I/O Architecture

Components within the I/O subsystem are the I/O controllers, internal peripheral bay, and multifunction Core I/O. The figure below shows the basic block diagram of the I/O subsystem. The Integrity I/O architecture utilizes industry standard PCI buses in a unique design for maximum performance, scalability, and reliability. To achieve maximum performance and availability, each PCI/PCI-X slot on the I/O board is controlled by its own Bus Converter ASIC and is also independently supported by its own half of the dual hot swap controllers. All PCI slots are designed to be compliant with PCI Rev.2.2, PCI-X Rev.2.0a, and PCI-express Gen1 specifications.

The PCI-X 2.0 I/O Backplane implemented an important change to power distribution to the I/O partitions. The PCI-X Power supply bricks have been redesigned to allow the pair of them to be N+1 redundant in operation. Both I/O partitions will sustain their operational state even if one of the PCI bricks has failed. All the PCI voltages will remain within the PCI specification. These power bricks are not part of the PCI-X I/O board assembly. They plug into the edge of the PCI-X I/O Backplane to provide power to the board and they are not backwards compatible with the previous PCI power bricks. Any PCI brick failures will be reported to the system so the failing brick could be hot swapped.

The HP Integrity rx8640 Server supports both PCI-X 2.0 and PCI-Express. Two different backplanes are available. The PCI-X 2.0 backplane (AB160A) supports sixteen (16) PCI-X slots. A combination PCI-Express/PXI-X 2.0 backplane (AD161A) supports eight (8) PCI-X slots and eight (8) PCI-Express slots. Each backplane contains two master I/O controller chips located on the backplane. Each I/O controller contains sixteen high performance 12 bit wide links, which connect to sixteen slave I/O controller chips supporting the PCI X or PCI-Express card slots and core I/O. Two links, one from each master controller is routed through the crossbar backplane and is dedicated to core I/O. The remaining thirty links are divided among the sixteen I/O card slots. This one card per link architecture leads to greater I/O performance and higher availability. Each controller chip is also directly linked to a host cell board. This means that at least two cell boards, located in cell slots 0 and 1, must be purchased in order to access all sixteen I/O card slots. With one cell board, access to eight slots is enabled.

The HP Integrity rx8640 Server can be purchased with either one or two core I/O boards (if an SEU 2 is added, then four core I/O boards with two core I/O in the SEU). Both core I/O boards are identical and provide console, SCSI, serial, and Management Processor (MP) functionality. The second core I/O is used to enable the dual hard partitioning in the HP Integrity rx8640 Server and provide access to a second set of disk drives.

The internal peripheral bay is divided into two identical halves. Each half supports up to two low profile disks and one removable media device. A SCSI controller chip located on each core I/O board supports each half of the internal peripheral bay. This means that both core I/O boards must be purchased to access both halves of the peripheral bay.

PCI Backplane

Eight of sixteen I/O card slots are supported by dual high performance fat links. Each link is capable of providing 1060 MB/s of bandwidth. This means that half HP Integrity rx8640 Server I/O slots are capable of sustained 2.12 GB/s. Six of the sixteen I/O card slots are supported at 1060 MB/s of bandwidth. Aggregate I/O slot bandwidth is approximately 23 GB/s. In addition, because each I/O slot has a dedicated bus, any slot can be "hot plugged" or serviced without affecting other slots. The hot plug operation is very easy, and can be done with minimal training and effort.

The HP Integrity rx8640 Server supports a number of PCI, PCI X, and PCI Express HBA (I/O) cards for I/O expansion.

NOTE: The PCI X backplane is backward compatible with the older PCI backplane and can support many PCI HBA (I/O) cards.

When HP 9000 rp8400 servers are upgraded to HP Integrity rx8640 servers using the chassis upgrade kit, the older and slower PCI backplanes in the HP 9000 rp8400 server must be upgraded to the newer and faster PCI X (AD160A) or PCI Express/PCI X (AD161A) backplanes

When the rx8640 Server Expansion Unit 2 is connected to the HP Integrity rx8640 Server, its I/O backplanes act as PCI X or PCI Express I/O backplanes. See the rx8640 Server Expansion Unit 2 section for more details.

Supported I/O Cards

Cards can be in any combination (see Special Note section). Servers with one (1) cell board, minimum 1 - maximum 8. Severs with two (2) cell boards in base system, minimum 1 - maximum 16. Servers configured with SEU-2 and three (3) cell boards, minimum 1 - maximum 24. Servers with SEU-2 and four (4) cell boards, minimum 1 - maximum 32.

SEU-2 only, cards can be in any combination (see Special note Section), minimum 1 - maximum 8 with three (3) cell boards in base server. SEU-2 only with four (4) cell boards in base server, minimum 1 - maximum 16.

NOTE: While ordering Windows Server 2008, do not mix differing brands of HBAs (Emulex and Qlogic) within the same server configuration in an MPIO environment.This is to avoid issues which occur when different Fibre Channel HBAs are used within the same server which support different I/O max transfer packet sizes in an MPIO environment. For example, the Emulex Fibre Channel HBAs support a max I/O transfer packet size of 1MB and the Qlogic Fibre Channel HBAs support a max I/O transfer packet size of 2MB. Mixing these two cards in an MPIO configuration can cause the system to hit a BSOD 0X000000D1 with a reference to elxstor.sys

This applied to the following products:
Emulex:
HP StorageWorks single port 8 Gigabit PCI-e FC Emulex HBA (AH402A)
HP StorageWorks dual port 8 Gigabit PCI-e FC Emulex HBA (AH403A)
HP StorageWorks 2 Gb Fibre Channel HBA (AB232A)
HP StorageWorks 2 Gb, 64-Bit/133 MHz PCI-X-to-Fibre Dual Channel HBA (AB466A)
HP StorageWorks 2 Gb, 64-Bit/133 MHz PCI-X-to-Fibre Single Channel HBA (AB467A)
HP StorageWorks 4 Gb Single Port 64-bit 266 MHz Fibre Channel HBA (AD167A)
HP StorageWorks 4 Gb Dual Port 64-bit 266 MHz Fibre Channel HBA (AD168A)
HP StorageWorks FC2142 PCIe Single Port 4 Gb Fibre Channel adapter (A8002A)
HP StorageWorks FC2242 PCIe Dual Port 4 Gb Fibre Channel adapter (A8003A)

Qlogic:
HP StorageWorks single port 8 Gigabit PCI-e FC Qlogic HBA (AH400A)
HP StorageWorks dual port 8 Gigabit PCI-e FC Qlogic HBA (AH401A)
HP StorageWorks 4 Gb Single Port 64-bit 266 MHz Fibre Channel HBA (AB429A)
HP StorageWorks 4 Gb Dual Port 64-bit 266 MHz Fibre Channel HBA (AB379A)
HP StorageWorks 4 Gb Dual Port 64-bit 266 MHz Fibre Channel HBA (AB379B)
HP StorageWorks FC1142 PCIe Single Port 4 Gb Fibre Channel adapter (AE311A)
HP StorageWorks AD300A PCIe Dual Port 4 Gb Fibre Channel adapter (AD300A)

I/O Card Description	Product Number	Operating Environment				Special Notes
Mass Storage Host Bus Adaptors		HP-UX	Win	Linux	Open VMS	
PCI-X 2-port Ultra 320 SCSI	A7173A	Y	Y	Y	Y	
PCI X 2 port Fiber Channel 2Gb HBA for Windows 64-bit	AB466A		Y			Cannot be factory integrated with AD167A or AD168A
PCI X 266 1 port Fiber Channel 4Gb HBA	AB378B	Y			Y	
PCI X 266 2 port Fiber Channel 4Gb HBA	AB379B	Y	Y	Y	Y	
PCI X 266 1 port Fiber Channel 4Gb HBA	AB429A		Y	Y		
PCI X 1 port Fiber Channel4Gb HBA	AD167A		Y	Y		Cannot be factory integrated with AB466A or AB467A in the same partition.
PCI X 2 port Fiber Channel 4Gb HBA	AD168A		Y	Y		Cannot be factory integrated with AB466A or AB467A in the same partition.
PCIe 1 port Fiber Channel 4Gb HBA (Emulex)	A8002A		Y	Y		Cannot be factory integrated with AB466A or AB467A in the same partition. Windows maximum 12; Linux maximum 8.
PCIe 2 port Fiber Channel 4Gb HBA (Emulex)	A8003A		Y	Y		Cannot be factory integrated with AB466A or AB467A in the same partition. Windows maximum 12; Linux maximum 8.
PCIe 1 port Fiber Channel 4Gb HBA (Emulex)	AD299A	Y			Y	Supported by HP UX 11i v3 and v2. OpenVMS maximum 8 per partition.
PCIe 2 port Fiber Channel 4Gb HBA (Qlogic)	AD300A	Y	Y	Y	Y	HP UX maximum 8; Windows maximum 8; Linux maximum 8; OpenVMS maximum 8 per partition.

Configuration

PCIe 1 port Fiber Channel 4Gb HBA (Emulex)	AE311A		Y	Y		Windows maximum 12; Linux maximum 8.
PCIe 2 port Fiber Channel 4-Gb HBA (Emulex)	AD355A	Y			Y	OpenVMS maximum 8 per partition
HP PCIe 1-port 8-Gb FC SR (QLogic) HBA	AH400A	Y	Y			
HP PCIe 2-port 8Gb FC SR (QLogic) HBA	AH401A	Y	Y			
HP PCIe 1-port 8GB FC SR (Emulex) HBA	AH402A	Y	Y			
HP PCIe 2-port 8Gb FC Sr (Emulex) HBA	AH403A	Y	Y			

Mass Stoarge Adapters - Smart Array

I/O Card Description	Product Number	Operating Environment				Special Notes
Mass Storage Adaptors - Smart Array		HP-UX	Win	Linux	Open VMS	
SmartArray E500 SAS	AH226A		Y	Y		Battery pack is not supported at this time. Windows maximum 8; Linux maximum 4.
SmartArray 6402/128MB cache controller with factory integrated internal RAID 1 array	AB362A		Y	Y		Must be ordered with two (2) indentical HDD in the hard partition. AB338A cables are included Max (1) per partition
SmartArray 6404/256MB cache controller with factory integrated internal RAID 1 array	AB363A		Y			Must be ordered with two (2) indentical HDD in the hard partition. AB338A cables are included Max (1) per partition
SmartArray 6402/128MB cache controller	A9890A	Y	Y	Y	Y	Max (8) any combination of A9890A + AB262A. For OpenVMS, max (2) per partition Order AB363A for SmartArray 6404 controller with factory integrated internal RAID
SmartArray 6404/256 MB cache controller	A9891A	Y	Y		Y	Max (8) any combination of A9891A + AB263A. For OpenVMS, max (1) per partition Order AB363A for SmartArray 6404 controller with factory integrated internal RAID
SmartArray P600/256MB cache controller	337972-B21		Y	Y		Max (8) For external storage only
512MB cache memory upgrade for SmartArray P600, 6402, and 6404	372538-B21	Y	Y	Y	Y	No factory integration
SmartArrayPCIe P800 SAS RAID controller	AD335A	Y	Y	Y	Y	OpenVMS max (8). HP-UX 11i v3 support expected March, 2008.
PCIe SC44Ge SAS Host Bus Adapter	AH303A	Y		Y	Y	Max (8)
SmartArray Internal RAID cables (Qty 2) for rx76xx/rx86xx servers	AB338A		Y	Y		Includes two (2) cables One (1) cable required per SmartArray controller for field installation of internal RAID

Local Area Network (LAN) Adapters

Configuration

I/O Card Description	Product Number	Operating Environment				Special Notes
Local Area Network (LAN) Adapters		HP-UX	Win	Linux	Open VMS	
HP PCI X 2-port 1000Base SX (optical) Gigabit Adapter	A7011A	Y	Y	Y	Y	Intel chip.
PCI X 1000Base T dual port (Intel Chip)	A7012A	Y			Y	Intel chip.
PCI X 1000Base T dual port (Intel Chip) for Windows and Linux	A9900A		Y	Y		Intel chip.
HP PCI X 4 port 1000Base T Gigabit Adapter	AB545A	Y			Y	OpenVMS (3) per partition.
HP PCI X 1 port 1000Base T Adapter	AD331A	Y			Y	
HP PCI X 1 port 1000Base SX Adapter	AD332A	Y			Y	
HP PCI X 266MHz. 10GigE SR (card half height PCI X card)	AD385A	Y	Y	Y	Y	HP UX maximum 4; Linux maximum 2; OpenVMS maximum 4 per partition
PCIe 2 port 1000Base-T GbE Network Adapter	AD337A	Y	Y	Y	Y	HP UX maximum 8; Windows maximum 12; Linux maximum 8; OpenVMS maximum 8 per partition. OpenVMS boot not supported.
PCIe 2 port 1000Base SX GbE Network Adapter	AD338A	Y	Y	Y	Y	HP UX maximum 8; Windows maximum 12; Linux maximum 8; OpenVMS maximum 8 per partition. OpenVMS boot not supported.
HP NC364T PCIe 4-port 1000Base-T Gigabit Adapter	AD339A	Y			Y	
HP PCIe 10GbE SR card	AD386A	Y				
HP PCIe 2-port 4x DDR Fast IB HCA	AH304A	Y				No HP-UX boot support

I/O Combination Adapters (Mass Storage/LAN)

I/O Card Description	Product Number	Operating Environment				Special Notes
I/O Combination Adapters (Mass Storage/LAN)		HP-UX	Win	Linux	Open VMS	
PCI X 1000Base-SX GigE / 2G FC Combo	A9782A	Y			Y	OpenVMS maximum 4 per partition.
PCI X 2 port U320 SCSI/2 port 1000Base T adapter	AB290A	Y			Y	OpenVMS maximum 2 per partition.
PCI X 1000Base T GigE/1 port 4G Fibre Channel combo	AD193A	Y			Y	
PXI X 1000Base T GigE/2 port 4G Fibre Channel combo	AD194A	Y			Y	
PCIe 4-Gb Fibre Channel / GbE-T HBA combo	AD221A	Y			Y	For HPUX, pnly HPUX v3 is supported today.
PCIe 2-port 4Gb Fibre Channel / 2-port GbE-T HBA combo	AD222A	Y			Y	For HPUX, pnly HPUX v3 is supported today.
PCIe 2-port 4Gb Fibre Channel / 2-port GbE-SX HBA combo	AD393A	Y			Y	For HPUX, pnly HPUX v3 is supported today.

Wide Area Network (WAN) Adapters

Configuration

I/O Card Description	Product Number	Operating Environment				Special Notes
Wide Area Network (WAN) Adapters		HP-UX	Win	Linux	Open VMS	
2 port serial (X25/FR/SDLC)	J3525A	Y				Order appropriate cable (RS 232 C; V.35; X.21/V11; RS 499; or RS 530). Must order at least one appropriate software product.
X.25/9000 SW Media	J2793B	Y				
SNAplus2 Link Server LTU	J6380AA	Y				Required for use with any of the SNAplus2 software products.
SNAplus2 Enterprise Extender	J6378AA	Y				Order one per processor core.
SNAplus2 APPN End Node Server LTU	J6382AA	Y				Order one per processor core.
SNAplus2 3270/3179G Server LTU	J6383AA	Y				Order one per processor core.
SNAplus2 RJE Server LTU	J6384AA	Y				Order one per processor core.
SNAplus2 API Server LTU	J6385AA	Y				Order one per processor core.
TN3270 System LTU for Servers and Workstations	J6381AA	Y				Order one per processor core.

Serial Multiplexer Products

I/O Card Description	Product Number	Operating Environment				Special Notes
Serial Multiplexer Products		HP-UX	Win	Linux	Open VMS	
HP PCI 8 port serial MUX adapter	AD278A	Y				
HP PCI 64 port serial MUX adapter	AD279A	Y				Minimum 1, maximum 4 port modules AD280A and/or AD281A is required. AD280A and AD281A port modules can be intermixed.
HP 16 port RS 232 RJ45 port module	AD280A	Y				Power supplies required for third and fourth modules connected to AD279A.
HP 16 port RS 232 DB25 port module	AD281A	Y				Power supplies required for third and fourth modules connected to AD279A.

Cluster Interconnect

I/O Card Description	Product Number	Operating Environment				Special Notes
Cluster Interconnect		HP-UX	Win	Linux	Open VMS	
PCI X 2 port 4x Infiniband Fabric Host Channel Adapter	AB286C	Y				

Remote Manageability & Graphics/ USB Cards

I/O Card Description	Product Number	Operating Environment				Special Notes
Remote Manageability & Graphics/ USB Cards		HP-UX	Win	Linux	Open VMS	
HP Lights Out Advanced KVM	AD307A	Y	Y	Y	Y	HP UX, Linux, OpenVMS support USB only - no VGA support. Maximum 1 per partition.
HP USB/VGA PCIK adapter	A6869B	Y	Y	Y	Y	HP UX, Linux, OpenVMS support USB only - no VGA support. Maximum 1 per partition

Configuration

Integrity Integrated Lights Out (iLO-2) Management Processor Functionality for sx2000-based servers

Lights-Out remote management port with both HP 9000 command line interface and new iLO-2 web GUI interface. iLO-2 standard features are part of the iLO-2 management processor. iLO-2 advanced features are added with optional PCI card per managed partition (option AD307A).

Standard Features:

- Password protected console ports
- Console mirroring between all local, modem, LAN, and web consoles
- Remote power up and power down control, per OS partition
- Configurable remote access control
- Interface to system monitoring and diagnostic hardware via an internal IC bus
- System Event logs and 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.
- Integration with HP management tools such as Systems Insight Manager
- Secure Sockets Layer security on web console
  (LDAP is not yet available for this product)

Advanced Features, available through Integrity Lights Out Advanced / KVM card (option AD307A):

- Physical VGA/USB 2.0
- Integrated Remote Console (virtual Keyboard Video Mouse)
- Virtual Media USB 1.1

  Card provides one physical VGA port and two physical USB ports, should be used instead of graphics/USB option A6869A. One card should be installed in each nPar where additional management features are required. Card cannot be used in systems without iLO-2 management processor firmware installed.

AD307A card Integrated Remote Console (virtual Keyboard Video Mouse) and virtual Media (read-only CD/DVD/ISO file) support per OS:

Operating System	**Integrated Remote Console (vKVM)**	**Virtual Media**
HP UX	not supported	supported
Windows	supported	supported
Linux	not supported	not supported
OpenVMS	not supported	supported

VGA port is supplied by an ATI ES1000 controller. Supported resolutions and refresh rates include:

Operating System	**Refresh Rate**	**Maximum Resolution**
Windows	75 Hz	640x480
Windows	75 Hz	800x600
Windows	75 Hz	1024x768
Windows	75 Hz	1280x1024
Windows	60 Hz	1600x1200

External Server storage connectivity

HP has the broadest, most robust server and storage line up in the industry, providing exactly the right fit for every need. Refer to the Storage Server matrix to see a matrix that highlights which storage device, server and operating system is interoperable.

Configuration

Integrated Multifunction Core I/O

The HP Integrity rx8640 Server chassis supports either one or two Core I/O cards (AB314A). Core I/O slots are located along the right rear vertical edge of the chassis. One core I/O card is included with each system. The first core I/O card will support up to four cell boards in the server and all I/O slots. For support of two hard partitions, a second core I/O is required in the host system. For support of three or four hard partitions (nPars), a third and/or fourth core I/O card can be added in the rx8640 Server Expansion Unit 2. See the SEU-2 section for more details.

HP Integrity rp8400/rp8420/rx8620 Core I/O cards cannot be carried forward to the HP Integrity rx8640 server.

Each Integrity core I/O card provides the following features:

Management Processor: The Management Processor (MP) is a dedicated processor that simplifies and extends system management, as well as, enhances serviceability. The MP feature set was designed to minimize/eliminate the need for the System Administrator to be physically at the system to perform tasks such as diagnostics, system management, or even hard resets.

Features:

- System management over the Internet or Intranet
- System console redirection
- Console mirroring
- System configuration for automatic restart
- Viewing history log of system events
- Viewing history log of console activity
- Setting MP inactivity timeout thresholds
- Remote system control
- Remote power cycle (except for MP housekeeping power)
- Viewing system status
- Event notification to system console, e-mail, pager, and/or HP Response Centers
- Automatic hardware protection of critical environmental problems
- Access to management interface and console(s) on LAN failure (modem required)
- Auto system restart
- Remote resetting of hardware partitions
- Forward progress indicator (Virtual front-panel)
- Out-of-band Manageability and PDC firmware update
- Configure manageability and console security
- SSL

External LAN port: 1-GbE LAN port using an RJ-45 connector

External SCSI port: Ultra320 SCSI port for connections to mass storage or media. (A second U320 external port only available when internal drive off of LAN/SCSI is connected to Smart Array).

Access to internal peripheral bay: The first core I/O card enables half of the HP Integrity rx8640 Server peripheral bay, which includes one removable media and two low profile disks. The second core I/O card enables the remaining internal peripherals, two disks, and one removable media bays. Customers that require access to more than two internal disks and/or one removable media slot must purchase the second core I/O card and more than one cell board.

Core I/O Loading Rules

The integrated multifunction I/O provides core I/O functionally and includes the Management Processor technology.

- 1 Core I/O card is included with each HP Integrity rx8640 Server
- Load the first Core I/O board into slot 0.
- Core I/O slot 0 corresponds to Cell Board slot 0. Core I/O slot 1 corresponds to Cell Board slot 1.
- A cell board must be installed in slot 0 to enable use of Core I/O 0. Likewise, a cell board must be installed in slot 1 to enable use of Core I/O 1.
- Access to two internal disk drives and one Removable Media bay is enabled with the installation of the first Core I/O board.
- The optional second Core I/O board must be ordered to enable hardware partitioning (systems not using the Server Expansion Unit 2).
- The optional second Core I/O board must be ordered to enable access to the third/fourth internal disks and second removable media drive. (**NOTE:** For support of 3 or 4 hard partitions [nPartitions], a third and fourth core I/O board is included in the rx8640 Server Expansion Unit 2. See the SEU 2 section for more details.)

Internal Disk Drives

HP Integrity rx8640 Server supports up to four internal low-profile hot-plug disk drives.

Internal Disk Drive Specifications

Configuration

Product Number	Disk Capacity	Rotational speed	Average seek time (read/write)	Sustained Bandwidth
AD147A	73 GB	15,000 RPM	3.6 msec (read); 3.9 msec (write)	40 MB/s
AD210A	146 GB	15,000 RPM	3.6 msec (read); 3.9 msec (write)	40 MB/s
AD265A	300 GB	15,000 RPM	3.6 msec (read); 3.9 msec (write)	40 MB/s

HP Integrity rp8400/rp8420/rx8620 disk drives can be carried forward to the HP Integrity rx8640 server.

For HP-UX:

- Independent UltraSCSI controllers provide each disk drive with an independent SCSI channel
- Supported by MirrorDisk/UX across disk drives, controllers, and Core I/O boards
- Must order two Core I/O cards to support more than two internal disk drives

For Windows:

- An rx8640 customer need only order AB362A-0D1 in order to receive an SA6402 Smart Array card cabled and configured for RAID-1 mirroring in the factory. The AB362A product includes both the SA6402 Smart Array Card (A9890A) and the internal RAID cables (AB338A).
- An rx8640 customer need only order AB363A-0D1 in order to receive an SA6404 Smart Array card cabled and configured for RAID-1 mirroring in the factory. The AB363A product includes both the SA6404 Smart Array Card (A9891A) and the internal RAID cables (AB338A).
- The customer is limited to maximum of one AB362A or AB363A per partition.
- The customer may order additional Smart Array controllers as add in cards for connection to external storage devices. When these products are ordered with option 0D1 they will be installed, but will not be connected to the internal HDDs. The supported Smart Array products (for external storage) on rx8640 are:
  - A9890A–SA6402
  - A9891A–SA6404
  - 337972 B21–SA P600

Internal Removable Media

- HP Integrity rx8640 Server contains two removable media bays, which will support either a DVD+RW or DAT drive. Removable media drives are not hot plug capable.
- DVD+RW drive provides enhanced features while preserving backward read compatibility with 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. (**NOTE:** Installing the Smart Array card connected to the internal drives does not affect the function of the DVD-ROM.)
- A DVD drive is required for all OpenVMS and Windows configurations.
- DAT 72-GB drive has a maximum storage capacity of 72 GB and is RoHS compliant.
- Must order two Core I/O cards to enable more than one Internal Media device.
- HP Integrity rp8400/rp8420/rx8620 removable media drives can be carried forward to the HP Integrity rx8640 server

Internal Removable Media Specifications

Product Number	Device	Capacity	Data transfer rate
AB351B*	DVD+RW		
AB400A**	DAT-72	72 GB	

* Third Party software (not included with AB351A) is required to support DVD write capability with Windows.

** Not supported with Linux

I/O Configuration Rules

The following table summarizes previously mentioned configuration rules pertaining to usage of I/O slots and internal peripherals.

Configuration	Minimum Required Number of Cells	Minimum Number of Core I/Os
>8 I/O card slots	2	1
>2 Internal Disks	2	2
2 Internal Removable Media	2	2
2 Partitions	2	2

Configuration

Additional I/O resources using the Server Expansion Unit 2 (SEU-2)

Additional I/O resources can be obtained by adding the HP Server Expansion Unit 2 (SEU-2). The SEU-2 is an add on chassis containing I/O resources that complement the I/O and partitioning capabilities within the HP Integrity rx8640 Server. The SEU-2 mirrors the I/O resources embedded within the HP Integrity rx8640 Server chassis, adding 16 I/O card slots, 4 disk bays, 2 removable media slots, and enabling 2 additional hard partitions.

The SEU-2 must be installed in the same cabinet and directly above the host rx8640 server. Please refer to the Server Expansion Unit 2 section in this guide or more specific details.

The following table summarizes the I/O configuration rules when an SEU-2 is configured with the HP Integrity rx8640 Server.

Required Configuration	Minimum Required Number of Cells	Minimum Required Number of Core I/Os
>16 I/O card slots	3	4(1)
>24 I/O card slots	4	4(1)
>4 Disks	3	4(1)
>6 Disks	4	4(1)
3 Removable Media	3	4(1)
4 Removable Media	4	4(1)
3 Hard Partitions	3	4(1)
4 Hard Partitions	4	4(1)

(1) Two Core I/O cards are included each SEU

External Storage

HP has the broadest, most robust server and storage line up in the industry, providing exactly the right fit for every need. Refer to the Storage Server matrix to see a matrix that highlights which storage device, server and operating system is interoperable.

AC/DC Power

DC Power Supplies
The HP Integrity rx8640 Server supports up to six hot swap bulk power supplies for 2N+1 protection. The hot swap design allows for the replacement of a failed power supply without interrupting server operation. Two supplies are included with the base system. A minimum of one additional supply is required for each cell board. Following this rule, all configurations will have 2N+1 power protection. HP Integrity rp8400/rp8420/rx8620 DC power supplies can be carried forward to the HP Integrity rx8640 server.

PCI Power Supplies
PCI power supply is now a redundant N+1 design. One PCI power supply failure will not affect the I/O bay since the remaining PCI power supply will power both I/O bays (this is an upgrade from the sx1000 based systems). PCI power supplies are hot swap capable (this is an upgrade from the sx1000 based systems). HP Integrity rp8400/rp8420/rx8620 PCI power supplies cannot be carried forward to the HP Integrity rx8640 server.

AC Power
The HP Integrity rx8640 Server contains four C20 power receptacle ports located at the bottom rear bulkhead. A minimum of two power cords must be used to maintain normal operation of the HP Integrity rx8640 Server. A second set of two cords can be added to improve system availability by protecting, for example, against power grid failures or accidentally tripped circuit breakers. The HP Integrity rx8640 Server hardware is capable of receiving AC input from two different AC power sources. The objective is to maintain full equipment functionality when operating from power source A and power source B, or A alone, or B alone. This capability is called "fault tolerant power compliance."

Although many HP Integrity rx8640 Server configurations can be sufficiently powered from a single 16 /20 amp branch circuit, HP strongly recommends using one 16-amp (minimum) branch circuit per power cord. Due to the variety of 16/20 plugs used throughout the world, the HP Integrity rx8640 Server menu offers a choice of plug options.

All HP Integrity rx8620 servers are shipped with four AC power cords.
The drawing below represents the power receptacle ports on the HP Integrity rx8640 Server. If only two power cords are used, they must be plugged into either A0 and A1, or B0 and B1.

AC Power Consumption
The HP Integrity rx8640 Server power consumption will vary greatly depending on the hardware configuration and the input line voltages supplied at customer sites. Because of the disparity of line voltages throughout the world it's best to represent power consumption in VA (Volt Amperes). With power consumption being of high concern throughout the world, it's necessary to specify consumption in a couple of different ways.

- **Maximum Theoretical Power** or "Maximum Configuration" (input power at the AC input

expressed as volt amps to take into account power factor correction)–The calculated sum of the maximum worst case power consumption for every subsystem in the server. This number will never be exceeded by a functioning server for any combination of hardware and software under any conditions.

- **Marked Electrical Power** (input power at the AC input expressed as volt amps)–The server Marked Electrical Power is the rating given on the chassis label and represents the input power required for facility AC power planning and wiring requirements. This number represents the expected maximum power consumption for the server based on the power rating of the bulk power supplies. This number can safely be used to size AC circuits and breakers for the system under all conditions.
- **Typical Maximum Power,** User Expected Maximum Power, or "Typical Configuration" (expressed as volt amps)–The measured maximum worst case power consumption. This number represents the larges power consumption that HP engineers were able to produce for the server with any combination of hardware under laboratory conditions using aggressive software applications designed specifically to work the system at maximum load. This number can safely be used to compute thermal loads and power consumption for the system under all conditions.

Power Numbers per configuration are shown below. For further power consumption details, see the HP Integrity rx8640 Installation Manual.

Configuration

HP Integrity rx8640 Server Fully Loaded Configuration

- 16 Intel Dual core Itanium processor or 1.6 GHz Itanium processors
- 256 GB of Memory
- 16 PCI cards
- 4 cell boards
- 4 internal hard drives
- 2 DVD drives
- 2 Core I/O cards
- 6 bulk power supplies
- Typical maximum power: 3,962 VA (3,883 W) (19.81 A @ 200 VAC across 2 cords)
- Marked Electrical for the server: 5400 VA (30A @ 180 VAC across 2 cords)
- Marked Electrical per line cord: 2700 VA (15A @ 180 VAC across each cord)
- Maximum theoretical power: 5,982 VA (5,862 W)

HP Integrity rx8640 Server Average Configuration

- 8 Intel Dual-core Itanium processors or Eight Intel Itanium processors
- 16 GB of Memory
- 8 PCI cards
- 2 cell boards
- 2 internal hard drives
- 1 DVD drives
- 2 Core I/O cards
- 3 bulk power supplies
- Typical power consumption: 1870 VA (9.35 A @ 200 VAC across 2 cords)

Power Distribution Units

60 amp Power Distribution Unit

- AF916A (NA/JPN) and AF917A (International)–supported with 10K G2 rack
- E7683A (US) and E7684A (International)–supported in Rack System E

A 60-amp Power Distribution Unit (PDU) has been developed for Integrity customers that prefer to use fewer, higher amperage connections into their wall electrical infrastructure. This PDU is sold separately and can be ordered with any HP Server solution. For more details on PDUs, please refer to the PDU sales collateral.

The drawing below is an example of how the PDU can be configured with the HP Integrity rx8640 Server in a dual grid configuration. In this case there are two HP Integrity rx8640 servers (average configurations drawing ~9 amps each) and two 60-amp PDUs configured with redundant power. The blue cords represent the primary power connections needed for normal operation. In this example, cords from each server are plugged into a separate branch circuits. However, it is acceptable, for lower VA configurations, for each server to plug both grid A cords into one branch circuit and both grid B cords into second branch circuit. The remaining PDU outlets can be used to power other components as long as the specifications for the PDU rating are not exceeded.

For redundant power inputs, the second set of red cords is added. If the second PDU is plugged into a second grid this configuration provides protection against:

- Losing power from a single power grid
- Accidental tripping of one or two circuit breakers
- Accidental disconnect of a single-PDU power cord
- Accidental disconnect of up to four system power cords

30 amp Power Distribution Unit

- 252663-D75 (NA/JPN) and 252663-B33 (International)-supported on 10K G2 rack
- E7681A (NA/JPN) and E7682A (International)-supported on Rack System E

A 30 amp Power Distribution Unit (PDU) is also supported with HP Integrity rx8640 Server. This PDU is sold separately and can be ordered with any HP Server solution.

The following configuration guidelines apply when using the 30-amp PDU:

- HP Integrity rx8640 Server plugs A0 and A1 should be plugged into the same PDU
- Ax and Bx cords should never be plugged into the same PDU
- Use two 30-amp PDUs to achieve input power redundancy. A0/A1 and B0/B1 into separate PDUs.
- Ordering tools will not force the purchase of a second PDU for input power redundancy. A second PDU must be manually selected if redundant input power is desired.

24-amp Power Distribution Unit

- 252663-D74 4.9kVA

Partitioning

A hardware partition corresponds roughly to a single, standalone system. The HP Integrity rx8640 Server can be subdivided into four partitions, each containing one or more cells that communicates coherently over a high bandwidth, low latency crossbar fabric. Special programmable hardware in the cells defines the boundaries of a partition in such a way that the isolation is enforced from the actions of other partitions. Each partition runs its own independent instance of the operating system (HP UX 11i v3, HP UX 11i v2, Windows Server 2008, Linux, or OpenVMS). Applications cannot span partitions since each partition runs its own instance of the OS, essentially functioning as a stand alone server. However, different partitions may be executing the same or different revisions of an operating system, or they may be executing different operating systems altogether (such as HP UX 11i v3, HP UX 11i v2, Windows Server 2008, Linux, or OpenVMS), with OS availability.

Each partition has its own independent processors, memory and I/O resources consisting of the resources of the cells that make up the partition. Resources may be removed from one partition and added to another without having to physically manipulate the hardware just by using commands that are part of the System Management interface. With future releases of HP-UX and Windows, using the related capabilities of dynamic reconfiguration (e.g. on line addition, on line removal), new resources may be added to a partition and failed modules may be removed and replaced while the partition continues in operation.

Partitioning the resources of the complex in this way makes it easy to run multiple applications on the same physical system; you can allocate physical resources and tune the operating system running on each partition depending on the needs of the application (or the most important application) you intend to run on it. Alternatively, you can configure the HP Integrity rx8640 Server as a single partition, allowing all the resources to be focused on a single set of tasks, for example a large online transaction processing application.

You can increase or reduce the processing power of a partition by adding or deleting cells. With the

rx8640, you must shut down the operating system running on the affected partition(s) before moving cells, and before making configuration changes that will take effect. Though the OS may include commands for some configuration tasks, HP recommends you use the Partition Manager (parmgr) to configure partitions.

Hardware based partition configuration changes may require a reboot of the partition depending upon the configuration change. The reboot of the partition only affects the partition that is being reconfigured. The other partitions defined in the chassis are not affected and will continue to execute without interruption. In a future HP-UX release, dynamic hard partitions will be supported. Dynamic partitions imply that partition configuration changes do not require a reboot of the partition.

The HP Integrity rx8640 Server can be divided into four independent hardware partitions when configured with the HP Server Expansion Unit 2. In a partitioned configuration, I/O bay resources such as I/O slots, core I/O, disk and removable media bays, are always dedicated to the corresponding cell board slot. In other words, I/O bay 0 resources are always configured to the cell board in Cell slot 0. Therefore, in a partitioned system, the amount of resources within a partition is always proportional to the number of cells within that partition. There is no flexibility to otherwise divide these components. For example, in a system configured with two cells in separate nPars, it is not possible to include twelve I/O slots in partition 0 and four I/O slots in partition 1. Please refer to the "HP Server Expansion Unit 2" section in this document for more specific details.

The table below summarizes the resource availability based on hardware partitions.

Number of Hard Partitions	Minimum Number of Cells	Minimum Available I/O slots	Core I/O (Rquired)	Minimum Available Disk/Media Bays
1 Partition	Any one cell	8	1	2/1
2 Partitions	Any two cells	16	2	4/2
3 Partitions	Any three cells	24	4	6/3
4 Partitions	Four cells	32	4	8/4

Software Partitioning

HP Integrity rx8640 servers support virtual partitioning (vPars) to the single processor level similar to support on HP 9000 servers with HP-UX 11i v1. With vPars, a user will be able to support up to eight separate virtual partitions each with an instance of HP-UX within each hard partition. VPars will provide many of the features of nPars but without the electrical isolation and support for hardware failures that nPars provides.

HP Virtual Machines is supported on the rx8640 server. HP Virtual Machines:

- increases server utilization
- enables server consolidation
- provides rapid deployment of new environments (a requirement for test and development environments)
- enhances the HP Virtual Server Environment by providing soft partitioning with shared I/O, sub CPU granularity, and built in dynamic resourcing for all Integrity servers

HP System Insight Manager

HP Systems Insight Manager (SIM) is the central point of administration for management applications that address the Integrity rx7640 and rx8640 server's management requirements. HP SIM delivers powerful monitoring and control, notifying the administrator of potential hardware or software problems before they occur. It also provides inventory reporting capabilities that dramatically reduce the time and effort required to track server assets. HP SIM provides secure communications as well as role based security to make certain that its powerful capabilities are kept secure from unauthorized users.

HP-UX

- Please see: http://www.hp.com/go/hpux for latest details regarding HP-UX.
- HP Integrity Essentials for HP-UX 11i are advanced plug ins to HP SIM that provides modular, integrated system management software for complete HP Integrity server management. It integrates with many other HP-UX-specific system management tools, including the following tools available on Integrity servers:
- Ignite-UX addresses the need for HP-UX system administrators to perform fast deployment for one or many servers. It provides the means for creating and reusing standard system configurations, enables replication of systems, permits post installation customizations, and is capable of both interactive and unattended operating modes.
- Software Distributor-UX (SD-UX) is the HP-UX administration toolset used to deliver and maintain
  HP-UX operating systems and layered software applications. Delivered as part of HP-UX, SD-UX can help you manage your HP-UX operating system, patches, and application software on HP Integrity servers.
- System Management Homepage (SMH) is used to manage accounts for users and groups, perform auditing and security operations, and handle disk and file system management and

peripheral device management. HP Systems Insight Manager allows these tasks to be distributed to multiple systems and delegated using role based security.

- HP-UX Kernel Configuration is used for self optimizing kernel changes. The new HP-UX Kernel Configuration tool allows users to tune both dynamic and static kernel parameters quickly and easily from a Web based GUI to optimize system performance. This tool also sets kernel parameter alarms that notify you when system usage levels exceed thresholds.
- Partition Manager creates and manages nPars for high end servers. After the partitions are created, the systems running on those partitions can be managed consistently with all the other tools integrated into SIM.
- HP-UX 11i Webmin based Admin is a Web based system management framework that allows a wide variety of open source Webmin system management modules to be plugged in. HP supports this tool for the configuration of the HP-UX 11i Apache based Web Server and the HP-UX 11i Tomcat based Servlet Engine.
- HP-UX Bastille is a security hardening/lockdown tool that enhances the security of an HP-UX 11i UNIX® host. It accommodates the various degrees of hardening required of servers used for webs, applications, and databases.
- Security Patch Check efficiently improves systems security by performing analysis of file sets and patches installed on an HP-UX 11i system and generating a report of recommended security patches.
- System Inventory Manager is for change and asset management. It enables you to easily collect, store, and manage inventory and configuration information for HP-UX-based servers. It provides an easy to use, web based interface, superior performance, and comprehensive reporting capabilities.
- Event Monitoring Service (EMS) keeps the administrator of multiple systems aware of system operation throughout the cluster, and it notifies the administrator of potential hardware or software problems before they occur. HP Systems Insight Manager can launch the EMS interface and configure EMS monitors for any node or node group that belongs to the cluster, resulting in increased reliability and reduced downtime.
- HP Process Resource Manager (PRM) controls the resources that processes use during peak system load. PRM can manage the allocation of processor, memory resources, and disk bandwidth. It allows administrators to run multiple mission critical applications on a single system, improve response time for critical users and applications, allocate resources on shared servers based on departmental budget contributions, provide applications with total resource isolation, and dynamically change configuration at any time–even under load.
- HP-UX Workload Manager (WLM) provides automatic processor resource allocation and application performance management based on prioritized service level objectives (SLOs). In addition, WLM allows administrators to set real memory and disk bandwidth entitlements (guaranteed minimums) to fixed levels in the configuration. The use of workload groups and SLOs improves response time for critical users, allows system consolidation, and helps manage user expectations for performance.
- HP OpenView Operations Agent provides a fully integrated, single pane of glass management solution for systems, networks, applications, and databases. A powerful ability to monitor, filter, correlate, and respond to events enables IT organizations to establish central management control over their managed environments and improve overall availability and reliability.
- HP OpenView Performance Agent monitors and analyzes the performance of systems and applications to compare SLOs with actual application performance, and it enables real time performance monitoring as well as action on alarm.
- HP OpenView GlancePlus is a powerful system monitoring and diagnostic tool that provides online performance information, examination of system activities, identification and resolution of performance bottlenecks, and system fine tuning.
- HP OpenView Data Protector (Omniback II) provides reliable, high performance data protection for enterprise wide heterogeneous environments without impacting system or application performance. It centralizes and automates backup and recovery operations and tracks file versions and media to enable swift recovery of information.
- HP OpenView Network Node Manager (NNM) management station runs on Itanium based HP UX servers. NNM provides a powerful network management solution that includes concise, in depth views of network devices and their status in an intuitive graphical format. NNM helps network managers evaluate network performance, pinpoint problem sources, and proactively manage their networks and network availability.
- All other HP OpenView management tools, such as HP OpenView Operations, Service Desk, and Service Reporter, will be able to collect and process information from the agents running on Integrity servers with HP-UX.

Windows

- Please see: http://www.hp.com/go/windows and select Integrity Windows for latest details regarding Integrity Windows
- The HP Integrity Essentials Foundation Pack for Windows is a complete toolset for installing, configuring, and managing HP Integrity rx7640 and rx8640 Servers running Windows. The following tools are included in the package:
- Smart Setup CD includes an EFI based setup utility designed for easy server and array controller configuration. The CD also includes all the latest tested and compatible drivers, HP firmware, HP utilities, and HP management agents that assist in the server deployment

process (by preparing the server for installation of a standard Windows operating system) and in the ongoing management of the server.

- System Management Homepage for HP Integrity servers with Windows helps system administrators rapidly respond to potential and actual system failures, increases system stability, and reduces troubleshooting complexity. It provides consolidated information about system health and configuration through a simple, web based user interface. All system faults and major subsystem status are reported within the System Management Homepage. The System Management Homepage is accessible directly through a browser or through a management application such as System Insight Manager or an enterprise management application.
- Microsoft Windows System Resource Manager (WSRM) provides resource management and enables the allocation of resources, including processor and memory resources, among multiple applications based on business priorities. An administrator sets targets for the amount of hardware resources that users or running applications are allowed to consume. This means resources can be allocated among multiple applications on a server according to business priorities.
- HP OpenView management tools, such as HP OpenView Operations and Network Node Manager, will be able to collect and process information from the SNMP agents and WMI running on Itanium-based Windows servers, proactively monitoring and measuring the availability and performance of heterogeneous servers and applications from a services perspective and a Windows management platform. In the future, OpenView agents will be able to directly collect and correlate event, storage, and performance data from Itanium-based Windows servers, enhancing the information HP OpenView management tools will process and present.

Linux

- The HP Integrity Essentials Foundation Pack for Linux is a set one DVD and one CD that includes tools for server install, configure and manage the Integrity rx7640 and rx8640 servers as a part of an adaptive infrastructure.
- The Smart Setup CD contains the latest documentation, firmware, and tools that assist in the server deployment process by preparing the server for installation of the Linux operating systems. This EFI based setup utility application assists with tasks such as configuring storage adapters, upgrading firmware, preparing a system hardware inventory, and installing diagnostics tools.
- HP Integrity Essentials Foundation Pack for Linux also includes one Management DVD to assist in the on going server management tasks. These media contain the complimentary HP value added software that aid in remotely diagnosing and monitoring system resources, and storage attached to the system. This software includes:
  - HP Insight Management Agents
  - WBEM providers
  - System Management Homepage
  - HP System Insight Manager
- System Management Homepage provides a consolidated view of system hardware health, configuration, performance and status information for individual HP servers. Included with the HP Integrity Essentials Foundation Pack for Linux, the System Management Homepage is a secure web based application that helps systems administrators respond rapidly and proactively to potential and actual system failures, increasing system stability and reducing troubleshooting complexity. It provides a consolidated view of all system health, in depth instrumentation and configuration data, and simplifies access to HP web enabled management tools that include the Insight Management Agents, Software Version Control Agents and the Array Configuration Utility.
- The HP Systems Insight Manager is a core management element of the Integrity Essentials Foundation Pack that is also included on the Management DVD. This application gathers and organizes raw system management agent information that enables operators to more effectively monitor system usage and troubleshoot system problems. Customer benefits include greater system uptime, quicker problem resolution, and lower cost of ownership for your Integrity and ProLiant servers.
- Serviceguard Manager can monitor and manage Serviceguard on Linux and HP-UX 11i clusters from a single point. It provides a GUI to administer HP Serviceguard, Serviceguard Extension for RAC, Metrocluster, and Continentalclusters and to display their status.

OpenVMS

- Factory installed software
- Partition Manager creates and manages nPartitions-hard partitions for high end servers. Once the partitions are created, the systems running on those partitions can be managed consistently with all the other tools integrated into HP Systems Insight Manager. See "Partitioning" for more information.
- OpenVMS Management Station to manage user accounts, printers, and disks
- Availability Manager for real time performance monitoring
- Global Workload Manager (gWLM)–Global Workload Manager provides automatic CPU resource allocation and application performance management based on prioritized service level objectives (SLOs).

- Class Scheduler for resource management
- HP Systems Insight Manager (see above) in conjunction with (Web) Management Agents
- Central Management Server (CMS)-Management agent for gWLM
- HP-UX Kernel Configuration allows users to tune both dynamic and static kernel parameters quickly and easily from a Web based GUI to optimize system performance. This tool also sets kernel parameter alarms that notify you when system usage levels exceed thresholds.
- Partition Manager creates and manages nPartitions-hard partitions for high end servers. Once the partitions are created, the systems running on those partitions can be managed consistently with all the other tools integrated into HP Systems Insight Manager. See "partitioning" for more information.
- HP-UX webmin based Admin is a Web based system management framework that allows a wide variety of open source webmin system management modules to be plugged in. HP supports this tool for the configuration of the HP-UX Apache based Web Server and the HP-UX Tomcat based Servlet Engine.
- HP-UX Bastille is a security hardening/lockdown tool that enhances the security of an HP-UX UNIX® host. It accommodates the various degrees of hardening required of servers used for webs, applications, and databases.
- Security Patch Check performs analysis of file sets and patches installed on an HP-UX system and then generate a report of recommended security patches. Use of the Security Patch Check software tool can help efficiently improve system security.
- Event Monitoring Service (EMS) keeps the administrator of multiple systems aware of system operation throughout the cluster, and notifies the administrator of potential hardware or software problems before they occur. HP Systems Insight Manager can launch the EMS interface and configure EMS monitors for any node or node group that belongs to the cluster, resulting in increased reliability and reduced downtime.
- OpenView Operations Agent-collects and correlates OS and application events (fee based)
- OpenView Performance Agent-determines OS and application performance trends (fee based)

Instant Capacity (iCAP, formerly known as Instant Capacity on Demand [iCOD])-For HP-UX and OpenVMS only (Windows is currently not supported)

For a complete description of how to configure Instant Capacity (iCAP), please refer to the Instant Capacity QuickSpec.

Racking

The HP Integrity rx8640 Server was designed to provide industry leading performance density and availability when ordered in a racked configuration. At 17 EIA units (29.75 inches), two HP Integrity rx8640 servers can be mounted into a single HP rack two-meter cabinet with 7 or 8 EIA units of extra space for mounting external peripherals. One rx8640 can be mounted in a rack along with a Server Expansion Unit 2.

The HP Integrity rx8640 Server industrial design and packaging was designed to allow easy and quick access to all of the system's components. The most frequently handled devices, removable media and disks, are directly accessible at the system's front. By removing the front bezel, hot-swap fans, hot-swap power supplies, and PCI power supplies can be completely serviced. At the rear, core I/O and more hot-swap fans are directly accessible. For access to all other components, the rack-mounted HP Integrity rx8640 Server comes with rack sliders.

These rack sliders enables the HP Integrity rx8640 Server to be slid forward out of the HP Rack cabinet for servicing of internal components such as fans, cell boards, and I/O cards, while the system is still running. The sliders also allows for servicing or replacement of any FRU (field replaceable unit) without removing the chassis from the cabinet. The HP Integrity rx8640 Server industrial design and slider strategy enables access and removal of any FRU within 15 minutes or less. This design feature minimizes the downtime associated with system upgrades in the rare event of a component failure. Also included with ever rack mounted HP Integrity rx8640 Server is a cable management arm (CMA). The CMA neatly secures data cables and prevents cables from becoming entangled while servicing of the system.

The following racking rules apply for HP Integrity rx8640 servers configured with an HP Server Expansion Unit 2 that is factory integrated.

- The HP Server Expansion Unit 2 must be mounted in the same cabinet as the host HP Integrity rx8640 Server.
- The HP Integrity rx8640 Server must be mounted directly below the HP Server Expansion Unit

When adding an SEU-2 in the field to an existing host server, It is preferred that the SEU-2 be installed directly above the host server. When not possible to install the SEU-2 above the host server in the field, it is supported to install the SEU-2 in an adjacent rack. Please consult the SEU-2 install guide for more details.

Configuration

Heavy Duty Stabilizing Kit for 10K G2 Universal Rack (not used with Rack System E)	A heavy duty stabilizing kit is required for the rack of the rx8640 server to add stability for the HP Universal 10K G2 rack. With this stabilizing kit, the ballast is no longer needed with the new HP Universal rack. Use of the Heavy Duty Stabilizing kit is mandatory and should be installed immediately.
Ballasts for Rack System E Cabinets (not used with Universal Rack 10K G2)	Due to the weight of the HP Integrity rx8640 Server, ballast kits have been developed to add stability to HP Rack Systems/E cabinets while the system is being serviced. Every HP Integrity rx8640 Server shipped to customers will be shipped with a ballast kit. These ballasts were designed to easily attach to the rear anti tip foot that comes standard with every HP Rack System E cabinet. Use of the HP Integrity rx8640 Server ballast kit is mandatory and should be installed immediately.
UPS	Management of local UPSs for the rx7640 and rx8640 is now through a LAN port on the core I/O card. Management of UPSs by the predecessor, rx7620 and rx8620 servers was through a serial port on the core I/O. The serial port is not available on the rx7640 and rx8640 servers. Therefore, when upgrading or adding rx7640 and rx8640 servers to your environment and using local UPSs (as opposed to datacenter wide UPSs), make sure there is a LAN management card available on the local UPS.
10000 and 9000 Racks (These racks are the pre-merger Compaq racks)	The HP 9000 and Integrity servers are supported for field installs into these racks. Factory integration will not be supported for HP 10000 and HP 9000 racks. Differing depth requirements of the HP 9000/Integrity racking kits preclude racking HP 9000/Integrity servers and HP ProLiant servers in the same racks. Refer to the 10000 G2 Series Rack Best Practices Guide for Information on rack deployment, stabilization, and transportation. Go to: http://h18004.www1.hp.com/products/servers/platforms/rackandpower.html for more information. When field racking for the mid-range servers in any rack (10K G2, System E or third-party), the customer will have t order the appropriate service product (HA124A1 option 570 - HP Startup Field Racked Mid Server Service). For further details, refer to the racking solutions section in the configuration guide.
Third-Party Racking	HP Servers are designed to maximize performance density when installed into HP Rack Systems. HP Rack Solutions maintain the high level of safety and reliability of HP Server solutions that customers have come to expect. Although HP strongly recommends racking servers in HP Rack Solutions, it recognizes that some customer circumstances may prohibit this. For those customers, HP has developed a set of guidelines that when followed, enables server installations into third party cabinets. It is extremely important that the guidelines be followed due to the wide variety of cabinets in the market place. Please refer to the racking solutions section in the configuration guide for configuration guidelines.

HP Integrity rx86xx/HP 9000 rp84xx Upgrades to HP Integrity rx8640 Servers

All HP rp84xx, rx84xx servers are in box upgradeable to rx8640 servers in the current chassis. In box upgrades may take one to two 8 hour periods either of successive days or using successive shifts on the same day. In box upgrades will have the advantage of asset tag retention.

You can also accomplish an upgrade by combining the purchase of a new server with Trade Up credits on the older server. Box swap upgrades may have the advantage of less upgrade down time.

In box upgrades and box swap upgrades may have similar prices depending on the amount of memory and number of cell boards and processors that have to be upgraded.

Included in the In box Upgrade Kit (AD056A)

- System Backplane–The HP Integrity rx8640 server backplane is a new design with the following feature modifications:
  - New high speed differential links
  - Redesign of the crossbar ASIC
  - Additional switch fabric on the backplane
  - Redesign of the backplane power subsystem
  - Redesign of the system clock infrastructure
  - New high speed, impedance controlled, board to board connectors will be used
- Mass Storage Backplane PCA–the mass storage subsystem upgrades from SCSI SE interconnect to U320.
- Other Miscellaneous
  - Nameplates and labels
  - "Read Me" documents, Upgrade Guide, CD ROM
  - Miscellaneous cables

Must Order Separately for an In box Upgrade

- Processors–Unless already have supported processors
- Cell Boards–New Cell board design to support new chipset and future Itanium CPUs
- Memory DIMMs–The memory system uses Double Data Rate DRAMs (DDR II)
- I/O Backplane–The I/O backplane must be ordered
- Core I/O–U320 support
- Installation services

Material to be Reused in an In Box Upgrade

- Chassis
- 1.6-GHz, 6-MB cache single core Itanium processor modules
- System fans
- AC power distribution PCA
- DC power distribution PCA
- OL* PCA (I/O cards)
- Bulk power supplies
- Hard disk drives
- Removable media drives
- Supported I/O cards (please refer to supported I/O card list)

Technical Specifications

Server model number		**rx8640**
	Number of Single-core Itanium processor cores	1-16
	Number of Dual-core Itanium processor cores	1-32

Server product numbers	Chipset	sx2000
	Server Product Number (Base)	AB297A

Fast Bundles (all include base chassis and power supplies)	**Product Number**	**Number of Processor cores**	**Number of Cell Boards in bundle**	**Number of Core I/O Cards in bundle**	**Number of Power Supplies in bundle**
	AB443A	**8**	**1**	**1**	**3**
	1.4 GHz Itanium 9120N (Montvale) processor 12 MB cache				Option 004
	1.6 GHz Itanium 9140N (Montvale) processor 18 MB cache				Option 005
	AB444A	**16**	**2**	**1**	**4**
	1.4 GHz Itanium 9120N (Montvale) processor 12 MB cache				Option 004
	1.6 GHz Itanium 9140N (Montvale) processor 18 MB cache				Option 005
	1.6 GHz Itanium 9150N (Montvale) processor 24 MB cache				Option 006
	AB446A	**32**	**4**	**1**	**6**
	1.4 GHz Itanium 9120N (Montvale) processor 12 MB cache				Option 004
	1.6 GHz Itanium 9140N (Montvale) processor 18 MB cache				Option 005
	1.6 GHz Itanium 9150N (Montvale) processor 24 MB cache				Option 006

Supported Processors	1.6 GHz Itanium 9150N (Montvale) processor*	24 MB cache
	1.6 GHz Itanium 9140N (Montvale) processor*	18 MB cache
	1.4 GHz Itanium 9120N (Montvale) processor*	12 MB cache
	1.6 GHz Itanium 9050 (Montecito) processor*	24 MB cache
	1.6 GHz Itanium 9040 (Montecito) processor*	18 MB cache
	1.4 GHz Itanium 9020 (Montecito) processor*	12 MB cache
	* Intel Dual-core processor	
	NOTE: All processors contain Floating Point Coprocessor	

Memory	Memory slots	64 (16 per cell board)
	Min memory module (1pair of 2GB DIMMs)	4 GB
	Maximum memory capacity	512 GB (128 GB per cell board)

Internal Disks	Maximum disk mechanisms	4
	Maximum disk capacity	1.2 TB
	Maximum disk capacity (8 mechanisms with SEU-2)	2.4 TB
	Internal removable media	2 slots
	Internal removable media (with SEU-2)	4 slots
	DVD+RW (2 additional slots with SEU-2)	2 slots
	DAT-72 GB (2 additional slots with SEU-2)	2 slots

Core I/O (items per Core I/O)	Ultra320 SCSI-LVD	1
	1 GbE (RJ-45 connector)	1
	RS-232 serial port (one console)	1
	100Base-T port (LAN console connection)	1

I/O Buses and Slots (Numbers double with SEU-2)	Total hot plug PCI X/PCIe Slots	16
	Either BP1 config: 16 PCI-X slots (8 @ 266Mhz, 8 @ 133Mhz) or BP2 config: 8 PCI-X slots @ 133Mhz + 8 PCI-e slots @ 266Mhz)	

Technical Specifications

Maximum I/O Cards (See supported I/O table for specific products)	(Maximums double with SEU-2)	
	Mass Storage	8-16
	LAN	4-16
	WAN	16
	Multi-Function (Mass Storage/LAN)	14-16
	Additional Interface Cards	4-16

Electrical Characteristics	AC Input power	200-240V 50/60 Hz
	Hot swap Power supplies	6 total, 2 included with base
	Redundant AC power inputs	2 required, 4 cords for 2N
	Typical maximum power dissipation for maximum processor, memory, disk, I/O configurations	3,962 VA (3,883 W) 19.8A @200VAC
	Marked Electrical for server	5,400 VA, (30A @180VAC)
	Marked Electrical per line cord	2,700 VA (15A @180VAC)
	Power factor at full load	0.98 (approximately)
	kW rating for UPS loading*	6.0

* Represents theoretical maximum power/heat dissipation under worst case conditions, may increase with future upgrades

Site Preparation	Site planning and installation included	Yes
	Depth (in/mm)	30 in (762 mm)
	Width (in/mm)	19 in (482 mm)
	Height (in/mm/EIA) Racked	29.75 in (755 mm)/17 units
	Height (in/mm) Pedestal	32.8 in (833 mm)
	Weight (lbs/kg)	378 lbs (171.4 kg)

Environmental Characteristics	Acoustics (sound power) at 25°C	7.2 Bels LwA
	Acoustics (sound power) at 30°C	7.5 Bels LwA
	Acoustics (operator/bystander) at 24°C	61.0 dB LpA
	Operating Temperature (up to 5000 ft)*	41° to 89° F (5° to 32° C)
	Non-operating Temperature	-40° to 158° F (-40° to 70° C)
	Maximum rate of temperature change	68° F (20° C)/hour
	Operating relative humidity	15% to 80%, non-condensing, max. web bulb = 78.8° F (26° C)
	Non-operating relative humidity	5% to 90%, non-condensing
	Operating altitude above sea level	To 10,000 feet (3.0 km)
	Non-operating altitude above sea level	To 15,000 feet (4.5 km)

* Maximum operating temperature range up to 1524 meters (5000 feet.) For higher altitudes, derate the maximum temperature by 1°C/350 meters (1000 feet) above 1524 meters (5000 feet).

Regulatory Compliance	Regulatory Model Number	
	Electromagnetic Interference	Complies with FCC Rules and Regulations, Part 15, as a Class A digital device. Manufacturer's Declaration to EN55022 Level A, VCCI Registered, Class 1, Korea RLL
	Safety	UL Listed, cUL Certified, compliant with EN 60950