Dell

PowerEdge R910

Technical Guide

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1.1 Overview of PowerEdge R910 Benefits

The Dell™ PowerEdge™ R910 provides performance and reliability in a scalable 4U, four-socket server allowing large workload consolidation or max virtualization machine density.

With Intel® Advanced RAS (Reliability, Availability, Serviceability) Technology, internal dual SD modules for hypervisor redundancy, including design and component quality paired with Dell Lifecycle Controller, technicians avoid having to load diagnostics from other media. Dell built-in reliability saves valuable time and minimizes downtime for mission-critical workloads.

Purpose Built for Reliability

The PowerEdge R910 is built for reliability through factory integration and validation. The Dell "one-touch" process is designed to ensure one person is responsible for the entire server build, resulting in greater quality control. Every fully configured Dell server is tested (and re-tested) before it leaves the factory providing customers a fully configured and tested ready-to-deploy server.

Internal Dual SD module provides failover at the hypervisor; this feature was designed based on customer reliability feedback. Dell listened and delivered.

With Intel Advanced RAS Technology features never before seen in an industry-standard server, the PowerEdge R910 can automatically monitor, report, and recover from hardware errors to maintain data integrity and keep mission-critical services online.

Efficient Infrastructure

Performance resources, power efficiency, I/O, and memory scalability are essential to maximizing workload in the data center.

The PowerEdge R910 delivers the highest performing Xeon 7500 Series processors, up to 1TB of DDR3 memory, and 2 x 10Gb Optional LOM with 10 PCIe slots to help consolidate inefficient workloads.

Energy-efficient system design built with Energy Smart technologies includes power management features enabling power capping, power inventory, and power budgeting within your specific environment. Logical component layout of the internal components aids with airflow direction, helping to keep the server cool.

Intelligent Platforms, Connected Foundations

The PowerEdge R910 follows the 11th Generation PowerEdge behavioral specifications with the same system design commonality and usability true to the entire portfolio. All 11th Generation servers are designed to make the user experience easier while saving time and money.

Dell system management solutions focus on simplicity, efficiency, cost containment and reduction, and an adherence to open standards. Our systems management solutions are complemented by, connected to, and integrated with 3rd-party offerings, thereby delivering comprehensive solutions across the complete solutions stack.

The Lifecycle Controller is a chip that is integrated on the server. It helps to simplify administrator tasks by performing a complete set of provisioning functions such as system deployment, system updates, hardware configuration, and diagnostics in a pre-OS environment—all from a single, intuitive interface called the Unified Server Configurator (USC).

The PowerEdge R910 is easy to deploy, better to manage and maintain. Designed to save customers time and money to focus on what matters most, their people and business.

1.2 Comparison of PowerEdge R910 to PowerEdge R900

The Dell™ PowerEdge™ R910 is Dell's 11th generation general purpose 4-socket 4U Intel® based rack server. The R910 features the highest level performance scalability, system availability, and I/O expandability, providing performance and capacity leadership with reliability built-in to run business-critical applications. R900 is the predecessor of R910.

The PowerEdge R910 and the rest of the 11th generation servers are designed around optimizing virtualization, system management, usability and industrial design, and best-in-class power and thermals. The PowerEdge R910 is ideal for large database, virtualization, and business-critical applications.

Table 1. Product Comparison

Feature/Spec	PowerEdge R910	PowerEdge R900 (predecessor)
Processor	Intel® Xeon® Processor 7500 Series Two or four 4-core, 6-core, or 8-core 95W, 105W, and 130W TDP options	Intel® Xeon® Processor 7200, 7300, & 7400 Series Two or four 2-core, 4-core, or 6-core 80W, 90W, and 120W TDP options
Front Side Bus	Up to 6.4 GT/s Quick Path Interconnect (QPI) links	1066MHz
# Processors	2 or 4	2 or 4
# Cores	4, 6, or 8	2, 4, or 6
L2/L3 Cache	12MB or 18MB or 24MB	8MB or 12MB or 16MB
Chipset	Intel® 7500	Intel® 7300
DIMMs	64 x DDR3 1066 MHz DDR3 RDIMM	32 x FBD 667MHz FBD
Min/Max RAM	4GB/1TB	2GB/256GB
HD Bays	Hot Swap HDD 16 x 2.5" HDD	Hot Swap HDD 8 x 2.5" HDD 5 x 3.5" HDD
HD Types	SAS, SSD	SAS, SATA, Near-line SAS
Ext Drive Bay(s)	External USB floppy & SATA optical drives	External USB floppy & SATA optical drives
Int. HD Controller	PERC H200 or PERC H700	SAS6iR or PERC6/I
Opt. HD Controller	PERC H800 or 6Gbps SAS	PERC 6/E or SAS5/E
Availability	Hot Swap HDD Hot Swap Redundant PSU Redundant Cooling ECC memory Sparing, Mirroring Single Device Data Correction (SDDC)	Hot Swap HDD Hot Swap Redundant PSU Redundant Cooling ECC memory Sparing, Mirroring Single Device Data Correction (SDDC)
Server Management	OpenManage™ 6.2	OpenManage™ 5.4
I/O Slots	Standard: 7 PCIe Gen2 slots (2 x4, 4	7 PCIe Gen1 (4 x8, 3 x4)

Feature/Spec	PowerEdge R910	PowerEdge R900 (predecessor)
	x8, 1 x16) Optional: 10 PCIe Gen2 (6 x4, 4 x8) Slot5 is Gen1	
RAID	PERC H200, PERC H700, PERC H800, and 6Gbps SAS	PERC 6/I, SAS 6iR and PERC 6/E
NIC/LOM	1GbE or 10Gb embedded NIC options 4-port (4 x 1GbE) Embedded NIC Broadcom 5709c (or) 4-port (2 x 10Gb SFP+ & 2 x 1GbE) Embedded NIC Broadcom 57711 + Broadcom 5709c	1GbE embedded NIC 4 port Embedded NIC Broadcom 5708
USB	2 in the rear 2 in the front 1 internal	2 in the rear 2 in the front 1 internal
Power Supplies	Hot swap redundant PSUs 4 x 750W (Energy Smart PSU) (or) 4 x 1100W (High Output PSU)	Hot swap redundant PSUs 2 x 1570W
Fans	Redundant Cooling	Redundant cooling
Chassis	4U Rack	4U Rack
Chassis depth	~29.6”	~27.5”

2 New Technologies

2.1 Overview

The PowerEdge R910 uses a number of new technologies:

- Intel 7500 chipset
- Intel Xeon processor 7500 series
- DDR3 RDIMM memory
- Internal Dual SD module
- 6G SAS technology
- 10GbE Embedded NIC

2.2 Detailed Information

The Intel Xeon processor 7500 series 4S is the microprocessor designed specifically for server applications. The processor features 4-core, 6-core, and 8-core processing to maximize performance and performance/watt for data center infrastructures and highly dense deployments. The Intel Xeon processor 7500 series 4S also features Intel's Core™ micro-architecture and Intel 64 architecture for flexibility in 64-bit and 32-bit applications and operating systems.

2.2.1 Intel Xeon Processor 7500 Series

Key Features of the Intel Xeon processor 7500 series:

- Up to eight cores per socket
- Up to 24MB shared L3 cache
- 45nm process technology
- Four full-width, bidirectional point-to-point Intel® QuickPath Interconnect (QPI) links at 6.4 GT/s
- Four Intel® Scalable Memory Interconnects (SMI) at 6.4 GT/s
- Socket – LS, LGA 1567 package
- No termination required for non-populated CPUs (must populate CPU socket 1 first)
- Integrated QuickPath DDR3 memory controller
- 64-byte cache line size
- RISC/CISC hybrid architecture
- Compatible with existing x86 code base
- Optimized for 32-bit code
- MMX support
- Execute Disable Bit
- Intel® Wide Dynamic Execution (Executes up to four instructions per clock cycle)
- Simultaneous Multi-Threading (SMT) capability (2 threads/core)
- Support for CPU Turbo Mode on certain SKUs (Increases CPU frequency if operating below thermal, power, and current limits)
- Streaming SIMD (Single Instruction, Multiple Data) Extension 4
- Intel® 64 Technology
- Intel® VT-x and VT-d Technology for virtualization support
- Enhanced Intel® SpeedStep® Technology
- Demand-based switching for active CPU power management as well as support for ACPI P-States, C-States, and T-States

2.2.2 Internal Dual SD Module (IDSM)

The PowerEdge R910 also offers a second internal USB port dedicated for embedded Hypervisor for virtualization operating systems like Citrix® and VMware® through a dual SD-to-USB daughter card called an Internal Dual SD Module. The IDSM port is located on the back of the IO riser board. The SD Flash Cards contains a bootable OS image for virtualized platforms. IDSM consists of up to two SD cards that are mirrored when set in the redundant mode for the higher availability.

2.2.3 10Gb Embedded NIC

10Gb I/O cards (Embedded NICs) are designed to provide higher data throughput for demanding applications like virtualization.

The 10Gb NICs are Broadcom® BCM57711 Gigabit MAC with BCM8727 SFP+ PHY. Features include:

- x8 PCI Express Gen2 capable interface
- SFP+ interface supported with SR and LRM optics or direct attached cable
- TOE (TCP Offload Engine)
- iSCSI controller
- RDMA controller (RNIC) (enabled through an optional hardware key)
- NC-SI (Network Controller-Sideband Interface) connection
- Wake-On-LAN (WOL)
- PXE 2.0 remote boot
- iSCSI boot
- IPv4 and IPv6 support
- Bare metal deployment support

3 System Information

Table 2. Summary of R910 features

Feature	Details
Processor	Intel® Xeon® Processor 7500 Series Two or four 4-core, 6-core, or 8-core 95W, 105W and 130W TDP options
Front Side Bus	Intel® QuickPath Interconnect (QPI) links @ maximum of 6.4 GT/s
# Cores	4, 6, or 8 cores
L2/L3 Cache	12MB, 16MB, 24MB
Chipset	Intel® 7500
Maximum Internal Storage	Up to 4.8TB
DIMMs/Speed	64 RDIMM DDR3 – 1066 MHz Memory module capacities of 1GB, 2GB, 4GB, 8GB, or 16GB RDIMMs
Min/Max RAM	4GB/1TBB
HD Bays	Hot-swap HDDs Up to sixteen 2.5" SAS or SSD hard drives Mixing of SAS and SSD drives
HD Types	SAS and SSD
Ext Drive Bay(s)	External USB floppy Optional SATA half-height optical drives such as DVD-ROM or DVD+RW Optional SATA or SCSI half-height (or full-height) tape back-up drive
HD Controller	Internal: PERC H200 or PERC H700 Optional: PERC H800 and 6Gbps SAS
BIOS	4MB flash for system BIOS and Video BIOS
Video	Integrated Matrox® G200, 8MB shared video memory
Availability	Hot-swap Hard Drives, Hot-swap Power; Memory SDDC, ECC, Control Line Parity, Redundant Cooling, Add Interactive LCD with hot-swap HDD chassis
Server Management	Dell™ Embedded Server Management provides IPMI 2.0 compliance.
Remote Management	iDRAC6 Express + Optional iDRAC6 Enterprise
I/O Slots	Standard: 7 PCIe Gen2* slots (2 x4, 4 x8, 1 x16) Optional: 10 PCIe Gen2* (6 x4, 4 x8) *Slot5 is Gen1 The storage controller card has a dedicated slot (PCIe x8) apart from the available 10 PCIe slots.
RAID	PERC H200, PERC H700, PERC H800 and 6Gbps SAS
Network Interface Cards	Embedded NICs: 1GbE or 10Gb embedded NIC options with iSCSI offload 2x Broadcom® 5709c (4 ports x 1GbE Base-T Copper) Embedded NIC or

Feature	Details
	Broadcom® 57711 (2 ports x 10Gb SFP+) and Broadcom® 5709c (2 ports x 1GbE Base-T Copper) Embedded NIC Optional NICs: Broadcom® 57710 Single Port 10GbE NIC, Copper CAT6 PCIe-8 Intel® DA 10GbE NIC, Dual Port, Optical, PCIe-8 Intel® 10GbE Single Port 10GbE NIC, Copper, PCIe-8 Broadcom® NetXtreme® II 5709 Gigabit NIC w/TOE & iSOE, Quad Port, Copper, PCIe-4 Broadcom® 5709 Dual Port 1GbE NIC w/TOE PCIe-4, Low Profile Broadcom® 5709 Dual Port 1GbE NIC w/TOE iSCSI, PCIe-4, Low Profile Broadcom® 5709 Dual Port 1GbE NIC w/TOE iSCSI, PCIe-4 Broadcom® NetXtreme® II 5709 Gigabit NIC w/TOE & iSOE, Quad Port, Copper, PCIe-4, Low Profile Broadcom® 5709 Dual Port 1GbE NIC w/TOE PCIe-4 Broadcom® NetXtreme® II 57711 10GbE NIC w/TOE & iSOE, Dual Port, SFP+, PCIe-8 Intel® Gigabit ET NIC, Dual Port, Copper, PCIe-4, Low Profile Intel® Gigabit ET Dual Port NIC, PCIe-4 Intel® Gigabit ET NIC, Quad Port, Copper, PCIe-4, Low Profile Broadcom® 5709 Dual Port 1GbE NIC w/TOE PCIe-4, Low Profile Intel® Gigabit ET Quad Port NIC, PCIe-4
USB	Total: 5 , USB 2.0 compliant 2 in the rear 2 in the front 1 internal
Power Supplies	Hot-swap redundant PSUs 4 x 750W (Energy Smart PSU) (or) 4 x 1100W (High Output PSU)
Front Panel	The system control panel is located on the front of the system chassis to provide user access to buttons, display, and I/O interfaces LCD on front panel for error messaging
System ID	System ID switch with LED indicator at rear side and LCD indication at front side 128x20 pixel LCD with controls on front panel for system ID and error messaging System ID for PE R910 is 0x02d3
Fans	Redundant Cooling
Chassis	4U rack-mount Chassis depth is ~29.6”
Rack Support	ReadyRails™ sliding rails for tool-less mounting in 4-post racks with square or unthreaded round holes, with support for optional tool-less cable management arm
Operating Systems	Microsoft® Windows® Essential Business Server 2008 Microsoft® Windows Server® 2008 SP2, x86/x64 (x64 includes Hyper-V™) Microsoft® Windows Server® 2008 R2, x64 (includes Hyper-V™ v2) Microsoft® Windows® HPC Server 2008

Feature	Details
	Novell® SUSE® Linux® Enterprise Server Red Hat® Enterprise Linux® For more information on the specific versions and additions, visit www.dell.com/OSsupport.
Systems Management	BMC, IPMI 2.0 compliant Dell™ OpenManage™ featuring Dell Management Console, Unified Server Configurator, Lifecycle Controller enabled via optional iDRAC6 Express, iDRAC6 Enterprise, and vFlash

4 Mechanical

4.1 Chassis Description

The PowerEdge R910 fits in a rack mount 4U chassis. The R910 chassis brings some new features over previous generations, including:

- DIMMs on memory risers
- Updated industrial design including a new LCD, bezel, and hard drive carriers
- Toolless rack latches
- Pull-out tray for Express Service Tag and customer labels
- Support for persistent storage (internal USB and SD card slots and external SD card slot)
- Updated power supply removal process

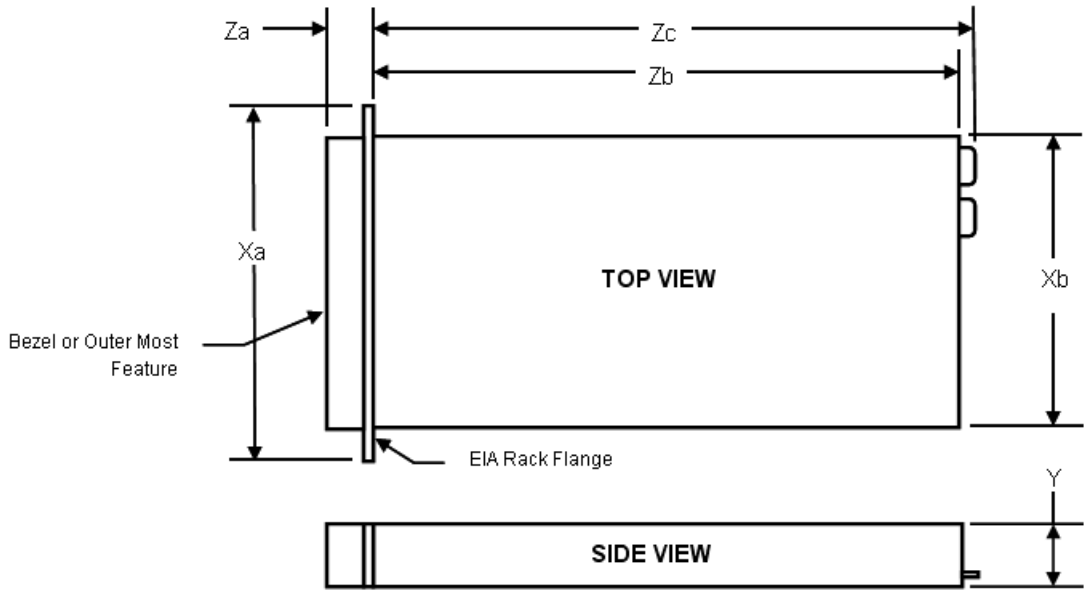
Figure 1. R910 Front View with Bezel

Figure 2. R910 Front View without Bezel

Figure 3. R910 Rear View

4.2 Dimensions and Weight

The R910 weight with maximum configuration is 47.60 kg (105 lb). Weight empty is 26.31 kg (58 lb).



*** Note: Zb goes to the nominal rear wall external surface where the motherboard I/O connectors reside.**

Xa (Width w/ Rack Latches)	Xb (Width w/o Rack Latches)	Y (Height)	Za (Depth w/ bezel)	Za (Depth w/o bezel)	Zb (Depth w/o power supply and bezel)	Zc (Depth w/ power supply)
48.24 mm (18.99 in)	42.20 mm (16.62 in)	17.26 mm (6.8 in)	35.0 mm	20.4 mm	699.0 mm	753.0 mm

Figure 4. R910 Dimensions

4.3 Front Panel View and Features

Figure 5. Front Panel View of R910

The following components and connectors are located on the front of the R910:

- Power-on indicator, Power button
- USB connectors; connects USB devices to the system; two 4-pin, USB 2.0-compliant
- LCD menu buttons which allow you to navigate the control panel LCD menu
- LCD panel which provides system ID, status information, and system error messages
- Non-Maskable Interrupt (NMI) button
- Ambient temperature sensor
- System identification button
- Optical drive (optional)
- Hard drives

The LCD panel is a graphics display controlled by the iDRAC. Error codes can be sent to the display by either ESM or BIOS. See LCD Panel Features in the *Hardware Owner's Manual* for more information.

BIOS will have the ability to enter a "Secure Mode" through Setup, which will lock the Power and NMI buttons. When in this mode, pressing either button has no effect and does not mask other sources of NMI and power control.

The system control panel is located on the front of the system chassis to provide user access to buttons, display, and I/O interfaces. See Front-Panel Features and Indicators in the *Hardware Owner's Manual*.

Features of the system control panel include:

- ACPI-compliant power button with an integrated green power LED (controlled by iDRAC6)
- 128x20 pixel LCD panel with controls
- Two navigation buttons
- One select button
- One system ID button
- Non-Maskable Interrupt (NMI) button (recessed)
- Ambient temperature sensor
- Two external USB 2.0 connectors

The LCD panel is a graphics display controlled by the iDRAC6. Error codes can be sent to the display by either iDRAC6 or BIOS.

BIOS will have the ability to enter a “Secure Mode” through Setup, which will lock the Power and NMI buttons. When in this mode, pressing either button has no effect but does not mask other sources of NMI and power control.

Figure 6. R910 LCD

4.4 Back Panel View and Features

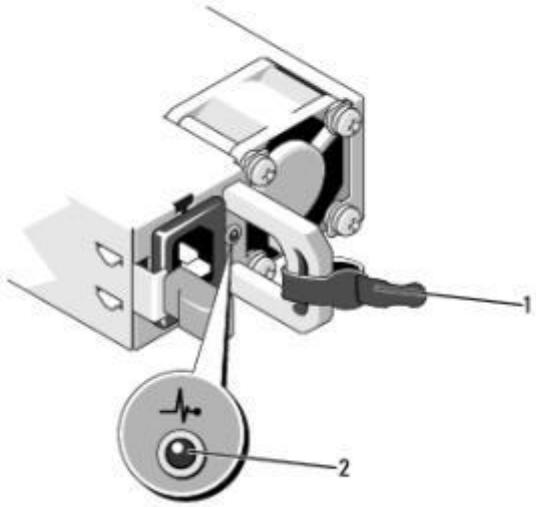
Figure 7. Back Panel View

The following components and connectors are located on the rear panel of the R910:

- 15-pin VGA connector
- DB-9 Serial Port connector
- (4) RJ-45 Ethernet connectors with 1 GbE IO riser, OR
- (2) RJ-45 Ethernet + (2) SFP+ connectors with 10Gb IO riser
- Rear System ID button
- Rear System Status/ID blue/amber LED

- Active ID Cable Management Arm (CMA) external led jack
- (2) USB ports
- (Optional) RJ-45 iDRAC6 Enterprise connector
- (Optional) vFlash card on the iDRAC6 Enterprise card

4.5 Power Supply Indicators



1	strap	2	power supply status indicator

Figure 8. Power Supply Indicators

See Power Indicator Codes in the *Hardware Owner's Manual* for information.

4.6 NIC Indicators

1	link indicator	2	activity indicator

Figure 9. NIC Indicators

See NIC Indicator Codes in the *Hardware Owner's Manual* for information.

4.7 Internal Chassis View

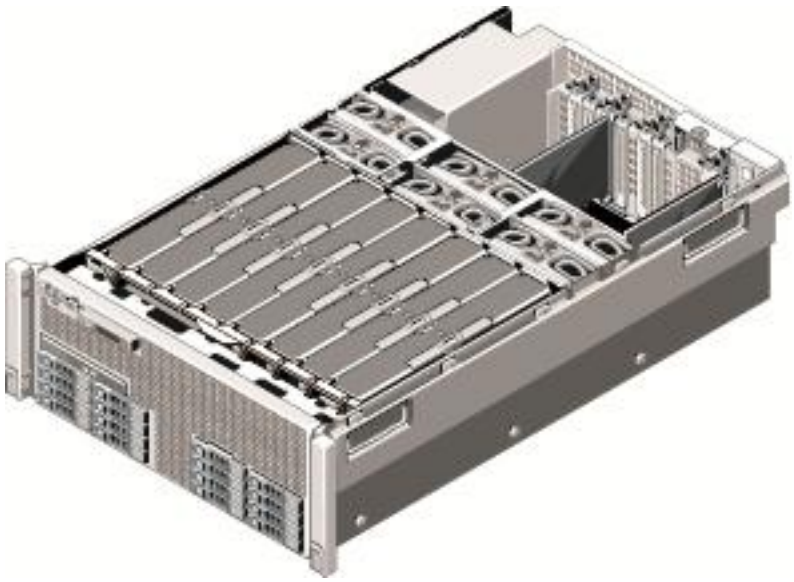


Figure 10. R910 Internal View

4.8 Rails and Cable Management

ReadyRails™ Sliding Rails for 4-post racks support the following:

- Toolless installation in 19" EIA-310-E compliant square or unthreaded round hole 4-post racks including all generations of Dell racks (Note: Threaded 4-post racks require Dell's fixed shelf or 3rd party adapter brackets available through Dell Software & Peripherals.)
- Full extension of the system out of the rack to allow serviceability of key internal components
- Optional cable management arm (CMA) except on racks less than 1m in depth including Dell 4200 & 2400 racks

Measurements and adjustment ranges for the rack:

- Rail depth without the CMA: 755 mm
- Rail depth with the CMA: 883 mm
- Square-hole rack adjustment range: 686–883 mm
- Round-hole rack adjustment range: 672–876 mm

See Section 16 for more information.

4.9 Fans

Six 120mm single-rotor hot-swappable fans are mounted in a fan bay in the rear of the chassis. Each fan has a single wire harness that plugs into the planar fan connectors (FAN1 through FAN6).

The Embedded Server Management (ESM) logic in the system controls and monitors the speed of the fans. A fan speed fault or over-temperature condition results in a notification by ESM.

The R910 Power Supply Units have integrated fans. The system requires a blank in place of the empty power supply slot. System fan speed is pulse-width modulated.

The iDRAC6 controls and monitors the speed of the fans. A fan speed fault or over-temperature condition results in a notification by iDRAC6.

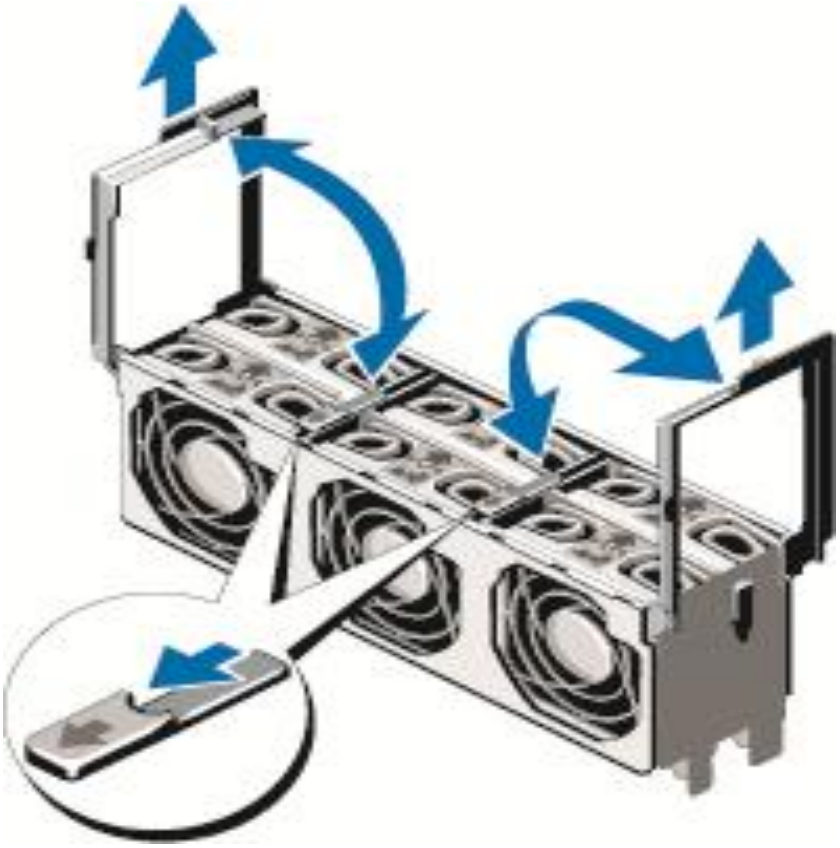


Figure 11. R910 Fan Cage

4.10 Cabling

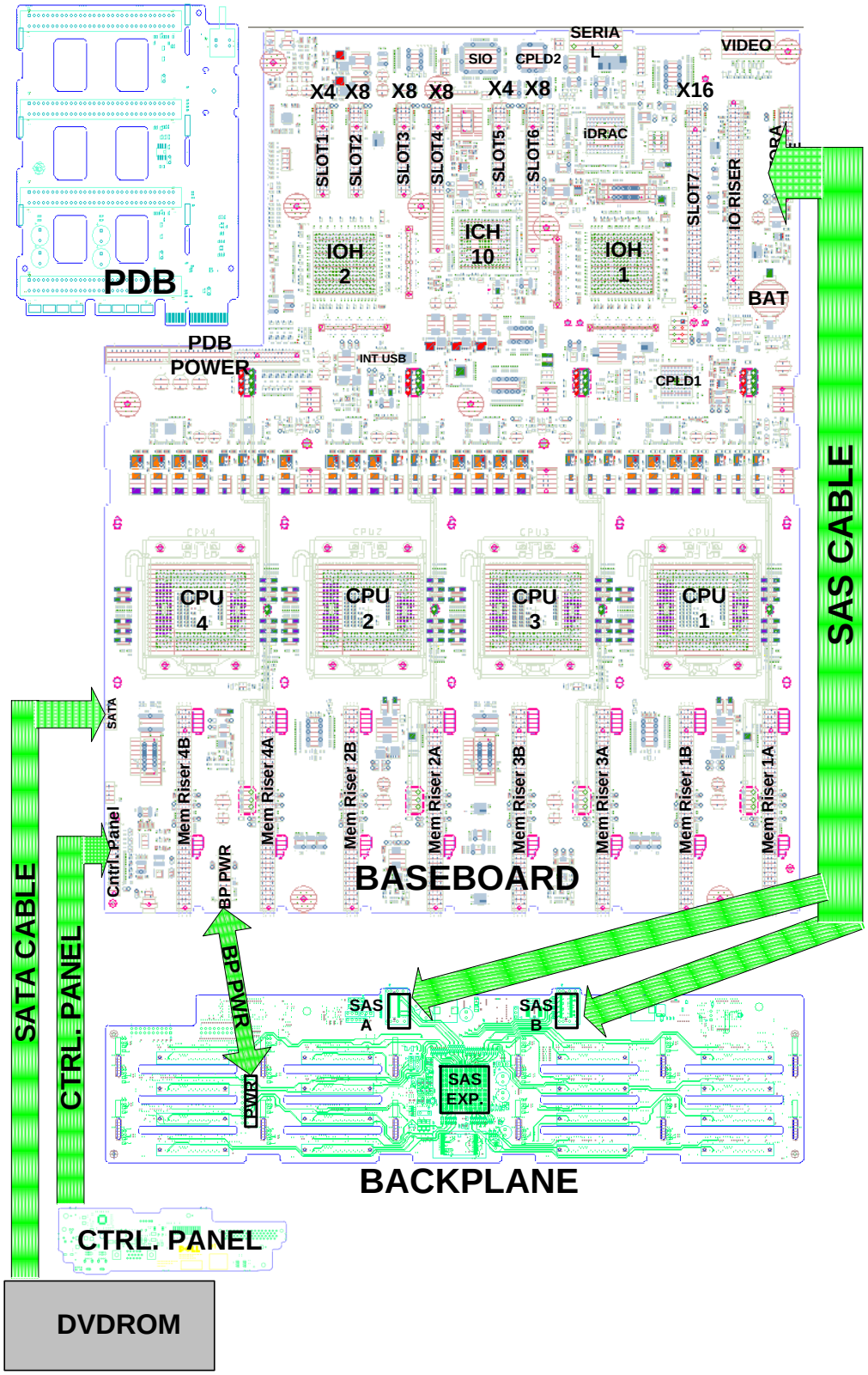


Figure 12. Cabling Diagram

4.11 Security

4.11.1 Cover Latch

A tooled latch is integrated in the side cover to secure it to the tower chassis. A locked bezel secures the cover latch.

Figure 13. R910 Cover Latch

4.11.2 Bezel

A lock on the bezel is used to protect unauthorized access to system hard drives and the system cover. System status (through the LCD) is viewable when the bezel is installed.

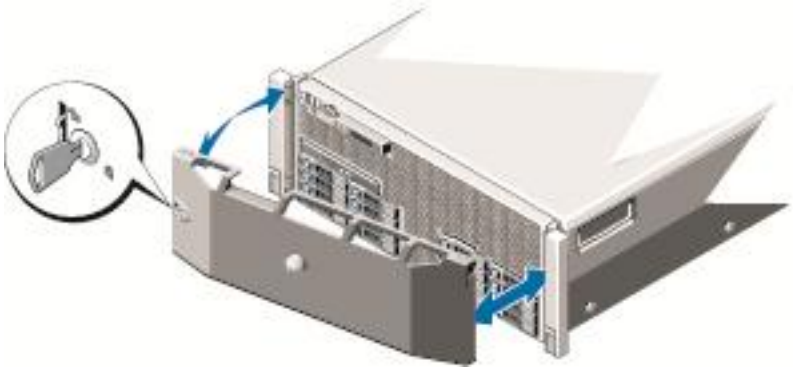


Figure 14. R910 Bezel Lock

4.11.3 Hard Drive

The front bezel of the system contains a lock. A locked bezel secures the system hard drives.

4.11.4 Trusted Platform Module (TPM)

TPM is used to generate/store keys, protect/authenticate passwords, and create/store digital certificates. TPM can also be used to enable the BitLocker™ hard drive encryption feature in Windows Server 2008.

TPM is enabled through a BIOS option and uses HMAC-SHA1-160 for binding. A Trusted Computing Module (TCM) version of the planar is available for use where TCM is the standard, for example, in China.

4.11.5 Power Off Security

The control panel is designed such that the power switch cannot be accidentally activated. The lock on the bezel secures the switch behind the bezel. In addition, there is a setting in the CMOS setup that disables the power button function

4.11.6 Intrusion Alert

A switch mounted on the cooling shroud is used to detect chassis intrusion. When the cover is opened, the switch circuit closes to indicate intrusion to the iDRAC6. When enabled, the software can provide notification to the customer that the cover has been opened.

4.11.7 Secure Mode

BIOS has the ability to enter a secure boot mode via Setup. This mode includes the option to lock out the power and NMI switches on the Control Panel or set up a system password.

4.12 USB Key

An optional USB memory key installed inside your system can be used as a boot device, security key, or mass storage device. The USB connector must be enabled by the Internal USB Port option in the Integrated Devices screen of the System Setup program.

To boot from the USB memory key, configure the USB memory key with a boot image and then specify the USB memory key in the boot sequence in the System Setup program.

See Figure 15 below.

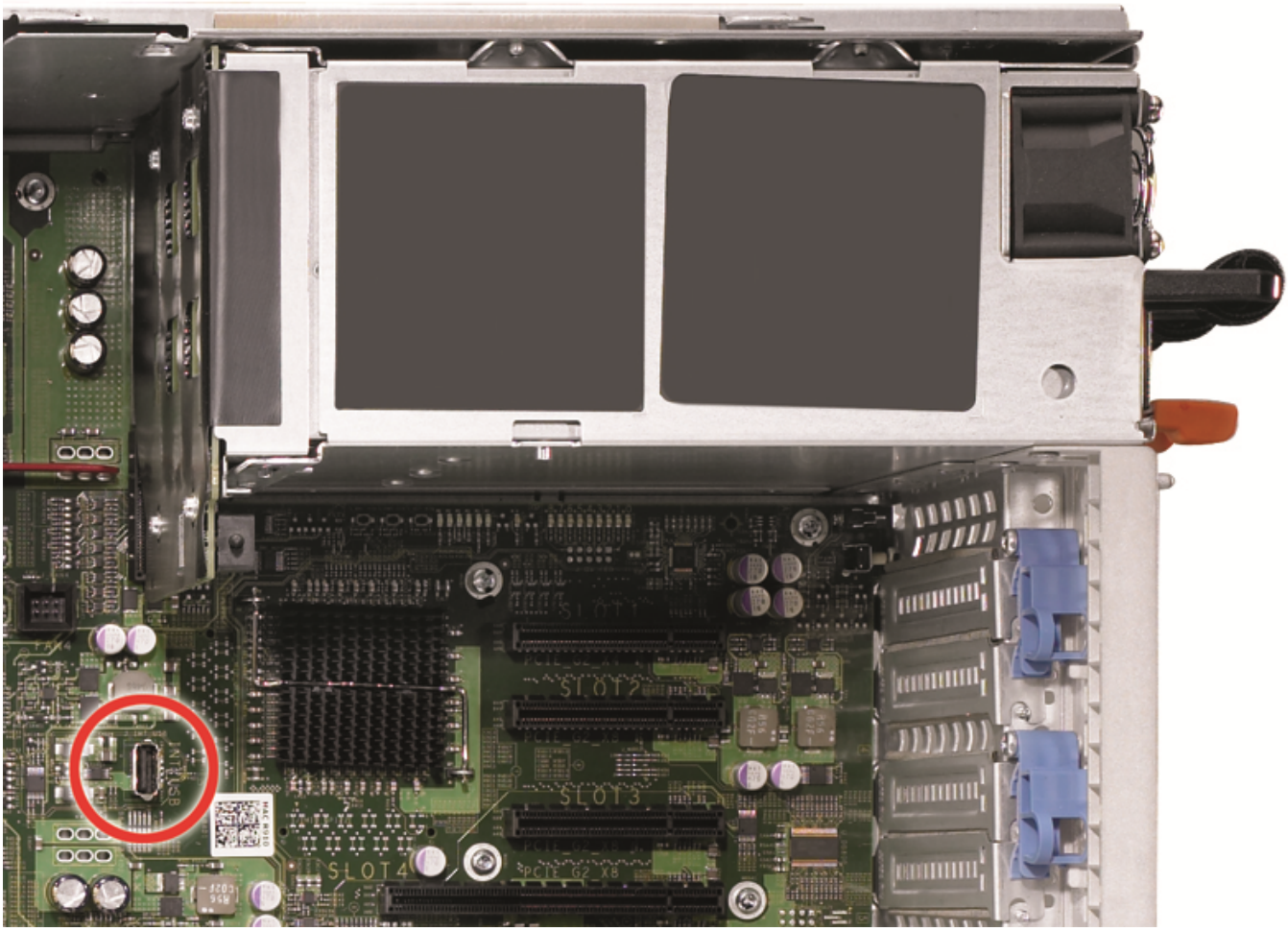


Figure 15. USB Key Location

4.13 Battery

A replaceable coin cell CR2032 3V battery is mounted on the planar to provide backup power for the Real-Time Clock and CMOS RAM on the ICH10 chip. See Figure 16 below.

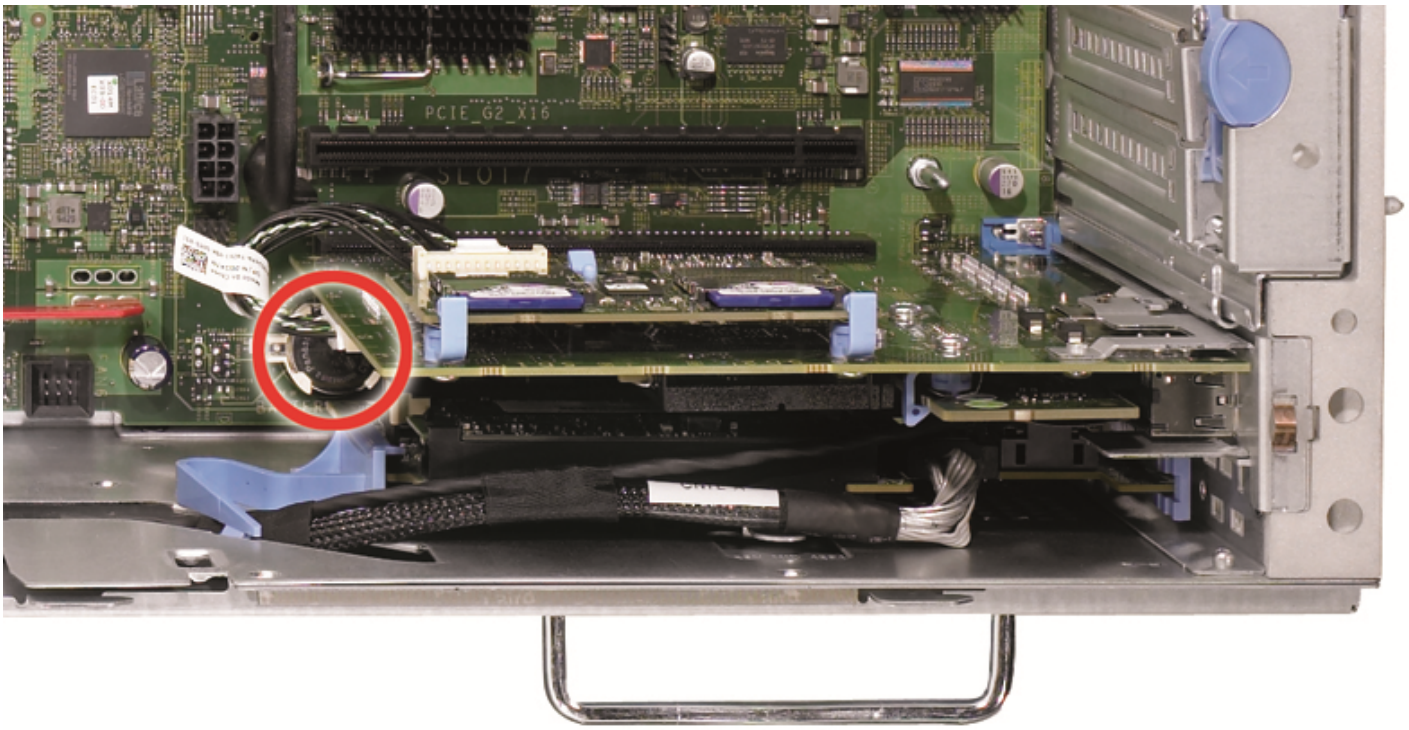


Figure 16. Coin Cell Battery on Motherboard

4.14 Field Replaceable Units (FRU)

The planar contains a serial EEPROM to store FRU information including Dell part number, part revision level, and serial number. The backplane SEP and the power supply microcontroller are also used to store FRU data.

4.15 User Accessible Jumpers, Sockets, and Connectors

For information on jumpers and connector settings, see Jumpers and Connectors in the *Hardware Owner's Manual*.

5 Electrical

5.1 Clock Circuitry

System clock circuitry is based on Intel CK410B+ synthesizer and DB1200/DB800 driver specification. A clock synthesizer device is a single chip solution. The CK410B+ synthesizes and distributes a multitude of clock outputs at various frequencies, timings and drive levels using a single 14.318 MHz crystal.

- PCI Express Gen2 support
- Host clock support (133 MHz)
- Spread spectrum support
- 33 MHz, 48 MHz, 100 MHz clock support
- 14.318 MHz clock support

6 Power, Thermal, Acoustic

The PowerEdge R910 achieves enhanced power efficiency by implementing the following features:

- User-selectable power cap (subsystems will throttle to maintain the specified power cap)
- Improved power budgeting
- Larger heat-sinks for processors and IOH
- Accurate inlet temperature
- PSU/VR efficiency improvements
- Switching regulators instead of linear regulators
- Closed loop thermal throttling
- Increased rear venting/3D venting
- PWM fans with an increased number of fan zones and configuration-dependent fan speeds
- Use of DDR3 memory (lower voltage than DDR2)
- CPU VR dynamic phase shedding
- Memory VR static phase shedding
- Random time interval for system start
- Allows an entire rack to power on without exceeding the available power
- BIOS Power/Performance options page
- BIOS-based CPU P-state manager (power management in a virtualized environment)
- Ability to slow down or throttle memory
- Ability to disable a CPU core
- Ability to turn off items not being used (i.e., USB ports, embedded NICs, unused PCIe lanes, etc.)
- Option to run PCIe at Gen1 speeds instead of Gen2

6.1 Power Supplies and Power Subsystem

PowerEdge R910 supports two types of power supply units (PSUs):

- 1100W High Output PSU
- 750W EnergySmart PSU

Figure 17. R910 Power Supply

The power supply bay is designed to prevent unsupported power supplies from being installed. Mixing of 1100W and 750W power supplies is *not* supported. R910 power supplies have embedded cooling fans and one bi-colored status LED.

The PowerEdge R910 PSUs have a FRU EEPROM; FRU data is stored in the memory of the PSU Microcontroller. PSU Firmware can be updated by iDRAC over the PMBus. Power is "soft-switched," allowing power cycling via a switch on the front of the system enclosure or through a software control (through server management functions). The power system is compatible with industry standards, such as ACPI and the Microsoft Windows Server Hardware Design Guide.

If not using all 4 power supplies, it is preferred that the power supply be installed starting from PS1 bay in order to avoid power loss in the PDB Copper planes. However, there is nothing that prevents the use of the rest of the bays in that case. The empty bays should be populated with the PS sheet metal blanks for thermal reasons.

The power supplies connect indirectly to the planar via the Power Distribution Board (PDB). There is a power cable that connects between the PDB and the backplane. Another cable also connects the PDB to the optical and/or tape drives.

R910 has 4 power supply bays. PSU system configurations are shown in Table 3.

Table 3. PSU System Configurations

High Output Power Supply (1100W), Non-Redundant configuration (1+0)
High Output Power Supply (1100W), Redundant Energy Optimal configuration (1+1)
High Output Power Supply (1100W), Non-Redundant Full-power configuration (2+0)
High Output Power Supply (1100W), Fail-over configuration (2+1)
High Output Power Supply (1100W), Redundant Full-power configuration (2+2)
Energy Smart Power Supply (750W), Non-Redundant configuration (1+0)
Energy Smart Power Supply (750W), Redundant Energy Optimal configuration (1+1)
Energy Smart Power Supply (750W), Non-Redundant Full-power configuration (2+0)
Energy Smart Power Supply (750W), Fail-over configuration (2+1)
Energy Smart Power Supply (750W), Redundant Full-power configuration (2+2)

There are two different redundancy modes with 2 PSUs present in the system. One is (2+0) non-redundant capable of running full system configuration, and the other is (1+1) redundant running limited configuration. The user could switch the mode between (1+1) and (2+0) via iDRAC GUI only for the two PS case depending on if the system is capable of supporting the new mode or not. The other modes of redundancy are automatics based on the functional supplies present at the time when AC is applied and system is powered ON. See Power Supplies in the *Hardware Owner's Manual* for more information.

In the (2+2) mode, if the power supplies are evenly split across two separate grids on the AC line side, then this mode would also be considered "AC or Grid" redundant in addition to power.

The system power distribution consists of one, two, three or four AC-to-DC power supplies connected to the planar through the PDB. The power supply only provides +12V and +12Vaux. The power supplies connect directly to the planar via the Power Distribution Board (PDB). There are no cables involved for delivering the power from the PSUs to the motherboard.

The 12V power is then distributed to the rest of the subsystems like the backplane and optical drive from the motherboard using cables. There are several voltage regulators in the system to supply different voltage levels needed by different logic devices.

Table 4. Power Supply Specifications

AC Power supply (per power supply)	
Wattage	1100 W (High Output PSU)
	750 W (Energy Smart PSU)
Voltage	90–264 V, 47–63 Hz, auto-ranging
Heat dissipation	8407 BTU/hr maximum (with two or four 1100 W PSUs)
	5732 BTU/hr maximum (with two or four 750W PSUs)
Maximum inrush current	Under typical line conditions and over the entire system ambient operating range, the inrush current may reach 55 A per power supply for 10 ms or less

6.2 Environmental Specifications

Airborne Contaminant Level: Class G2 or lower as defined by ISA-S71.04-1985

For additional information about environmental measurements for specific system configurations, see Product Safety, EMC, and Environmental Datasheets on Dell.com.

6.3 Thermal

The R910 thermal solution includes:

- Optimized airflow impedance for optimum cooling efficiency
- Custom air baffling directs airflow through the components to maintain proper cooling
- Custom designed heat sinks maintain CPU, IOH, and Mill Brook chip temperatures within thermal design targets
- Highly Optimized Fan Control Algorithm
    - Base fan speeds are a function of hardware configuration and ambient temperature to minimize airflow for a given environment.
    - PID control algorithms are used for both CPU and DIMMs to maintain appropriate thermal margin
    - Double refresh switching allows for DIMM temperature excursions up to 95°C while maintaining performance and thermal design targets
        - The R910 thermal algorithm monitors the thermal sensor on each DIMM to maintain DIMM temperatures below the typical 85°C specification in normal operating conditions.
        - Under extreme operating conditions the thermal algorithm can switch the DIMMs into Double Refresh mode allowing an additional 10°C of thermal headroom. In Double Refresh mode DIMMs are allowed to operate as high as 95°C.

Table 5. Operating/Non-Operating (Storage) Requirements

Temperature	
Operating	10° to 35° C (50° to 95° F) with a maximum temperature gradation of 10° C per hour. Note: For altitudes above 2950 feet, the maximum operating temperature is derated 1° F/550 feet.
Storage	–40° to 65° C (-40° to 149° F) with a maximum temperature gradation of 20° C per hour
Relative Humidity	
Operating	20% to 80% (noncondensing) with a maximum humidity gradation of 10% per hour
Storage	5% to 95% (noncondensing) with a maximum humidity gradation of 10% per hour
Maximum Vibration	
Operating	0.26 Grms at 5-350 Hz in operational orientations
Storage	1.54 Grms at 10-250 Hz in all orientations
Maximum Shock	
Operating	Half sine shock in all operational orientations of 31G +/- 5% with a pulse duration of 2.6 ms +/- 10%
Storage	Half sine shock on all six sides of 71G +/- 5% with a pulse duration of 2 ms +/-10%; Square wave shock on all six sides of 27 G with velocity change @ 235 in/sec or greater
Altitude	
Operating	-16 to 3048 m (-50 to 10,000 ft) Note: For altitudes above 2950 feet, the maximum operating temperature is derated 1°F/550 feet
Storage	-16 to 10,600 m (-50 to 35,000 ft)

6.4 Acoustics

The acoustical design of the PowerEdge R910 reflects the following:

- **Adherence to Dell's high sound quality standards.** Sound quality is different from sound power level and sound pressure level in that it describes how humans respond to annoyances in sound, like whistles, hums, etc. One of the sound quality metrics in the Dell specification is prominence ratio of a tone, and this is listed in the table below.
- **Noise ramp and descent at bootup.** Fan speeds, hence noise levels, ramp during the boot process in order to add a layer of protection for component cooling in the case that the system were not to boot properly.
- **Noise levels vs. configurations.** Hardware configurations do result in different noise levels. For example, processor-power dependence is shown in the following table.

Table 6. Acoustics of the PowerEdge R910

Typical Configuration(1) @ 23 ± 2 °C				Operating Mode	LWA-UL(2) (Bels)	LpA(3) (dBA)	TONES(4)
CPU	HDD	RAID	DIMM				
4 x Intel 105W procs	4 x 146GB SAS 15 krpm)	PERC H800	16 x 2GB DIMM	Standby	3.2	16	No prominent tones
				Idle	5.7	38	No prominent tones
				Stress	5.6	38	No prominent tones
Higher End Configuration @ 23 ± 2 °C				**Operating Mode**	**LWA-UL(2) (Bels)**	**LpA(3) (dBA)**	**TONES**
CPU	**HDD**	**RAID**	**DIMM**				
4 x Intel 130W procs	4 x 600GB SAS (2.5”/ 15k RPM)	PERC H800	16 x 8GB DIMM	Standby	3.2	16	No prominent tones
				Idle	6.4	45	No prominent tones
				Stress	6.4	45	No prominent tones

(1) Typical configuration means the system is populated with projected average quantity, type, capacity, speed, etc., of components, as shown in the table below
(2) LwA – UL is the upper limit sound power level (LwA) calculated per section 4.4.2 of ISO 9296 (1988) and measured in accordance to ISO 7779 (1999).
(3) LpA is the average bystander A-Weighted sound pressure level. The system is placed in a rack with its bottom at 25 cm from the floor, and four acoustical transducers are at bystander positions, ref ISO7779 (1999) Section 8.6.2.
(4) Prominent tone: Criteria of D.5 and D.8 of ECMA-74 9th ed. (2005) are followed to determine if discrete tones are prominent. The system is placed in a rack with its bottom at 75 cm from the floor. The acoustical transducer is at front bystander position, ref ISO7779 (1999) Section 8.6.2.

Table 7. Configuration Corresponding to Acoustical Data Presented

Component	Description	Qty
Processor	Highest attach-rate range bin Intel® E7540 (105-W)	4
Memory	2 GB(1066)	16
Power supply	Redundant, 1100-W	4
Hard Drives	146 GB SAS, 15 krpm	4
PCI Cards	PERC H800	1
ODD	DVD-ROM	1

7 Processors

7.1 Overview

The Intel Xeon processor 7500 series is designed specifically for high-end server applications. The processor features up to eight-core processing to maximize performance and performance/watt for data center infrastructures and highly dense deployments. The Intel Xeon processor 7500 series also features Intel® Core™ micro-architecture and Intel 64 architecture for flexibility in 64-bit and 32-bit applications and operating systems.

The Intel Xeon processor 7500 series uses a 1567-contact Flip-Chip Land Grid Array (FC-LGA) package that plugs into a surface-mount socket (Socket-LS). The PowerEdge R910 provides support for up to four processors.

Selective Intel Xeon processor 7500 series 4S SKUs also support Turbo Mode. Turbo Mode is an OS-controlled operation that automatically allows the processor to run faster than the marked frequency if the CPU is operating below power, temperature, and current limits.

Table 8. Intel Xeon Processor 7500 Series Cache Sizes

Cache	Size
L1 cache size	32 KB instruction 32 KB data
L2 cache size	1.0MB, 1.5MB or 2MB
L3 cache size	12MB, 18MB or 24 MB (shared)

7.2 Features

Key features of the Intel 7500 processor series include:

- Up to eight cores per processor
- Four point-to-point QuickPath Interconnect links at 6.4 GT/s
- 1567-pin FC-LGA(Flip Chip-Land Grid Array) package
- 45 nm process technology
- No termination required for non-populated CPUs (must populate CPU socket 1 first)
- Two Integrated DDR3 memory controllers
- Each Memory controller supports two Intel Scalable Memory Interconnects (SMI) for a total of 4 SMIs
- 64-byte cache line size
- RISC/CISC hybrid architecture
- Compatible with existing x86 code base
- MMX™ support
- Execute Disable Bit
- Intel Wide Dynamic Execution
- Executes up to four instructions per clock cycle
- Simultaneous Multi-Threading (SMT) capability
- Support for CPU Turbo Mode (on certain SKUs)
- Increases CPU frequency if operating below thermal, power and current limits
- Streaming SIMD (Single Instruction, Multiple Data) Extensions 2, 3, and 4

- Intel 64 Technology
- Intel VT-x and VT-d Technology for virtualization support
- Enhanced Intel SpeedStep® Technology
- Demand-based switching for active CPU power management as well as support for ACPI P-States, C-States and T-States

7.3 Supported Processors

Table 9. R910 Supported Intel Xeon Processor 7500 Series

Model	Speed	TDP Power	Cache	Cores	QPI Speed
X7560	2.26GHz	130W	24M	8	6.4GT/s
X7550	2.00GHz	130W	18M	8	6.4GT/s
E7540	2.00GHz	105W	18M	6	6.4GT/s
L7555	1.86GHz	95W	24M	8	5.86GT/s
L7545	1.86GHz	95W	18M	6	5.86GT/s
E7530	1.86GHz	105W	12M	6	5.86GT/s
E7520	1.86GHz	105W	18M	4	4.8GT/s

7.4 Processor Configurations

The system is designed such that at least both CPU1 & CPU2 processors are required to access all the I/O expansion slots. There are two IOH QPI-to-PCIe bridges in order to provide sufficient PCIe lanes to meet the MRD requirements. IOH1 is the legacy bridge that is connected to CPU1 and where as IOH2 is connected to CPU2. If only CPU1 is populated, the I/Os behind IOH2 (slots 1, 2, 3, 4 and 6) will not be available.

The system will not boot up if the CPUs are not installed correctly. The supported CPU configuration is either 2-processors or 4-processors.

7.5 Additional Processor Information

Refer to the Hardware Owner's Manual for additional processor information.

8 Memory

8.1 Overview

The PowerEdge R910 uses DDR3 memory providing a high-performance, high-speed memory interface capable of low latency response and high throughput. The R910 supports Registered ECC DDR3 DIMMs (RDIMM).

R910 uses Intel 7500 series CPUs that have two integrated memory controllers. Each of those memory controllers then has two Scalable Memory Interconnect (SMI) channels that connect to the memory buffer. The R910 has both the SMI channels from each controller routed to the memory riser with two memory buffers connected.

The SMI channels from each controller operate in lockstep i.e. the DIMMs need to be populated in matched pairs behind lockstep channel. Each Millbrook buffer has two DDR3 channels that can support up to two DIMMs per channel.

The DDR3 memory interface consists of 16 Mill Brook buffers, each of which has two DDR3 memory channels. Each channel supports up to two RDIMMs for single/dual/quad rank. By limiting to two DIMMs per DDR channel, the system can support DIMMs at 1067 MHz.

The R910 memory interface supports memory demand and patrol scrubbing, single-bit correction and multi-bit error detection. Correction of a x4 or x8 device failure (“chip kill”) is supported with SDDC. The following properties/rules apply to R910:

- DIMMs must be populated in matched pairs for each CPU (A1/A2, A3/A4…). Single DIMM operation is not supported.
- If DIMMs of different speeds are mixed, all channels will operate at the fastest common frequency. (Note that R910 only supports DDR3 1067 modules)
- Memory Mirroring and Sparing configurations will be supported as follows:
- Memory sparing will be allowed on configurations with >= 64GB populated
- Memory Mirroring will be enabled on configurations with >=64GB populated
- The first DIMM slot in each channel is color-coded with white ejection tabs for ease of installation.
- In the case of mixed-rank population, populate the DIMM with the highest number of ranks first (in sockets with white ejection tabs)
- DIMM sockets are placed 0.450” (11.43 mm) apart, center-to-center in order to provide enough space for sufficient airflow to cool stacked DIMMs. DIMMs must be installed in each channel starting with the DIMM farthest from the processor (DIMM 1). Population order is identified by silkscreen and a label. The order is dependent on the memory configuration used. See Figure 18 for DIMM naming and population ordering.

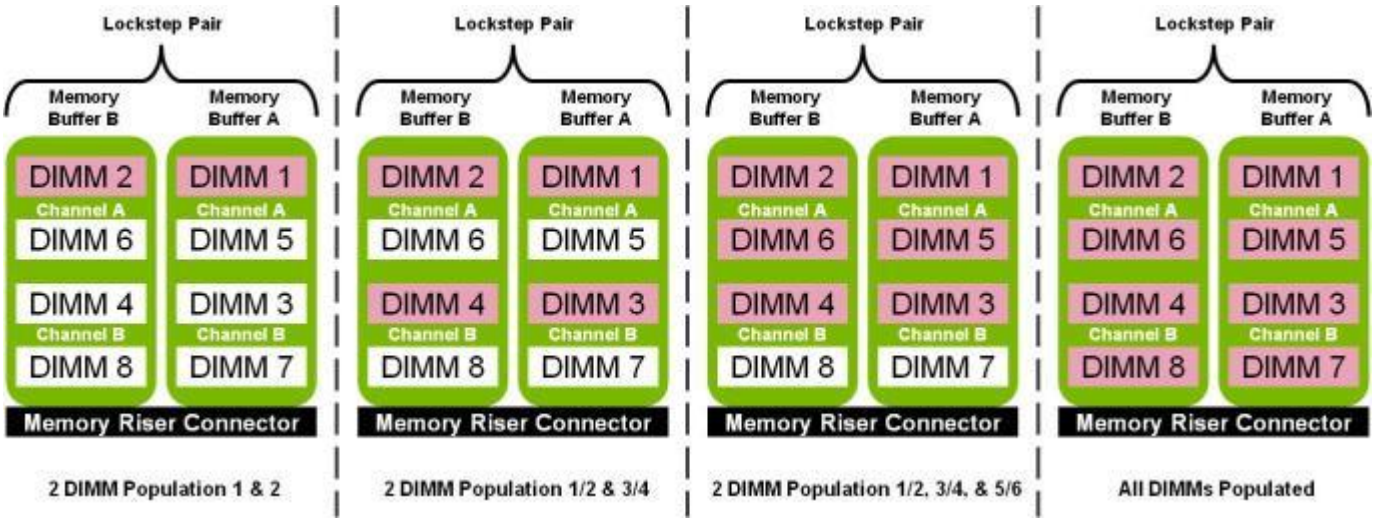


Figure 18. PowerEdge R910 DIMM Naming and Numbering

8.2 Slots/Risers

R910 has 8 memory risers; each memory riser has 8 DIMM slots. So there are a total of 64 DIMMs. See System Memory in the *Hardware Owner's Manual* for detailed information.

8.3 Key Features of the R910 Memory Subsystem

Registered (RDIMM) ECC DDR3 technology

- Each channel carries 64 data and 8 ECC bits
- Support for up to 1TB of memory (with 64 16GB RDIMMs)
- Support for 1066 MHz single, dual, and quad rank DIMMs
- Support ODT (On Die Termination)
- Clock gating (CKE) to conserve power when DIMMs are not accessed
    - DIMMs enter a low power self-refresh mode
- I^2C access to SPD EEPROM for access to RDIMM thermal sensors
- Single-Bit Error Correction
- SDDC (Single Device Data Correction — x4 or x8 devices)
- Support for Closed Loop Thermal Management on RDIMMs
- Multi-Bit Error Detection
- Support for Memory Mirroring in limited configurations
- Support for Memory (Rank) Sparing in limited configurations

8.4 Memory Speed Limitations

The memory frequency is determined by a variety of inputs:

- Speed of the DIMMs
- Speed supported by the CPU (note the DDR3 speed is 1/6 the frequency of the SMI link)
- BIOS can limit frequency to DDR3 800 based on user power savings configuration in the SETUP menu

The PowerEdge R910 supports DDR3 1067 DIMMs. Some CPU SKU's will have lower SMI link speeds resulting in slower DDR3 buses. The supported frequencies are as follows:

- SMI link speed at 4.8GT/sec => DDR3 800
- SMI link speed of 5.86 GT/sec => DDR3 978
- SMI link speed of 6.4 GT/sec => DDR3 1067

8.5 Sparing

For Rank sparing, one rank on each lockstep Mill Brook pair will be reserved as a spare, and in the event that another rank exceeds a threshold of correctable ECC errors, the "failing" rank will be copied to the spare. Once that operation is complete, the failed rank will be disabled.

8.6 Mirroring

For mirroring, the PowerEdge R910 supports 2P/4P configurations for 64GB and larger only. When mirroring is enabled, only half of the physical memory is visible to the system software. A full copy of the memory is maintained, and in the event of an uncorrectable error, the system will switch over to the mirrored copy. The R910 uses intra-socket mirroring.

8.7 RAID

The PowerEdge R910 does not support memory RAID.

8.8 Supported Configurations

See System Memory in the *Hardware Owner's Manual* for detailed information.

9 Chipset

The R910 system-board incorporates the Intel 7500 chipset (Boxboro-EX) for I/O and processor interfacing. The Intel 7500 chipset is designed to support Intel's 6500 and 7500 4S processor family, QPI interconnect, DDR3 memory technology, and PCI Express Generation 2. The Intel 7500 chipset consists of the EX IOH, Intel® 7500 Scalable Memory Buffer, and the ICH10 South Bridge.

9.1 Intel 7500 Chipset I/O Hub (IOH)

The R910 motherboard incorporates dual Intel 7500 chipset IOH to provide a link between the Intel Xeon 6500 and 7500 series 4S processors and the I/O components. The main components of the IOH consist of two full-width QPI links (one to each processor), 72 lanes of PCIe Gen2, and a x4 DMI link to connect directly to the ICH10 South Bridge.

9.2 IOH QuickPath Interconnect (QPI)

The QuickPath Architecture consists of serial point-to-point interconnects for the processors and the IOH. The PowerEdge R910 has a total of four QuickPath Interconnect (QPI) links including one link connecting the processors and links connecting both processors with the IOH and links connecting both IOHs. Each link consists of 20 lanes (full-width) in each direction with a link speed of 6.4 GT/s. An additional lane is reserved for a forwarded clock. Data is sent over the QPI links as packets.

The QuickPath Architecture features four layers. The Physical layer consists of the actual connection between components. It supports Polarity Inversion and Lane Reversal for optimizing component placement and routing. The Link layer is responsible for flow control and the reliable transmission of data. The Routing layer is responsible for the routing of QPI data packets. Finally, the Protocol layer is responsible for high-level protocol communications, including the implementation of a MESIF (Modify, Exclusive, Shared, Invalid, Forward) cache coherence protocol.

9.3 PCI EXPRESS GENERATION 2

PCI Express is a serial point to point interconnects for I/O devices. PCIe Gen2 doubles the signaling bit rate of each lane from 2.5 Gb/s to 5 Gb/s. Each of the PCIe Gen2 ports is backwards compatible with Gen1 transfer rates.

9.4 Direct Media Interface (DMI)

The DMI (previously called the Enterprise Southbridge Interface) connects the Boxboro-EX Legacy IOH with the Intel I/O Controller Hub (ICH). The DMI is equivalent to a x4 PCIe Gen1 link with a transfer rate of 1 GB/s in each direction.

9.5 Intel I/O Controller Hub 10 (ICH10)

ICH10 is a highly integrated I/O controller, supporting the following functions:

- Six x1 PCIe Gen1 ports, with the capability of combining ports 1-4 as a x4 link
- These ports are used on PowerEdge R910 for slot 5
- PCI Bus 32-bit Interface Rev 2.3 running at 33 MHz
- Up to six Serial ATA (SATA) ports with transfer rates up to 300 MB/s
- R910 features one SATA port for optional internal optical drive
- Six UHCI and two EHCI (High-Speed 2.0) USB host controllers, with up to twelve USB ports (R910 has four external USB ports and one internal ports dedicated for IDSM and embedded storage)
- Power management interface (ACPI 3.0b compliant)

- Platform Environmental Control Interface (PECI)
- Intel Dynamic Power Mode Manager
- I/O interrupt controller
- SMBus 2.0 controller
- Low Pin Count (LPC) interface to Super I/O, Trusted Platform Module (TPM), and SuperVU
- Serial Peripheral Interface (SPI) support for up to two devices (R910 BIOS flash device is connected to the ICH10 using SPI)

9.6 PCI Express Connectors

The R910 planar incorporates four 164-pin PCI Express-style x8 (slots 1, 2, 3 and 5) and three 164-pin PCI Express-style x16 connectors (slots 4, 6 and 7) for connectivity to the PCIe cards. Only one x16 (slot 7) out of the three physical connectors is electrically x16 as well. The other two (slots 4 & 6) are electrically x8 using a x16 physical connector for double wide GPGPU adapters.

10 BIOS

10.1 Overview

The R910 BIOS is based on the Dell BIOS core, and supports the following features:

- Intel Xeon Processor 7500 Series Support
- Simultaneous Multi-Threading (SMT) support
- CPU Turbo Mode support
- PCI 2.3 compliant
- Plug n' Play 1.0a compliant
- MP (Multiprocessor) 1.4 compliant
- Boot from hard drive, optical drive, iSCSI drive, USB key, and SD card
- ACPI support
- Direct Media Interface (DMI) support
- PXE and WOL support for on-board NICs
- Memory mirroring and spare bank support
- SETUP access through <F2> key at end of POST
- USB 2.0 (USB boot code is 1.1 compliant)
- F1/F2 error logging in CMOS
- Virtual KVM, CD, and floppy support
- Unified Server Configurator (UEFI 2.1) support
- Power management support including DBS, Power Inventory and multiple Power Profiles

10.2 System ID

The System ID for the PowerEdge R910 is 0x02d3.

10.3 I2C

I2C is a simple bi-directional 2-wire bus for efficient inter-integrated circuit control. All I2C-bus compatible devices incorporate an on-chip interface which allows them to communicate directly with each other via the I2C-bus. These I2C devices perform communication functions between intelligent control devices (e.g., microcontrollers), general-purpose circuits (e.g., LCD drivers, remote I/O ports, memories) and application-oriented circuits.

The PE R910, BIOS accesses the I2C through the ICH10 (Intel I/O Controller Hub 10). There are two MUXes on ICH10's I2C bus.

- One MUX (U_ICH_SPD) controls the DIMM SPDs through four split segments
- The other MUX (U_ICH_MAIN) controls the clock buffers, TOE, USB Hub through four split segments.
- BIOS controls both the MUXes through the two select lines using GPIO pins.

Clock chip, USB hub, and the front panel EEPROM device addresses are located on the IOH I2C bus.

11 Embedded NICs/LAN on Motherboard (LOM)

R910 supports two options for Embedded NICs (I/O riser card):

- 4-port 1GbE using 2x Broadcom 5709c
- 4-port (2 x 10Gb SFP+ & 2 x 1GbE) using 1 x Broadcom 57711 & 1 x Broadcom 5709c

iSCSI offload is standard on both options.

Option 1: 1GbE I/O riser

Two dual-port Broadcom BCM5709C Gigabit Ethernet controllers with support circuitry are embedded on the R910 1GbE IO riser board. Features of the LAN device include:

- x4 PCI Express Gen2 capable interface
  - R910 operates dual-port controllers at Gen1 speed
- MAC and PHY integrated
- 3072x18 Byte context memory
- 64 KB receive buffer
- TOE (TCP Offload Engine)
- iSCSI controller
- RDMA controller (RNIC) (enabled through an optional hardware key)
- NC-SI (Network Controller-Sideband Interface) connection
- Wake-On-LAN (WOL)
- PXE 2.0 remote boot
- iSCSI boot
- IPv4 and IPv6 support
- Bare metal deployment support

Option 2: 10Gb I/O riser

In addition to a Broadcom BCM5709C dual port Ethernet controller, there is a dual-port 10 Gb MAC controller along with the external PHY embedded on the R910 10 Gb IO riser board. The devices are Broadcom BCM57711 Gigabit MAC with BCM8727 SFP+ PHY. Features include:

- x8 PCI Express Gen2 capable interface
- SFP+ interface supported with SR and LRM optics or direct attached cable
- TOE (TCP Offload Engine)
- iSCSI controller
- RDMA controller (RNIC) (enabled through an optional hardware key)
- NC-SI (Network Controller-Sideband Interface) connection
- Wake-On-LAN (WOL)
- PXE 2.0 remote boot
- iSCSI boot
- IPv4 and IPv6 support
- Bare metal deployment support

NOTE: Four functional PSUs (2+2 config) are required in order to use the 10Gb I/O riser.

12 I/O Slots

12.1 Overview

The R910 planar provides seven PCI Express expansion slots as the base. There is an option to expand the x16 Slot7 with a PCIe riser to four x4 additional slots, bringing the total number of open expansion slots to ten with the riser option. There is also a dedicated storage slot.

- One x4 PCIe Gen2 slot full height with x8 physical connector (Slot 1)
- One x4 PCIe Gen1 slot full height with x8 physical connector (Slot 5)
- Two x8 PCIe Gen2 slots full height with x8 physical connector (Slots 2 & 3)
- Two x8 PCIe Gen2 slots full height with x16 physical connector (Slots 4 & 6)
- One x16 PCIe Gen 2 slot full height with x24 physical connector (Slot 7)
- Four x4 PCIe Gen 2 slots half height with x8 physical connector on optional riser (Slots 7-10)
- One x8 PCIe Gen2 slot for dedicated storage controller card—connected to the IOH
- System supports 25 W maximum power capability for each expansion slot
- R910 does not support hot-swapping of PCIe cards
- R910 does not support full length PCIe cards

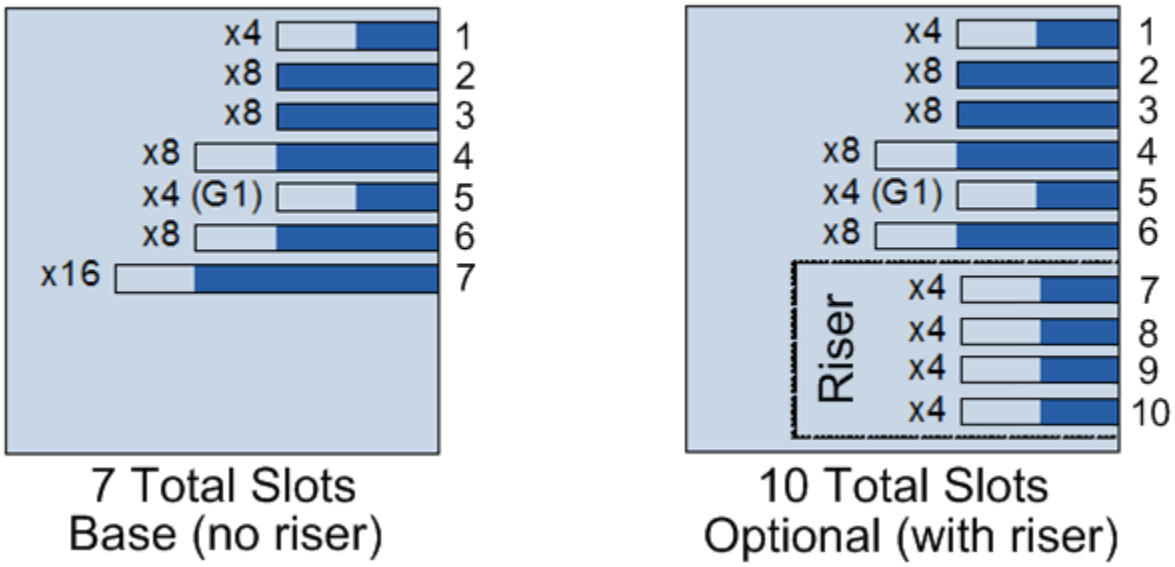


Figure 19. PCIe I/O slots

12.2 Quantities and Priorities

See Expansion Cards and Expansion Card Riser in the *Hardware Owner's Manual* for information on PCI slot priorities and installation order.

12.3 PCI Card Information

PCI card dimensions and limitations are as follows:

- Standard height (4.376")
- The R910 does not support full-length cards (Half length cards are 6.6', Full length cards are 12.283")
- No support for hot-swap or hot-removal
- Compliant with the PCI Express Card Electromechanical Specification Rev 2.0

The PowerEdge R910 supports x16 cards that meet the following requirements:

- Standard height (4.376")
- Half length (6.6")
- Support for full bandwidth of x16 Gen2 link
- No support for hot-swap or hot-removal
- Maximum power of 25W
- R910 provides +12V, +3.3V, and +3.3Vaux in accordance with Power Supply Rail Requirements.
- x16 slot is not compliant with the PCI Express x16 Graphics 150W-ATX Specification
- x16 cards must be compliant with the PCI Express Card Electromechanical Specification Rev 2.0
- x16 cards could occupy the space of two slots (dual wide)
- x16 card is limited to 25W initial start-up power until it is configured as a high power device. If no value is set for the Slot Power Limit, the card is limited to 25W. The card must then either scale down to 25W or disable operation per PCI Express Base Spec Rev 2.0
- x16 card must be able to support a maximum operating temperature of 55°C as defined in the Dell PCI Environmental Spec and the PCI Express Card Electromechanical Spec (See Product Safety, EMC and Environmental Datasheets on Dell.com). The R910 provides a minimum transverse air velocity of "x" LFM (linear feet per minute) to the x16 card.

For more information, please refer to the following specifications:

- PCI Express Base Specification, Rev 2.0, 12/20/06
- PCI Express Card Electromechanical Specification, Rev 2.0, 4/11/07
- PCI Express x16 Graphics 150W-ATX Specification, Rev 1.0, 10/25/04
- PCI Environmental Specification, Rev A00, 2/14/05

13 Storage

13.1 Overview

The R910 system supports up to sixteen 2.5” hard disk drives.

- Support for 10,000 and 15,000 rpm 2.5” SAS drives
- Support for SATA 2.5” solid state drives (SATA SSD)
- Support for 7,200 rpm 2.5” Enterprise SATA drives (only 1 SATA HDD supported)
- Hard drives must use the 2.5” drive carrier
- Mixing of SAS and SATA 2.5” drives in the same system is not supported
- Mixing of SAS and SSD drives in the same system is supported

13.2 Backplanes

R910 supports either a (1) sixteen drive backplane or a (2) four drive backplane for 2.5” drives.

Depending on the type of backplane, there are sixteen or four hot-swap capable Serial Attached SCSI (SAS) or Serial ATA (SATA) drive slots with two LED indicators per slot, up to two Mini-SAS cable connectors for connecting the backplane to the integrated PERC H200 or H700 storage adapters, and a 20-pin planar signal/power connector. PERC H200 storage adapter will only be supported with the 2.5” 4-drive HDD backplane.

13.2.1 2.5” x4 Backplane

The 4-drive 2.5” HDD backplane assembly is as follows:

- Only 2.5” HDD are supported in this configuration
- One Mini-SAS cable is used to connect channel “A” of the integrated PERC H200 or H700 storage controller card to the four-drive backplane.
- Mixing SATA and SAS is NOT supported.

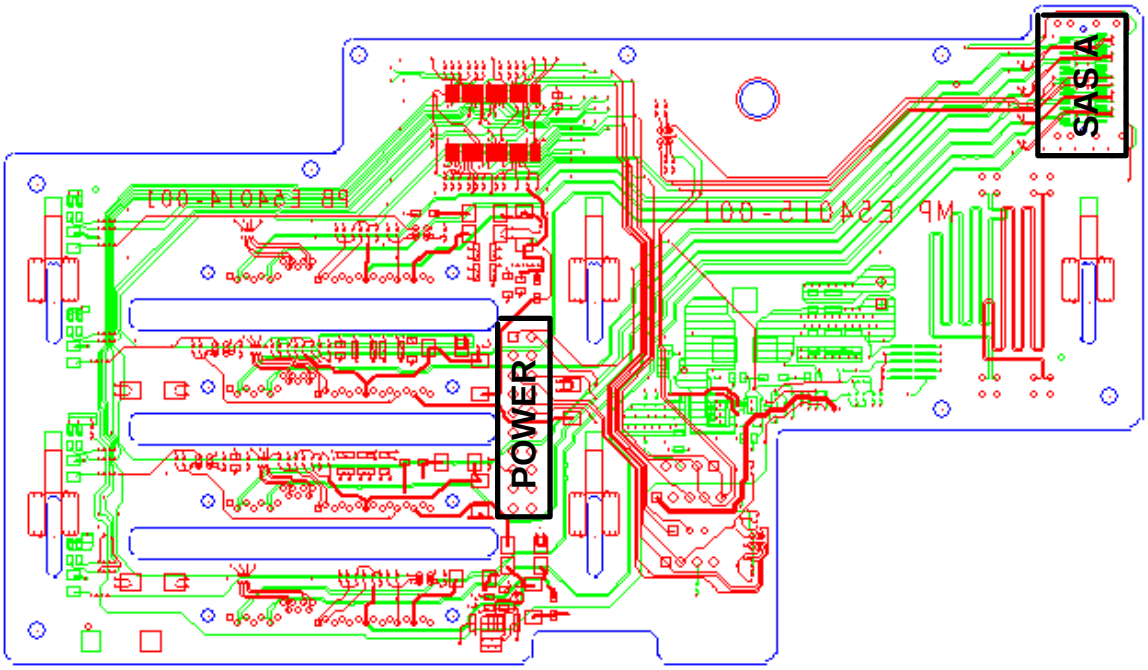


Figure 20. 2.5” x4 Backplane

13.2.2 2.5” x16 Backplane

The 16-drives 2.5” HDD backplane assembly is as follows:

- Only 2.5” HDD are supported in this configuration
- Two Mini-SAS cables are used to connect both channels of the integrated PERC H700 storage card to the sixteen-drive backplane.
- A SAS expander is used to map 16 HDD to the PERC H700 (2 x4 SAS) controller
- Mixing SATA and SAS is NOT supported.
- Mixing SAS and SSD is supported.

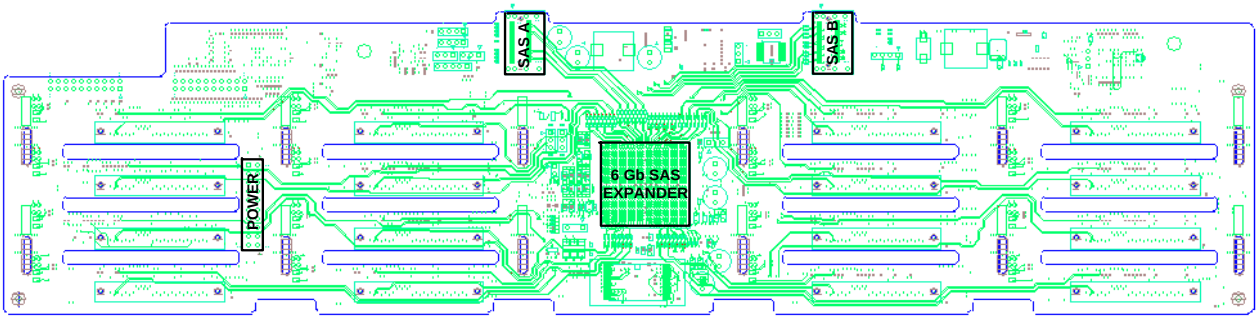


Figure 21. 2.5” x16 Backplane

13.3 Flash BIOS Memory

A Flash EEPROM resides on the SPI Bus for BIOS and configuration storage. A 16 Mbit device is utilized for this function. The Flash memory permits the BIOS to be upgraded in the field. The Flash BIOS may be write-protected by software

13.4 Drives

The PowerEdge R910 supports the new 2.5” hard drive carriers. These carriers implement new industrial design to match the front bezel.

For the slots that are not occupied by drives, a carrier blank is provided to maintain proper cooling, maintain a uniform appearance to the unit, and provide EMI shielding.

R910 supports diskless configuration.

Figure 22. 2.5” HDD carrier

Each hard drive carrier has two LED indicators visible from the front of the system. One is a green LED for disk activity and the other is a bicolor (Green/Amber) LED for status information. The activity LED is driven by the disk drive during normal operation. The bicolor LED is controlled by the SEP device on the backplane. Both LEDs are used to indicate certain conditions under direction of a storage controller.

Table 10. R910 Supported HDDs

SAS HDD (2.5”)	146GB, 300GB
SATA HDD (2.5”)	160GB
SATA SSD (2.5”)	50GB, 100GB

13.5 RAID Configurations

Table 11. RAID Configurations

Configuration Type	Configs		Description	Non Mixed drives (all SATA HDD, all SAS HDD, or all SATA SSD or all SAS SSD) 2.5" Drives			
				x4 Backplane		x16 Backplane	
				Min Drives	Max Drives	Config Type	Max Drives
Diskless Configuration	C0	NCZ	Diskless Configuration	0	0	X	X
SAS HDD/SATA HDD/SATA SSD/SAS SSD – No RAID	C1	MSS	Integrated SAS HDD/SATA HDD/ SSD No RAID (PERC H200, PERC H700)	1	4	X	X
SAS HDD/SATA HDD/SATA SSD/SAS SSD – RAID	C2	MSSRO	Integrated SAS HDD / SSD RAID 0 (PERC H200, PERC H700)	2	4	2	16
	C3	MSSR1	Integrated SAS HDD/ SSD RAID 1 (PERC H200, PERC H700)	2	2	2	2
	C4	MSSR5	Integrated SAS HDD/ SSD RAID 5 (PERC H700)	3	4	3	16
	C5	MSSR6	Integrated SAS HDD/ SSD RAID 6 (PERC H700)	4	4	4	16
	C6	MSSR10	Integrated SAS HDD/ SSD RAID 10 (PERC H700, PERC H200)	4	4	4	16
	C7	MSSR50	Integrated SAS HDD/ SSD RAID 50 (PERC H700)	X	X	6	16
	C8	MSSR60	Integrated SAS HDD/ SSD RAID 60 (PERC H700)	X	X	8	16
	C9	MSSR1R1	Integrated SAS HDD/ SSD RAID 1/ RAID 1 (PERC H700, PERC H200)	4 (2+2)	4 (2+2)	4 (2+2)	4 (2+2)
	C10	MSSR1R5	Integrated SAS HDD/ SSD RAID 1/RAID 5 (PERC H700)	X	X	5 (2+3)	16 (2+14)
	C11	MSSR1R6	Integrated SAS HDD/ SSD RAID 1/RAID 6 (PERC H700)	X	X	5 (2+4)	16 (2+14)

Configuration Type	Configs		Description	Mixed SATA SSD / SAS HDD 2.5" Drives			
				x4 Backplane		x16 Backplane	
				Min Drives	Max Drives	Min Drives	Max Drives
SSD/SAS HDD - RAID	C12	MSSROR1-X	Integrated SSD/SAS HDD RAID 0/RAID 1 (PERC H200, PERC H700) RAID 0 set is SSD, RAID 1 set is SAS	1+2	1+2	1+2	14+2
	C13	MSSR1R1-X	Integrated SSD/SAS HDD RAID 1/RAID 1 (PERC H200, PERC H700) RAID 1 set is SSD, second RAID 1 set is SAS	2+2	2+2	2+2	2+2
	C14	MSSR1R5-X	Integrated SSD/SAS HDD RAID 1/RAID 5 (PERC H700) RAID 1 set is SSD, RAID 5 set is SAS	X	X	2+3	2+14
	C15	MSSR1R10-X	Integrated SSD/SAS HDD RAID 1/RAID 10 (PERC H700) RAID 1 set is SSD, RAID 10 set is SAS	X	X	2+4	2+14
	C16	MSSR1R50-X	Integrated SSD/SAS HDD RAID 1/RAID 50 (PERC H700) RAID 1 set is SSD, RAID 50 set is SAS	X	X	2+6	2+14
	C17	MSSR10R50-X	Integrated SSD/SAS HDD RAID 10/RAID 50 (PERC H700) RAID10 set is SSD, RAID 50 set is SAS	X	X	4+6	8+8

Notes:

All connection types are backplane.

X indicates not supported.

The x16 Backplane is supported only by PERC H700.

The x4 Backplane is supported by both PERC H200 & PERC H700.

SATA HDDs will be supported only on x4 Backplane. Max of only 1 SATA HDDs allowed and is only in C1 config.

13.6 Storage Controllers

13.6.1 PERC H200

The PERC H200 integrated HBA is a SAS 2.0 6Gb native PCIe half-length half-height expansion card that plugs into a dedicated x8 storage slot. It supports RAID0, RAID1, RAID10 and non-RAID HDD configurations. It incorporates one four-channel mini-SAS internal connector (SFF8087) for connection to internal x4 2.5" drive backplane. Since there are a maximum of up to 4-drives, the second mini-SAS connector from H200 to the backplane would not get used. PERC H200 will only be supported when the 4-drive 2.5" backplane is present on R910.

13.6.2 PERC H700

For customers who need a more advanced hardware RAID solution, the PERC H700 (formerly known as PERC 7/iR) is an option. The PERC H700 is a SAS 2.0 6Gb half length PCIe x8 expansion card that uses the LSI 2108 ROC (RAID on Chip) processor running at 800MHz with a PCI Express host interface and DDR2 memory. It supports 512MB cache that is battery backed. It supports RAID0, RAID1, RAID5, RAID6, RAID50, RAID 60 and PRL-11 HDD configurations. It incorporates two four-channel mini-SAS connectors (SFF8087) for connection to internal x4 or x16 2.5" drive backplanes. The second mini-SAS connectors would not get used when connecting PERC H700 to the x4 internal backplane. For details of that card, see the PERC H700 Hardware Specification.

13.6.3 PERC H800

R910 can support up to four PERC 800 adapter cards for access to external SAS direct-attach storage. Features of the PERC H800 include:

- LSI 2108 (Liberator) ROC
- 6Gb/s SAS
- x8 PCIe Gen2
- 800Mz Core PPC
- DDRII - 800MHz – mini-DIMM
- 512MB Dual Mini-SAS Connectors
- Supports connection to PowerVault MD1220 and PowerVault MD1200 6Gb enclosures only

13.6.4 Storage Card Support Matrix

Table 12. Storage Card Support Matrix

	SKU Product	Usage	PowerEdge R910 Support	Slot	PCIe Con	PCI Bracket	I/O Con	RAID	BBU
PERC SAS/SATA	PERC H700 Integrated	Internal Backplane Storage	Yes – Max 1	Storage slot	x8	No	2 x4 mini-SAS int	0, 1, 5, 6, 10, 50, 60, PRL-11	BBU
	PERC H800 Adapter	External SAS/SATA Storage	Yes – Max 4 (PowerVault MD1200 and PowerVault MD1220)	PCIe slot	x8	Yes	x4 ext x4 ext	0, 1, 5, 6, 10, 50, 60, PRL-11	TBBU
	PERC 6/E Adapter	External Legacy Storage	Backup to H800 – Max 2 (MD1000 PowerVault MD1000 only & MD1020 PowerVault MD1120)	PCIe slot	x8	Yes	x4 ext x4 ext	0, 1, 5, 10, 50	TBBU
SAS HBA SAS/SATA	PERC H200 Integrated	Internal Backplane Storage	Yes – Max 1	Storage slot	x8	No	x4 mini-SAS int	0, 1, 10	No
	6Gbps SAS HBA	External SAS tape and RBODs	Yes – Max 2	PCIe slot	x8	Yes	x4 int	None	No
	SAS 5/E Adapter	External SAS (DAS, Tape)	Backup to 6Gbps SAS HBA – Max 2	PCIe slot	x8	Yes	x4 ext x4 ext	None	No
ICH10 SATA	On Planar via chipset	Internal SATA Optical (No HDD)	Yes - 1 port for Optical	n/a	n/a	n/a	x1 int	n/a	n/a
LSI 2032 SCSI	LSI 2032 Adapter	External SCSI Tape or External legacy SCSI storage	Yes - Max 2	PCIe slot	x4	Yes	SCSI (ext)	n/a	n/a

13.7 LED Indicators

Each hard drive carrier has two LED indicators visible from the front of the system. One is a green LED for disk activity and the other is a bicolor (Green/Amber) LED for status information. The activity LED is driven by the disk drive during normal operation. The bicolor LED is controlled by the SEP device on the backplane. Both LEDs are used to indicate certain conditions under direction of a storage controller. See Hard Drive Indicator Patterns in the Hardware Owner's Manual for more information.

13.8 Optical Drives

SATA optical drives are optional in all R910 systems and connect to the planar via the SATA interface to ICH10. IDE (PATA) optical drives are not supported.

The following internal optical drives are available on R910: DVD-ROM and DVD+RW.

If the optical drive is not ordered with the system, a blank is installed in its place.

14 Video

The R910 Integrated Dell Remote Access Controller 6 (iDRAC6) incorporates an integrated video subsystem, connected to the 32-bit PCI interface of the ICH10. This logic is based on the Matrox G200. The device only supports 2D graphics.

The video device outputs are multiplexed between the front and rear video ports. If a monitor is connected to the front video connector, it will take precedence over the rear connection, thereby removing the display from the rear connection.

The integrated video core shares its video memory with the iDRAC6's 128 MB DDR2 application space memory. This memory is also used for the KVM buffer.

The R910 system supports the following 2D graphics video modes:

Table 13. Supported Video Modes

Resolution	Refresh Rate (Hz)	Color Depth (bit)
640 x 480	60, 72, 75, 85	8, 16, 32
800 x 600	56, 60, 72, 75, 85	8, 16, 32
1024 x 768	60, 72, 75, 85	8, 16, 32
1152 x 864	75	8, 16, 32
1280 x 1024	60, 75, 85	8, 16
1280 x 1024	60	32

15 Audio

R910 does not support speakers or audio output.

16 Rack Information

16.1 Overview

The ReadyRails™ sliding rail system for the R910 provides tool-less support for racks with square or unthreaded round mounting holes including all generations of Dell racks. The optional cable management arm (CMA) can be mounted on either the left or right side of the sliding rails without the use of tools for fast and easy deployment.

IMPORTANT NOTES:

- The R910 is not compatible with any other Dell rails including previous generation rails, but it does use the same rails as the R810 & R815.
- The R910 supports sliding rails only. Static rails are not supported.
- Threaded hole racks require Dell's fixed shelf or adapter brackets available from RackSolutions.
- The CMA is not supported on racks that are less than 1m in depth including Dell's 4200 & 2400 racks.

16.2 Rails

The ReadyRails sliding rails for the R910 support tool-less mounting in 19"-wide, EIA-310-E compliant square hole and unthreaded round hole racks and are available with or without the optional cable management arm (CMA).

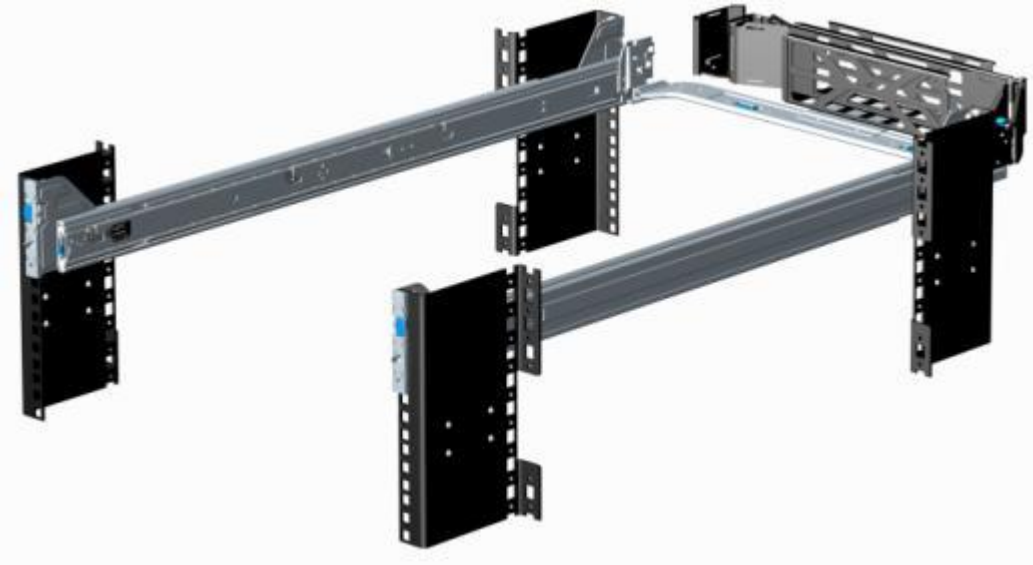


Figure 23. R910 ReadyRails Sliding Rails with Optional CMA

As noted below, the R910 rails do not support mounting in threaded hole or 2-post racks*.

Table 14. Rack Types Supported by the R910

Rail Identifier	Mounting Interface	Rail Type	Rack Types Supported				
			4-Post			2-Post	
			Square	Round	Thread	Flush	Center
B2	ReadyRails™	Sliding	√	√	X	X	X

**Adapter brackets are available from RackSolutions that allow the R910 sliding rails to mount in threaded racks. The only option available for 2-post racks is to mount the system on a fixed shelf.*

Other factors to consider when deploying the R910 include the spacing between the front and rear mounting flanges of the rack, the type and location of any equipment mounted in the back of the rack such as power distribution units (PDUs), and the overall depth of the rack. For example, use of the CMA requires racks that are a minimum of 1m in depth with the PDUs or other rack accessories positioned on the sides or rear of the rack away from the CMA.

Table 15. Rail Adjustability Range and Depth

Rail Adjustability Range (mm)						Rail Depth (mm)	
Square		Round		Threaded		without CMA	with CMA
Min	Max	Min	Max	Min	Max		
686	883	672	876	-	-	755	883

NOTE: The min-max values listed above represent the allowable distance between the front and rear mounting flanges in the rack. Rail depth without the CMA represents the minimum depth of the rail with the outer CMA brackets removed (as measured from the front mounting flanges of the rack).

16.3 Cable Management Arm (CMA)

The optional cable management arm (CMA) for the R910 organizes and secures the cords and cables exiting the back of the server and unfolds to allow the server to extend out of the rack without having to detach the cables. Some key features of the R910 CMA include:

- Large U-shaped baskets to support dense cable loads
- Open vent pattern for optimal airflow
- Fully reversible (can be mounted on either side) with no conversion required
- Utilizes hook-and-loop straps rather than plastic tie wraps to eliminate the risk of cable damage during cycling
- Includes a low profile fixed tray to both support and retain the CMA in its fully closed position
- Both the CMA and the tray mount without the use of tools via simple and intuitive snap-in designs

16.4 Rack View

The R910 ReadyRails sliding rails are a “drop-in” design, meaning that the system is installed vertically into the rails by inserting the shoulder nuts on the sides of the system into the J-slots in the inner rail members with the rails in the fully extended position.

Figure 24. R910 Mounted in the B2 Sliding Rails

The R910 CMA can be mounted to either side of the rails without the use of tools or the need for conversion, but it is recommended that it be mounted on the side opposite the power supplies to allow easier access to the power supplies for service or replacement.

Figure 25. R910 CMA Mounted on the Side Opposite the Power Supplies (Recommended)

17 Operating Systems

For the most up-to-date information, see the Operating System Support Matrix for Dell PowerEdge Systems on Dell.com.

18 Virtualization

The following virtualization software is supported:

- Microsoft Windows Server 2008 Hyper-V
- VMware ESXi Version 4.0 update1
- Citrix® XenServer™ 5.6

19 Systems Management

19.1 Overview/Description

Dell aims on delivering open, flexible, and integrated solutions that help you reduce the complexity of managing disparate IT assets by building comprehensive IT management solutions. Combining Dell PowerEdge Servers with a wide selection of Dell-developed management solutions gives you choice and flexibility, so you can simplify and save in environments of any size. To help you meet your server performance demands, Dell offers Dell OpenManage™ systems management solutions for:

- Deployment of one or many servers from a single console
- Monitoring of server and storage health and maintenance
- Update of system, operating system, and application software

Dell offers IT management solutions for organizations of all sizes—priced, sized, and supported right.

19.2 Server Management

A Dell Systems Management and Documentation DVD and a Dell Management Console DVD are included with the product. ISO images are also available. A brief description of available content:

- Dell Systems Build and Update Utility: Dell Systems Build and Update Utility assists in OS install and pre-OS hardware configuration and updates.
- OpenManage Server Administrator: The OpenManage Server Administrator (OMSA) tool provides a comprehensive, one-to-one systems management solution, designed for system administrators to manage systems locally and remotely on a network. OMSA allows system administrators to focus on managing their entire network by providing comprehensive one-to-one systems management.
- Management Console: Our legacy IT Assistant console is also included, as well as tools to allow access to our remote management products. These tools are Remote Access Service, for iDRAC, and the BMC Management Utility.
- Active Directory Snap-in Utility: The Active Directory Snap-in Utility provides an extension snap-in to the Microsoft Active Directory. This allows you to manage Dell specific Active Directory objects. The Dell-specific schema class definitions and their installation are also included on the DVD.
- Dell Systems Service Diagnostics Tools: Dell Systems Service and Diagnostics tools deliver the latest Dell optimized drivers, utilities, and operating system-based diagnostics that you can use to update your system.
- eDocs: The section includes Acrobat files for PowerEdge systems, storage peripheral, and OpenManage software.
- Dell Management Console DVD: The Dell Management Console is a Web-based systems management software that enables you to discover and inventory devices on your network. It also provides advanced functions, such as health and performance monitoring of networked devices and patch management capabilities for Dell systems.
- Server Update Utility: In addition to the Systems Management Tools and Documentation and Dell Management Console DVDs, customers have the option to obtain Server Update Utility DVD. This DVD has an inventory tool for managing updates to firmware, BIOS and drivers for either Linux or Windows varieties.

19.3 Embedded Server Management

The PowerEdge R910 implements circuitry for the next generation of Embedded Server Management. It is Intelligent Platform Management Interface (IPMI) v2.0 compliant. The optional iDRAC (Integrated Dell Remote Access Controller) is responsible for acting as an interface between the host system and its management software and the periphery devices.

The optional upgrade to iDRAC6 provides features for managing the server remotely or in data center lights-out environments.

Advanced iDRAC features require the installation of the optional iDRAC6 Enterprise card.

19.4 Lifecycle Controller and Unified Server Configurator

Embedded management is comprised of several interdependent pieces:

- Lifecycle Controller
- Unified Server Configurator
- iDRAC6
- vFlash

Lifecycle controller powers the embedded management features. It is integrated and tamperproof storage for system-management tools and enablement utilities (firmware, drivers, etc.). It is flash partitioned to support multiple, future-use cases.

Dell Unified Server Configurator (USC) is a local 1:1 graphical user interface embedded on Lifecycle Controller that aids in local server provisioning in a pre-OS environment. For servers with iDRAC Express, the Lifecycle Controller offers OS install, platform updates, platform configuration, and diagnostics capabilities. For servers without iDRAC Express, this utility has limited functionality and offers OS install and diagnostics capabilities only.

To access the Unified Server Configurator, press the <F10> key within 10 seconds of the Dell logo's appearance during the system boot process. Current functionality enabled by the Unified Server Configurator includes:

Table 16. Unified Server Configurator Features and Description

Feature	Description
Faster O/S Installation	Drivers and the installation utility are embedded on system, so no need to scour DELL.COM
Faster System Updates	Integration with Dell support automatically directed to latest versions of the Unified Server Configurator, iDRAC, RAID, BIOS, NIC, and Power Supply
Update Rollback	Ability to recover to previous "known good state" for all updatable components
More Comprehensive Diagnostics	Diagnostic utilities are embedded on system
Simplified Hardware Configuration	Detects RAID controller and allows user to configure virtual disk and choose virtual disk as boot device, eliminating the need to launch a separate utility. Also provides configuration for iDRAC, BIOS, and NIC/LOM.

19.5 Optional iDRAC Express

The optional iDRAC Express is the first tier of iDRAC6 upgrades. In addition to upgrading the system with a Lifecycle Controller, the iDRAC6 Express offers the following key features:

- Graphical web interface
- Standard-based interfaces
- Server Sensor monitoring and fault alerting
- Secure operation of remote access functions including authentication, authorization, and encryption
- Power control and management with the ability to limit server power consumption and remotely control server power states
- Advanced troubleshooting capabilities

For more information on iDRAC6 Express features see table below.

19.6 iDRAC6 Enterprise

The optional iDRAC6 Enterprise card provides access to advanced iDRAC6 features. The iDRAC6 Enterprise connects directly to the R910 planar and is mounted parallel to the planar with stand-offs.

Key features for the iDRAC6 Enterprise include:

- Scripting capability with Dell's Racadm command-line
- Remote video, keyboard, and mouse control with Virtual Console
- Remote media access with Virtual Media
- Dedicated network interface

Additionally, the iDRAC6 Enterprise can be upgraded by adding the vFlash Media card. This is a 1 GB Dell branded SD card that enables a persistent 256 MB virtual flash partition. In the future, vFlash will be expanded to include additional features.

A more detailed feature list for iDRAC6 Enterprise and vFlash is included in the table below.

Table 17. Features List for BMC, iDrac, and vFlash

Feature	BMC	iDRAC 6 Express	iDRAC6 Enterprise	vFlash Media
Interface and Standards Support				
IPMI 2.0	✓	✓	✓	✓
Web-based GUI		✓	✓	✓
SNMP		✓	✓	✓
WSMAN		✓	✓	✓
SMASH-CLP		✓	✓	✓
Racadm command-line			✓	✓
Conductivity				
Shared/Failover Network Modes	✓	✓	✓	✓
IPv4	✓	✓	✓	✓

Feature	BMC	iDRAC 6 Express	iDRAC6 Enterprise	vFlash Media
VLAN Tagging	✓	✓	✓	✓
IPv6		✓	✓	✓
Dynamic DNS		✓	✓	✓
Dedicated NIC			✓	✓
Security and Authentication				
Role-based Authority	✓	✓	✓	✓
Local Users	✓	✓	✓	✓
Active Directory		✓	✓	✓
SSL Encryption		✓	✓	✓
Remote Management and Remediation				
Remote Firmware Update	✓	✓	✓	✓
Server power control	✓	✓	✓	✓
Serial-over-LAN (with proxy)	✓	✓	✓	✓
Serial-over-LAN (no proxy)		✓	✓	✓
Power capping		✓	✓	✓
Last crash screen capture		✓	✓	✓
Boot capture		✓	✓	✓
Serial-over-LAN		✓	✓	✓
Virtual media			✓	✓
Virtual console			✓	✓
Virtual console sharing			✓	✓
Virtual flash				✓
Monitoring				
Sensor Monitoring and Alerting	✓	✓	✓	✓
Real-time Power Monitoring		✓	✓	✓
Real-time Power Graphing		✓	✓	✓
Historical Power Counters		✓	✓	✓
Logging Features				

Feature	BMC	iDRAC 6 Express	iDRAC6 Enterprise	vFlash Media
System Event Log	✓	✓	✓	✓
RAC Log		✓	✓	✓
Trace Log			✓	✓

20 Peripherals

20.1 USB peripherals

PE R910 supports the following USB devices:

- DVD (bootable; requires two USB ports)
- USB Key (bootable)
- Keyboard (only one USB keyboard is supported)
- Mouse (only one USB mouse is supported

20.2 External Storage

Table 18. External Storage

Type	Model
SAN Support	EMC's AX Arrays (SCSI, FC and iSCSI)
	EMC's CX Arrays (SCSI, FC and iSCSI)
	Equal Logic's PS5XXX Arrays (iSCSI)
SAS Management SW for xBOD	OMSS for MD1000
	OMSS for MD1020
PowerVault NAS	Attachment to PV NX1950 including iSCSI and clustering support
	Attachment to Win Storage Server on PE
	Attachment to EMC NS500G (S&P)
PV DAS	MD1000 JBOD
	MD3000 RBOD
	MD1120 2.5 SAS/SATA JBOD
	MD1100 3.5 SAS/SATA JBOD
PV SAN	MD3000i iSCSI RAID array
EqualLogic™	PS5000 family
	PS5500 family
IDM	IDM support
SAS xBOD SW	OpenManage Storage Manager

Appendix A. Regulatory Certifications

Table 19. Standards Compliance

Standard	URL for Information and Specifications
ACPI Advance Configuration and Power Interface Specification, v2.0c	http://www.acpi.info/
Ethernet IEEE 802.3-2005	http://standards.ieee.org/getieee802/802.3.html
IPMI Intelligent Platform Management Interface, v2.0	http://www.intel.com/design/servers/ipmi/
DDR3 Memory DDR3 SDRAM Specification, Rev. 3A	http://www.jedec.org/download/search/JESD79-3A.pdf
LPC Low Pin Count Interface Specification, Rev. 1.1	http://developer.intel.com/design/chipsets/industry/lpc.htm
PCI Express PCI Express Base Specification Rev. 2.0	http://www.pcisig.com/specifications/pciexpress/
PMBus Power System Management Protocol Specification, v1.1	http://pmbus.info/specs.html
SAS Serial Attached SCSI, v1.1	http://www.t10.org/ftp/t10/drafts/sas1/sas1r10.pdf
SATA Serial ATA Rev. 2.6; SATA II, Extensions to SATA 1.0a, Rev. 1.2	https://www.sata-io.org/secure/spec_download.asp http://www.sata-io.org/docs/S2Ext_1_2_Gold.pdf
SMBIOS System Management BIOS Reference Specification, v2.6	http://www.dmtf.org/standards/smbios/
TPM Trusted Platform Module Specification, v1.2	https://www.trustedcomputinggroup.org/downloads/specifications/tpm/tpm
UEFI Unified Extensible Firmware Interface Specification, v2.1	http://www.uefi.org/specs/
USB Universal Serial Bus Specification, Rev. 2.0	http://www.usb.org/developers/docs/

Standard	URL for Information and Specifications
Windows Logo Windows Logo Program System and Device Requirements, v3.10	http://www.microsoft.com/whdc/winlogo/hwrequirements.mspx

Appendix B. R910 Volatility Table

Table 20. R910 Volatility

Server BIOS Memory (SPI Flash, IC)	
Size:	4 MB
Type [e.g., Flash PROM, EEPROM]:	Flash EEPROM (Serial Peripheral Interface)
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Boot Code, Configuration Information, EUFI environment
How is data input to this memory?	Loading flash memory requires a vendor-provided firmware file and loader program which is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. System loaded with arbitrary data in firmware memory will not operate.
How is this memory write protected?	Software write protected
Server CMOS (Complementary Metal-Oxide Semiconductor) Memory	
Size:	512 Bytes
Type [e.g., Flash PROM, EEPROM]:	Battery-Backed NVRAM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	RTC and storing system configuration settings
How is data input to this memory?	F2 Setup Menu during POST
How is this memory write protected?	N/A
Remarks	Jumper on motherboard can be used to clear to factory default settings. Removing CMOS battery will clear to factory defaults settings as well.
Server BMC (Baseboard Management Controller)/iDRAC Express Boot Block Flash	
Size:	2 MB
Type [e.g., Flash PROM, EEPROM]:	Serial Flash
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	iDRAC boot loader and configuration (i.e. MAC address), Lifecycle log.
How is data input to this memory?	Data pre-programmed or update using Dell utility which is a DOS or Windows or Linux based

	executable containing firmware file and loader
How is this memory write protected?	Software write protected
Remarks	Bad contents yield the iDRAC inoperable and is unrecoverable in the customer environment. Note the lifecycle log is automatically updated by the iDRAC as various system component FW, HW and SW versions are changed.
Server BMC/iDRAC Express Internal Flash	
Size:	1 GB
Type [e.g., Flash PROM, EEPROM]:	NAND Flash
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	iDRAC Operating System plus Managed System Services Repository (i.e., Unified Server Configurator, OS drivers, diagnostics, rollback versions of various programmables)
How is data input to this memory?	iDRAC OS: Loading flash memory requires a vendor-provided firmware file and loader program which is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. System loaded without a good iDRAC firmware image yields a non-functional iDRAC. Managed Services Repository: Various partitions are loaded via vendor-provided firmware file and loader program just like iDRAC OS.
How is this memory write protected?	Software write protected
System Event Log (SEL) Memory and Baseboard FRU	
Size:	4 KB
Type [e.g., Flash PROM, EEPROM]:	SERIAL EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Store system events from BMC and BIOS. FRU information for board such as PPID, MAC addresses etc.
How is data input to this memory?	For SEL, BMC writes to it. For FRU, data is pre-programmed or input using Dell utility at ICT/Functional Tester during board assembly.
How is this memory write protected?	Software write protected
FRU Memory for the I/O Risers (1GbE or 10Gb) and Memory Riser	
Size:	256 Bytes

Type [e.g., Flash PROM, EEPROM]:	EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	FRU information for boards such as board name, PPID, manufacturing date etc.
How is data input to this memory?	Data pre-programmed or using Dell utility at ICT/Functional Tester during board assembly.
How is this memory write protected?	Not write protected
DIMM Modules SPD (Serial Presence Detect) EEPROM (up to 64 depending on the number of DIMM modules present)	
Size:	256 Bytes
Type [e.g., Flash PROM, EEPROM]:	EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	DIMM information and temperature settings
How is data input to this memory?	Data preprogrammed by the DIMM vendors (lower 128 bytes). Also during boot sequence, data is written to SPD EEPROM (upper 128 Bytes).
How is this memory write protected?	Not write protected
TPM (Trusted Platform Module) (if applicable)	
Size:	128 Bytes
Type [e.g., Flash PROM, EEPROM]:	EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Stores encryption keys for TPM functionality
How is data input to this memory?	Data is pre-programmed by vendor. Keys are updated using TPM-enabled operating systems.
How is this memory write protected?	Software write protected
Remarks	F2 BIOS setup option to enable/activate/clear
TPM Alternative Plug-in Module (if applicable)	
Size:	256 Bytes
Type [e.g., Flash PROM, EEPROM]:	EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Stores encryption keys for TPM functionality

How is data input to this memory?	Data is pre-programmed by vendor. Keys are updated using TPM enabled operating systems.
How is this memory write protected?	Software write protected
Remarks	F2 BIOS setup option to enable/activate/clear
Server CPLD Devices (x2 per baseboard)	
Size:	2280 macro-cells and 256 macro-cells
Type [e.g., Flash PROM, EEPROM]:	Internal Flash EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	System power sequence control, error/config detection, and BIOS-BMC interaction.
How is data input to this memory?	Programming CPLD(s) requires a vendor-provided logic file and loader program which is executed by booting up the system from a floppy or OS-based executable containing the logic file and the loader. System loaded with arbitrary data in CPLD(s) will not operate.
How is this memory write protected?	Software write protected
Remarks	Need AC cycle after updating CPLD
Broadcom® 5709/57711 PCI-e Network Interface Controller Flash	
Size:	1MB
Type [e.g., Flash PROM, EEPROM]:	Serial Flash
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Embedded Network Controller FW and config data
How is data input to this memory?	Loading flash memory requires a vendor-provided firmware file and loader program which is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. System loaded with arbitrary data in firmware memory would not have the network ports operational.
How is this memory write protected?	Software write protected
Remarks	There is a quantity of 2 SPI flash on both the I/O risers. On 1GbE I/O riser, both flash parts are for the two 5709C controllers where as on 10Gb I/O riser, one is for 5709C and the other one is for 57711 network controller.
Broadcom 8727 PHY (Physical Layer) EEPROM (applicable to only 10Gb I/O riser)	
Size:	32KB

Type [e.g., Flash PROM, EEPROM]:	Serial EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Stores the PHY firmware
How is data input to this memory?	Data is preprogrammed or update using Dell LOM FW update utility. System loaded with arbitrary data in firmware memory will not have the 10Gb SFP+ network ports operational
How is this memory write protected?	Software write protected
Remarks	10Gb I/O riser is optional
10 Gb I/O riser CPLD (applicable to only 10Gb I/O riser when present)	
Size:	64 Macrocells
Type [e.g., Flash PROM, EEPROM]:	CPLD
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Stores the standby power delivery routing to 10Gb network controller and its PHY
How is data input to this memory?	Data is preprogrammed at board build
How is this memory write protected?	Software write protected
Remarks	10Gb I/O riser is optional
Dell PERC H700i storage controller CPLD/Flash/NVSRAM etc. (if applicable)	
Size:	FRU: 256 Bytes Boot ROM: 8 KB Flash: 8 MB CPLD: 128 Macrocells NVSRAM: 128 KB iButton key EEPROM: 128 Bytes Battery-Backed Cache: 512 MB
Type [e.g., Flash PROM, EEPROM]:	FRU, EEPROM, Flash, CPLD, Non-volatile SRAM and a 1-wire EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Flash stores the storage controllers firmware CPLD controls the power sequencing & battery backup logic NVSRAM stores the controller configuration FRU stores the PPID, manufacturing date etc. Battery-Backed Cache: Stores the data if the cache is not cleared and battery backup unit is

	enabled in the case of a power loss.
How is data input to this memory?	FRU/CPLD data is preprogrammed at board build. NVSRAM is updated by the storage controller Flash is updated by Dell provided update package Cache stores the data before getting written to the disks when WriteBack policy is enabled with battery backup.
How is this memory write protected?	FRU is not write protected but other components detailed above in the Size row are software write protected.
Remarks	PERC H700i controller is optional
Dell PERC H200i storage controller Flash/NVSRAM/FRU (if applicable)	
Size:	FRU: 256 Bytes Boot ROM: 8 KB Flash: 8 MB NVSRAM: 128 KB
Type [e.g., Flash PROM, EEPROM]:	Flash (NOR), EEPROM and NVSRAM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Flash stores the storage controllers firmware NVSRAM stores the controller configuration FRU stores the PPID, manufacturing date etc.
How is data input to this memory?	FRU data is preprogrammed at board build. NVSRAM is updated by the storage controller Flash is updated by Dell provided update package
How is this memory write protected?	FRU is not write protected but everything else is software write protected
Remarks	PERC H200i controller is optional
Server (4- or 16-drive SAS) Backplane Storage Controller Memory	
Size:	32KB
Type [e.g., Flash PROM, EEPROM]:	Embedded Microcontroller Flash
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Stores the server storage backplane FW and FRU

How is data input to this memory?	Loading flash memory requires a vendor-provided firmware file and loader program which is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. System loaded with arbitrary data in firmware memory would not operate.
How is this memory write protected?	Software write protected
Remarks	There is quantity of "1" PSoC device on the 4-drive backplane versus "2" on the 16-drive backplane.
Server (16-drive SAS only) Backplane SAS Expander EEPROM	
Size:	4MB
Type [e.g., Flash PROM, EEPROM]:	Flash EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Store SAS expander firmware and configuration data
How is data input to this memory?	Data pre-programmed or update using Dell utility which is a DOS-based executable containing the firmware file and loader.
How is this memory write protected?	Software write protected
Remarks	Ensure that SAS x16 BP cables are attached to planar prior to update. After update, the system should be AC cycled before update takes effect.
Power Supply Firmware and FRU (Field Replacement Unit) Memory	
Size:	1100W LiteOn: 4KB FLASH with 256 Bytes RAM 1100W/750W Emerson: 8K and 16K FLASH with 384 and 1024 Bytes RAM respectively 750W Delta: Flash ROM size 48K bytes and EEPROM size 1K bytes
Type [e.g., Flash PROM, EEPROM]:	FLASH, EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Stores PSU controller firmware. FRU information for boards such as name, manufacturing date etc.
How is data input to this memory?	FRU and firmware data pre-programmed by the PSU vendors. PSU firmware can be updated by Dell provided update package.
How is this memory write protected?	Software write protected
Remarks	The number of these devices depends on the

	number of PSUs installed.
Dell Internal Dual SD Module (IDSM) microcontroller flash (if present)	
Size:	256 KB
Type [e.g., Flash PROM, EEPROM]:	EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Store firmware for IDSM functionality
How is data input to this memory?	Loading flash memory requires a vendor-provided firmware file and loader program. IDSDM module loaded with arbitrary data in firmware memory would not operate.
How is this memory write protected?	Software write protected
Remarks	IDSM is an option
Dell Internal Dual SD Module (IDSM) write journal flash (if present)	
Size:	8 MB
Type [e.g., Flash PROM, EEPROM]:	EEPROM
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Store write journal for shutdown recovery
How is data input to this memory?	IDSM microcontroller writes to and read from these memory via SPI interface during operation.
How is this memory write protected?	Software write protected
Remarks	IDSM is an option
SD card(s) (if present) for IDSM (one or two SD cards depending on the redundancy mode ordered with it)	
Size:	Multiple (1GB, 2GB, 8GB)
Type [e.g., Flash PROM, EEPROM]:	Secure Digital NAND Flash
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Normal usage is embedded Hypervisor OS but not limited
How is data input to this memory?	Factory load, OS run time usage and OS updates and configuration changes.
How is this memory write protected?	Media-write protection or software-write protected
Remarks	IDSM is an option

vFlash for iDRAC Enterprise	
Size:	Multiple
Type [e.g., Flash PROM, EEPROM]:	Secure Digital NAND Flash
Can user programs or operating system write data to it during normal operation?	No
Does it retain data when powered off?	Yes
Purpose? [e.g., boot code]	Storage of logs, user images like files, drivers, OS's etc.
How is data input to this memory?	Preloaded media before installation, or remote out-of-band upload of user data (i.e., ISO images, files) or local server read/write capability to use like a hard disk.
How is this memory write protected?	Media write protection or Software write protected
Remarks	iDRAC Enterprise and vFlash are optional