# DELL™ POWEREDGE™ R710

## TECHNICAL GUIDEBOOK

### INSIDE THE POWEREDGE R710

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# THE DELL™ POWEREDGE™ R710

**The Dell PowerEdge R710 is designed to be the cornerstone of today's competitive enterprise. Engineered in response to input from IT professionals, it is the next-generation 2U rack server created to efficiently address a wide range of key business applications. The successor to the PowerEdge 2950 III, the R710 runs the Intel® Xeon® 5500 Series Processors and helps you lower the total cost of ownership with enhanced virtualization capabilities, improved energy efficiency, and innovative system management tools.**

### Strong IT Foundation

As an IT professional, you want a data center built to allow for organic growth and the ability to scale based on your company's changing requirements. You need complete solutions that allow you to focus your time and money on managing and growing your business. Dell understands your needs and responds with an expanding portfolio of enterprise servers, storage technologies, and services with a single goal: to help you simplify IT.

### Purposeful Design

The R710 takes advantage of Dell's system commonality. Once your IT managers learn one system, they understand how to manage next-generation Dell servers. Logical component layout and power supply placement also provide a straightforward installation and redeployment experience. Featuring 18 DIMM slots and 4 integrated network connections, the R710 delivers the critical components to virtualization and database performance. The Intel Xeon Processor 5500 Series adapts to your software in real time, processing more tasks simultaneously. Using Intel® Turbo Boost Technology, the R710 can increase performance during peak usage periods. You can then help reduce operating costs and energy usage with Intel® Intelligent Power Technology, which proactively puts your server into lower power states when demand decreases. Increased memory slots also save money by enabling you to use smaller, less-expensive DIMMs to meet your computing needs.

### Enhanced Virtualization

Featuring Intel Xeon-based architecture, embedded hypervisors, large memory capacity, and integrated I/O, the next-generation Dell PowerEdge R710 delivers better overall system performance and greater virtual machine-per-server capacity. With optional factory-integrated virtualization capabilities, you get tailored solutions – built with the latest technologies from Dell and our trusted partners – which allow you to streamline deployment and simplify virtual infrastructures. Choose your hypervisor from market leaders such as VMware®, Citrix®, and Microsoft®, and enable virtualization with a few mouse clicks.

### Energy-Optimized Technologies

Using the latest Energy Smart technologies, the R710 reduces power consumption while increasing performance capacity versus the previous generation servers. Enhancements include efficient power supply units right-sized for system requirements, improved system-level design efficiency, policy-driven power and thermal management, and highly efficient standards-based Energy Smart components. Dell's advanced thermal control delivers optimal performance at minimal system and fan power consumption resulting in our quietest 2U servers to date. These enhancements maximize energy efficiency across our latest core data center servers without compromising enterprise performance.

### Simplified Systems Management

Gain more control with the next-generation Dell OpenManage™ suite of management tools. These tools provide enhanced operations and standards-based commands designed to integrate with existing systems for effective control. Dell Management Console (DMC) helps simplify operations and creates stability by shrinking infrastructure management to one console. This console delivers a single view and a common data source into the entire infrastructure management. Built on Symantec® Management Platform, it has an easily extensible, modular foundation that can provide basic hardware management all the way up to more advanced functions, such as asset and security management. Dell Management Console reduces or eliminates manual processes, enabling you to save time and money for more

strategic technology usage. Secure, efficient, and more user friendly than its predecessors, the Dell Unified Server Configurator (USC) delivers "Instant On" integrated manageability through a single access point. You get quick, persistent access to the tool because it is embedded and integrated into the system for increased flexibility and capabilities. The USC is a one-stop shop for deploying operating systems with built-in driver installations, firmware updates, hardware configuration, and issue diagnoses.

## SECTION 1. SYSTEM OVERVIEW

### A. Overview / Description

The PowerEdge R710 will lead Dell's 11th Generation PowerEdge portfolio in key areas of differentiation, primarily:

- Virtualization
- Power, thermal, efficiency
- Systems management, and usability

### B. Product Features Summary

| FEATURE | DETAILS |
|---|---|
| | |
| **Processor** | Nehalem EP |
| **Front Side Bus** | Intel® QuickPath Interconnect (QPI) @ maximum 6.GT/s |
| **# Procs** | 2S |
| **# Cores** | 4 cores |
| **L2/L3 Cache** | 4MB and 8MB |
| **Chipset** | Tylersberg |
| **DIMMs/Speed** | 18 RDIMM or UDIMM DDR3 (9 per processor) |
| **Min/Max RAM** | 1GB – 144GB |
| **HD Bays** | Internal hard drive bay and hot-plug backplane<br>Up to six 3.5" SAS or SATA drives without optional flex bay OR<br>Up to eight 2.5" SAS or SATA drives with optional flex bay |
| **HD Types** | SAS, SATA, Near-line SAS, and SSD |
| **Ext Drive Bay(s)** | Optional flex-bay expansion to support a half-height TBU |
| **Int. HD Controller** | PERC 6i and SAS 6/iR |
| **Opt. HD Controller** | |
| **BIOS** | |
| **Video** | Based on the Matrox G200 w/iDRAC |
| **Availability** | |
| **Server Management** | |
| **I/O Slots** | Two x8 and two x4 PCIe Gen2 slots or One x16 PCIe slot and two x4 PCIe Gen2 |

| FEATURE | DETAILS |
|---|---|
| **RAID** | PERC 6i utilizing battery backed 256MB DDRII 667 |
| **NIC/LOM** | Broadcom 5709C (2 cards/4ports) |
| **USB** | Five (two front, two rear, one internal) |
| **Power Supplies** | Two hot-plug high-efficient 570W PSU OR<br>Two hot-plug 870W PSUs (1+1) |
| **Front Control 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 |
| **System ID** | Front and rear (0x0235) |
| **Fans** | Five hot-swappable<br>Additional fan integrated into each power supply<br>Single processor configurations will only have four fans |
| **Chassis** | 2u Rackmount |

## SECTION 2. MECHANICAL

### A. Chassis Description

PowerEdge R710 is a 2U rackmount chassis. The updated design includes a new LCD, bezel and hard-drive carriers. Additional changes include tool-less rack latches, a pull out tray for customer labels, and LOM0/iDRAC MAC address; labels; support persistent storage (internal USB and SD card slots and external SD card slots); updated power supplies and removal process.

From view 3.5″ HDD Chassis (without bezel)

From view 2.5″ HDD Chassis (without bezel)

### B. Dimensions and Weight

| | |
|---|---|
| Height | 8.64cm (3.40″) |
| Width | 44.31cm (17.44″) |
| Depth | 68.07cm (26.80″) |
| Weight (maximum config) | 26.1kg (57.54lbs) |

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### C. Front Panel View and Features

Front I/O panel access including USB and VGA interfaces. The following components are located on the front:

- Express service tag (Information tag). A slide-out panel for system identification labels
- Power on indicator, power button
- NMI indicator (Nonmaskable interrupt). A device sends an NMI to signal the processor about hardware errors. It is used to troubleshoot software and device driver errors when using certain operating systems
- (2) USB connectors. Connects USB devices to the system. The ports are USB 2.0 compliant
- Video connector
- LCD menu buttons. Allows you to navigate the control panel LCD menu
- LCD panel. Provides system ID, status information, and system error messages
- System identification button
- Optical drive (optional)
- Hard drives
- Flex bay

### D. Back Panel View and Features

The following components are located on the rear panel of the R710 enclosure:

- (1) 15-pin VGA connector
- (1) 9-pin serial port connector
- (4) 10/100/1000 Ethernet RJ-45 connectors
- (1) Rear system ID button
- (1) Active ID Cable Management Arm external LED jack
- (2) USB ports
- (1) (Optional) iDRAC6 Enterprise RJ-45 connector
- (1) Optional) iDRAC6 Express SD module

### E. Power Supply Indicators

The PSUs on the PE R710 have one status bi-color LED: green for AC power present and amber for a fault.

| LED | POWER SUPPLY STATUS |
|---|---|
| | AC power is not present |
| | AC power is present |
| | Fault of any kind is detected |
| | DC power is applied to the system |
| ←→ | PSU mismatch (when hot-added/swapped) |

Table: Power Supply Indicator

### F. NIC Indicators

| INDICATOR | INDICATOR CODE |
|---|---|
| **Link and activity indicators are off** | The NIC is not connected to the network |
| **Link indicator is green** | The NIC is connected to a valid network link at 1000 Mbps |
| **Link indicator is amber** | The NIC is connected to a valid network link at 1000 Mbps |
| **Activity indicator is green blinking** | Network data is being sent or received |

### G. Side Views and Features

## H. Rails and Cable Management

Rack installation components such as rails are provided with the PowerEdge R710 Rack Kit. The rack installation components are as follows: Sliding rack mount with latest generation Cable Management Arm (CMA). When the system is installed in a rack, please observe the following guideline:

When the system is installed in a rack, only Dell-approved CMAs should be installed behind the chassis.

### Rails

- Enable the replacement of thumbscrews with slam latches on the chassis for easier stowing in the rack.
- Include the new simple and intuitive ReadyRail™ tool-less rack interface for square-hole and round-hole racks.
- Provide significantly improved compatibility with non-Dell racks.
- Static rails for the R610 & R710 fit in all types of four-post and two-post racks available in the industry including four-post threaded hole racks.

### CMAs

- Provide much larger vent pattern for improved airflow through the CMA.
- Include a common support tray for eliminating CMA sag.
- Replaced tie wraps with hook and loop straps to eliminate risk of cable damage during cycling.
- Maintain key feature of being fully reversible with no conversion required.

## I. Fans

### Fans

Five hot-swappable fans are mounted in a fan gantry that is located in the chassis between the hard drive bay and the processors. Each fan has a blind mate 2x2 connector that plugs directly into the planar. There is an additional fan integrated in each power supply to cool the power supply subsystem and also provide additional cooling for the whole system. Single processor configurations will have four fans populated.

The Embedded Server Management logic in the system monitors the speed of the fans. A fan failure or over-temperature in the system results in a notification by iDRAC6. All system fans are pulse-width modulated fans. Redundant cooling is supported with one fan failing at a time.

### J. Control Panel / LCD

The control panel board is connected to the planar via a 60-wire ribbon cable and a separate 5-wire cable for USB signals only. The LCD plugs into the control panel through a 20-pin ZIF connector and flex cable.

The system control panel is located on the front of the system chassis to provide user access to switches, display, and I/O interfaces. Features of the system control panel are:

- ACPI-compliant power button with an integrated green power LED (controlled by ESM)
- 128x20 pixel LCD 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 (with two internal connectors dedicated for UIPS)
- 15-pin VGA connector


The LCD panel is a graphics display controlled by the BMC/ESM. Both ESM and BIOS can send error codes and messages to the display.

The system's LCD panel provides system information and status messages to signify when the system is operating correctly or when the system needs attention.

The LCD backlight lights blue during normal operating conditions and lights amber to indicate an error condition. When the system is in standby mode, the LCD backlight is off and can be turned on by pressing the Select button on the LCD panel. The LCD backlight will remain off if the "No Message" option is selected through the iDRAC6, the LCD panel, or other tools.

BIOS has the ability to enter a "Secure Mode" through Setup, which locks 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.

### K. Security

#### I. Cover Latch

A tooled entry latch is provided on the top of the unit to secure the top cover to the chassis

### II. Bezel
A metal bezel is mounted to the chassis front to provide the Dell ID. A lock on the bezel is used to protect un-authorized access to system peripherals and the control panel. System status via the LCD is viewable even when the bezel is installed.

### III. Hard Drive
The optional front bezel of the system contains a lock. A locked bezel secures the system hard drives.

### IV. TPM
The 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. There will be different planar PWA part numbers to accommodate the different TPM solutions. The "Rest of World" (ROW) version will have the TPM soldered onto the planar. The other version of the planar (post RTS and primarily for use by China) will have a connector for a plug-in module.

### V. 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.

### VI. Intrusion Alert
A switch mounted on the left riser board is used to detect chassis intrusion. When the cover is opened, the switch circuit closes to indicate intrusion to ESM. When enabled, the software can provide notification to the customer that the cover has been opened.

### VII. 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. See the 11th generation of PowerEdge servers BIOS Specification for details

## L. USB Key
The port on the control panel is for an optional USB key and is located inside the chassis. Some of the possible applications of the USB key are:

- User custom boot and pre-boot OS for ease of deployment or diskless environments
- USB license keys for software applications like eToken™ or Sentinel Hardware Keys
- Storage of custom logs or scratch pad for portable user defined information (not hot-swappable)

## M. 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 ICH9 chip.

## N. Field Replaceable Units (FRU)
The planar contains a serial EEPROM to contain FRU information including Dell part number, part revision level, and serial number. The Advanced Management Enablement Adapter (AMEA) also contains a FRU EEPROM. The backplane's SEP and the power supplies' microcontroller are also used to store FRU data.

## Section 3. Electrical

### A. Volatility

See Appendix A of this Technical Guidebook

### B. ePPID (Electronic Piece Part Identification)

ePPID is an electronic repository for information from the PPID label that is stored in non-volatile RAM. The BIOS reports the ePPID information using SMBIOS data structures. ePPID includes the following information:

- Dell part number
- Part revision level
- Country of origin
- Supplier ID code
- Date code (date of manufacture)
- Unique sequence number

| COMPONENT | DESCRIPTION | STORAGE LOCATION |
|---|---|---|
| **BOARDS** | | |
| **Planar** | PWA,PLN,SV,DELL,R710 | iDRAC FRU |
| **2.5″ x 8′ Backplane** | PWA,BKPLN,SV,R710,2.5SASX8 | SEP |
| **3.5″ x 6′ Backplane** | PWA,BKPLN,SV,R710,3.5SASX6 | SEP |
| **3.5″ x 4′ Backplane** | PWA,BKPLN,SV,R710,3.5SASX4 | SEP |
| **iDRAC Enterprise** | PWA,RSR, SV, DELL,AMEA | FRU |
| **POWER SUPPLIES** | | |
| **870W PowerEdge™ PSU** | PWR SPLY,885W,RDNT,ASTEC | PSU Microcontroller |
| | PWR SPLY,885W,RDNT,DELTA | PSU Microcontroller |
| **570W Energy Smart PSU** | PWR SPLY,598W,RDNT,ASTEC | PSU Microcontroller |
| | PWR SPLY,598W,RDNT,COLDWATT | PSU Microcontroller |
| **STORAGE CARDS** | | |
| **PERC 6/i Integrated** | ASSY,CRD,PERC6I-INT,SAS,NOSLED | FRU |
| **PERC 6/E External** | PWA,CTL,PCIE,SAS,PERC6/E,ADPT | FRU |
| **SAS 6/iR Integrated** | PWA,CTL,SAS,SAS6/IR,INTG | FRU |

Table: ePPID Support list

Note: The fans do not have any integrated NVRAM. The PPID tables are currently scanned into a database by the system integrator.

## SECTION 4. POWER, THERMAL, ACOUSTIC

### A. Power Efficiencies

One of the main features of the 11th generation of PowerEdge servers is enhanced power efficiency. PowerEdge R710 achieves higher power efficiency by implementing the following features:

- User-selectable power cap (subsystems will throttle to maintain the specified power cap)
- Improved power budgeting
- 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 compared to DDR2, UDIMM support)
- 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
- Active Power Controller (BIOS-based CPU P-state manager)
- Ability to power down or throttle memory
- Ability to disable a CPU core
- Ability to turn off LOMs or PCIe lanes when not being used
- Option to run PCIe at Gen1 speeds instead of Gen2

### B. Power Supplies

#### I. Main Power Supply

The base redundant system consists of two hot-plug 570W Energy Smart (energy efficient) power supplies in a 1+1 configuration. An 870W high-output power supply is also available. The power supplies connect directly to the planar.

There is a power cable to connect between the planar and the backplane. PowerEdge R710 power supplies have embedded cooling fans.

Starting with the 11th generation of PowerEdge servers (R710, R610, T610, M610, and M710), the power supplies no longer have a FRU EEPROM. FRU data is now stored in the memory of the PSU Microcontroller. Additionally, the PSU Firmware can now be updated by the BMC over the PMBus. Power is “soft-switched,” allowing power cycling via a switch on the front of the system enclosure, or via software control (through server management functions). In a single power supply configuration, the power supply is installed in the PS1 location and a blank module (metal cover) is installed in the PS2 location for factory consistency. Electrically, the system can operate with a single power supply in either bay.

## C. Power Supply Specifications

| AC POWER SUPPLY (PER POWER SUPPLY) | |
|---|---|
| **Wattage** | 870 Watt (High Output)<br>570 Watt (Energy Smart) |
| **Voltage** | 90-264 VAC, autoranging, 47-63Hz |
| **Heat Dissipation** | 2968.6 BTU/hr maximum (High Output)<br>1944.9 BTU/hr maximum (Energy Smart) |
| **Maximum Inrush Current** | Under typical line conditions and over the entire system ambient operating range, the inrush current may reach 55A per power supply for 10ms or less. |

## D. Environmental Specifications

| 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 ft. |
| **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 5-350Hz in operational orientations |
| **Storage** | 1.54 Grms at 10-250Hz 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 27G 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 ft. |
| **Storage** | -16 to 10,600 m (-50 to 35,000 ft) |

### E. Power Consumption Testing

| FEATURE | ENERGY SMART PSU | HIGH OUTPUT PSU |
|---|---|---|
| **Dimensions** | L-206.4 mm[1] x W-67.5 mm x H-76.5 mm | |
| **Status Indicators** | 1 x bi-color Light Emitting Diode | |
| **Integrated Fans** | 1 x 60 mm | |
| **Fixed Input Plug** | IEC-C14 | |
| **AC Cord Rating** | 15 Amps @ 120 VAC, 10 Amps @ 240 VAC | |
| **Input Voltage** | 90 – 264 VAC | |
| **Auto-ranging** | Yes | |
| **Line Frequency** | 47 – 63Hz | |
| **Maximum Inrush Current** | 55 Amps per supply for 10 ms or less | |
| **Hot-Swap Capability** | Yes | |
| **Output Power** | 570W | 870W |
| **Maximum Heat Dissipation** | 1944.9 BTU per hour | 2968.6 BTU per hour |
| **Efficiency (20% - 100% Load)** | 86.9 – 90.5% @ 115 VAC<br>88 – 92% @ 230 VAC | 85 – 88% @ 115 VAC<br>87 – 90% @ 230 VAC |

[1] Does not include the power supply handle or ejection tab

### F. Maximum Input Amps

Max input current (High Output): 12A @ 90 VAC, 6A @ 180 VAC

Max input current (EnergySmart): 7.8A @ 90 VAC, 3.9A @ 180 VAC

### G. Energy SMART Enablement

The 11th generation of PowerEdge servers implements aspects of Dell's new Energy Smart strategy. Major differences include:

- Discontinuing Energy Smart-branded servers with limited configurations and instead offering Energy Smart components on a portfolio level, such as high capacity and Energy Smart power supplies
- Allowing customers to order either a lowest power footprint configuration or a best performance-per-watt configuration
- Offering Energy Smart selected components such as DIMMs or hard drives, but not "cherry picking" or screening individual manufacturers' components based on energy consumption.

## H. Acoustics

The acoustical design of the PowerEdge R710 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.
- Office environment acoustics. Compare the values for LpA in the table below and note that they are lower than ambient noise levels of typical office environments.
- Hardware configurations affect system noise levels. Dell's advanced thermal control provides for optimized cooling with varying hardware configurations. Most typical configurations will perform as listed in the table below. However some less typical configurations and components can result in higher noise levels. For example, a system configured with a PERC6/E card will be approximately twice as loud (~9 dBA higher) in 23+/-2° C ambient.
- 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.

PowerEdge R710 (2.5″ and 3.5″ chassis) with RK385 fans (quantity below), 2x 870-W FU096 Power Supplies, 2.40 GHz Quad-Core E5530 CPUs (quantity below), 7x 2-GB DIMMs, 1x DVD Drive, Perc 6i card, and 4x Hard Disk Drives (type below)
Acoustical dependence on quantities of fans, CPUs, and Hard Disk Drive type is not strong. The values below represent therefore the performance for redundant (5x fans and 2x CPUs) as well as the nonredundant (4x fans and 1x CPU) configurations. They also represent performance for 2.5″ 10k SAS XK112 as well as 3.5″ 7.2k SATA NW340 Hard Disk Drives.

| Condition in 23 ± 2° C ambient | LwA-UL, bels | LpA, dBA | Tones |
|---|---|---|---|
| Standby | 3.1 | 18 | No prominent tones |
| Idle | 5.5 | 39 | No prominent tones |
| Active Hard Disk Drives | 5.5 | 39 | No prominent tones |
| Stressed Processor | 5.5 | 39 | No prominent tones |

**Definitions**

**Standby:** AC Power is connected to Power Supply Units but system is not turned on.

**Idle:** Reference ISO7779 (1999) definition 3.1.7; system is running in its OS but no other specific activity.

**Active Hard Drives:** An operating mode per ISO7779 (1999) definition 3.1.6; Section C.9 of ECMA-74 9th ed. (2005) is followed in exercising the hard disk drives.

**Stressed Processor:** An operating mode per ISO7779 (1999) definition 3.1.6; SPECPower set to 50% loading is used.

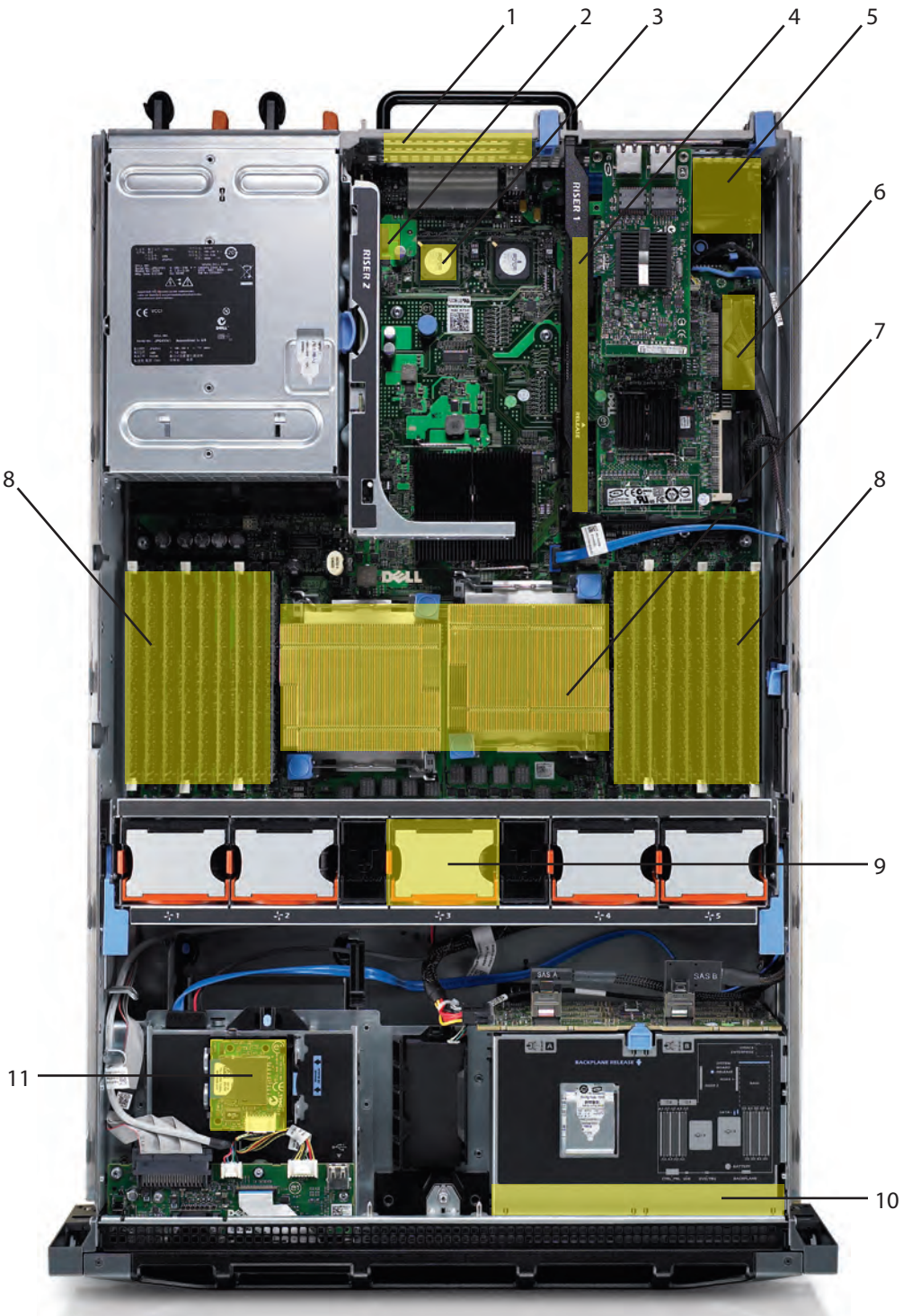
**LwA-UL:** The upper limit sound power level (LwA) calculated per section 4.4.2 of ISO 9296 (1988) and measured in accordance with ISO7779 (1999).

**LpA:** The average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (1999). The system is placed in a rack with its bottom at 25-cm from the floor.

**Tones:** 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 acoustic transducer is at front bystander position, ref ISO7779 (1999), Section 8.6.2.

## SECTION 5. BLOCK DIAGRAM


Figure: PowerEdge R710 Main Components




1. Embedded Network Interface Ports (4)
2. PCIe Gen2 Riser / Slots
3. Broadcom 5709c Network Interface Chip
4. PCIe Gen2 Riser / Slots
5. iDRAC6 Enterprise (Optional)
6. iDRAC6 Express / Lifecycle Controller
7. Heat Sink / Processor Socket
8. DIMM Slots
9. Hot plug, redundant fans
10. Hard drive bay, 6" x 3.5"
11. Internal SD Module
    (Embedded Hypervisor Optional)

## SECTION 6. PROCESSORS

### A. Overview / Description

The Intel 5500 series 2S processor (Nehalem - Efficient Processor (EP)), is the microprocessor designed specifically for servers and workstation applications. The processor features quad-core processing to maximize performance and performance/watt for data center infrastructures and highly dense deployments. The Nehalem-EP 2S processor also features Intel's Core™ micro-architecture and Intel 64 architecture for flexibility in 64-bit and 32-bit applications and operating systems.

The 5500 series 2S processor (Nehalem EP) utilizes a 1366-contact Flip-Chip Land Grid Array (FC-LGA) package that plugs into a surface mount socket. PowerEdge R710 provides support for up to two 5500 series 2S processors (Nehalem EP).

| NEHALEM-EP 2S PROCESSOR | FEATURES |
|---|---|
| **Cache Size** | 32KB instruction, 32KB data, 4 or 8MB (shared) |
| **Multi-processor Support** | 1-2 CPUs |
| **Package** | LGA1366 |

Table: Nehalem-EP Features

### B. Features

Key features of the 5500 series 2S processor (Nehalem EP) include:

- Four or two cores per processor
- Two point-to-point QuickPath Interconnect links at up to 6.4 GT/s
- 1366-pin FC-LGA package
- 45 nm process technology
- No termination required for non-populated CPUs (must populate CPU socket 1 first)
- Integrated three-channel DDR3 memory controller at up to 1333MHz
- 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 (Hyper-Threading) 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 Tecnology for Virtualization
- Intel VT-x and VT-d Technology for Virtualization
- Demand-based switching for active CPU power management as well as support for ACPI P-States, C-States, and T-States

### C. Supported Processors

| MODEL | SPEED | POWER | CACHE | CORES |
|---|---|---|---|---|
| **X5570** | 2.93GHz | 95W | 8M | 4 |
| **X5560** | 2.80GHz | 95W | 8M | 4 |
| **X5550** | 2.66GHz | 95W | 8M | 4 |
| **E5540** | 2.53GHz | 80W | 8M | 4 |

| MODEL | SPEED | POWER | CACHE | CORES |
|---|---|---|---|---|
| **E5530** | 2.40GHz | 80W | 8M | 4 |
| **E5520** | 2.26GHz | 80W | 8M | 4 |
| **L5520** | 2.26GHz | 60W | 8M | 4 |
| **E5506** | 2.13GHz | 80W | 4M | 4 |
| **L5506** | 2.13GHz | 60W | 4M | 4 |
| **E5504** | 2.00GHz | 80W | 4M | 4 |
| **E5502** | 1.86GHz | 80W | 4M | 2 |

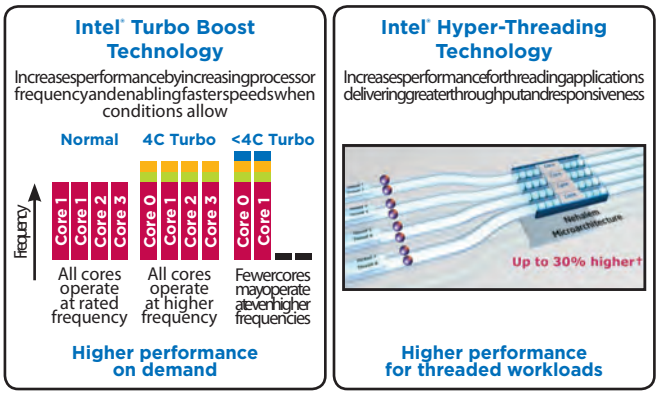
### D. Processor Configurations

#### Single CPU Configuration

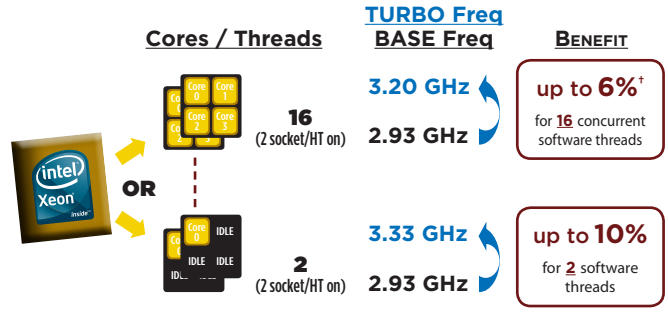
The PowerEdge R710 is designed such that a single processor placed in the CPU1 socket will function normally, however PowerEdge R710 systems require a CPU blank in the CPU2 socket for thermal reasons. The system will be held in reset if a single processor is placed in the CPU2 socket.

## Performance Enhancements

**Intel Xeon® 5500 Series Processor (Nehalem-EP)**




## Intel® Turbo Boost Technology




| MODEL | SPEED | POWER | CACHE | CORES |
|---|---|---|---|---|
| **X5570** | 2.93GHz | 95W | 8M | 4 |
| **X5560** | 2.80GHz | 95W | 8M | 4 |
| **X5550** | 2.66GHz | 95W | 8M | 4 |
| **E5540** | 2.53GHz | 80W | 8M | 4 |
| **E5530** | 2.40GHz | 80W | 8M | 4 |
| **E5520** | 2.26GHz | 80W | 8M | 4 |
| **L5520** | 2.26GHz | 60W | 8M | 4 |
| **E5506** | 2.13GHz | 80W | 4M | 4 |
| **L5506** | 2.13GHz | 60W | 4M | 4 |
| **E5504** | 2.00GHz | 80W | 4M | 4 |
| **E5502** | 1.86GHz | 80W | 4M | 2 |

### CPU Power Voltage Regulation Modules (EVRD 11.1)

Voltage regulation to the 5500 series 2S processor (Nehalem EP) is provided by EVRD (Enterprise Voltage Regulator-Down). EVRDs are embedded on the planar. CPU core voltage is not shared between processors. EVRDs support static phase shedding and power management via the PMBus.

## SECTION 7. MEMORY

### A. Overview / Description

The PowerEdge R710 utilizes DDR3 memory providing a high performance, high-speed memory interface capable of low latency response and high throughput. The PE R710 supports Registered ECC DDR3 DIMMs (RDIMM) or Unbuffered ECC DDR3 DIMMs (UDIMM).

Key features of the PowerEdge R710 memory system include:

- Registered (RDIMM) and Unbuffered (UDIMM) ECC DDR3 technology
- Each channel carries 64 data and eight ECC bits support for up to 96GB of RDIMM memory (with twelve 8GB RDIMMs)
- Support for up to 24GB of UDIMM memory (with twelve 2GB UDIMMs)
- Support for 1066/1333MHz single- and dual-rank DIMMs
- Support for 1066MHz quad rank DIMMs
- Single DIMM configuration only with DIMM in socket A1
- 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 and UDIMMs
- Multi Bit Error Detection Support for Memory Optimized Mode
- Support for Advanced ECC mode
- Support for Memory Mirroring

### B. DIMMs Supported

The DDR3 memory interface consists of three channels, with up to two RDIMMs or UDIMMs per channel for single-/dual-rank and up to two RDIMMs per channel for quad rank. The interface uses 2GB, 4GB, or 8GB RDIMMs. 1GB or 2GB UDIMMs are also supported. The memory mode is dependent on how the memory is populated in the system:

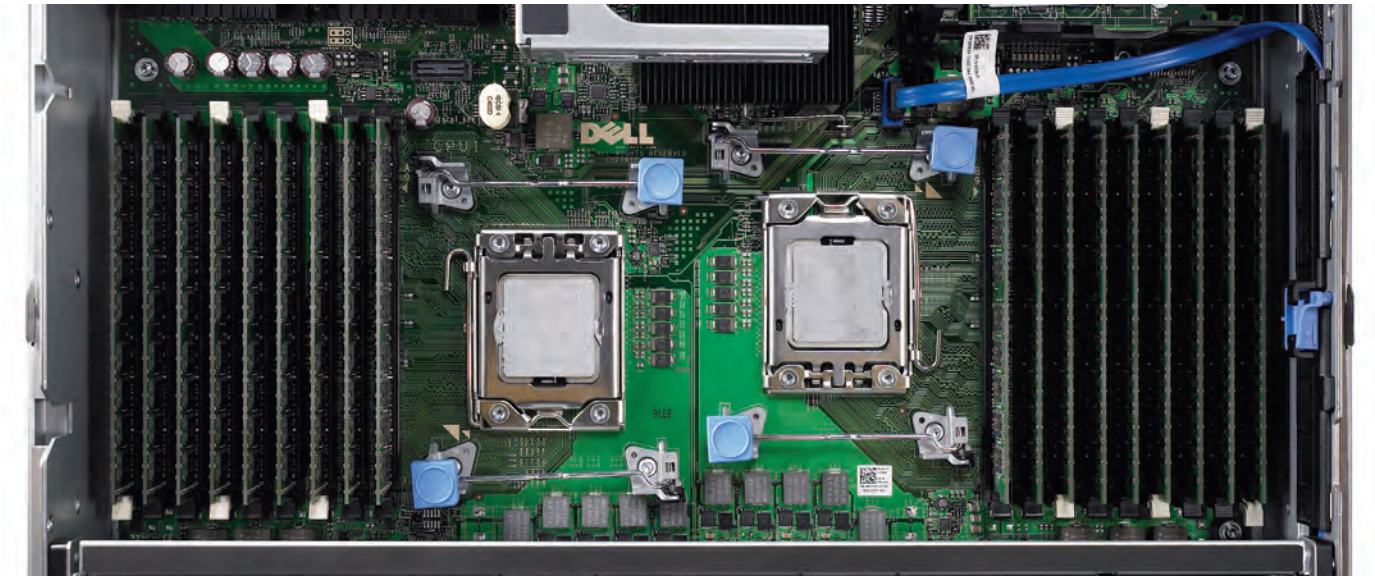
Three channels per CPU populated identically:

- Typically, the system will be set to run in Memory Optimized (Independent Channel) mode in this configuration. This mode offers the most DIMM population flexibility and system memory capacity, but offers the least number of RAS (reliability, availability, service) features.
- All three channels must be populated identically.
- Users wanting memory sparing must also populate the DIMMs in this method, but one channel is the spare and is not accessible as system memory until it is brought online to replace a failing channel.
- The first two channels per CPU populated identically with the third channel unused
    - Typically, two channels operate in Advanced ECC (Lockstep) mode with each other by having the cache line split across both channels. This mode provides improved RAS features (SDDC support for x8-based memory).
    - For Memory Mirroring, two channels operate as mirrors of each other — writes go to both channels and reads alternate between the two channels.

- One channel per CPU populated:
    - This is a simple Memory Optimized mode. Mirroring is not supported.

The PowerEdge R710 memory interface supports memory demand and patrol scrubbing, single-bit correction and multi-bit error detection. Correction of a x4 or x8 device failure is also possible with SDDC in the Advanced ECC mode. Additionally, correction of a x4 device failure is possible in the Memory Optimized mode. If DIMMs of different speeds are mixed, all channels will operate at the fastest common frequency. RDIMMs and UDIMMs cannot be mixed.

- If memory mirroring is enabled, identical DIMMs must be installed in the same slots across both channels.
- The third channel of each processor is unavailable for memory mirroring.
- The first DIMM slot in each channel is color-coded with white ejection tabs for ease of installation.
- The DIMM sockets are placed 450 mils (11.43 mm) apart, center-to-center in order to provide enough space for sufficient airflow to cool stacked DIMMs.
- The PE R710 memory system supports up to 18 DIMMs. DIMMs must be installed in each channel starting with the DIMM farthest from the processor. Population order will be identified by the silkscreen designator and the System Information Label (SIL) located on the chassis cover.
    - Memory Optimized: {1, 2, 3}, {4, 5, 6}, {7, 8, 9}
    - Advanced ECC or Mirrored: {2, 3}, {5, 6}, {8, 9}
    - Quad Rank or UDIMM: {1, 2, 3}, {4, 5, 6}, {7, 8, 9}




### C. Speed

Memory Speed Limitations
The memory frequency is determined by a variety of inputs:

- Speed of the DIMMs
- Speed supported by the CPU
- Configuration of the DIMMs

The table below shows the memory populations and the maximum frequency achievable for that configuration.

| DIMM TYPE | DIMM 0 | DIMM 1 | DIMM 2 | # OF DIMMS | 800 | 1066 | 1333 |
|---|---|---|---|---|---|---|---|
| UDIMM | SR | | | 1 | | | |
| | DR | | | 1 | | | |
| | SR | SR | | 2 | | | |
| | SR | DR | | 2 | | | |
| | DR | DR | | 2 | | | |
| RDIMM | SR | | | 1 | | | |
| | DR | | | 1 | | | |
| | QR | | | 1 | | | |
| | SR | SR | | 2 | | | |
| | SR | DR | | 2 | | | |
| | DR | DR | | 2 | | | |
| | QR | SR | | 2 | | | |
| | QR | DR | | 2 | | | |
| | QR | QR | | 2 | | | |
| | SR | SR | SR | 3 | | | |
| | SR | SR | DR | 3 | | | |
| | SR | DR | DR | 3 | | | |
| | DR | DR | DR | 3 | | | |

Note: For QR mixed with an SR/DR DIMM, the QR needs to be in the white DIMM connector. There is no requirement in the order of SR and DR DIMMs.

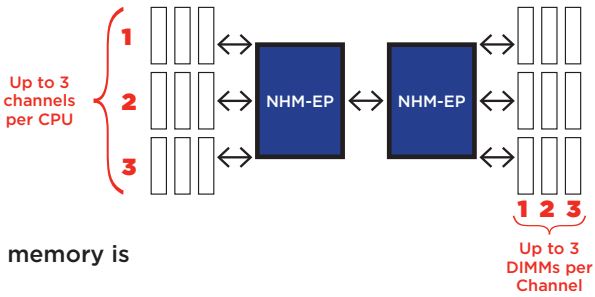
Supported

Not Supported

NOTE: For Quad Rank DIMMs mixed with Single- or Dual-Rank DIMMs, the QR DIMM needs to be in the slot with the white ejection tabs (the first DIMM slot in each channel). There is no requirement for the order of SR and DR DIMMs

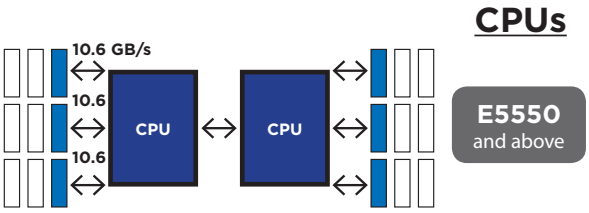
# NHM-EP Platform Memory Overview

- Platform capability (18 DIMMs):
  - Up to 3 channels per CPU
  - Up to 3 DIMMS per channel
- Memory Types Supported:
  - DDR 1333, 1066, and 800
  - Registered (RDIMM) and unbuffered (UDIMM)
  - Single-rank (SR), dual-rank (DR), quad-rank (QR)
- System memory Speed (i.e. the speed at which the memory is actually running) is set by BIOS depending on:
  - CPU capability
  - DIMM type(s) used (memory speed, U/RDIMM, SR/DR/QR)
  - DIMM populated per channel
- All channels in a system will run at the fastest common frequency

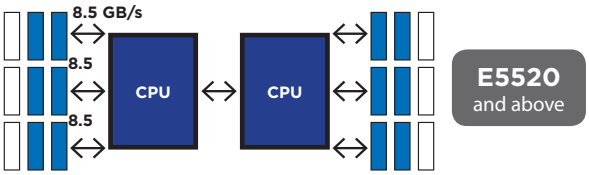



# Memory Population Scenarios

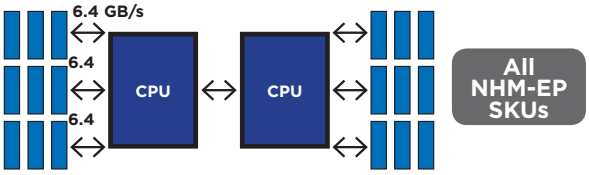
- **Maximum B/W:**
  - DDR3 1333 across 3 channels
  - 1 DPC (6 DIMMs)
  - Max capacity: 48 GB+



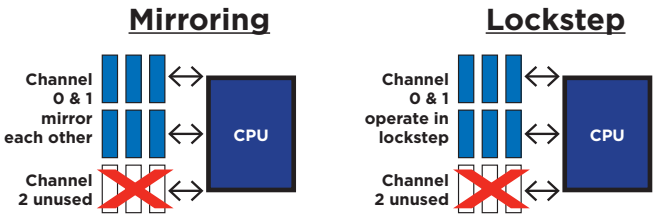

- **Balanced Performance:**
  - DDR3 1066 across 3 channels
  - Up to 2 DIMMs per Channel (DPC) (12 DIMMs)
  - Max capacity: 96 GB+




- **Maximum capacity:**
  - DDR3 800 across 3 channels
  - Up to 3 DPC (18 DIMMs total)
  - Max capacity: 144 GB+




- **RAS capabilities:**



### D. Slots / Risers

The PowerEdge R710 has 18 DIMM slots for memory. It does not have any riser cards for DIMM population.

### E. Supported Configurations

| MEMORY MODE | RDIMM MEMORY MODULE SIZE | MEMORY SOCKETS | | | | | | SINGLE PROCESSOR | | DUAL PROCESSOR | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | 2 | | 3 | | PHYSICAL MEMORY (GB) | AVAILABLE MEMORY (GB) | PHYSICAL MEMORY (GB) | AVAILABLE MEMORY (GB) |
| | | | 4 | | 5 | | 6 | | | | |
| OPTIMIZER | 2GB | x | | | | | | 2 | All | 4 | All |
| | | x | | x | | | | 4 | | 8 | |
| | | x | | x | | x | x | 6 | | 12 | |
| | | x | x | | | | | 4 | | 8 | |
| | | x | x | x | x | | | 8 | | 16 | |
| | | x | x | x | x | x | x | 12 | | 24 | |
| | 4GB | x | | | | | | 4 | All | 8 | All |
| | | x | | x | | | | 8 | | 16 | |
| | | x | | x | | x | x | 12 | | 24 | |
| | | x | x | | | | | 8 | | 16 | |
| | | x | x | x | x | | | 16 | | 32 | |
| | | x | x | x | x | x | x | 24 | | 48 | |
| | 8GB[a] | x | | | | | | 8 | All | 16 | All |
| | | x | | x | | | | 16 | | 32 | |
| | | x | | x | | x | x | 24 | | 48 | |
| | | x | x | | | | | 16 | | 32 | |
| | | x | x | x | x | | | 32 | | 64 | |
| | | x | x | x | x | x | x | 48 | | 96 | |
| ADVANCED ECC[b] OR MIRRORING | 2GB | None | | x | | x | | 4 | 2 | 8 | 4 |
| | | | | x | x | x | x | 8 | 4 | 16 | 8 |
| | 4GB | None | | x | | x | | 8 | 4 | 16 | 8 |
| | | | | x | x | x | x | 16 | 8 | 32 | 16 |
| | 8GB | None | | x | | x | | 16 | 8 | 32 | 16 |
| | | | | x | x | x | x | 32 | 16 | 64 | 32 |

Table: RDIMM Memory Configurations (Each Processor)

| MEMORY MODE | UDIMM MEMORY MODULE SIZE | MEMORY SOCKETS | | | | | | SINGLE PROCESSOR | | DUAL PROCESSOR | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 4 | 2 | 5 | 3 | 6 | PHYSICAL MEMORY (GB) | AVAILABLE MEMORY (GB) | PHYSICAL MEMORY (GB) | AVAILABLE MEMORY (GB) |
| OPTIMIZER | 1GB | x | | | | | | 1 | All | 2 | All |
| | | x | | x | | | | 2 | | 4 | |
| | | x | | x | | x | | 3 | | 6 | |
| | | x | x | x | x | | | 4 | | 8 | |
| | | x | x | x | x | x | x | 6 | | 12 | |
| | 2GB | x | | | | | | 2 | All | 4 | All |
| | | x | | x | | | | 4 | | 8 | |
| | | x | | x | | x | | 6 | | 12 | |
| | | x | x | x | x | | | 8 | | 16 | |
| | | x | x | x | x | x | x | 12 | | 24 | |
| ADVANCED ECC[a] | 1GB | None | | x | | x | | 2 | All | All | All |
| | | | | x | x | x | x | 4 | | | |
| | 2GB | None | | x | | x | | 4 | All | All | All |
| | | | | x | x | x | x | 8 | | | |
| MIRRORING | 1GB | None | | x | | x | | 2 | 1 | 4 | 2 |
| | | | | x | x | x | x | 4 | 2 | 8 | 4 |
| | 2GB | None | | x | | x | | 4 | 2 | 8 | 4 |
| | | | | x | x | x | x | 8 | 4 | 16 | 8 |

Table: UDIMM Memory Configurations (Each Processor)

[a] When available
[b] Requires x4- or x8-based memory modules

### F. Mirroring

The system supports memory mirroring if identical memory modules are installed in the two channels closest to the processor (memory is not installed in the farthest channel). Mirroring must be enabled in the System Setup program. In a mirrored configuration, the total available system memory is one-half of the total installed physical memory.

### G. Advanced ECC (Lockstep) Modes

In this configuration, the two channels closest to the processor are combined to form one 128-bit channel. This mode supports Single Device Data Correction (SDDC) for both x4- and x8-based memory modules. Memory modules must be identical in size, speed, and technology in corresponding slots.

### H. Optimizer (Independent Channel) Mode

In this mode, all three channels are populated with identical memory modules. This mode permits a larger total memory capacity but does not support SDDC with x8-based memory modules. A minimal single-channel configuration of 1GB memory modules per processor is also supported in this mode.

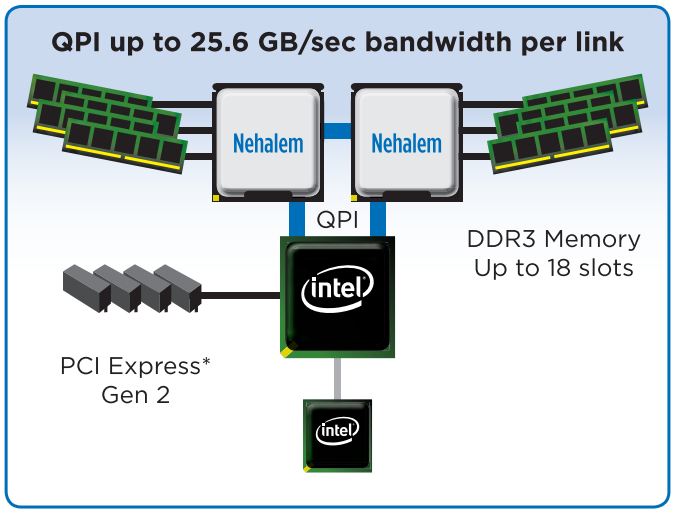
## SECTION 8. CHIPSET

### A. Overview / Description

The PowerEdge R710 planar incorporated the Intel 5520 chipset (code named Tylersburg) for I/O and processor interfacing. Tylersburg is designed to support Intel's 5500 series processors (code named Nehalem-EP), QPI interconnect, DDR3 memory technology, and PCI Express Generation 2. The Tylersburg chipset consists of the Tylersburg-36D IOH and ICH9.

# Delivering Intelligent Performance

**Next Generation Intel® Microarchitecture**




**Bandwidth Intensive**
Intel® QuickPath Technology
Integrated Memory Controller

**Threaded Applications**
45nm Quad-Core Intel® Xeon® processors
Intel® Hyper-Threading Technology Controller

**Performance On Demand**
Intel® Turbo Boost Technology
Intel® Intelligent Power Technology

**Performance that adapts to your software environment**

**The Intel 5520 chipset (code named Tylersburg) I/O Hub (IOH)**

The planar uses the The Intel® 5520 chipset (code named Tylersburg) I/O Hub (IOH)-36D IOH to provide a link between the 5500 series 2S processor (Nehalem EP) and I/O components. The main components of the IOH consist of two full-width QuickPath Interconnect links (one to each processor), 36 lanes of PCI Express Gen2, a x4 Direct Media Interface (DMI), and an integrated IOxAPIC.

**IOH QuickPath Interconnect (QPI)**

The QuickPath Architecture consists of serial point-to-point interconnects for the processors and the IOH. The PowerEdge R710 has a total of three QuickPath Interconnect (QPI) links: one link connecting the processors and links connecting both processors with the IOH. Each link consists of 20 lanes (full-width) in each direction with a link speed of up to 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 implemented in the IOH and CPUs 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.

### Intel Direct Media Interface (DMI)

The DMI (previously called the Enterprise Southbridge Interface) connects the Tylersburg 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.

### PCI Express Generation 2

PCI Express is a serial point-to-point interconnect 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 are backwards-compatible with Gen1 transfer rates.

In the Tylersburg-36D IOH, there are two x2 PCIe Gen2 ports (1Gb/s) and eight x4 PCIe Gen2 ports (2 Gb/s). The x2 ports can be combined as a x4 link; however, this x4 link cannot be combined with any of the other x4 ports. Two neighboring x4 ports can be combined as a x8 link, and both resulting x8 links can combine to form a x16 link.

### Intel I/O Controller Hub 9 (ICH9)

ICH9 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 unused on the PowerEdge R710
- PCI Bus 32-bit Interface Rev 2.3 running at 33MHz
- Up to six Serial ATA (SATA) ports with transfer rates up to 300 MB/s
  - The PowerEdge R710 features two SATA port for optional internal optical drive or tape backup
- Six UHCI and two EHCI (High-Speed 2.0) USB host controllers, with up to twelve USB ports
  - The PowerEdge R710 has eight external USB ports and two internal ports dedicated for UIPS. Refer to the 11th generation of PowerEdge servers Hardware/BIOS Specification for the USB assignments for each platform
- 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
  - The PowerEdge R710's BIOS is connected to the ICH using SPI

## SECTION 9. BIOS

### A. Overview / Description

The PowerEdge R710 BIOS is based on the Dell BIOS core, and supports the following features:

- Nehalem-EP 2S 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

The PowerEdge R710 BIOS does not support the following:

- Embedded Diagnostics (embedded in MASER)
- BIOS language localization
- BIOS recovery after bad flash (but can be recovered from iDRAC6 Express)

### B. Supported ACPI States

Advanced Configuration and Power Interface – A standard interface for enabling the operating system to direct configuration and power management.

The Nehalem processor supports the following C-States: C0, C1, C1E, C3, and C6. R710 will support all of the available C-States.

The PowerEdge R710 will support the available P-States as supported by the specific Nehalem processors:

| PROC NUMBER | QDF # | FREQUENCY | STANDARD TDP | LFM TDP | P-STATE | NOTES |
|---|---|---|---|---|---|---|
| | | 1.60 | | | Pmin+0 | |
| | | 1.73 | | | Pmin+1 | |
| **E5502** | Q1G8 | 1.86 | 80 | 75 | Pmin+2 | D-0 |
| **E5504** | Q1GM | 2.00 | 80 | 75 | Pmin+3 | D-0 |
| **L5506** | Q1HG | 2.13 | 60 | 52 | Pmin+4 | D-0 |
| **E5506** | Q1GL | 2.13 | 80 | 75 | Pmin+4 | D-0 |
| **L5520** | Q1GN | 2.26 | 60 | 52 | Pmin+5 | D-0 |
| **E5520** | Q1GR | 2.26 | 80 | 75 | Pmin+5 | D-0 |
| **E5530** | Q1GK | 2.40 | 80 | 75 | Pmin+6 | D-0 |

| PROC NUMBER | QDF # | FREQUENCY | STANDARD TDP | LFM TDP | P-STATE | NOTES |
|---|---|---|---|---|---|---|
| **E5540** | Q1G2 | 2.53 | 80 | 75 | Pmin+7 | D-0 |
| **X5550** | Q1GJ | 2.67 | 95 | 75 | Pmin+8 | D-0 |
| **X5560** | Q1GF | 2.80 | 95 | 75 | Pmin+9 | D-0 |
| **X5570** | Q1G9 | 2.93 | 95 | 75 | Pmin+10 | D-0 |
| **W5580** | Q1G6 | 3.20 | 130 | 98 | Pmin+12 | D-0 |

Table: Nehalem P-State Projections

**C. I²C (Inter-Integrated Circuit)**
What is I²C? 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. This design concept solves the many interfacing problems encountered when designing digital control circuits. 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 PowerEdge R710, BIOS accesses the I²C through the ICH9 (Intel I/O Controller Hub 9). There are two MUXes on ICH9'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.

## SECTION 10. EMBEDDED NICS / LAN ON MOTHERBOARD (LOM)

### A. Overview / Description

Embedded Gigabit Ethernet Controllers with TCP Offload Engine (TOE) support
Two embedded Broadcom 5709C dual-port LAN controllers are on the R710 planar as independent Gigabit Ethernet interface devices. The following information details the features of the LAN devices.

- x4 PCI Express Gen2 capable interface
    - The PowerEdge R710 operates this controller at Gen1 speed
- Integrated MAC and PHY 3072x18 Byte context memory
- 64 KB receive buffer
- TOE (TCP Offload Engine)
- iSCSI controller (enabled through an optional hardware key)
- RDMA controller (RNIC) (enabled post-RTS through an optional hardware key)
- NC-SI (Network Controller-Sideband Interface) connection for manageability
- Wake-On-LAN (WOL)
- PXE 2.0 remote boot
- iSCSI boot
- IPv4 and IPv6 support
- Bare metal deployment support

## SECTION 11. I/O SLOTS

### A. Overview / Description

The PowerEdge R710 requires two PCI Express risers: Riser 1 and Riser 2. Each riser connects to the planar through an x16 PCI Express connector.

- Riser 1 consists of two x4 slots and a third x4 slot dedicated for internal SAS storage through the PERC 6i or SAS 6/iR.
- The default Riser 2 consists of two x8 PCI Express connectors.
- There is also an optional x16 Riser 2 that supports one x16 PCI Express card.

To ensure proper cooling, no more than two of the four expansion cards can have a power consumption of greater than 15W (up to 25W maximum each), not including the integrated storage controller.

The system does not support hot-plug or hot-removal of PCI Express cards.

The table below provides a guide for installing expansion cards to ensure proper cooling and mechanical fit. The expansion cards with the highest priority should be installed first using the slot priority indicated. All other expansion cards should be installed in card priority and slot priority order.

| CARD PRIORITY | CARD TYPE | SLOT PRIORITY | MAX ALLOWED | 25W CARD? |
|---|---|---|---|---|
| 1 | PERC 5/E controller | 1, 3, 4 | 2 | Y |
| 2 | PERC 6/E | 3, 4, 1 | 2 | Y |
| 3 | 10Gb NIC | 3, 4, 1, 2 | 2 | Y |
| 4 | All other Dell storage cards | 3, 4, 1 | 2 | Y |
| 5 | All other NICs | 2, 1 | 4[a] | N[b] |
| 6 | Non-Dell storage cards | 1, 2 | 4[a] | N[b] |

[a] Maximum of 2 of any card whose maximum power exceeds 15w
[b] Refer to the expansion card's documentation to determine if the maximum power exceeds 15w

| POWEREDGE R710 | | | | | | |
|---|---|---|---|---|---|---|
| **PCI Express Gen2 Slots** | | | | | | |
| Slot 1: Half-Length (6.6" Factory Installation) / Full-Height (x8 connector), x4 link width | | | | | | |
| Slot 2: Full-Length (12.2" Factory Installation) / Full-Height (x8 connector), x8 link width | | | | | | |
| Slot 3: Full-Length (12.2" Factory Installation) / Full-Height (x8 connector), x8 link width | | | | | | |
| Slot 4: Half-Length (6.6" Factory Installation) / Full-Height (x8 connector), x4 link width | | | | | | |
| Slot 5: Half-Length (6.6" Factory Installation) / Full-Height (x8 connector), x4 link width | | | | | | |
| **Category** | **Card Priority** | **Description** | **Dell PN** | **PCIe Link Width** | **Slot Priority** | **Max Cards** |
| Internal Storage (Integrated Slot) | 1 | Dell™ PERC 6/i Integrated (Sled) | T95 4J | Gen1 x8 | Integrated | 1 |
| Internal Storage (Integrated Slot) | 2 | Dell SAS 6/iR Integrated (Sled) | YK8 38 | Gen1 x8 | Integrated | 1 |
| External Storage Controller | 3 | *Dell PERC 5/E Adapter (Test only, no factory install) | GP2 97 | Gen1 x8 | Slot 4, 5[1] | 2[2] |
| External Storage Controller | 4 | *Dell PERC 6/E Adapter (512MB) | J15 5F | Gen1 x8 | Slot 3, 2, 5, 4, 1 | 2[2] |
| External Storage Controller | 5 | *Dell PERC 6/E Adapter (256MB) | F98 9F | Gen1 x8 | Slot 3, 2, 5, 4, 1 | 2[2] |
| 10Gb NIC | 6 | *Intel 10GBase-T Copper Single Port NIC (Copperpond) | XR9 97 | Gen1 x8 | Slot 4, 5, 1, 2, 3 | 2 |
| 10Gb NIC | 7 | *Broadcom BCM57710 10GBase-T Copper Single Port NIC (Quiver) | RK3 75 | Gen1 x8 | Slot 4, 5, 1, 2, 3 | 2 |
| 10Gb NIC | 8 | Intel® 10GBase-SR Optical Single Port NIC (BelleFontaine) | RN 219 | Gen1 x8 | Slot 4, 5, 1, 2, 3 | 2 |
| External Storage Controller | 9 | *Dell SAS 5/E Adapter | M7 78G | Gen1 x8 | Slot 3, 2, 4, 5, 1 | 2[2] |
| Internal Tape Controller | 10 | Dell SAS 5/iR Adapter (for internal tape only) | UN 939 | Gen1 x8 | Slot 3, 2, 4, 5, 1 | 2[2] |
| Fibre Channel 8 HBA | 11 | Emulex LPe12002 FC8 Dual-Channel HBA | C85 6M | Gen2 x4 | Slot 4, 5, 1, 2, 3 | 5 |
| Fibre Channel 8 HBA | 12 | Emulex LPe12000 FC8 Single-Channel HBA | C85 5M | Gen2 x4 | Slot 4, 5, 1, 2, 3 | 5 |

[1] Thermal testing to determine if the PERC5 can be installed in other slots is pending.
[2] A maximum of 2 nternal/external storage controllers (Dell PERC and SAS cards) are allowed in the system in addition to the integrated storage controller.

### B. PCI Express Risers

The two PowerEdge R710 PCI Express risers provide up to four expansion slots and one internal slot as follows:

- Two x8 and two x4 PCI Express Gen2 slots, connected to the IOH
- One x4 PCI Express Gen1 slot for internal storage, connected to the IOH
- Support for three full-height 9.5" long PCI Express cards and one full-height bracket, low-profile PCB PCI Express card
- Support for field upgrading one slot (on the center riser) to a full-length 12.2" PCI Express card
- System supports 25W maximum power for the first two cards and 15W for the third and fourth cards
    - The lower power support on the third and fourth cards is due to system thermal limitations
- An optional x16 riser to accommodate interface cards for external GPU boxes that supports a maximum power of 25W. Use of this riser reduces the number of PCI Express slots from four to three

### C. Additional Riser Restrictions

- The riser connectors on the planar do not support plugging in a standard PCI Express card. Do not attempt this for troubleshooting.
- Two PowerEdge R710 risers must be installed or the system will not power up.

### D. X16 Express Card Specifications

The PowerEdge R710 supports x16 cards that meet the following requirements:

- Standard height (4.376")
- Maximum length of 9.5" (Half-length cards are 6.6"; Full-length cards are 12.283")
- x16 cards can only plug into the optional PowerEdge R710 x16 left riser
- Support for full bandwidth of x16 Gen2 link
- No support for hot-plug or hot-removal
- Maximum power of 25W
- The PowerEdge R710 provides +12V, +3.3V, and +3.3Vaux in accordance with Power Supply Rail Requirements (Table 4-1 of PCIe Card Electromechanical Spec, Rev 2.0)
- The PowerEdge R710 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 must only occupy the space of one slot. Cards that occupy the space of two slots are not supported
- The 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
- The 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. The PowerEdge R710 provides a minimum transverse air velocity of 100 LFM (linear feet per minute) to the x16 card.

### E. Boot Order

PCIe scan order (from the BIOS HW spec v1.0)
IOH port 1,2 (PCI Express Gen1 x4) – Broadcom BCM5709C Gigabit Embedded NIC #1
IOH port 3 (PCI Express Gen1 x4) – Broadcom BCM5709C Gigabit Embedded NIC #2
IOH port 4 in Bluefish or ICH9 port1-4 in Thidwick (PCI Express Gen1 x4) – Integrated PERC6i or SAS6i on the Riser 1
IOH port 5 (PCI Express Gen2 x4) – Slot 2 on Riser 1
IOH port 6 (PCI Express Gen2 x4) – Slot 1 on Riser 1
IOH port 7/8 (PCI Express Gen2 x8) – Slot 3 on Riser 2
IOH port 9/10 (PCI Express Gen2 x8) – Slot 4 on Riser 2
For PCI-e X16 optional left riser, IOH port 7,8,9,10 are combined into one x16 PCI-e slot.

## SECTION 12. STORAGE

### A. Overview / Description

The PowerEdge R710 supports three different backplanes to support different hard drive configurations: six 3.5″ hard drives, four 3.5″ hard drives, or eight 2.5″ hard drives.

On each backplane are two LED indicators per drive slot with one or two mini-SAS x4 cable connectors for connecting the backplane to the integrated SAS 6/iR or PERC 6i, and a power connector to connect to the planar. Both Serial Attached SCSI (SAS) and Serial ATA (SATA) hard drives are supported. For SAS/SATA mixing, two SAS drives are supported with the 3.5″ backplane.

### B. Drives

#### I. Internal Hard Disk drives

The PowerEdge R710 supports up to eight 2.5″ or six 3.5″ hard disk drives.

- Support for 15,000 rpm 3.5″ SAS drives
- Support for 10,000 and 15,000 rpm 2.5″ SAS drives
- Support for 7,200 rpm 3.5″ Near Line SAS drives
- Support for 7,200 rpm 3.5″ and 2.5″ Enterprise SATA drives
- Support for 7,200 rpm 3.5″ and 2.5″ SATAu drives
- For SAS/SATA mixing, two SAS and up to six SATA drives are possible
    - A pair of SAS drives must be installed in slots 0 and 1
- One mixed 2.5″ and 3.5″ hard drive configuration is allowed:
    - A pair of 2.5″ 10k rpm SAS drives must be installed with an adapter in a 3.5″ hard drive carrier in drive slots 0 and 1
    - The remaining hard drives must be 3.5″ hard drives and must be either all SAS or all SATA
- Support for 25 and 50GB 2.5″ solid state drives at RTS (additional solid state drive support is Post RTS)
- SSDs require the PERC 6/i Integrated storage controller and cannot be mixed with any other type of hard drive

| 2.5 HDDs | |
|---|---|
| **2.5″ Enterprise SATA 7.2K HDs** | 160GB, 250GB, and 500GB |
| **2.5″ SAS 10K HDs:** | 73GB, 146GB, and 300GB |
| **2.5″ entry 10K SAS in 3.5″ HDD carrier** | |
| **2.5″ SAS 15K HDs** | 73GB and 146GB |
| **2.5″ Enterprise SATA SSD** | 25GB, 50GB, and 100GB |
| **2.5″ SSD** | 25GB and 50GB |
| **3.5 HDDs** | |
| **Support for 3.5″ Enterprise SATA 7.2K:** | 160GB, 250GB, 500GB, 750GB, and 1,000GB |
| **Support for 3.5″ Enterprise SATAu 7.2K:** | 500GB SATAu, 750GB SATAu, and 1 ,000GB SATAu |
| **Support for 3.5″ Green Enterprise SATA 5.4K** | 1,000GB |
| **Support for 3.5″ Near Line SAS 7.2K** | 500GB, 750GB, and 1,000GB |
| **Support for 3.5″ SAS 15K HDs:** | 146GB, 300GB, and 450GB |

Table: R710 supported HDD matrix

For mixed SAS/SATA configurations, SAS drives must be installed as a pair in drive slots 0 and 1.

One mixed 2.5″ and 3.5″ hard drive configuration is allowed: a pair of 2.5″ 10k rpm SAS drives can be installed with an adapter in a 3.5″ hard drive carrier in drive slots 0 and 1. The remaining hard drives must be 3.5″ hard drives and must be either all SAS or all SATA.

| | POWEREDGE R710 |
|---|---|
| **Platforms** | 4 |
| **All 2.5″ HDD SAS (or) SATA** | 4 |
| **All 2.5″ SSD*** ** | 4 |
| **Mixed SSD/SAS**** | 4 |
| **All 3.5″ HDD SAT (or) SATA** | 4 |
| **Mixed SAS/SATA*** | 4 |
| **2.5″ SAS in 3.5″ HDD Carrier (RTS+)** | 4 |
| **2.5″ SAS HDD in 3.5″ HDD Carrier + 3.5″ SATA HDDs (Mixed SAS)** | 4 |
| **2.5″ SAS HDD in 3.5″ HDD Carrier + 3.5″ SATA HDDs (Mixed SAS/SATA)*** | 4 |

- SAS HDDs should be in slots 0 & 1 and min/max number of SAS HDDs is 2, rest will be SATA HDDs and min/max number of SATA HDDs depends on the configuration.
- **No maximum for SAS HDD's combined with SSD
- ***SSD Support requires PERC 6/i

20GB and 50GB solid state drives (SSD) support will be supported at RTS

**II. Hard Disk Drive Carriers**
Hard drives must use the Dell 2.5″ and the 3.5″ Hard Drive Disk Carriers.


Figure: 2.5″ HDD Carrier

**III. Empty Drive Bays**
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.

### IV. Diskless Configuration Support

The system supports diskless configuration with no storage controller (SAS 6/iR or PERC 6i) installed in the system. A 2.5" HDD backplane is still installed in this configuration.

### V. Hard Drive LED Indicators

Each disk 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.

## C. RAID Configurations

PowerEdge R710 Factory Configuration Summary

| CONFIG TYPE | CONFIGS | | DESCRIPTION | NON-MIXED DRIVES, ALL SATA OR ALL SAS | | MIXED SAS/ SATA MIN 2xSAS+1xSATA 2.5": MAX 2xSAS + 6xSATA 3.5": MAX 2xSAS + 6xSATA | |
|---|---|---|---|---|---|---|---|
| | | | | MIN HDD | MAX HDD | MIN HDD | MAX HDD |
| **SAS/SATA (No RAID)** | 0 | MSS | Integrated SAS/SATA No RAID (SAS 6/iR) | 2.5"=1<br>3.5"=1 | 2.5"=8<br>3.5"=8 | | |
| **SAS/SATA (RAID)** | 1 | MSSR0 | Integrated SAS/SATA RAID 0 (SAS 6/iR, PERC6/I) | 2.5"=1*<br>3.5"=1* | 2.5"=8<br>3.5"=8 | N/A | |
| | 2 | MSSR1 | Integrated SAS/SATA RAID 1 (SAS 6/iR, PERC6/I) | 2.5"=2<br>3.5"=2 | 2.5"=2<br>3.5"=2 | N/A | |
| | 3 | MSSR5 | Integrated SAS/SATA RAID 5 (PERC 6/i) | 2.5"=3<br>3.5"=3 | 2.5"=8<br>3.5"=8 | N/A | |
| | 4 | MSSR6 | Integrated SAS/SATA RAID 6 (PERC 6/i) | 2.5"=4<br>3.5"=4 | 2.5"=8<br>3.5"=8 | N/A | |
| | 5 | MSSR10 | Integrated SAS/SATA RAID 10 (PERC 6/i) | 2.5"=4<br>3.5"=4 | 2.5"=8<br>3.5"=8 | | |
| | 6 | MSSR1R1 | Integrated SAS/SATA RAID 1/RAID 1 (SAS 6/iR, PERC 6/i) | 2.5"=2+2<br>3.5"=2+2 | 2.5"=2+2<br>3.5"=2+2 | | |
| | 7 | MSSR1R5 | Integrated SAS/SATA RAID 1/RAID 5 (PERC 6/i) | 2.5"=2+3<br>3.5"=2+3 | 2.5"=2+6<br>3.5"=2+6 | | |
| **SAS/SATA (No RAID)** | 8 | MSS-X | Integrated SAS/SATA No RAID (SAS 6/iR) | | | 2.5"=3<br>3.5"=3 | 2.5"=6<br>3.5"=6 |

| CONFIG TYPE | CONFIGS | | DESCRIPTION | NON-MIXED DRIVES, ALL SATA OR ALL SAS | | MIXED SAS/ SATA MIN 2xSAS+1xSATA 2.5″: MAX 2xSAS + 6xSATA 3.5″: MAX 2xSAS + 6xSATA | |
|---|---|---|---|---|---|---|---|
| | | | | MIN HDD | MAX HDD | MIN HDD | MAX HDD |
| SAS/SATA (RAID) | 9 | MSSR1R1- X | Integrated SAS/SATA RAID 1/RAID 1 (SAS 6/iR, PERC 6/i) | | | 2.5"=2+2<br>3.5"=2+2 | 2.5"=2+2<br>3.5"=2+2 |
| | 10 | MSSR1R5-X | Integrated SAS/SATA RAID 1/RAID 5 (PERC 6/i) | | | 2.5"=2+3<br>3.5"=2+3 | 2.5"=2+6<br>3.5"=2+6 |
| SSD (RAID) | 11 | MSSR1 | Integrated SSD RAID 1 (PERC 6/i) | 2.5"=2<br>3.5"=N/A | 2.5"=2<br>3.5"=N/A | N/A | |
| | 12 | MSSR5 | Integrated SSD RAID 5 (PERC 6/i) | 2.5"=3<br>3.5"=N/A | 2.5"=<br>3.5"=N/A | N/A | |
| | 13 | MSSR10 | Integrated SSD RAID 10 (PERC 6/i) | 2.5"=4<br>3.5"=N/A | 2.5"=8<br>3.5"=N/A | N/A | |
| SSD/SAS (RAID) | 14 | MSSR1R5-X | Integrated SSD/SAS RAID 1/RAID 5 (PERC 6/i) | | | 2.5"=2+3<br>3.5"=N/A | 2.5"=2+6<br>3.5"=N/A |

* Minimum of 1 hard drive for PERC6i ; and minimum of 2 for SAS6iR.

## D. Storage Controllers

### I. SAS 6/iR

The PowerEdge R710 internal SAS 6/iR HBA is an expansion card that plugs into a dedicated PCI Express x8 slot (only four lanes wired). It incorporates two four-channel SAS IOCs for connection to SAS/SATA hard disk drives. It is designed in a form factor that allows the same card to be used in R610 and T610.

### II. PERC 6i

For customers who want a hardware RAID solution, the PERC 6i is an option. The PERC 6i uses the LSI 1078 ROC (RAID on Chip) processor with a PCI Express host interface and DDR2 memory. A battery is also available for backup.

| | PRODUCT | USAGE | R710 SUPPORT | SLOT | PCIe CON | PCIe BRACKET | I/O CON | RAID | BBU |
|---|---|---|---|---|---|---|---|---|---|
| PERC SAS/SATA | PERC 6/i Integrated | Internal Backplane Storage (HDD, SSD) | Yes, Max 1 | Storage slot | x8 | No | x4 int x4 int | 0, 1, 5, 6, 10, 50, and 60 | Yes |
| | PERC 6/E Adapter | External SAS/SATA Storage | Yes, Max 2 (MD1000 Pompano & MD1020 Ridgeback) | PCIe slot | x8 | Yes | x4 ext x4 ext | 0, 1, 5, 6, 10, 50, and 60 | TBBU |
| | PERC 5/E Adapter | External Legacy Storage | Yes, Max 2 (MD1000, Pompano, & MD1020 Ridgeback) | PCIe slot | x8 | Yes | x4 ext x4 ext | 0, 1, 5, 10, 50 | TBBU |
| SAS HBA SAS/SATA | SAS 6/iR Integrated | Internal Backplane Storage (No tape or SSD support) | Yes, Max 1 | Storage slot | x8 | No | x4 int x4 int | 0, 1 | No |
| | SAS 5/E Adapter | External SAS (DAS, Tape) | Yes, Max 2 | PCIe slot | x8 | Yes | x4 ext x4 ext | none | No |
| ICH9 | On Planar via chipset | Internal slim-line SATA Optical and/or TBU Only (no HDD) | Yes, 2 ports for Optical and/or TBU | n/a | n/a | n/a | x1 int | n/a | n/a |
| LSI 2032 SCSI | LSI 2032 Adapter | Internal or External SCSI Tape/ Legacy External storage | Yes, Max 2 | PCIe slot | x8 | Yes | SCSI int SCSI ext | n/a | n/a |

Note: A maximum of 2 external storage controllers (Dell PERC or SAS cards) are allowed in the system in addition to the integrated storage controller.

### E. LED Indicators

Each disk 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.

### F. Optical Drives

Optical drives are optional in all of the PowerEdge R710 systems and connect to the planar via the SATA interface. The following internal slim-line drives are available on the PowerEdge R710: DVD-ROM and DVD+RW. PATA (IDE) optical drives are not supported.

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

### G. Tape Drives

Internal tape drives are optional in systems with the 4x3.5" or 8x2.5" backplanes. Internal SATA tape drives connect directly to the SATA connector on the planar. Internal SCSI tape drives connect through the LSI 2032 PCI Express SCSI adapter card.

| TAPE DRIVES | |
|---|---|
| **Internal Tape** | Internal (RD1000 Half-Height SATA) |
| | DAT72 Half –Height SCSI |
| **Internal Tape Drive Bays** | One 3.5" Half-Height Tape Drive Bay |
| **External TBU** | External (RD1000 USB) |
| | LTO-2L (Legacy, SCSI) |
| | LTO-3-060 (SCSI) |
| | LTO-3 (Legacy, SCSI) |
| | LTO-4-120 (Half-Height SAS) |
| | LTO-4-120 (Full-Height SAS) |
| | 2U external TBU (PV114T) |
| | DAT72 Half–Height SCSI |
| **External TBU/Automation** | 4U SAS, SCSI, iSCSI, and FC |
| | 2U SAS, SCSI, iSCSI, and FC |
| | ML6000 Family SAS, SCSI, and FC |
| | 2U external TBU (PV124T ) Legacy SCSI |

| CHASSIS CONFIG | TAPE BACKUP UNIT (INTERNAL) | | |
|---|---|---|---|
| **Backplane Type** | **Config** | **TBU Controller** | **TBU Cable** |
| 3.5" x 6" | No TBU | N/A | N/A |
| 3.5" x 4" | No TBU | N/A | N/A |
| | Internal for 3.5 Bay (RD 1000 Half-Height SATA) | Connects to MB | XR724 |
| | DAT72 for 3.5 Bay (Half-Height SCSI) | LSI 2032 (SCSI) HBA | DR017 |
| | No TBU | N/A | N/A |
| | Internal for 3.5 Bay (RD 1000 Half-Height SATA) | Connects to MB | RN694 |
| 2.5" x 8 | DAT72 for 3.5 Bay (Half-Height SCSI) | LSI 2032 (SCSI) HBA | CJ176 |

## SECTION 13. VIDEO

### A. Overview / Description

The PowerEdge R710 Integrated Dell Remote Access Controller 6 (iDRAC6) incorporates an integrated video subsystem, connected to the 32-bit PCI interface of the ICH9. 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 128MB DDR2 application space memory. This memory is also used for the KVM buffer.

The PowerEdge R710 system supports the following 2D graphics video modes:

| RESOLUTION | REFRESH RATE (Hz) | COLOR DEPTH (BIT) |
|---|---|---|
| 640 x 480 | 60, 72, 75, and 85 | 8, 16, and 32 |
| 800 x 600 | 56, 60, 72, 75, and 85 | 8, 16, and 32 |
| 1024 x 768 | 60, 72, 75, and 85 | 8, 16, and 32 |
| 1152 x 864 | 75 | 8, 16, and 32 |
| 1280 1024 | 60, 75, and 85 | 8 and 16 |
| 1280 1024 | 60 | 32 |

## SECTION 14. AUDIO

### A. Overview / Description
No speakers supported

## SECTION 15. RACK INFORMATION

### A. Overview / Description
Rack installation components such as rails are provided with the PowerEdge R710 Rack Kit. The rack installation components are as follows: Sliding Rack mount with latest generation Cable Management Arm (CMA). When the system is installed in a rack, please observe the following guidelines:

Nothing should be located within 12″ of the front of the unit that would restrict the airflow into the system.

Nothing should be mounted or placed behind the chassis that would restrict airflow from exiting the system. Only Dell approved CMAs can be placed behind the chassis. All other objects should be located at least 24″ away from the rear of the chassis.

When two systems are placed back to back, the separation between the units should be at least 24″ if the exit airflow is equivalent for the two chassis. This allows the exit air to escape without creating an extreme back pressure at the rear of one of the chassis.

### B. Cable Management Arm (CMA)

| CABLE TYPE | NUMBER OF CABLES |
|---|---|
| Mouse – USB | 1 |
| Keyboard – USB | 1 |
| Video – VGA | 1 |
| Power Cords | 2 |
| LOMs – Ethernet | 1 |
| PCI NICs | 1 |
| Total | 8 |

Notes:
- CMA supports for the maximum number of cables supported by system
- The numbers in this matrix represent the number and types of external cables required to be supported by the CMA solution.
- This matrix is built on the practical worst case configuration in each platform based on prior and projected take rates. Note that other combinations of adapters and associated cables exist, but are assumed to fall within these guidelines from the standpoint of bend radius and flexibility, cable bundling, cable volume, etc.
- PCI NIC cables are assumed to be Ethernet.
- KVM cable dongle may be used for mouse/keyboard/video.

### C. Rails

| |
|---|
| Support for tool-less installation in CEA-310-E compliant square hole 4-post racks including:<br>Support for Dell 2410 24U Rack<br>Support for Dell 4210 Rack<br>Support for HP/Compaq 10xxx series |
| Support for tooled or tool-less installation in CEA-310-E compliant round hole 4-post racks<br>(tool-less preferred) |
| Support for flush and center mount installation in CEA-310-E compliant 2-post racks (1U & 2U only) |

The R710 rail supports the following racks:

| |
|---|
| Support for Dell 4210 & 2410 racks |
| Support for Dell 4200 & 2400 racks without CMA |
| Support for HP/Compaq 10XXX series racks |
| Support for HP/Compaq 9XXX & 7XXX series racks without CMA |

## SECTION 16. OPERATING SYSTEMS

### A. Overview / Description

The PowerEdge R710 supports Windows®, Linux®, and Solaris™ Operating Systems.

Windows® Support:

| X86 OR X64 | INSTALLATION | FACTORY INSTALLATION | LOGO CERTIFICATION | SCHEDULE | TEST/ VALIDATE | SUPPORT |
|---|---|---|---|---|---|---|
| **Windows® Small Business Server 2008 and Essential Business Server 2008** | | | | | | |
| x64 | Standard/ Premium | Yes | Windows Hardware Quality Labs - Windows 2008 | Shipping | Yes | Yes |
| **Windows Server® 2008 (x64 includes Hyper-V™)** | | | | | | |
| x64 | Standard | Yes | Windows Hardware Quality Labs - Windows 2008 | Shipping | Yes | Yes |
| | Enterprise | | | | | |
| | Datacenter | | | | | |
| **Windows Server® 2008** | | | | | | |
| x86 | Standard | Yes | Windows Hardware Quality Labs - Windows 2008 | Shipping | Yes | Yes |
| | Enterprise | | | | | |
| **Windows® Web Server 2008** | | | | | | |
| x86 and x64 | Web | Yes | Windows Hardware Quality Labs - Windows 2008 | Shipping | Yes | Yes |
| **Windows Server® 2008, SP2 (x64 includes Hyper-V™)** | | | | | | |
| x64 | Standard | Yes | Windows Hardware Quality Labs - Windows 2008 | Available in August - October 2009 | Yes | Yes |
| | Enterprise | | | | | |
| | Datacenter | | | | | |
| **Windows Server® 2008, SP2** | | | | | | |
| x86 | Standard | Yes | Windows Hardware Quality Labs - Windows 2008 | Available in August - October 2009 | Yes | Yes |
| | Enterprise | | | | | |
| **Windows® Web Server 2008, SP2** | | | | | | |
| x86 and x64 | Web | Yes | Windows Hardware Quality Labs - Windows 2008 | Available in August - October 2009 | Yes | Yes |

| X86 OR X64 | INSTALLATION | FACTORY INSTALLATION | LOGO CERTIFICATION | SCHEDULE | TEST/ VALIDATE | SUPPORT |
|---|---|---|---|---|---|---|
| **Windows Server® 2008, R2, (x64 includes Hyper-V™)** | | | | | | |
| x64 | Standard | Yes | Windows Hardware Quality Labs - Windows 2008 Release 2 | Available in November 2009 - January 2010 | Yes | Yes |
| | Enterprise | | | | | |
| | Datacenter | | | | | |

Linux support:

| | | | | | | |
|---|---|---|---|---|---|---|
| **Red Hat® Enterprise Linux 4.7** | | | | | | |
| x86 and x64 | ES/AS | Available in June 2009 | N/A | Available in June 2009 | Yes | Yes |
| **Red Hat Enterprise Linux 5.2** | | | | | | |
| x86 and x64 | Standard/AP | Yes | N/A | Shipping | Yes | Yes |
| **Red Hat Enterprise Linux 5.3** | | | | | | |
| x86 and x64 | Standard/AP | Available in June 2009 | N/A | Available in June 2009 | Yes | Yes |
| **Novell® SUSE® Linux Enterprise Server 10 SP2** | | | | | | |
| x64 | Enterprise | Yes | N/A | Shipping | Yes | Yes |
| **Novell SUSE Linux Enterprise Server 11** | | | | | | |
| x64 | Enterprise | Available in June 2009 | N/A | Available in June 2009 | Yes | Yes |
| **Solaris™ 10 05/09** | | | | | | |
| x64 | Enterprise | Drop in the box | N/A | Available in June 2009 | Yes | Yes |

## SECTION 17. VIRTUALIZATION

### A. Overview / Description

Supported embedded hypervisors:

- Microsoft® Windows Server® 2008 Hyper-V
- VMware® ESXi Version 4.0 and 3.5 update 4
- Citrix® XenServer 5.0 with Hotfix 1 or later

## SECTION 18. SYSTEMS MANAGEMENT

### A. Overview / Description

Dell is focused on delivering open, flexible, and integrated solutions the help our customers reduce the complexity of managing disparate IT assets. We build comprehensive IT management solutions. Combining Dell PowerEdge Servers with a wide selection of Dell-developed management solutions, we provide customers 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

We offer IT management solutions for organizations of all sizes – priced right, sized right, and supported right.

### B. 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. The following sections briefly describe the 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 include: 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.

## C. Embedded Server Management

The PowerEdge R710 implements circuitry for the next generation of Embedded Server Management. It is Intelligent Platform Management Interface (IPMI) v2.0 compliant. The iDRAC6 (Integrated Dell Remote Access Controller) is responsible for acting as an interface between the host system and its management software and the periphery devices. These periphery devices consist of the PSUs, the storage backplane, integrated SAS HBA or PERC 6/i and control panel with semi-intelligent display.

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

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

### I. Unmanaged Persistent Storage

The unmanaged persistent storage consists of two ports:

- one located on the control panel board
- one located on the Internal SD Module

The port on the control panel is for an optional USB key and is located inside the chassis. Some of the possible applications of the USB key are:

- User custom boot and pre-boot OS for ease of deployment or diskless environments
- USB license keys for software applications like eToken™ or Sentinel Hardware Keys
- Storage of custom logs or scratch pad for portable user-defined information (not hot-pluggable)

The Internal SD Module is dedicated for an SD Flash Card with embedded Hypervisor for virtualization. The SD Flash Card contains a bootable OS image for virtualized platforms.

### II. Lifecycle Controller/Unified Server Configurator

Embedded management is comprised of several pieces which are very interdependent.

- Lifecycle Controller
- Unified Server Configurator
- iDRAC6
- vFLASH

Lifecycle controller is the hardware component that 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 is a 1:1 user interface exposing utilities from Lifecycle Controller. Customers will use this interface to configure hardware, update server, run diagnostics, or deploy the operating system. This utility resides on Lifecycle Controller. To access the Unified Server Configurator, press <F10> key within 10 seconds of the Dell logo display during the system boot process. Current functionality enabled by the Unified Server Configurator includes:

| 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** | Description: 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 and also provides configuration for iDRAC, BIOS, and NIC/LOM. |

### III. iDRAC6 Express

The iDRAC6 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 the table below.

### IV. iDRAC6 Enterprise

The optional iDRAC6 Enterprise card provides access to advanced iDRAC6 features. The iDRAC6 Enterprise connects directly to the PowerEdge R710 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 1GB Dell branded SD card that enabled a persistent 256MB 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.

| FEATURE | BMC | IDRAC6 EXPRESS | IDRAC6 ENTERPRISE | VFLASH MEDIA |
|---|---|---|---|---|
| **Interface and Standards Support** | | | | |
| **IPMI 2.0** | 4 | 4 | 4 | 4 |
| **Web-based GUI** | | 4 | 4 | 4 |
| **SNMP** | | 4 | 4 | 4 |
| **WSMAN** | | 4 | 4 | 4 |
| **SMASH-CLP** | | 4 | 4 | 4 |
| **Racadm command-line** | | | 4 | 4 |
| **Conductivity** | | | | |
| **Shared/Failover Network Modes** | 4 | 4 | 4 | 4 |
| **IPv4** | 4 | 4 | 4 | 4 |
| **VLAN tagging** | 4 | 4 | 4 | 4 |
| **IPv6** | | 4 | 4 | 4 |
| **Dynamic DNS** | | 4 | 4 | 4 |
| **Dedicated NIC** | | | 4 | 4 |
| **Security & Authentication** | | | | |
| **Role-based Authority** | 4 | 4 | 4 | 4 |
| **Local Users** | 4 | 4 | 4 | 4 |
| **Active Directory** | | 4 | 4 | 4 |
| **SSL Encryption** | | 4 | 4 | 4 |
| **Remote Management & Remediation** | | | | |
| **Remote Firmware Update** | 4 | 4 | 4 | 4 |
| **Server power control** | 4 | 4 | 4 | 4 |
| **Serial-over-LAN (with proxy)** | 4 | 4 | 4 | 4 |
| **Serial-over-LAN (no proxy)** | | 4 | 4 | 4 |
| **Power capping** | | 4 | 4 | 4 |
| **Last crash screen capture** | | 4 | 4 | 4 |
| **Boot capture** | | 4 | 4 | 4 |
| **Serial-over-LAN** | | 4 | 4 | 4 |
| **Virtual media** | | | 4 | 4 |
| **Virtual console** | | | 4 | 4 |

| FEATURE | BMC | IDRAC6 EXPRESS | IDRAC6 ENTERPRISE | VFLASH MEDIA |
|---|---|---|---|---|
| **Virtual console sharing** | | | 4 | 4 |
| **Virtual flash** | | | | 4 |
| **Monitoring** | | | | |
| **Sensor Monitoring and Alerting** | 4 | 4 | 4 | 4 |
| **Real-time Power Monitoring** | | 4 | 4 | 4 |
| **Real-time Power Graphing** | | 4 | 4 | 4 |
| **Historical Power Counters** | | 4 | 4 | 4 |
| **Logging Features** | | | | |
| **System Event Log** | 4 | 4 | 4 | 4 |
| **RAC Log** | | 4 | 4 | 4 |
| **Trace Log** | | 4 | 4 | 4 |

## SECTION 19. PERIPHERALS

### A. USB peripherals

The PowerEdge R710 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)

### B. External Storage

| EXTERNAL STORAGE | |
|---|---|
| **SAN Support** | EMC's AX Arrays (SCSI, FC, and iSCSI) |
| | EMC's CX Arrays (SCSI, FC, and iSCSI) |
| | EqualLogic's PS5XXX Arrays (iSCSI) |
| **SAS Management SW for xBOD** | OMSS X.X for MD1000 |
| | OMSS X.X for MD1020 |
| | X.X for MD3000 |
| | for MD3000i |
| **PV 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 |
| **SAS xBOD SW** | OpenManage Storage Manager |

## SECTION 20. DOCUMENTATION

### A. Overview, Description, and List

PowerEdge R710 and other 11G systems use the new enterprise documentation set. The following is a summary of some of the documents slated for the PowerEdge R710 product. For the complete list of documents, including language requirements and delivery scheduling, refer to the Documentation Matrix and the Documentation Milestones in the InfoDev Functional Publications Plan.

- Getting Started Guide: This guide provides initial setup steps, a list of key system features, and technical specifications. This document is required for certain worldwide regulatory submittals. This guide is printed and shipped with the system, and is also available in PDF format on the Dell support site.
- Hardware Owner's Manual: This document provides troubleshooting and remove/replace procedures, as well as information on the System Setup program, system messages, codes, and indicators. This document is provided to customers in HTML and PDF format at the Dell support site.
- System Information Label: The system information label documents the system board layout and system jumper settings and is located on the system cover. Text is minimized due to space limitations and translation considerations. The label size is standardized across platforms.
- Information Update: This is a PDF document that provides information on late changes and issues having significant customer impact which were discovered after document signoff.
- General System Information Placemat: This is a paper document that is provided with every system. The document provides general information about the system, including software license agreement information and the location of the service tag.
- Rack Placemat: This is a paper document that is provided with the rack kits. The document provides an overview of procedures for setting up the rack.

## SECTION 21. PACKAGING OPTIONS

| PACKAGING | PROVIDE PACKAGING TO SUPPORT SYSTEM | |
|---|---|---|
| | | |
| | Packaging should incorporate keyboard, mouse, bezel, Doc, CDs, rails | • Will not bag the server in outbound pack<br>• Multi-pack rails targeted to go in a box within the multi-pack but investigation underway for a separate box for ease of customer staging<br>• Accessory tray needs a cover and icon showing contents<br>• Doc Box – separate box within the main box containing import documentation and software (OS, OM, etc.) |

## Appendix

R710 Volatility Chart.

| | NON-VOLATILE RAM | VOLATILE RAM | REFERENCE DESIGNATOR | QTY | SIZE | TYPE [e.g., FLASH PROM, EEPROM]: |
|---|---|---|---|---|---|---|
| **PLANAR, POWEREDGE R710** | | | | | | |
| System BIOS SPI Flash | Y | | U_SPI_BIOS | 1 | 4MB | Flash EEPROM (SPI interface) |
| LOM Configuration Data | Y | | U15, U16 | 2 | 512KB | FLASH (NOR) |
| iDRAC6 Controller ROM | Y | | U_IBMC | 1 | 4KB | ROM |
| iDRAC6 Controller RAM | | Y | U_IBMC | 1 | 8KB | RAM |
| System CPLD | Y | | U_CPLD | 1 | 1200 Macro cells | Internal Flash EEPROM |
| System CPLD | | Y | U_CPLD | 1 | 1KB | RAM |
| iDRAC6 Express Internal Flash | Y | | U_EMMC | 1 | 1GB | NAND FLASH |
| System RAM | | Y | J_CPU(2:1)_ CH(2:0)_ DIMM(3:1) | 18 | up to 18 DIMMs *16GB | RAM |
| TPM ID EEPROM (Plug in module only) | Y | | U_SEEPROM | 1 | 256B | EEPROM |
| **TPM Binding EEPROM (on China planar only)** | Y | | U7261 | 1 | 256B | EEPROM |
| iDRAC6 SDRAM | | Y | U_IBMC_ MEM | 1 | 128MB | DDR2 RAM |
| iDRAC6 FRU | Y | | U_IBMC_ FRU | 1 | 4KB | EEPROM |
| iDRAC6 Boot Block Flash | Y | | U_IBMC_SPI | 1 | 2MB | FLASH (NOR) |
| Trusted Platform Module | Y | N | U_TPM | 1 | 128 bytes | EEPROM |
| **CHIPSET** | | | | | | |
| CMOS | Y | | U_ICH9 | 1 | 256KB | Battery backed RAM |
| **2.5" BACKPLANE OR 3.5" BACKPLANE** | | | | | | |
| Storage Controller Processor | Y | | U_SEP | 1 | 32KB | Embedded Microcontroller Flash |
| **CONTROL PANEL** | | | | | | |
| Internal USB | Y | | J_USBKEY (connector) | 1 | User selectable | License key hard set ROM or user choice |
| Internal SD Module | Y | | J_SDCARD (Connector) | 1 | User selectable - 1GB shipped | Secure Digital NAND Flash |
| **POWER SUPPLY** | | | | | | |
| PSU Microcontroller | Y | | Varies by part number | Up to 2 | Maximum supported = 2MB per PSU | Embedded microcontroller flash |
| **PERC 6/I INTEGRATED** | | | | | | |
| PERC NVSRAM Config Data | Y | | U23 | 1 | 32KB | Non-volatile SRAM |
| PERC Firmware | Y | | U24 | 1 | 4MB | FLASH (NOR) |
| PERC Cache RAM | | Y | U58-61 | 1 | 256MB | RAM |
| FRU | Y | | U40 | 1 | 256MB | EEPROM |
| IBUTTON Key EEPROM | Y | | U21 | 1 | 1KB | EEPROM |
| CPLD | Y | | U_CPLD | 1 | 72 macrocells | Internal Flash EEPROM |
| SAS 6/iR Integrated | | | | | | |
| Controller Configuration Data | Y | | U3 | 1 | 4MB | FLASH (NOR) |
| FRU | Y | | U4 | 1 | 256KB | EEPROM |
| Integrated Mirroring NVSRAM | Y | | U1 | 1 | 32KB | Non-volatile SRAM |
| iDRAC6 Enterprise | | | | | | |
| VFlash | Y | | J_SD (connector) | 1 | 1GB @ RTS, Larger later | Secure Digital NAND Flash |

R710 Volatility Chart Continued.

| | CAN USER PROGRAMS OR OPERATING SYSTEM WRITE DATA TO IT DURING NORMAL OPERATION? | PURPOSE? [e.g., BOOT CODE] |
|---|---|---|
| **PLANAR, POWEREDGE R710** | | |
| System BIOS SPI Flash | No | Boot Code, System Configuration Information, EUFI environment |
| LOM Configuration Data | No | LAN on motherboard configuration and firmware |
| iDRAC6 Controller ROM | No | not utilized |
| iDRAC6 Controller RAM | No | iDRAC internal RAM |
| System CPLD | No | System-specific hardware logic |
| System CPLD | No | not utilized |
| iDRAC6 Express Internal Flash | No for iDRAC Operating System. Yes for Managed System Services Repository | iDRAC Operating System plus Managed System Services Repository (i.e., Unified Server Configurator, OS drivers, diagnostics, rollback versions of various programmables) |
| System RAM | Yes | System OS RAM |
| TPM ID EEPROM (Plug in module only) | No | BIOS Identification of TPM module |
| **TPM Binding EEPROM (on China planar only)** | No | BIOS binding of plug in module to a particulare planar |
| iDRAC6 SDRAM | No | BMC OS + VGA frame buffer |
| iDRAC6 FRU | No | Motherboard electronic product identifier |
| iDRAC6 Boot Block Flash | No | iDRAC boot loader and configuration (i.e., MAC address), life cycle log, and system event log |
| Trusted Platform Module | yes | Storage of encryption keys |
| **CHIPSET** | | |
| CMOS | No | BIOS settings |
| **2.5" BACKPLANE OR 3.5" BACKPLANE** | | |
| Storage Controller Processor | No | Backplane firmware (HDD status, etc.) |
| **CONTROL PANEL** | | |
| Internal USB | Yes as allowed by OS | Normal usage is read only software license key, but not limited |
| Internal SD Module | Yes as allowed by OS | Normal usage is embedded hypervisor OS but not limited |
| **POWER SUPPLY** | | |
| PSU Microcontroller | No | Power supply operation, power telemetry data, and fault behaviors |
| **PERC 6/I INTEGRATED** | | |
| PERC NVSRAM Config Data | No | Stores configuration data of HDDs |
| PERC Firmware | No | Storage Controller Firmware |
| PERC Cache RAM | No - not directly. | Storage RAID controller cache |
| FRU | No | Card product identification for system inventory purposes |
| IBUTTON Key EEPROM | No | Feature enablement encyrpted key |
| CPLD | No | HW control logic (i.e., power sequencing) |
| SAS 6/iR Integrated | | |
| Controller Configuration Data | No | Stores configuration data of HDDs |
| FRU | No | Card product identification for system inventory purposes |
| Integrated Mirroring NVSRAM | No | Stores configuration data of HDDs |
| iDRAC6 Enterprise | | |
| VFlash | Yes - When enabled, installed, and the media does not have the write protect switch applied | Storage of logs, user images like files, drivers, OS's, etc. |

R710 Volatility Chart Continued.

| | HOW IS DATA INPUT TO THIS MEMORY? |
|---|---|
| **PLANAR, POWEREDGE R710** | |
| System BIOS SPI Flash | Loading flash memory requires a vendor-provided firmware file and loader program that 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. Future firmware releases may add support for recovery of a bad/corrupted BIOS ROM image via the iDRAC (administrator privilege plus specific firmware, binary, and commands) |
| LOM Configuration Data | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable containing the firmware file and the loader. LOMs loaded with arbitrary data in firmware memory would not operate. |
| iDRAC6 Controller ROM | N/A |
| iDRAC6 Controller RAM | iDRAC embedded system |
| System CPLD | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (currently only DRMK utility support) containing the firmware file and the loader. System loaded with arbitrary data in CPLD memory would not operate. |
| System CPLD | Not utilized |
| iDRAC6 Express Internal Flash | iDRAC OS: Loading flash memory requires a vendor-provided firmware file and loader program that 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. |
| System RAM | System OS |
| TPM ID EEPROM (Plug in module only) | Factory load only. |
| **TPM Binding EEPROM (on China planar only)** | BIOS only |
| iDRAC6 SDRAM | Embedded iDRAC OS for 108MB and 8MB for VGA frame buffer |
| iDRAC6 FRU | Factory and iDRAC embedded OS |
| iDRAC6 Boot Block Flash | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable or out-of-band firmware updates across the management network. Bad contents yield the iDRAC inoperable and unrecoverable in the customer environment. Note the life cycle log is automatically updated by the iDRAC as various system component FW, HW, and SW verions are changed. |
| Trusted Platform Module | Using TPM-enabled operating systems |
| **CHIPSET** | |
| CMOS | BIOS control only via input such as BIOS F2 menu user configuration settings (such as boot order) |
| **2.5" BACKPLANE OR 3.5" BACKPLANE** | |
| Storage Controller Processor | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (DRMK, USC, OS DUPs utility support) containing the firmware file and the loader. Backplane loaded with bad firmware will not provide backplane and HDD status. |
| **CONTROL PANEL** | |
| Internal USB | Either read-only license key or OS control copies |
| Internal SD Module | Factory load, OS run time usage, and OS updates and configuration changes. |
| **POWER SUPPLY** | |
| PSU Microcontroller | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (Unified Server Configurator) containing the firmware file and the loader. PSUs loaded with bad firmware will not provide PSU functional behavior and result in PSU system faults. |
| **PERC 6/I INTEGRATED** | |
| PERC NVSRAM Config Data | Embedded storage firmware controls this data |
| PERC Firmware | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (DUPs, Unified Server Configurator) containing the firmware file and the loader. Storage adapters loaded with bad firmware will not provide storage controller behavior. |
| PERC Cache RAM | Embedded storage firmware controls the use of storage cache data. |
| FRU | Factory only. Not customer updatable. |
| IBUTTON Key EEPROM | Factory only. Not customer updatable. |
| CPLD | Factory only. Not customer updatable. |
| SAS 6/iR Integrated | |

R710 Volatility Chart Continued.

| | HOW IS DATA INPUT TO THIS MEMORY? |
|---|---|
| **PLANAR, POWEREDGE R710** | |
| Controller Configuration Data | Loading flash memory requires a vendor-provided firmware file and loader program that is executed by booting up the system from a floppy or OS-based executable (DUPs, Unified Server Configurator) containing the firmware file and the loader. Storage adapters loaded with bad firmware will not provide storage controller behavior. |
| FRU | Factory only. Not customer updatable. |
| Integrated Mirroring NVSRAM | Embedded storage firmware controls this data |
| iDRAC6 Enterprise | |
| VFlash | 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? | HOW IS THE MEMORY CLEARED? |
|---|---|---|
| **PLANAR, POWEREDGE R710** | | |
| System BIOS SPI Flash | Software write protected | Not possible with any utilities or applications and system is not functional if corrupted/removed. |
| LOM Configuration Data | Not explicitly protected but special applications are needed to communicate through the LOMs to reprogram this ROM. | Not user clearable |
| iDRAC6 Controller ROM | Protected permanently by hardware | Not clearable |
| iDRAC6 Controller RAM | n/a | iDRAC reset |
| System CPLD | Requires special system-specific utility | Not possible with any utilities or applications and system is not functional if corrupted/removed. |
| System CPLD | It's not accessible | Not clearable |
| iDRAC6 Express Internal Flash | Writes are proxied through a temporary iDRAC scratchpad RAM and not directly made from an OS or OS application. | Not user clearable |
| System RAM | OS control | Reboot or power down system |
| TPM ID EEPROM (Plug in module only) | HW read only | Not - read only |
| **TPM Binding EEPROM (on China planar only)** | Locked by BIOS from physical access by anyone after boot | N/A - BIOS control only |
| iDRAC6 SDRAM | n/a | AC cycle for BMC OS and reset / power off server for VGA frame buffer |
| iDRAC6 FRU | Writes controlled by iDRAC embedded OS | EPPID is not clearable |
| iDRAC6 Boot Block Flash | iDRAC embedded OS control of the write protection. | Not possible with any utilities or applications and iDRAC does not function as expected if corrupted/ removed. Lifecycle log is clearable only in a factory environment. SEL is user clearable. |
| Trusted Platform Module | SW write protected | F2 setup option |
| **CHIPSET** | | |
| CMOS | N/A - BIOS only control | Planar NVRAM_CLR jumper or remove AC cord, remove cover, remove coin cell battery. Wait for 30 seconds, replace battery, cover, and then AC cord. F2 system setup option to restore defaults |
| **2.5" BACKPLANE OR 3.5" BACKPLANE** | | |
| Storage Controller Processor | Embedded firmware only writeable through controlled iDRAC methods | Not possible with any utilities or applications and backplane does not function as expected if corrupted/ removed. |
| **CONTROL PANEL** | | |
| Internal USB | OS control | OS control format |
| Internal SD Module | Only by SD card write-protect switch. | OS control format |
| **POWER SUPPLY** | | |
| PSU Microcontroller | Protected by the embedded microcontroller. Special keys are used by special vendor-provided utilities to unlock the ROM with various CRC checks during load. | N/A - not in-system clearable |

R710 Volatility Chart Continued.

| | HOW IS THIS MEMORY WRITE PROTECTED? | HOW IS THE MEMORY CLEARED? |
|---|---|---|
| **PLANAR, POWEREDGE R710** | | |
| **PERC 6/I INTEGRATED** | | |
| PERC NVSRAM Config Data | Storage controller firmware accessed only | N/A - not in-system clearable |
| PERC Firmware | Write control access by storage controller firmware | N/A - not in-system clearable |
| PERC Cache RAM | Storage controller firmware accessed only | Storage controller firmware clearable only. Remove AC AND deplete or remove backup battery. |
| FRU | Protected in that no iDRAC-embedded firmware writes to this device. Although very convoluted, theoretically, IPMI $I^2C$ Master write commands would flow through to overwrite this EEPROM | N/A - not in-system clearable |
| IBUTTON Key EEPROM | SHA1 encryption included. Storage controller use only | N/A - not in-system clearable |
| CPLD | Only factory programmable | N/A - not in-system clearable |
| SAS 6/iR Integrated | | |
| Controller Configuration Data | Write control access by storage controller firmware | N/A - not in-system clearable |
| FRU | Protected in that no iDRAC-embedded firmware writes to this device. Although very convoluted, theoretically, IPMI $I^2C$ Master write commands would flow through to overwrite this EEPROM | N/A - not in-system clearable |
| Integrated Mirroring NVSRAM | Storage controller firmware accessed only | N/A - not in-system clearable |
| iDRAC6 Enterprise | | |
| VFlash | Media write protection switch or OS control | iDRAC-based format or local OS format or delete or card removal and formatted on a client |