

Dell EMC PowerEdge R940

Technical Guide

Notes, cautions, and warnings

 **NOTE:** A NOTE indicates important information that helps you make better use of your product.

 **CAUTION:** A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

 **WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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System overview

Topics:

- [Introduction](#)
- [New Technologies](#)

Introduction

The Dell EMC PowerEdge R940 is a 4-socket, 3U monolithic rack server designed to run complex workloads using highly scalable memory, I/O, and network options. The system features the 2nd Generation Intel® Xeon® Processor Scalable family, with up to 48 DDR4 DIMMs, up to 13 PCI Express (PCIe) 3.0 enabled expansion slots, and a choice of embedded NIC technologies.

The PowerEdge R940 is a general-purpose platform capable of handling demanding workloads and applications, such as data warehouses, ecommerce, databases (like CRM and OLTP), and high-performance computing (HPC). The PowerEdge R940 adds extraordinary storage capacity options, making it well-suited for data-intensive applications that require greater storage, while not sacrificing I/O performance.

The scalable business architecture of the Dell EMC PowerEdge R940 can deliver the most mission critical workloads. With optimized workload tuning for many workloads, configuration is quick. With up to 15.36TB of memory and 13 PCIe Gen 3 slots, the R940 has all the resources to maximize application performance and scale for future demands.

New Technologies

Table 1. New technologies

Technology	Detailed Description
2nd Generation Intel® Xeon® Processor Scalable family	<ul style="list-style-type: none"> • 14nm process technology • Intel Ultra Path Interconnect (UPI) up to 3 links @ 10.4GT/s with shelf-4 • Up to 28 cores per socket with Hyper-Threading (HT) • 6x DDR4 channels @ 2933 MT/s 2 DPC. 3 DPC not supported. • Max TDP: 205W • Mismatched SKUs not allowed Refer the Processor section for specific details.
Intel® C620 Chipset	Intel Platform Controller Hub (PCH) with Intel Node Manager 4.0 ME
Intel® Optane persistent memory (PMem)	Address data-heavy workloads like Microsoft SQL Server, SAS or analytics with up to 15.36TB of memory. <ul style="list-style-type: none"> • Up to 6 per CPU socket. Max 24 for 4S configuration. • 128GB, 256GB, 512GB per DIMM • 1866, 2133, 2400, 2666 MT/s • Up to 12.28TB max, (15.36TB max with PMem and LDRIMM)
2933 MT/s DDR4 Memory	The 2nd Generation Intel® Xeon® Processor Scalable family support up to 2933 MT/s memory. The R940 supports two DIMMs per channel at 2933 MT/s with select processors. See the Memory section for details.
iDRAC9 with Lifecycle Controller	The embedded systems management solution for PowerEdge features hardware and firmware inventory and alerting, in- depth memory alerting, faster performance, a dedicated gigabit port and many more features. See the OpenManage systems management section for details.

Table 1. New technologies (continued)

Technology	Detailed Description
Wireless Management	The Quick Sync 2.0 will offer feature parity with previous server generation NFC interface with improved user experience. To extend this Quick Sync feature to wide variety of Mobile OS's with higher data throughput, the Quick Sync 2.0 version replaces the previous server generation NFC technology with wireless at-the-box system management.

System features

Topics:

- [Specifications](#)

Specifications

Table 2. Technical specifications

Feature	Specification
Form factor	3U rack
Processors	2nd Generation Intel® Xeon® Processor Scalable family
Processor sockets	2 socket or 4 sockets
Internal interconnect	Intel Ultra Path Interconnect (UPI) up to 10.4 GT/s
Chipset	Intel C620
Memory	<ul style="list-style-type: none"> • 48 DDR4 DIMM slots (12 NVDIMM or 24 PMem slots) • Maximum memory: • RDIMM 3TB • LRDIMM 6TB • NVDIMM 384GB • PMem 12.28TB (15.36TB with LRDIMM)
PCIe slots	Maximum 13 PCIe slots (three x8 slots and ten x16 slots)
RAID controller	<ul style="list-style-type: none"> • H330 • H740P • H840 • Software RAID: S140 • Hardware RAID: M.2 SATA adapter (BOSS)
Host Bus Adapter (HBA)	<ul style="list-style-type: none"> • 12 Gb SAS HBA
Drives	<ul style="list-style-type: none"> • 2.5 -inch, 12 GB SAS and 6 GB SATA • 8 hard drives on passive backplane • 24 hard drives on active backplane with up to 12 PCIe NVMe hard drive capable universal slots.
Maximum internal storage	<ul style="list-style-type: none"> • Up to 184.32TB using 24x2.5 -inch 7.68TB SAS/SATA/SSD/NVMe (Up to 12 per CPU) + 12x2.5 -inch NVMe PCIe SSD's available.
Embedded NIC	<ul style="list-style-type: none"> • Flexible Rack Network Daughter Cards (rNDC). • PCIe Gen 3 x8
Power supply	<ul style="list-style-type: none"> • Platinum 1100W, 1100W 380VDC, 1600W, 2000W, 2400W • Titanium: 1600 W HLAC, 2600 W HLAC • Gold 1100W-48VDC • Hot plug power supplies with full redundancy option
Availability	<ul style="list-style-type: none"> • RDIMM, LRDIMM • Hot-plug hard drives, redundant cooling fans, and power supply

Table 2. Technical specifications (continued)

Feature	Specification
	<ul style="list-style-type: none">● Internal Dual SD Module (IDSMD)● Boot Optimized Storage Subsystem (BOSS) via M.2
Systems management	<ul style="list-style-type: none">● LC 3.x● OpenManage● QuickSync2.0● OMPC3● Digital License Key● iDRACDirect (dedicated micro-USB port)● Easy Restore● vFlash
Operating systems	<ul style="list-style-type: none">● Canonical® Ubuntu® Server LTS● Citrix® Hypervisor● Microsoft Windows Server® LTSC with Hyper-V● Oracle® Linux Red Hat® Enterprise Linux● SUSE® Linux Enterprise Server● VMware® ESXi <p>For more information on the specific versions and additions, visit Dell.com/OSsupport.</p>

Chassis views and features

Topics:

- Chassis view and features
- Control panels, LCD and LED
- Quick Resource Locator (QRL)
- Security features

Chassis view and features

Front panel view and features

The following components are located on the front of the PowerEdge R940:



Figure 1. PowerEdge R940 front panel

1. Left control panel
2. System health and system identifier
3. iDRAC Quick Sync 2 wireless indicator
4. Hard drives
5. USB management port
6. Power button
7. Video connector
8. USB management port/iDRAC Direct
9. Information tag

Back view features

The following components are located on the back of the PowerEdge R940:

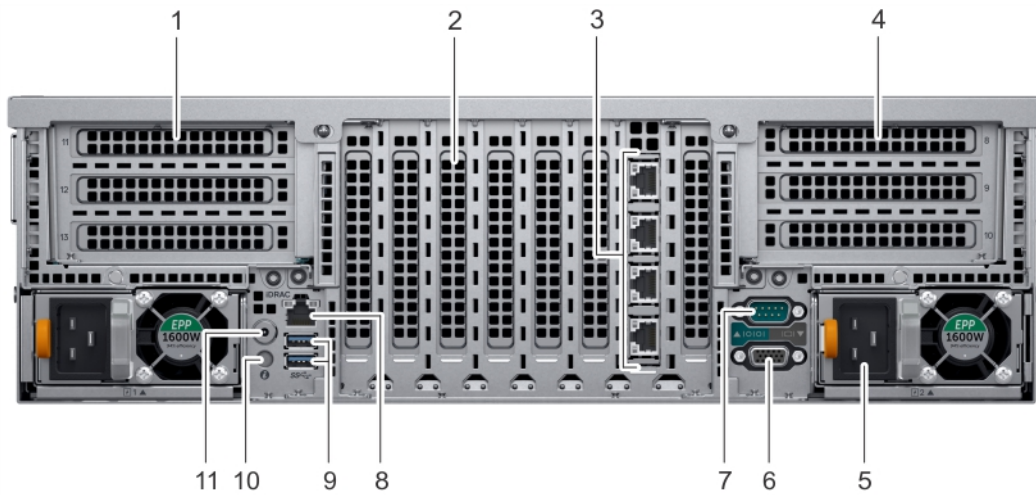


Figure 2. PowerEdge R940 back view

1. Full-height PCIe expansion card slot
2. Full-height PCIe expansion slots
3. Ethernet connector (4)
4. Full-height PCIe expansion card slot
5. Power supply unit (2)
6. Video port
7. Serial port
8. iDRAC9 Enterprise port
9. USB port
10. System identification button
11. Status indicator cable port

Control panels, LCD and LED

For more information about the PowerEdge R940 control panels, see the PowerEdge R940's Owner's Manual at Dell.com/Support/Manuals.

Quick Resource Locator (QRL)

The Embedded Service Tag (EST) is a generic QRL for R940 that links to the product webpage. The product webpage has links for system setup and service videos, iDRAC manual, and other documents related to R940. The QRL on the EST is unique to that service tag and will contain the Service Tag number and the iDRAC password. This QRL links to the product webpage that shows the exact configuration as built for that customer, and the specific warranty purchased.

The following image shows the service tag QRL label:



Figure 3. Service tag QRL label

Security features

The latest generation of PowerEdge servers has the features listed in the table to help ensure the security of your data center.

Table 3. Security features

Security feature	Description
Cover latch	A tooled latch is integrated in the top cover to secure it to the rack chassis.
TPM	The Trusted Platform Module (TPM) is used to generate/store keys, protect/authenticate passwords, and create/store digital certificates. TPM 1.2 is supported.
Power-off security	BIOS has the ability to disable the power button function.

Processor

The PowerEdge R940 server features the exceptional performance, value, and power efficiency of the Intel® Xeon® Scalable Processor. These processors can provide high performance no matter what your constraint—floor space, power, or budget—and on workloads that range from the most complicated scientific exploration to crucial web-serving and infrastructure applications. In addition to providing raw performance gains, improved I/O is also made possible with Intel Integrated I/O, which can reduce latency by adding more lanes and doubling bandwidth. This helps to reduce network and storage bottlenecks, which improves the processor performance capabilities.

Topics:

- [Processor Features](#)
- [Supported Processors](#)
- [Processor installation](#)
- [Chipset](#)

Processor Features

The Intel Xeon Scalable processor is the next generation core architecture with improved Instructions per Cycle (IPC) and other architectural improvements. The Intel Xeon Scalable processor features are as follows:

- Virtual address space of 48 bits and a physical address space of 46 bits.
- Intel Hyper-Threading Technology (Intel® HT Technology) when enabled allow each core to support two threads.
- First Level Cache (FLC) 64 KB total. The FLC is comprised of a 32 KB ICU (Instruction Cache) and 32 KB DCU (Data Cache).
- MB Mid-Level Cache (MLC) per core (non-inclusive with the LLC).
- Intel® Advanced Vector Extensions 512 (Intel® AVX-512) with a single AVX512 fused multiply add (FMA) execution units. SKUs which support Advanced RAS enable a 2nd FMA execution unit.

Supported Processors

The following table lists the supported processors for the PowerEdge R940 (including 1st and 2nd Generation of Intel Xeon Scalable processors):

Table 4. Supported Processors for R940

Medal	Processor	Frequency (GHz)	Cores/ Threads	R940
Platinum	8280	2.70	28/56	•
Platinum	8280M	2.70	28/56	•
Platinum	8280L	2.70	28/56	•
Platinum	8276	2.20	28/56	•
Platinum	8276M	2.20	28/56	•
Platinum	8276L	2.20	28/56	•
Platinum	8270	2.70	26/52	•
Platinum	8268	2.90	24/48	•
Platinum	8260	3.40	24/48	•
Platinum	8260M	2.40	24/48	•

Table 4. Supported Processors for R940 (continued)

Medal	Processor	Frequency (GHz)	Cores/ Threads	R940
Platinum	8260L	2.40	24/48	•
Platinum	8256	3.80	4/8	•
Platinum	8253	2.20	16/32	•
Platinum	8180M	2.5	28/56	•
Platinum	8180	2.5	28/56	•
Platinum	8176M	2.1	28/56	•
Platinum	8176	2.1	28/56	•
Platinum	8170M	2.1	26/52	•
Platinum	8170	2.1	26/52	•
Platinum	8168	2.7	24/48	•
Platinum	8164	2.0	26/52	•
Platinum	8160M	2.1	24/48	•
Platinum	8160	2.1	24/48	•
Platinum	8158	3.0	12/24	•
Platinum	8156	3.6	4/8	•
Platinum	8153	2.0	16/32	•
Gold	6254	3.10	18/36	•
Gold	6252	2.10	24/48	•
Gold	6248	2.50	20/40	•
Gold	6246	3.30	12/24	•
Gold	6244	3.60	8/16	•
Gold	6242	2.80	16/32	•
Gold	6240	2.60	18/36	•
Gold	6240M	2.60	18/36	•
Gold	6240L	2.60	18/36	•
Gold	6238	2.10	22/44	•
Gold	6238M	2.10	22/44	•
Gold	6238L	2.10	22/44	•
Gold	6234	3.30	8/16	•
Gold	6230	2.10	20/40	•
Gold	6226	2.70	12/24	•
Gold	6154	3.0	18/36	•
Gold	6152	2.1	22/44	•
Gold	6150	2.7	18/36	•
Gold	6148	2.4	20/40	•
Gold	6142M	2.6	16/32	•
Gold	6142	2.6	16/32	•

Table 4. Supported Processors for R940 (continued)

Medal	Processor	Frequency (GHz)	Cores/ Threads	R940
Gold	6140M	2.3	18/36	•
Gold	6140	2.3	18/36	•
Gold	6138	2.0	20/40	•
Gold	6136	3.0	12/24	•
Gold	6134M	3.2	8/16	•
Gold	6134	3.2	8/16	•
Gold	6132	2.6	14/28	•
Gold	6130	2.1	16/32	•
Gold	6128	3.4	6/12	•
Gold	6126	2.6	12/24	•
VM Density Optimized	6262V	1.90	24/48	•
VM Density Optimized	6222V	1.80	20/40	•
Gold	5222	3.80	4/8	•
Gold	5220	2.20	18/36	•
Gold	5218	2.30	16/32	•
Gold	5217	3.00	8/16	•
Gold	5215	2.50	10/20	•
Gold	5215M	2.50	10/20	•
Gold	5215L	2.50	10/20	•
Gold	5122	3.6	4/8	•
Gold	5120	2.2	14/28	•
Gold	5118	2.3	12/24	•
Gold	5115	2.4	10/20	•

NOTE: For the most up-to-date information on available processors, please visit www.dell.com/en-us/work/shop/povw/poweredge-r940 (view configurations) or talk to your Dell EMC representative.

Processor installation

For processor installation instructions, see the Dell PowerEdge R940 Hardware Owner's Manual.

Chipset

The Intel C620 PCH provides extensive I/O support. Functions and capabilities include:

- ACPI Power Management Logic Support, Revision 4.0a
- PCI Express* Base Specification Revision 3.0
- Integrated Serial ATA host controller, supports data transfer rates of up to 6 Gb/s on all ports.
- xHCI USB controller with SuperSpeed USB 3.0 ports
- Direct Media Interface
- Enhanced Serial Peripheral Interface

- Flexible I/O—Allows some high speed I/O signals to be configured as PCIe* root ports, PCIe* uplink for use with certain PCH SKUs, SATA (and sSATA), or USB 3.0.
- General Purpose Input Output (GPIO)
- Low Pin Count interface, interrupt controller, and timer functions
- System Management Bus Specification, Version 2.0
- Integrated Clock Controller / Real Time Clock Controller
- Intel® High Definition Audio and Intel® Smart Sound Technology
- Integrated 10/1 Gb Ethernet
- Integrated 10/100/1000 Mbps Ethernet MAC
- Supports Intel Rapid Storage Technology Enterprise
- Supports Intel Active Management Technology and Server Platform Services
- Supports Intel Virtualization Technology for Directed I/O
- Supports Intel Trusted Execution Technology
- JTAG Boundary Scan support
- Intel Trace Hub for debug

Memory

Each CPU has 12 memory DIMM slots. Those DIMMs are organized into six different channels so there are 2 DIMMs per channel. For best performance all memory channels should be populated with the same number of DIMMs, either 6 or 12 DIMMs per CPU.

Supported DIMM types are:


- RDIMMs (Registered DIMM) - Provides for higher capacity options and advanced RAS features. It is the most commonly used DIMM type, and offers the best mix of frequency, capacity, and rank structure choices.
- LRDIMMs (Load Reduced DIMM) - Provides maximum capacity beyond that of an RDIMM but at a higher power consumption. Uses a buffer to reduce memory loading to a single load on all DDR signals, allowing for greater density.
- NVDIMM-N (Non-Volatile DIMM) - Provides a persistent memory solution with NAND and DRAM that maintains data in power loss, system crash, or normal shutdown. This solution requires a battery as a power source for an AC loss condition. It can be used with RDIMMs.
- PMem (also known as Intel Optane persistent memory) - Provides a large memory capacity at an affordable price. Any application can take advantage of PMem in Memory Mode with a compatible operating system. Unlock more performance and persistency when using an application that supports App Direct Mode. PMem is used with RDIMMs or LRDIMMs, and a maximum number of 6 PMems can be used per CPU. This persistent memory technology does not require a battery.

Intel Optane persistent memory (PMem)

Intel Optane persistent memory is a new memory technology that allows customers to reach a large memory capacity at an affordable price. Also, when operating the memory in "App Direct Mode" the memory is persistent.

PMem comes in three different memory sizes, 128 GB, 256 GB, and 512 GB.

RDIMMs and LRDIMMs are used with Intel Optane persistent memory. Each channel is populated with up to one DIMM of DRAM and one DIMM of PMem. That means that each CPU has up to 6 DIMMs of DRAM and 6 DIMMs of PMem. For best performance, it is recommended to have all 12 DIMMs slots per CPU populated.

 **NOTE:** 2400 W PSU is required. View support documentation regarding additional details or restrictions at dell.com/support.

Intel Optane persistent memory operates in two modes, Memory Mode and Application Direct Mode:

Trait	Memory mode	App Direct Mode
Application support	Any application	Application must state that it supports "App Direct Mode"
DRAM	Used as cache and is not available as system memory.	Both PMem and DRAM are available as system memory.
Persistence	No	Yes

Supported memory

The table below lists the supported DIMMs for the R940.

Table 5. Supported memory for R940

DIMM Capacity (GB)	DIMM Type	DIMM Speed (MT/s)	Ranks per DIMM	Data Width
8 GB	RDIMM	2666	1	x8
16 GB	RDIMM	2933/2666	2	x8

Table 5. Supported memory for R940 (continued)

DIMM Capacity (GB)	DIMM Type	DIMM Speed (MT/s)	Ranks per DIMM	Data Width
32 GB	RDIMM	2933/2666	2	x4
64 GB	RDIMM	2933/2666	2	x4
64 GB	LRDIMM	2666	4	x4
128 GB	LRDIMM (3DS)	2666	8	x4
128 GB	LRDIMM (DDP)	2933	4	x4
16 GB	NVDIMM-N	2933/2666	-NA-	-NA-
128 GB	PMem	2666	-NA-	-NA-
256 GB	PMem	2666	-NA-	-NA-
512 GB	PMem	2666	-NA-	-NA-

DIMM speed and frequency

Table 6. DIMM speed and frequency

CPU Family	DIMM Type	DIMM Ranking	Capacity	Speed (MT/s)
Intel® Xeon® Scalable	RDIMM	1 R/2 R	8 GB, 16 GB, and 32 GB	2666
2nd Generation Intel® Xeon® Scalable	RDIMM	1 R	8 GB	2666
2nd Generation Intel® Xeon® Scalable	RDIMM	2 R	16 GB, 32 GB, and 64 GB	2933
Intel® Xeon® Scalable	LRDIMM	4 R/8 R	64 GB and 128 GB	2666
2nd Generation Intel® Xeon® Scalable	LRDIMM	8 R	128 GB	2666
2nd Generation Intel® Xeon® Scalable	PMem	-NA-	128 GB, 256 GB, and 512 GB	2666
Intel® Xeon® Scalable	NVDIMM	1 R	16 GB	2666
2nd Generation Intel® Xeon® Scalable	NVDIMM	1 R	16 GB	2933

Memory operating modes

Performance Optimized or Optimizer Mode: prioritizes performance and does not provide any RAS features beyond standard ECC (Error-Correcting Code).

Memory mirroring has two adjacent memory channels that are configured to write the same data to each channel. If one memory channel fails or encounters an error, the other channel continues to transmit data. It is an excellent safeguard for systems requiring uninterrupted operation, though it cuts memory capacity in half, can double the cost per GB, and can increase power consumption.

Fault resilient memory is a Dell patented technology that works with the VMWare ESXi Hypervisor to provide a fault resilient zone that protects virtual machines from the ramifications of memory faults.

Memory sparing can reduce downtime from correctable errors by allocating one rank (64-bit wide data area on a DIMM) per channel (Single Rank Spare Mode) or two ranks per channel (Multi Rank Spare Mode) as memory spares. If a correctable error occurs in a rank or channel, it is moved to the spare rank while the operating system is running. This prevents the error from causing a failure. Memory sparing reduces memory capacity by one rank per channel or two ranks per channel (depending if Single Rank or Multi Rank is selected) and can increase the cost per GB.

Storage

The PowerEdge R940 provides storage expandability that allows you to adapt to your workload and operational demands. With comprehensive storage options, the R940 offer various drive types, internal and external storage controllers, and different backplanes for varied number of drives.

Topics:

- [Supported hard drives](#)
- [RAID Controllers](#)
- [IDSDM with vFlash card](#)
- [External storage](#)

Supported hard drives

Table 7. Supported hard drives

Form factor	Type	Speed	Rotational speed	Capacities
2.5-inch	<ul style="list-style-type: none"> • SATA • SSD 	6 GB	N/A	400GB, 480GB, 800GB, 960GB, 1200GB, 1600GB, 1920GB, 3200GB, 3840GB, 960GB(SED FIPS), 1920GB(SED FIPS)
2.5-inch	<ul style="list-style-type: none"> • SATA 	6 GB	7.2 K	1TB, 2TB
2.5-inch	<ul style="list-style-type: none"> • SAS 	12 GB	7.2 K	1TB, 2TB, 2TB(SED FIPS)
2.5-inch	<ul style="list-style-type: none"> • SAS • SSD 	12 GB	N/A	400GB, 480GB, 800GB, 960GB, 1600GB, 1920GB, 3200GB, 3840GB, 7680GB, 15360GB, 1600GB(SED FIPS), 1920GB(SED FIPS), 3200GB(SED FIPS), 3840GB(SED FIPS)
2.5-inch	<ul style="list-style-type: none"> • SAS 	12 GB	10 K	600GB, 1.2TB, 1.8TB, 2.4TB, 1.2TB(SED FIPS), 2.4TB (SED FIPS)
2.5-inch	<ul style="list-style-type: none"> • SAS 	12 GB	15 K	300GB, 600GB, 900GB, 900GB (SED FIPS)

Supported NVMe drives

Table 8. Supported NVMe drives

Description
NVMe PM1735a 1.6 TB 2.5" PCIe SSD
NVMe PM1733a 1.9 TB 2.5" PCIe SSD
NVMe CD7 960 GB 2.5" PCIe SSD
NVMe CD7 1.92 TB 2.5" PCIe SSD

Table 8. Supported NVMe drives (continued)

Description
NVMe CD7 7.68 TB 2.5" PCIe SSD

RAID Controllers

The PowerEdge R940 supports full height PERC adapter form factor only in slot 1 (for primary) and slot 6 (for secondary), and does not support mini PERC form factors.

Table 9. PERC series offerings

Performance level	Controller and description
Entry	S140 (NVMe, M.2 SATA) SW RAID SATA
Value	H330+, 12Gb SAS HBA (External) Memory: None x8 12 Gb SAS x8 PCIe 3.0
Premium performance	H740P, H840 Memory: 4/8GB, NV 72-bit

IDSDM with vFlash card

The PowerEdge R940 system supports Internal Dual SD module (IDSDM) and vFlash card. In the latest generation of PowerEdge servers, IDSDM and vFlash card are combined into a single card module, and are available in these configurations:

- vFlash
- IDSDM
- vFlash and IDSDM

The IDSDM/vFlash card sits in the back of the system, in a Dell-proprietary slot. IDSDM/vFlash card supports three micro SD cards (two cards for IDSDM and one card for vFlash). Micro SD cards capacity for IDSDM are 16/32/64 GB while for vFlash the microSD card capacity is 16 GB.

Boot Optimized Storage Subsystem (BOSS)

BOSS is offered as a means of booting the latest servers to a full OS in the following scenarios:

- A solution such as IDSDM may be desired, but the target OS is a full OS (not just hypervisor).
- The user does not to trade off the standard hot-plug hard drive slot for OS install.

The Hardware RAID BOSS is a RAID controller with a limited feature set for the purpose of boot up to a full OS drive. The BOSS RAID controller presents M.2 SATA-only Solid State drives (SSD) as either Non-RAID disks or a single RAID1 volume configuration.

BOSS drives and cards are not hot-plug capable.

External storage

Table 10. Supported external storage devices

Device type	Description
External Tape	Supports connection to external USB tape products
NAS/IDM appliance software	Supports NAS software stack
JBOD	Supports connection to 12Gb MD-series JBODs

Tape drives

The R940 does not support internal tape drives. However, external tape backup devices will be supported. Below is a list of supported external tape drives:

- External RD1000 USB
- External LTO-5, LTO-6, and LTO-7 6 Gb SAS tape drives
- 114X rack mount chassis with LTO-5, LTO-6, and LTO-7 6 Gb SAS tape drives
- TL1000 with LTO-5, LTO-6, and LTO-7 6 Gb SAS tape drives
- TL2000 with LTO-5, LTO-6, and LTO-7 6 Gb SAS and 8Gb FC tape drives
- TL4000 with LTO-5, LTO-6, and LTO-7 6 Gb SAS and 8Gb FC tape drives
- ML6000 with LTO-5, LTO-6, and LTO-7 6 Gb SAS and 8Gb FC tape drives

Networking and PCIe

The PowerEdge R940 offer balanced, scalable I/O capabilities including integrated PCIe 3.0 expansion slots. Dell network adapters and daughtercards let you choose the right network fabric without using up valuable PCI slots. Pick the speed, technology, vendor and other options such as switching independent partitioning lets you share and manage bandwidth on 10 Gbe connections.

PCIe expansion

For information on card installation, requirements, and slot priorities, see the PowerEdge R940 Owner's Manual on [Dell.com/Support/Manuals](https://www.dell.com/support/manuals).

PCIe slots

Systems with 2 socket processors (without Processor Expansion Module) supports up to 7 PCIe Gen3 expansion slots. Systems with 4 socket processors (with Processor Expansion Module) supports up to 13 PCIe Gen3 expansion slots.

Topics:

- [PCIe expansion cards](#)

PCIe expansion cards

PCIe slot mapping

Table 11. PCIe slot mapping

Physical location	Slot number	Form factor	Controlling CPU	Slot electrical bandwidth/ Physical connector	Power	Length
Baseboard	1	Full height	CPU1	PCIe GEN3 x8 (x16 connector)	25 W	half length
Baseboard	2	Full height	CPU1	PCIe GEN3 x16 (x16 connector)	75 W	half length
Baseboard	3	Full height	CPU1	PCIe GEN3 x16 (x16 connector)	75 W	half length
Baseboard	4	Full height	CPU2	PCIe GEN3 x16 (x16 connector)	75 W	half length
Baseboard	5	Full height	CPU2	PCIe GEN3 x8 (x16 connector)	25 W	half length
Baseboard	6	Full height	CPU2	PCIe GEN3 x8 (x16 connector)	25 W	half length
Baseboard	7	Full height	CPU2	PCIe GEN3 x16 (x16 connector)	75 W	half length
Riser 2 on PEM for 4 socket configuration	8	Full height	CPU3	PCIe GEN3 x16 (x16 connector)	75 W	10.5" (~3/4 length)

Table 11. PCIe slot mapping (continued)

Physical location	Slot number	Form factor	Controlling CPU	Slot electrical bandwidth/ Physical connector	Power	Length
Riser 2 on PEM for 4 socket configuration	9	Full height	CPU3	PCIe GEN3 x16 (x16 connector)	25 W	half length
Riser 2 on PEM for 4 socket configuration	10	Full height	CPU3	PCIe GEN3 x16 (x16 connector)	25 W	half length
Riser 3 on PEM for 4 socket configuration	11	Full height	CPU4	PCIe GEN3 x16 (x16 connector)	75 W	10.5" (~3/4 length)
Riser 3 on PEM for 4 socket configuration	12	Full height	CPU4	PCIe GEN3 x16 (x16 connector)	25 W	half length
Riser 3 on PEM for 4 socket configuration	13	Full height	CPU4	PCIe GEN3 x16 (x16 connector)	25 W	half length

Power, thermal, and acoustics

Topics:

- Power, thermal and acoustics
- Power
- Thermal and acoustics
- Thermal
- Acoustical

Power, thermal and acoustics

PowerEdge servers have an extensive collection of sensors that automatically track thermal activity, which helps regulate temperature thereby reducing server noise and power consumption.

Power consumption and energy efficiency

Table 12. Power tools and technologies

Feature	Description
Power supply units (PSU) portfolio	Dell EMC's PSU portfolio includes intelligent features such as dynamically optimizing efficiency while maintaining availability and redundancy. Find additional information in the Power supply units section.
Tools for right-sizing	<p>Energy Smart Solution Advisor (ESSA) is a tool that can help you determine the most efficient configuration possible. With Dell EMC's ESSA, you can calculate the power consumption of your hardware, power infrastructure, and storage.</p> <p>ESSA can help you determine exactly how much power your server will use at a given workload, and the PSU Advisor can help you choose the best, most efficient PSU for your workload.</p> <p>Learn more at Dell.com/calc.</p> <p>Energy Smart Data Center Assessment is a Dell EMC Services offering that uses infrastructure and thermal analysis to help maximize system efficiency. Learn more at Dell.com/EnergySmart.</p>
Industry compliance	Dell EMC's servers are compliant with all relevant industry certifications and guidelines, including 80 PLUS, Climate Savers, and ENERGY STAR.
Power monitoring accuracy	<p>PSU power monitoring improvements include:</p> <ul style="list-style-type: none"> • Dell's power monitoring accuracy is currently 1%, whereas the industry standard is 5% • More accurate reporting of power • Better performance under a power cap
Power capping	Use Dell EMC's systems management to set the power cap limit for your systems to limit the output of a PSU and reduce system power consumption. Dell EMC is the first hardware

Table 12. Power tools and technologies (continued)

Feature	Description
	vendor to leverage Intel Node Manager for circuit- breaker fast capping.
Systems management	<p>iDRAC9 Enterprise provides server- level management that monitors, reports, and controls power consumption at the processor, memory, and system level.</p> <p>Dell OpenManage Power Center delivers group power management at the rack, row, and data center level for servers, power distribution units, and uninterruptible power supplies.</p>
Active power management	<p>Intel Node Manager is an embedded technology that provides individual server-level power reporting and power limiting functionality. Dell offers a complete power management solution comprised of Intel Node Manager accessed through Dell iDRAC9 Enterprise and OpenManage Power Center that allows policy- based management of power and thermal at the individual server, rack, and data center level.</p> <p>Hot spare reduces power consumption of redundant power supplies.</p> <p>Thermal control of fan speed optimizes the thermal settings for your environment to reduce fan consumption and lower system power consumption.</p> <p>Idle power enables Dell EMC servers to run as efficiently when idle as when at full workload.</p>
Fresh Air cooling	<p>FAC is supported with certain configuration limitations. With the thermal design and reliability of Dell EMC products, you can have the capability to operate at excursion- based temperatures beyond the industry standard of 35°C (95°F) without impacting your availability model. This solution takes into account servers, networking, storage, and other infrastructure.</p>
Rack infrastructure	<p>Dell offers some of the industry's highest- efficiency power infrastructure solutions, including:</p> <ul style="list-style-type: none"> ● Power Distribution Units (PDUs) ● Uninterruptible Power Supplies (UPSs) ● Energy Smart containment rack enclosures

Power

Energy Smart power supplies have intelligent features, such as the ability to dynamically optimize efficiency while maintaining availability and redundancy. Also featured are enhanced power-consumption reduction technologies, such as high-efficiency power conversion and advanced thermal-management techniques, and embedded power-management features, including high-accuracy power monitoring.

The following power supply unit options are available for the R940:

- 1100W,
- 1100W 380VDC
- 1100W 48DC
- 1600W
- 1600 W HLAC
- 2000W
- 2400W (UI)
- 2600 W HLAC

The PowerEdge R940 supports up to 2 AC or DC power supplies with 1+1 redundancy, auto sensing, and auto-switching capability.

Table 13. Power supply efficiency levels

Power supply output	Class	10%	20%	50%	100%
1100W AC	Platinum	89.00%	93.00%	94.50%	92.00%
1100W DC	Platinum	80.00%	88.00%	91.00%	88.00%
1600W AC	Platinum	87.00%	90.00%	94.00%	91.00%
2000W AC	Platinum	89.00%	93.00%	94.00%	91.00%
2400 AC	Platinum	89.00%	93.00%	94.00%	91.50%

Thermal and acoustics

Thermal management of PowerEdge R940 delivers high performance for the right amount of cooling to components at the lowest fan speeds across a wide range of ambient temperatures from 10°C to 35°C (50°F to 95°F) and to extended ambient temperature ranges (see Environmental Specifications) . The benefits to you are lower fan power consumption (lower server system power and data center power consumption) and greater acoustical versatility. The PowerEdge R940 is quiet enough to be used in an office environment in typical and minimum configurations.

Thermal

The thermal design of the PowerEdge R940 reflects the following:

- Optimized thermal design: The system layout is architected for optimum thermal design.
- System component placement and layout are designed to provide maximum airflow coverage to critical components with minimum expense of fan power.
- Comprehensive thermal management: The thermal control system regulates the fan speed based on several different responses from all system- component temperature sensors, as well as inventory for system configurations. Temperature monitoring includes components such as processors, DIMMs, chipset, the inlet air ambient, hard disk drives, NDC, and GPU.
- Open and closed loop thermal fan speed control: Open loop thermal control uses system configuration to determine fan speed based on inlet air ambient temperature. Closed loop thermal control method uses feedback temperatures to dynamically determine proper fan speeds.
- User-configurable settings: With the understanding and realization that every customer has unique set of circumstances or expectations from the system, in this generation of servers, we have introduced limited user- configurable settings residing in the iDRAC9 BIOS setup screen. For more information, see the PowerEdge R940 Owner’s Manual on Dell support.
- Cooling redundancy: The R940 allow N+1 fan redundancy, allowing continuous operation with one fan failure in the system.

Acoustical

The acoustical design of the PowerEdge R940 reflects the following:

- Versatility: The R940 saves power draw in the data center but are also quiet enough for office environment in typical and minimum configurations. You may find that the system is sufficiently quiet where the sound it emits blends into the environment.
- 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 and hums. One of the sound quality metrics in the Dell specification is prominence ratio of a tone.
- Noise ramp and descent at boot-up from power on: Fan speeds and noise levels ramp during the boot process (from power-on to power- on) in order to add a layer of protection for component cooling in the event that the system were not to boot properly. In order to keep the boot-up process as quiet as possible, the fan speed reached during boot-up is limited to about half of full speed.
- Noise level dependencies: If acoustics is important to you, several configuration choices and settings are important to consider:

- For lower acoustical output, use a small number of lower rotational- speed SATA hard drives, nearline SAS hard drives, or non-rotational devices like SSDs. 15k hard drives generate more acoustic noise than that of lower rotational- speed hard drives, and noise increases with number of hard drives.
- Fan speeds and noise may increase from baseline factory configurations if certain profiles are changed by the user or the system configurations are updated. The following is a list of items that impact fan speeds and acoustical output: 26 Power, thermal, and acoustics.
- iDRAC9 BIOS settings: Performance Per Watt (DAPC or OS) may be quieter than Performance or Dense Configuration (iDRAC Settings > Thermal > Max. Exhaust Temperature or Fan speed o-set).
- The quantity and type of PCIe cards installed: This affects overall system acoustics. Installation of more than two PCIe cards results in an increase in overall system acoustics.
- PCIe controller-based SSD drives: Drives such as Express flash drives and Fusion- IO cards require greater airflow for cooling, and result in significantly higher noise levels.
- Systems with an H330 PERC: This configuration may be quieter than those with an H730P PERC with battery backup. However, higher noise levels result when a system is configured as non-RAID.
- Hot spare feature of power supply unit: In the system default setting, the Hot Spare Feature is disabled; acoustical output from the power supplies is lowest in this setting.

Rack Rails

The rail offerings consist of sliding rails only.

The sliding rails allow the system to be fully extended out of the rack for service. There is also an optional Cable Management Arm (CMA) and optional Strain Relief Bar (SRB).

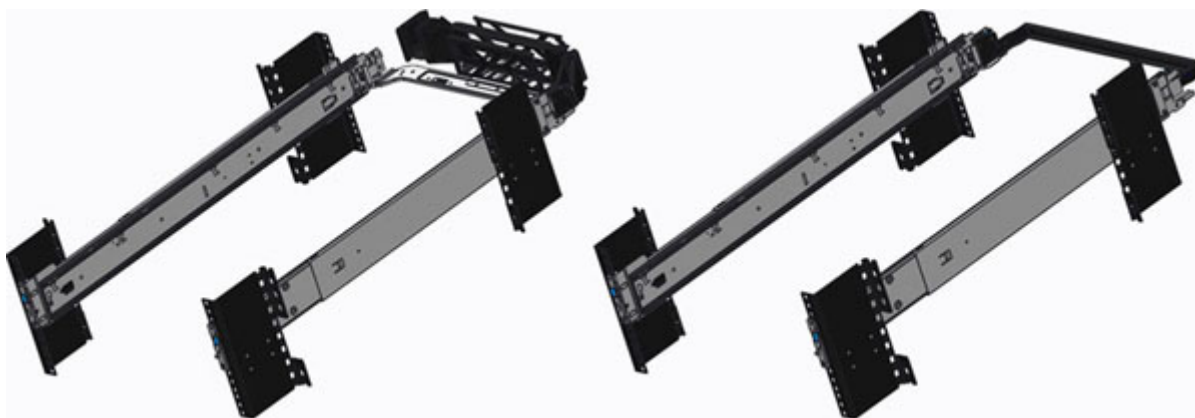


Figure 4. Sliding rails with optional CMA and optional SRB

One key factor in selecting the proper rails is identifying the type of rack in which they will be installed. Both the sliding rails and the static rails support tool-less mounting in 19"-wide, EIA-310-E-compliant square hole and unthreaded round hole 4-post racks. Both also support tooled mounting in threaded hole 4-post racks, but only the static rails, as the more universal solution, support mounting in 2-post (Telco) racks.

Table 14. Sliding rail

Product	Rail identifier	Rail type	Mounting interface	Rail adjustability range (mm)						Min rail mounting depth (mm)		
				Square		Round		Threaded		Without CMA or SRB	With CMA	With SRB
				min	max	min	max	min	max			
R940	B12	Sliding	ReadyRails II	600	894	586	887	600	909	773	926	877

NOTE: Screws are not included in either kit due to the fact that threaded racks are offered with a variety of thread designations. Users must therefore provide their own screws when mounting the rails in threaded racks.

NOTE: Screw head diameter for the sliding rails must be 10 mm or less.

Cable Management Arm (CMA) and Strain Relief Bar (SRB)

The optional cable management arm (CMA) and Strain Relief Bar (SRB) organizes and secures the cords and cables exiting the back of the server. The CMA supports up to medium size cable loads and unfolds to allow the server to extend out of the rack without having to detach the cables. The SRB is a bar that supports large cable loads and also allows the server to extend out of the rack without having to detach the cables if cable service loops are created.

Some key features of the CMA include:

- Large U-shaped baskets to support dense cable loads
- Open vent pattern for optimal airflow
- Ability to be mounted on either side by simply swinging the spring-loaded brackets from one side to the other

- Utilizes hook-and-loop straps rather than plastic tie wraps to eliminate the risk of cable damage during cycling
- Includes a low-profile fixed tray to both support and retain the CMA in its fully closed position
- Both the CMA and the tray mount without the use of tools via simple and intuitive snap-in designs

Some key features of the SRB include:

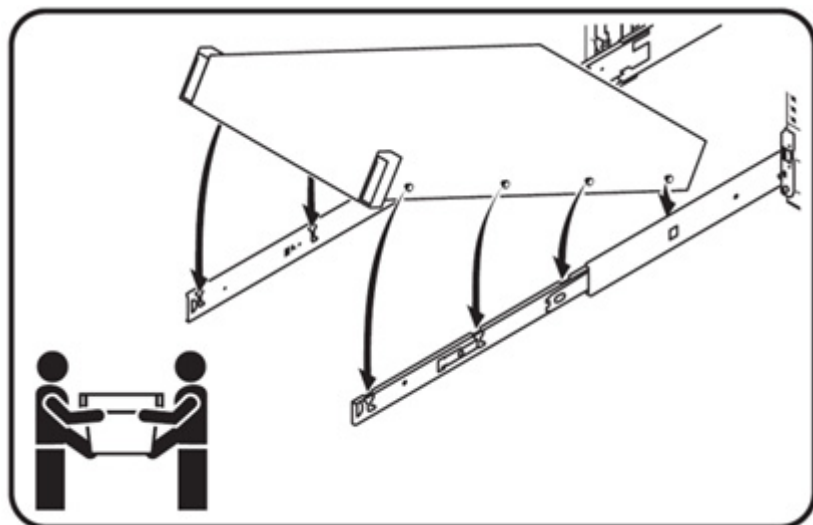
- Sturdy bar that supports large cable loads.
- Controls stresses on connectors.
- Utilizes hook-and-loop straps rather than plastic tie wraps to make securing cables quick and eliminates the risk of cable damage.
- Cables can be segregated into discrete, purpose specific bundles.
- Attaches to the rails without the use of tools via simple and intuitive latching design.

The CMA can be mounted to either side of the sliding rails without the use of tools or the need for conversion. However, it is recommended that it be mounted on the side opposite to the power supplies to allow easier access to the power supplies and rear hard drives (if applicable) for service or replacement.



Rack Installation

The sliding rails are a "drop-in" design. This means that the system is installed vertically into the rails by inserting the standoffs on the sides of the system into the "J-slots" in the inner rail members with the rails in the fully extended position. As with all 2U systems, a minimum of two people are required in order to properly install the system in the rails.



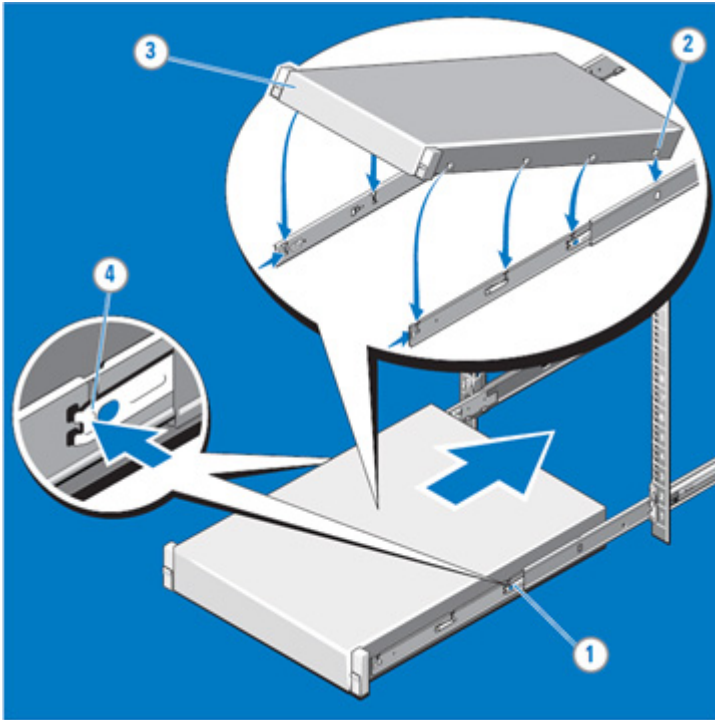
NOTE: The 2U system requires two people for installation due to its heavier weight.

Installing 14G Systems in Sliding Rails

To install the 14G system in sliding rails:

1. Pull the inner slide rails out of the rack until they lock into place.
 - Hold the system by its front and back ends and tilt the front end upward slightly.
 - Check the window on the sides of both rails to confirm that the heads of the standoffs are visible before adjusting or releasing your grip on the back end of the system.
 - Use your free hand to hold the rail against the side of the chassis if needed as the system is rotated downward into the remaining J-slots.

2. Locate the rear rail standoff on each side of the system and lower them into the rear J-slots of the slide assembly.
3. Rotate the system downward until all the rail standoffs are seated in the J-slots.
4. Push the system inward until the lock levers click into place. Press the slide-release lock buttons on both rails and slide the system into the rack.



Supported operating system

Table 15. Supported operating system

Operating system
Canonical® Ubuntu® Server LTS
Citrix® XenServer
Microsoft Windows Server® LTSC with Hyper-V
Oracle® Linux Red Hat® Enterprise Linux
SUSE® Linux Enterprise Server
VMware® ESXi

For specifications and interoperability details, see [Dell.com/OSsupport](https://www.dell.com/osupport).

Dell EMC OpenManage systems management

Dell EMC OpenManage Portfolio

Simplifying hardware management through ease of use and automation

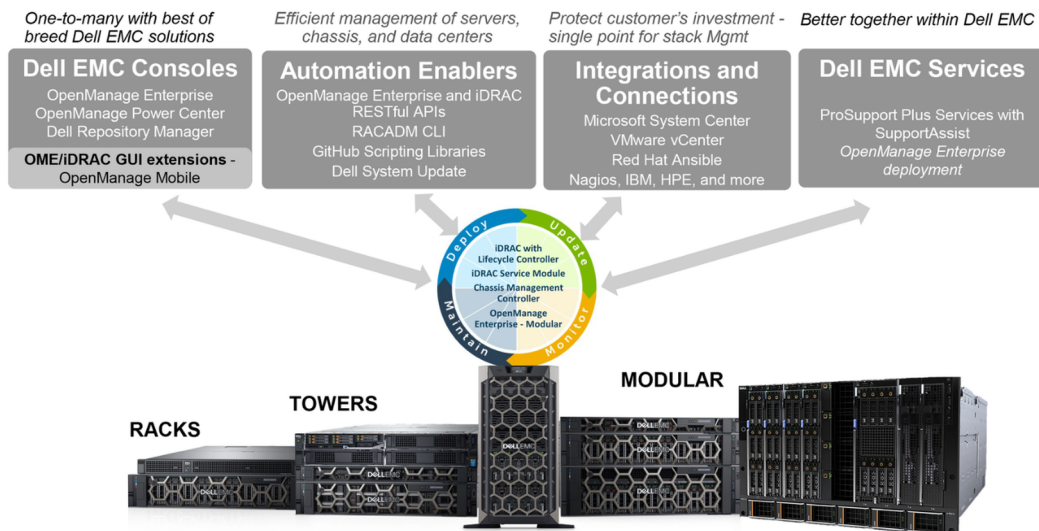


Figure 5. Dell EMC OpenManage Portfolio

Dell EMC delivers management solutions that help IT Administrators effectively deploy, update, monitor, and manage IT assets. OpenManage solutions and tools enable you to quickly respond to problems by helping them to manage Dell EMC servers effectively and efficiently; in physical, virtual, local, and remote environments, operating in-band, and out-of-band (agent-free). The OpenManage portfolio includes innovative embedded management tools such as the integrated Dell Remote Access Controller (iDRAC), Chassis Management Controller and Consoles like OpenManage Enterprise, OpenManage Power Manager plug in, and tools like Repository Manager.

Dell EMC has developed comprehensive systems management solutions based on open standards and has integrated with management consoles that can perform advanced management of Dell hardware. Dell EMC has connected or integrated the advanced management capabilities of Dell hardware into offerings from the industry's top systems management vendors and frameworks such as Ansible, thus making Dell EMC platforms easy to deploy, update, monitor, and manage.

The key tools for managing Dell EMC PowerEdge servers are iDRAC and the one-to-many OpenManage Enterprise console. OpenManage Enterprise helps the system administrators in complete lifecycle management of multiple generations of PowerEdge servers. Other tools such as Repository Manager, which enables simple yet comprehensive change management.

OpenManage tools integrate with systems management framework from other vendors such as VMware, Microsoft, Ansible, and ServiceNow. This enables you to use the skills of the IT staff to efficiently manage Dell EMC PowerEdge servers.

Topics:

- [Server and Chassis Managers](#)
- [Dell EMC Consoles](#)
- [Automation Enablers](#)
- [Integration with third-party consoles](#)
- [Connections for third-party consoles](#)
- [Dell EMC Update Utilities](#)
- [Dell resources](#)

Server and Chassis Managers

- Integrated Dell Remote Access Controller (iDRAC)
- iDRAC Service Module (iSM)

Dell EMC Consoles

- Dell EMC OpenManage Enterprise
- Dell EMC Repository Manager (DRM)
- Dell EMC OpenManage Enterprise Power Manager plugin to OpenManage Enterprise
- Dell EMC OpenManage Mobile (OMM)

Automation Enablers

- OpenManage Ansible Modules
- iDRAC RESTful APIs (Redfish)
- Standards-based APIs (Python, PowerShell)
- RACADM Command Line Interface (CLI)
- GitHub Scripting Libraries

Integration with third-party consoles

- Dell EMC OpenManage Integrations with Microsoft System Center
- Dell EMC OpenManage Integration for VMware vCenter (OMIVV)
- Dell EMC OpenManage Ansible Modules
- Dell EMC OpenManage Integration with ServiceNow

Connections for third-party consoles

- Micro Focus and other HPE tools
- OpenManage Connection for IBM Tivoli
- OpenManage Plug-in for Nagios Core and XI

Dell EMC Update Utilities


- Dell System Update (DSU)
- Dell EMC Repository Manager (DRM)
- Dell EMC Update Packages (DUP)
- Dell EMC Server Update Utility (SUU)
- Dell EMC Platform Specific Bootable ISO (PSBI)

Dell resources

For additional information about white papers, videos, blogs, forums, technical material, tools, usage examples, and other information, go to the OpenManage page at <https://www.dell.com/openmanagemanuals> or the following product pages:

Table 16. Dell resources

Resource	Location
Integrated Dell Remote Access Controller (iDRAC)	https://www.dell.com/idracmanuals
iDRAC Service Module (iSM)	https://www.dell.com/support/article/sln310557
OpenManage Ansible Modules	https://www.dell.com/support/article/sln310720
OpenManage Essentials (OME)	https://www.dell.com/support/article/sln310714
OpenManage Mobile (OMM)	https://www.dell.com/support/article/sln310980
OpenManage Integration for VMware vCenter (OMIVV)	https://www.dell.com/support/article/sln311238
OpenManage Integration for Microsoft System Center (OMIMSSC)	https://www.dell.com/support/article/sln312177
Dell EMC Repository Manager (DRM)	https://www.dell.com/support/article/sln312652
Dell EMC System Update (DSU)	https://www.dell.com/support/article/sln310654
Dell EMC Platform Specific Bootable ISO (PSBI)	Dell.com/support/article/sln296511
Dell EMC Chassis Management Controller (CMC)	www.dell.com/support/article/sln311283
OpenManage Connections for Partner Consoles	https://www.dell.com/support/article/sln312320
OpenManage Enterprise Power Manager	https://www.dell.com/solutions/openmanage/power-management.htm
OpenManage Integration with ServiceNow (OMISNOW)	Dell.com/support/article/sln317784

 **NOTE:** Features may vary by server. Please refer to the product page on <https://www.dell.com/manuals> for details.

Appendix A. Additional specifications

Topics:

- Chassis dimensions
- Environmental specifications
- Video specifications
- USB peripherals

Chassis dimensions

The following image shows the dimensions of the PowerEdge R940 chassis:

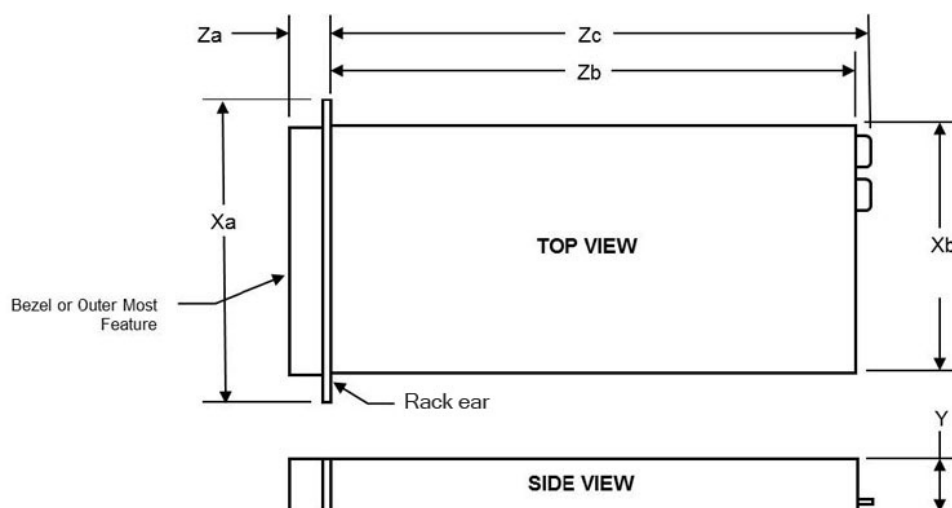


Figure 6. PowerEdge R940 chassis dimension

Table 17. Dimensions of the Dell PowerEdge R940

Xa	Xb	Y	Za with bezel	Za without bezel	Zb	Zc
482.0 mm	434.0 mm	130.3 mm	35.84 mm	22.0 mm	726.2 mm	777.046 mm

Environmental specifications

NOTE: For additional information about environmental measurements for specific system configurations, see [Dell.com/environmental_datasheets](https://www.dell.com/environmental_datasheets).

Table 18. Temperature specifications

Temperature	Specifications
Storage	-40°C to 65°C (-40°F to 149°F)
Continuous operation (for altitude less than 950 m or 3117 ft)	10°C to 35°C (50°F to 95°F) with no direct sunlight on the equipment.

Table 18. Temperature specifications (continued)

Temperature	Specifications
Maximum temperature gradient (operating and storage)	20°C/h (68°F/h)

Table 19. Relative humidity specifications

Relative humidity	Specifications
Storage	5% to 95% RH with 33°C (91°F) maximum dew point. Atmosphere must be non-condensing at all times.
Operating	10% to 80% relative humidity with 26°C (78.8°F) maximum dew point.

Table 20. Maximum vibration specifications

Maximum vibration	Specifications
Operating	0.26 G _{rms} at 5 Hz to 350 Hz (all operation orientations).
Storage	1.87 G _{rms} at 10 Hz to 500 Hz for 15 min (all six sides tested).

Table 21. Maximum shock specifications

Maximum shock	Specifications
Operating	Six consecutively executed shock pulses in the positive and negative x, y, and z axes of 6 G for up to 11 ms.
Storage	Six consecutively executed shock pulses in the positive and negative x, y, and z axes (one pulse on each side of the system) of 71 G for up to 2 ms.

Table 22. Maximum altitude specifications

Maximum altitude	Specifications
Operating	3048 m (10,000 ft)
Storage	12,000 m (39,370 ft)

Table 23. Operating temperature de-rating specifications

Operating temperature de-rating	Specifications
Up to 35°C (95°F)	Maximum temperature is reduced by 1°C/300 m (1°F/547 ft) above 950 m (3,117 ft).
35°C to 40°C (95°F to 104°F)	Maximum temperature is reduced by 1°C/175 m (1°F/319 ft) above 950 m (3,117 ft).
40°C to 45°C (104°F to 113°F)	Maximum temperature is reduced by 1°C/125 m (1°F/228 ft) above 950 m (3,117 ft).

Particulate and gaseous contamination specifications

The following table defines the limitations that help avoid any equipment damage or failure from particulates and gaseous contamination. If the levels of particulates or gaseous pollution exceed the specified limitations and result in equipment damage or failure, you may need to rectify the environmental conditions. Re-mediation of environmental conditions is the responsibility of the customer.

Table 24. Particulate contamination specifications

Particulate contamination	Specifications
Air filtration	Data center air filtration as defined by ISO Class 8 per ISO 14644-1 with a 95% upper confidence limit. <i>i</i> NOTE: This condition applies to data center environments only. Air filtration requirements do not apply to IT equipment designed to be used outside a data center, in environments such as an office or factory floor. <i>i</i> NOTE: Air entering the data center must have MERV11 or MERV13 filtration.
Conductive dust	Air must be free of conductive dust, zinc whiskers, or other conductive particles. <i>i</i> NOTE: This condition applies to data center and non-data center environments.
Corrosive dust	<ul style="list-style-type: none"> Air must be free of corrosive dust. Residual dust present in the air must have a deliquescent point less than 60% relative humidity. <i>i</i> NOTE: This condition applies to data center and non-data center environments.

Table 25. Gaseous contamination specifications

Gaseous contamination	Specifications
Copper coupon corrosion rate	<300 Å/month per Class G1 as defined by ANSI/ISA71.04-1985.
Silver coupon corrosion rate	<200 Å/month as defined by AHSRAE TC9.9.

i **NOTE:** Maximum corrosive contaminant levels measured at ≤50% relative humidity.

Standard operating temperature

Table 26. Standard operating temperature specifications

Standard operating temperature	Specifications
Continuous operation (for altitude less than 950 m or 3117 ft)	10°C to 35°C (50°F to 95°F) with no direct sunlight on the equipment.
Humidity percentage range	10% to 80% Relative Humidity with 26°C (78.8°F) maximum dew point.

Expanded operating temperature

Table 27. Expanded operating temperature specifications

Expanded operating temperature	Specifications
Less than or equal to 10% of annual operating hours	5°C to 40°C at 5% to 85% RH with 29°C dew point. <i>i</i> NOTE: Outside the standard operating temperature (10°C to 35°C), the system can operate continuously in temperatures as low as 5°C and as high as 40°C. For temperatures between 35°C and 40°C, de-rate maximum allowable dry bulb temperature by 1°C per 175 m above 950 m (1°F per 319 ft).
Less than or equal to 1% of annual operating hours	–5°C to 45°C at 5% to 90% RH with 29°C dew point.

Table 27. Expanded operating temperature specifications (continued)

Expanded operating temperature	Specifications
	<p>i NOTE: Outside the standard operating temperature (10°C to 35°C), the system can operate down to -5°C or up to 45°C for a maximum of 1% of its annual operating hours.</p> <p>For temperatures between 40°C and 45°C, de-rate maximum allowable temperature by 1°C per 125 m above 950 m (1°F per 228 ft).</p>

i **NOTE:** When operating in the expanded temperature range, system performance may be impacted.

i **NOTE:** When operating in the expanded temperature range, ambient temperature warnings maybe reported on the LCD panel and in the System Event Log.

Video specifications

Table 28. R940 video specifications

Resolution	Refresh rate	Horizontal frequency	Pixel clock
1024 x 768	60 Hz	48.4 kHz	65.0 MHz
1280 x 800	60 Hz	49.7 kHz	83.5 MHz
1280 x 1024	60 Hz	64.0 kHz	108.0 MHz
1360 x 768	60 Hz	47.71 kHz	85.5 M
1440 x 900	60 Hz	55.9 kHz	106.5 MHz
1600 x 900	60 Hz (RB)	55.54 kHz	97.75 M
1600 x 1200	60 Hz	75.0 kHz	162.0 MHz
1680 x 1050	60 Hz (RB)	64.7 kHz	119.0 MHz
1920 x 1080	60 Hz	67.158 kHz	173.0 MHz
1920 x 1200	60 Hz	74.556 kHz	193.25 MHz

*RB-Reduced Blanking for Digital Displays requiring less blank time. This was introduced for Signal Integrity improvements by reducing Pixel Clock rates for VGA-Analog input devices.

USB peripherals

USB peripherals are supported through the front and back USB ports on the R940. The front ports, back and internal ports are USB 3.0 compliant.

Appendix B. Standards compliance

Table 29. Industry standard documents

Standard	URL for information and specifications
ACPI Advance Configuration and Power Interface Specification, v2.0c	acpi.info
Ethernet IEEE 802.3-2005	standards.ieee.org/getieee802/802.3.html
HDG Hardware Design Guide Version 3.0 for Microsoft Windows Server	microsoft.com/whdc/system/platform/pcdesign/designguide/serverdg.msp
IPMI Intelligent Platform Management Interface, v2.0	intel.com/design/servers/ipmi
DDR4 Memory DDR4 SDRAM Specification	jedec.org/standards-documents/docs/jesd79-4.pdf
PCI Express PCI Express Base Specification Rev. 2.0 and 3.0	pcisig.com/specifications/pciexpress
PMBus Power System Management Protocol Specification, v1.2	pmbus.info/specs.html
SAS Serial Attached SCSI, v1.1	t10.org
SATA Serial ATA Rev. 2.6; SATA II, SATA 1.0a Extensions, Rev. 1.2	sata-io.org
SMBIOS System Management BIOS Reference Specification, v2.7	dmtf.org/standards/smbios
TPM Trusted Platform Module Specification, v1.2 and v2.0	trustedcomputinggroup.org
UEFI Unified Extensible Firmware Interface Specification, v2.1	uefi.org/specifications
USB Universal Serial Bus Specification, Rev. 2.0	usb.org/developers/docs

Appendix C. Additional resources

Table 30. Additional resources

Resource	Description of contents	Location
Installation and Service Manual	This manual, available in PDF format, provides the following information: <ul style="list-style-type: none"> • Chassis features • System Setup program • System messages • System codes and indicators • System BIOS • Remove and replace procedures • Troubleshooting • Diagnostics • Jumpers and connectors 	Dell.com/Support/Manuals
Getting Started Guide	This guide ships with the system, and is also available in PDF format. This guide provides the following information: <ul style="list-style-type: none"> • Initial setup steps • Key system features • Technical specifications 	Dell.com/Support/Manuals
Rack Installation Instructions	This document ships with the rack kits, and provides instructions for installing a server in a rack.	Dell.com/Support/Manuals
Information Update	This document ships with the system, is also available in PDF format online, and provides information on system updates.	Dell.com/Support/Manuals
System Information Label	The system information label documents the system board layout and system jumper settings. Text is minimized due to space limitations and translation considerations. The label size is standardized across platforms.	Inside the system chassis cover
Quick Resource Locator (QRL)	This code on the chassis can be scanned by a phone application to access additional information and resources for the server, including videos, reference materials, service tag information, and Dell contact information.	Inside the system chassis cover
Energy Smart Solution Advisor (ESSA)	The Dell online ESSA enables easier and more meaningful estimates to help you determine the most efficient configuration possible. Use ESSA to calculate the power consumption of your hardware, power infrastructure, and storage.	Dell.com/calc

Appendix D. Support and deployment services

Topics:

- [Server Deployment Services](#)
- [Dell EMC Remote Consulting Services](#)
- [Dell EMC Data Migration Service](#)
- [ProSupport Plus \(for business-critical servers\)](#)
- [ProSupport Enterprise Suite](#)
- [ProSupport](#)
- [ProSupport Flex for Data Center](#)
- [Additional professional services](#)
- [Dell Education Services](#)
- [Dell EMC Global Infrastructure Consulting Services](#)
- [Dell EMC Managed Services](#)

Server Deployment Services

Our Server Deployment Services can maximize the value of your servers quickly using our expert server deployment engineers. With over 10,000 server deployment projects each year, we have experience, best practices, and comprehensive deployment tools to install, configure, and integrate your new solution optimally and correctly. Our deployment experts will assess your environment and understand your goals, then design and integrate your server solution for you.

Table 31. Server deployment capabilities

	Server Installation	Server Integration
Place single server in target workspace	Yes	
Rack, cable, and label servers	Yes	
Install image	Yes	
Connect to network	Yes	Yes
Test and validate connection	Yes	Yes
Install operating system		Yes
Install applications		Yes
Perform advanced configuration services		Yes
Remote configuration services		Yes
Virtualization		Yes
Converged infrastructure		Yes
Test and validate data center integration		Yes

Dell EMC Remote Consulting Services

When you are in the final stages of your PowerEdge server implementation, you can rely on Dell EMC Remote Consulting Services and our certified technical experts to help you optimize your configuration with best practices for your software, virtualization, server, storage, networking, and systems management.

Dell EMC Data Migration Service

Protect your business and data with our single point of contact to manage your data migration project. Your project manager will work with our experienced team of experts to create a plan using industry-leading tools and proven processes based on global best practices to migrate your existing files and data so your business system get up and running quickly and smoothly.

ProSupport Plus (for business-critical servers)

When you purchase your PowerEdge server, we recommend ProSupport Plus, our proactive and preventative support for your business-critical systems. ProSupport Plus provides you with all the benefits of ProSupport, plus access to a dedicated Technical Account Manager and our elite ProSupport Plus engineers. ProSupport Plus gives you quick and efficient resolutions, working along with our [SupportAssist](#) technology that enables us to get ahead of issues in your environment before they become problems.

ProSupport Enterprise Suite

With Dell EMC ProSupport Services, we can help you keep your operation running smoothly, so you can focus on running your business. We will help you maintain peak performance and availability of your most essential workloads. Dell EMC ProSupport is a suite of support services that enable you to build the solution that is right for your organization. Choose support models based on how you use technology and where you want to allocate resources. From the desktop to the data center, address everyday IT challenges, such as unplanned downtime, mission-critical needs, data and asset protection, support planning, resource allocation, software application management and more. Optimize your IT resources by choosing the right support model.

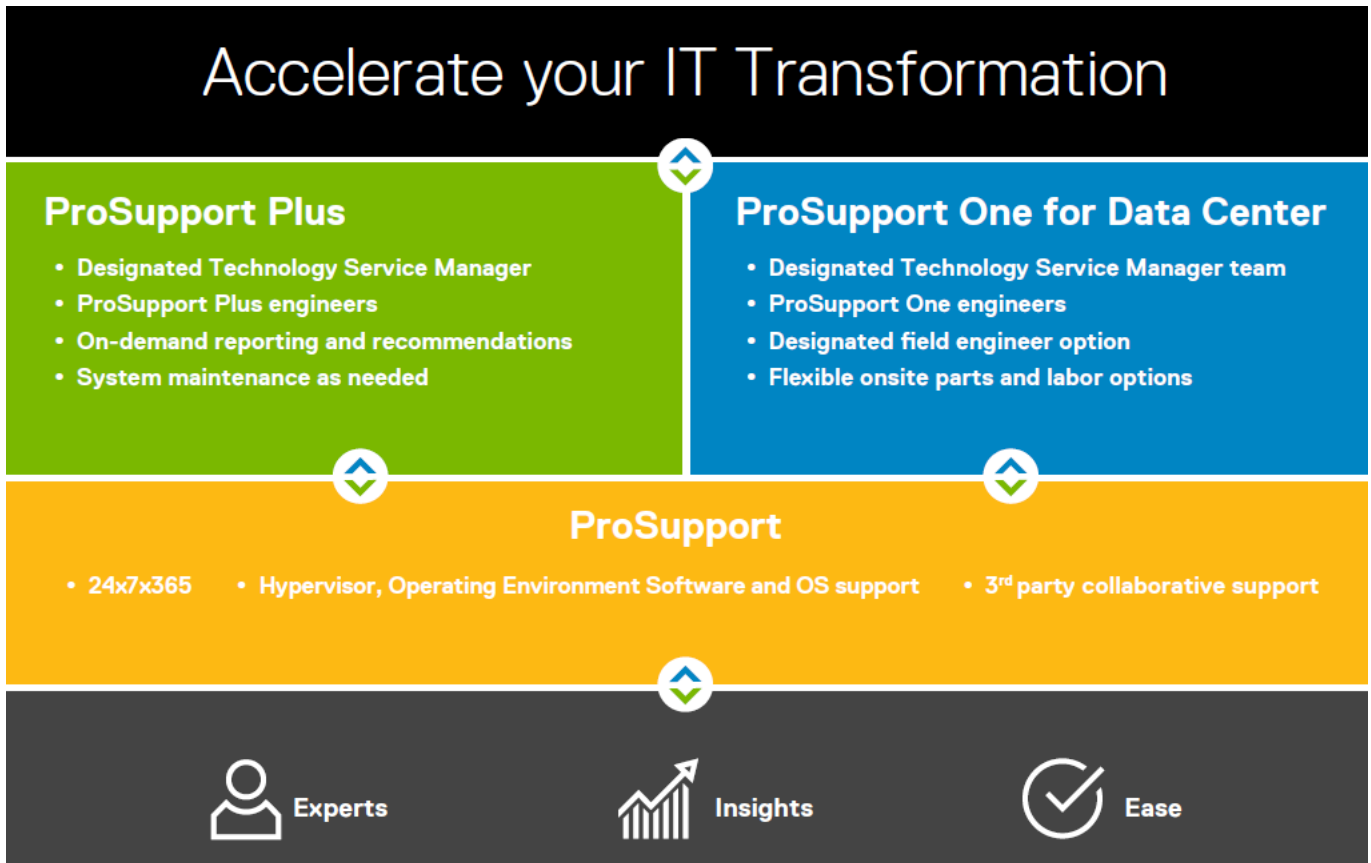


Figure 7. ProSupport Enterprise Suite

ProSupport

Our ProSupport service offers highly trained experts around the clock and around the globe to address your IT needs. We will help you minimize disruptions and maximize availability of your PowerEdge server workloads with:

- 24x7x365 access to certified hardware and software experts
- Collaborative 3rd party support
- Hypervisor and OS support
- Consistent level of support available for Dell EMC hardware, software and solutions
- Onsite parts and labor response options including next business day or four-hour mission critical

ProSupport Flex for Data Center

ProSupport Flex for Data Center offers flexible site-wide support for hyperscale data centers with more than 1,000 assets. Built on standard ProSupport components, Flex for Data Center leverages our global scale while being tailored to suit your needs. While not for everyone, it offers a flexible solution for those with large and complex environments. When you choose ProSupport Flex for Data Center, you will get:

- Enterprise-wide support that covers your entire data center.
- A dedicated Technical Account Manager with remote, on-site, part-time and full-time options.
- Dedicated elite ProSupport Flex technical and field engineers who are trained on your environment and configurations.
- Flexible on-site support and parts options that fit your operational model
- A tailored support plan for your operations staff.

	ProSupport	ProSupport Plus	ProSupport Flex for Data Center
Technical support access	24x7	24x7	24x7
Parts and labor response	NBD or Mission Critical	NBD or Mission Critical	Flexible
TechDirect online cases and dispatch	✓	✓	✓
SupportAssist remote monitoring	✓	✓	✓
Dispatch monitoring and crisis management	✓	✓	✓
Escalation management	✓	✓	✓
Hypervisor and OS support	✓	✓	✓
Collaborative 3 rd party software support	✓	✓	✓
SupportAssist proactive resolution	✓	✓	✓
Direct access to elite ProSupport Plus engineers		✓	✓
Dedicated Technical Account Manager		✓	✓
Monthly health check and performance recommendations		✓	✓
Monthly contract renewal and service history reporting		✓	✓
System maintenance (as needed)		✓	✓
Dedicated technical and field support teams			✓
Site-wide entitlement and contract			✓
Case management API			✓

Figure 8. ProSupport Enterprise Suite comparison

Additional professional services

Dell Education Services

Dell Education Services offers the PowerEdge server training courses designed to help you achieve more with your hardware investment. The curriculum is designed in conjunction with the server development team, as well as Dell EMC's technical support team, to ensure that the training delivers the information and practical, hands-on skills you and your team need to confidently manage and maintain your Dell EMC server solution. To learn more or register for a class today, visit LearnDell.com/Server.

Dell EMC Global Infrastructure Consulting Services

Dell EMC Global Infrastructure Consulting Services use skilled solution architects, innovative tools, automated analysis and Dell EMC's intellectual property to give rapid insight into the root causes of unnecessary complexity. We seek better answers than traditional service models, and our strategy is to help quickly identify high-impact, short-duration projects that deliver return on investment (ROI) and free up resources. The results are practical, action-oriented plans with specific, predictable, measurable outcomes. From data center optimization to server virtualization to systems management, our consulting services can help build a more efficient enterprise.

Dell EMC Managed Services

Dell EMC Managed Services are a modular set of lifecycle services designed to help you automate and centrally configure, deploy, and manage your day-to-day data center operations. These services extend your existing on-premise IT infrastructure with off-premise cloud services designed to better address challenges with mobility, highly distributed organizations, security, compliance, business continuity, and disaster preparedness.