

# Dell EMC PowerEdge VRTX

## 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.

# System overview

## Topics:

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

## Introduction

The Dell EMC PowerEdge VRTX brings order to chaos, redefines IT operations, and allows users to deploy performance anywhere. PowerEdge VRTX is a powerful, scalable, easy-to-manage solutions platform that is optimized for office environments. Clear up the complexity of disparate hardware, multiple management tools, and hardware sprawl with an optimized platform that integrates up to four PowerEdge M-series server nodes, storage, networking, and management into a compact 5U chassis.

With extensive scalability available inside the chassis, additional servers and hard drives can be inserted without the need for more floor space or rack space, and without any additional cables.

VRTX feature-rich, two-socket, half-height Dell EMC PowerEdge M520, M620, M630 and M640 server nodes and four-socket, full-height M820/M830 are proven platforms and technologies that deliver exceptional flexibility and scalable performance. With a choice of up to 12 x 3.5-inch or 25 x 2.5-inch hot-plug hard drives delivering up to 48 TB, VRTX is equipped with massive internal shared storage, keeping you ahead of the pace of data growth.

Integrate networking through the 1GbE internal switch module or an optional Ethernet pass-through module with eight 1GbE ports. Take advantage of flexible, expandable I/O with eight PCI Express® (PCIe) slots—three full-height or full-length and five low-profile or half-length. Capitalize with redundant 1100 W or 1600 W AC power supplies, fans, blower modules, and chassis management controllers.

## Simplified systems management

**Chassis Management Controller (CMC) of VRTX** reduces systems management tool proliferation and complexity by providing converged management of server nodes, shared storage, networking, and power in a single unified management console.

You can access the intuitive, easy to use GUI of **CMC** from a web browser, it works together with various Dell OpenManage™ tools including the integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller embedded in each server node. Embedded management in the VRTX platform allows IT administrators to simplify management of this platform in physical, virtual, local, and remote environments, and gives the choice of managing the system out-of-band, agent-free, or in-band with available systems management software agents.

**Unified management console of CMC** for the VRTX platform server nodes, storage, and networking devices reduces complexity, enhances productivity, and helps to enable maximum uptime. This in turn can reduce administration time and the cost of ownership. The CMC console can also monitor multiple VRTX systems at a glance, locally or remotely.

For local and remote monitoring and management of VRTX systems and other models of Dell servers, storage and networking platforms, OpenManage Essentials, a systems management console, is available. You can download it from <https://www.dell.com/support>. And exclusive to VRTX systems licensed with Enterprise-licensed CMC, OpenManage Essentials provides a geographical mapping view showing the location of each VRTX system that is accompanied with detailed information about the health status of each system and its components.

OpenManage embedded management capabilities also integrate and connect to leading third-party systems management solutions such as Microsoft®, VMWare®, and BMC Software®, so customer can leverage their existing IT investments and benefit from the simplified and automated management processes of iDRAC with Lifecycle Controller.

## Flexibility within a stable platform

VRTX is both flexible and stable. Flexible in its extensive hardware configurability and scalability, while consistent and uniform in performing systems management operations. These characteristics give users confidence that VRTX can readily adapt to accommodate new workload requirements, while protecting existing investments in hardware, software, management tools, and skills.

## Key Technologies

VRTX shared storage provides a massive amount of local storage within the chassis - up to 48 TB with the 3.5-inch hard drive chassis. The storage is shared among the server nodes and is managed through the CMC. Using the CMC, a user can create and assign virtual disks to single or multiple server nodes.

You can also use the CMC to assign PCIe slots to server nodes -up to four PCIe slots to a single-server node. Slots can be configured during initial setup so that any PCIe slot may be assigned to any server node, and the assignment may then be reassigned. Table summarizes other key technologies that are part of the PowerEdge VRTX platform.

**Table 1. Key technologies**

New technologies	Detailed descriptions
<b>Intel Xeon 2nd Generation Scalable Processors, processor E5-2400 and E5-2600 v2 product families and E5-2600 v3 series</b>	New Intel processors that work with the newest Intel series chipsets and are more advanced than previous generation processors, and delivering embedded PCIe lanes that improve I/O performance.
<b>Intel C620 and C610 series chipsets</b>	New Intel chips that replaced the ICH.
<b>2133-2933 MT/s DDR3/DDR4 memory</b>	Intel Xeon Scalable Processors support 2933MT/s DDR4 memory Advanced Intel Xeon E5-2600 processors support 1600MT/s memory; Intel Xeon E5-2600 v2 processors support 1866MT/s memory; Intel Xeon E5-2600 v3 processors support 2133MT/s memory.
<b>LRDIMM</b>	Load Reduced DIMM (LRDIMM), is designed with a buffer chip (or chips) to replace the register to help minimize loading. LRDIMMs can increase overall server system memory capacity and speed.
<b>Flexible LOM</b>	The Dell EMC Select Network Adapter option allows you to customize your LAN port combinations from choice of controller vendors.
<b>PERC S110 software RAID solution</b>	This new software RAID solution supports RAID 0, 1, 5, and 10; supports maximum of four hot-plug SATA hard drives or SATA solid-state drives.
<b>Dell PowerEdge RAID Controller (PERC) options</b>	VRTX supports the new PERC8 controller cards with improved functionality and faster performance.
<b>iDRAC with Lifecycle Controller</b>	The new embedded system management solution for Dell server features hardware, and firmware inventory, and alerting, in-depth memory alerting, faster performance, out-of-band management, and more.
<b>Advanced power management</b>	VRTX supports advanced power monitoring and power capping tools that can help manage power consumption.
<b>Fresh Air cooling</b>	Dell has tested and validated an integrated data center solution that enables you to operate at higher temperatures or even chiller-less.

**Table 1. Key technologies (continued)**

<b>Failsafe hypervisors</b>	The internal dual SD module enables unique failsafe virtualization architecture, ensuring uptime by providing failover capability for embedded hypervisors, such as VMware vSphere ® ESXi™ and Microsoft Windows Server ® 2012/2016 with Hyper-V ® .
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## System features

The Dell EMC PowerEdge VRTX integrates compute and storage capabilities through a 5U rackable tower chassis. VRTX supports up to four hot-plug PowerEdge M520, M620, M630 and M640 and M820/M830 server nodes. The M520, M620, M630 and M640 are half-height, two-socket blade servers. The M820/M830 is a half-height, four-socket blade server.

VRTX can be configured into four different chassis types:

- Tower form factor supporting up to 12 x 3.5-inch drives.
- Tower form factor supporting up to 25 x 2.5-inch drives.
- 5U rack form factor supporting up to 12 x 3.5-inch drives.
- 5U rack form factor supporting up to 25 x 2.5-inch drives.



**Figure 1. VRTX tower with 3.5-inch drives**



Figure 2. VRTX tower with 2.5-inch drives



**Figure 3. VRTX rack with 3.5-inch (top) and 2.5-inch (bottom) drives**

The chassis design of the VRTX is optimized for easy access to components, for effective air flow and efficient cooling. Components on the rear of the VRTX chassis includes the PCIe expansion cards, CMC ports, blower modules, and I/O modules.





Figure 4. VRTX rear view

Table 2. VRTX chassis features

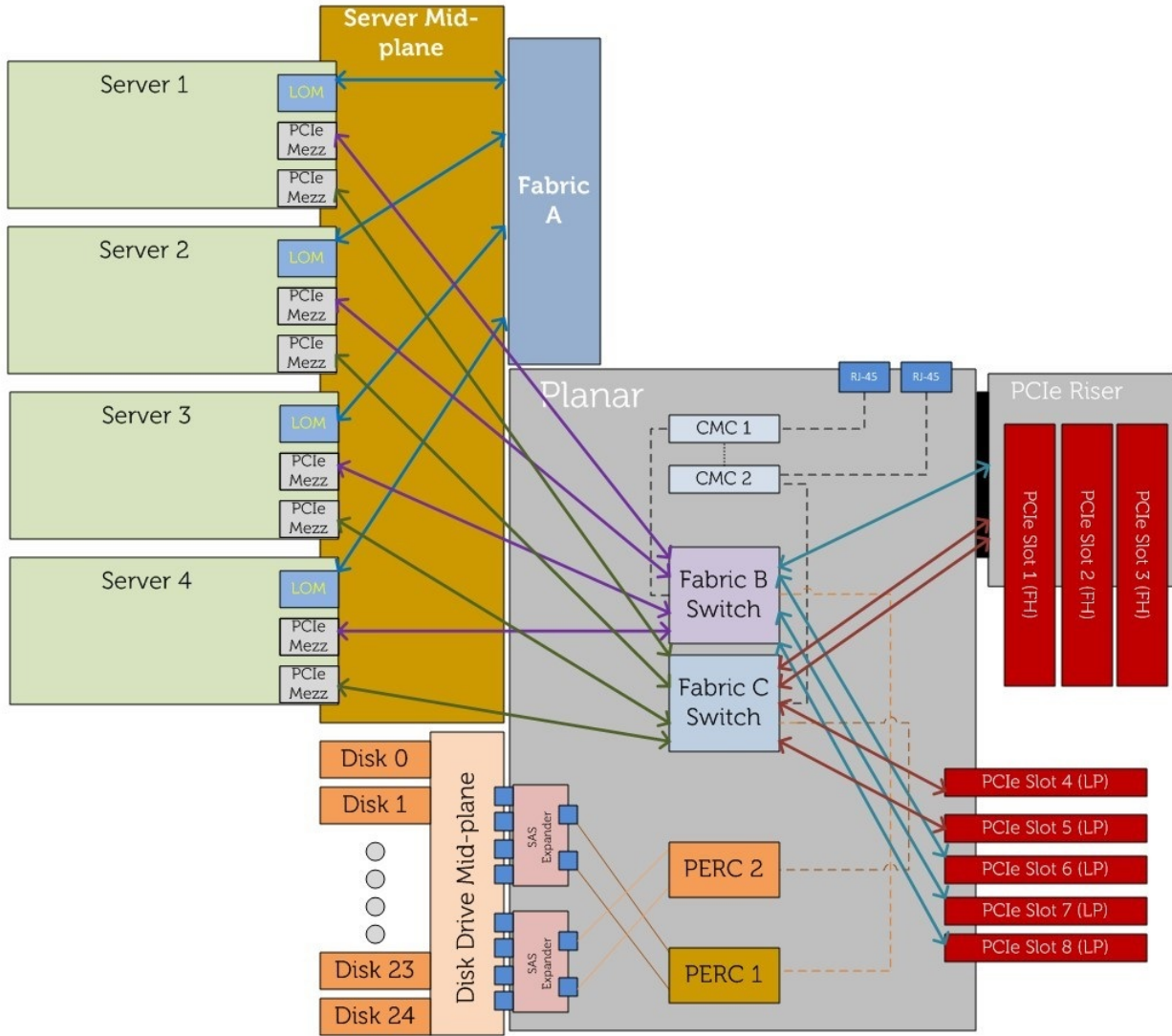
Feature	Description
<b>Power button</b>	Power on the system.
<b>LCD panel</b>	Provides system information and status or error messages
<b>Drives</b>	Up to 24 front-accessible, hot-plug, 2.5-inch drives or up to 12 front-accessible, hot-plug, 3.5-inch drives; see the <a href="#">Storage</a> section for details.
<b>USB connectors</b>	Two ports for keyboard and mouse connection
<b>Information tag</b>	Slide-out label panel for system information including the Express Service tab, with embedded NIC, and MAC address
<b>Video connector</b>	Connects a monitor to the system
<b>Optical drive</b>	Optional SATA DVD-ROM drive or DVD+/-RW drive
<b>Vents</b>	Vents for the temperature sensor
<b>Server nodes</b>	Dell EMC PowerEdge M520, M620, M630, M640 and M820/M830 server nodes
<b>Power supply units</b>	1100 W or 1600 W redundant power supply units: <ul style="list-style-type: none"> <li>• US/Canada: 110/220 V (typical)</li> <li>• EU/China: 220-240 V</li> <li>• Japan: 100/110 V</li> </ul>

**Table 2. VRTX chassis features (continued)**

Feature	Description
	<ul style="list-style-type: none"> <li>• Other: Up to 240 V</li> <li>• Redundant power supplies support 2+2 (AC redundancy) and 3+1 (power supply redundancy) modes</li> </ul>
<b>PCIe expansion card slots</b>	Connects up to 3 full-height and 5 low-profile PCIe expansion cards
<b>I/O module ports</b>	Network interface for I/O modules
<b>Serial connector</b>	DB-9 serial connector for local CMC configuration
<b>CMC ports</b>	2 ports; connects the primary CMC
<b>Blower modules</b>	4 modules provide cooling for the server modules
<b>Quick Resource Locator (QRL)</b>	Use a smartphone application to scan this code on the chassis to access additional information and resources for the server including videos, reference materials, service tag information, and Dell contact information.

**Table 3. VRTX security features**

Security feature	Description
<b>Cover latch</b>	An integrated tooled latch on the top cover with a coin keylock secures the system.
<b>Bezel</b>	An optional metal bezel mounted to the chassis front provide the Dell ID. A lock on the bezel is used to protect unauthorized access to hard drives. System status is viewable on the LCD screen when the bezel is installed.
<b>Trusted Platform Module (TPM)</b>	The TPM is used to generate/store keys, protect and authenticate passwords, and create/store digital certificates. It also supports the Intel Xeon TXT functionality. TPM can also be used to enable the BitLocker™ hard drive encryption feature in Windows Server 2008. TPM 1.2 is supported. No TPM version is available for China and Russia.
<b>Power-off security</b>	BIOS can disable the power button function.
<b>Intrusion alert</b>	When the cover is opened, the intrusion alert switch circuit closes to indicate intrusion to CMC. When enabled, the software provides notification that the cover has been opened.
<b>Secure mode</b>	For the server nodes, BIOS can enter a secure boot mode through Setup. This mode includes the option to lock out the server node power and server node NMI turns on the control panel or set up a system password.



**Figure 5. Block diagram of the PowerEdge VRTX platform**

For more detailed information about features and descriptions of the VRTX platform, see the *Dell EMC PowerEdge VRTX Systems Owner's Manual* on <https://www.dell.com/poweredgemanuals>

**Topics:**

- [Specifications](#)

## Specifications

Technical specifications for the PowerEdge VRTX platform. For the latest information about supported features, see <https://www.dell.com/poweredgemanuals>

**Table 4. Technical specifications**

Feature	Technical specification
<b>Form factor</b>	5U rackable tower chassis Tower configuration <ul style="list-style-type: none"> <li>• H: 48.4 cm (19.1 in) with system feet</li> </ul>

**Table 4. Technical specifications (continued)**

	<ul style="list-style-type: none"> <li>• W: 31.0 cm (12.2 in) with system feet opened</li> <li>• D: 73.0 cm (28.7 in)</li> <li>• Weight (empty) = 31.7 kg (69.7 lb)</li> <li>• Weight (maximum) = 74.8 kg (164.9 lb)</li> </ul> <p>Rack configuration</p> <ul style="list-style-type: none"> <li>• H: 21.9 cm (8.6 in)</li> <li>• W: 48.2 cm (19.0 in)</li> <li>• D: 73.0 cm (28.7 in)</li> <li>• Weight (empty) = 24.7 kg (54.5 lb)</li> <li>• Weight (maximum) = 68.7 kg (151.5 lb)</li> </ul>
<b>Server node options</b>	Dell PowerEdge M520, M620, M630, and M820 server nodes
<b>Storage</b>	Shared PERC8
<b>Power supplies</b>	<p>1100 W or 1600 W redundant power supply units:</p> <ul style="list-style-type: none"> <li>• US or Canada: 110/220 V (typical)</li> <li>• EU or China: 220-240 V</li> <li>• Japan: 100/110 V</li> <li>• Other: Up to 240 V</li> <li>• Redundant power supplies support 2+2 (AC redundancy) and 3+1 (power supply redundancy).</li> </ul>
<b>Cooling</b>	<p>VRTX comes standard with 6 hot-pluggable, redundant fan modules and 4 blower modules.</p> <ul style="list-style-type: none"> <li>• Based on Dell Energy Smart Technologies, VRTX fans and blowers are a breakthrough in power and cooling efficiency.</li> <li>• The fans and blowers consume low-power, but also use next-generation fan technologies to ensure that the lowest possible amount of fresh air is consumed to cool the enclosure.</li> </ul>
<b>Input devices</b>	<ul style="list-style-type: none"> <li>• Front control panel with interactive graphical LCD <ul style="list-style-type: none"> <li>&gt; Supports initial configuration wizard</li> <li>&gt; Local server blade, enclosure, module information, and troubleshooting</li> </ul> </li> <li>• Two USB keyboard/mouse connections and one video connection for local front "crash cart" console connections</li> <li>• Optional DVD-RW</li> </ul>
<b>Drive bays and hard drives</b>	<p>Up to 12 x 3.5 in. NLSAS or SAS hot-plug drives or</p> <p>Up to 25 x 2.5 in. NLSAS, SAS, or SAS SSD hot-plug drives.</p>
<b>Embedded NIC</b>	<p>1 GbE internal switch module (standard) with 16 internal 1 GbE ports and 8 external ports</p> <p>Ethernet pass-through module with 8 external ports (optional)</p>
<b>I/O slots</b>	<p>8 x flexible PCIe slots</p> <ul style="list-style-type: none"> <li>• 3 x full-height or full-length slots (150 W) with double-wide card support (225 W)</li> <li>• 5 x low-profile or half-length slots (25 W)</li> </ul>
<b>Systems management</b>	Chassis Management Controller (CMC), a unified management tool, manages all resources - server nodes, storage, networking, and power inside the chassis.

**Table 4. Technical specifications (continued)**

	<ul style="list-style-type: none"><li>• Delivers comprehensive functionality that is easy to use</li><li>• Monitors up to nine VRTX systems (up to 36 servers) from a single, consolidated CMC console</li><li>• Local and remote management</li><li>• Enterprise or Express CMC licensing</li><li>• Redundant CMC</li><li>• Server nodes each contain proven iDRAC with Lifecycle Controller for agent- free systems management that is fully supported within the OpenManage product portfolio and select third-party management solutions.</li></ul>
<b>Rack support</b>	ReadyRails™ II sliding rails for 4 post racks with square, round, or threaded holes

# Processors

See *Dell PowerEdge M520 Technical Guide*, *Dell PowerEdge M620 Technical Guide*, *Dell PowerEdge M820 Technical Guide*, *Dell PowerEdge M640 Technical Guide*, and *Dell PowerEdge M830 Technical Guide* on <https://www.dell.com/poweredgemanuals> for detailed information about supported processors.

For more information about the Intel® Xeon® Scalable processor family and E5 product family, see [Intel.com](https://www.intel.com)

# Memory

See the *Dell PowerEdge M520 Technical Guide*, the *Dell PowerEdge M620 Technical Guide*, the *Dell PowerEdge M820 Technical Guide*, the *M640 Technical Guide*, and the *M830 Technical Guide* on <https://www.dell.com/poweredgemanuals> for detailed information about supported memory.

# Storage

The PowerEdge VRTX platform provides comprehensive, shared internal storage options, including several drive types to choose from. VRTX supports up to 48 TB of internal, low-latency storage.

All four server nodes have access to the full storage space. Each server node sees the storage as its own singular storage pool. You can assign virtual disks to single-server nodes or across server nodes (with clustering) using the CMC.

## Topics:

- Infrastructure
- Supported hard drives
- PERC8/PERC9 storage controller

## Infrastructure

One of the key differentiators for VRTX is the integrated shared storage. Virtualization support at remote sites requires shared storage for VM migration. To date, shared storage solutions have been too expensive for these applications, however VRTX can leverage existing PERC technology to deliver a low-cost 6 Gb/s directly-attached storage (DAS) solution and virtualization support.

The PERC provides multiple channels of virtual I/O. PCIe switches help to map virtual functions to multiple servers through virtual PCIe hierarchies. CMC has a web interface that you can use to create maps to the servers, and create, and assign corresponding virtual drives.

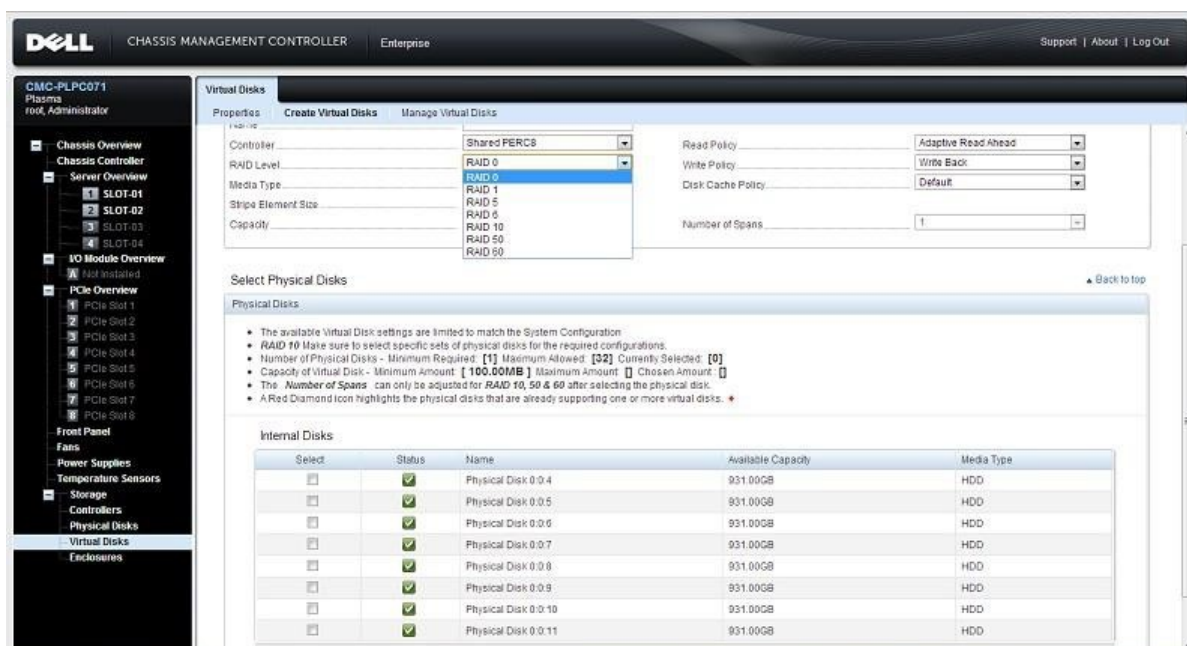


Figure 6. CMC Virtual Disks tab

## Supported hard drives

The VRTX shared storage supports the listed internal drives.



Form factor	Type	Speed (RPM)	Capacities
2.5-inch	Nearline SAS (6 Gb)	7.2 K	500 GB, 1 TB
	SAS (6 Gb)	10 K	600 GB, 900 GB, 1.2 TB
	SAS (6 Gb)	15 K	146 GB, 300 GB
	SSD (SLC)	N/A	200 GB, 400 GB, 800 GB
3.5-inch	Nearline SAS (6 Gb)	7.2 K	1 TB, 2 TB, 3 TB, 4 TB
	SAS (6 Gb)	10 K	600 GB, 900 GB, 1.2 TB
	SAS (6 Gb)	15 K	300 GB, 450 GB, 600 GB

For the latest information about supported hard drives, see <https://www.dell.com/poweredge/manuals>.

## PERC8/PERC9 storage controller

The shared PERC8 or PERC9 (depending on your server model) card is located between the storage array and the power distribution board on the VRTX planar. The shared PERC8 slot routes SAS to the nearby planar mini-SAS connectors, which are used to internally cable SAS from the PERC to the SAS expander cards in the storage array.

The VRTX shared PERC8 or PERC9 cards have additional features, beyond a standard monolithic PERC-mini card, at the driver and firmware level to support shared storage and fault tolerance. A unique PCIe ID is used to indicate shared storage capability and compatibility in the VRTX system.

The VRTX offers the following RAID options:

- M630/M830: H330, H730, H730P, PERC S130
- M640: H330, H730P, BOSS-M.2 SATA, PERC S140

For more information about the latest PERC offerings, see <https://www.dell.com/koa/search?q=perc#q=perc&t=default&sort=relevancy&layout=card&@dpsalessegment:radioGroup=dhs>.

# Networking

VRTX supports up to eight Ethernet connections on the back of the system. The Fabric A infrastructure supports either a pass-through or a switch card that is installed in the back of the chassis. These cards plug directly into the midplane.

Physical restraints in the Fabric A are:

- Fabric A internal connections that are limited to four server nodes times four lanes, or 16 lanes total
- Fabric A bulkhead space for external connection is limited to eight RJ45 connectors.
- Fabric A is limited to a single cold service card.
- For Fabric A, the M520 uses a quad-port 1 GbE LOM. The M620 has 10 GbE network daughter card (NDC) options for Fabric A that includes Broadcom® and Intel cards that are compatible with 1 GbE. The M630 and M640 have both 1 GbE and 10 GbE NDC options.

## Topics:

- [Fabric A system management](#)
- [Fabric A pass-through cards](#)
- [Fabric A switches](#)

## Fabric A system management

The system management paradigm for Fabric A is non-redundant. A single SMBus, serial port, or Ethernet management fabric is presented to the CMC for Fabric A, including the pass-through mode which is fabric redundant.

## Fabric A pass-through cards

The 1 Gb Ethernet pass-through card is defined as having no single points of failure at the Ethernet signal level. Maximum Ethernet signal pass-through is limited to eight lanes due to the bulkhead limit of eight RJ45 connectors.

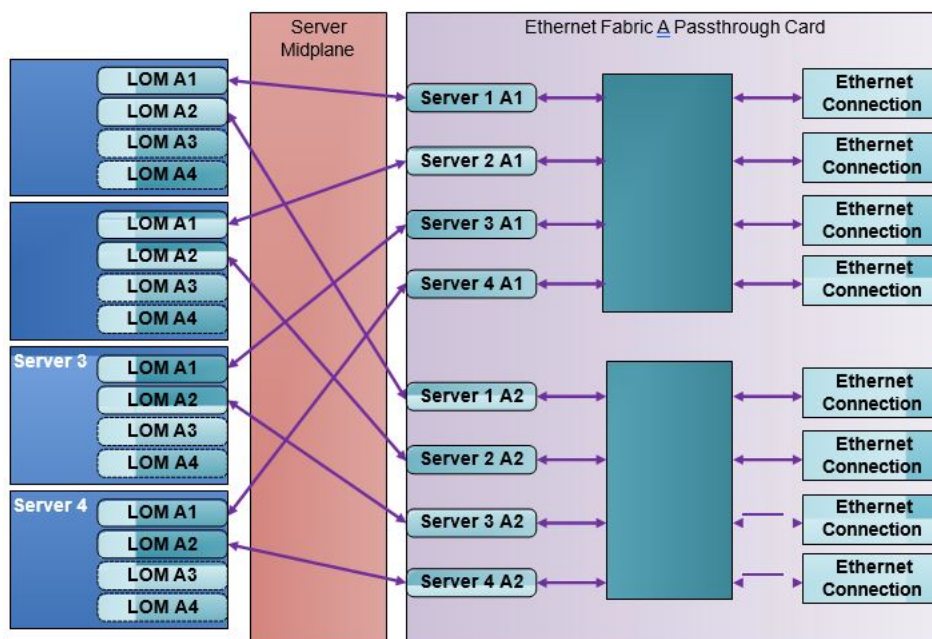


Figure 7. Fabric A Ethernet pass-through card configuration

# Fabric A switches

A single switch is implemented for all I/O, and allows maximum signal consolidation without forcing bifurcation of the Ethernet fabric. Switches accept up to 16 lanes from Fabric A and output up to eight lanes at the external ports. A switch is the only Fabric A card that can support the full four-lane count from Fabric A. When equipped with four servers and quad-port LOMs, VRTX can take full advantage of all 16 internal ports (four per server node).

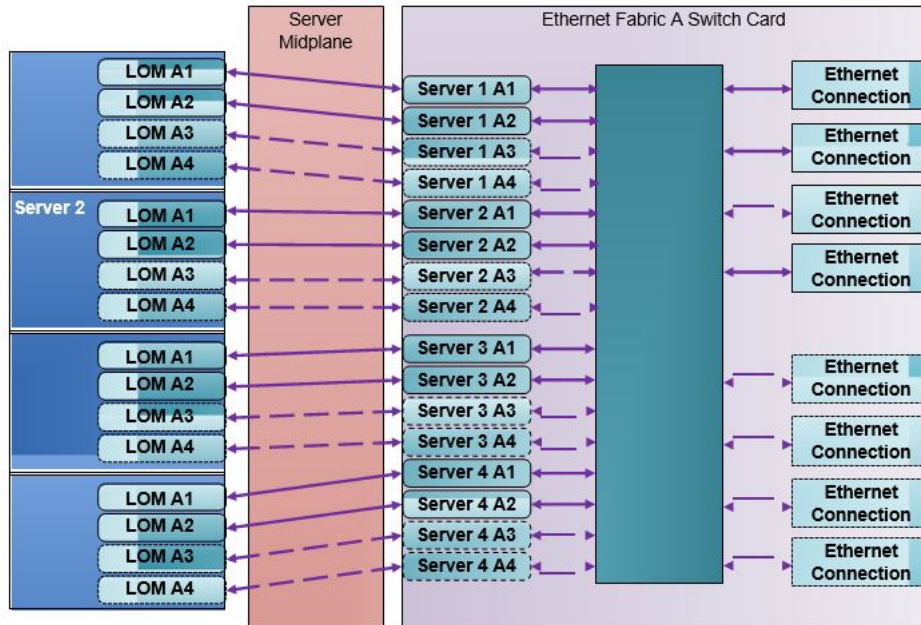


Figure 8. Fabric A Ethernet switch configuration

# PCIe infrastructure

Instead of using traditional I/O modules for Fabric B or Fabric C, Dell EMC designed the PowerEdge VRTX to use PCIe slots using two PCIe switches - one for Fabric B and one for Fabric C. Each PCIe switch ties into one of the two mezzanine cards on the server nodes.

The Fabric B PCIe switch provides connectivity to the following:

- PCIe slot 3
- PCIe slot 6
- PCIe slot 7
- PCIe slot 8
- Shared PowerEdge RAID Controller (SPERC) 1

The Fabric C PCIe switch provides connectivity to the following:

- PCIe slot 1
- PCIe slot 2
- PCIe slot 4
- PCIe slot 5
- SPERC 2

PCIe slots are nonshared and thereby dedicated to one server node within the VRTX system. The PCIe slots can be reassigned to a different server through the CMC as needed. Each slot can be exclusively assigned to any server node, although it requires powering the server node off. You can assign up to four PCIe slots to one server node.

## Topics:

- [Supported PCIe Cards](#)

## Supported PCIe Cards

VRTX supports the following PCIe expansion cards.

- AMD® FirePro™ W7000
- NVIDIA® K2 active GPGPU (full height)
- 6 Gb/s SAS HBA (low-profile and full-height) – compatible with M520, M620, and M820 only
- Broadcom dual-port 1 Gb Base-T (low-profile and full-height)
- Broadcom quad-port 1 Gb Base-T (low-profile and full-height)
- Intel dual-port 1 Gb Base-T (low-profile and full-height)
- Intel dual-port 10 Gb Base-T (low-profile and full-height)
- Intel dual-port 10 Gb Base-SFP+ (low-profile and full-height)
- Intel quad-port 1 Gb Base-T (low-profile and full-height)
- Intel quad-port 10 Gb Base-SFP+ (low-profile and full-height)
- Broadcom dual-port 10 Gb Base-SFP+ (low-profile and full-height)
- Broadcom dual-port 10 Gb Base-T (low-profile and full-height)
- Emulex® FC8: LPe12002 8 Gb/s Dual Port (low profile and full height)
- Qlogic® FC16 single-port HBA (low profile and full height) – compatible with M630 only
- Micron® P420M MLC PCIe 1.4 TB Solid-State Storage Card (full height) – compatible with M630 only
- Micron P420M MLC PCIe 700 GB Solid-State Storage Card (full height) – compatible with M630 only

# Power, thermal, and acoustics

Lower overall system- **level power draw is a result of breakthrough system design by Dell EMC.** The PowerEdge VRTX chassis maximizes performance-per-watt through a combination of power and cooling, energy-efficient technologies, and tools. Also, VRTX has an extensive collection of sensors that automatically track thermal activity, which helps regulate temperature by reducing server noise and power consumption.

## Topics:

- [Power consumption and energy efficiency](#)
- [Power supply units](#)
- [Thermal](#)
- [Acoustics](#)

## Power consumption and energy efficiency

PowerEdge VRTX has an extensive collection of sensors that automatically track thermal activity, and helps to regulate temperature and reduce server noise and power consumption.

**Table 5. Power tools and technologies**


Feature	Description
<b>Power supply units (PSU) portfolio</b>	Dell EMC's PSU portfolio includes intelligent features such as dynamically optimizing efficiency while maintaining availability and redundancy.
<b>Tools for right-sizing</b>	<b>Energy Smart Solution Advisor (ESSA)</b> helps 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. ESSA can help you determine the power your server uses at a given workload, and the PSU advisor can help you choose the best, most efficient PSU for your workload. Learn more at <a href="http://Dell.com/ESSA">Dell.com/ESSA</a> .
<b>Industry compliance</b>	Dell EMC's servers are compliant with all relevant industry certifications and guidelines, including 80 PLUS Climate Savers and ENERGY STAR®.
<b>Power monitoring accuracy</b>	PSU power monitoring improvements include: <ul style="list-style-type: none"> <li>• Power monitoring accuracy of 1%, lower than the industry standard is 5%</li> <li>• Higher power reporting accuracy</li> <li>• Better performance under a power cap</li> </ul>
<b>Power capping</b>	Use Dell EMC's systems management software to set your system power cap to limit the output of a PSU and reduce system power consumption.
<b>Systems management</b>	<b>iDRAC8/9 Enterprise</b> provides server-level management that monitors, reports, and controls power consumption at the processor, memory, and system level.  <b>Dell EMC OpenManage Power Center</b> delivers group power management at the rack, row, and data center level for

**Table 5. Power tools and technologies (continued)**


	servers, power distribution units (PDUs), and uninterruptible power supplies.
<b>Active power management</b>	<p><b>Intel Node Manager</b> is an embedded technology that provides individual server-level power reporting and power limiting functionality. Dell EMC offers a complete power management solution that consists of Intel Node Manager that is accessed through iDRAC with an Enterprise license and OpenManage Power Center that allows policy-based management of power and thermals at the individual server, rack, and data center level.</p> <p><b>Hot spare</b> reduces power consumption of redundant power supplies.</p> <p><b>Thermal control of fan speed</b> optimizes the thermal settings for your environment to reduce fan consumption and lower system power consumption.</p> <p><b>Idle power</b> enables Dell servers to run as efficiently when idle as when at full workload.</p>
<b>Fresh Air cooling</b>	With the thermal design and reliability of Dell EMC products, you can operate at excursion-based temperatures. This solution is comprised of servers, networking, storage, and infrastructure that run beyond the industry standard of 35°C (95°F) without impacting your availability model. For more information, see <a href="http://Dell.com/FreshAir">Dell.com/FreshAir</a> .
<b>Rack infrastructure</b>	<p>Dell EMC offers some of the industry's highest -efficiency power infrastructure solutions, including:</p> <ul style="list-style-type: none"> <li>• <a href="#">Power distribution units</a></li> <li>• <a href="#">Uninterruptible power supplies</a></li> <li>• <a href="#">Energy Smart containment rack enclosures</a></li> </ul> <p>For more information, see <a href="http://content.dell.com/us/en/enterprise/power-and-cooling-technologies-components-rack-infrastructure.aspx">http://content.dell.com/us/en/enterprise/power-and-cooling-technologies-components-rack-infrastructure.aspx</a></p>


## Power supply units

PowerEdge VRTX supports up to four 1100 W or 1600 W AC power supply units (PSUs) in 3+1 and 2+2 redundant configurations.

 **CAUTION: Unsupported PSU configurations can result in a PSU mismatch condition and failure to power on.**

 **NOTE:** Ensure all PSU are of the same rated output capacity, generation, and input voltage.

 **NOTE:** Unsupported PSU configurations are two or more PSUs that do not share the same supported model, rated output capacity, generation, or input voltage.

 **NOTE:** In the 2+2 redundant configuration, PSU1 and PSU2 are connected to one grid, and PSU3 and PSU4 are connected to another grid.

**Table 6. 1100 W PSU specifications**

Attribute	Value
<b>80 Plus</b>	Platinum Plus
<b>Power factor correction</b>	Active
<b>FCC classification</b>	Class A

**Table 6. 1100 W PSU specifications (continued)**

Attribute	Value
Max output current	108.0 Amps
Input voltage range	90—264 VAC, 47—63 Hz
Iin (100—240 VAC) for rating on safety label	12.0 Amps -6.5 Amps
Initial in-rush current	55 Amps (peak)
Secondary in-rush current	25 Amps (peak)

**Table 7. 1100 W PSU efficiency**

	10% load	20% load	50% load	100% load
Power supply efficiency at 115 VAC	87%	91%	92.5%	90%
Power supply efficiency at 230 VAC	89%	93%	94.5%	92%

**Table 8. 1600 W PSU specifications**

Attribute	Value
80 Plus	Platinum
Power factor correction	Active
FCC classification	Class A
Max output current	131.15 Amps @ 180—264 VAC 65.7 Amps @ 90—140 VAC
Input voltage range	90—264 VAC, 47—63 Hz
Iin (100-240 VAC) for rating on safety label	10.0 Amps
Initial in-rush current	25 Amps (peak)
Secondary in-rush current	25 Amps (peak)

**Table 9. 1600 W PSU efficiency**

	10% load	20% load	50% load	100% load
Power supply efficiency at 115 VAC	N/A	85%	88%	90%
Power supply efficiency at 230 VAC	87%	90%	94%	91%

## Thermal

The thermal design of the PowerEdge VRTX reflect the following:

- Four blower modules with dual blowers are located on the rear of the VRTX chassis.
- Six fans are located between the SAS backplane and expander cards and the system planar components.
  - ⓘ **NOTE:** You can check fan status using the control panel LCD or the systems management interfaces.
- In chassis standby mode, all components are unpowered except the CMC, the LCD control panel, and the two fans for cooling the CMC components.
- For chassis standby mode, the system must run one or two fans at low RPM to ensure that the CMCs are properly cooled.

# Acoustics

## Overview of PowerEdge VRTX acoustics

PowerEdge VRTX has been consciously designed with an open office layout in mind including its acoustical design. Acoustic intensity has been minimized as a function of delivered airflow and tones (buzzes, hums, whistles) have been removed. The result is a smooth sound that is masked by normal office air conditioning or conference room conversations. Certain configurations and utilizations are quieter than others if your environment is acoustically sensitive, Dell EMC can help you choose the right configuration.

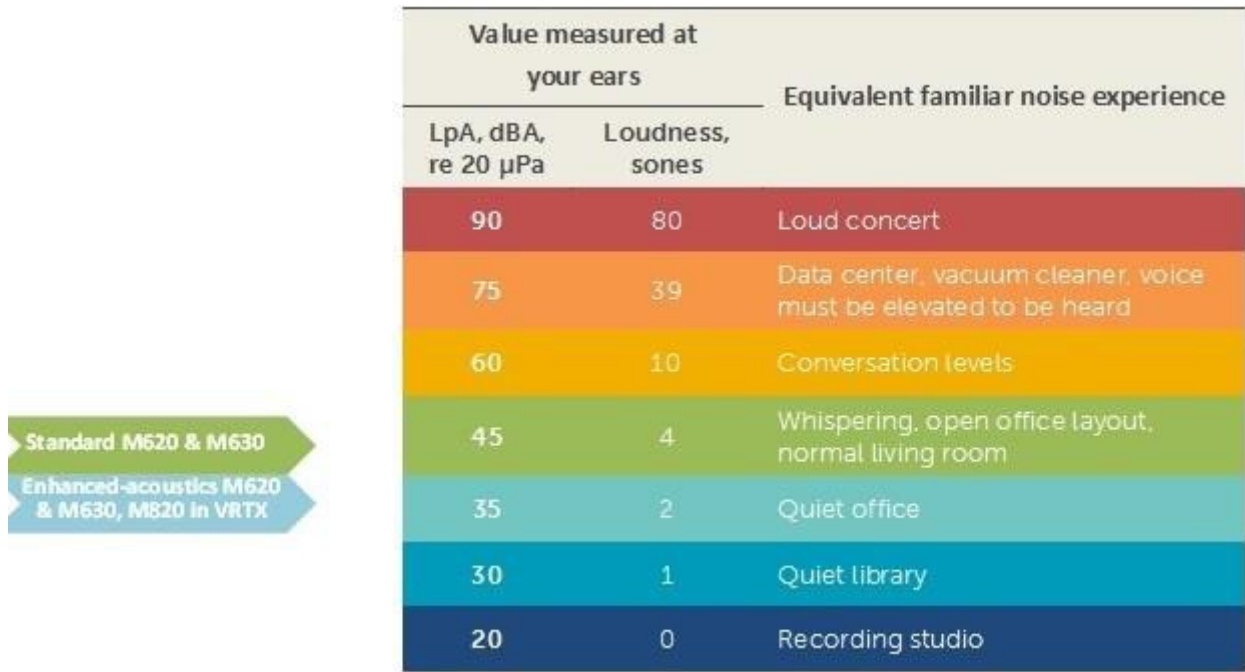


Figure 9. VRTX acoustics

For more information about Dell EMC enterprise acoustics, such as metrics, operating conditions, and so on, see the Dell EMC white paper [Dell Enterprise Acoustics](#).



## Rack, rails, and cable management

VRTX supports ReadyRails II sliding rails for 4-post racks and cable management arm (CMA) options:

- Support for toolless installation in 19-inch EIA-310-E compliant square or unthreaded round hole 4-post racks including all generations of Dell EMC racks
- Support for tooled installation in 19-inch EIA-310-E compliant threaded hole 4-post racks
- Support full extension of the system out of the rack to allow serviceability of key internal components
- Support for optional CM
- Minimum rail mounting depth without the CMA: 714 mm
- Minimum rail mounting depth with the CMA: 845 mm
- Square-hole rack adjustment range: 608 mm-915 mm
- Round-hole rack adjustment range: 594 mm-908 mm
- Threaded-hole rack adjustment range: 608 mm-930 mm

The rails ship in the toolless mounting configuration but can be converted to the tooled configuration quickly and easily. The below table lists the rack rail system that the VRTX system supports.

**NOTE:** The static rail mounting in 2-post racks is not supported.

**Table 10. Supported rack rail system**

Product	Rail Identifier	Mounting Interface	Rail Type	Rack type supported				
				4-Post			2-Post	
				Square	Round	Thread	Flush	Center
VRTX	C3	ReadyRails II	Sliding	Yes	Yes	Yes	No	No

The other factors to consider when deploying the VRTX system include the spacing between the front and back mounting flanges of the rack, the type and location of any equipment mounted in the back of the rack such as PDUs, and the overall depth of the rack. See below table for more information.

**Table 11. Rail adjustability range**

Product	Rail identifier	Rail type	Rail adjustability range (mm)						Rail depth (mm)	
			Square		Round		Threaded		without CMA	with CMA
			Min	Max	Min	Max	Min	Max		
VRTX	C3	Sliding	608	915	594	908	608	930	756	845

**NOTE:** The adjustment range of the rails is a function of the type of rack in which they are being mounted. The minimum and maximum values that are listed above represent the allowable distance between the front and rear mounting flanges in the rack. Rail depth represents the minimum depth of the rail as measured from the rack front mounting flanges when the rail rear bracket is positioned all the way forward.

### Topics:

- [Cable management](#)

## Cable management

The optional CMA can be mounted on either the left or right side of the rails without the use of tools for fast and easy deployment.

The optional CMA for the VRTX organizes and secures the cords and cables exiting the rear of the server and unfolds to allow the server to extend out of the rack without having to detach the cables. Some key features of the VRTX CMA include:

- Large U-shaped baskets to support dense cable loads
- Open vent pattern for optimal airflow
- Mounting on either side by swinging the attachment housings from one side to the other
- Simple and intuitive snap-in mounting designs without the need for tool for both the CMA and tray
- Hook-and-loop straps rather than plastic tie wraps to eliminate the risk of cable damage during cycling
- Low-profile fixed tray to support and retain the CMA in its fully closed position

# Operating systems and virtualization

The PowerEdge VRTX supports a wide range of industry-standard operating systems and virtualization software. For the latest information about supported operating systems, see [www.dell.com/ossupport](http://www.dell.com/ossupport).

## Topics:

- [Supported operating systems](#)
- [Supported virtualization](#)

## Supported operating systems

Operating systems supported on the VRTX platform.

**Table 12. Primary operating system support**

Operating System	Platform	Edition
Windows Server 2016	x64	Standard Enterprise Datacenter
Windows Server 2012 R2	x64	Standard Enterprise Datacenter
Windows Server 2012	x64	Standard Enterprise Datacenter
Windows Server 2008 R2 SP1	x64	Standard Enterprise Datacenter HPC
Windows Server 2008 SP2	x32	Standard Enterprise
	x64	Standard Enterprise Datacenter
SUSE Linux Enterprise Server @ 11 SP3 (for single PERC configurations only)	x64	N/A
Red Hat @ Enterprise Linux 6.5 (for single PERC configurations only)	x64	N/A

## Supported virtualization

VRTX platform supports the following virtualization.

**Table 13. Virtualization support**

Operating systems		Install version	Factory options	Internal dual SD module install support
VMware	VMware vSphere 2016 U1	ESXi	FI/DIB	Yes
VMware	VMware vSphere 2015 U3	ESXi	FI/DIB	Yes
VMware	vSphere v5.1 U1	ESXi	FI/DIB	Yes
VMware	vSphere v5.5	ESXi	FI/DIB	Yes
VMware	vSphere v5.5 U1	ESXi	FI/DIB	Yes
Hyper-V	Integrated in Windows Server operating system	2008, 2008 R2, 2012, 2012 R2	FI/DIB	No
Citrix Xen Server 7.1				

# Dell EMC OpenManage systems management

## Dell EMC OpenManage Portfolio

Simplifying hardware management through ease of use and automation

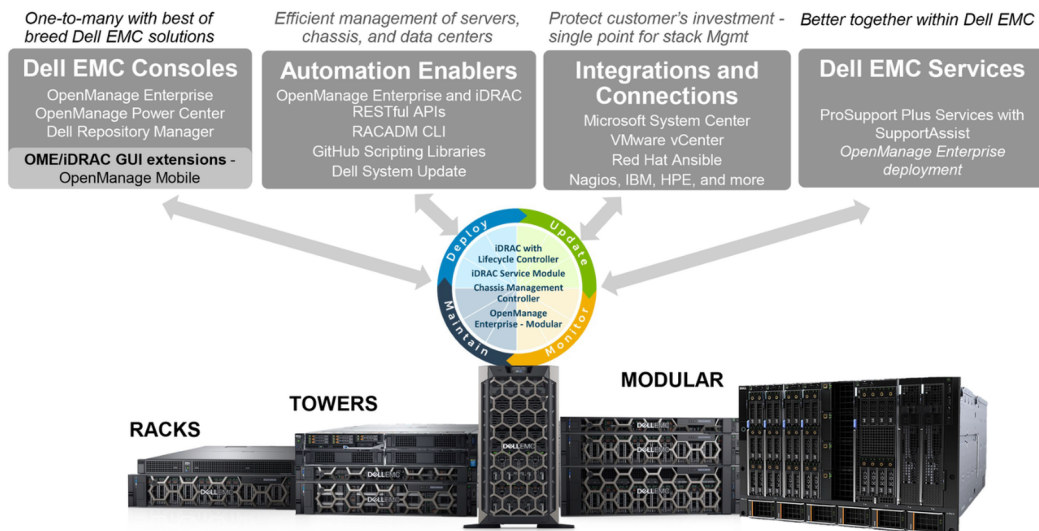


Figure 10. Dell EMC OpenManage Portfolio

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)
- Dell EMC OpenManage Enterprise Modular (OME-M)
- Chassis Management Controller (CMC)
- 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 14. Dell resources**

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

 **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 and weight
- Environmental specifications
- USB peripherals

## Chassis dimensions and weight

The VRTX chassis dimensions for the tower and rack form factors differ due to chassis feet and rack ears. Also, while chassis depth measured at the base chassis sheet metal is less than 26 inches, server handles and power supply handles increase the depth slightly.

**Table 15. VRTX tower form factor dimensions**

VRTX tower variations	Dimensions
Height with system feet	48.4 cm (19.1 in)
Height without system feet	46.4 cm (18.3 in)
Width without system feet	21.9 cm (8.6 in)
Width with system feet open	31.0 cm (12.2 in)
Depth with or without bezel	73.0 cm (28.7 in)
Weight (empty)	31.7 kg (69.7 lb)
Weight (maximum)	74.8 kg (164.9 lb)

**Table 16. VRTX rack form factor dimensions**

VRTX tower variations	Dimensions
Height	21.9 cm (8.6 in)
Width without rack ears	44.6 cm (17.6 in)
Width with rack ears	48.2 cm (19.0 in)
Depth with or without bezel	73.0 cm (28.7 in)
Weight (empty)	24.7 kg (54.5 lb)
Weight (maximum)	68.7 kg (151.5 lb)

## Environmental specifications

The following tables illustrates the environmental specifications for the PowerEdge VRTX. For additional information about environmental measurements for specific system configurations, see [Dell.com/environmental\\_datasheets](https://www.dell.com/environmental_datasheets).

**Table 17. Environmental specifications**

Fresh Air: temperature, humidity, altitude de-rating	
Expanded operation	Expanded operating temperature ranges are supported for fresh air environments.

**Table 17. Environmental specifications (continued)**

	<p>≤ 10% of annual operating hours: 5°C to 40°C at 5% to 85% RH with 26°C dew point.</p> <p>≤ 1% of annual operating hours: - 5°C to 45°C at 5% to 90% RH with 26°C dew point.</p> <p>Outside the standard operating temperature (10°C to 35°C), the system can operate down to 5°C or up to 40°C for a maximum of 10% of its annual operating hours. For temperatures between 35°C and 40°C, derate maximum allowable dry bulb temperature by 1°C per 175 m above 950 m (1°F per 319 ft).</p> <p>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, derate maximum allowable dry bulb temperature by 1°C per 125 m above 950 m (1°F per 228 ft).</p> <p>When operating in the expanded temperature range, system performance may be impacted.</p> <p>When operating in the expanded temperature range, ambient temperature warnings may be reported on the LCD and in the System Event Log.</p> <p>Various configuration limitations will apply to systems eligible to run in the expanded operating temperature ranges.</p>
Continuous operation	10°C to 35°C (50°F to 95°F) at 20% to 80% relative humidity with 26°C (78.8°F) maximum dew point (maximum wet bulb temperature). De-rate maximum allowable dry bulb temperature at 1°C per 300 m above 900 m (1°F per 547 ft above 2953 ft).
<b>Temperature</b>	
Operating	See Fresh Air for temperature information.
Storage	- 40°C to 65°C (-40°F to 149°F) with a maximum temperature gradation of 20°F per hour
<b>Relative humidity</b>	
Operating	See Fresh Air for relative humidity information.
Storage	5% to 95% at a maximum wet bulb temperature of 33°C (91°F); atmosphere must be condensing always
<b>Maximum vibration</b>	
Operating	0.26 Grms at 5 Hz to 350 Hz for 15 minutes
Storage	1.54 Grms at 10 Hz to 250 Hz for 15 minutes
<b>Maximum shock</b>	
Operating	One shock pulse in the positive z axis (one pulse on each side of the system) of 31 G for up to 2.6 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
<b>Altitude</b>	
Operating	-15.2 m to 3048 m (-50 ft to 10,000 ft)
Storage	-15.2 m to 10,668 m (-50 ft to 35,000 ft)
<b>Airborne contaminant level</b>	



**Table 17. Environmental specifications (continued)**

Class G1 or lower as defined by ISA-S71.04-1985
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## USB peripherals

VRTX supports USB peripherals through the front USB ports, which are USB 2.0 compliant.

## Appendix B. Standards compliance

VRTX conforms to the industry standards:

**Table 18. Industry standard documents**

Standard	URL for information and specifications
<b>ACPI</b> Advance Configuration and Power Interface Specification, v2.0c	<a href="http://acpi.info">acpi.info</a>
<b>Ethernet</b> IEEE 802.3-2005	<a href="http://standards.ieee.org/getieee802/802.3.html">standards.ieee.org/getieee802/802.3.html</a>
<b>HDG</b> Hardware Design Guide Version 3.0 for Windows Server	<a href="http://microsoft.com/whdc/system/platform/pcdesign/desguide/servervdg.msp">microsoft.com/whdc/system/platform/pcdesign/desguide/servervdg.msp</a>
<b>IPMI</b> Intelligent Platform Management Interface, v2.0	<a href="http://intel.com/design/servers/ipmi">intel.com/design/servers/ipmi</a>
<b>DDR3 Memory</b> DDR3 SDRAM Specification, Rev. 3A	<a href="http://jedec.org/download/search/JESD79-3C.pdf">jedec.org/download/search/JESD79-3C.pdf</a>
<b>LPC</b> Low Pin Count Interface Specification, Rev. 1.1	<a href="http://developer.intel.com/design/chipsets/industry/lpc.htm">developer.intel.com/design/chipsets/industry/lpc.htm</a>
<b>PCI Express</b> PCI Express Base Specification Rev. 2.0 and 3.0	<a href="http://www.pcisig.com/specifications/pciexpress">www.pcisig.com/specifications/pciexpress</a>
<b>PMBus</b> Power System Management Protocol Specification, v1.2	<a href="http://pmbus.info/specs.html">pmbus.info/specs.html</a>
<b>SAS</b> Serial Attached SCSI, v1.1	<a href="http://t10.org">t10.org</a>
<b>SATA</b> Serial ATA Rev. 2.6; SATA II, SATA 1.0a Extensions, Rev. 1.2	<a href="http://sata-io.org">sata-io.org</a>
<b>SMBIOS</b> System Management BIOS Reference Specification, v2.7	<a href="http://dmtf.org/standards/smbios/">dmtf.org/standards/smbios/</a>
<b>TPM</b> Trusted Platform Module Specification, v1.2	<a href="http://trustedcomputinggroup.org">trustedcomputinggroup.org</a>
<b>UEFI</b> Unified Extensible Firmware Interface Specification, v2.1	<a href="http://uefi.org/specs">uefi.org/specs</a>
<b>USB</b> Universal Serial Bus Specification, Rev. 2.0	<a href="http://usb.org/developers/docs">usb.org/developers/docs</a>
<b>Windows Logo</b>	<a href="http://microsoft.com/whdc/winlogo/hwrequirements.msp">microsoft.com/whdc/winlogo/hwrequirements.msp</a>

**Table 18. Industry standard documents (continued)**

<b>Standard</b>	<b>URL for information and specifications</b>
Windows Logo Program System and Device Requirements, v3.10	

## Appendix C. Additional resources

Resource	Description of contents	Location
<b>Dell EMC PowerEdge VRTX Systems Owner's Manual</b>	This manual, available in PDF format, provides the following information: <ul style="list-style-type: none"> <li>• Chassis features</li> <li>• System Setup program</li> <li>• System messages</li> <li>• System codes and indicators</li> <li>• System BIOS</li> <li>• Remove and replace procedures</li> <li>• Troubleshooting</li> <li>• Diagnostics</li> <li>• Jumpers and connectors</li> </ul>	<a href="http://Dell.com/Support/Manuals">Dell.com/Support/Manuals</a>
<b>Dell EMC PowerEdge VRTX Getting Started Guide</b>	This guide ships with the system and is also available in PDF format on the Dell support site. This guide provides the following information: <ul style="list-style-type: none"> <li>• Initial setup steps</li> <li>• Key system features</li> <li>• Technical specifications</li> </ul>	<a href="http://Dell.com/Support/Manuals">Dell.com/Support/Manuals</a>
<b>Rack Installation Instructions</b>	This document ships with the rack kits and provides instructions for installing a system in a rack.	<a href="http://Dell.com/Support/Manuals">Dell.com/Support/Manuals</a>
<b>Cable Management Arm Installation Instructions</b>	This document ships with the rack kits and provides instructions for installing the cable management arm on a rack.	<a href="http://Dell.com/Support/Manuals">Dell.com/Support/Manuals</a>
<b>System Information Label</b>	The system information label documents the system board layout and system jumper settings.	On the system
<b>Quick Resource Locator (QRL)</b>	This code on the chassis scanned by a phone application to access additional information and resources for the server, including videos, reference materials, service tag information, and Dell EMC contact information.	On the system
<b>Information Update</b>	This document ships with the system and is also available in PDF format on the Dell support site. This document provides system update information.	<a href="http://Dell.com/Support/Manuals">Dell.com/Support/Manuals</a>
<b>Dell EMC Energy Smart Data Center Assessment</b>	Uses infrastructure and thermal analysis to help maximize system efficiency.	<a href="http://Dell.com/EnergySmart">Dell.com/EnergySmart</a>
<b>Energy Smart Solution Advisor (ESSA)</b>	This Dell EMC online advisor enables easier and more meaningful estimates to help you determine the most efficient	<a href="http://Dell.com/ESSA">Dell.com/ESSA</a>

	configuration possible. Use ESSA to calculate the power consumption of your hardware, power infrastructure, and storage.	
<b>Power and cooling technologies</b>	Provides details for improving energy efficiency in the data center.	<a href="http://Dell.com/PNC">Dell.com/PNC</a>
<b>Energy management</b>	Provides information about Dell EMC's Fresh Air cooling solutions.	<a href="http://Dell.com/FreshAir">Dell.com/FreshAir</a>
<b>Operating system matrix for Dell EMC PowerEdge systems</b>	Provides updated information about which operating systems are available on which PowerEdge systems.	<a href="http://Dell.com/OSsupport">Dell.com/OSsupport</a>
<b>Processor and chipset</b>	Provides more information about system processors and chipset.	<a href="http://Intel.com">Intel.com</a>
<b>Dell EMC PowerEdge RAID controllers</b>	Provides more information about Dell EMC PERC cards.	<a href="http://Dell.com/PERC">Dell.com/PERC</a>
<b>Power distribution unit</b>	Provides help selecting a PDU.	<a href="http://DellPDU.com">DellPDU.com</a>
<b>Uninterruptible power supply</b>	Provides help selecting a UPS model.	<a href="http://DellUPS.com">DellUPS.com</a>
<b>Volatility information</b>	Contact your Dell EMC Sales Representative.	
<b>Dell EMC Enterprise Acoustics</b>	White paper that explores the mechanisms of, people's reaction to, language of, and Dell EMC's work to control noise from Enterprise products.	<a href="http://www.dell.com/downloads/global/products/pedge/en/acoustical-education-dell-enterprise-white-paper.pdf">www.dell.com/downloads/global/products/pedge/en/acoustical-education-dell-enterprise-white-paper.pdf</a>