Dell EMC PowerEdge MX5016s Technical Guide

D&LL Technologies

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Product overview

The Dell EMC PowerEdge MX portfolio delivers a fully managed, high performance system that will free up valuable IT resources and personnel so you can focus on innovation. Break free from the bounds of technology silos and routine, daily and time consuming operational management to realize your IT and digital business transformations.

PowerEdge MX, a unified, high performance kinetic infrastructure, provides the agility, resiliency and efficiency to optimize a wide variety of traditional and new, emerging data center workloads and applications. With its kinetic architecture and agile management the MX portfolio dynamically configures compute, storage and fabric, increases team effectiveness and accelerates operations. Its responsive design delivers the innovation and longevity customers of all sizes need for their IT and digital business transformations. PowerEdge MX ecosystem consists of a new chassis infrastructure, compute sleds, fabric switches, and a storage sled, all managed by the Dell EMC OpenManage Enterprise-Modular Edition.

Topics:

*   Introduction
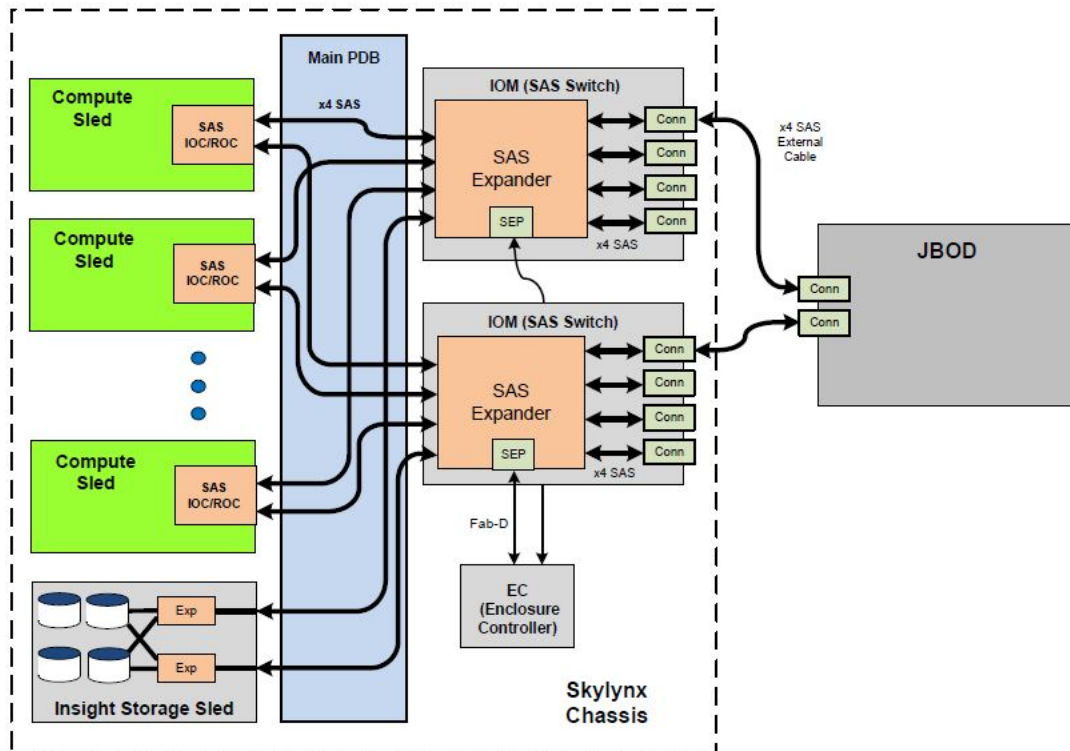*   New technologies

Introduction

The PowerEdge MX5016s is designed to be used within the 7U PowerEdge MX7000 chassis to provide disk expansion for compute sleds. Within the PowerEdge MX7000 chassis the internal connection of the storage subsystem is referred to as "Fabric C". This fabric is connected through a mid-plane (actually a horizontal distribution board) between nodes in the front of the chassis and switch modules in the rear. The Fab-C switch IOM is used to provide flexible SAS connectivity between compute sleds and internal storage sleds or external JBODs connected to a PowerEdge MX7000 chassis.

The PowerEdge MX5016s supports up to sixteen hot plug SAS disk drives (SSD or HDD) in a side loading, front translating storage drawer. The drives are accessed by translating the storage drawer outward and accessing the drives from the sides. The drives will utilize newly designed carriers which are unique to the PowerEdge MX5016s solution. The sleds are independently serviceable while the PowerEdge MX7000 chassis is in operation.

(i) **NOTE:** For MX5016s configuration options, see the *Dell EMC PowerEdge MX5016s and MX5000s Installation and Service Manual* on the product documentation page.

(i) **NOTE:** The PowerEdge MX5016s does not plug into any other enclosures such as M1000e, FX2 or VRTX.

The diagram below shows how the SAS storage sled is implemented within the PowerEdge MX7000 chassis:

New technologies

The list below shows the new technologies for the PowerEdge MX5016s storage sled:

- Sixteen side loading, hot pluggable 2.5" drives in a front translating sled
- Hot-serviceable Dual Expanders providing dual SAS paths to all HDDs
- Dual Power delivery for redundancy
- Dual x4 SAS links to the PowerEdge MX7000 infrastructure
- 12Gb/s SAS support

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System features

Topics:

Specifications

The following table shows the specifications for the PowerEdge MX5016s:

Table 1. Specifications

Feature	Specifications
Hard drives	supports up to sixteen 2.5-inch, hot-swappable SAS hard drives, SSDs
Storage expander	support PowerEdge RAID Controller(PERC) H745PMX and HBA 330MMZ.

Chassis view and features

Topics:

- Front view of the sled
- Control panel, LCD and LED
- Locating the Service Tag of your system

Front view of the sled
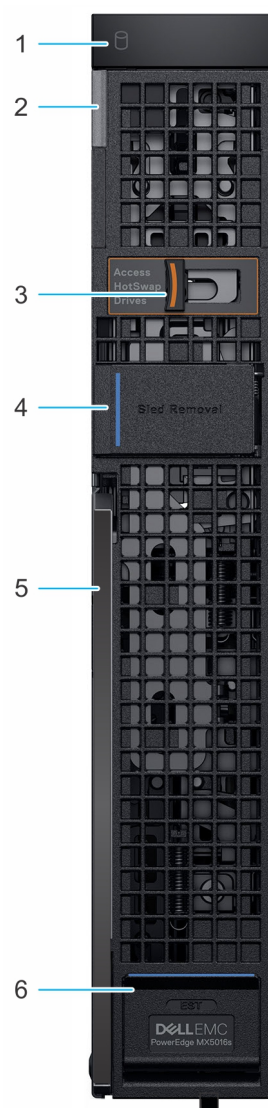
Figure 1. Front view of the sled

1. Drive status indicator
3. Drive drawer release latch
5. Sled release lever

2. System health and system ID indicator
4. Sled removal hatch
6. Information tag panel

Control panel, LCD and LED

For more information about the PowerEdge MX5016s control panels, LCD and LED, see the PowerEdge MX5016s Owner's Manual at Dell.com/support

Locating the Service Tag of your system

You can identify your system using the unique Express Service Code and Service Tag. Open the Information tag panel on the front of the system to view the Express Service Code and Service Tag. Dell uses this information to route support calls to the appropriate personnel.

Figure 2. Information tag panel

SAS expanders

The SAS expanders each connect to ports on all 16 HDDs. The first expander connects to "port A" of the first eight HDDs and "port B" of the second eight HDDs. The second expander is the opposite and connects to "port B" of the first eight HDDs and port A of the other eight HDDs. There is also a x4 link between the expanders to facilitate communication/synchronization between the two.

There are two indicator LEDs on the SAS expander module. The "heartbeat" icon refers to the bicolor green/amber health status. And the "*i*" icon refers to the blue identify function.

The following table shows the "heartbeat" behaviors:

Condition	Initiator	Behavior	Blink rate
Power on/ health	CPLD	Solid Green if power applied AND no fault exists	N/A
Expander fault	Expander	Blink Amber if Expander FW has fault (driven by GPIO72 on Expander)	2 secs ON, 1 sec OFF
	Expander CPLD	Blink Amber if Expander power fault occurs	
	Expander	Blink Amber if Expander THERMTRIP occurs	
Expander firmware mismatch	Expander	Blinks GREEN if a mismatch detected between EMMs	Blinks GREEN 5 times at 4Hz, OFF 2 seconds, repeat

Power control module

The Power module interfaces to the PowerEdge MX7000 Main PDB to receive power and control signals. The board also passes through the Main 12V to an internal power cable connector. This cable will carry power directly to the Backplane Board. The Power control module also provides a sideband signal connection to the Backplane, providing control signals and Auxiliary power. The intrusion switch indicates to systems management when the sled is opened for HDD or Expander service access during runtime.

Drive backplane

There are 12 HDD connectors on the top of the board. From the bottom of the board, 4 additional HDD connectors and two Expander connectors allow for hot-servicing. The Drive Backplane Board is mainly a pass-through for signals between the HDDs and the Expander devices.

Drives on the left side of the bay are numbered 0 to 9 while drives on the right side of the bay are numbered 10 to 15.

Front panel LED board

The front panel LED board is a very small board located at the top front of the chassis. There is a cable connection to the Expander Board to pass the signals. The Front Panel Board is a simple board which drives the LEDs visible from the front of the enclosure.

Storage

The Dell EMC PowerEdge MX5016s supports up to 16 hot swappable 2.5-inch SAS drives.

Table 2. Supported drive options for the PowerEdge MX5016s system

Drive Type	Supported drive capacity
2.5" SAS HDD, 10k RPM	600 GB, 1.2 TB, 1.8 TB, 2.4 TB, 1.2 TB FIPS-140, 2.4 TB FIPS-140
2.5" SAS HDD, 15k RPM	300 GB, 600 GB, 900 GB
2.5" SAS HDD, 7.2k RPM	1 TB, 2 TB
2.5" SAS SSD, Mixed use	400 GB, 480 GB, 800 GB, 960 GB, 1.6 TB, 1.92 TB, 3.84 TB, 1.92 TB FIPS-140
2.5" SAS SSD, Read Intensive	960 GB, 1.92 TB, 3.84 TB, 7.68 TB
2.5" SAS SSD, Write Intensive	400 GB, 800 GB, 1.6 TB

ⓘ **NOTE:** SATA and NVMe drives are not supported but mixing of rotational and SSD SAS drives is supported.

Thermal management

The PowerEdge MX5016s thermal management will be owned by the expander module firmware. Temperature data is collected through multiple paths. The following components can be monitored for temperature:
- Sled hardware temperatures:
  - Ambient inlet temperature to sled
  - Expander die temperatures
- Hard drive temperatures (read via in-band SAS access)
  - May also be read by an OOB mehanism associated with the HDD_ACT pin (UI)

The expanders each have a local die temperature that they will read directly. The expander "in charge" (i.e., the primary expander exposing its SEP function) collects the die temperature from the secondary expander. It also reads the local ambient temperature through the shared I2C bus. These temperatures are made visible as SES elements on the SAS interface. The IOM will be responsible for reading the expander SES pages to get the ambient and die temperatures. This will be for reporting only, and not as part of the thermal control loop. In addition to SES reporting, the expander in charge shall write the temperature bytes via I2C to the CPLD slave interface. The expander module shall collect the sled ambient and expander die temperatures from the PowerEdge MX5016s CPLD. This data path shall be used by the thermal control loop.

Expanders also collect hard drive temperatures from the iDRAC. The iDRAC polls the PERC or IOC, those controllers in turn go through in-band access to the hard drives to read the temperatures. The following diagram depicts the thermal data collection for PowerEdge MX5016s hard drive temperatures (still UI for HBA330 drive temp reading).

Expander threshold

The expander firmware should maintain temperature elements in the SES page. The associated threshold levels for the temperature sensors are shown in the table below:

Threshold	Default threshold for expander sensors	Default thresholds for Ambient (inlet) sensor
High critical	110°C	47°C
High warning	100°C	43°C
THERMTRIP setting	120°C	N/A
Low warning	N/A	3°C
Low critical	N/A	-7°C

Appendix A. Additional specifications

Topics:

Standard operating temperature

Table 3. 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.

Table 4. Expanded operating temperature specifications

Expanded operating temperature	Specifications
Continuous operation	5°C to 40°C at 5% to 85% Relative Humidity with 29°C dew point. ⓘ **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 temperature between 35°C to 40°C, de-rate maximum allowable temperature by 1°C per 175 m above 950 m (1°F per 319ft).
	≤1% of annual operating hours -5°C to 45°C at 5% to 90% Relative Humidity with 29°C dew point. ⓘ **NOTE:** Outside the standard operating temperature(10°C to 35°C), the system can operate down to - 5°C or upto 45°C for a maximum of 1% of its annual operating hours. For temperatures between 40°C and 45°C, de-rate maximum allowable temperatures by 1°C per 125m above 950m(1°F per 228 ft). ⓘ **NOTE:** When operating in the expanded temperature range, system performance may be impacted. ⓘ **NOTE:** When operating in the expanded temperature range, ambient temperature warnings maybe reported on the LCD panel and in the System Event Log.

Expanded operating temperature restrictions

*   Do not perform a cold startup below 5°C.
*   The operating temperature specified is for a maximum altitude of 3050m (10,000 ft).

Expanded operating temperature

Table 5. 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) **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. (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. 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).

(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.

Particulate and gaseous contamination specifications

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

Table 6. 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) **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) **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) **NOTE:** This condition applies to data center and nondata center environments.
Corrosive dust	● Air must be free of corrosive dust. ● Residual dust present in the air must have a deliquescent point less than 60% relative humidity. (i) **NOTE:** This condition applies to data center and nondata center environments.

Table 7. 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.

Environmental specifications

(i) **NOTE:** For additional information about environmental measurements for specific system configurations, see **Dell.com/ environmental_datasheets**.

Table 8. 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.
Maximum temperature gradient (operating and storage)	20°C/h (68°F/h)

Table 9. Relative humidity specifications

Relative humidity	Specifications
Storage	5% to 95% RH with 33°C (91°F) maximum dew point. Atmosphere must be noncondensing always.
Operating	10% to 80% relative humidity with 26°C (78.8°F) maximum dew point.

Table 10. 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 11. Maximum shock specifications

Maximum shock	Specifications
Operating	One shock pulse in the positive z axis of 31 G for 2.6 ms in the operational orientation.
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 12. Maximum altitude specifications

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

Table 13. Operating temperature de-rating specifications

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

Appendix B. Standards compliance

Table 14. 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/desguide/serverdg.mspx
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 15. Additional resources

Resource	Description of contents	Location
Installation and Service Manual	This manual, available in PDF format, provides the following information: ● 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: ● 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

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 16. 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.
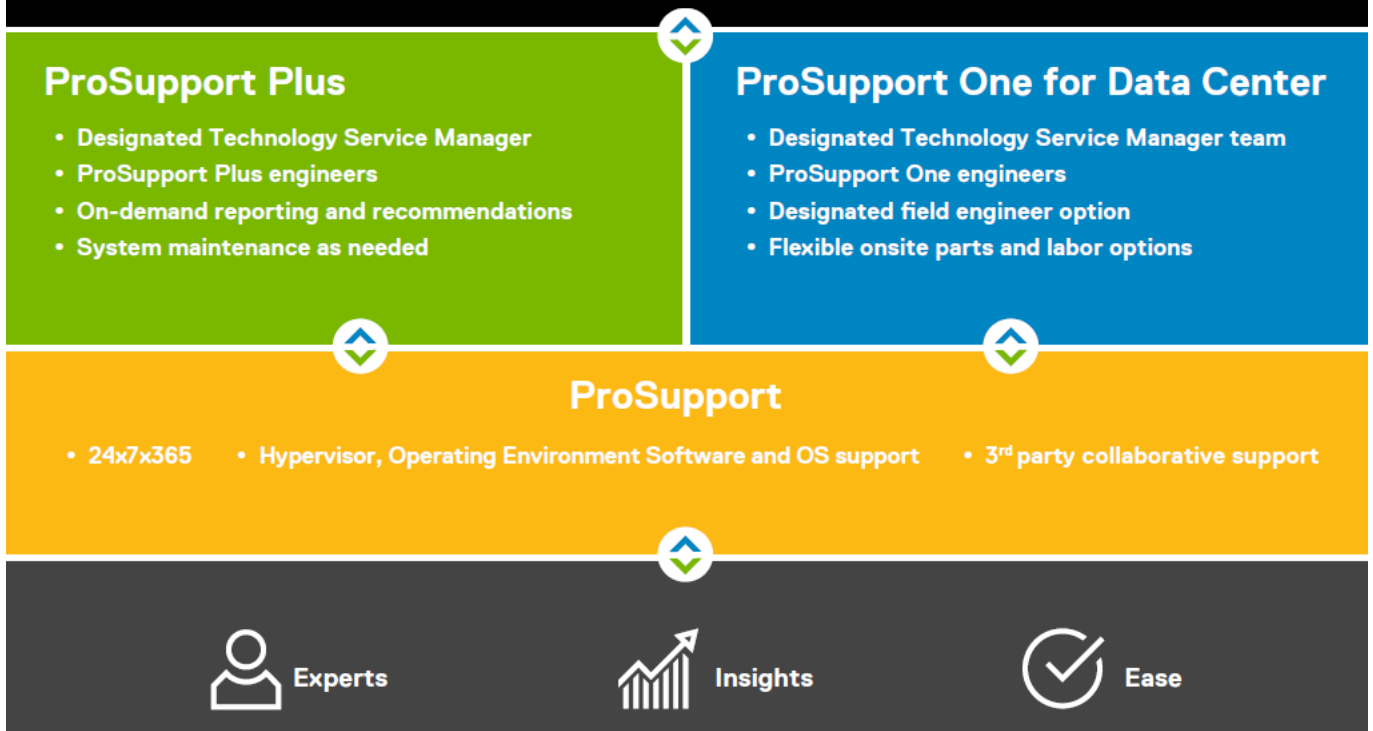
Figure 3. ProSupport Enterprise Suite

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 3rd 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 4. 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.