PowerEdge FX Architecture

Technical guide

PowerEdge FX— Dell's revolutionary approach to converged infrastructure — combines blade density and efficiency with the cost advantages of rack servers.

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1 System overview

The PowerEdge FX2 is a 2U hybrid rack-based computing platform that combines the density and efficiencies of blades with the simplicity and cost benefits of rack-based systems. With an innovative modular design that accommodates IT resource building blocks of various sizes — compute, storage, networking and management — the FX2 enables data centers to construct their infrastructures with greater flexibility.

Flexible configurations, more choice

The foundation of the FX architecture is a 2U rack enclosure — the Dell PowerEdge FX2 — that can accommodate various sized resource blocks of servers or storage. Resource blocks slide into the chassis, like a blade server node, and connect to the shared infrastructure through a flexible I/O fabric. Currently, FX architecture components include the following server nodes and storage block:

- PowerEdge FM120x4: world's first enterprise-class microserver
- PowerEdge FC430: ultimate in shared infrastructure density
- PowerEdge FC630: shared infrastructure workhorse
- PowerEdge FD332: ultimate dense direct-attached storage with unprecedented flexibility

There are two versions of the FX2 chassis — a "switched" configuration, the PowerEdge FX2s, supports up to eight low-profile PCI Express$^®$ (PCIe) 3.0 expansion slots, and the "unswitched" FX2 configuration, a lower-cost alternative that does not offer expansion slots. The FX2 enclosure also offers I/O modules to several I/O aggregators that can simplify cabling, improve East/West traffic within the server, and enable LAN/SAN convergence — reducing cost and complexity.

The efficiencies of shared infrastructure

The FX2 enclosure enables servers and storage to share power, cooling, management and networking. It houses redundant power supply units (2000W, 1600W or 1100W) and eight cooling fans. With a compact highly flexible design, the FX2 chassis lets you simply and efficiently add resources to your infrastructure when and where you need them, so you can let demand and budget determine your level of investment.

Innovative management with intelligent automation

The Dell OpenManage systems management portfolio simplifies and automates server lifecycle management — making IT operations more efficient and Dell servers the most productive, reliable and cost effective. Dell's agent-free integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller makes server deployment, configuration and updates automated and efficient. Using Chassis Management Controller (CMC), an embedded component that is part of every FX2 chassis, you'll have the choice of managing server nodes individually or collectively via a browser-based interface. OpenManage Essentials provides enterprise-level monitoring and control of Dell and third-party data center hardware, and works with OpenManage Mobile to provide similar information on smart phones. OpenManage Essentials now also delivers server configuration management capabilities that automate bare-metal server and OS deployments, replication of configurations, and ensures ongoing compliance with set system configurations.

New technologies

Table 1 lists new technologies for the PowerEdge FX architecture.

Table 1. New technologies

New technologies	Detailed descriptions
Intel® Xeon® processor E5-2600 v3 product family	This new family of Intel processors has embedded PCIe lanes for improved I/O performance. See the Processor section for details.
Intel C610 series chipset	The Intel Platform Controller Hub (PCH) chip is implemented on the FC630 and FC430 server nodes.
2133MT/s DDR4 memory	Certain models of the Intel Xeon E5-2600 v3 processors support 2133MT/s memory. See the Memory section for details.
LRDIMM	This memory option, 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. See the Memory section for more information.
Next-generation PERC options	The FX architecture supports new PERC controller cards with improved functionality and faster performance. See the Storage section for details.
PERC S130 software RAID solution	This new software RAID solution supports RAID 0, 1, 5, and 10, and supports a maximum of eight hot-plug SATA hard drives or SATA solid-state drives (SSDs). See the Storage section for details.
Express Flash drives	Dell Express Flash PCIe solid-state drives provide fast performance without requiring processor resources or capturing DRAM. FX server nodes support Express Flash drives. See the Storage section for details.
iDRAC8 with Lifecycle Controller	The new embedded system management solution for Dell servers features hardware and firmware inventory and alerting, in-depth memory alerting, faster performance, dedicated gigabit port and more features. Dell OpenManage systems management section for complete details.
Advanced power management	The FX architecture supports advanced power monitoring and power capping tools that can help manage power consumption. See the Power, thermal and acoustics section for details.
Dell Fresh Air	Dell has tested and validated select Dell PowerEdge 13th generation servers that operate at higher temperatures enabling you to reduce your hours of economization or even go chiller-less. See the Power, thermal and acoustics section for details.
Failsafe hypervisors	The internal dual SD module is a modular fail-safe design dedicated for an embedded ESX hypervisor or other embedded operating system.

2 System features

The PowerEdge FX architecture is a revolutionary design and new offering for Dell. There are no comparable products in the current Dell portfolio. That being said, Dell does have other converged infrastructure chassis offerings in the PowerEdge portfolio — namely, the PowerEdge M1000e and PowerEdge VRTX, though the FX2 is not a blade chassis.

Comparison of PowerEdge systems

Table 2 compares the varying features of the PowerEdge FX2 enclosure, PowerEdge VRTX and PowerEdge M1000e blade enclosure.

Table 2.   Comparison of PowerEdge FX, M1000e and VRTX

Specification	PowerEdge FX2	PowerEdge M1000e	PowerEdge VRTX
Form factor	2U rack chassis	10U rack chassis	Standalone tower/5U rack
Server node options	FC630 (up to 4) FC430 (up to 8) FM120x4 (up to 4)	(up to 32) PowerEdge M420, M520, M620, M820, M630, M830	(up to 4) PowerEdge M520, M620, M820, M630, M830
Storage	FD332 (up to 3)	EqualLogic PS-M4110 Blade Array option (storage can be shared)	Up to 12 x 3.5" SAS HDDs/SSDs or up to 25 x 2.5" SAS HDDs/SSDs (storage can be shared)
PCI slots	8 PCIe low-profile slots (supporting Ethernet, Fibre Channel, SAS HBA, PERC external)	6 IOMs (supporting Ethernet, Fibre Channel, Mellanox Infiniband)	8 PCIe slots (supporting Ethernet, Fibre Channel, GPU, SAS HBA, PERC external)
I/O module (IOM)	2 pass-through IOMs (1Gb or 10Gb) 3 different FN IOA Modules (see the PowerEdge FN I/O Aggregators section for detailed information)	6 IOMs (supporting Ethernet, Fibre Channel, Mellanox Infiniband)	
Power supplies	2 x 2000W, 1600W PSU (FC430, FC630) Up to 2 x 1100W PSU (FM120x4)	Up to 6 x 3000W PSUs (PSU and AC redundant options)	Up to 4 x 1100W PSUs (PSU and AC redundant options)

Specification	PowerEdge FX2	PowerEdge M1000e	PowerEdge VRTX
Systems management	1 CMC iDRAC8	1 or 2 CMC	1 or 2 CMC

Specifications

Table 3 summarizes the product features for the PowerEdge FX2 chassis, FM120x4, FC430 and FC630 server nodes and FD332 storage block. For the latest information on supported features for the PowerEdge FX, visit Dell.com/PowerEdge.

<p align="center">Table 3.   PowerEdge FX architecture technical specifications</p>

Feature	FX2	FM120x4	FC430	FC630	FD332
Form factor	2U chassis in height	Half-width: up to 4 FM120 per FX2 chassis	Quarter-width: up to 8 FC430 per FX2 chassis	Half-width: up to 4 FC630 per FX2 chassis	Half-width: up to 16 x SFF 2.5" storage devices; Up to 3 FD332 per FX2 chassis
Processors	N/A	4 x Intel® Atom™ processor C2000 product family	Intel Xeon processor E5-2600 v3 product family	Intel Xeon processor E5-2600 v3 product family	N/A
Processor sockets	N/A	1	2	2	N/A
Cache	N/A		2.5MB per core; core options: 4, 6, 8, 10, 12, 14	2.5MB per core; core options: 4, 6, 8, 10, 12, 16, 18	N/A
Chipset	N/A	SoC	Intel C610 series	Intel C610 series	N/A
Memory[1]	N/A	2 x DIMMs DDR3 memory per SOC, UDIMM only, 8 per sled	Up to 256GB (8 DIMM slots): 4GB/8GB/16GB/32GB DDR4 up to 2133MT/s	Up to 768GB (24 DIMM slots): 4GB/8GB/16GB/32GB DDR4 up to 2133MT/s	N/A
PCIe slots	FX2s: Up to 8 PCIe 3.0 slots	N/A	Access to 1 x PCIe 3.0 slot	Access to 2 x PCIe 3.0 slots	N/A

Feature	FX2	FM120x4	FC430	FC630	FD332
RAID controller	N/A	PERC S110 (SW RAID)	Internal controllers: PERC S130 (SW RAID)	PERC S130 (SW RAID), PERC H330 PERC H730 PERC H730P	FD33xS (Single PERC), FD33xD (Dual PERC)
Storage	N/A	1 x 2.5" SATA HDD/SSD or 2 x 1.8" uSATA SSD per Intel Atom processor	Up to 2 x 1.8" uSATA SSDs	PowerEdge Express Flash NVMe PCIe SSD, SATA HDD/SSD or SAS HDD/SSD; Up to 8 x 1.8" SSD or 2 x 2.5"	SATA HDD/SSD or SAS HDD/SSD; Up to 16 x SFF storage devices per FD332
Power supply	2000W AC, 1600W or 1100W AC power supplies in 1+1 redundant, redundancy alerting only, 2+0 non-redundant configurations.				
Systems management	- FX uses CMC to manage all resources (server nodes and shared infrastructure) in a single web console - OpenManage portfolio for FX supports local and remote management, consistent with other PowerEdge products - CMC and iDRAC are available with either Enterprise or Express licensing to best suit specific management needs - Server nodes each contain proven iDRAC with Lifecycle Controller for agent-free, automated systems management				
Operating systems	N/A	- Microsoft® Windows Server® 2008 R2 SP1 (includes Hyper-V®) - Microsoft Windows Server 2012 - Microsoft Windows Server 2012 R2 (includes Hyper-V) - Novell® SUSE® Linux Enterprise Server - Red Hat® Enterprise Linux®			N/A

[1]GB means 1 billion bytes and TB equals 1 trillion bytes; actual capacity varies with preloaded material and operating environment and will be less.

3 Chassis views and features

Depending on system configuration, the FX2/FX2s chassis can include up to four half-width server nodes or eight quarter-width server nodes. Each server node has standard PCIe slots and direct-attached storage, rather than a blade system with mezzanine cards attached to SANs. To function as a system, a server node is inserted into an FX2 enclosure, which supports power supplies, fan modules, a Chassis Management Controller (CMC) module, and two I/O modules for external network connectivity. The power supplies, fans, CMC, KVM panel, and I/O modules are shared resources of the server nodes in the PowerEdge FX2 enclosure.

Note: The PowerEdge FM120x4 does not have connection to any PCIe slots and the FX2 chassis will not have PCIe slots available.

Two power supplies provide system power and are attached through a Power Interface Board (PIB) to the server midplane. Up to 8 sleds are cooled by 8 hot pluggable fans.

KVM features

Local KVM access can be remotely disabled on a per server basis, using the iDRAC interface. The KVM provides access to the servers. One server can be accessed at a time using the select button

- VGA connector—The KVM supports one video display resolution range from 640 × 480 at 60Hz up to 1280 × 1024 × 65,000 colors (non-interlaced) at 75Hz
- USB—One port for USB keyboard or mouse

Table 4 lists required and optional chassis components for FX2 and FX2s chassis configurations. The base configuration is the minimum set to have a functional chassis. Optional components may be installed at the factory or at the customer site, except as noted. The FX2s configuration does not support FM120x4. The FX2 enclosure is 2U in height and targeted for a 1000mm rack.

For additional information on the FX2 chassis features, see the *Dell PowerEdge FX Owner's Manual* on Dell.com/Support/Manuals.

Table 4.   FX2/FX2s chassis components

Feature	FX2s 4-bay	FX2s 6-bay	FX2s 8-bay	FX2
Server node	Up to 4 FC630	2 x FC430 required in chassis Up to 2 x FC630 or Up to 2 x FD332	Up to 8 FC430	Up to 4 x FM120x4 4 x FC630 8 x FC430
Sled blanks	Up to 3	Up to 4 (2 x quarter-width and 2 x half-width can be blank)	Up to 7	Up to 3
Midplane	1	1	1	1
PCIe switch board	1	0	1	0

Feature	FX2s 4-bay	FX2s 6-bay	FX2s 8-bay	FX2
Fan only board	0	0	0	1
PCIe modules x8	8	8	8	0
CMC	1	1	1	1
1GbE IOM	Up to 2	Up to 2	Up to 2	Up to 2
10GbE IOM	Up to 2	Up to 2	Up to 2	Up to 2
IOA IOM	Up to 2	Up to 2	Up to 2	Up to 2
Right ear (VGA/USB)	1	1	1	1
Power button, LED Indicators	1	1	1	1
Power distribution board	1	1	1	1
Power supplies	2 x 2000W or 1600W	2 x 2000W or 1600W	2 x 2000W or 1600W	2 1100W (FM120x4) 2 2000W/1600W (FC430 and FC630)
Fans	8	8	8	8

Chassis views

Figure 1.   Front panel features and indicators — PowerEdge FX2/FX2s
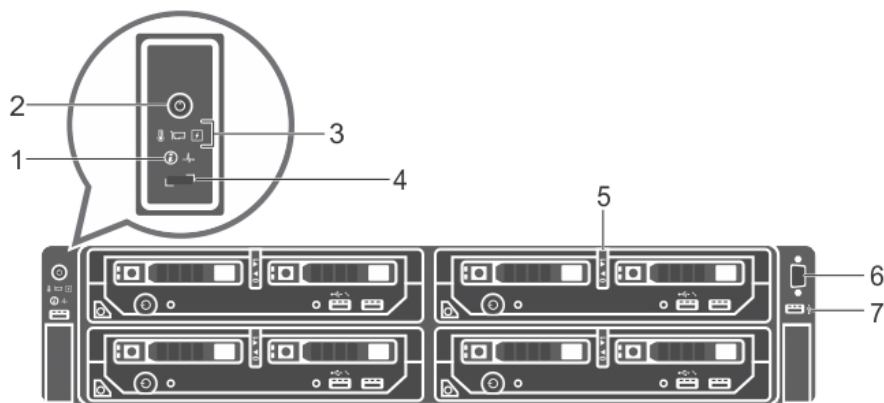
Feature		Description
1	System identification button	Identification buttons on the front and back panels can be used to locate a particular system within a rack. When a button is pressed, the system status indicator flashes until one of the buttons is pressed again.

Feature		Description
2	Power button	The power-on indicator lights when the enclosure power is on. The power button controls the power supply output to the system.
3	Diagnostic indicators	The diagnostic indicators on the system front panel display error status during system startup.
4	KVM select button	• Allows you to select between sleds • Local KVM access can be remotely disabled on the enclosure, using the CMC interface
5	Server nodes	PowerEdge FX2 enclosure supports up to eight quarter-width sleds or four half-width sleds.
6	Video connector	Allows a monitor to be connected to the system.
7	USB connector	Allows a keyboard or mouse to be connected to the system.

Back panel view and features

Figure 2.   FX2s back panel features (FC630)

Feature		Description
1	Serial connector	DB-9 serial connector for CMC configuration
2	GbE connector (Gb1)	Connects network cable from the management system to CMC
3	GbE connector (stack/Gb2)	Used for daisy-chaining CMCs in separate enclosures (can also be used for CMC NIC failover)
4	PCIe expansion slots	Allows you to connect up to eight low-profile PCIe expansion cards
5	Power supply (PSU1)	1100W, 1600W, 2000W AC
6	Power supply (PSU2)	1100W, 1600W, 2000W AC
7	I/O module (2)	Allows you to connect up to two I/O modules
8	I/O module ports	Network interface for I/O modules (figure shows 1Gb pass-through)
9	I/O module indicators	Indicates I/O activity

Figure 3.   FX2 back panel features with no PCIe slots (FM120x4, FC630)

Feature		Description
1	Serial connector	DB-9 serial connector for CMC configuration
2	GbE connector (Gb1)	Connects network cable from the management system to CMC
3	GbE connector (stack/Gb2)	Used for daisy-chaining CMCs in separate enclosures (can also be used for CMC NIC failover)
4	PCIe expansion slots	No-PCIe options (shows filler panel)
5	Power supply (PSU1)	1100W, 1600W, 2000W AC (FM120x4 1100W PSU only)
6	Power supply (PSU2)	1100W, 1600W, 2000W AC (FM120x4 1100W PSU only)
7	I/O module (2)	Allows you to connect up to two I/O modules
8	I/O module ports	Network interface for I/O modules (figure shows 1Gb pass-through)
9	I/O module indicators	Two indicators for Status and Power

Internal chassis view

Figure 4.   FX2 internal chassis view
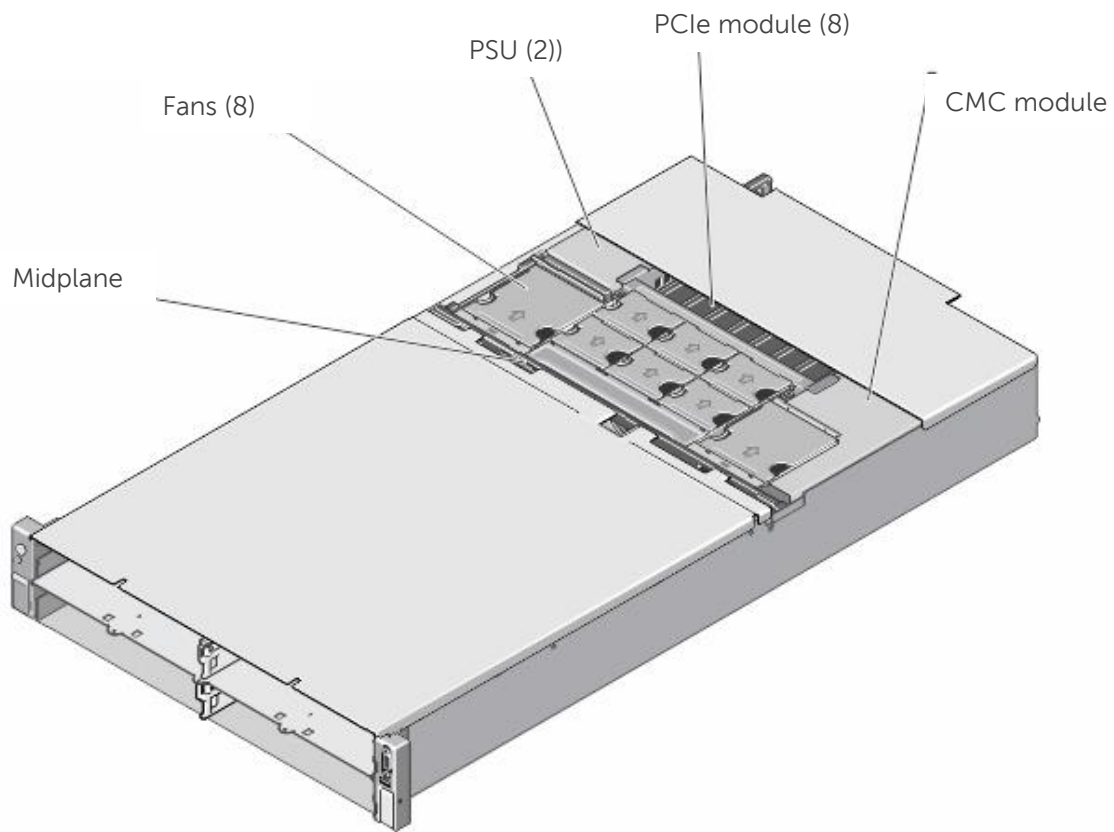
In the PowerEdge FX2s enclosure configurations that support storage sleds mapped to compute sleds, the PCIe slots are mapped to the compute sleds in the following manner:

- Four-bay chassis with two half-width compute sleds — each half-width compute sled is mapped to four PCIe slots.
- Four-bay chassis with one half-width compute sled — the half-width compute sled is mapped to eight PCIe slots.
- Three-bay chassis with one full-width compute sled — the full-width compute sled is mapped to eight PCIe slots.
- Six-bay chassis with four quarter-width compute sleds — each quarter-width compute sled is mapped to two PCIe slots

Quick Resource Locator

The QRL is a model-specific Quick Response code located inside the server chassis as shown in Figure 5.

Figure 5.   QRL code inside chassis

Use a smartphone to access the Dell QRL app to learn more about the server:

- View step-by-step videos, including overviews of system internals and externals, as well as detailed, concise, task-oriented videos and installation wizards
- Locate reference materials, including searchable owner's manual content, LCD diagnostics, and an electrical overview
- Look up your service tag so you can quickly gain access to your specific hardware configuration info and warranty information
- Contact Dell directly (by link) to get in touch with technical support and sales teams and provide feedback to Dell

These codes provide an easy way to retrieve the critical support information you need when you need it, making you more efficient and effective in managing your hardware.

Security features

The latest generation of PowerEdge servers has the features listed in Table 5 to help ensure the security of your data center.

Table 5.   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. 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 or Russia.
Power-off security	BIOS has the ability to disable the power button function.
Secure mode	BIOS has the ability to enter a secure boot mode through system setup. This mode includes the option to lock out the power and NMI switches on the control panel or set up a system password.

4 Processor

Processor features

The Intel Xeon processor E5-2600 v3 product family not only adds new features, but also improves upon many features of the predecessor Intel Xeon processor E5-2600 v2 product family, including:

- Up to 18 cores and 36 threads per socket
- 46-bit physical addressing and 48-bit virtual addressing
- 1GB large page support
- 32KB instruction and 32KB data first-level cache (L1) for each core
- 256KB shared instruction/data mid-level cache (L2) for each core
- Up to 24 DIMMs per two-socket server to support multiple data-hungry VMs
- Two QPI links up to 9.6GT/s
- Four DMI2 lanes
- 40 PCIe 3.0 links capable of 8.0GT/s
- Intel Turbo Boost Technology takes advantage of power and thermal headroom to increase processor frequencies for diverse workloads
- Intel AVX2 accelerates floating point and integer computations with support for 256-bit vectors
- No termination required for non-populated CPU
- Integrated 4-channel DDR4 memory controller. (Not all processors support 2133MT/s memory.)
- 64 byte cache line size
- Execute Disable Bit
- Support for CPU Turbo Mode
- Increases CPU frequency if operating below thermal, power, and current limits
- Streaming SIMD (Single Instruction, Multiple Data) Intel Advanced Vector Extensions (Intel AVX)
- Intel 64 Technology
- Intel VT-x and VT-d Technology for virtualization support
- Enhanced Intel SpeedStep Technology
- Demand-based switching for active CPU power management as well as support for ACPI P-States, C-States, and T-States
- Intel Secure Key provides high-quality security keys

Supported processors

The FC630 server node supports up to 2 processors with up to 18 cores per processor. The FC430 server node supports up to 2 processors with up to 14 cores per processor. Table 6 lists the processors supported by the PowerEdge FC630. Table 7 lists the processors supported by the PowerEdge FC430. For the latest information on supported processors, visit Dell.com/PowerEdge.

Table 6.   FC630 supported processors

Model	Speed	TDP	Cache	Cores	QPI	Turbo
E5-2603 v3	1.6GHz	85W	15M	6	6.4GT/s	No
E5-2609 v3	1.9GHz	85W	15M	6	6.4GT/s	No
E5-2620 v3	2.4GHz	85W	15M	6	8.0GT/s	Yes
E5-2623 v3	3.0GHz	105W	10M	4	8.0GT/s	Yes
E5-2630 v3	2.4GHz	85W	20M	8	8.0GT/s	Yes
E5-2630L v3	1.8GHz	55W	20M	8	8.0GT/s	Yes
E5-2637 v3	3.5GHz	135W	15M	4	9.6GT/s	Yes
E5-2640 v3	2.6GHz	90W	20M	8	8.0GT/s	Yes
E5-2643 v3	3.4GHz	135W	20M	6	9.6GT/s	Yes
E5-2650 v3	2.3GHz	105W	25M	10	9.6GT/s	Yes
E5-2650L v3	1.8GHz	65W	30M	12	9.6GT/s	Yes
E5-2660 v3	2.6GHz	105W	25M	10	9.6GT/s	Yes
E5-2667 v3	3.2GHz	135W	20M	8	9.6GT/s	Yes
E5-2670 v3	2.3GHz	120W	30M	12	9.6GT/s	Yes
E5-2680 v3	2.5GHz	120W	30M	12	9.6GT/s	Yes
E5-2683 v3	2.0GHz	120W	35M	14	9.6GT/s	Yes
E5-2690 v3	2.6GHz	135W	30M	12	9.6GT/s	Yes
E5-2695 v3	2.3GHz	120W	28M	14	9.6GT/s	Yes
E5-2697 v3	2.6GHz	145W	35M	14	9.6GT/s	Yes
E5-2698 v3	2.3GHz	135W	40M	16	9.6GT/s	Yes
E5-2699 v3	2.3GHz	145W	45M	18	9.6GT/s	Yes

Table 7.   FC430 supported processors

Model	Speed	TDP	Cache	Cores	QPI	Turbo
E5-2603 v3	1.6GHz	85W	15M	6	6.4GT/s	No
E5-2609 v3	1.9GHz	85W	15M	6	6.4GT/s	No
E5-2620 v3	2.4GHz	85W	15M	6	8.0GT/s	Yes
E5-2623 v3	3.0GHz	105W	10M	4	8.0GT/s	Yes

Model	Speed	TDP	Cache	Cores	QPI	Turbo
E5-2630 v3	2.4GHz	85W	20M	8	8.0GT/s	Yes
E5-2630L v3	1.8GHz	55W	20M	8	8.0GT/s	Yes
E5-2640 v3	2.6GHz	90W	20M	8	8.0GT/s	Yes
E5-2650 v3	2.3GHz	105W	25M	10	9.6GT/s	Yes
E5-2650L v3	1.8GHz	65W	30M	12	9.6GT/s	Yes
E5-2660 v3	2.6GHz	105W	25M	10	9.6GT/s	Yes
E5-2670 v3	2.3GHz	120W	30M	12	9.6GT/s	Yes
E5-2680 v3	2.5GHz	120W	30M	12	9.6GT/s	Yes
E5-2683 v3	2.0GHz	120W	35M	14	9.6GT/s	Yes
E5-2695 v3	2.3GHz	120W	28M	14	9.6GT/s	Yes

For information on processor installation and configuration, see the *Dell PowerEdge FX Architecture Owner's Manual* on Dell.com/Support/Manuals.

Chipset

The Intel C610 chipset is implemented on the PowerEdge FC430 and FC630. For more information, visit Intel.com.

The PowerEdge FM120x4 microserver features the low-power Intel Atom C2000 processor and ultra-dense System-on-a-Chip (SoC) design. See the PowerEdge FM120x4 section for more details.

5 Memory

More memory options are available than ever before with the PowerEdge FX architecture — greater capacities, higher frequencies and more flexibility. The FC430 supports up to 256GB of memory and speeds up to 2133MT/s. The FC630 supports up to 768GB of memory and speeds up to 2133MT/s, providing high performance in a variety of applications. Not all processors support 2133MT/s memory speed. High memory density means there is no compromise when it comes to virtualization.

Increase your uptime and reduce data loss due to Dell's focus on reliability, availability, and serviceability (RAS) features. RAS aids in the rapid and accurate diagnosis of faults which require service, increasing your memory reliability. System uptime is reinforced with RAS features like memory mirroring, sparing, and many others.

The FC630 supports both registered and load reduced DIMMs (LRDIMMs), which use a buffer to reduce memory loading and provide greater density, allowing for the maximum platform memory capacity. The FC430 supports both registered DIMMs (RDIMMs). Unbuffered DIMMs (UDIMMs) are only supported on the FM120x4.

Supported memory

Table 8 lists the memory technologies supported by the FC630 (RDIMM or LRDIMM) and FC430 (RDIMM).

Table 8.   Memory technologies supported

Feature	RDIMM	LRDIMM
Register	Yes	Yes
Buffer	No	Yes
Frequencies	Up to 2133MT/s	Up to 2133MT/s
Ranks supported	Single or dual rank	Quad rank
Capacity per DIMM	4, 8, 16, or 32GB	32GB
Maximum DIMMS per channel	3	3
DRAM technology	x4 or x8	x4
Temperature sensor	Yes	Yes
Error Correction Code (ECC)	Yes	Yes
SDDC	Yes	Yes
Address parity	Yes	Yes

Table 9 lists DIMMs supported by the FC630. Table 10 lists the DIMMs supported by the FC430. For the latest information on supported memory, visit PowerEdge memory on Dell.com.

Table 9. DIMMs supported — PowerEdge FC630

Capacity (GB)	Speed (MT/s)	Type	Ranks per DIMM	Data width	SDDC support	Voltage
4	2133	RDIMM	1	x8	Advanced ECC	1.2
8	2133	RDIMM	2	x8	Advanced ECC	1.2
16	2133	RDIMM	2	x4	All modes	1.2
32	2133	LRDIMM	4	x4	All modes	1.2

Table 10. DIMMs supported — PowerEdge FC430

Capacity (GB)	Speed (MT/s)	Type	Ranks per DIMM	Data width	SDDC support	Voltage
4	2133	RDIMM	1	x8	Advanced ECC	1.2
8	2133	RDIMM	2	x8	Advanced ECC	1.2
16	2133	RDIMM	2	x4	All modes	1.2
32	2133	RDIMM	2	x4	All modes	1.2

DIMM speeds

The FC630 and FC430 support memory speeds of 2133MT/s, 1866MT/s, 1600MT/s, 1333MT/s, 1066MT/s, and 800MT/s depending on the DIMM types installed and the configuration. All memory on all processors and channels run at the same speed and voltage. By default, the systems run at the highest speed for the channel with the lowest DIMM voltage and speed. The operating speed of the memory is also determined by the maximum speed supported by the processor, the speed settings in the BIOS, and the operating voltage of the system. Not all processors support 2133MT/s speed.

Table 11 lists the memory configuration and performance details for the FC630 and FC430, based on the population of the number and type of DIMMs per memory channel. Note: The FC430 supports only 1DPC.)

Table 11. Memory configuration and performance

DIMM type	DIMM ranking	Capacity	DIMM rated voltage, speed	1 DPC	2 DPC	3 DPC
RDIMM	1R and 2R	4GB, 8GB, 16GB and 32GB (FC430 only)	DDR4 1.2V, 2133MT/s	2133MT/s	2133MT/s	1866MT/s
LRDIMM	4R	32GB (FC630 only)	DDR4 1.2V, 2133MT/s	2133MT/s	2133MT/s	1866MT/s

Memory configurations

PowerEdge FC630 server node: supports flexible memory configurations ranging from capacities of 4GB (minimum) to 768GB (maximum). The FC630 supports up to 12 DIMMs per processor (up to 24 DIMMs in a dual-processor configuration). Each server has four memory channels per processor with each channel supporting up to three DIMMs.

The FC630 supports a flexible memory configuration, according to the following basic rules:

- Speed: If DIMMs of different speeds are mixed, all channels across all processors operate at the slowest DIMM's common frequency.
- DIMM type: Only one type of DIMM is allowed per system: RDIMM or LRDIMM. These types cannot be mixed.

PowerEdge FC430 server node: supports one DIMM per channel for single-rank, dual-rank and quad-rank DIMMs. There are 8 sockets (288-pin) in total.

- Speed: The FC430 supports DDR4 Registered DIMMs (RDIMMs) at 2133MT/s.
- DIMM type: The FC430 does not support mixing DIMM types — the platform supports RDIMMs.

For more information on memory configuration, see the *Dell PowerEdge FX Owner's Manual* on Dell.com/Support/Manuals.

Memory RAS features

Reliability, availability, serviceability (RAS) features help keep the system online and operational without significant impact to performance, and can decrease data loss and crashing due to errors. RAS aids in rapid, accurate diagnosis of faults which require service.

Table 12 describes the RAS features supported on the FX server nodes.

Table 12.   RAS features

Feature	Description
Dense configuration optimized profile	Increased memory reliability can be a result from this selectable platform profile that adjusts parameters to reduce faults regarding refresh rates, speed, temperature and voltage
Memory demand and patrol scrubbing	Demand scrubbing is the ability to write corrected data back to the memory once a correctable error is detected on a read transaction. Patrol scrubbing proactively searches the system memory, repairing correctable errors.
Recovery from single DRAM device failure (SDDC)	Recovery from Single DRAM Device Failure (SDDC) provides error checking and correction that protects against any single memory chip failure as well as multi-bit errors from any portion of a single memory chip.
Failed DIMM isolation	Provides the ability to identify a specific failing DIMM channel pair, thereby enabling the user to replace only the failed DIMM pair.

Feature	Description
Memory mirroring: intra-socket	Memory mirroring is a method of keeping a duplicate (secondary or mirrored) copy of the contents of memory as a redundant backup for use if the primary memory fails. The mirrored copy of the memory is stored in memory of the same processor socket.
Memory address parity protection	This feature provides the ability to detect transient errors on the address lines of the DDR channel.
Memory sparing (rank)	Memory sparing allocates one rank per channel as a spare. If excessive correctable errors occur in a rank or channel, it is moved to the spare area while the operating system is running to prevent the error from causing an uncorrectable failure.
Memory thermal throttling	This feature helps to optimize power/performance and can also be used to prevent DIMMs from overheating.

For information on memory mirroring and sparing configurations, see the *Dell PowerEdge FX Owner's Manual* on Dell.com/Support/Manuals.

6 Storage

The PowerEdge FX architecture provides storage expandability that allows you to adapt to your workload and operational demands. The PowerEdge FC630, FC430 and FM120x4 offer comprehensive storage options, various drive types, internal and external storage controllers. The PowerEdge FD332 storage block likewise enables you to flexibly provision up to 48 SFF storage devices in a 2U FX2 chassis. The flexibility of the FX architecture's modular components results in 2U rack computing with massive direct-attached storage (DAS) capacity. (Note: PowerEdge FM120 microservers are not supported to work with the FD332.)

Features such as Express Flash PCIe SSDs provide vastly accelerated performance over previous technologies. Dell Express Flash drives use PCIe lanes to connect directly to the processor and chipset and are easily accessible through a hot-plug drive bay.

Internal storage

Table 13 details storage option and storage controllers for PowerEdge FX server nodes.

Table 13.   Internal storage options

Server	Storage options	Storage controllers
FC630	PowerEdge Express Flash NVMe PCIe SSD SATA HDD/SSD or SAS HDD/SSD Up to 8 x 1.8" SSD or 2 x 2.5"	PERC S130 (SW RAID) PERC H330 PERC H730 PERC H730P
FC430	Up to 2 x 1.8" uSATA SSDs	PERC S130 (SW RAID)
FM120x4	1 x 2.5" front-access hard drives or 2 x 1.8" SSD drives	PERC S110 (SW RAID)

Supported hard drives

Table 14 lists internal hard drives supported by the PowerEdge FX architecture. Note: not all drives listed below are available on all FX server nodes. Please consult the PowerEdge FC630, PowerEdge FC430 and PowerEdge FM120x4 sections for platform-specific technical specifications. For the latest information on supported hard drives, visit Dell's Enterprise Hard Drives page.

Table 14.   Supported hard drives

Form factor	Type	Speed (RPM)	Capacities
1.8"	uSATA SSD (6Gb)		200GB, 400GB, 800GB*
2.5"	Nearline SAS (6Gb)	7.2K	500GB, 1TB, 2TB
	SAS HDD (6Gb)	10K	300GB, 600GB, 900GB, 1.2TB, 1.8TB
	SAS HDD (6Gb)	15K	300GB, 600GB
	SATA HDD (6Gb)	7.2K	500B, 1TB
	SATA SSD (6Gb)		120GB, 200GB, 400GB, 480GB, 500GB, 800GB

*Available April, 7, 2015

Express Flash drives

Express Flash drives use PCIe and SSD technologies to provide performance, scalability and optimal serviceability. Accelerated performance with high IOPS is made possible without requiring processor resources or capturing DRAM. Also, Express Flash drives use a standardized 2.5" hot-plug form factor, which saves critical PCIe slot space by moving drives from the back to the front of the system, and allows a common management process for all drives. The PowerEdge FC630 has an option to support Express Flash PCIe SSDs in the 2.5" chassis.

PowerEdge RAID Controllers

Dell PowerEdge RAID Controller (PERC) cards provide enhanced performance, increased reliability and fault tolerance, and simplified management for a powerful, easy-to-manage way to create a robust infrastructure and help maximize server uptime. PERC9 cards feature:

- PCIe 3.0 support and 12Gb/s SAS host interface
- Significantly increased IOPS performance and throughput performance capability
- Capable of RAID as well as non-RAID operations
- FastPath™ I/O for accelerating performance when operating on SSDs
- Split Mirror function for breaking mirrored disk connection to quickly replace a drive
- Dimmer Switch™ for power control of spare or idle drives to save energy and operating expenses

The PowerEdge FC630 supports PERC cards listed in Table 15. **Note: not all PERC options listed below are supported on every FX server node.** For more information about the latest PERC offerings, see Dell.com/PERC.

<p style="text-align: center;">**Table 15.   Supported RAID controllers**</p>

Controller	Features	RAID modes supported	Form factor	Solution
PERC H830	• External 8-port 12Gb/s SAS • Supports SAS HDDs or SSDs • 2GB 1866MT/s DDR3 SDRAM non-volatile cache	0, 1, 10, 5, 50, 6, 60	Adapter (low-profile)	Performance-hungry external storage environments
PERC H730P	• Internal 8-port 12Gb/s PCIe RAID controller • Supports 3Gb/s, 6Gb/s and 12Gb/s SAS or SATA HDDs or SSDs • 2GB 1866MT/s DDR3 SDRAM non-volatile cache	0, 1, 10, 5, 50, 6, 60	Mini and Slim (Slim for 8 x 1.8" configuration)	Premium performance for significant performance gains
PERC H730	• Internal 8-port 12Gb/s PCIe RAID controller • Supports 3Gb/s, 6Gb/s and 12Gb/s SAS or SATA HDDs or SSDs • 1GB 1866MT/s DDR3 SDRAM non-volatile cache	0, 1, 10, 5, 50, 6, 60	Mini	Value/performance RAID and non-RAID for high-density servers and workstations
PERC H330	• Internal 8-port 12Gb/s PCIe RAID controller • Supports 3Gb/s, 6Gb/s and 12Gb/s SAS and 3Gb/s and 6Gb/s SATA HDDs or SSDs	0, 1, 10, 5, 50	Mini	Low-cost, entry RAID and non-RAID for high-density servers and workstations
PERC S130	• Software RAID controller • Supports up to 8 6Gb/s SATA HDDs and SSD • Only available on the 8-drive 2.5" configuration • Currently supports only Microsoft Windows operating systems	0, 1, 5, 10	System board-embedded SATA	Software

7 Networking and PCIe

The Dell PowerEdge FX architecture offers balanced, scalable I/O capabilities, including PCIe 3.0-capable expansion slots via the FX2 enclosure. Table 16 lists optional select network adapters (SNAs), converged network adapters (CNAs), network interface controllers (NICs) and host bus adapters (HBAs) available for the PowerEdge FX architecture.

Table 16.   Optional add-in PCIe expansion cards

Component	Adapter
PowerEdge FX2	Broadcom® 5719 quad-port 1Gb NIC
	Broadcom 57810 dual-port 1Gb
	QLogic® 57810S dual-port 10Gb Base-T network adapter
	QLogic 57810S dual-port 10Gb DA/SFP+ CNA
	Intel Ethernet I350 dual-port 1Gb server adapter
	Intel Ethernet I350 QP 1Gb server adapter
	Intel Ethernet X540 DP 10GBASE-T server adapter
	Intel X710 2-port 10GbE adapter
	Intel X520 DP 10Gb DA/SFP+ server adapter
	Emulex® OneConnect OCe14102-U1-D 2-port PCIe 10GbE CNA
	Emulex LPE 12000, single-port 8Gb Fibre Channel HBA
	Emulex LPE 12002, dual-port 8Gb Fibre Channel HBA
	Emulex LPe16002B, dual-port 16Gb Fibre Channel HBA
	Emulex LPe16000B, single-port 16Gb Fibre Channel HBA
	Emulex OneConnect OCe14102-N1-D 2-port PCIe 10GbE NIC
	QLogic 2560, single-port 8Gb Optical Fibre Channel HBA
	QLogic 2562, dual-port 8Gb Optical Fibre Channel HBA
	QLogic 2662, dual-port 16GB Fibre Channel HBA
	QLogic 2660, single-port 16GB, Fibre Channel HBA
	Mellanox® ConnectX®-3 single-port 10Gb Direct Attach/SFP+ network adapter
	Mellanox ConnectX-3 single-port 40Gb Direct Attach/QSFP network adapter

Component	Adapter
PowerEdge FX2	PERC H830 RAID adapter for external JBOD, 1GB NV Cache
	SAS 12Gbps HBA external controller
PowerEdge FC630	Broadcom 5720 1Gb quad-port KR Blade NDC
	QLogic 57840S 10Gb quad-port KR Blade NDC
	QLogic 57810-k dual-port 10Gb KR Blade NDC
	Emulex OneConnect OCm14102-U4-D, dual-port 10GbE, KR CNA NDC
	Intel i350 quad-port 1 Gigabit, KR Blade NDC
	Intel x520-k dual-port 10Gb KR Blade NDC
	Intel X710 dual-port 10GbE Blade NDC
	Intel X710 quad-port 10GbE Blade NDC
PowerEdge FC430 LAN On Motherboard (LOM)	QLogic 57810 dual-port 10G KR
	Intel i350 dual-port 1G KX

8 Power, thermal and acoustics

The PowerEdge FX2 chassis includes highly efficient power supplies and fans, and a layout optimized for balanced cooling of the compute, PCIe, I/O, and power subsystems. The optimized hardware design coupled with sophisticated power-management capabilities built into the Chassis Management Controller (CMC), power supplies and iDRAC allow you to further enhance a power-efficient server environment.

Power consumption and energy efficiency

With the rise in the cost of energy coupled with increasing data center density, Dell provides tools and technologies to help you realize greater performance with less energy cost and waste. More efficient data center usage can reduce costs by slowing the need for additional data center space.

Table 17 lists the tools and technologies Dell offers to help you achieve your data center goals by lowering power consumption and increasing energy efficiency.

Table 17.   Power tools and technologies

Feature	Description
Power supply units (PSU) portfolio	Dell'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	Energy Smart Solution Advisor (ESSA) is a tool that helps IT professionals plan and tune their computer and infrastructure equipment for maximum efficiency by calculating the hardware power consumption, power infrastructure and storage. Learn more at Dell.com/calc.
Industry compliance	Dell's servers are compliant with all relevant industry certifications and guidelines, including 80 PLUS and Climate Savers.
Power monitoring accuracy	PSU power monitoring improvements include: • Power monitoring accuracy of 1%, whereas the industry standard is 5% • More accurate reporting of power • Better performance under a power cap
Power capping	Use Dell'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 is the first hardware vendor to leverage Intel Node Manager for circuit-breaker fast capping.
Systems management	iDRAC8 Enterprise provides server-level management that monitors, reports and controls power consumption at the processor, memory and system level. 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.
Dell Fresh Air 2.0	With the thermal design and reliability of Dell products, certain configurations of PowerEdge 13th generation servers have the capability to operate at temperatures beyond the industry standard of 35°C (95°F). The supported configurations that meet Dell Fresh Air 2.0 specifications can operate

Feature	Description
	continuously at 40°C (104°F) and up to 45°C (113°F) for excursionary periods of time and up to a 29°C dew point at 90% relative humidity without impacting your availability model. Find additional information at Dell.com/FreshAir.
Active power management	**Dell Active Power Controller (DAPC)** provides operating system-agnostic power-management capability designed to save you money by lowering the system-level power draw at times of low utilization.
	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 iDRAC8 Enterprise and OpenManage Power Center that allows policy-based management of power and thermals at the individual server, rack and data center level.
	Hot Spare improves the operating PSU efficiency, thereby reducing overall power consumption.
	Thermal Control of Fan Speed optimizes the thermal settings for your environment to reduce fan consumption and lower system power consumption.
	Idle Power enables Dell servers to run as efficiently when idle as when at full workload.

Find additional information at Dell.com/PowerCenter and Dell.com/PowerAndCooling.

Power supply units

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 FX2 enclosure:

- 2000W, 1600W or 1100W AC power supplies in 1+1 redundant, redundancy alerting only, 2+0 non-redundant configurations.

Power management features of PowerEdge FX2 help administrators configure the enclosure to reduce power consumption and to adjust the power as required specific to the environment.

The FX2 enclosure consumes AC power and distributes the load across the active power supply unit. The system can deliver up to 3371W of AC power that is allocated to server modules and the associated enclosure infrastructure. However, this capacity varies based on the power redundancy policy selected.

Power management through OpenManage Power Center

When OpenManage Power Center (OMPC) controls power externally, CMC continues to maintain redundancy policy and remote power logging. OMPC then manages server power, and system input power capacity. Note: actual power delivery is based on configuration and workload.

You can use the CMC web interface or RACADM to manage and configure power controls on CMC:

- View the status for the chassis, servers and PSUs.
- Configure power budget and redundancy policy for the chassis.
- Execute power control operations (turn on, turn off, system reset, power-cycle) for the chassis

Thermal and acoustics

The PowerEdge FX2 enclosure supports eight hot-swappable cooling fans that provide cooling to the I/O components in the system. To provide increased cooling to the PCIe components in the system, the user can enable the "Fan Offset" feature in the CMC web interface. For more information on the "Fan Offset" option, see the Dell Chassis Management Controller User's Guide for FX2.

Acoustical design

The PowerEdge FX2 enclosure requirements meet the Category 5 Acoustic specification as defined as an Unattended Data Center for the minimal configurations. Typical configurations will be Category 6. Requirements at Category are idle configurations ≤ 7.8 bels and active configurations ≤ 8.0 bels.

ISO acoustical standards such as ISO7779 and ISO9296 mandate temperature at 23 +/-2 degrees C.

Most combinations of FX2 sleds and configurations result in acoustical output that is most appropriate for data center usage, i.e., environments in which people standing next to each other must elevate their voices to be heard and cannot discern speech on a telephone. The following are however two specific sled scenarios that are quieter — note that in both cases, all sleds in FX2 must be the same (i.e., homogeneous).

- PowerEdge FC630 with "reduced acoustics option" and restricted list of components (all sleds must have the "reduced acoustics option," i.e., if one does not, it will dominate the sound) results in FX2 with acoustical output acceptable for attended data centers or labs (i.e., people standing next to each may talk with each other or discern speech on a telephone with only slight interference from data center noise). The following is a list of restrictions with use of "reduced acoustics option:"
  - > All FC630 sleds structured in the chassis must be homogenous
  - > 104mm wide CPU heatsink MUST be required and will occupy DIMM space, only support either 16xunbalance DIMM or 8xbalance DIMM
  - > Chassis must use dual 1600W PSUs
  - > 1Gb/10Gb pass-through for FAB A and B.
- PowerEdge FM120 may be used in FX2 with minimal impact to office environment acoustics.

FX2 acoustics vary significantly with utilization. Acoustical output from FX2 with a standard FC630 in operating states (e.g., CPUs at 50% TDP) is significantly higher (about four times as loud) than that for their idle states. (This is not the case for the FX2 with a homogeneous population of FM120x4 server nodes — operating and idle states with all FM120 server nodes are about the same and, as stated above, appropriate for office environments.)

Figure 6.   PowerEdge FX architecture acoustics

For background information on Dell Enterprise acoustics, please see the Dell white paper, "Dell Enterprise Acoustics."

Data summary for FX acoustics

Acoustical Performance Data and Interpretation, re: typically configured[1] FX2 chassis in 23 $\pm$ 2 °C ambient (per ISO acoustical standards) with the following blades and utilization

- All FC630 sleds with same "volume" or "typical" configuration WITH *"reduced acoustics option"*
  - > Idle & Operating: LwA-UL(2) = 5.5 & 6.7 bels; LpA (3) = 36 & 47 dBA; Audible but not objectionable tones(4)
  - > What does this mean? These sounds would be acceptable in attended data centers but not office environments. Note that "Operating" mode, i.e., ~50% workload is about 50% louder than Idle.
  - > The "reduced acoustics option" consists of a larger heat sink at the tradeoff of DIMM count: 104mm wide CPU Heatsink MUST be required and will occupy DIMM space, only support either 16xunbalance DIMM or 8xbalance DIMM
  - > Other configuration restrictions to gain benefit of "reduced acoustics option" are the following:
  - > All FC630 sleds structured in the chassis must be homogenous
  - > Chassis must use dual 1600W PSUs
  - > 1Gb/10Gb pass through for FAB A and B
- All FC630 sleds with same "volume" or "typical" configuration without "reduced acoustics option"
  - > Idle and operating: LwA-UL[2] = 5.5 & 7.7 bels; LpA [3] = 37 & 54 dBA; Audible but not objectionable tones[4]

> What does this mean? Idle is acceptable in attended data center, but acoustics ramp significantly with utilization, such that ~50% workload would be about four times louder than Idle and only acceptable in unattended data centers.

- All FM120 sleds with same "volume" or "typical" configuration
    - Idle and operating: LwA–UL(2) = 5.0 bels; LpA (3) = 33 dBA; Audible but not objectionable tones(4)
    - What does this mean? These levels are acceptable for office environments however some tones may be audible.

- Other Acoustical Notes
    - Utilization: As work load on processor increases, acoustical levels also increase. The FM120 and FC630 with "reduced acoustics option" are less sensitive to utilization changes, but the standard FC630 will exhibit significant acoustical change with utilization.
    - Transients: As utilization changes, e.g., from Idle to 50% workload, fan speeds and hence acoustics will temporarily exceed the steady-state values.

Footnotes:

(1) Typical configuration means a population for FX2 are the following:
    - FX2 must be populated with homogeneous sleds, i.e., all same sleds, not mixed, in FX2.
    - FX2 chassis must be populated with PCI switch (Fan only board for FM120), PCI card blanks, 2 x 1600W PSUs (2 x 1100W PSUs for FM120), CMC, 2 x 1Gb ILM pass-through.
    - FX2 must also, for FC630, contain 1 x Fibre Channel HBA per sled (total of 4 x Fibre Channel HBA) + 8 x PCIe Cards
    - FX2 must also, for FM120 population, contain 0 x Fibre channel or PERC

(2) LwA – UL is the upper limit sound power levels (LwA) calculated per section 4.4.1 of ISO 9296 (1988) and measured in accordance to ISO 7779 (2010).

(3) LpA is the average bystander position A-weighted sound pressure level calculated per section 4.3 of ISO9296 (1988) and measured in accordance with ISO7779 (2010). The system is placed in a Dell rack 75cm above ground.

(4) Prominent tone: Criteria of D.6 and D.11 of ECMA-74 11th ed. (2010) are followed to determine if discrete tones are prominent. The system is placed in a Dell rack 75cm above ground and acoustic transducer is at front bystander position, ref ISO7779

9 Rack, rails and cable management

The rail systems for the PowerEdge FX2 and FX2s chassis consist of two types: sliding and static.

- ReadyRails II sliding rails for tool-less mounting in 4-post racks with square or unthreaded round holes or tooled mounting in 4-post threaded hole racks with support for strain relief bar (SRB.)
- ReadyRails static rails for tool-less mounting in 4-post racks with square or unthreaded round holes or tooled mounting in 4-post threaded racks

Sliding and static rail systems

The sliding rails allow the system to be extended out of the rack for fan service. The SRB can only be used with the sliding rails.

The sliding and static rail systems for the FX2/FX2s provide tool-less support for 4-post racks with square or unthreaded round mounting holes, including all generations of Dell racks. Both also support tooled mounting in 4-post threaded racks.

The rails ship in the tool-less mounting configuration but can be converted to the tooled configuration very quickly and easily as shown in the figure below.

Figure 7.   FX2/FX2s sliding rails with strain relief bar
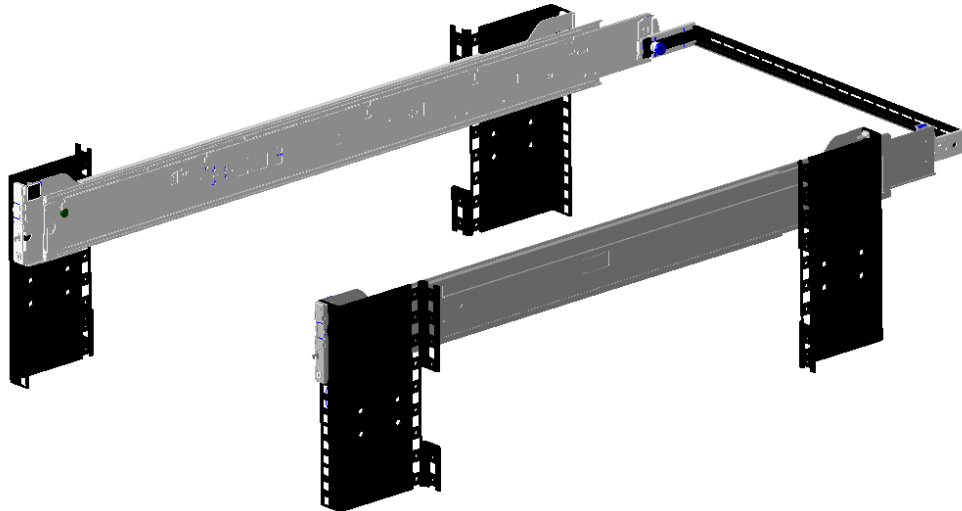
Static rails support a wider variety of racks than the sliding rails but do not support serviceability in the rack and are thus not compatible with the SRB.

Figure 8.   FX2/FX2s static rails
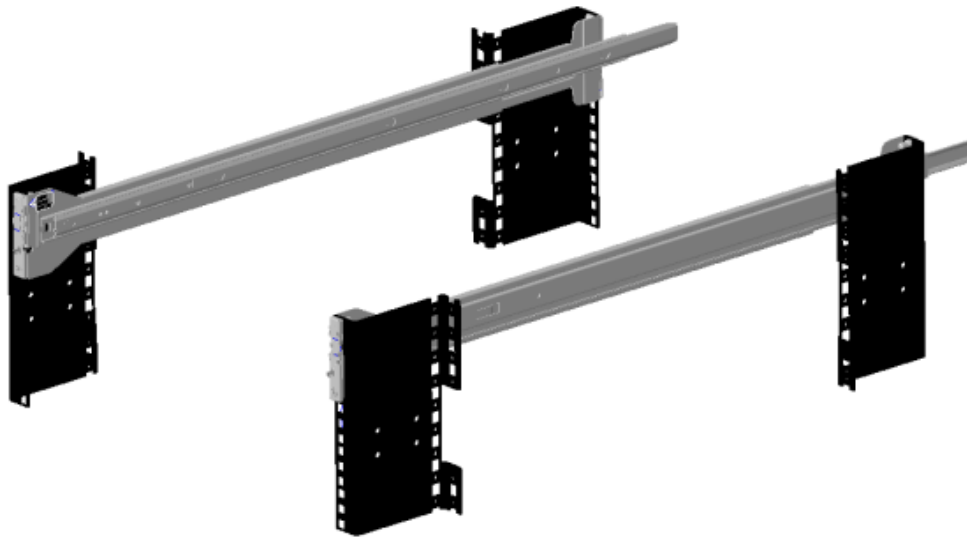
Both sliding rails and static rails support tool-less mounting in 19-inch-wide, EIA-310-E compliant square hole and unthreaded round hole 4-post racks. Both also support tooled mounting in threaded hole 4-post racks, but do not support mounting in 2-post (Telco) racks.

| Product | identifier | Mounting interface | Type | Rack types supported | | | | |
| | | | | 4-post | | | 2-post | |
				Square	Round	Thread	Flush	Center
FX2/FX2s	B10	ReadyRails II	Sliding	√	√	√	X	X
	B11	ReadyRails II	Static	√	√	√	X	X

Note that 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 must be 10 mm or less.

Some key factors governing proper rail selection include the spacing between the front and rear mounting flanges of the rack, the type and location of any equipment mounted in the back of the rack such as power distribution units (PDUs), and the overall depth of the rack. Due to their reduced complexity and lack of SRB support, the static rails offer a greater adjustability range and a smaller overall mounting footprint than the sliding rails.

| Product | Identifier | Type | Adjustability range (mm) | | | | | | Depth (mm) | |
| | | | Square | | Round | | Threaded | | without CMA/SRB | with CMA/SRB |
			Min	Max	Min	Max	Min	Max		
FX2/FX2s	B10	Sliding	677	815	665	809	677	830	836	888
	B11	Static	644	916	632	910	644	930	828	-

Note that the adjustment range of the rails is a function of the type of rack in which they are being mounted. The min-max values listed above represent the allowable distance between the front and rear mounting flanges in the rack. Rail depth without the SRB represents the minimum depth of the rail with the SRB attachment brackets removed (if applicable) as measured from the front mounting flanges of the rack.

Strain relief bar

The strain relief bar (SRB) for the FX2/FX2s organizes and secures the cables exiting the back of the server. It supports large cable loads and 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 FX2/FX2s SRB include:

- Sturdy bar that supports large cable loads
- Controls stresses on connectors
- Can be adjusted for depth, to accommodate various cable loads and rack depths
- 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

10 Operating systems and virtualization

The Dell PowerEdge FX architecture supports a wide range of industry-standard operating systems and virtualization software.

Supported operating systems

Table 18 lists the primary operating systems supported on the FX Architecture. For the latest information on supported operating systems, see Dell.com/OSsupport.

Table 18.   Primary operating system support

Operating system	Platform	Edition	FC630	FC430	FM120x4
Microsoft Windows Server 2012	x64	Essentials			x
		Standard	x	x	x
		Datacenter	x	x	
Microsoft Windows Sever 2012 R2	x64	Essentials			x
		Standard	x	x	x
		Datacenter	x	x	
Microsoft Windows Server 2008 R2 SP1	x64	Standard	x	x	x
		Enterprise	x	x	
		Datacenter	x	x	
Microsoft Windows Server 2008 SP2	x86/x64	Standard	x	x	x
	x86/x64	Enterprise	x	x	
	x64	Datacenter	x	x	
Red Hat Enterprise Linux 6.5	x86/x64	N/A	x	x	x
Red Hat Enterprise Virtualization 3.31	x64	N/A	x	x	x
SUSE Linux Enterprise Server 11 SP3	x64	N/A	x	x	x

[1] Based on RHEL 6.5

Supported virtualization

One of the key features for virtualization on the FX architecture.is the support for a fail-safe hypervisor. By running the hypervisor on an optional SD card and installing a backup copy on the other mirrored SD card, you can protect against hardware failure and maximize virtualization uptime.

Table 19 highlights the virtualization support for the FX architecture.

Table 19.   Virtualization support

Operating systems	Option	Supported
Microsoft Windows Server 2008 R2 SP1 (with Hyper-V enabled), x64 Standard	FI	FC630, FC430, FM120x4
Windows Server 2012 Hyper-V R3	FI	FC630, FC430, FM120x4
Citrix® XenServer® 6.2	-	FC630, FC430
VMware vSphere ESXi 5.5	FI	FC630, FC430
VMware vSphere ESXi 5.1	FI	FC630, FC430
VMware vCenter plug-in	N/A	FC630, FC430

FI = factory install
(OpenManage Integration with VMware vCenter hypervisor support: v5.5, v5.5 U1 and v5.1 U2)

11 Dell OpenManage systems management

Whether your IT environment consists of a few servers or a few thousand, the Dell OpenManage systems management portfolio provides comprehensive management for evolving IT environments. OpenManage is based on open standards and offers both agent-free and agent-based server lifecycle management functionality for Dell PowerEdge servers. OpenManage solutions help you automate and streamline essential hardware management tasks.

The advanced embedded management capabilities of Dell OpenManage technology also integrate and connect with third-party systems management solutions that you may already use, making Dell platforms easy to manage and deploy in any IT environment. If your IT environment already uses tools from third parties such as Microsoft, VMware, BMC Software, or others, you can use OpenManage integrations and/or connections to leverage your existing management framework to efficiently manage Dell PowerEdge servers and converged platforms,

OpenManage systems management solutions consist of a combination of embedded management components, tools and software solutions that help you automate and simplify the entire server management lifecycle through its various phases: deploy, update, monitor and maintain. OpenManage solutions are innovatively designed for simplicity and ease of use to help you reduce complexity, save time, achieve efficiency, control costs and empower productivity.

Server Lifecycle Management

Dell's system management solutions begin with the integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller that is part of every Dell PowerEdge server.

Figure 9.   Server lifecycle management operations
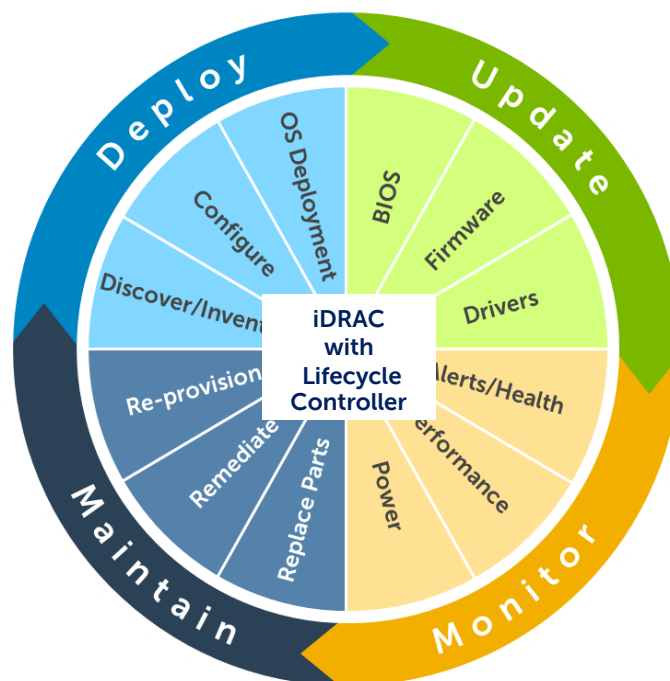
OpenManage systems management

The Dell OpenManage systems management portfolio includes powerful hardware and software management tools, consoles, and integration and connections with Dell SupportAssist and third- party systems management consoles.

iDRAC with Lifecycle Controller

The Integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller is the heart of Dell PowerEdge servers' embedded management functionality. In addition to enabling agent-free management, iDRAC with Lifecycle Controller provides remote access to the system — whether or not there is a functioning operating system or hypervisor running on the server. These embedded features help simplify and automate all aspects of server lifecycle management: deployment, updates, monitoring and maintenance.

Table 20 describes the functions and benefits of iDRAC with Lifecycle Controller.

Table 20.   iDRAC with Lifecycle Controller functions and benefits

Feature	Function	Benefit
Out-of-band	iDRAC with Lifecycle Controller offers real-time out-of-band discovery, inventory, deployment, monitoring, alerting and updates for server nodes and internal storage	Manage servers independent of the OS/hypervisor type or status—even if an OS/hypervisor is not installed
Dedicated GigE port (PowerEdge rack and tower systems)	Gigabit Ethernet connectivity	Fast throughput for better performance; compatibility with setup for switches
Email alerts	Simplified, informative, and actionable messaging including key information on systems and components, service tag, and so on	More detail allows IT administrators to be more efficient in diagnosing and remediating if an issue occurs; alerts include a direct, embedded URL in the email notification to further speed resolution
vFlash media	Enabled with iDRAC Enterprise	Allows for use of a non-Dell SD card
Electronic licensing	To obtain a software license key for iDRAC Express for Blades or iDRAC Enterprise after server purchase (APOS), submit a request to purchase a software license key through the Dell Licensing Portal or with a Dell sales representative	If iDRAC Express for Blades or iDRAC Enterprise is ordered during initial point of sale, license key is installed. If Basic Management is ordered during initial point of sale, customer must request a license key through the Dell Licensing Portal. For most server models, embedded server management and electronic licensing enables feature enhancements that do not require installation of additional hardware or system downtime.

iDRAC with Lifecycle Controller and FX configuration options

iDRAC Enterprise is the standard offering for the FX architecture since it is designed for optimal remote management. The Express version is optional for cost-conscious customers, but has a reduced feature set.

iDRAC feature comparison

iDRAC Enterprise and Express are available for the PowerEdge FX Architecture. A detailed feature comparison for iDRAC Enterprise and iDRAC Express is shown in Table 21.

Table 21.   Feature comparison for iDRAC Enterprise and iDRAC Express for FX

	Feature	iDRAC8 Enterprise	iDRAC8 Express
Interface and standard support	IPMI 2.0	●	●
	Web-based GUI	●	●
	SNMP and IPMI discovery	●	●
	WSMan	●	●
	SMASH-CLP (SSH)	●	●
	RACADM CLI (SSH and local)	●	●
	RACADM CLI (remote)	●	●
	NTP and time zone support	●	●
Connectivity	DNS	●	●
	VLAN tagging	●	●
	IPv4	●	●
	IPv6	●	●
	Dynamic DNS	●	●
Security and Authentication	Role-based authority	●	●
	Local users	●	●
	SSL Encryption	●	●
	Active Directory	●	
	Generic LDAP support	●	
	Two-factor authentication[1]	●	
	Single sign-on	●	
	PK Authentication (for SSH)	●	

Remote Management and Remediation	Embedded Diagnostics	•	•
	Remote firmware update	•	•
	Server power control	•	•
	Serial-over-LAN (with proxy)	•	•
	Serial-over-LAN (no proxy)	•	•
	Last crash screen capture	•	•
	Last crash video capture/playback	•	
	Virtual Media[2]	•	•
	Virtual Console[2]	•	•
	Virtual Console sharing[2]	•	
	Remote Virtual Console Launch	•	
	Virtual Folders	•	
	Virtual Console Chat	•	
	Remote File Share	•	
	Virtual Flash	•	
	Virtual Flash Partitions	•	
Monitoring and Power	Sensor monitoring and alerting	•	•
	SNMP Alerts (v1, v2)	•	•
	SNMPv3 Gets	•	•
	Email Alerts	•	•
	DIMM Ranking	•	•
	Real-time power monitoring	•	•
Logging	System Event Log	•	•
	RAC Log	•	•
	Trace Log	•	•
	Lifecycle Controller Log	•	•
	Remote Sys Log	•	

DELL

Lifecycle Controller	Local updates	•	•
	Driver Packs	•	•
	One to Many Hardware Configuration (WSMan or RACADM)	•	•
	Asset Inventory Export	•	•
	Remote services (by WSMan)	•	•
	Auto-configuration of replaced parts	•	•
	System backup and restore	•	

[1]Two-factor authentication is available via Active-X and therefore only supports Internet Explorer
[2]Virtual Console and Virtual Media are available via both Java and Active-X plug-ins

Upgrade options after point of sale

You can evaluate and purchase upgrades from Dell from your iDRAC web interface with no need to install additional hardware. You have a choice of ordering either the software license, or order an Enterprise license with an 8GB or 16GB vFlash SD card. The vFlash is factory installed, but a license key is required for activation. You may purchase an SD card locally larger than 16GB. You may create multiple partitions on the SD card, but individual partition size is limited to 4GB.

Agent-based management

Many systems management solutions require software agents to be installed on each compute node in order to be managed within the IT environment. Additionally, the systems management agent is often used as a local interface into the hardware health and may be accessed remotely as a management interface, typically referred to as a one-to-one interface. For customers that prefer to use agent-based management solutions, Dell provides OpenManage Server Administrator software

iDRAC Service Module (ISM)

iDRAC Service Module is an optional software service that installs in a supported server OS and expands iDRAC's management capabilities by providing a very lightweight means to report OS-aware attributes such as the host OS IP addresses and also provides key OS information when troubleshooting issues.

OpenManage Server Administrator

The Dell OpenManage Server Administrator (OMSA) agent provides a comprehensive, one-to-one systems management solution for both local and remote servers and their storage. OMSA can help simplify single-server monitoring with a secure CLI or web interface. It can also be used to view system configuration, inventory, health, and performance.

Agent-free management

Because Dell PowerEdge servers include embedded server management with iDRAC8 with Lifecycle Controller, in many cases there is no need to install an OpenManage systems management software agent

into the operating system of a Dell PowerEdge FX system. This greatly simplifies and streamlines the management footprint and performance of management tasks in multi-operating system and hypervisor environments.

Dell OpenManage consoles

Chassis Management Controller (CMC)

As mentioned previously, CMC is a systems management hardware component which provides both command-line and graphical interfaces that are used to monitor and manage multiple FX server nodes and chassis. The CMC hardware is a hot-pluggable module housed inside the FX2 chassis. CMC provides a secure web interface that allows an IT administrator to inventory, perform configuration and monitoring tasks, remotely power on/off server nodes, and enable alerts for events related to the FX2 chassis, server nodes and components, shared storage and networking within the FX system. The CMC utilizes each server node's embedded iDRAC with Lifecycle Controller to perform management functions, such as opening a remote console session from the CMC interface.

As Table 22 shows, the highest level of CMC functionality is provided by an Enterprise CMC license which is the default license. With an Enterprise license, a high level of systems management capabilities is included with CMC for FX. An entry-level Express management license is also available. Please note: CMC licensing is not the same as iDRAC licensing. Each Dell PowerEdge server node within the FX platform must have an iDRAC with Lifecycle Controller Enterprise or Express license, and it is suggested that both components should be used with the same license level. The CMC is used to manage the FX platform and its components, in addition to the server nodes, so separate licenses are required.

Table 22.   Additional features offered with Enterprise CMC licensing

Automation of Server Configuration Profile replication
Directory Services
Enclosure-level Power Capping
Enclosure Restore and Backup
Multi-chassis Management
PK Authentication
Remote File Share
Two-Factor Authentication
Server Module Firmware Update
Single Sign-On Support

For more information on these and other features, visit the [Dell Tech Center page for CMC](). For the Dell online License Management portal, go to [Dell.com/support/retail/lkm]().

Dell OpenManage Essentials (OME)

OpenManage Essentials, available as a no-charge software download from Support.Dell.com, is a one:many systems management console that provides comprehensive monitoring and health status reports for Dell server, storage, networking, and firewall devices as well as supported third-party hardware. OME also delivers integration with OpenManage Mobile, Dell's app for Android and iOS devices, for anywhere, anytime systems management capability through a handheld smart device as well as integration with Dell SupportAssist for automated Tech Support case generation and quick resolution if issues occur. The most recent enhancement to OME, available via an additional software license, is Server Configuration Management, which enables automated bare-metal PowerEdge server configuration and OS deployment, in addition to detection and reporting of server configuration drift from baseline settings within production environments.

Dell OpenManage Mobile

OpenManage Mobile (OMM) is a free Dell software application for Android and iOS that allows IT administrators to securely perform a subset of data center monitoring and remediation tasks anytime, anywhere using their mobile device. OpenManage Mobile communicates directly with PowerEdge servers' iDRAC with Lifecycle Controller for 1:1 management operations or through integration with OpenManage Essentials, operates as a 1:Many connection to browse hardware inventory, perform power operations, forward alerts and receive push notifications for critical alerts.

Additional OpenManage systems management tools, utilities and protocols

Dell OpenManage systems management tools and utilities also include the following:

- **Dell Repository Manager**—The Dell Repository Manager (RM) is a standalone GUI-based productivity tool that helps simplify the process of managing downloads and baseline BIOS, firmware, and driver updates. Repository Manager can create deployment disks as well as create and manage customized repositories.
- **Dell Update Packages**—The Dell Update Packages (DUP) are self-contained executables delivered in a standard package format that updates firmware and/or software components on a Dell server such as the BIOS, drivers, component firmware and other software updates.
- **Dell OpenManage Deployment Toolkit**—The Dell OpenManage Deployment Toolkit (DTK) is a command line-based tool that includes a set of utilities for configuring and deploying Dell PowerEdge systems and can be used to build scripted, unattended OS installations to deploy large numbers of servers in a reliable fashion.
- **RACADM**—The RACADM command-line utility provides a scriptable interface that allows you to locally or remotely configure iDRAC8.
- **IPMITool**—IPMITool includes scriptable console application programs used to control and manage remote systems using the IPMI version 1.5 and later protocol.
- **Web Services for Management (WSMAN)**—WSMAN is a SOAP-XML–based protocol for exchanging system management information. Dell's implementation provides remote management capabilities through a secure and standards-based Web Services–Management (WS-MAN) interface to PowerEdge servers and blade server node chassis.

Integration with third-party consoles

Dell OpenManage provides integration with several leading third-party consoles, including:

- **OpenManage Integration Suite for Microsoft System Center**—This suite helps you further streamline, automate and simplify your most essential IT management tasks. For more information, visit http://www.dell.com/learn/us/en/04/solutions/dcsm-microsoft-system-center.
- **OpenMange Integration for VMware vCenter**—This plug-in allows IT administrators to monitor, provision, and manage the physical PowerEdge server hardware and firmware from a dedicated Dell menu accessed through the VMware vCenter console using the same role-based access control model as vCenter, combining physical server management. For more information, visit http://www.dell.com/learn/us/en/04/virtualization/management-plug-in-for-vmware-vcenter.
- **BMC Software**—Dell and BMC Software work together to simplify IT by ensuring tight integration between Dell server, storage, and network management functionality and the BMC Software process and data center automation products. BMC has included this integration in their datacenter management platform, so there are no additional components needed from Dell to use this technology.

Connections with third-party consoles

Dell OpenManage Connections give administrators an easy path to adding support for third-party devices, so you can continue to use your existing management tools while easily adding Dell server systems to that existing IT environment. Integrate new systems at your own pace. Manage new Dell servers and storage with your legacy management tools, while extending the useful life of your existing resources. With these OpenManage Connections you can add monitoring and troubleshooting of Dell assets to your IT infrastructure:

- OpenManage Connection for CA
- OpenManage Connection for Nagios
- OpenManage Connection for Oracle
- OpenManage Connections for HP
- OpenManage Connections for IBM

For more information on these OpenManage Connections, visit dell.com/learn/us/en/04/solutions/dcsm-partner-consoles.

12   PowerEdge FC630

Introduction

With powerful processors, impressively large memory and highly scalable I/O capabilities, the PowerEdge FC630 excels at running applications for midsize and large businesses, like enterprise resource planning and customer relationship management. Combining exceptional performance and functional flexibility, the FC630 is also ideal for large databases or substantial virtualization environments.

Flexible, scalable, powerful

Powered by up to two 18-core Intel Xeon E5-2600 v3 processors, each FC630 has 24 DIMMs of memory, two 2.5-inch or eight 1.8-inch front-access drives, a 10Gb SNA and access to two PCIe expansion slots in the shared chassis.

Fit the infrastructure to the job

With the capability to handle demanding business applications and the databases that support them, the future FC630 is the perfect building block for the core of a corporate data center. Offering exceptional performance and a rich set of storage options, including the FD332 storage block with up to 16 direct-attached drives, the FX architecture enables you to build an infrastructure that is tailor-made to suit your unique IT requirements.

The efficiencies of shared infrastructure

FC630 servers are housed in the FX2 enclosure — a 2U rack-based converged platform that delivers the density of a blade architecture with the simplicity and cost benefits of rack-based systems — all in a compact modular design. The FX2 delivers efficiency through shared power, cooling, networking, and management, as well as PCIe expansion slots and I/O module options that enable DAS, SAN or NAS storage.

New technologies

Table 23 lists new technologies on the PowerEdge FC630.

Table 23.   New technologies

New technologies	Detailed descriptions
Intel Xeon processor E5-2600 v3 product family	This new family of Intel processors has embedded PCIe lanes for improved I/O performance. See the Processor section for details.
Intel C610 series chipset	The Intel Platform Controller Hub (PCH) chip is used on the FC630.
2133MT/s DDR4 memory	Certain models of E5-2600 v3 series processors support 2133MT/s memory. The FC630 supports 768GB (24 DIMM slots) up to 2133MT/s. See the Memory section for details.
Next-generation PERC	The FC630 supports new PERC controller cards with improved functionality and faster performance. See the Storage section for details.

New technologies	Detailed descriptions
PERC S130	This new software RAID solution supports RAID 0, 1, 5 and 10 and supports a maximum of eight hot-plug SATA HDDs or SSDs. See the Storage section for details.
iDRAC8 with Lifecycle Controller	The new embedded system management solution for Dell servers features hardware and firmware inventory and alerting, in- depth memory alerting, faster performance, a dedicated gigabit port and many more features. See the Dell OpenManage systems management section for details
iDRAC Direct	The front USB port on FC630 (marked with tool symbol) provides direct access to the iDRAC GUI via a laptop browser. An A-to-A USB cable is required to use this feature. This port can also be used to upload xml configuration files to the iDRAC.
Failsafe hypervisors	The internal dual SD module (IDSDM) enables Dell's unique Failsafe Virtualization architecture, ensuring uptime by providing failover capability for embedded hypervisors, such as VMware vSphere ESXi.
Dell Fresh Air 2.0	Dell has tested and validated select Dell PowerEdge 13th generation servers that operate at higher temperatures enabling you to reduce your hours of economization or even go chiller-less. See the Power, thermal and acoustics section for details.
12Gb/s SAS	SAS-3 doubles the interface bandwidth from the previous generation at 12Gb/s. SAS-3 addresses signal quality through transmitter training, which gives one of the receiver device's key interconnects, its PHY, the ability to modify the settings of the transmitter device's PHY.
6Gb/s SATA	SATA 3.0 runs with a native transfer rate of 6Gb/s, and taking 8b/10b encoding into account, the maximum uncoded transfer rate is 4.8Gb/s (600MB/s). The theoretical burst throughput of SATA 3.0 is double that of SATA 2.0.
Next-generation Express Flash drives	Dell Express Flash PCIe solid-state drives provide fast performance without requiring processor resources or capturing DRAM. The FC630 supports up to two Express Flash drives.
1.8" SSDs	1.8" form factor SATA SSDs provide a high spindle count and fast cache layer for tiered storage applications.
USB 3.0	USB 3.0 can operate in both USB 2.0 speed and USB 3.0 speed modes. USB 3.0 driver is required to control USB device in USB 3.0 speed mode.

Specifications

Table 24 summarizes the product features for the PowerEdge FC630 server node. For the latest information on supported features for the PowerEdge FX, visit Dell.com/PowerEdge.

Table 24.   Technical specifications

| Feature	PowerEdge FC630 technical specification
Form factor	Half-width – supports up to 4 sleds per PowerEdge FX2 chassis

Feature	PowerEdge FC630 technical specification
Processors	Intel Xeon processor E5-2600 v3 product family **Processor sockets:** 2 **Cache:** 2.5MB per core; core options: 4, 6, 8, 10, 12, 16, 18 **Chipset**: Intel C610 series
Memory[1]	Up to 768GB (24 DIMM slots): 4GB/8GB/16GB/32GB DDR4 up to 2133MT/s
PCIe slots	Access to 2 x PCIe 3.0 (x8) expansion slots
RAID controller	PERC S130 (SW RAID), PERC H330, PERC H730, PERC H730P
Primary storage	**Hot-plug hard drive options:** PowerEdge Express Flash NVMe PCIe SSD, SATA HDD/SSD or SAS HDD/SSD; Up to 8 x 1.8" SSD or 2 x 2.5"
Power supplies	Chassis level – PowerEdge FX2 hot-plug PSU: 2000W or 1600W AC in 1+1 redundant or 2+0 non-redundant configurations
Systems Management	• FX uses Chassis Management Controller (CMC) to manage all resources (server nodes and shared infrastructure) in a single web console • OpenManage portfolio for FX supports local and remote management, consistent with other • PowerEdge products CMC and iDRAC are available with either Enterprise or Express licensing to best suit specific management needs • Server nodes each contain proven iDRAC8 with Lifecycle Controller for agent-free, automated systems management
Supported hypervisors	Optional supported hypervisors: Citrix XenServer
Operating systems	Microsoft Windows Server 2008 R2 SP1, (includes Hyper-V) Microsoft Windows Server 2012 Microsoft Windows Server 2012 R2 (includes Hyper-V) Novell SUSE Linux Enterprise Server Red Hat Enterprise Linux

[1]GB means 1 billion bytes and TB equals 1 trillion bytes; actual capacity varies with preloaded material and operating environment and will be less.

FC630 views and features

Figure 10.   Inside the PowerEdge FC630
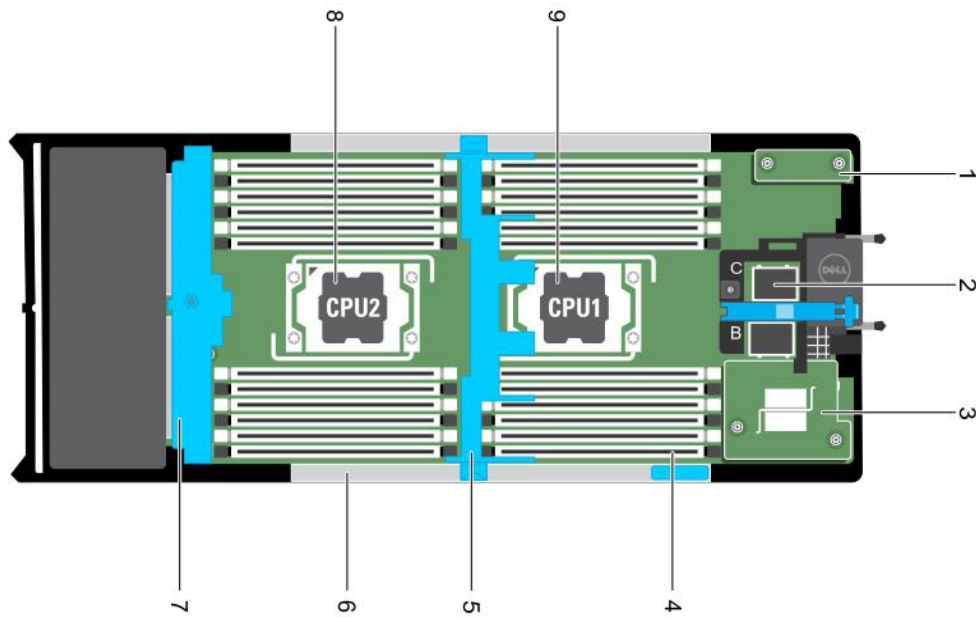
1	Serial Peripheral Interface (rSPI) card
2	PCIe mezzanine card connector (2)
3	Network daughter card (bNDC)
4	DIMM (24)
5	Cooling shroud
6	PERC H730P Slim card blank
7	Hard-drive/SSD backplane
8	Processor 2
9	Processor 1

Figure 11. Rear view of the PowerEdge FC630
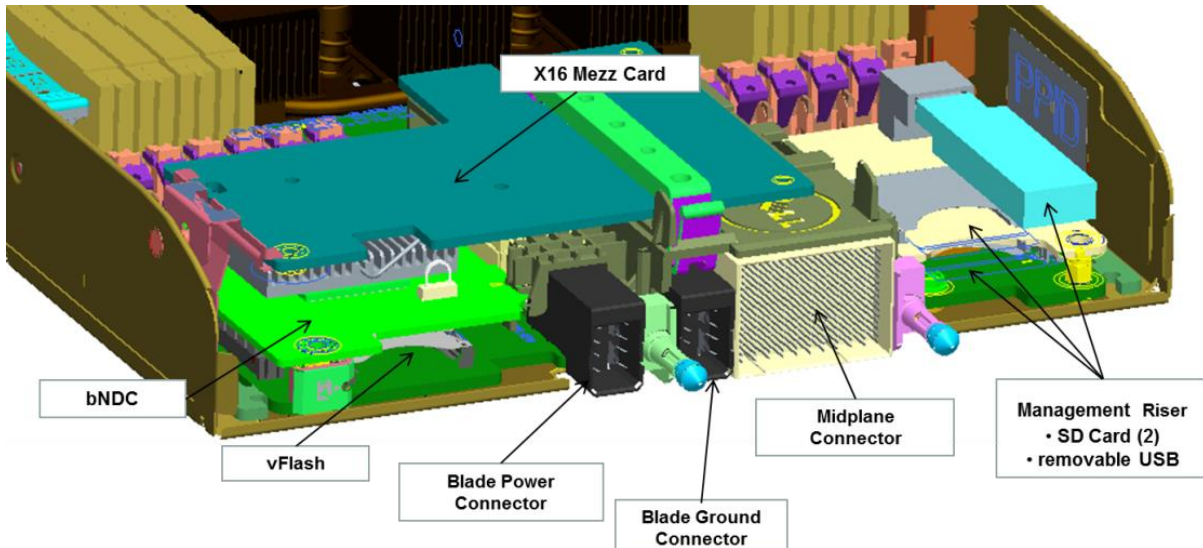
FX2 Chassis	FC630	LP PCIe X8 Add in cards (in Chassis options)
PCI Switch board (FX2s)	X16 Mezz	HH: up to 2 /sled
PCI Pass through Bd (FX2p)	X16 Mezz	HH: up to 2 /sled
Fan ONLY (FX2 entry)	No Mezz "0" or Blank	Not allowed

Figure 12. Front view of the FC630 − hard drive configurations

Diskless

2 x 2.5"
  − w/mini-PERC
  − chipset SATA
  − PCIe SSD

8 x 1.8"
  − w/Slim PERC
  − chipset SATA

Processors

The Dell PowerEdge FC630 features the Intel Xeon processor E5-2600 v3 product family, offering an ideal combination of performance, power efficiency, and cost. See the Processor section for complete details. For more information on the Intel Xeon processor E5-2600 v3 product families, visit Intel.com.

Chipset

The Intel C610 chipset is implemented on the PowerEdge FC630. For more information, visit Intel.com.

Networking and PCIe

The Dell PowerEdge FX Architecture offers balanced, scalable I/O capabilities, including integrated PCIe 3.0 expansion slots via the FX2 chassis. See the Networking and PCIe section for a full list of options.

13   PowerEdge FC430

Introduction

With the perfect balance of performance, memory and high-speed I/O to rapidly deliver resources to applications, the FC430 is ideal for mainstream enterprise workloads, including midsized virtualization and database environments, and is an excellent choice for distributed environments needing higher levels of reliability. With the ability to host applications in smaller, physically discrete servers, the FC430 can help minimize the scope of potential system failures.

Optimize for workload

The FC430 offers choices:

- Two 14-core Intel Xeon E5-2600 v3 processors, or a single-socket Intel Xeon E5-1600 v3 alternative
- Two 1.8-inch drives or one 1.8-inch drive with a front-access mezzanine port Mellanox InfiniBand connection. All configurations have up to 8 DIMMs of memory and 1Gb/10Gb LOM options for networking. Each FC430 has access to one PCIe 3.0 expansion slot.

Implement higher reliability

One of the FC430's distinguishing features is its quarter-width size. It can run multiple applications as a virtualized environment, or house the operations of different clients as a dedicated host. Either way, it offers the benefit of higher reliability through physical separation; one server failing does not disrupt the operation of virtual machines or clients running on other servers.

Right-size your IT

React at the speed of business with the highly flexible FX architecture. Add resources to the chassis at the single server level or add one or more fully loaded 2U enclosures. An FX2 chassis fully loaded with eight FC430s has 224 cores and 48 DIMMs of memory available for processing — all in a dense 2U space.

Innovative management with intelligent automation

The Dell OpenManage systems management portfolio simplifies and automates server life-cycle management — making IT operations more efficient and Dell servers the most productive, reliable and cost effective. Dell's agent-free integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller makes server deployment, configuration and updates automated and efficient. Using Chassis Management Controller (CMC), an embedded component that is part of every FX2 chassis, you'll have the choice of managing FC430 server nodes individually or collectively via a browser-based interface. OpenManage Essentials provides enterprise-level monitoring and control of Dell and third-party data center hardware and works with OpenManage Mobile to provide similar information on smart phones. OpenManage Essentials now also delivers server configuration management capabilities that automate bare-metal server and OS deployments, replication of configurations, and ensures ongoing compliance with set system configurations.

New technologies

Table 25 lists the new technologies for the FC430 architecture.

Table 25.   New technologies

New technologies	Detailed descriptions
Intel Xeon processor E5-2600 v3 product family	This new family of Intel processors has embedded PCIe lanes for improved I/O performance. See the Processors section for details.
Intel C610 series chipset	The Intel Platform Controller Hub (PCH) chip is used on the FC430.
2133MT/s DDR4 memory	Certain models of E5-2600 series processors support 2133 MT/s memory. The FC430 supports a single DIMM per channel at 2133MT/s with these processors. See the Memory section for details.
PERC S130 (SW RAID)	This new software RAID solution supports RAID 0, 1
iDRAC8 with Lifecycle Controller	The new embedded system management solution for Dell servers features hardware and firmware inventory and alerting, in- depth memory alerting, faster performance, a dedicated gigabit port and many more features. See the Dell OpenManage systems management section for details
iDRAC Direct	The front USB port on FC430 (marked with tool symbol) provides direct access to the iDRAC GUI via a laptop browser.) An A-to-A USB cable is required to use this feature. This port can also be used to upload xml configuration files to the iDRAC.
Failsafe hypervisors	The internal dual SD module (IDSDM) enables Dell's unique Failsafe Virtualization architecture, ensuring uptime by providing failover capability for embedded hypervisors, such as VMware vSphere ESXi. The FC430 supports dual hypervisor or single hypervisor/single vFlash
1.8" SSDs	1.8" SSDs provide a high spindle count and fast cache layer for tiered storage applications.
USB 3.0	USB 3.0 support can operate in both USB 2.0 speed and USB 3.0 speed modes. USB 3.0 driver is required to control USB device in USB 3.0 speed mode.

Specifications

Table 26 summarizes the product features for the PowerEdge FC430 server node. For the latest information on supported features for the PowerEdge FX, visit Dell.com/PowerEdge.

Table 26.   Technical specifications

| Feature	PowerEdge FC430 technical specification
Form factor	Quarter-width – supports up to 8 sleds per PowerEdge FX2 enclosure
Processors	Intel Xeon processor E5-2600 v3 product family **Processor sockets**: 2 **Cache**: 2.5MB per core; core options: 4, 6, 8, 10, 12, 14 **Chipset**: Intel C610 series
Memory[1]	Up to 256GB (8 DIMM slots): 4GB/8GB/16GB/32GB DDR4 up to 2133MT/s
PCIe slots	Access to 1 x PCIe 3.0 (x8) expansion slots
RAID controller	Internal controllers: PERC S130 (SW RAID)
Primary storage	**Hot-plug hard drive options:** Up to 2 x 1.8" uSATA SSDs
Power supplies	Chassis level – PowerEdge FX2 hot-plug PSU: 2000W or 1600W AC in 1+1 redundant or 2+0 non-redundant configurations
Video card	Video type: Matrox G200 (integrated with iDRAC8) Video memory: 16MB shared with iDRAC8 application memory
Systems Management	• FX uses Chassis Management Controller (CMC) to manage all resources (server nodes and shared infrastructure) in a single web console • OpenManage portfolio for FX supports local and remote management, consistent with other • PowerEdge products CMC and iDRAC are available with either Enterprise or Express licensing to best suit specific management needs • Server nodes each contain proven iDRAC8 with Lifecycle Controller for agent-free, automated systems management
Optional supported hypervisors	Citrix XenServer

Feature	PowerEdge FC430 technical specification
Operating systems	Microsoft Windows Server 2008 R2 SP1, (includes Hyper-V)
	Microsoft Windows Server 2012
	Microsoft Windows Server 2012 R2 (includes Hyper-V)
	Novell SUSE Linux Enterprise Server
	Red Hat Enterprise Linux

FC430 views and features

Figure 13.   PowerEdge FC430 front-panel features and indicators
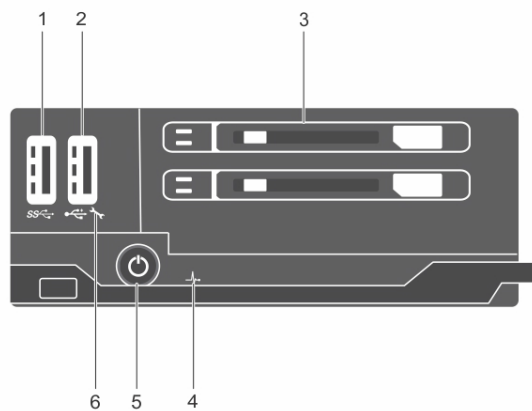
1	USB connectors
2	USB Management
3	SSD (2)
4	Health status indicator icon
5	sled power button/indicator
6	iDRAC indicator icon

Figure 14.   FC430 front-panel features and indicators – single port only

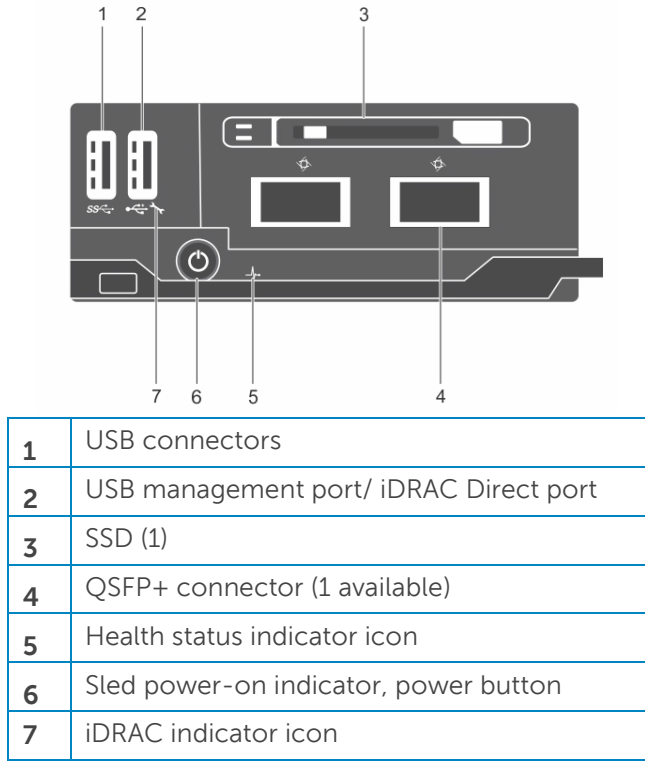| 1	USB connectors
2	USB management port/ iDRAC Direct port
3	SSD (1)
4	QSFP+ connector (1 available)
5	Health status indicator icon
6	Sled power-on indicator, power button
7	iDRAC indicator icon

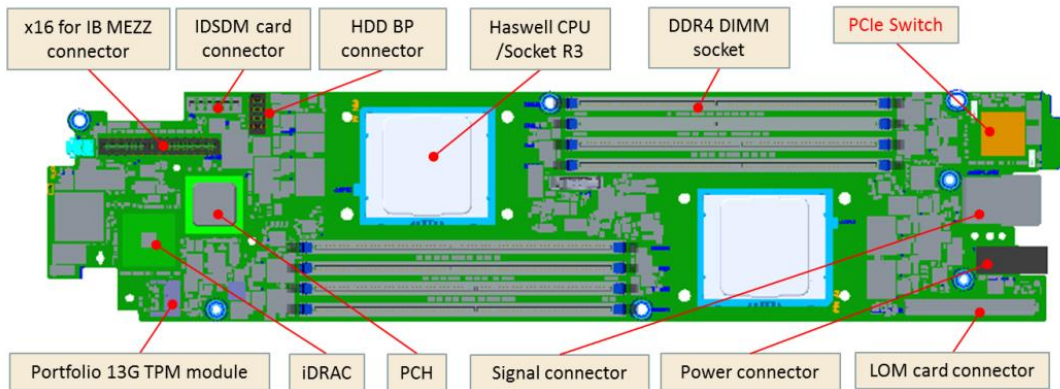**Figure 15.   Inside the FC430**
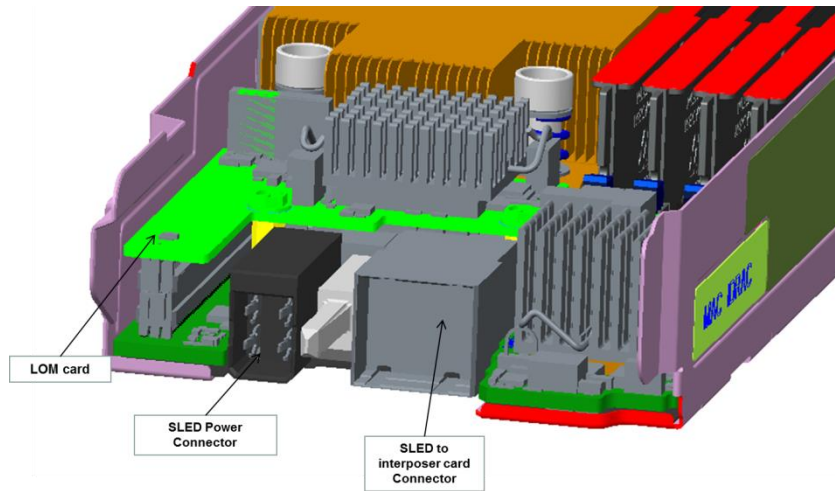
Figure 16.   PowerEdge FC430 rear view

Figure 17.   PowerEdge FC430 front area placement
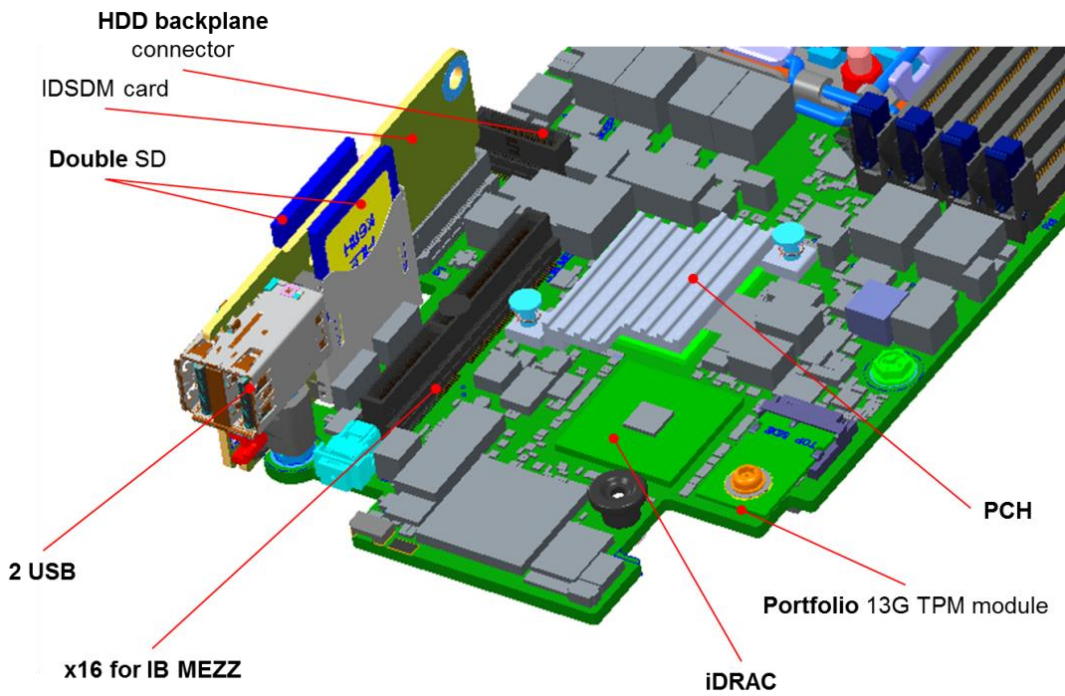
Figure 18.   PowerEdge FC430 in the FX2 chassis
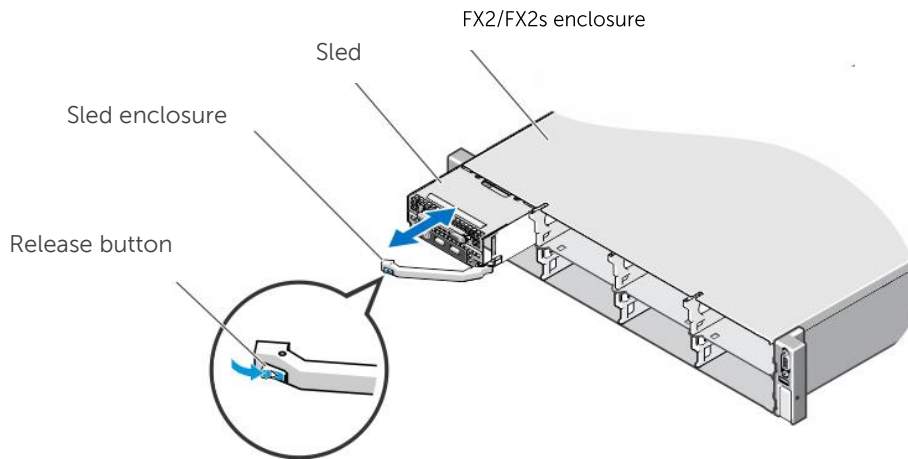
Processors

The Dell PowerEdge FC430 features the Intel Xeon processor E5-2600 v3 product family, offering an ideal combination of performance, power efficiency, and cost. See the Processor section for complete details. For more information on the Intel Xeon processor E5-2600 v3 product families, visit Intel.com.

Chipset

The Intel C610 chipset is implemented on the PowerEdge FC430. For more information, visit Intel.com.

Networking and PCIe

The Dell PowerEdge FX architecture offers balanced, scalable I/O capabilities, including integrated PCIe 3.0 expansion slots via the FX2 chassis. See the Networking and PCIe section for a full list of options.

14 PowerEdge FM120x4

Introduction

The PowerEdge FM120x4 microserver, featuring the low-power Intel Atom processor C2000 product family and ultra-dense system-on-a-chip (SoC) design, is ideal for large-scale static web hosting and lighter weight processing, like batch data analytics.

Innovative design

Each FM120 microserver is powered by a single Intel Atom processor C2000 with up to eight cores, two DIMMs of memory, one 2.5-inch front-access hard drive or two 1.8-inch SSDs and two integrated 1GbE LOMs per SoC. PCIe connectivity is not supported for the FM120x4. The compact design of the C2000 allows the FM120x4 sled to hold four microservers. A fully loaded FX2 chassis can hold 16, offering impressive density. Using eight-core processors, 128 cores and 32 DIMMs of memory can be utilized in a single 2U FX2 chassis. The low-power characteristics of the C2000 enable certain configurations of the FM120x4 to meet Dell Fresh Air temperature and humidity operating ranges, letting you save on energy and cooling costs for your data center.

Efficiencies of shared infrastructure

FM120x4 server blocks are housed in the Dell PowerEdge FX2 chassis — a 2U rack-based hybrid computing platform that delivers the density of a blade architecture with the simplicity and cost benefits of rack-based systems — all in a compact modular design.

With shared power, cooling and networking, the FX2 delivers efficiency and flexibility for data center infrastructures. Simply and efficiently add resources to your infrastructure, when and where you need them. Add to the chassis at the single-server level or add one or more fully loaded 2U enclosures.

Comprehensive systems management with intelligent automation

The Dell OpenManage systems management portfolio simplifies and automates server lifecycle management — making IT operations more efficient and Dell servers the most productive, reliable and cost effective. Dell's agent-free integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller makes server deployment, configuration and updates automated and efficient. Using Chassis Management Controller (CMC), an embedded component that is part of every FX2 chassis, you'll have the choice of managing FM120x4 microservers individually or collectively via a browser-based interface. OpenManage Essentials provides enterprise-level monitoring and control of Dell and third-party data center hardware, and works with OpenManage Mobile to provide similar information on smart phones. OpenManage Essentials now also delivers server configuration management capabilities that automate bare-metal server and OS deployments, replication of configurations, and ensures ongoing compliance with set system configurations.

New technologies

Table 27 lists the new technologies for the PowerEdge FM120x4 server node.

Table 27.   New technologies

Key technologies	Detailed descriptions
Intel Atom processor C2000 microserver product family	The Intel Atom processor C2000 product family delivers a major leap forward for microserver performance and efficiency. This second-generation, 64-bit system-on-a-chip (SoC) delivers more cores, memory capacity, and I/O resources than previous generations and provides increased platform flexibility with integrated GbE, SATA and USB ports.
PERC S110 software RAID solution	This new software RAID solution supports RAID 0, 1, 5, and 10, and supports a maximum of four 2.5" hot-plug SATA hard drives or SATA solid-state drives (SSDs) or eight 1.8" SSDs. See the Storage section for details.
iDRAC with Lifecycle Controller	The embedded system management solution for Dell servers features hardware and firmware inventory and alerting, in-depth memory alerting, faster performance, a dedicated gigabit port and many more features.
Fresh Air Cooling	Dell has tested and validated select Dell PowerEdge 13th generation servers that operate at higher temperatures enabling you to reduce your hours of economization or even go chiller-less. See the Power, thermal and acoustics section for details.

Specifications

Table 3 summarizes product features for the PowerEdge FM120x4. For the latest information on supported features for the PowerEdge FX, visit Dell.com/PowerEdge.

Table 28.   Technical specifications

Feature	PowerEdge FM120x4 technical specification
Form factor	Half-width – supports 4 FM120 microservers per FX2 enclosure
Processors	4 x Intel Atom processor C2000 product family Cache: 1MB shared L2 between two cores – 4MB total cache for eight cores; core options: 2, 4, 8; Intel i350 1Gb embedded LOM
Memory[1]	2 x DIMMs DDR3 memory per SOC, UDIMM only, 8 per sled
PCIe slots	No PCIe slots (Up to 2 pass-through modules via FX2 chassis)
RAID controller	PERC S110 (SW RAID)

Feature	PowerEdge FM120x4 technical specification
Primary storage	1 x 2.5" front-access HDD or 2 x 1.8" SSD per SoC
Power supply	1100W power supply via FX2 chassis
Systems management	• FX uses Chassis Management Controller (CMC) to manage all resources (server nodes and shared infrastructure) in a single web console • OpenManage portfolio for FX supports local and remote management, consistent with other • PowerEdge products CMC and iDRAC are available with either Enterprise or Express licensing to best suit specific management needs • Server nodes each contain proven iDRAC with Lifecycle Controller for agent-free, automated systems management
Hypervisor support	Citrix XenServer (optional)
Operating systems	Microsoft Windows Server 2008 R2 SP1, (includes Hyper-V) Microsoft Windows Server 2012 Microsoft Windows Server 2012 R2 (includes Hyper-V) Novell SUSE Linux Enterprise Server Red Hat Enterprise Linux

FM120x4 views and features

Inside the PowerEdge FM120x4 details interior features of the FM120x4.

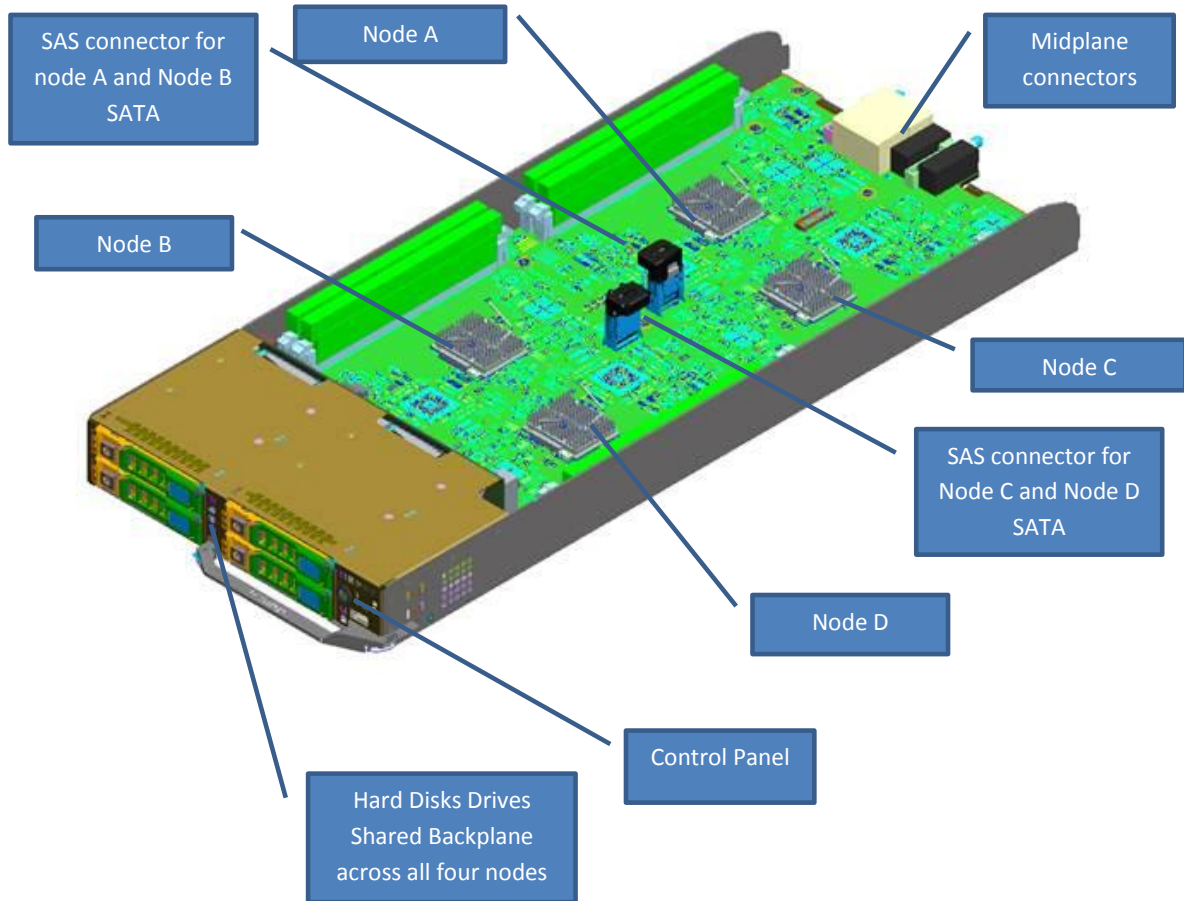**Figure 19.   Inside the PowerEdge FM120x4**

SAS connector for node A and Node B SATA

Node A

Midplane connectors

Node B

Node C

SAS connector for Node C and Node D SATA

Node D

Control Panel

Hard Disks Drives Shared Backplane across all four nodes

Figure 20.   Front-panel features and indicators — 2.5" HDD/SSD system
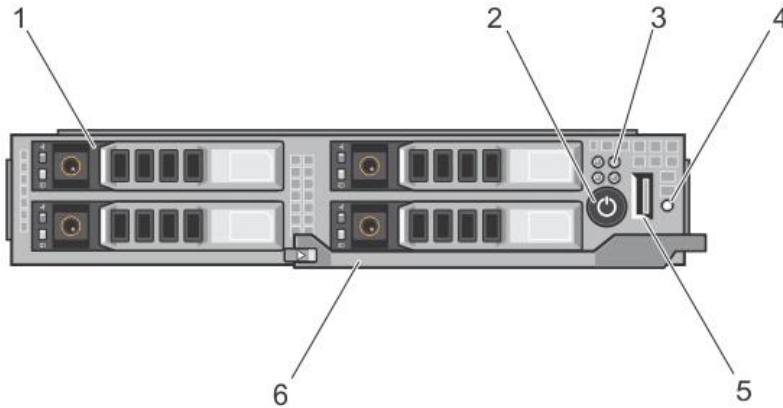
Figure 21.   Front-panel features and indicators — 1.8" SSD system
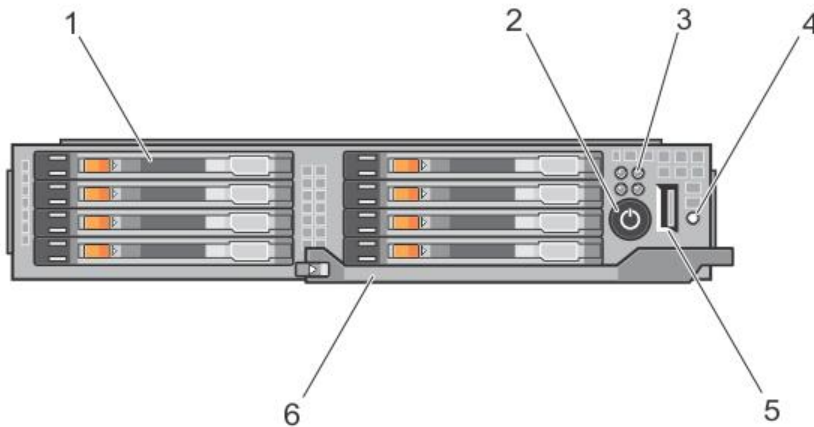
Item	Feature	Description	
1	HDDs/SSDs	2.5" HDD/SSD system	Up to four 2.5" warm-swap SATA HDDs/SDDs
		1.8" SSD system	Up to eight 1.8" hot-swap SATA SSDs
2	Power-on indicator, power button	The power-on indicator lights when the sled power is on. The power button controls the power supply output to the system	
3	Node status indicators	Provides status information about the four nodes in the sled	
4	USB select button	Allows USB selection on the nodes in the sled	
5	USB connector	Allows a USB device to be connected to the system	
6	Sled handle	Used to slide the sled out of the enclosure	

Hard drives and solid-state drives

The FM120x4 supports four 2.5-inch SATA hard drives/SSDs or eight 1.8-inch SATA SSDs. All drives connect to the system board through the hard-drive/SSD backplane. Hard drives/SSDs are supplied in special hot-swap drive carriers that fit in the drive bays.

Hard drives/SSDs are not shared resources between the nodes in the system. Each hard drive/SSD is assigned to a specific node. Depending on the configuration, the hard drives/SSDs are assigned to the nodes in the following order.

Storage

The FM120x4 sled only supports hard disk storage. Internal flash media and IDSDM are not supported.

Hard-disk backplane options

The FM120x4 supports two backplane options. The first backplane option contains four 2.5 inch drive slots. The backplane will connect one 2.5 inch drive server node. The second backplane option supports eight 1.8 inch hard disk drives. Two hard disk drives attach to each server.

Supported SATA configurations

FM120x4 supports native SATA mode, AHCI as well as Dell SW RAID (S110). BIOS will give the user the ability to select between these three options.

RAID support

The FM120x4 supports Dell SW RAID (S110) in all listed both Backplane configurations. S110 will run on all supported Windows OS configurations and will communicate Drive LED status via the Dell OMSA Software to each node's iDRAC via IPMI. iDRAC will support all Drive LED Status patterns specified in the Dell Enclosure Management Drive LED specification, but is not required to report discreet drive presence status 'up the stack' to the SW RAID Driver via OMSA. S110 will support RAID 0, 1 and the creation of a non-RAID Volume in the 1.8" HDD configuration, and will support a Volume in the single drive 2.5" HDD configuration.

Inside the FM120x4

Figure 22.   Inside the FM120—2.5" HDD/SSD system

1. System board
2. Cooling shroud
3. Cable cover
4. SATA cables (2)
5. DIMMs (8)
6. HDD/SSD backplane
7. HDD/SSDs
8. Sled handle
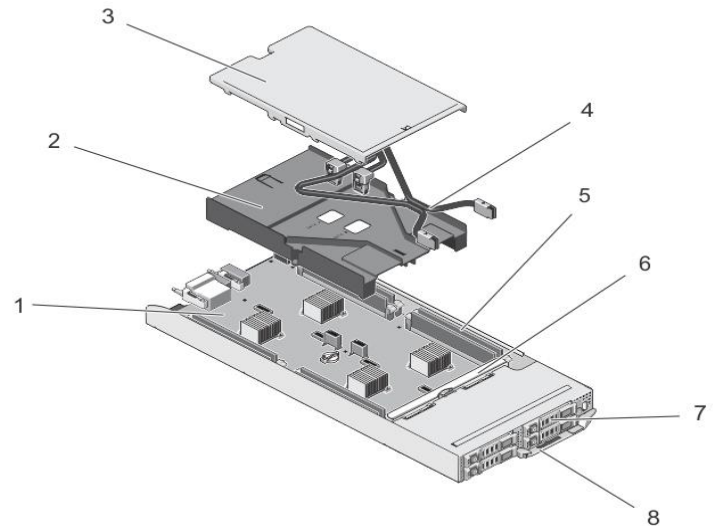
Figure 23.   Inside the FM120x4—1.8-inch SSD system

2. System board
3. Cooling shroud
4. Cable cover
5. SATA cables (2)
6. DIMMs (8)
7. HDD/SSD backplane
8. HDD/SSDs
9. Sled handle
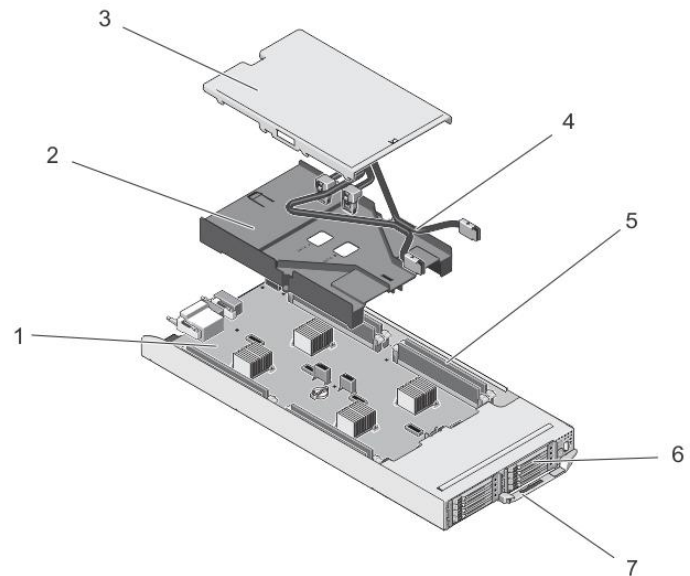
Processor features

The Intel Atom processor C2000 product family is Intel's second-generation of 64-bit servers. Based on Intel's low-power 22nm process, the C2000 product family offers a range of multi-core processing capabilities (from two cores to eight cores) and features high levels of I/O and acceleration integration, resulting in a scalable, single-chip system-on-chip (SoC) design delivering:

- More Compute, memory and I/O resources: Delivers up to 7x higher performance than the previous-generation Intel Atom processors with up to 8 cores and 64GB of memory
- Intel's Industry-leading 22nm silicon technology: Provides tighter integration while improving energy efficiency
- Ultra-low thermal design power (TDP): Low TDPs enable significant energy cost savings and higher rack densities to deliver more performance with lower operating costs.
- Feature-rich SoC: Built-in GbE, SATA, and USB ports simplify the design of workload-optimized microservers and help to improve performance, density and energy efficiency.
- Enterprise-class features: 64-bit, Error Correcting Code (ECC) memory and Intel Virtualization Technology provide flexibility and reliability for data center workloads.

There are three processor core configurations for each of the four node processors supported on the PowerEdge FM120x4.

- 2.4GHz, 2 core
- 2.4GHz, 4 core
- 2.4GHz, 8 core

Supported processors

Table 29 lists the processors supported on the FM120x4 microserver. For more information on the Intel Atom processor C2000 product family, visit intel.com/microservers.

Table 29.   FM120x4 supported processors

Model	Speed	TDP	Cores	Cache	Turbo
C2750	2.4GHz	20W	8	4M	Yes
C2551	2.4GHz	15W	4	2M	Yes
C2351	2.4GHz	13W	2	1M	Yes

Memory

The FM120x4 supports unregistered ECC DIMMs (ECC UDIMMs). It supports 1.35V DDR3L voltage specifications. The memory bus operating frequency is 1600MT/s.

Table 30 shows the memory populations and operating frequencies for the supported configurations.

Table 30.   Memory population

DIMM type	DIMMs per channel	Frequency	Maximum DIMM rank per channel
UDIMM	1	1600MT/s	Single rank
UDIMM	1	1600MT/s	Dual rank

Networking configurations

The LAN On Motherboard (LOM) network provides Ethernet connectivity from the I/O modules on the FX2 enclosure to the sleds in the enclosure. The network traffic from the nodes in an FM120x4 sled to the I/O modules on the FX2 enclosure is routed through a network switch that is embedded on the sled system board. Each FM120x4 sled in the enclosure maps to two ports on each I/O module. For more information, see the *Dell PowerEdge FX Architecture Owner's Manual* on Dell.com/Support/Manuals.

Three networking configurations are supported on the FM120x4 system. Selection of the network configuration is from the CMC web interface. All FM120x4 sleds in the FX2 enclosure have the same network configuration. For more information on the networking configurations supported on your system, see the *Dell PowerEdge FX Architecture Owner's Manual* on Dell.com/Support/Manuals.

15 PowerEdge FN I/O Aggregators

Introduction

The PowerEdge FN I/O Aggregator (IOA) for FX2 is a modular I/O device focused on ease of use. The FN I/O Aggregator simply aggregates Ethernet traffic from compute nodes (including converged storage traffic) in the FX2 chassis. Each FX2 chassis can house 2 x FN I/O Aggregators in the back of the chassis. The FN IOA is purpose-built for the FX2. The intent of the FN IOA is to simplify networking deployments and optimize FX2 performance for a converged LAN/SAN data center environment. Figure 24 outlines the three different types of FN I/OA modules for the FX2 architecture.

Figure 24.   FN IOA models and their naming conventions

All FN I/OA modules support eight internal/server facing 10GbE KR ports (numbered 1-8). They differ in the external uplink ports. Each FN I/OA external ports are numbered 9-12. This FN2210S enables true convergence at the box. In default mode, this module offers 2-ports as GbE/10GbE and 2-ports as 2/4/8G Fibre Channel SFP+. You can convert Fibre Channel ports to GbE/10GbE SFP+, which requires software reboot of the module.

Table 31.   FN I/O Aggregator models

Model	FN2210S	FN410S	FN410T
Module differentiator	Two native Fibre Channel ports and two SFP+ ports Four SFP+ ports with reboot Fibre Channel NPIV Proxy Gateway (NPG) with gateway capabilities to existing SAN fabrics	Four SFP+ ports. Supports optical and DAC cable media	Four 10GBASE-T ports. Supports copper media up to 100m

Model	FN2210S	FN410S	FN410T
Port speed	2/4/8/Gb and 1/10GbE	1/10GbE	100Mb/1/10GbE
Protocol support	Native Fibre Channel and Ethernet	Ethernet	Ethernet
Media types	2/4/8GbE FC SFP+ optics	Optical transceivers SFP+ 10Gb: SR, LR SFP 1 GbE: SX, LX SFP to RJ45 converter 10000 Base-T (only capable of 1Gbps) SFP+ Direct Attach Cable (Twinax)	RJ45/Cat6a copper

FN I/O Aggregators and FX2 enclosure

A maximum of two FN I/OA modules can reside within the FX2 chassis for a redundant configuration but one FN I/OA in the FX2 chassis is a valid configuration, albeit non-redundant configuration.

Each FN I/OA also has two USB 3.0 ports. The top port is a USB console port used to manage the switch through an RS-232 serial interface. This port provides a direct connection to the switch and allows you to access the command-line interface (CLI) from a console terminal connected to the port through the provided serial cable (with USB UART-A to back-plane of the chassis management controller.

The lower port is the USB storage port. It functions as an external flash drive where you can store configuration files, load new images, import/export scripts or reports. Figure 25 highlights features like system status and power status LEDs.

Figure 25.   FN I/O Aggregator features

Table 32 compares similarities and differences between FN IOAs and FX2 pass-through modules

Table 32. FN IOA and FX2 pass-through comparison

	PowerEdge FNIOA	FX2 pass-through
Adapter	• 4-port 10GbE SFP+ • 4-port 10G Base-T • 2-port FC2/4/8G + 2-port 10GbE SFP+ (combo)	• 8-port GbE • 8-port 10GbE SFP+
Local switching	Yes, L2 switch	No
Oversubscription to 8 servers		1:1, node to use all port for server connectivity to upstream ToR
LAN and iSCSI converged	Supported	Supported
LAN and FCoE converged	FSB supported on SFP+ & 10G Base-T NPG supported on FN2210S	Pass-through supported
Advanced features	• LAG/LACP supported • VLT offers active-active redundancy	Not an L2 switch device (LAG/VLT not supported)
Future expansion	In a typical scenario with 8 or 4 servers, each having 2x10GbE CNAs, you could potentially start with 1-2 ports from FN IOA to ToR. This way you can save expensive ToR ports. As your bandwidth need grows, you can connect the other ports to ToR.	In the same scenario with pass-through, you are bound to connect all 8 or 4 ports to upstream ToR, otherwise all servers won't be accessible.

16 PowerEdge FD332 storage block

Introduction

The FX architecture brings greater flexibility and density to data center infrastructures with relatively "bite-sized" blocks that enable you to add resources incrementally, and tailor an infrastructure that's optimized for specific workloads. The PowerEdge FD332 delivers on the storage component of the FX promise.

With up to 16 devices in each FD332, you can flexibly provision up to 48 SFF storage devices in a 2U FX2 chassis. (This example leaves one half-width slot to house a PowerEdge FC630 for processing.) The flexibility of the FX architecture's modular components results in 2U rack computing with massive direct-attached storage (DAS) capacity, enabling a pay-as-you-grow IT model. (Note: PowerEdge FM120 microservers are not supported to work with the FD332.)

FX servers can be attached to a single FD332, or multiple FD332s, and can either attach to all 16 devices in the block or, when using dual RAID controllers, split access and attach to eight devices separately. So, you can combine FX servers and storage in a wide variety of configurations to address specific processing needs. Additionally, software can be employed to pool storage attached to multiple controllers or multiple FD332s across FX servers.

The FD332 accommodates up to 16 hot-plug SAS or SATA disk drives (SSD and HDD) in a side-loading, front removable drive bay sleeve that are independently serviceable while the FX2 chassis is in operation.

Workloads love it

The FD332's flexibility and scalability enable it to span customer environments from traditional IT to cutting-edge service providers. The FD332 is an excellent option for enabling dense virtual SAN clusters by combining compute and storage blocks. It can also help consolidate applications like Hadoop that require high-performance, low-cost scale-out storage. It's also ideal for database-driven centralized software that needs scale-up and scale-out DAS capability.

Innovative management with intelligent automation

The Dell OpenManage systems management portfolio simplifies and automates server lifecycle management — making IT operations more efficient and Dell servers the most productive, reliable and cost effective. Dell's agent-free integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller makes server deployment, configuration and updates automated and efficient. Because the FD332 is direct-attached storage, it is monitored by iDRAC — just like any DAS storage on any PowerEdge server. Using the Chassis Management Controller (CMC), an embedded component that is part of every FX2 chassis, you'll have the choice of managing components individually or collectively via its browser-based interface. The CMC gives an administrator the choice of connecting one or two controllers on the FD332 to one or two hosts. This can also be done via Dell's RACADM commands via the iDRAC.

Specifications

Table 33 summarizes product features for the PowerEdge FD332 storage block. For the latest information on supported features for the PowerEdge FX, visit Dell.com/PowerEdge.

Table 33. Technical specifications

Feature	PowerEdge FD332 technical specification
Form factor	Half-width – supports up to 16 small form factor 2.5" storage devices Up to 3 FD332 storage blocks per PowerEdge FX2 enclosure (configuration dependent)
Dimensions	H: 40.15 mm (1.58 in), W: 211.9 mm (8.32 in), D: 518.8 mm (20.43 in)
Enclosure	Dell PowerEdge FX2s enclosure
RAID controllers	FD332S (Single PERC), FD332D (Dual PERC) Default is HBA mode; upgradeable to PERC H730P RAID mode via license
Hot-plug hard drive options	SATA HDD/SSD or SAS HDD/SSD Up to 16 x SFF storage devices per FD332
Power supplies	Supplied by the FX2 enclosure
Remote management	iDRAC8 Express with Lifecycle Controller (default) iDRAC8 Enterprise with Lifecycle Controller (upgrade option)
Systems management	• FX uses Chassis Management Controller (CMC) to manage all resources (server nodes and shared infrastructure) in a single web console • OpenManage portfolio for FX supports local and remote management, consistent with other PowerEdge products • CMC and iDRAC are available with either Enterprise or Express licensing to best suit specific management needs • Server nodes each contain proven iDRAC8 with Lifecycle Controller for agent-free, automated systems management

Chassis views and features

FD332 is a new modular storage half-width sled supporting up to 16 hot plug SAS or SATA storage devices (HDDs or SSDs) that can be implemented within the 2U FX2 chassis alongside FX2 full-width server nodes (up to two FD332s supported), half-width server nodes (up to three FD332s supported), or quarter-width server nodes (up to two FD332s supported). Figure 26 shows three FD332 sleds installed in an FX2 chassis.

Figure 26. FX2 chassis with three FD332s (and one FC630)

The flexibility of the PowerEdge FD332 storage block allows for multiple system configurations of the FX2 platform. The FD332 supports one or two instantiations of a Series 9 PERC storage controller which can run in either HBA mode or RAID mode. This flexibility allows for multiple system configurations. In Figure 27, the FD332 sleds are mapped 1-to-1 to individual half width compute sleds

Figure 27.   FD332 in a 1-to-1 mapping

In Figure 28, all three FD332 sleds are mapped to a single half width compute sled.

Figure 28.   FD332 in a 3-to-1 mapping

Figure 29 shows FD332 storage blocks in dual controller mode (either HBA or RAID) with individual FD332 blocks mapped 1-to-2 to two quarter-width server nodes. In this case the 16 drives in the FD332 block will be split (8 and 8) between the two storage controllers. The FD332 storage block also supports the ability to map all 16 disk drives to a single quarter-width server node. In this case, the second FC430 server node above the storage sled has only its local drives in the compute sled and none of the storage in the FD332.

Figure 29.   FD332 in a 1-to-2 mapping

Figure 30.   FD332 standalone chassis

Figure 31.   FD332 front panel features
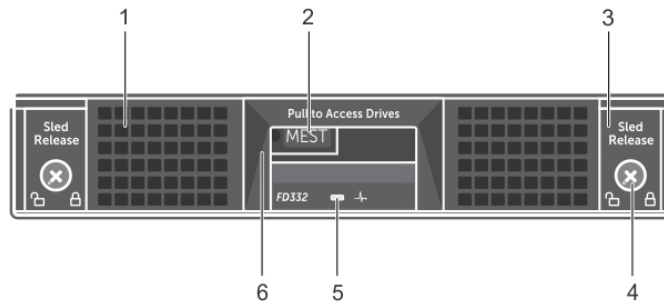
Item	Feature	Description
1	Drive drawer	Up to 16 x 2.5" HDDs/SSDs
2	MEST tag	Removable label panel lists system Service Tag
3	Sled release latch (2)	Slides storage block out of enclosure
4	Sled lock (2)	Secures or releases storage block from enclosure
5	Storage sled status indicator	Provides information on the overall status of the storage block.
6	Drive drawer release handle	Slides drive drawer out of storage block

Supported hard drives

Error! Reference source not found. lists the internal hard drives supported by the PowerEdge FD332. Refer to the Storage section for detailed information on supported hard drives, or visit Dell.com/PowerEdge.

Appendix A. Additional specifications

FX architecture component dimensions

Table 34.   FX architecture dimensions

Server node dimensions		
PowerEdge FX2 chassis	Height	8.68 cm (3.41 inch)
	Width	43.35 cm (17.06 inch) without rack ears 48.19 cm (18.97 inch) with rack ears
	Depth	85.16 cm (33.52 inch)
PowerEdge FC630	Height	4.03 cm (1.58 inch)
	Width	21.09 cm (8.3 inch)
	Depth	50.83 cm (20.01 inch)
PowerEdge FC430	Height	4.03 cm (1.58 inch)
	Width	10.27 cm (4.04 inch)
	Depth	47.17 cm (18.57 inch)
PowerEdge FM120x4	Height	4.03 cm (1.58 inch)
	Width	10.27 cm (4.04 inch)
	Depth	47.17 cm (18.57 inch)
PowerEdge FD332	Height	4.02 cm (1.58")
	Width	21.2 cm (8.32")
	Depth	51.9 cm (20.4")

FX architecture component weight

Configuration	FX2 chassis	FC630	FC430	FM120x4	FD332
Maximum	42.6 kg (93.9 lb.)	5.4 kg (11.9 lb.)	2.2 kg (4.8 lb.)	2.2 kg (4.8 lb.)	~18 lb.
Empty chassis	21.5 kg (47.4 lb.)				

USB 3.0

The FX compute nodes (FC430, FC630 and FC830) support USB 3.0 which can operate in both USB 2.0 speed and USB 3.0 speed modes. A USB 3.0 driver is required to control USB device in USB 3.0 speed mode.

Environmental specifications

See *Dell PowerEdge FX Owner's Manual* on Dell.com/Support/Manuals for detailed environmental specifications including expanded operating temperature (Fresh Air) information.

Video specifications

The Dell integrated Remote Access Controller (iDRAC8) incorporates an integrated video subsystem. The graphics controller is the 2-D Matrox® G200. The video frame buffer (16MB) is contained within the iDRAC RAM (256MB) device. Support the 2D graphics video modes listed in Table 35.

Table 35.   Supported video modes

Resolution	Refresh Rate (Hz)	Color Depth (bit)
640 x 480	60, 70	8, 16, 32
800 x 600	60, 75, 85	8, 16, 32
1024 x 768	60, 75, 85	8, 16, 32
1152 x 864	60, 75, 85	8, 16, 32
1280 x 1024	60, 75	8, 16, 32
1440 x 900 (stretch goal)	60	8, 16, 32

Appendix B. Standards compliance

The PowerEdge FX Architecture conforms to the industry standards listed in Table 36.

Table 36. 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
DDD4 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	.trustedcomputinggroup.org
UEFI Unified Extensible Firmware Interface Specification, v2.1	uefi.org/specs

Standard	URL for information and specifications
USB Universal Serial Bus Specification, Rev. 2.0	.usb.org/developers/docs
Windows Logo Windows Logo Program System and Device Requirements, v3.10	microsoft.com/whdc/winlogo/hwrequirements.mspx

Appendix C. Additional resources

Table 37 provides a list of documents and websites that provide for more information on the Dell PowerEdge FX architecture.

Table 37.   Additional resources

Resource	Description of contents	Location
Dell PowerEdge FX Owner's 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
Dell PowerEdge FX Getting Started Guide	This guide is printed and shipped with the system, and is also available in PDF format on the Dell support site. This guide provides information on the following: • Initial setup steps • Key system features • Technical specifications	Dell.com/Support/Manuals
Rack Installation Instructions	This printed document is provided with the rack kits. The document provides the instructions for installing the server in a rack.	Dell.com/Support/Manuals
Information Update	This document is printed and shipped with the system, and is also available in PDF format on the Dell support site. This document 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	Inside the system chassis cover

Resource	Description of contents	Location
	materials, service tag information, and Dell contact information.	
Energy Smart Solution Advisor	The online advisor provides 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
Power and cooling technologies	Provides details for improving energy efficiency in the data center.	Dell.com/powerandcooling
Energy management	Provides information on Dell's Fresh Air cooling solutions.	Dell.com/FreshAir
Operating system matrix for Dell PowerEdge systems	Provides updated information on which operating systems are available on which PowerEdge systems.	Dell.com/OSsupport
Processor and chipset	Provides more information about the Intel Xeon E5-2600 v3 processors and Intel C610 chipset.	Intel.com
Dell PowerEdge RAID Controllers	Provides more information about Dell PERCs.	Dell.com/PERC
Power distribution unit (PDU) and uninterruptible power supply (UPS)	Provides help selecting a rack-based power distribution unit and an uninterruptible power supply model.	DellUPS.com
Volatility information	Contact your Dell sales representative or visit the Dell Support site.	Dell.com/Support/Manuals
Dell Enterprise Acoustics	White paper that explores the mechanisms of, people's reaction to, language of, and Dell's work to control noise from Enterprise products.	www.dell.com/downloads/global/products/pedge/en/acoustical-education-dell-enterprise-white-paper.pdf

Appendix D. Support and Deployment Services

Dell Global Services include a wide, customizable range of service choices to simplify the assessment, design, implementation, management and maintenance of your IT environment and to help you transition from platform to platform. Depending on your current business requirements and the level of service you want, we can provide you with factory, on-site, remote, modular and specialized services that fit your needs and budget. We'll help you with a little or a lot—your choice—and provide you with access to our global resources.

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.

Server Deployment Capabilities

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

In addition, we are also experts at rack integration and solutions such as High Performance Computing, Openstack and Hadoop.

Dell's Server Deployment Services help you optimize your server configurations and quickly and correctly install and integrate your solution—so you can be up and running faster with minimal disruption to day-to-day business operations. Our deployment experts provide:

- Single point of project management contact from beginning to end
- Evaluation of your environment with a detailed project plan
- Optimized configurations for your workloads and user environment
- Personalized documentation and orientation

Remote Consulting Services

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

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 your plan using industry leading tools and proven processes based on global best practices to migrate your existing files and data, so your business gets up and running quickly and smoothly.

ProSupport Enterprise Suite

With Dell ProSupport Services, we can help you keep your operation running smoothly, so you can focus on running your business. We'll help you maintain peak performance and availability of your most essential workloads. Dell ProSupport is a suite of support services that enable you to build the solution that's 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.
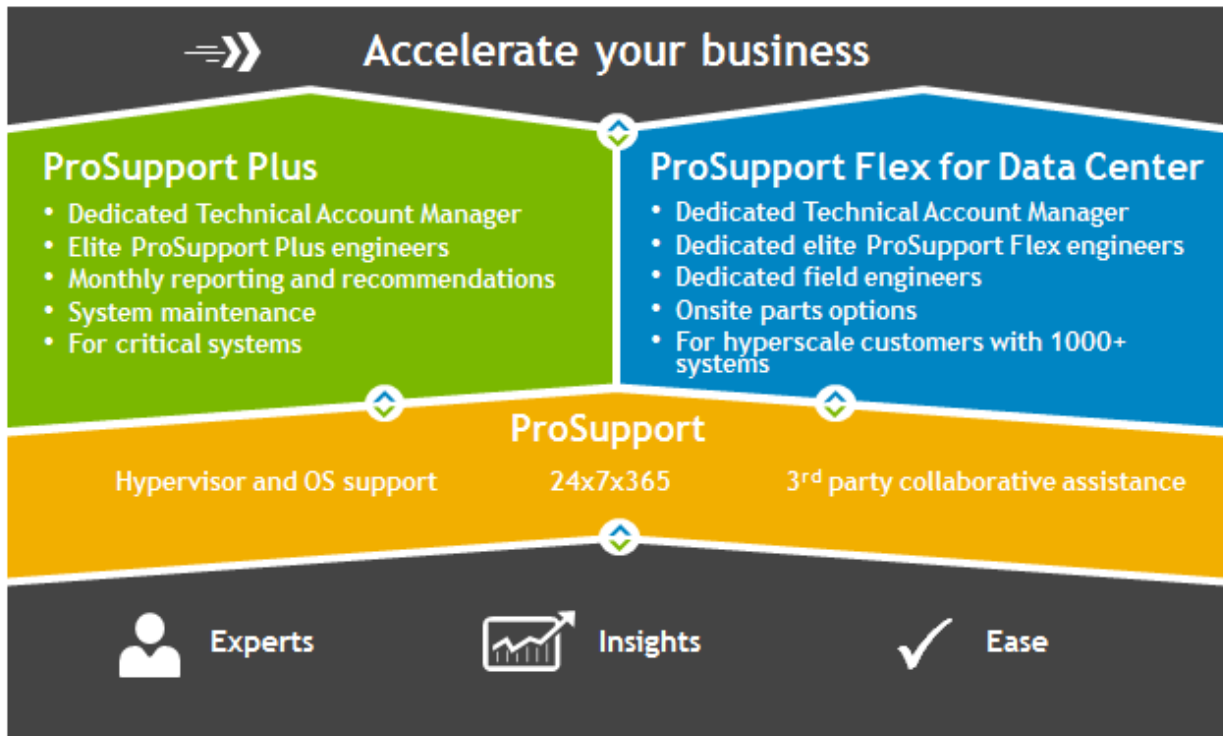
ProSupport Plus (for business-critical servers)

When you purchase your PowerEdge server, we recommend ProSupport Plus, our proactive and preventative support for your business-critical systems. Dell 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

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

- 24x7x365 access to certified hardware experts
- Collaborative support assistance with over 195 third-party vendors
- Hypervisor and operating system support
- Onsite parts and labor response options including next business day or four-hour mission critical

ProSupport Flex for Data Center

Dell ProSupport Flex for Data Center offers flexible site-wide support for hyperscale data centers with more than 1,000 assets. Built on standard Dell 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 Dell ProSupport Flex for Data Center, you'll 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 Enterprise Suite comparison

	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			✓

Additional Professional Services

Dell Training Services

Dell Education Services offers 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'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 Server solution. To learn more or register for a class today, visit learndell.com/server.

Dell IT Consulting Services

Dell Global Infrastructure Consulting Services use skilled solution architects, innovative tools, automated analysis and Dell's intellectual property to give you rapid insight into the root causes of unnecessary complexity. We seek better answers than traditional service models, and our strategy is to help you 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 you build a more efficient enterprise.

Dell Managed Services

Dell 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