

Dell PowerEdge C410x



Technical Guide



With up to 16 PCIe devices and up to 8 servers, the Dell PowerEdge C410x expansion chassis maximizes space, weight, energy and cost efficiency with unprecedented flexibility.

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1 System overview

New technologies

The Dell™ PowerEdge™ C410x is the only PCI Express (PCIe) expansion chassis on the market that offers up to 16 graphics processing units (GPUs) connected to up to eight x16 host interfaces with varying host-to-GPU ratios. This expansion chassis is part of the Dell hyperscale-inspired PowerEdge C series, designed to bring the most compute power in the least amount of space and energy draw to lower operational costs. The PowerEdge C410x PCIe expansion chassis connects to servers through a host interface card (HIC) and iPASS cable to add PCIe expansion and GPU compute capability.

The PowerEdge C410x is not a server and does not have processors. It has 16 PCIe slots with 8 PCIe 2.0 x16 iPASS ports, enabling up to 8 host nodes to connect to up to 16 PCIe slots. While the PCIe slots come empty, the PowerEdge C410x is available and qualified with NVIDIA® Tesla® M2075, M2090, K10 and K20 GPUs. For the latest information on host servers and cards that have been qualified on the PowerEdge C410x, see the specifications sheet at: Dell.com/PowerEdgeC.

System features

The PowerEdge C410x is a 3U external PCIe expansion chassis that connects up to eight host nodes to up to 16 PCIe devices. The PowerEdge C410x does not have processors or memory. Compared to servers with internal GPUs, it delivers faster results while saving power, reducing costs and maintaining the most flexible configurations in the industry. The PowerEdge C410x supports n+1 redundant power supplies and n+1 redundant fans, and allows PCIe modules to be individually serviced while still in use. The PowerEdge C410x features:

- 1 to 8 eight host connections with up to 16 PCIe devices
- 10 front, 6 back PCI Express (PCIe) x16 slots
- Hot plug fans, power supplies and PCIe modules
- N+1 energy efficient fans and power supplies
- On-board BMC, IPMI 2.0 dedicated management port
 - Map PCIe devices to hosts through IPMI
- Supports NVIDIA Tesla M2075 and M2090 GPU cards

Specifications

Table 1 summarizes the product features for the PowerEdge C410x. For the latest information on supported features for the PowerEdge C410x, visit Dell.com/PowerEdgeC.

Table 1. Technical specifications

Feature	PowerEdge C410x technical specification
Form factor	3U rack mount chassis supporting up to 8 host connections and up to 16 PCIe devices
Platforms	PowerEdge C6220 PowerEdge C6145 PowerEdge R720
PCIe sleds	10 front and 6 back



Feature	PowerEdge C410x technical specification
PCIe slots	16 PCIe 2.0 2 x16 slots
iPass ports	8 PCIe 2.0 x16 iPass ports
PCI slot-to-host ratios	2, 4, 8 slots ¹
Fans	8 high-efficiency 92mm hot-plug fans with N+1 redundant cooling Fan speeds are detectable with PWM control
Supported GPUs models	M2075 and M2090 ²
HIC options	Dell PLX single-port LP HIC Dell PLX single-port full height HIC
Cable options	.75m or 1.0m iPASS cable
Operating systems	Microsoft® Windows Server® 2012 Microsoft Windows Server 2008 R2 ³ Novell® SUSE® Linux Enterprise Server 2011 Red Hat® Enterprise Linux®
Power supplies	4 hot-plug platinum N+1 redundant 1400W power supplies
Server management	Embedded BMC with IPMI 2.0 support with RJ45 connector for dedicated management port access.
Rack support	ReadyRails™ sliding rails with a PowerEdge sliding rail kit.

¹ PCIe slots listed host ratios only with a x16 HIC connection.

² Mixing GPUs on the same host server is not supported.

³ Support is limited. Contact your Dell PowerEdge C representative.

Supported host servers

Table 2 lists the C410x supported servers, and the GPU support and HICs required with each server.

Table 2. PowerEdge C410x supported PowerEdge servers and features¹

PowerEdge servers	PowerEdge C410x support	Supported GPUs	Required HICs
C6145	Up to 12 GPUs	M2075, M2090, K10 and K20	Dell
C6220	Up to 8 GPUs	M2075, M2090, K10 and K20	Dell
R720	Up to 8 GPUs	M2075, M2090, K10 and K20	Dell

¹ Check the server documentation to confirm validated GPUs.



2 Chassis views and features

Front panel view and features

The PowerEdge C410x is a 3U rack-mounted chassis. The front panel shown in Figure 1 features status indicators, power button, ID button, and access to 10 PCIe module sleds with power LEDs. These components are located on the front of the PowerEdge C410x:

- System LED
- UID LED/button
- Power LED/button
- GPGPU – card cages 1–10
- GPU LED – power buttons 1–10

Figure 1. Front panel: C410x expansion chassis



Back panel view and features

The back panel shown in Figure 2 features access to four power supplies, eight iPASS connectors, and six PCIe module sleds with power LEDs. These components are located on the back of the PowerEdge C410x:

- Power supplies 1–4
- BMC LAN cable
- iPASS connectors 1–8
- GPGPU – card cages 11–16
- GPU LED – power buttons 11–16

Figure 2. Back panel: C410x expansion chassis



System setup overview

The PowerEdge C410x is an external PCIe x16 expansion chassis, which means that general purpose graphics processing units (GPGPU) cards are not housed inside the server. Cards are installed in an externally attached chassis designed solely to act as a x16-slot PCIe expansion module.

This externally attached chassis has a Remote Management Console (RMC) utility through which you can monitor system behavior such as temperature, power and fan speeds.

To connect the PowerEdge C410x to an external server:

- Install a host interface card (HIC) in the host server's PCIe x16 slot
- Connect to the PowerEdge C410x enclosure with an external iPASS cable

Figure 3 shows the HIC low-profile card that ships with full-height and low-profile brackets.

Figure 3. PCIe HIC with external iPASS connector

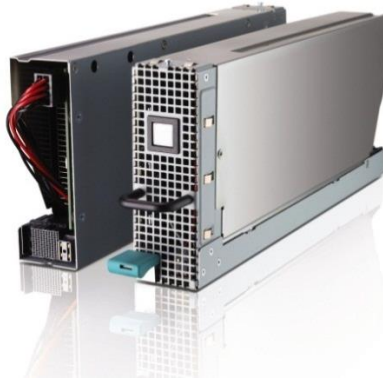


Inside the PowerEdge C410x expansion chassis is an iPASS board that features the iPASS connectors as well as the PCIe switch and a middle board. For host server support details, see Table 2.

Carrier sled modules and features

The PCIe slots in the PowerEdge C410x are housed in removable carrier sleds. Based on the unique requirements and form factors of the PCIe cards, there are a number of carrier sled options for the PowerEdge C410x. Figure 4 shows front and back views of a carrier sled.

Figure 4. C410x carrier sled



GPU carrier module

The various GPUs supported within the C410x may have slightly different sled designs. The correct sled to support the selected GPU will ship with the card.

Common PCIe carrier module

To support a broader range of cards, the common carrier is designed for low-profile, half-length, single-width PCIe cards with a standard full-height bracket. This sled provides access to any external ports on the PCIe cards, making it suitable for InfiniBand® and other fabric options.

Common carrier modules support the following features:

- x16 PCIe connector
- 8-pin power connector
- Power/status LED
- Retention latch

Figure 5 shows a side view of the common PCIe carrier module seated in the carrier sled.

Figure 5. Common PCIe carrier module



Carrier module LEDs

GPGPU PCIe carrier modules are designed with individual power button/LEDs on the front of the carrier.

Figure 6. Common carrier and carrier sled module power button LED



Carrier module current sensor

The PowerEdge C410x has a current sensor for each GPU card. The sensor is a high-side current shunt and power monitor with a I2C interface. The sensor monitors both shunt drop and supply voltage, with programmable conversion times and filtering. A programmable calibration value, combined with an internal multiplier, enables direct readouts in amperes. An additional multiplying register calculates power in watts. The I2C interface features 16 programmable devices. Using the I2C bus interface, the BMC can monitor the current draw for each GPGPU card.



Carrier module hot-plug support

The PowerEdge C410x supports a PCIe hot-plug feature that permits the replacement of a carrier module without PowerEdge C410x system power interruption.

- When replacing cards, the host must be rebooted for it to detect the newly added PCIe cards.
- Turn off the power to the card (green LED off) before removing the carrier module from the PowerEdge C410x system.

Carrier power control

The PCI Express carrier offers three power cycling options:

- Powering on/off the PowerEdge C410x PCIe expansion chassis.
- Pressing the power button on each PCIe individual carrier module.
- Powering on/off remotely through the IPMI. (See the *Dell PowerEdge C410x Using the Baseboard Management Controller* manual on Dell.com/Support/Manuals for commands).

Fan

The PowerEdge C410x features eight 92mm x 38mm hot-pluggable 7+1 redundant fans. Shown in Figure 7, these fans are designed with a BMC notification in the event of a system fan failure.

Figure 7. C410x expansion chassis fans

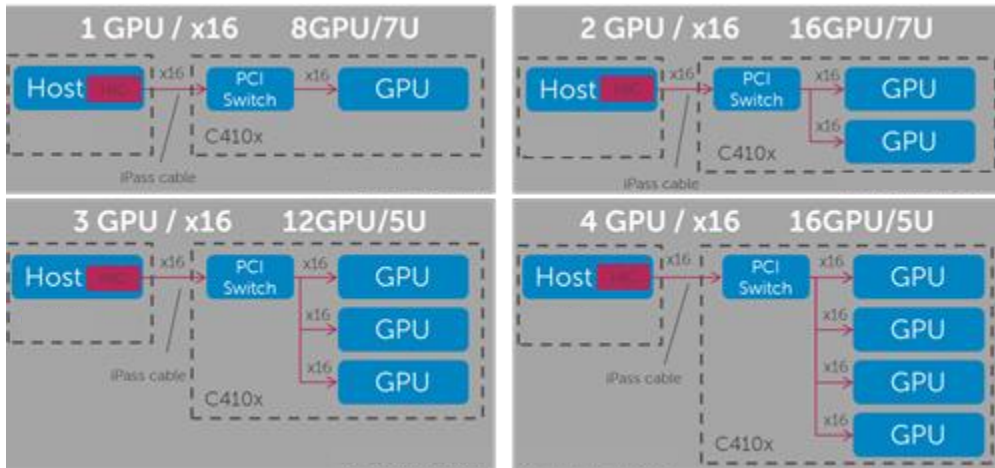


For more information, see the *Dell PowerEdge C410x Systems Hardware Owner's Manual* on Dell.com/Support/Manuals.

3 PCIe card slots

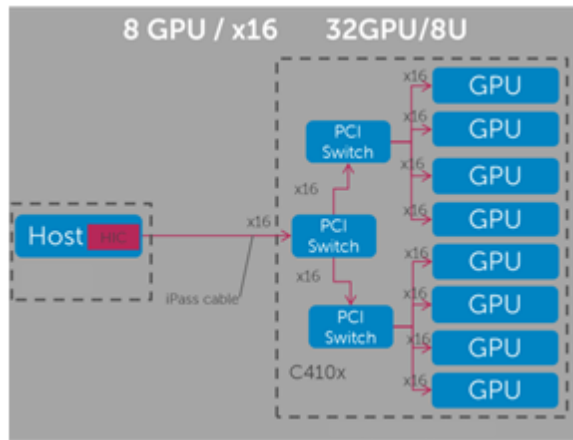
The PowerEdge C410x expansion chassis contains eight primary switches and can support up to x32 PCIe devices for one server's HIC in a 4:1 mode, as shown in Figure 8 and Figure 9. Each switch uses the x32 PCIe located on the host server, and can fan out for up to four devices. Support for the PCIe slot configuration shown in Figure 8 is still available.

Figure 8. PowerEdge C410x PCIe 2:1 and 4:1 fan out support



*GPU/U ratios assume PowerEdge C6220 with 4 servers per 2U chassis.

Figure 9. PowerEdge C410x PCIe 8:1 fan out support



*GPU/U ratios assume PowerEdge C6220 with 4 servers per 2U chassis.

GPGPU cards

The C410x supports a number of GPGPU card models; however, you cannot mix different GPU models on the same host server.



NVIDIA M2075/M2090 GPUs

NVIDIA Tesla GPUs provide enhanced features and significant performance improvements including:

- Lower power consumption
- Enhanced power scaling
- Error-correcting code (ECC) reporting
- Greater memory speed and memory bandwidth

For more information, see the *Dell PowerEdge C410x Systems Hardware Owner's Manual* on Dell.com/Support/Manuals.



4 Power

The PowerEdge C410x is powered by four highly efficient power supply units that are easy to access through the back panel.

Power supply units

The base redundant system consists of four hot-plug power supplies in a 1+1 configuration available at 1400W. Figure 10 shows the 1400W PSUs in the PowerEdge C410x chassis.

Figure 10. PowerEdge C410x 1400W PSUs



The PowerEdge C410x supports up to four power supplies with 1+1 redundancy, auto-sensing and auto-switching capabilities. Dell power supplies have achieved Platinum efficiency levels, as shown in Table 3.

Table 3. Power supply efficiency

Form factor	Output	Class	Efficiency targets by load		
			20%	50%	100%
Redundant 86mm	1400W AC	Platinum+	88.0%	92.0%	88.0%



5 Rack information

Rack installation components such as rails are provided with the PowerEdge C410x rack kit. The components consist of a sliding rail system; there is no support for a cable management arm.

NOTE: Before installing sliding rail systems in a rack, install front and side stabilizers on stand-alone (single) racks. Install front stabilizers on racks joined with other racks. Stabilizers are separately orderable and ensure safe installation of the rack.

For more information, see the *Dell C410x Getting Started with Your System* guide at Dell.com/Support/Manuals.



6 Operating systems

The Dell PowerEdge C410x supports a wide range of industry standard operating systems.

Supported operating systems

The PowerEdge C410x supports the following operating systems:

- Microsoft Windows Server 2008 R2
- Red Hat Enterprise Linux
- Novell SUSE Linux Enterprise Server 11 SP2
- Microsoft Windows Server 2012

Note: Support for Microsoft Windows Server 2008 R2 is limited. Contact your PowerEdge C representative for more information.



7 Systems management

The PowerEdge C410x features an onboard BMC that supports IPMI 2.0 that enables the following:

- IPMI over LAN with remote management control protocol (RMCP)
- Remote power control (for chassis and GPGPU) through the IPMI chassis command
- Field-replaceable unit (FRU) and system event log (SEL)
- Hardware monitor Sensor Data Record (temperature, voltage, PSU status, fan status)
- Local BMC firmware update (through out of band IPMI LAN)

Out-of-band notifications indicating the specific GPGPU location are provided for the following events:

- If a GPGPU is removed from chassis
- If a GPGPU is inserted into chassis
- If a GPGPU is experiencing a fault
- For a GPGPU temperature notification

The firmware code is field upgradable.

PCIe-to-node mapping management

Table 4 identifies the PCIe device mapping to the iPASS port number and the respective iPass port to the PCIe device ratio.

Table 4. iPass port to PCIe device mapping

iPass port	1:2 mode	1:4 mode	1:8 mode
1	1, 15	1, 2, 15, 16	1, 2, 3, 4, 13, 14, 15, 16
2	3, 13	3, 4, 13, 14	Disabled
3	5, 11	5, 6, 11, 12	5, 6, 7, 8, 9, 10, 11, 12
4	7, 9	7, 8, 9, 10	Disabled
5	2, 16	Disabled	Disabled
6	4, 14	Disabled	Disabled
7	6, 12	Disabled	Disabled
8	8, 10	Disabled	Disabled

Embedded server management

The PowerEdge C410x supports BMCs that comply with IPMI v2.0. The PowerEdge C410x BMC provides the following features for managing the server remotely or in data center lights-out environments:

- Out-of-band monitoring and control for server management over LAN
- Dedicated NIC for remote management through network (through the RJ45 port on the PowerEdge C410x chassis)



- FRU information report, which includes main board part number, product name, manufacturer and more
- Health status/hardware monitoring report
- Sled management, which includes power control and power monitoring
- View and clear events log
- Event notification by lighting chassis LED indicator and Platform Event Trap (PET)
- Platform Event Filtering (PEF) to take selected action for selected events
- Support for multisession and user and alert destination for LAN channel

Firmware and drivers

In order to set up the PowerEdge C410x, various types of firmware must be updated and/or maintained, including:

- BMC firmware
- Drivers for the PCIe card (for example, NVIDIA drivers) on the [NVIDIA Driver Downloads](#) website. No drivers are needed for the HIC or PowerEdge C410x PCIe chassis.

Updating BMC firmware

The C410x BMC firmware can be updated through the RMC web user interface.

For more information, see the *Dell PowerEdge C410x Systems Hardware Owner's Manual* and the *Dell PowerEdge 410x Using the Baseboard Management Controller* on Dell.com/Support/Manuals.



8 GPGPU software

Customized software is required to provide optimal GPGPU functionality and ensure proper communication between the graphics processors and the rest of the system. An example of this software is the NVIDIA CUDA GPU computing software.

The NVIDIA CUDA technology is the latest software architecture that uses the parallel computational power of the GPU. When executing CUDA programs, the GPU operates as a coprocessor to the host server CPU.

The GPU handles the core processing on large quantities of parallel information while the CPU organizes, interprets and communicates information. Compute-intensive segments of applications that are executed multiple times, but on different data. These segments are extracted from the main application and compiled to execute in parallel on the GPU.

GPGPU technology uses

Some popular uses for the GPGPU technology include:

- Physics simulations and physics engines
- High-performance computing clusters (HPCC)
- Digital audio and sound effects processing
- Hardware accelerated video decoding and post-processing
- Geometric computing
- Gene sequencing research
- Financial modeling
- Geometric computing (weather research, quantum physics modeling, and medical imaging)

These are just a few examples of applicable technology for this new method of general purpose processing through the use of graphic processing units.

For more information about using the NVIDIA CUDA GPGPU application software, see [NVIDIA TESLA Developing with GPUs](#).



Appendix A. Additional specifications and options

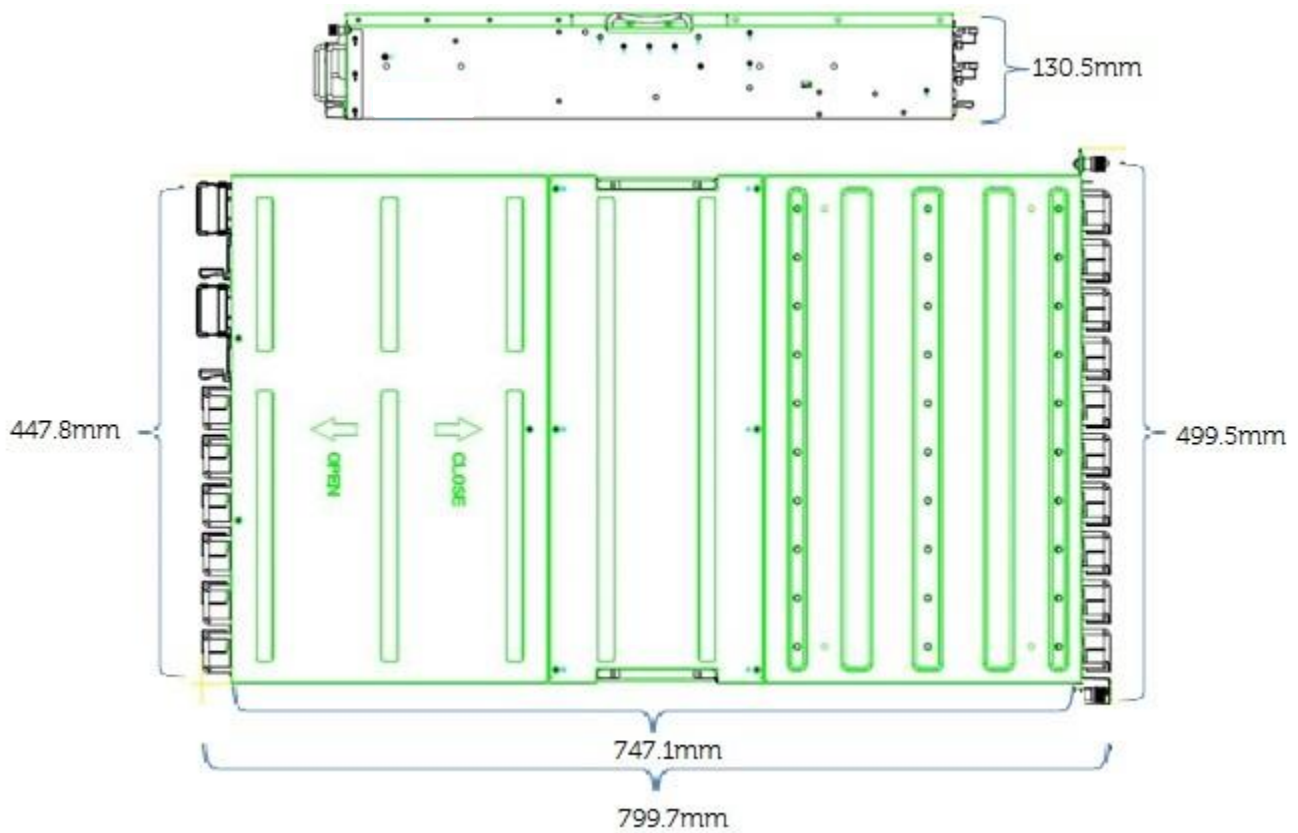
System dimensions

Figure 11 details and Table 5 lists the dimensions of the PowerEdge C410x.

Table 5. C410x chassis dimensions

Dimensions	
Depth	Front: 499.5mm (19.6in). Back: 447.8 (17.6in)
Height	130.5mm (5.1in)
Width	Chassis: 747.1 (29.4in), Total width: 799.7mm (31.5in)

Figure 11. C410x dimensions



System weight

Table 6 lists the weight of the C410x rack expansion at minimum and maximum configuration.

Table 6. System weight

Form Factor	Maximum configuration	Minimum configuration
C410x expansion chassis	56.0kg (123.5lb)	30.0kg (66.1lb)



Environmental specifications

Table 7 details the environmental specifications for the C410x. For the most up-to-date information, see the *Dell PowerEdge C410x Getting Started Guide* on Dell.com/Support/Manuals. For additional information about environmental measurements for specific system configurations, see Dell.com/environmental_datasheets.

Table 7. Environmental specifications

Temperature	
Operating	10° to 35°C (50° to 95°F)
Storage	-40° to 65°C (-40° to 149°F)
Relative humidity	
Operating	20% to 80% (non-condensing)
Storage	5% to 95% (non-condensing)

Power supply specifications

Table 8 lists power supply specifications for the PowerEdge C410x.

Table 8. Power supply specifications

Specification	1400W AC power supply
Current consumption	9,6A
Supply voltage	200–240VAC
Frequency	50/60Hz
Maximum inrush current	Initial in-rush current cannot exceed 55A (peak). Secondary inrush current cannot exceed 35A (peak).



Appendix B. Standards compliance

C410x conforms to the industry standards listed in Table 9.

Table 9. Industry standard documents

Standard	URL for information and specifications
Ethernet IEEE 802.3-2005	standards.ieee.org/getieee802/802.3.html
IPMI Intelligent Platform Management Interface, v2.0	intel.com/design/servers/ipmi
PCI Express PCI Express Base Specification Rev. 2.0	pcisig.com/specifications/pciexpress



Appendix C. Additional resources

Table 10 provides a list of documents and websites that provide for more information on the Dell PowerEdge C410x.

Table 10. Additional resources

Resource	Description of contents	Location
PowerEdge C410x Owner's Manual	This manual is provided in in PDF format and provides information on the following: <ul style="list-style-type: none">• Chassis features• Power sequencing• GPGPU configuration• Remove and replace procedures• Troubleshooting• Diagnostics• Jumpers and connectors	Dell.com/Support/Manuals
PowerEdge C410x 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: <ul style="list-style-type: none">• Initial setup steps• Key system features• Technical specifications	Dell.com/Support/Manuals
Dell PowerEdge 2420, 4220, and 4820 Rack Enclosures Technical Guide	This guide describes the expanded portfolio of rack enclosures and components.	Dell.com/us/Enterprise
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

