

### Overview

HP supports 56 Gbps Fourteen Data Rate (FDR) and 40Gbps 4X Quad Data Rate (QDR) InfiniBand (IB) products that include mezzanine Host Channel Adaptors (HCA) for server blades, dual mode InfiniBand or Ethernet mezzanine adaptors, switch blades for c-Class enclosures, and rack switches and cables for building scale-out solutions. This QuickSpecs focuses on mezzanine adaptors for server blades, and InfiniBand switch blades for c-Class enclosures; for details on the InfiniBand rack switches, standup PCI Express HCAs and FlexLOM Adaptors for HP ProLiant and Integrity servers, as well as InfiniBand cables, please refer to the HP InfiniBand for HP ProLiant and Integrity servers QuickSpecs at:

[http://h18000.www1.hp.com/products/quickspecs/13078\\_na/13078\\_na.html](http://h18000.www1.hp.com/products/quickspecs/13078_na/13078_na.html)

The following InfiniBand products based on Mellanox technology are available for the HP BladeSystem c-Class from HP:

- HP IB QDR/EN 10Gb 2P 544M Adaptor for HP BladeSystem c-Class (Gen8 and beyond)
- HP IB FDR/EN 10/40Gb 2P 544M Adaptor for HP BladeSystem c-Class (Gen8 and beyond)
- HP 4X QDR IB CX-2 Dual Port Mezz HCA for HP BladeSystem c-Class (G6 and G7)
- HP BLc 4X FDR IB Managed Switch for HP BladeSystem c-Class
- HP BLc 4X FDR IB Switch for HP BladeSystem c-Class
- HP BLc 4X QDR IB Switch for HP BladeSystem c-Class

**NOTE:** The above Mellanox based devices of either speed can be used together but cannot be used with QLogic based devices.

The HP IB FDR/EN 10/40Gb 2P 544M Mezzanine Adaptor for HP BladeSystem c-Class is based on the Mellanox ConnectX-3 IB technology. The FDR IB HCA delivers low-latency and up to 56Gbps (FDR) bandwidth (single port) for performance-driven server and storage clustering applications in High-Performance Computing (HPC) and enterprise data centers. The HP IB FDR/EN 10/40Gb 2P 544M Adaptor also is capable of dual 40 or 10 Gb Ethernet ports when connected to a supported Ethernet switch in the C7000 enclosure. The HP IB FDR/EN 10/40Gb 2P 544M Mezzanine HCA card is designed for PCI Express 3.0 x8 connectors on HP BladeSystem c-Class Gen 8 server blades. In FDR mode the card must be used in mezzanine slot 1 of the blade server, in the other modes it can be used in any mezzanine slot.

The HP IB QDR/EN 10 Gb 2P 544M Mezzanine Adaptor for HP BladeSystem c-Class is based on the Mellanox ConnectX-3 IB technology. The QDR IB HCA delivers low-latency and up to 40Gbps (QDR) bandwidth (dual port) for performance-driven server and storage clustering applications in High-Performance Computing (HPC) and enterprise data centers. The HP IB QDR/EN 10 Gb 2P 544M Adaptor also is capable of dual 10 Gb Ethernet ports when connected to a supported Ethernet switch in the C7000 enclosure. The HP IB QDR/EN 10 Gb 2P 544M Mezzanine HCA card is designed for PCI Express 3.0 x8 connectors on HP BladeSystem c-Class Gen8 server blades and can be used in either mezzanine slot of the blade server.

The HP 4X QDR IB CX-2 Dual-port Mezzanine HCA for HP BladeSystem c-Class is based on the Mellanox ConnectX-2 IB technology. The QDR IB HCA delivers low-latency and up to 40Gbps (QDR) bandwidth for performance-driven server and storage clustering applications in High-Performance Computing (HPC) and enterprise data centers. Parallel or distributed applications running on multi-processor multi-core servers will benefit from the reliable transport connections and advanced multicast support offered by ConnectX IB. End-to-end Quality of Service (QoS) enables partitioning and guaranteed service levels while hardware-based congestion control prevents hot spots from degrading the effective throughput. The HP 4X QDR IB CX-2 Dual-port Mezzanine HCA card is designed for PCI Express 2.0 x8 connectors on HP BladeSystem c-Class G6 and G7 server blades.

InfiniBand host stack software (driver) is required to run on servers connected to the InfiniBand network. For mezzanine HCAs based on Mellanox technologies, HP supports Mellanox OFED Driver 1.5.3-3.0.0 or newer on Linux 64-bit operating systems, and Mellanox WinOF 3.0 driver stack on Microsoft Windows (HPC) server 2008.

For the latest information on Mellanox OFED software, please refer to: [http://www.mellanox.com/content/pages.php?pg=software\\_overview\\_ib&menu\\_section=34](http://www.mellanox.com/content/pages.php?pg=software_overview_ib&menu_section=34).

The HP BLc 4X FDR IB Switch for HP BladeSystem c-Class is a double wide switch for the new HP BladeSystem c7000 enclosure. It is



### Overview

based on the Mellanox Switch X technology. The FDR IB switch blade has 16 downlink ports to connect up to 16 server blades in the c7000 enclosure, and 18 QSFP uplink ports for inter-switch links or to connect to external servers. All ports are capable of supporting 56Gbps (FDR) bandwidth. A subnet manager has to be provided; see the paragraph on subnet managers for more details.

The HP BLc 4X FDR Managed IB Switch for HP BladeSystem c-Class is a double wide switch for the new HP BladeSystem c7000 enclosure. It is based on the Mellanox Switch X technology. The FDR IB switch blade has 16 downlink ports to connect up to 16 server blades in the c7000 enclosure, and 18 QSFP uplink ports for inter-switch links or to connect to external servers. All ports are capable of supporting 56Gbps (FDR) bandwidth. The switch contains an integrated management module that is capable of managing a cluster of up to 648 nodes. A subnet manager has to be provided; see the paragraph on subnet managers for more details.

The HP BLc 4X QDR IB Switch for HP BladeSystem c-Class is a double wide switch for the new HP BladeSystem c7000 enclosure. It is based on the Mellanox InfiniScale IV technology. The QDR IB switch blade has 16 downlink ports to connect up to 16 server blades in the c7000 enclosure, and 16 QSFP uplink ports for inter-switch links or to connect to external servers. All ports are capable of supporting 40Gbps (QDR) bandwidth. A subnet manager has to be provided; see the paragraph on subnet managers for more details.

An InfiniBand fabric consists of one or more InfiniBand switches connected via inter-switch links. The most commonly deployed fabric topology is a fat tree or its variations. A subnet manager is required to manage and control an InfiniBand fabric. The subnet manager functionality can be provided by either a rack-mount InfiniBand switch with an embedded fabric manager (aka internally managed switch) or host-based subnet manager software on a server connected to the fabric. OpenSM is a host-based subnet manager that runs on a server connected to the InfiniBand fabric. Mellanox OFED software stack includes OpenSM for Linux, and Mellanox WinOF includes OpenSM for Windows. For comprehensive management and monitoring capabilities, Mellanox Unified Fabric Manager™ (UFM) is recommended for managing the InfiniBand fabric based on Mellanox/Voltaire InfiniBand switch products and Mellanox ConnectX-based mezzanine HCA.

An embedded fabric manager is available on Mellanox internally managed 36-port 4X FDR switch, and modular QDR switches. Please refer to: [http://h18000.www1.hp.com/products/quickspecs/13078\\_na/13078\\_na.html](http://h18000.www1.hp.com/products/quickspecs/13078_na/13078_na.html) for information about InfiniBand rack switches.

The following InfiniBand products based on QLogic technology are available for the HP BladeSystem c-Class from HP:

- QLogic 4X QDR IB Mezzanine HCA for HP BladeSystem c-Class
- QLogic BLc 4X QDR IB Switch for HP BladeSystem c-Class
- QLogic BLc 4X QDR IB Management Module

**NOTE:** The above QLogic based devices cannot be mixed with Mellanox based devices in a HP BladeSystem c7000 Enclosure.

The QLogic 4X QDR IB Mezzanine HCA is based on the QLogic TrueScale ASIC architecture which has a unique hardware architecture that delivers unprecedented levels of performance, reliability, and scalability, making it an ideal solution for highly scaled High Performance Computing (HPC) and high throughput, low-latency enterprise applications.

InfiniBand host stack software (driver) is required to run on servers connected to the InfiniBand fabric. For HCAs based on QLogic technology, HP supports QLogic OFED driver stacks on Linux 64-bit operating systems.

The QLogic BLc 4X QDR IB Switch for HP BladeSystem c-Class uses the QLogic TrueScale ASIC architecture designed to cost-effectively link workgroup resources into a cluster or provide an edge switch option for a larger fabric. Customers have the ability to internally or externally manage the modular IB switch. The QLogic BLc 4X QDR IB Switch also has an optional management module that includes an embedded subnet manager. This management module is an option for both the 32-port QDR BladeSystem switch and the 36-port QDR edge switch. When combined with the optional InfiniBand Fabric Suite software, users can manage up to a 288 node fabric using only the management capability of the unit, without requiring additional host processing. In a bladed environment this alleviates the need to use a node for fabric management.



### Overview

An InfiniBand fabric is constructed with one or more InfiniBand switches connected via inter-switch links. The most commonly deployed fabric topology is a fat tree or its variations. A subnet manager is required to manage an InfiniBand fabric. OpenSM is a host-based subnet manager that runs on a server connected to the InfiniBand fabric. QLogic OFED software stack includes OpenSM for Linux. For comprehensive management and monitoring capability, QLogic InfiniBand Fabric Suite (IFS) is recommended for managing the InfiniBand fabric based on QLogic InfiniBand products.

HP supports InfiniBand copper and fiber optic cables with QSFP to QSFP connectors. The QSFP to QSFP QDR copper cables range from 1M to 7M for HCA to switch, or inter-switch links at QDR speed (please note that QLogic QDR switches only support up to 5 meters at QDR speed), and up to 10M at DDR speed. The QSFP to QSFP FDR copper cables range from 0.5M to 3M for HCA to switch, or inter-switch links at FDR speed. The QSFP to QSFP FDR optical cables range from 3M to 30M for HCA to switch, or inter-switch links at FDR speed.

Please refer to: [http://h18000.www1.hp.com/products/quickspecs/13078\\_na/13078\\_na.html](http://h18000.www1.hp.com/products/quickspecs/13078_na/13078_na.html) for more details on supported InfiniBand cables.

### What's New

- Next generation of Mellanox chip technology (ConnectX-3 and SwitchX)
- FDR InfiniBand
- Dual function mezzanine adaptors (InfiniBand or Ethernet)

### At A Glance

- **InfiniBand mezzanine HCA based on Mellanox technology for Gen 8 blades**
  - HP FDR IB CX-3 Dual-port Mezzanine HCA for HP BladeSystem c-Class
    - Single-port FDR InfiniBand
    - Dual-port QDR InfiniBand
    - Dual-port 40 Gb Ethernet
    - Dual-port 10 Gb Ethernet
    - Supported on: HP ProLiant BL460c Gen 8
    - Support Mellanox OFED Linux driver stack and Mellanox WinOF 2.0 on Microsoft Windows HPC server 2008
- **InfiniBand mezzanine HCA based on Mellanox technology for G7 blades**
  - HP 4X QDR IB CX-2 Dual-port Mezzanine HCA for HP BladeSystem c-Class
    - Dual-port 4X QDR InfiniBand PCI Express G2 Mezzanine card
    - Supported on: HP ProLiant BL280c G6, HP ProLiant BL2x220c G6, HP ProLiant BL460c G6, HP ProLiant BL460c G7, HP ProLiant BL465c G7, HP ProLiant BL490c G6, HP ProLiant BL490c G7, HP ProLiant BL620c G7, HP ProLiant BL680c G7, HP ProLiant BL685c G7 Server Blades and HP ProLiant WS460c G6 Workstation Blade
    - Support Mellanox OFED and Mellanox OFED Linux driver stacks and Mellanox WinOF 2.0 on Microsoft Windows HPC server 2008
- **InfiniBand mezzanine HCA based QLogic technology for G7 Blades**
  - QLogic 4X QDR IB Dual Port Mezzanine HCA for HP BladeSystem c-Class
    - Dual-port 4X QDR InfiniBand PCI Express G2 Mezzanine Card
    - Supported on HP ProLiant BL280c G6, HP ProLiant BL2x220c G6, HP ProLiant BL460c G6, HP ProLiant BL460c G7, HP ProLiant BL465c G7, HP ProLiant BL490c G6, HP ProLiant BL490c G7, HP ProLiant BL620c G7, HP ProLiant BL680c G7, HP ProLiant BL685c G7 Server Blades and HP ProLiant WS460c G6 Workstation Blade
    - Full support for QLogic OFED including all standard OFED transport protocols, plus optional value-added components to improve management and performance
- **InfiniBand switch blades based on Mellanox technology**
  - HP BLc 4X FDR IB Switch for HP BladeSystem c-Class
    - Double wide switch blade for the new c7000 enclosure with 16 downlink ports to connect server blades via the midplane, and 18 QSFP unlink ports for the inter-switch links or to connect to external servers. All ports are capable of supporting 56Gbps (FDR) bandwidth. All uplink ports support copper and fiber optic cables. One



### Overview

version of the switch is externally managed, i.e. a subnet manager has to be provided on the fabric (see the subnet manager discussion above). The other version of the switch contains a management module and can run the subnet manager.

- **HP BLc 4X QDR IB Switch for HP BladeSystem c-Class**

- Double wide switch blade for the new c7000 enclosure with 16 downlink ports to connect server blades via the midplane, and 16 QSFP unlink ports for the inter-switch links or to connect to external servers. All ports are capable of supporting 40Gbps (QDR) bandwidth. All uplink ports support copper and fiber optic cables. The switch is externally managed, i.e. a subnet manager has to be provided on the fabric (see the subnet manager discussion above)

- **InfiniBand switch blades based on QLogic technology**

- QLogic BLc 4X QDR IB Switch for HP BladeSystem c-Class

- Double wide switch blade for the new c7000 enclosure with 16 downlink ports to connect server blades via the midplane, and 16 QSFP unlink ports for the inter-switch links or to connect to external servers. All ports are capable of supporting 40Gbps (QDR) bandwidth. All uplink ports support copper and fiber optic cables
- Optional Management Module with an embedded subnet manager and management of up to 288 nodes



### Models

Mellanox CX-3 Dual Function Mezzanine Adapters	HP FDR/EN InfiniBand 10/40Gb Dual Port 544M Adapter	644161-B21
	<b>NOTE:</b> Supports HP ProLiant Gen8 server blades only.	
Mellanox InfiniBand CX-2 mezzanine HCA cards and options	HP QDR/EN InfiniBand 10Gb Dual Port 544M Adapter	644160-B21
	<b>NOTE:</b> Supports HP ProLiant Gen8 server blades only.	
	<b>NOTE:</b> The HCA cards listed in this section are based on Mellanox technology.	
Mellanox InfiniBand CX-2 mezzanine HCA cards and options	HP 4X QDR InfiniBand ConnectX-2 Dual Port Mezzanine HCA for c-Class BladeSystem	592519-B21
	Mellanox Fabric IT Fabric Manager Per Node Right To Use License	TE078A
	Voltaire Unified Fabric Manager Per Node Right To Use License	590643-B21
<b>NOTE:</b> Right to use (RTU) License for Mellanox Unified Fabric Manager (UFM), 1 per node for every node connected to the Mellanox InfiniBand fabric.		
QLogic IB mezzanine HCA card	HP 4X QDR QLogic InfiniBand Dual Port Mezzanine HCA for c-Class BladeSystem	583210-B21
Mellanox IB switch blades and options	<b>NOTE:</b> Supports HP ProLiant G7 server blades only.	
	HP 4X FDR InfiniBand Managed Switch Module for c-Class BladeSystem	648311-B21
	HP 4X FDR InfiniBand Switch Module for c-Class BladeSystem	648312-B21
	HP 4X QDR InfiniBand Switch Module for c-Class BladeSystem	489184-B21
<b>NOTE:</b> The HP BLc QDR and FDR IB Switches are only supported on the HP BladeSystem c7000 Enclosures (P/N's: 507014-B21, 507015-B21, 507016-B21, 507017-B21 and 507019-B21).		
<b>NOTE:</b> Please see the HP BladeSystem c7000 Enclosure QuickSpecs for additional information at:		
	<a href="http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html">http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html</a>	
QLogic IB switch blade and options	HP 4X QDR QLogic InfiniBand Switch Module for c-Class BladeSystem	505958-B21
	QLogic InfiniBand 4X QDR Management Module for c-Class BladeSystem	505959-B21
	QLogic InfiniBand Fabric Suite Fabric Flexible License	QL470A
	<b>NOTE:</b> Right to use (RTU) License for QLogic IFS, 1 per node for every node connected to the QLogic InfiniBand fabric.	
<b>NOTE:</b> The QLogic BLc 4X QDR IB Switch for HP BladeSystem c-Class is only supported on the HP BladeSystem c7000 Enclosures (P/N's: 507014-B21, 507015-B21, 507016-B21, 507017-B21 and 507019-B21).		
<b>NOTE:</b> Please see the HP BladeSystem c7000 Enclosure QuickSpecs for additional information at:		
	<a href="http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html">http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html</a>	



### Standard Features

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#### Performance

##### Bandwidth:

- All ports on 4X FDR HCA card and switch are capable of supporting 56Gbps signaling rate, with a peak data rate of 52 Gbps in each direction.
  - All ports on 4X QDR HCA card and switch are capable of supporting 40Gbps signaling rate, with a peak data rate of 32 Gbps in each direction.
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#### Scalability and Reliability Standards support:

- Dual-port 4X FDR mezzanine HCA: PCI Express revision 3.0x8 (1.1 compliant)
  - Dual-port 4X QDR mezzanine HCA: PCI Express revision 2.0x8 (1.1 compliant)
  - IBTA version 1.2 compatible
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#### Operating systems support

- Mellanox OFED 1.5.3\_3.0.0 for Linux (64 bit)
    - RHEL 5, U5, U6, U7 in G7 servers U7 in Gen8 servers
    - RHEL 6 U1, U2
    - SLES 10 SP4,
    - SLES 11 SP1, SP2
    - Mellanox WinOF 3.0 for Microsoft Windows HPC server 2008 (64-bit)
    - Microsoft Windows 2008
    - Microsoft Windows HPC server 2008
    - Microsoft Windows HPC server 2008 R2
  - QLogic OFED+ 7.0.1.0.43 for Linux (64-bit)
    - RHEL 5 U4, U5, U6, U7
    - RHEL 6 U1, U2
    - SLES 10 SP3, SP4
    - SLES 11 SP1
    - CentOS (Rocks) 5.4, 5.5, 5.6, 6.0
    - Scientific Linux 5.4, 5.5, 5.6, 6.0
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#### PCI-Express Mezzanine connectors

- The HP QDR and FDR IB HCA Gen 8 mezzanine card is specified to run on PCI Express Gen3 connectors.
- The QDR IB HCA G7 mezzanine card from Mellanox and QLogic are specified to run on PCI Express Gen2 connectors.

**NOTE:** Depending on the server blade models, multiple HCAs per server blade may be supported; please refer to server blades specification for more details.

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#### Switch bays on c-Class enclosure

HP IB switch blades are designed to fit into the double wide switch bays on the c-Class enclosures. Depending on the mezzanine connectors used for IB HCA mezzanine cards, the IB switch blade has to be inserted into corresponding switch bays.

- At FDR speeds the switch bays 3 and 4 must be used.
  - At QDR speeds the switch bays 3 and or 5 and 6 or 7 and 8 can be used.
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### Standard Features

#### InfiniBand Fabric Management

##### Auto-negotiation/self-discovery:

InfiniBand FDR or QDR ports support auto-negotiation down to lower frequencies. For example, external uplink ports of a FDR switch blade will negotiate down to QDR or DDR speed if they are connected to a device which can only operate at those speeds.

Self-discovery is supported by subnet manager. Check the documents of the specific subnet manager for more details <http://www.docs.hp.com>.

##### Management Support:

Mellanox OFED and QLogic OFED+ include drivers and utilities to configure and manage the HCA in a Linux environment and Mellanox WinOF includes drivers and utilities to configure and manage the HCA in the Microsoft Windows server HPC 2008 environment.

InfiniBand fabric has to be set up with a subnet manager: see the subnet manager discussion above.

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#### Warranty

HP branded hardware options qualified for BladeSystem c-Class and p-Class servers are covered by a global limited warranty and supported by HP Services and a worldwide network of HP Authorized Channel Partners. The HP branded hardware option diagnostic support and repair is available for one year from date of purchase, or the length of the server they are attached to, whichever is greater. Support for software and initial setup is available for 90 days from date of purchase. Additional support may be covered under the warranty or available for an additional fee. Enhancements to warranty services are available through HP Care Pack services or customized service agreements.

Additional information regarding worldwide limited warranty and technical support is available at: <http://h18004.www1.hp.com/products/servers/platforms/warranty/index.html>



### Service and Support

#### Service and Support

#### HP Technology Services

HP Technology Services offers you consultants and support experts to solve your most complex infrastructure problems. We help keep your business running, boost availability and avoid downtime.

#### **Protect your business beyond warranty with HP Care Pack Services**

When you buy HP Options, it's also a good time to think about what level of service you may need. HP Care Pack services provide total care and support expertise with committed response choices designed to meet your IT and business need.

HP Foundation Care services deliver scalable support-packages for HP industry-standard servers and software. You can choose the type and level of service that is most suitable for your business needs. New to this portfolio is HP Collaborative Support. If you are running business critical environments, HP offers Proactive Care or Critical Advantage. These services help you deliver high levels of application availability through proactive service management and advanced technical response.

Here is the support service recommendation from the Foundation Care and Proactive Care portfolio. For customized support service solution, HP can work with you to tailor a service solution for your unique support requirements using broader services portfolio of Foundation Care and Proactive Care.

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#### Recommended Services

#### Recommended HP Care Pack Services for optimal satisfaction with your HP product

##### **3-Year HP 24x7 4 hour Response, Hardware Support Onsite Service**

Provides you with rapid remote support and if required an HP authorized representative who will arrive on site any time and day of the year to begin hardware maintenance service within 4 hours of the service request being logged.

<http://h20195.www2.hp.com/V2/GetPDF.aspx/5982-6547EEE.pdf>

##### **3-Year HP 24x7 4 hour Response, HP Collaborative Support**

Offers customers a single point of contact for server problem diagnosis, hardware problem resolution, and basic software problem diagnosis, fault isolation, and resolution if available to HP. If the problem is with HP HW, the representative will arrive on site any time and day of the year to begin hardware maintenance service within 4 hours of the service request being logged. In case, the issue is with HP or supported third-party software product and cannot be resolved by applying known fixes, HP will contact the third-party vendor and create a problem incident on your behalf.

##### **HP ProLiant Server Hardware Installation**

Provides for the basic hardware installation of HP branded servers, storage devices and networking options to assist you in bringing your new hardware into operation in a timely and professional manner.

<http://h20195.www2.hp.com/V2/GetPDF.aspx/5981-9356EN.pdf>

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### Service and Support

#### Related Services

Related HP Care Pack Services to enhance your HP product experience

#### 3-Year HP 24x7 4 hour Response, Proactive Care or Critical Advantage

Helps optimize your systems and delivers high levels of application availability through proactive service management and advanced technical response. A skilled Technical Manager will own your query or issue end to end until resolved, delivering a single point of contact for you.

<http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-2140ENW.pdf>

#### 3-Year HP 6-hour Onsite Call-to-Repair, HP Collaborative Support

Offers customers a single point of contact for server problem diagnosis, hardware problem resolution to return the hardware in operating condition within 6 hours of the initial service request to the HP Global Solution Center, and basic software problem diagnosis, fault isolation, and resolution if available to HP. In case, the issue is with HP or supported third-party software product and cannot be resolved by applying known fixes, HP will contact the third-party vendor and create a problem incident on your behalf.

#### HP Proactive Select Service

Provides a flexible way to purchase HP best-in-class consultancy and technical services. You can buy Proactive Select Service Credits when you purchase your hardware and then use the credits over the next 12 months.

<http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA2-3842ENN.pdf>

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#### Insight Remote Support

Provides 24 X 7 remote monitoring, proactive notifications, and problem resolution. Learn more

<http://www.hp.com/go/insightremotesupport>



### Related Options

#### Cabling Options

##### FDR Cables

HP 0.5M FDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	670759-B21
HP 1M FDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	670759-B22
HP 1.5M FDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	670759-B23
HP 2M FDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	670759-B24
HP 3M FDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	670759-B25
HP 3M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B21
HP 5M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B22
HP 7M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B23
HP 10M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B24
HP 12M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B25
HP 15M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B26
HP 20M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B27
HP 30M FDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	670760-B28

##### QDR Cables

HP 0.5M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B26
HP 1M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B21
HP 1.5M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B27
HP 2M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B22
HP 3M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B23
HP 5M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B24
HP 7M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Copper Cable	498385-B25
HP 3M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	498386-B23
HP 5M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	498386-B24
HP 10M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	498386-B25
HP 15M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	498386-B26
HP 20M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	498386-B27
HP 30M 4X DDR/QDR Quad Small Form Factor Pluggable InfiniBand Optical Cable	498386-B28

#### HP Ethernet Interconnect Modules

HP 6120XG Blade Switch	516733-B21
HP GbE2c Layer 2/3 Ethernet Blade Switch	438030-B21
HP 10GbE Ethernet Pass-Thru Module for c-Class BladeSystem	538113-B21



### Technical Specifications

<b>Compliance</b>	<b>Mezzanine:</b>	Dual-port QDR/FDR CX-3 HCA: PCI Express 3.0 ROHS-R6 Dual-port QDR CX-2 HCA: PCI Express 2.0
		ROHS-R5 Dual-port QDR QLogic HCA: PCI Express 2.0 ROHS-R6
<b>General Specifications</b>	<b>Switches:</b>	IBTA version 1.2 compatible ROHS-R6
	<b>Communications Processor</b>	<b>Mezzanine:</b> Dual-port FDR HCA: Mellanox ConnectX-3 Dual-port QDR HCA: Mellanox ConnectX-3 Dual-port QDR HCA: Mellanox ConnectX-2 QLogic QDR HCA: QLogic TrueScale
		<b>FDR switch:</b> Mellanox Switch X <b>QDR switch:</b> MT48436A1-FCC-Q, InfiniScale IV <b>QLogic QDR switch:</b> QLogic TrueScale
	<b>Dimensions (LxW)</b>	<b>G7 Mezzanine HCA:</b> HP type 1; 4.5 x 4.0 in <b>Gen 8 Mezzanine HCA:</b> HP Type A 3.5 x 3.9 in
<b>Power and Environmental Specifications</b>	<b>Operating Temperature</b>	<b>Mezzanine HCA:</b> 32° to 131° F (0° to 55° C)
		<b>Switch module:</b> 32° to 104° F (0° to 40° C)
	<b>Humidity (non-condensing)</b>	<b>Mezzanine HCA:</b> 5% to 85%
		<b>Switch module:</b> 5% to 85%
<b>Power requirement</b>	<b>Mezzanine HCAs:</b> Dual-port FDR CX-3 HCA: max 11.2 Dual-port QDR CX-3 HCA: max Dual-port QDR CX-2 HCA: max 11.4W QLogic QDR HCA: max 8.4W	
	<b>Switch blades:</b> FDR switch: 150W @ 12V QDR switch: 10.8A at 12V Max (130W) DDR Gen2 switch: 10 A at 12V max ( 120 W) QLogic QDR switch: 150W @ 12V QLogic Management Module: 1.5W @ 12V	
<b>Emissions Classifications</b>	<b>HCA and Switches:</b> FCC CFR 47 Part 15 Class A CISPR 22 Class A ICES-003 Class A VCCI Class A ACA CISPR 22 Class A	
	<b>Switches:</b> MIC Korea "EMC Registration Regulation" Class A	

### *Technical Specifications*

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