An HP Cluster Platform 3000 or 4000 with 128 compute nodes (HP ProLiant DL160 G6 or HP ProLiant DL165 G5 Servers) and an InfiniBand high-speed interconnect. The configuration consists of 3 compute building blocks (CBB) racks containing 114 compute nodes and Ethernet switches, and 1 utility building block (UBB) rack. The UBB contains 1 control node, 14 compute nodes, an InfiniBand switch, a TFT display, and the root Ethernet switches.

What's New
- Application node and control node options expanded according to latest HP ProLiant server offering.
- Includes new HP ProLiant BL460c G6, BL280c G6, DL380 G6 and DL160 G6 servers.
- InfiniBand QDR

At A Glance
- Comprehensive cluster offerings for high performance computing (HPC), integrating rackmount servers and blade servers, networks and rack infrastructure with choice of HPC software and services
- Modular framework supports configurations from 5 to 1024 nodes (larger configurations available through regional HPC Competency Centers). Two packaging options are offered: Dense packaging is available in configurations up to 128 nodes and is designed for lowest solution footprint and optimized cost infrastructure. The modular packaging is available in configurations up to 1024 nodes and is designed to facilitate easy scalability and possible future growth.
- HP Cluster Platform 3000 feature HP ProLiant servers utilizing dual and quad-core Intel Xeon 5200/5400/5500 series processors, and cluster interconnect choice of InfiniBand and Gigabit Ethernet.
- HP Cluster Platform 4000 feature HP ProLiant servers utilizing dual-core and quad-core AMD Opteron 2300 series processors, and cluster interconnect choice of InfiniBand and Gigabit Ethernet. In addition to dual socket node options (HP ProLiant DL165, HP ProLiant BL465c and HP ProLiant DL385 servers), the quad socket HP ProLiant DL585 is also offered.
- HP Cluster Platforms are also available with Integrity servers, featuring the Intel Itanium2 processor. See: http://www.hp.com/go/clusters for more information.
- Software options include operating systems (Linux or Windows), and cluster management software (HP CMU or Platform HPC for Insight Control Environment for Linux (ICE-LX), and, bundled with the OS, Microsoft HPC Server 2008), with optional in-factory installation. HP-MPI library is offered. Complementary HPC software products are offered by HP, tested and supported on HP Cluster Platforms by leading developers of cluster tools and applications. The HP ProLiant HPC Partner Software Suite offers...
Overview

extensive set of infrastructure software including: compilers and cluster development tools, Job Management, Grid Resource Management, and Storage Management solutions suited for both Linux and Windows environments.

- Clusters are assembled to worldwide design specifications developed, tested and supported by HP. Clusters are configured and tested within HP Integration centers prior to final integration occurs at customer site for tasks such as rack-to-rack cabling.
- HP Consulting and Integration services offered include: Start-up Services and Knowledge Transfer, Cluster Implementation Program Management, Quickstart Services, including applications migration, and On-site Training.

HP Cluster Platforms are available from HP Sales Representatives and HPC-Certified Resellers, utilizing Cluster Platform configurators and menus.

Basic Architecture Components: Nodes

- One control node is included per cluster. Choice of node is often based on capability to support external networks and/or attached storage. The control node can be optionally connected to the high-speed cluster interconnect.
- Up to 1024 compute, utility, and visualization nodes:
  - Compute (or application) nodes: nodes are primarily used for application computation, rather than administrative workloads. Each HP Cluster Platform is engineered to support up to two pools of different compute nodes within the same processor family (e.g., AMD Opteron). For example, one pool may have a set of nodes based on 2 processor HP ProLiant DL165 G5 servers, while another pool in same cluster will feature 8 processor (4 socket/dual core) HP ProLiant DL585 G5 Servers.
  - Utility nodes: used for any particular task including running applications. They can also provide I/O and file system access by adding a Fibre Channel host bus adapter to be connected to an MSA2000 subsystem or an external SAN. Two groups/pools of utility nodes can be defined for each cluster.
  - Visualization nodes are equipped with high performance 3D graphics adapters and are intended to run visualization applications. When not used for visualization, they can run any other compute application. The HP Cluster Platform has been extended to offer two pools of visualization nodes within the same processor family, to allow different configurations, for example, two different graphics adapters.

Basic Architecture Components: Networks

- One High-Performance Cluster Interconnect: A dedicated network to support inter-nodal application traffic (such as MPI communications) and file transfer can be selected. Cluster Interconnects offered are Gigabit Ethernet, InfiniBand, Myrinet, and Quadrics (not currently offered on HP Cluster Platform 3000). Microsoft HPC Server 2008 configurations support Gigabit Ethernet or InfiniBand.
- Administrative network: The administrative network facilitates administration and management of the cluster, such as management of the user's applications. A choice of Fast Ethernet or Gigabit Ethernet is offered. The Gigabit Ethernet admin network can also be used as alternate to having a dedicated high-performance interconnect, although not recommended for deployments anticipating volume of inter-nodal application traffic.
- One console network provides access to the node's console network, enabling use of node-specific command functions such as power on. Each compute node IPMI or iLO port is connected to the Fast Ethernet-based console network. Each c-Class enclosure OA port is connected to the Fast Ethernet-based console network. Visualization nodes based on HP personal workstations are not connected to the console network. The administrative and console networks can be connected, based upon user requirements.

Basic Architecture Components: Storage

- The HP Cluster Platform system can be attached to an external storage subsystem as a RAID array integrated into the cluster configuration or as a separate HP storage subsystem. The HP Modular Smart Array 2000 (MSA2000) is the option available for integration in the Cluster Platform. HP Smart Array Controllers along with MSA60 shelves can also be integrated in the cluster configuration.
- An HP Enterprise Virtual Array (EVA) can be connected to an HP Cluster Platform utility node or control node equipped with a Fiber Channel adapter.
Overview

- The HP Scalable File Share system can be connected to the HP Cluster Platform system via the high-speed interconnects. If selected, additional interconnect ports must be allocated to connect the HP Scalable File Share servers.

Basic Architecture Components: Infrastructure

- Rack: The HP Rack 10642 and 10622 are the only models used. All HP Cluster Platform components are factory integrated and shipped within the racks on shock pallets. Side panels and joiner kits are available, to be ordered based on computer room layout.
- Power: Two to four PDUs per rack of HP ProLiant DL servers, based on packaging selections. HP ProLiant BL based solutions may require up to eight PDUs in single phase configuration. Three phase power modules are also available for c-Class enclosures. All PDUs are high voltage (200-240 VAC) models for all countries, equipped with appropriate power plugs.
- A rack-mount keyboard/monitor (RKM) is supplied with each HP Cluster Platforms. This 1U RKM with TFT display is attached to the control node that is designated as the cluster system administration node. A TFT display provides local user access to the cluster. In systems with utility nodes, an 8-port KVM switch is also available to connect the RKM to multiple utility nodes (up to 7) to allow for failover connectivity to other nodes. Systems with HP personal workstation visualization nodes are also equipped with a KVM and necessary expander modules so all visualization nodes are connected to the RKM.
- Cable management kits specifically designed for HP Cluster Platforms are included.

Basic Architecture Components: Software

The following components are available on the HP Cluster Platform product menu, and can be factory installed by HP:

- Operating systems options
  - Linux: Red Hat Enterprise Linux subscriptions. HPC 8 packs subscriptions offered for Basic Server. SUSE SLES available per node, or in HPC 8 pack.
  - HPC 8 packs require purchase of at least one 10-incident Care Pack from HP Services, per cluster, unless systems are covered by broad HP Service agreement for Linux support.
  - Microsoft Windows HPC Server 2008
- Cluster management software options
  - HP Cluster Management Utility is a software suite of tools that will help you to manage a large collection of systems within a HPC cluster environment
  - HP-MPI is HP’s high-performance implementation of the Message-Passing Interface (MPI) Standard, and provides developers of technical applications with an API and software library to support parallel, message-passing applications that are efficient, portable and flexible. HP-MPI is available for either Linux or Windows based clusters
  - Platform HPC for ICE-LX enables deployment and administration of an HPC cluster with choice of open source components, fully supported by HP and Platform Computing. Platform HPC for ICE-LX is not offered factory integrated.
  - Microsoft Windows HPC Server 2008 combines the Windows OS, interfaces, utilities, and management infrastructure to support cluster deployment for HPC, in a Windows environment.

Summary Table of Cluster Platform Options
## Overview

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<td>HP ProLiant DL160 G6</td>
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<td>Gigabit Ethernet, InfiniBand</td>
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<td>HP ProLiant DL380 G6</td>
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<tr>
<td><strong>Cluster Platform 3000BL</strong></td>
<td>HP ProLiant BL280c G6</td>
<td>HP ProLiant BL280c G6</td>
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<td>HP ProLiant DL160 G6</td>
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<td><strong>Cluster Platform 4000</strong></td>
<td>HP ProLiant DL165 G5</td>
<td>HP ProLiant DL165 G5</td>
<td>HP ProLiant DL385 G5</td>
<td>HP xw9400</td>
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<td>HP ProLiant DL385 G5p</td>
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<td></td>
<td>HP ProLiant DL585 G5</td>
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<tr>
<td><strong>Cluster Platform 4000BL</strong></td>
<td>HP ProLiant BL465c G5</td>
<td>HP ProLiant BL465c G5</td>
<td>HP ProLiant BL465c G5</td>
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<td>HP ProLiant DL385 G5p</td>
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<td></td>
<td>HP ProLiant DL165 G5</td>
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</tbody>
</table>
Packaging for HP Cluster Platform 3000 and 4000—Dense Design

- One cabinet: up to 32 compute nodes with Myrinet, Gigabit Ethernet, InfiniBand and Quadrics Interconnects
- Two cabinets: up to 64 compute nodes
- Three cabinets: up to 96 compute nodes
- Four cabinets: up to 128 compute nodes

Maximums based on selecting 1U compute nodes and no utility nodes. Selection of larger nodes (e.g., HP ProLiant DL585 or HP ProLiant DL380) or MSA Storage option will reduce node count per cabinet.

Each dense cluster includes one Utility Building Block (UBB) cabinet, which houses the control node, RKM, and the optional high-performance interconnect switch, and utility nodes. Other cabinets are used to house the compute nodes. Compute nodes may be integrated into the UBB, as space permits, in dense configurations.

Total utility node count in dense configurations cannot exceed 7 nodes

Each cabinet includes two switches: one for administrative network, and one for console network.

Visualization nodes can be ordered with a dense or modular cluster, but the maximum number of nodes per cabinet will be reduced. The visualization nodes based on HP personal workstations will be placed in separate cabinets (VBB), as described below. HP ProLiant based visualization nodes will be placed in the compute building blocks (CBB). Node count limitation applies in that case.

Optional MSA2000 storage subsystem, with up to 3 expansion disk shelves. Optional MSA60 disk shelves attached to HP Smart Array P800 controllers.

Delivered on shock resistant pallet

Servers, Switches, RKM & storage are rack installed

Fully pre-wired and factory integrated

Packaging for HP Cluster Platform 3000 and 4000—Modular Design, HP Cluster Platform 3000BL and 4000BL

HP Cluster Platform modular solutions are organized in building blocks that can be easily replicated to build large-scale clusters.

- The compute building block (CBB) is a cabinet that contains, among other things, up to 38 2-socket 1U compute nodes, up to nine 4U compute nodes or up to four c-Class enclosures. One enclosure can house up to sixteen half-height blade nodes or up to eight full-height blade nodes.
- The utility building block (UBB) is the core cabinet of the cluster that contains the control node and its keyboard/monitor, additional utility nodes if required, cluster management root switches, one optional high-speed interconnect switch for solutions up to 128 nodes and optional MSA2000 or MSA60 raid arrays.
- The utility eXpansion rack (UXR) is an optional cabinet that can contain up to ten utility nodes when no more room is available in the UBB.
- The interconnect building block (IBB) is a cabinet that contains multiple interconnect switches for solutions that are larger than 128 nodes.
- The visualization building block (VBB) is a cabinet that contains up to 8 5U HP personal workstation visualization nodes.
- Smallest rackmount server configuration: one UBB cabinet and one CBB cabinet-up to 38 compute nodes
- Smallest blade server configuration: one UBB cabinet with up to 3 c-Class enclosures
- Maximum number of CBB: 35 for rackmount servers, 22 for blade servers
- Maximum number of UBB: 1
- Maximum number of UXR: 1
- Maximum number of IBB: 3 with Myrinet, 1 with Gigabit Ethernet, 4 with InfiniBand, 6 with Quadrics
Standard Features (HP Cluster Platform 3000 and 4000: Dense and Modular Design)

- Maximum number of VBB: 12

Each CBB and UBB includes two switches: one for administrative network, and one for console network. Console interfaces for the UXR and IBB are connected to the root switch housed in the UBB. VBB cabinets have one branch administration switch in every other cabinet and no console switch. One 24-port administration switch services up to 16 nodes in 2 VBB cabinets.

Each UBB, UXR and CBB includes three or four PDUs with rackmount servers. With blade servers, UBB and CBB include two PDUs are utilized in each IBB (three PDUs for Quadrics based IBB). The VBB uses a dual power monitoring PDU.

Delivered on shock resistant pallet

Servers, switches, RKM & storage are rack installed

Fully pre-wired and factory integrated

---

**HP Cluster Platforms 3000: Dense and Modular Design**

**Control Node (HP Cluster Platform 3000)** Select One Server

- HP ProLiant DL380 G6 Server (recommended for PCI slot availability)
- HP ProLiant DL160 G6 Server

**NOTE:** Complete information on the HP ProLiant Servers can be found in the following QuickSpecs:


**Choose Processor Option**

All currently shipping processors for each control node are available. Select one or two processors

**Memory Options**

HP ProLiant DL160 G6 is available with DDR3 memory. HP ProLiant DL380 G6 is available with DDR3 memory. Maximum memory will vary by server.

**DVD Drive Options**

DVD is required option for control nodes in HP Cluster Platforms

**Disk Options**

One disk minimum for control nodes. HP ProLiant DL380 G6 Server available with up to eight SATA or SAS small form factor drives, or up to six SATA or SAS Large Form Factor drives.. HP ProLiant DL160 G6 available with up to four NHP SATA, HP SATA or HP SAS drives.

**PCI - I/O Options**

Control nodes feature option to connect to the high-performance cluster interconnect. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. When InfiniBand interconnect selected, control node is configured with PCI-Express supported adapter

**Redundant Power Supply**

Recommended for control nodes

---

**Specify Node per Pool and Number of Nodes**

- HP ProLiant DL160 G6 Server

Configure servers as base for one or two compute pools. Total nodes cannot exceed 512 nodes.

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:


**Choose Processor Option**

All currently shipping processors for each compute node are available. Select one or two processors.

**Memory Options**

HP ProLiant DL160 G6 is available with DDR3 memory. Maximum memory is 144GB per node.

**DVD Drive Options**

Optional
| Disk Options | One to four NHP SATA, HP SATA or HP SAS Drives. HP (Hot Plug) Drives require low profile PCI adapter and an HDD. |
| PCI - I/O Options | When InfiniBand interconnect selected, compute nodes are configured with PCI-Express supported adapter. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. |
| Redundant Power Supply | Not offered for compute nodes |

**Utility Node**

| Select Node Configuration per Pool and Number of Nodes | HP ProLiant DL380 G6 server |
| Choose Processor Option | All currently shipping processors for the HP ProLiant DL380 G6 node are available. Select one or two processors. |
| Memory Options | HP ProLiant DL380 G6 is available with up to 144 GB DDR3 memory. |
| DVD Drive Options | DVD is optional |
| Disk Options | One disk minimum for utility nodes. HP ProLiant DL380 G6 Server available with up to eight SATA or SAS small form factor drives, or up to six SATA or SAS Large Form Factor drives. |
| PCI - I/O Options | When InfiniBand interconnect selected, compute nodes are configured with PCI-Express supported adapter. PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. |
| Redundant Power Supply | Optional |

**Visualization Node**

| Select Node Configuration per Pool and Number of Nodes | HP xw8400 Workstation or HP ProLiant DL160 G6 |
| Choose Processor Option | All currently shipping processors for the HP xw8400 or HP ProLiant DL160 G6 are available. Select one or two processors |
| Memory Options | HP xw8400 are available with up to 32 GB DDR2 FB-DIMM memory. HP ProLiant DL160 G6 are available with up to 144GB DDR3 memory. |
| DVD Drive Options | Required with the HP Workstation |
| Disk Options | One disk minimum. HP xw8400 available with up to 4 SAS drives or 5 SATA drives. HP ProLiant DL160 G6 available with up to four SAS or SATA drives. |
| PCI - I/O Options | Based on interconnect selected, visualization nodes are configured with supported adapter. PCI options include an additional Gigabit Ethernet interface. |
| Graphics | Supported PCI-Express 16X graphics adapters are NVIDIA FX1500, FX3500, FX4600 and FX5500. Only NVIDIA FX3700 is supported on HP ProLiant DL160 G6. |
| Redundant Power Supply | Not available. |

**HP Cluster Platforms 3000BL**

**Control Node (HP Cluster Platform 3000BL)**

| Select One Server | HP ProLiant DL380 G6 Server (recommended for PCI slot availability) HP ProLiant DL160c G6 Server HP ProLiant BL280c G6 |
## HP ProLiant BL2x220c G5

## HP ProLiant BL460c G6

**NOTE:** Complete information on the HP ProLiant Servers can be found in the following QuickSpecs:

### Choose Processor Option

All currently shipping processors for each control node are available. Select one or two processors.

### Memory Options

- HP ProLiant DL160 G6, HP ProLiant DL380 G6, HP ProLiant BL280c G6 and HP ProLiant BL460c G6 are available with DDR3 memory. HP ProLiant BL2x220c G5 is available with PC2-5300 memory. Maximum memory will vary by server.

### DVD Drive Options

DVD is required option for control nodes in HP Cluster Platforms.

### Disk Options

- One disk minimum for control nodes. HP ProLiant DL380 G6 Server available with up to eight HP SATA or SAS small form factor drives, or up to six SATA or SAS Large Form Factor drives. HP ProLiant DL160 G6 available with up to four NHP SATA, HP SATA or HP SAS drives. HP ProLiant BL280c G6 available with up to two NHP SATA or SAS drives. HP ProLiant BL2x220c G5 available with up to one NHP SATA drive per server. HP ProLiant BL460c G6 available with up to two HP SATA or SAS drives.

### PCI - I/O Options

Control nodes feature option to connect to the high-performance cluster interconnect. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. When InfiniBand interconnect selected, control node is configured with PCI-Express supported adapter.

### Redundant Power Supply

Recommended for control nodes.

---

## Compute Node

### Specify Node per Pool and Number of Nodes

- HP ProLiant BL280c G6
- HP ProLiant BL2x220c G5
- HP ProLiant BL460c G6

Configure servers as base for one or two compute pools. Total nodes cannot exceed 512 nodes.

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:

### Choose Processor Option

All currently shipping processors for each utility node are available. Select one or two processors, two or four per HP ProLiant BL2x220c G5 blade.

### Memory Options

- HP ProLiant BL280c G6 and HP ProLiant BL460c G6 are available with DDR3 memory. HP ProLiant BL2x220c G5 is available with PC2-5300 memory. Maximum memory will vary by server.

### DVD Drive Options

DVD is optional.

### Disk Options

- HP ProLiant BL280c G6 available with up to two NHP SATA or SAS drives. HP ProLiant BL2x220c G5 available with up to one NHP SATA drive per server. HP ProLiant BL460c G6 available with up to two HP SATA or HP SAS Small Form Factor drives.

### PCI - I/O Options

- When InfiniBand interconnect selected, compute nodes are configured with mezzanine supported adapter. PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface.
- Optional

### Redundant Power Supply

Not applicable.
### Utility Node

| Select Node Configuration per Pool and Number of Nodes | HP ProLiant DL380 G6 server | HP ProLiant BL460c G6 |

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:

### Choose Processor Option

All currently shipping processors for the HP ProLiant DL380 G6 node are available. Select one or two processors.

### Memory Options

HP ProLiant DL380 G6 is available with up to 144 GB DDR3 memory.

### DVD Drive Options

DVD is optional.

### Disk Options

One disk minimum for utility nodes. HP ProLiant DL380 G6 Server available with up to eight SATA or SAS small form factor drives, or up to six SATA or SAS Large Form Factor drives.

### PCI - I/O Options

When InfiniBand interconnect selected, compute nodes are configured with PCI-Express supported adapter. PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface.

### Redundant Power Supply

Optional

---

### HP Cluster Platforms 4000: Dense and Modular Design

#### Control Node (HP Cluster Platform 4000)

| Select One Server | HP ProLiant DL385 G5p Server (recommended for PCI slot availability) | HP ProLiant DL165 G5 Server, HP ProLiant DL585 G5 Server |

**NOTE:** Complete information on the HP ProLiant Servers can be found in the following QuickSpecs:

#### Choose Processor Option

All currently shipping processors for each control node are available. Select one or two processors (two or four with HP ProLiant DL585).

#### Memory Options

HP ProLiant DL165 G5 is available with up to 16GB PC2-6400 memory per processor and HP ProLiant DL385 G5p nodes is available with up to 64GB PC2-5300 or 32GB PC2-6400 memory per processor. HP ProLiant DL585 G5 is available with up to 128 GB PC2-6400 Registered DIMM memory.

#### DVD Drive Options

DVD is required option for control nodes in HP Cluster Platforms.

#### Disk Options

One disk minimum for control nodes. HP ProLiant DL385 G5p Server available with up to eight SAS or SATA drives, or up to six SATA or SAS Large Form Factor drives. HP ProLiant DL165 G5 available with up to four SATA (NHP or HP) or SAS HP drives. Hot Plug drives require low profile SAS PCI adapter and an HDD backplane when more than two drives are configured. HP ProLiant DL585 G5 Server available with up to eight SAS or SATA drives.

#### PCI - I/O Options

Control nodes feature option to connect to the high-performance cluster interconnect. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. When supported on selected control node, PCI-Express riser cards are optional with InfiniBand.

#### Redundant Power Supply

Recommended for control nodes

---

### Compute Node

| Specify Node per Pool and Number of Nodes | HP ProLiant DL585 G5 Server | HP ProLiant DL165 G5 Server |

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**QuickSpecs**

HP Cluster Platform 3000 and HP Cluster Platform 4000

Standard Features (HP Cluster Platform 3000 and 4000: Dense and Modular Design)
Configure servers as base for one or two compute pools. Total nodes cannot exceed 512 nodes.

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:

<table>
<thead>
<tr>
<th>Choose Processor Option</th>
<th>All currently shipping processors for each compute node are available. Select one or two processors (two or four with HP ProLiant DL585)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory Options</td>
<td>HP ProLiant DL585 G5 is available with up to 128GB PC2-6400 Registered DIMM memory. HP ProLiant DL165 G5 is available with up to 16GB PC2-6400 memory per processor</td>
</tr>
<tr>
<td>DVD Drive Options</td>
<td>Optional</td>
</tr>
<tr>
<td>Disk Options</td>
<td>HP ProLiant DL585 G5 Server available with up to eight SAS or SATA drives. HP ProLiant DL165 G5 available with up to four SATA (NHP or HP) or SAS drives. <strong>NOTE:</strong> HP (Hot Plug) options on HP ProLiant DL165 G5 requires low profile PCI adapter. HDD backplane required when more than two drives are configured on this server.</td>
</tr>
<tr>
<td>PCI - I/O Options</td>
<td>When non Gigabit Ethernet interconnect selected, compute nodes are configured with supported adapter. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. When supported on selected control node, PCI-Express riser cards are optional with InfiniBand</td>
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<td>Choose Processor Option</td>
<td>All currently shipping processors for HP ProLiant DL385 G5p Servers are available. Select one or two processors.</td>
</tr>
<tr>
<td>Memory Options</td>
<td>HP ProLiant DL385 G5p is available with up to 64GB PC2-5300 or 32GB PC2-6400 memory per processor.</td>
</tr>
<tr>
<td>DVD Drive Options</td>
<td>DVD is optional.</td>
</tr>
<tr>
<td>Disk Options</td>
<td>HP ProLiant DL385 G5p Server available with up to eight SAS or SATA drives, or up to six SATA or SAS Large Form Factor drives.</td>
</tr>
<tr>
<td>PCI - I/O Options</td>
<td>When non Gigabit Ethernet interconnect selected, compute nodes are configured with supported adapter (PCI-Express card for InfiniBand solutions). PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface.</td>
</tr>
<tr>
<td>Redundant Power Supply</td>
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**Visualization Node**

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<th>Select Node Configuration per Pool and Number of Nodes</th>
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<tr>
<td>Choose Processor Option</td>
<td>All currently shipping processors for the HP xw9400 node are available. Select one or two processors</td>
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<tr>
<td>Memory Options</td>
<td>HP xw9400 are available with up to 64 GB DDR memory.</td>
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<tr>
<td>DVD Drive Options</td>
<td>Required</td>
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</table>

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:
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<th><strong>QuickSpecs</strong></th>
<th><strong>HP Cluster Platform 3000 and HP Cluster Platform 4000</strong></th>
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<tbody>
<tr>
<td><strong>Standard Features (HP Cluster Platform 3000 and 4000: Dense and Modular Design)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Disk Options</strong></td>
<td>One disk minimum. Available with up to 4 SAS drives or 5 SATA drives.</td>
</tr>
<tr>
<td><strong>PCI - I/O Options</strong></td>
<td>Based on interconnect selected, visualization nodes are configured with supported adapter. PCI options include an additional Gigabit Ethernet interface.</td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
<td>Supported PCI-Express 16X graphics adapters are NVIDIA FX3500, FX4600 and FX5500, up to 2 per node. NVIDIA G-sync card is an available option with the FX5500 adapter.</td>
</tr>
<tr>
<td><strong>Redundant Power Supply</strong></td>
<td>Not available.</td>
</tr>
</tbody>
</table>

| **HP Cluster Platforms 4000BL** | |
| **Control Node (HP Cluster Platform 4000BL)** | **Select One Server** |
| HP ProLiant DL385 G5p Server (recommended for PCI slot availability) |
| HP ProLiant DL165 G5 Server |
| HP ProLiant BL465c G5 |
| **NOTE:** Complete information on the HP ProLiant Servers can be found in the following QuickSpecs: http://h18000.www1.hp.com/products/quickspecs/division/12534.html |
| **Choose Processor Option** | All currently shipping processors for each control node are available. Select one or two processors. |
| **Memory Options** | HP ProLiant DL165 G5, HP ProLiant DL385 G5p, HP ProLiant BL465c G5 are available with PC2-5300 or PC2-6400 memory. Maximum memory will vary by server. |
| **DVD Drive Options** | DVD is required option for ProLiant DL control nodes. If the control node is a ProLiant BL465c G5, there is no DVD drive option available. The control node is intended to be used with the virtual media feature included in the Integrated Lights-Out 2 Standard Blade Edition (comes with the server blade). |
| **Disk Options** | One disk minimum for control nodes. HP ProLiant DL385 G5p Server available with up to eight SATA or SAS Small Form Factor drives, or up to six SATA or SAS Large Form Factor drives. HP ProLiant DL165 G5 available with up to four NHP SATA, HP SATA or HP SAS drives. HP ProLiant BL465c G5 available with up to two HP SATA or HP SAS Small Form Factor drives. |
| **PCI - I/O Options** | Control nodes feature option to connect to the high-performance cluster interconnect. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface. When InfiniBand interconnect selected and control node connection to the interconnect selected, control node is configured with PCI-Express or Mezzanine card supported adapter. |
| **Redundant Power Supply** | Recommended for control nodes when available |
## Standard Features (HP Cluster Platform 3000 and 4000: Dense and Modular Design)

### Compute Node

<table>
<thead>
<tr>
<th>Specify Node per Pool and Number of Nodes</th>
<th>HP ProLiant BL465c G5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configure servers as base for one or two compute pools. Total nodes cannot exceed 512 nodes.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:


### Choose Processor Option

All currently shipping processors for each compute node are available. Select one or two processors.

### Memory Options

HP ProLiant BL465c G5 is available with PC2-6400 memory. Maximum memory is 16GB per processor.

### DVD Drive Options

Not offered

### Disk Options

HP ProLiant BL465c G5 available with up to two HP SATA or HP SAS Small Form Factor drives.

### PCI - I/O Options

When InfiniBand interconnect selected, compute nodes are configured with mezzanine supported adapter. Other PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface.

### Redundant Power Supply

Not applicable

### Utility Node

<table>
<thead>
<tr>
<th>Select Node Configuration per Pool and Number of Nodes</th>
<th>HP ProLiant DL385 G5p server</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP ProLiant DL585 G5 server</td>
<td>HP ProLiant BL465c G5</td>
</tr>
</tbody>
</table>

**NOTE:** Complete information on the servers can be found in the following QuickSpecs:


### Choose Processor Option

All currently shipping processors for each utility node are available. Select one or two processors (two or four processors with DL585 G5).

### Memory Options

HP ProLiant DL385 G5p, HP ProLiant DL585 G5 and HP ProLiant BL465c G5 are available with PC2-5300 or PC2-6400 memory. Maximum memory will vary by server.

### DVD Drive Options

DVD is optional.

### Disk Options

One disk minimum for utility nodes. HP ProLiant DL385 G5p Server available with up to eight SATA or SAS small form factor drives, or up to six SATA or SAS Large Form Factor drives. HP ProLiant DL585 G5 Server available with up to eight SATA or SAS small form factor drives. HP ProLiant BL465c G5 available with up to two HP SATA or HP SAS Small Form Factor drives.

### PCI - I/O Options

When InfiniBand interconnect selected, compute nodes are configured with mezzanine supported adapter. PCI options include Fibre Channel HBA, and additional Gigabit Ethernet interface.

### Redundant Power Supply

Optional
High Speed Interconnects (up to one interconnect fabric per Cluster Platform)

InfiniBand DDR and QDR

Numerous InfiniBand implementations are supported and can be selected based on the bandwidth requirements of the cluster. Typical clusters use half bandwidth since this satisfies the bandwidth requirements of most clusters. Some clusters select the higher full bandwidth. Half Bandwidth (2:1) topology relies on twelve uplinks for every twenty four node connections while the Full Bandwidth (1:1) utilizes eighteen uplinks for every eighteen node connections, avoiding bottlenecks.

Two switch models are offered for InfiniBand QDR cluster interconnect.

- The InfiniBand 36-port switch can be used as a standalone switch for configurations up to 36 nodes or as root and node-level switch in tree topologies with configurations up to 128 nodes. This is an internally managed switch. The HP 4X QDR IB Switch Module for HP BladeSystem c-Class, a double wide switch module for the c-Class enclosure. The HP 4X QDR IB Switch Module for HP BladeSystem c-Class provides 32 InfiniBand 4X QDR ports with 40 Gbps port-to-port connectivity. The ports are arranged as 16 downlinks to connect up to 16 blade servers in the enclosure, and 16 uplinks to connect to the external InfiniBand switches to build an InfiniBand fabric.

Four switch sizes are offered for InfiniBand DDR cluster interconnect.

- The InfiniBand 288-port switch can be used as a standalone switch for configurations up to 288 nodes, in pair for configurations up to 384 nodes or as root switch in tree topologies with configurations up to 512 nodes. It must be equipped with two management boards, two or four fabric boards, up to twelve 24-port line boards and power supply modules in N+1 configuration.
- The InfiniBand 96-port switch can be used as a standalone switch for configurations up to 96 nodes.
- The InfiniBand 36-port switch can be used as a standalone switch for configurations up to 36 nodes or as root and node-level switch in tree topologies with configurations up to 128 nodes. This is an internally managed switch. The HP 4X DDR IB Switch Module for HP BladeSystem c-Class, a double wide switch module for the c-Class enclosure. The HP 4X DDR IB Switch Module for HP BladeSystem c-Class provides 24 InfiniBand 4X DDR ports with 20 Gbps port-to-port connectivity. The ports are arranged as 16 downlinks to connect up to 16 blade servers in the enclosure, and 8 uplinks to connect to the external InfiniBand switches to build an InfiniBand fabric.
- The HP 4X DDR IB Gen 2 Switch Module for HP BladeSystem c-Class, a double wide switch module for the c-Class enclosure. The HP 4X DDR IB Switch Module for HP BladeSystem c-Class provides 32 InfiniBand 4X DDR ports with 20 Gbps port-to-port connectivity. The ports are arranged as 16 downlinks to connect up to 16 blade servers in the enclosure, and 16 uplinks to connect to the external InfiniBand switches to build an InfiniBand fabric.
Gigabit Ethernet

The HP 2824 switch is only used as a standalone switch for small configurations up to 20 nodes (non-blocking).

The HP 3500-24G switch can be used as a standalone switch for small configurations up to 24 nodes (non-blocking).

The HP 2848 switch can be used as a standalone switch for configurations up to 40 nodes (non-blocking up to 40 ports), in pair (one) for configurations up to 64 nodes (8 links between switches), or as root switch or node level switch in tree topologies (8 uplinks/32 node ports or 4 uplinks/40 node ports).

The HP 3500-48G switch can be used as a standalone switch for small configurations up to 48 nodes (non-blocking).

The HP 5406zl switch can be used as a standalone switch for configurations up to 144 nodes (six 24-port 1000T modules) or as root switch with 4-port 10GigE modules in tree topologies for configurations up to 512 nodes (11 node level HP 3500-48G switches attached by 2 10GigE uplinks each).

The HP 5412zl switch can be used as a standalone switch for configurations up to 288 nodes or combined with another one for configurations up to 512 nodes (one 4-port 10GigE module in each switch to aggregate switches).

Administrative and Console Network

The HP Switch 2610-24, 2610-48, 2848 and 2824 are used to build the internal administrative and console networks for the HP Cluster Platforms. These two networks are independent and organized in a tree topology with root switches and branch switches. The two root switches can be connected together based upon software or the end-user’s requirements.

The console network is built only with either the HP 2610-24 or the 2610-48 Fast Ethernet models, while the administrative network can use the HP 2848 or 2824 models. Multiple uplinks between branch and root switches can be aggregated by trunking. The Gigabit administrative network is configured with 2 uplinks.

Each c-Class enclosure is equipped with an HP GbE2c Ethernet Blade Switch for c-Class BladeSystem (GbE2c).

HP 2610-48 Switch
- 48 10/100 ports
- 2 Gigabit link ports
- 10/100 auto-sensing per port automatically detects and sets the speed
- A comprehensive LED display with per-port indicators provides an at-a-glance view of status, activity, and speed
- Special 10000 rack-mounting kit to allow integration into rack for shipment

HP 2610-24 Switch
- 24 10/100 ports
- 2 Gigabit link ports
- 10/100 auto-sensing per port automatically detects and sets the speed
- A comprehensive LED display with per-port indicators provides an at-a-glance view of status, activity, and speed
- Special 10000 rack-mounting kit to allow integration into rack for shipment
QuickSpecs

HP Cluster Platform 3000 and HP Cluster Platform 4000

Standard Features (HP Cluster Platform 3000 and 4000: Dense and Modular packaging)

**HP 2848 Switch**
- 44 10/100/1000 ports
- 4 dual-personality ports—each port can be used as either an RJ-45 10/100/1000 port or an open mini-GBIC slot
- A comprehensive LED display with per-port indicators provides an at-a-glance view of status, activity, and speed
- Special 10000 rack-mounting kit to allow integration into rack for shipment

**HP 2824 Switch**
- 20 10/100/1000 ports
- 4 dual-personality ports—each port can be used as either an RJ-45 10/100/1000 port or an open mini-GBIC slot

**HP GbE2c Ethernet Blade Switch for c-Class BladeSystem**
- Full set of industry standard Gigabit Ethernet Layer 2 features
- Sixteen internal downlinks and five uplinks and two internal cross-connects
- Wire speed switching on all sixteen 1Gb server ports
- Wire speed switching on all five 10/100/1000T uplink ports

**Rack Infrastructure**

**Keyboard and Monitor**
A rackmount keyboard/monitor (RKM) is required with the HP Cluster Platforms. This 1U RKM with TFT display is attached to the control node that is designated as the cluster system administration node. The TFT display is mounted in the utility rack (UBB) and provides local user access to the cluster. In systems with utility nodes, an 8-port KVM switch is also available to connect the RKM to multiple utility nodes (up to 7) to allow for failover connectivity to other nodes. Systems with visualization nodes are also equipped with a KVM and necessary expander modules so all visualization nodes are connected to the RKM.

**Racks**

**Rack 10000 series Cabinets**
The increasing power of new high-performance processor technology requires increased cooling efficiency for rack-mounted servers. The 10000 Series Racks provide enhanced airflow for maximum cooling, allowing these racks to be fully loaded with servers using the latest processors.

**Power**
HP Cluster Platform CBB, UBB, and UXR cabinets are equipped with three or four power distribution units while the IBB cabinet is equipped with two. These 1U units are installed front to back. They are all high voltage (200–240 VAC) models for all countries, equipped with appropriate power plugs:

- North America, Japan 24A (200–240 VAC): attached input cord NEMA L6-30P
- Optionally, North America, Japan 40A (200–240 VAC): attached input cord: Non-NEMA Locking CS8265C, 50A
- EMEA 32A (200–240 VAC): attached input cord IEC 309-32A

HP Cluster Platform 3000BL and 4000BL CBB are equipped with up to eight power distribution units. These 1U units are installed front to back. They are all high voltage (200–240 VAC) models for all countries, equipped with appropriate power plugs:

- North America, Japan 40A (200–240 VAC): attached input cord: Non-NEMA Locking CS8265C, 50A
- EMEA 40A (200–240 VAC): attached input cord IEC 309-60A

HP Cluster Platform VBB cabinets are equipped with one dual power monitoring power distribution unit that mounts on the cabinet rail. These PDUs are high voltage (200–240 VAC) models for all countries, equipped with appropriate power plugs:

- North America, Japan dual 40A (200–240 VAC): attached input cords non-NEMA, locking, CS8265, 50 A
- EMEA dual 32A (200-240 VAC): attached input cords IEC 60309, 32A 3-pin
QuickSpecs

HP Cluster Platform 3000 and HP Cluster Platform 4000

Standard Features (HP Cluster Platform 3000 and 4000: Dense and Modular packaging)

**Documentation**
HP Cluster Platform systems include one hardware documentation kit. Each hardware documentation kit contains both a CD and a hard copy of:

- HP Cluster Platform Installation and Operation Guide
- HP Cluster Platform Overview and Site Preparation Guide

The CD contains a soft copy of the same guides and Installation and User Guides of the various components integrated in the HP Cluster Platform system.

**Storage**

**MSA2000**
- The HP Modular Smart Array 2000 (MSA2000) is a 2 Gb Fibre Channel storage system designed for the entry-level to mid-range Storage Area Network (SAN). The MSA2000 is a scalable, high performance storage system. With the addition of expansion disk enclosures, the maximum storage capacity is 48TB, when connected to the control node integrated in the UBB. Control node and utility nodes can be attached to a SAN, depending on the end-user's requirements and required system I/O bandwidth. Select one Fibre Channel host bus adapter for each designated node.

**MSA60**
- Direct attached storage subsystems can be configured with HP MSA60 shelves connected to Smart Array P800 controllers integrated in the control node. Up to eight MSA60 can be directly attached to one or two controllers and integrated in the UBB. This gives a maximum of 96 disk drives for a total of 72TB with 750GB SATA drives.

**Software**

**OS Support**

**Linux**
- Red Hat EL (RHEL) (1 year and 3 year subscriptions)
  - Standalone server
  - HPC 8 pack for RH EL Basic Server
- SUSE SLES(1 year and 3 year subscriptions)
  - Standalone server
  - HPC 8 packs: 1-8 processor nodes
- HPC 8 packs for Red Hat and SUSE support up to 8 compute nodes per 8 pack.

**HPC 8 pack ordering information**

1. Order one base kit for the 1st eight compute nodes: A standalone server subscription is recommended for control node (for SUSE SLES, the base kit includes the subscription for the control node in addition to the first eight subscriptions for compute nodes. A standalone subscription is not necessary for the control node).
2. Order add-on kits to cover remaining compute nodes(1 kit per 8 nodes in case of SUSE SLES, one kit per node in case of RHEL)
3. 8 packs require purchase of HPS 10 incident care pack (one per cluster - E for electronic only)

**Windows**

Microsoft Windows HPC Server 2008
Cluster Management

The HP Cluster Management Utility is designed to manage a large number of compute nodes with a Single System View GUI (Graphics User Interface). HP CMU comes with a full Java GUI that can be tailored for your needs and for any number of nodes in the cluster. HP CMU is HP SIM (System Integration Manager) level 1 integration compliant. HP CMU provides a Command Line Interface (CLI) for day-to-day administration and cloning. Through its user friendly graphical interface HP CMU provides the cluster administrator with three main features:

- **Administration**: From HP CMU you can administrate your cluster (e.g., halt, boot, reboot, power off, broadcast commands from a single keyboard session)
- **Cloning**: For the first installation or for future updates, the cluster administrator has the capability to propagate a system configuration image to all or a part of the compute nodes in the cluster
- **Monitoring**: At a glance the manager can see the complete behavior of the cluster without painfully analyze the performance of the individual compute nodes.

In a CMU cluster configuration, all the compute nodes must be licensed. Every management node just needs a base license that includes HP CMU distribution and documentation. HP CMU software supports HP ProLiant Intel and AMD Opteron servers running Linux.

**NOTE**: Complete information on HP CMU software, including QuickSpecs, can be found at the following URL: [www.hp.com/go/cmu](http://www.hp.com/go/cmu)

Platform HPC for Insight Control Environment for Linux (ICE-LX)

Platform HPC enables easy and rapid deployment and administration of an HPC cluster with choice of popular open source components, fully supported by HP and Platform Computing. The combination of Platform HPC and ICE-LX builds on the market-proven ProLiant system management technology developed by HP for scalable monitoring and provisioning of its servers, and adds features and options required to deploy a fully functional HPC cluster, including resource management, MPI and interconnect network drivers. Platform HPC includes the packages and kitting capability utilized by Platform in its Open Cluster Stack (OCS) product.

**NOTE**: Ordering information on HP ICE-LX can be found in the QuickSpecs for the product at the following URL: [http://h18004.www1.hp.com/products/quickspecs/13193_div/13193_div.html](http://h18004.www1.hp.com/products/quickspecs/13193_div/13193_div.html)

Note that ICE-LX is a pre-requisite for use of Platform HPC for ICE-Linux.

HP-MPI

A high-performance implementation of the Message-Passing Interface (MPI) Standard that provides developers of technical applications with an API and software library to support parallel, message-passing applications that are efficient, portable and flexible. HP-MPI complies with the MPI-1.2 and MPI-2 standards and is a high performance, robust, high quality, native implementation. HP-MPI enhancements provide optimized point-to-point and collective communication routines. (Note: HP-MPI is also included with XC Software, so no separate purchase requirement if XC selected)
Service and Support

HP Cluster Platform solutions warranties and service options are based on the offerings of the underlying components.

HP customer support provides onsite hardware break/fix support and remote, remedial software call-center support. Customer support offsite software services include level 1 and 2 support:

- Level 1 is defined as everyday user/system administration issues.
- Level 2 is defined as problems related to installation and configuration, along with other problems not solvable by following the vendor-supplied documentation.

The HP software support team will work in parallel with the appropriate vendor and development groups to address level 3 and 4 support elevations:

- Level 3 elevations typically require that patches and modifications be generated by the vendor to resolve deficiencies in the product.
- Level 4 elevations deal with enhancements in the functionality of the product that will typically be included in future releases.

Optional customer services

HP has experience servicing systems, networks, storage devices, and software for HPC deployments and environments of all sizes. A wide range of purchasing options and solutions built from standards-based service modules ensure the service coverage and the level of expert assistance desired.

Optional services may be purchased at the time of the product purchase as HP Care Pack services, easy to order and easy to use service packages. Optional services may also be purchased at a later point of time as HP Contractual or Per-Event Services to extend and/or expand and/or complement the standard product warranty.

Hardware Support: Service capabilities include total lifecycle support, preventive and diagnostic services, access to a global service network, and support for an array of third-party peripherals.

Hardware Support Services offer a full range of high-quality remote and onsite hardware support options to meet specific response or repair-time objectives. These support options range from next-day or 4-hour onsite response to 6-hour call-to-repair time commitments. To accommodate specific hours of operations, coverage window options range from standard business hours (9x5), Monday-Friday 8am-5pm local time up to 24x7.

Software Support: Standard software support includes 9x5 telephone support and rights to new versions for the specified period of time (one year or three years). 24x7 software support extends the telephone support window to round-the-clock access. Standard software support includes customer access to technical resources during standard hours (see later), problem analysis, escalation management, and resolution. HP also provides unlimited access to an electronic facility that includes a knowledge database with known symptoms and solutions, software product descriptions, specifications, and technical literature.

Software support contracts can be obtained to meet the needs of customers, including remedial technical remote support along with migration and upgrade planning and a full suite of proactive deliverables.

NOTE: For more complete information on HP Services offerings, customers and resellers, please visit us at: http://www.hp.com/hps

NOTE: Additional information regarding worldwide limited warranty and technical support is available at: http://h18004.www1.hp.com/products/servers/platforms/warranty/index.html
IMPORTANT: The HP Cluster Platforms are customized by HP and resellers using the Configure-To-Order process to receive a complete factory integrated cluster with options delivered in a single package. The Purchase Order must list each part number individually. The steps below describe the Factory Integration services provided during assembly and delivery of HP Cluster Platforms.

**Step 1: Determine Hardware Factory Integration services**

Factory Integration for HP Cluster Platforms.

Factory integration of all hardware components conforming to HP Cluster Platform configuration rules. This includes all cables routing and test of these components at hardware level. Factory integration requires hardware installation services, per solution, per cabinet and per node (if no software load required). An additional charge per node is required if software installation is selected (Step 2).

A Base Hardware Integration service is required per cabinet. Select one Custom Placement and one Rack Signal Cable Interconnect services for every cabinet in the solution.

- HP Custom Placement within Rack Service
- HP Rack Signal Cable Interconnect Svc

A Base Hardware Integration service is required per solution. Select one Modular or High Density base hardware integration

- HP HW Integration SVC - Modular Cluster Platforms
- HP Cluster Platforms High Density Base HW Integration Service
- HP Cluster Platforms Node HW Integration Service

**Step 2: Determine Software Factory Installation Services**

HPTC Cluster Platform Software Installation Service - predetermined schedule of charges based on total node count. If factory software installation is required, order appropriate service based on total number of nodes. For more than 257 nodes, contact HP for a quotation. These services replace the AC069A node hardware integration service from Step 1 above.

- HP Cluster Platform Factory Software Service (4-8 nodes)
- HP Cluster Platform Factory Software Service (9-17 nodes)
- HP Cluster Platform Factory Software Service (18-33 nodes)
- HP Cluster Platform Factory Software Service (34-65 nodes)
- HP Cluster Platform Factory Software Service (66-129 nodes)
- HP Cluster Platform Factory Software Service (130-257 nodes)

For a solution containing visualization nodes, Custom Integration Services must be ordered in addition to the above Factory Software Service.

- HP Factory Express Standard ISS Custom Service
- HP Factory Express Complex ISS Custom Service
Step 3: Add on-site Field Installation

Field installation of the cluster, ie unpacking, assembling, cabling, power up and quick check (if software is factory loaded) - Highly recommended. The following part numbers cover both, factory integration and on-site installation services. Therefore the Factory Express part numbers listed in Step 1 (HA864A1 and HA865A1) are not necessary when these Step 3 part numbers are ordered. AC067A, AC068A and AC069A part numbers listed at Step 1 remain necessary for Cluster Platform integration and test. Part numbers listed at Step 2 also remain necessary for Software installation.

A Factory Express Level 3 Integration Service is required on a per rack basis

<table>
<thead>
<tr>
<th>HA453A1-000</th>
</tr>
</thead>
</table>

A Factory Express Level 3 Integration Service is required on a per component basis:

For 1U, 2U and 4U nodes (DL160 G5, DL165 G5, DL380 G5, DL385 G5, DL585 G5)

<table>
<thead>
<tr>
<th>HA453A1-001</th>
</tr>
</thead>
</table>

For c-Class enclosures. One per enclosure.

<table>
<thead>
<tr>
<th>HA453A1-003</th>
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</thead>
</table>

For storage and networking, MSA60, modular switches

<table>
<thead>
<tr>
<th>HA453A1-021</th>
</tr>
</thead>
</table>

For storage, MSA1500 based

<table>
<thead>
<tr>
<th>HA453A1-022</th>
</tr>
</thead>
</table>

Consulting and Integration Services

C& I options include on-site systems software support and applications development and optimization, as well as clusters training. This is in addition to options for Factory and Field On-site installation (see above). Based on compute node counts.

Start Up Services - On-site Introduction to Cluster Platform 3000/4000 Recommended for each cluster deployment. Required for platforms with HP installed cluster software (e.g., XC System Software).

- up to 16 nodes - HPC Clusters—one day on-site systems software knowledge transfer and five hours of customer integration management
- U5628A#001

- up to 32 nodes - HPC Clusters—two days on-site systems software knowledge transfer and six hours of customer integration management
- U5628A#002

- up to 64 nodes - HPC Clusters—three days on-site systems software knowledge transfer and six hours of customer integration management
- U5628A#003

- up to 128 nodes - HPC Clusters—five days on-site systems software knowledge transfer and six hours of customer integration management
- U5628A#004

- up to 256 nodes - HPC Clusters—ten days on-site systems software knowledge transfer and twelve hours of customer integration management
- U5628A#005

Greater than 256 nodes: Custom quote

Recommended Services - (For clusters up to 32 nodes)

- HPC Cluster Implementation Program Management - 40 hours implementation management consulting
- U5617A

- HPC Cluster systems software QuickStart - 5 days on site consulting and six hours management coordination
- U5618A

- HPC Cluster Applications Migration, Development, and Optimization QuickStart - 5 days on site consulting six hours mgt coordination
- U5619A

- HPC Applications Programming and Migration - 2 days on-site formal customer training
- U5626A

- HPC Cluster Systems Administration Course - 4 days on-site formal customer training
- U5627A

Recommended Services - (For clusters from 33 nodes up to 128 nodes)

- HPC Implementation Program Management - 80 hours implementation management consulting
- U5620A

- HPC Cluster Systems QuickStart - 10 days on site consulting and twelve hours management coordination
- U5621A
<table>
<thead>
<tr>
<th>Service</th>
<th>Duration</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPC Cluster Applications Migration, Development, and Optimization QuickStart</td>
<td>10 days on site consulting and 20H mgt coordination</td>
<td>U5622A</td>
</tr>
<tr>
<td>HPC Applications Programming and Migration</td>
<td>2 days on-site formal customer training</td>
<td>U5626A</td>
</tr>
<tr>
<td>HPC Cluster Systems Administration Course</td>
<td>4 days on-site formal customer training</td>
<td>U5627A</td>
</tr>
<tr>
<td><strong>Recommended Services</strong> - (For clusters from 129 nodes up to 256 nodes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPIC Implementation Program Management</td>
<td>120 hours implementation management consulting</td>
<td>U5623A</td>
</tr>
<tr>
<td>HPIC Cluster Systems QuickStart</td>
<td>15 days on site consulting and sixteen hours management coordination</td>
<td>U5624A</td>
</tr>
<tr>
<td>HPIC Cluster Applications Migration, Development, and Optimization QuickStart</td>
<td>15 days on site consulting and 16H mgt coordination</td>
<td>U5625A</td>
</tr>
<tr>
<td>HPIC Applications Programming and Migration</td>
<td></td>
<td>U5626A</td>
</tr>
<tr>
<td>HPIC Cluster Systems Administration Course</td>
<td></td>
<td>U5627A</td>
</tr>
<tr>
<td><strong>Recommended Services</strong> - For clusters above 256 nodes, customized service plan is recommended</td>
<td></td>
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</tr>
</tbody>
</table>
### Software

#### OS Support

**Linux**
- Red Hat Enterprise Linux 8-Pack 2S 1year License: 443934-B21
- Red Hat Enterprise Linux 8-Pack 2S 3year License: 443935-B21
- Red Hat Enterprise Linux Single Node 2S 1year License: 443938-B21
- Red Hat Enterprise Linux Single Node 2S 3year License: 443939-B21
- Red Hat Enterprise Linux 8-Pack 4S 1year License: 443936-B21
- Red Hat Enterprise Linux 8-Pack 4S 3year License: 443937-B21
- Red Hat Enterprise Linux Single Node 4S 1year License: 443940-B21
- Red Hat Enterprise Linux Single Node 4S 3year License: 443941-B21
- SLES 10 1year HPC Base Universal 8 Pack: 431123-B21
- SLES 10 1year HPC Add-on Universal 8 Pack: 431127-B21
- SLES 10 1year HPC Base Universal 8 Pack: 431128-B21
- SLES 10 3year HPC Add-on Universal 8 Pack: 431129-B21

**Microsoft Windows Compute Cluster Server 2003**
- MS W2008 HPC Svr Npi FIO Eng SW: 504103-B21

*NOTE:* For more complete and up-to-date information on how to buy server operating systems from HP please visit the OS product site at: [http://h18004.www1.hp.com/products/servers/software/OEM.html](http://h18004.www1.hp.com/products/servers/software/OEM.html)

### Cluster Management

**HP CMU**
- HP Cluster Management Utility License and Media: 433257-B21
- HP Cluster Management Utility Compute Node License: 433258-B21

**HP-MPI**
- HP MPI/MLIB for Linux Media Kit: 433039-B21
- HP MPI for Linux for 4 Cores LTU: 433028-B21
- HP MPI for Linux for 32 Cores LTU: 433031-B21
- HP MPI for Linux for 256 Cores LTU: 433034-B21

*NOTE:* HP MPI is also included with XC Software, so no separate purchase requirement if XC selected.

- HP MPI for Windows Media Kit: 433051-B21
- HP MPI for Windows 4 Cores LTU: 433040-B21
- HP MPI for Windows 16 Cores LTU: 433042-B21
- HP MPI for Windows 128 Cores LTU: 433045-B21

*NOTE:* Above is a list of supported licenses. Some may be discontinued.
### Service and Support Offerings

(HP Care Pack Services)

<table>
<thead>
<tr>
<th>Offering Description</th>
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<td>HP 1 year 9x5 10 incidents SuSE IA32 Software Technical Support</td>
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</tr>
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</tr>
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<tr>
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<td>UF094E</td>
</tr>
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<td>UF095E</td>
</tr>
<tr>
<td>HP 3 year 24x7 Message-Passing Interface 4 Cores Software Support</td>
<td>UF096E</td>
</tr>
<tr>
<td>HP 1 year 9x5 Message-Passing Interface 32 Cores Software Support</td>
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<td>HP 3 year 24x7 Message-Passing Interface 32 Cores Software Support</td>
<td>UF104E</td>
</tr>
<tr>
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<td>HP 1 year 9x5 Message-Passing Interface 16 Cores Software Support</td>
<td>UF097E</td>
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<tr>
<td>HP 1 year 24x7 Message-Passing Interface 16 Cores Software Support</td>
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<td>HP 1 year 24x7 Message-Passing Interface 128 Cores Software Support</td>
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<tr>
<td>HP 3 year 24x7 Message-Passing Interface 128 Cores Software Support</td>
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</tr>
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</table>
The following section contains information on components used in HP Cluster Platforms from our partner suppliers, and HP Cluster Platform Building Block Racks. Please refer to product-specific QuickSpecs for information on HP products offered in the Cluster Platform.

### InfiniBand high-speed interconnect

**Voltaire Grid Director 403636-port InfiniBand QDR Switch**
- **Dimensions (H x W x D)**: 1.69 x 16.93 x 15.7 in (4.3 x 43 x 40 cm) (1U)
- **Weight (single power system)**: 17 lb (7.7 kg max)
- **Temperature (operating)**: 32° to 113° F (0° to 45° C)
- **Temperature (storage)**: -13° to 158° F (-25° to 70° C)
- **Humidity**: Operating-15 to 80%, non-condensing
- **Voltage**: 100 to 240 VAC 50/60 Hz
- **Power**: 216 W Maximum
- **Heat dissipation**: BTU/hr. max (internal Managed model)

**Voltaire ISR 9288 288-port InfiniBand Switch**
- **Dimensions (H x W x D)**: 24.5 x 17.5 x 22.75 in (62.2 x 44.4 x 57.8 cm) (14U)
- **Weight (single power system)**: 110 to 187.5 lb (50 to 85 kg) max
- **Temperature (operating)**: 32° to 113° F (0° to 45° C)
- **Humidity**: Operating-15 to 80%, non-condensing
- **Voltage**: 85 to 265 VAC 50/60 Hz
- **Power**: 2,500 W max for full configuration
- **Heat dissipation**: 8,000 BTU/hr. max for full configuration

### HP Cluster Platform Compute Building Block rack:
The compute building block with one 10642 rack, 38 HP ProLiant DL145 G2 nodes, two HP switches (one 2650 and one 2848), four PDUs, and cabling (maximum configuration)

<table>
<thead>
<tr>
<th><strong>Total cabinet</strong></th>
<th><strong>Shipping</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>78.7 in (199.90 cm)</td>
</tr>
<tr>
<td>Depth</td>
<td>39.69 in (100.82 cm)</td>
</tr>
<tr>
<td>Width</td>
<td>24 in (60.96 cm)</td>
</tr>
<tr>
<td>Weight (est.)</td>
<td>1500 lb (680 kg)</td>
</tr>
<tr>
<td>Power connection-4 PDUs</td>
<td>220 to 240, 24 amp, 50/60 Hz (each PDU) NA/Japan</td>
</tr>
<tr>
<td>Power consumption (est.)</td>
<td>31,000 W (maximum) -15,000 W (typical)</td>
</tr>
<tr>
<td>Heat dissipation (est.)</td>
<td>90,000 BTU/hr.(maximum)</td>
</tr>
<tr>
<td>Temperature range (est.)</td>
<td>50° to 95° F (10° to 35° C) operating</td>
</tr>
<tr>
<td>Relative humidity (est.) (non-condensing)</td>
<td>20% to 80% operating</td>
</tr>
</tbody>
</table>
HP Cluster Platform Utility Building Block rack: The utility building block with one 10642 rack, one Myricom 17-slot chassis, TFT display, one HP 2848 switch, one HP 2650 switch, one MSA1500 storage array, one MSA30 disk shelf, five DL585 nodes, three PDUs, and cabling (maximum configuration in modular packaging up to 128 nodes).

<table>
<thead>
<tr>
<th></th>
<th>Total cabinet</th>
<th>Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (in)</td>
<td>78.7 in (199.90 cm)</td>
<td>86.22 in (219 cm)</td>
</tr>
<tr>
<td>Depth (in)</td>
<td>39.69 in (100.82 cm)</td>
<td>48 in (121.92 cm)</td>
</tr>
<tr>
<td>Width (in)</td>
<td>24 in (60.96 cm)</td>
<td>32 in (81.28 cm)</td>
</tr>
<tr>
<td>Weight (est.) (lb)</td>
<td>1200 lb (544 kg)</td>
<td>1272 lb (577 kg)</td>
</tr>
<tr>
<td>Power connection-4 PDUs</td>
<td>NA/Japan-220 to 240, 24 amp, 50/60 Hz (each PDU)</td>
<td>Int-220 to 240, 32 amp, 50/60 Hz (each PDU)</td>
</tr>
<tr>
<td>Power consumption (est.)</td>
<td>8000 W (maximum)- 5200W (typical)</td>
<td>N/A</td>
</tr>
<tr>
<td>Heat dissipation (est.)</td>
<td>27,000 BTU/hr.</td>
<td>N/A</td>
</tr>
<tr>
<td>Temperature range (est.)</td>
<td>50° to 95° F (10° to 35° C) operating</td>
<td>-22° to 122° F (-30° to 50° C) non-operating</td>
</tr>
</tbody>
</table>

HP Cluster Platform Interconnect Building Block rack: The interconnect building block with one 10642 rack, four Myricom 17-slot chassis, and two PDUs (maximum configuration).

<table>
<thead>
<tr>
<th></th>
<th>Total cabinet</th>
<th>Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (in)</td>
<td>78.7 in (199.90 cm)</td>
<td>86.22 in (219 cm)</td>
</tr>
<tr>
<td>Depth (in)</td>
<td>39.69 in (100.82 cm)</td>
<td>48 in (121.92 cm)</td>
</tr>
<tr>
<td>Width (in)</td>
<td>24 in (60.96 cm)</td>
<td>32 in (81.28 cm)</td>
</tr>
<tr>
<td>Weight (est.) (lb)</td>
<td>700 lb (318 kg)</td>
<td>772 lb (350 kg)</td>
</tr>
<tr>
<td>Power connection-2 PDUs</td>
<td>NA/Japan-220 to 240, 24 amp 50/60 Hz (each PDU)</td>
<td>Int-220 to 240, 32 amp 50/60 Hz (each PDU)</td>
</tr>
<tr>
<td>Power consumption (est.)</td>
<td>4000 W</td>
<td>N/A</td>
</tr>
<tr>
<td>Heat dissipation (est.)</td>
<td>14,000 BTU/hr.</td>
<td>N/A</td>
</tr>
<tr>
<td>Temperature range (est.)</td>
<td>50° to 95° F (10° to 35° C) operating</td>
<td>-22° to 122° F (-30° to 50° C) non-operating</td>
</tr>
<tr>
<td>Relative humidity (est.) (non-condensing)</td>
<td>15% to 80% operating</td>
<td>5% to 95% non-operating</td>
</tr>
</tbody>
</table>
## HP Cluster Platform Utility eXpansion Rack
The utility expansion rack has one 10642 rack, nine DL585 nodes or eighteen DL385, and four PDUs (maximum)

<table>
<thead>
<tr>
<th></th>
<th>Total cabinet</th>
<th>Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height</strong></td>
<td>78.7 in (199.90 cm)</td>
<td>86.22 in (219 cm)</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>39.69 in (100.82 cm)</td>
<td>48 in (121.92 cm)</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>24 in (60.96 cm)</td>
<td>32 in (81.28 cm)</td>
</tr>
<tr>
<td><strong>Weight (est.)</strong></td>
<td>1400 lb (634 kg)</td>
<td>1550 lb (700 kg)</td>
</tr>
<tr>
<td><strong>Power connection-3 PDUs</strong></td>
<td>220 to 240, 24 amp 50/60 Hz (each PDU) NA/Japan</td>
<td>220 to 240, 32 amp 50/60 Hz (each PDU) Int'L</td>
</tr>
<tr>
<td><strong>Power consumption (est.)</strong></td>
<td>22,000 W (maximum)- 14,000 W (typical)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Heat dissipation (est.)</strong></td>
<td>74,700 BTU/hr.</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Temperature range (est.)</strong></td>
<td>50° to 95° F (10° to 35° C) operating</td>
<td>-22° to 122° F (-30° to 50° C) non-operating</td>
</tr>
<tr>
<td><strong>Relative humidity (est.)</strong></td>
<td>20% to 80% operating</td>
<td>5% to 95% non-operating</td>
</tr>
</tbody>
</table>

## HP Cluster Platform Visualization Building Block Rack
The visualization building block has one 10642 rack, eight xw8200 or xw9300 nodes, and one dual power monitoring PDU (maximum)

<table>
<thead>
<tr>
<th></th>
<th>Total cabinet</th>
<th>Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height</strong></td>
<td>78.7 in (199.90 cm)</td>
<td>86.22 in (219 cm)</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>39.69 in (100.82 cm)</td>
<td>48 in (121.92 cm)</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>24 in (60.96 cm)</td>
<td>32 in (81.28 cm)</td>
</tr>
<tr>
<td><strong>Weight (est.)</strong></td>
<td>700 lb (318 kg)</td>
<td>772 lb (350 kg)</td>
</tr>
<tr>
<td><strong>Power connection-1 PDU with 2 cables</strong></td>
<td>220 to 240, 40 amp 50/60 Hz (2 per PDU) NA/Japan</td>
<td>220 to 240, 32 amp 50/60 Hz (2 per PDU) Int'L</td>
</tr>
<tr>
<td><strong>Power consumption (est.)</strong></td>
<td>10,600 W (maximum)- 6,000 W (typical)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Heat dissipation (est.)</strong></td>
<td>31,000 BTU/hr.(maximum)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Temperature range (est.)</strong></td>
<td>50° to 95° F (10° to 35° C) operating</td>
<td>4° to 140° F (-20° to 60° C) non-operating</td>
</tr>
<tr>
<td><strong>Relative humidity (est.)</strong></td>
<td>20% to 80% operating</td>
<td>5% to 90% non-operating</td>
</tr>
</tbody>
</table>

### Notes
- **Power connection-3 PDUs**
  - 220 to 240, 24 amp 50/60 Hz (each PDU) NA/Japan
  - 220 to 240, 32 amp 50/60 Hz (each PDU) Int'L

- **Power consumption (est.)**
  - 22,000 W (maximum)- 14,000 W (typical)

- **Heat dissipation (est.)**
  - 74,700 BTU/hr.

- **Temperature range (est.)**
  - 50° to 95° F (10° to 35° C) operating
  - -22° to 122° F (-30° to 50° C) non-operating

- **Relative humidity (est.)**
  - 20% to 80% operating
  - 5% to 95% non-operating
<table>
<thead>
<tr>
<th>Product Description</th>
<th>Dimensions</th>
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<th>P/N</th>
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<tr>
<td>RHEL WS3 1Yr Base 8 pack, Media for ProLiant (64 bit)</td>
<td>.25&quot;x9&quot;x6&quot;</td>
<td>Red Hat HPC Ent Linux WS3 1Y Base 8pk 64bit OS</td>
<td>372724-B21</td>
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<td>RHEL WS3 1Yr Add-on 8 pack for ProLiant (64-bit)</td>
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<td>Red Hat HPC Ent Linux WS3 1Y Addtl 8pk 64bit OS</td>
<td>372725-B21</td>
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<tr>
<td>RHEL WS3 3Yr Base 8 pack, Media for ProLiant (64 bit)</td>
<td>.25&quot;x9&quot;x6&quot;</td>
<td>Red Hat Ent Linux WS3 3yr Base 8pk ET/OPT SW</td>
<td>372728-B21</td>
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<tr>
<td>RHEL WS4 1Yr Base 8 pack, Media for ProLiant (64 bit)</td>
<td>1.25&quot;x8&quot;x6&quot;</td>
<td>Red Hat Ent Linux HPC WS4 1Yr Base 8pk ET/Opt SW</td>
<td>398384-B21</td>
</tr>
<tr>
<td>RHEL WS4 1Yr Add-on 8 pack for ProLiant (64-bit)</td>
<td>1.25&quot;x8&quot;x6&quot;</td>
<td>Red Hat Ent Linux HPC WS4 1Yr Addon 8pk ET/Opt SW</td>
<td>398385-B21</td>
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<tr>
<td>RHEL WS4 3Yr Base 8 pack, Media for ProLiant (64 bit)</td>
<td>1.25&quot;x8&quot;x6&quot;</td>
<td>Red Hat Ent Linux HPC WS4 3Yr Base 8pk ET/Opt SW</td>
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<tr>
<td>RHEL WS4 3Yr Add-on 8 pack for ProLiant (64 bit)</td>
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<td>Red Hat Ent Linux HPC WS4 3Yr Addon 8pk ET/Opt SW</td>
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<td>SUSE SLES9 1Yr Base 8 pack, Media (64 &amp; 32 bit) for ProLiant (3-8 processor nodes)</td>
<td>1&quot; x9&quot;x6&quot;</td>
<td>SUSE Linux Enterprise Srvr 9 HPC 1Yr Base 8 Pak SW</td>
<td>382355-B21</td>
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<td>SUSE Linux Enterprise Server 9 HPC 1Yr 8 Pak SW</td>
<td>382357-B21</td>
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<td>SUSE SLES9 3Yr Base 8 pack, Media (64 &amp; 32 bit) for ProLiant (3-8 processor nodes)</td>
<td>1&quot; x8.25&quot;x6&quot;</td>
<td>SUSE Linux Ent Srvr 9 HPC 3Y Base 3-16 8 Pak 64 SW</td>
<td>382356-B21</td>
</tr>
<tr>
<td>SUSE SLES9 3Yr Add-on 8 pack for ProLiant (64 &amp; 32-bit) (3-8 processor nodes)</td>
<td>.25&quot;x5&quot;x3&quot;</td>
<td>SUSE Linux Ent Srvr 9 HPC 3Yr 8 Pak Add 3-16 SW</td>
<td>382358-B21</td>
</tr>
</tbody>
</table>

**NOTE:** Please refer to the individual Control Node and/or Compute Nodes (HP ProLiant DL140 G2, HP ProLiant DL145 G2 or HP ProLiant DL585) for Technical specifications at [http://h18004.www1.hp.com/products/servers/platforms/index-dl.html](http://h18004.www1.hp.com/products/servers/platforms/index-dl.html)