HP BladeSystem p-Class System Overview and Planning

Introduction

This white paper provides an overview of the HP BladeSystem p-Class solution. This solution includes:

- HP ProLiant BL p-Class servers
- HP ProLiant BL p-Class interconnect components
- HP BladeSystem power components
- HP BladeSystem enclosures
- HP BladeSystem management tools

In addition to this document, HP recommends referring to the *HP BladeSystem System Best Practices Guide* and the *HP BladeSystem Common Procedures Guide* when planning and setting up a ProLiant BL system environment. The *HP BladeSystem Best Practices Guide* and the *HP BladeSystem Common Procedures Guide* include the instructions, best practices, helpful hints, and suggestions for setting up and configuring ProLiant BL systems and the tools needed for common system management tasks such as deployment, configuration, and monitoring. The *HP BladeSystem Best Practices Guide* and the *HP BladeSystem Common Procedures Guide* are available on the HP website, http://h18000.www1.hp.com/products/servers/proliant-bl/p-class/index.html

Executive summary

The HP BladeSystem p-Class solution consists of ProLiant BL server blades, network interconnect components, a rack-centralized power subsystem, and management tools that enable adaptive computing and is optimized for rapid deployment. ProLiant BL p-Class servers are designed for the high performance and high availability that you have come to expect from HP ProLiant industry-standard servers. The HP BladeSystem p-Class solution protects your investment with a modular approach that supports a complete family of server blades and network interconnect options including:

- ProLiant BL20p and BL25p Server Blades—Ideal for multi-tiered enterprise data centers. The ProLiant BL20p and 25p Server Blades feature a dual-processor-capable design, high-performance DDR2 memory (BL20p) or PC3200 DDR2 memory (BL25p), an integrated SmartArray RAID controller, Universal hot-plug SCSI hard drives, Integrated Lights-Out (iLO) Advanced functionality, four general-purpose Gigabit Ethernet network controllers, and optional Fibre Channel (FC) SAN connectivity.

- ProLiant BL30p and BL35p Server Blades— Ideal for high-performance technical computing and enterprise datacenter environments that use external storage architectures. The ProLiant BL30p and BL35p Server Blades feature a dual-processor-capable design optimized for maximum server density. Server blades feature high-performance DDR memory, BIOS-Enhanced RAID, iLO Advanced functionality, two general-purpose Gigabit Ethernet network controllers, and optional FC SAN connectivity.

- ProLiant BL40p Server Blades—Designed to power back-end and mission-critical applications, the ProLiant BL40p Server Blade supports up to four Intel® Xeon™ processors, maximum performance DDR memory, integrated SmartArray RAID controller, Universal hot-plug SCSI hard drives, iLO Advanced functionality, five general-purpose Gigabit Ethernet network controllers, and two PCI-X slots for optional redundant FC SAN connectivity.

HP BladeSystem modular architecture key benefits

- Rapid deployment/redeployment saves valuable time
  - Server blades and interconnect switches can be installed and ready for immediate automated provisioning
  - Easy access to most pluggable components from the front of the rack, including server blades, hot-plug hard drives, and interconnect options
  - Easily add server blade capacity as needed without disrupting the system

- Innovative design dramatically cuts network and power cables compared to traditional servers
  - As few as one network cable per 16 server blades using the interconnect switch options
  - Designed for headless management, eliminating the need for keyboard, video, and mouse cables for each server and a KVM switch infrastructure
  - Rack-centralized power subsystem eliminates individual server power cables as well as power distribution units (PDUs)
  - Modular interconnect design enables server blades and interconnect options to be rapidly added and replaced without re-cabling Ethernet and FC connections
  - Server blade management module on new enclosures provides a single network cable connection for managing up to 16 server blades simultaneously

- Designed to protect your investment
  - Broad server blade portfolio enables complete, end-to-end solutions, including enterprise applications and high-performance computing clusters using modular building blocks.
  - Server blades and network interconnect options can be mixed in the same blade enclosure and share the rack-centralized power system while operating independently and running different operating systems and applications.
  - ProLiant BL p-Class GbE2 Interconnect Switch options are enabled for future 10-Gigabit Ethernet uplinks and layer 3-7 switching capability supporting enterprise networking requirements well into the future.
  - HP BladeSystem enclosures may be installed in HP, telco, and third-party racks.
  - HP BladeSystem enclosures may share racks with traditional servers, networking, and storage devices.
  - Power and network interconnect options support all current and future ProLiant BL p-Class server blades, including the new ProLiant BL30p.
  - FC SAN connectivity options support HP and select third party storage products.

- Availability features to provide peace of mind
  - Redundant, hot-plug power supplies
  - Hot-plug SCSI hard drives and integrated RAID controller on some blade models
  - Dual-port FC SAN connectivity
  - Multiple general-purpose NICs on each server blade for redundant connections to data networks
  - Redundant ROM on each server blade
  - Redundant pairs of hot-plug interconnect switch options

HP BladeSystem manageability key benefits

- Quickly configure both server blades and interconnect switches from a centralized deployment console using HP ProLiant Essentials Rapid Deployment Pack (RDP).
  - Configure tens to hundreds of server blades simultaneously in a fraction of the time required to configure conventional servers using multicasting
  - Automatically restore the role of a previous blade to a new server blade
  - Integrate interconnect switch scripts in RDP for deployment interconnect switches as well as server blades

- Leverage IT personnel by managing a larger number of server blades both locally and remotely with less time and effort.
  - Preboot eXecution Environment (PXE) technology enhances remote access by installing and configuring operating systems to boot over a network.
  - iLO Advanced functionality ships standard on every ProLiant BL p-Class server blade, including full remote console virtual media (diskette and CD-ROM) capabilities.
  - Fully integrates with HP Systems Insight Manager (HP SIM) so you can manage ProLiant blades and traditional servers with the same tools.

- Take greater control of HP BladeSystem environments with HP SIM.
  - HP SIM is the easy-to-use, flexible, scalable, and secure solution for managing HP servers and client devices by providing rapid access to detailed fault and performance information.
  - HP SIM provides visualization of server blades and interconnect switches at both enclosure and rack levels for better awareness and control of all blade system components.
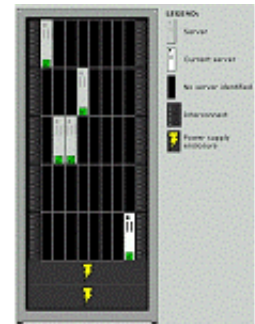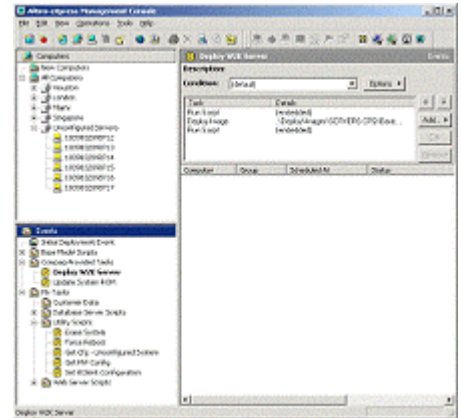
p-Class rack in HP SIM
with physical detail view

HP BladeSystem overview

Figure 1 shows an HP BladeSystem p-Class Blade Enclosure.

Figure 1. HP BladeSystem enclosure
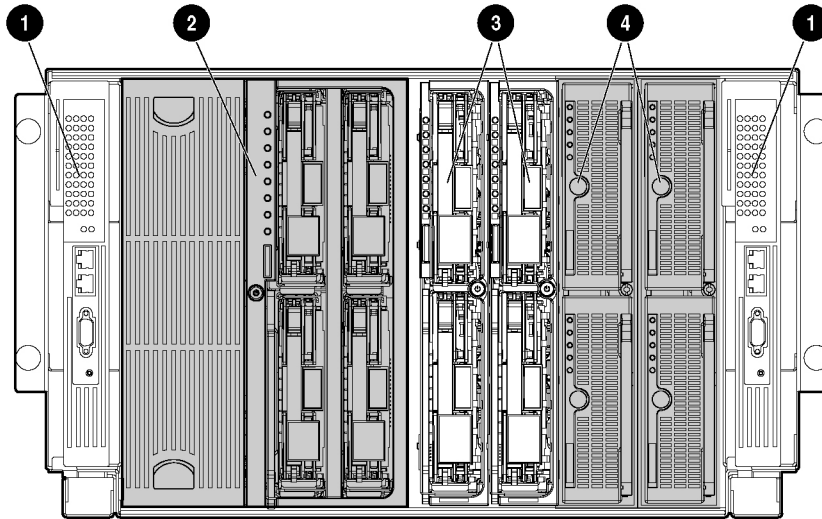
Table 1. Server Blade Components

Item	Description
1	HP BladeSystem p-Class Interconnects (2) in a server blade enclosure (Interconnect Switch shown)
2	ProLiant BL40p Server Blade
3	ProLiant BL20p or BL25p Server Blades
4	ProLiant BL30p or BL35p Server Blades

Figure 2 shows an HP BladeSystem p-Class power subsystem installed in a 42U rack.

Figure 2. Power supply and power distribution components in a 42U rack.

Table 2. Power Subsystem Components

Item	Description
1	Hot-plug power supplies in two power enclosures
2	Power distribution (scalable bus bars shown)

Table 3. HP BladeSystem Required Components

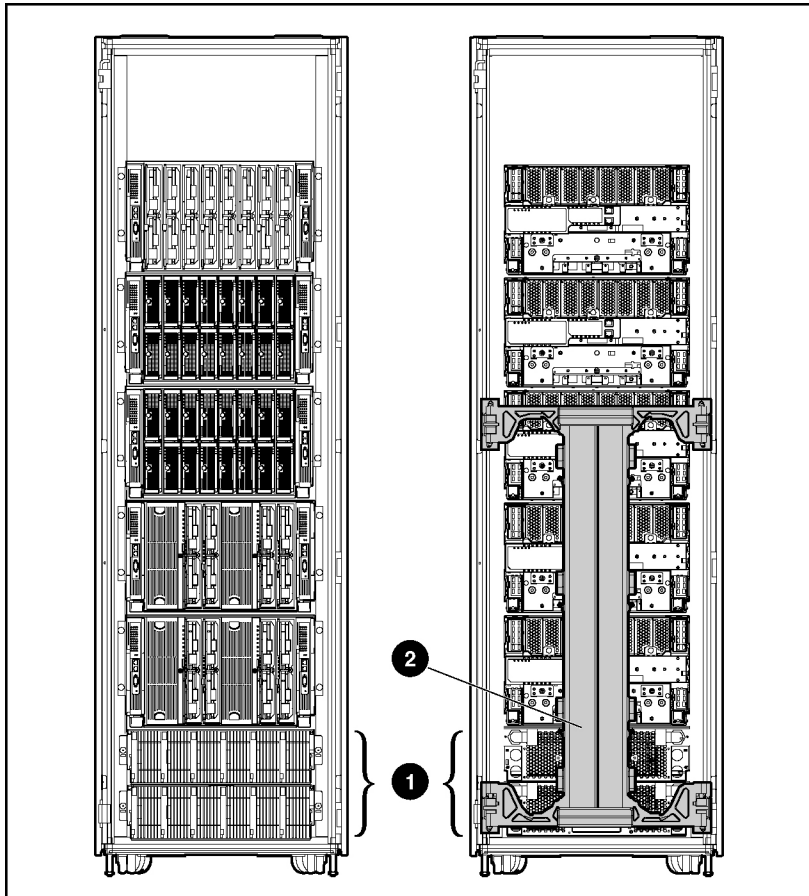| Required Components	Function
Server blade	ProLiant BL20p, ProLiant BL25p, ProLiant BL30p, ProLiant BL35p, and ProLiant BL40p Server Blades contain one or more processors, memory, internal and external storage options, and integrated management. For FC connectivity, server blades must also be configured with FC card options. ProLiant BL30p and ProLiant BL35p Server Blades require a sleeve for mounting in a server blade enclosure.
Enclosure	HP BladeSystem p-Class enclosures hold server blades and network interconnect options. Combinations of different series server blades are supported in the same blade enclosure.
	Each enclosure supports a pair of switch or patch panel interconnects for network cable management. The upgraded enclosure also provides a single Ethernet port for connecting to the iLO interface of every installed server blade. ProLiant BL30p, ProLiant BL35p, and some models of the ProLiant BL20p and BL25p Server Blades require the use of the enclosure with enhanced backplane components.
Network interconnects	HP BladeSystem p-Class interconnects pass the network adapter (NIC) signals from the server blades to external networks. Several options are available:
	• Patch Panel interconnects route each NIC (Network Interface Card) signal individually from the server blades to the customer network.
	• Interconnect switches consolidate the server blade NIC connections to just a few uplinks thereby reducing the required cables to connect the solution to your network.
	Both patch panel and interconnect switches are available with or without FC pass-through capability.
Power enclosure with power supplies (Not needed if using facility -48 VDC ±10%)	The HP BladeSystem p-Class solution has a power subsystem that is external to and shared by all the server blade enclosures in a rack. At the core of the power system is a 3U power enclosure that holds up to six hot-plug power supplies. Additional power supplies and power enclosures can be added to a system for redundancy.
	Power enclosures are available in single-phase and three-phase versions.
Power distribution	Power is carried from the power supplies in the power enclosure(s) to the blade enclosure(s) through bus bars (for powering multiple enclosures) or a power bus box (for powering a single enclosure).
	HP BladeSystem p-Class bus bars are available in mini and scalable versions depending on the number of server blade enclosures being deployed. The dual power input kit option for mini bus bars is required for supporting two power enclosures with the mini bus bar.

Note: Power requirements for an HP BladeSystem p-Class solution: 200 V to 240 VAC, 30 A or facility DC –48V ±10%

Hardware components

The HP BladeSystem p-Class solution consists of the following:

• Server blades
• Network interconnects
• Blade enclosures
• Power supplies
• Power distribution components

ProLiant BL20p G3 Server Blade

The ProLiant BL20p G3 Server Blade is ideal for infrastructure and enterprise applications, including:

- Web
- E-commerce
- Server-based computing
- AV and streaming media
- Messaging front-end and mobility
- Small database

Figure 3. ProLiant BL20p G3 Server Blade
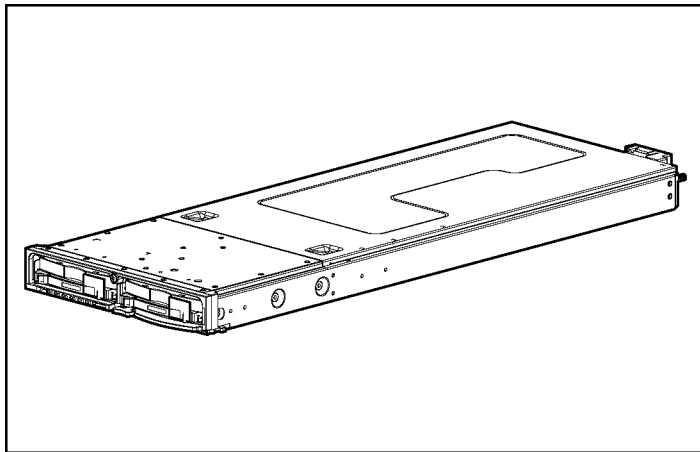
Features of the ProLiant BL20p G3 Server Blade include:

- Processor—Up to two Intel Xeon processors
- Internal storage—Up to two Universal hot-plug SCSI hard drives offer up to 600-GB capacity and are connected to a SCSI Smart Array 6i Controller with optional Battery-Backed Write Cache Enabler.
- Memory—Four DIMM slots provide a capacity of 8 GB of PC3200, ECC, Registered SDRAM, and 2 x 1 memory interleaving for added performance. DIMMs must be added in identical pairs.
- NICs—Four general-purpose NC7781 Gigabit PCI-X 10/100/1000T NICs with WOL (Wake-on LAN), plus one 10/100T NIC dedicated to iLO. The four general-purpose NC-Series NICs support PXE and HP NIC teaming.
- LEDs—Common with all ProLiant servers, including LEDs for:
  - Power
  - NIC link and activity
  - Disk drive activity
  - Server blade health
  - Unit identification (UID)—A blue LED that can be activated remotely to help an on-site user find a specific blade in a loaded rack.
- Density—Up to 8 ProLiant BL20p G3 Server Blades fit the 6U server blade enclosure.

ProLiant BL25p Server Blade

The ProLiant BL25p Server Blade is ideal for infrastructure and enterprise applications, including:

- Web
- E-commerce
- Server-based computing
- AV and streaming media
- Messaging front-end and mobility
- Small database

Figure 4. ProLiant BL25p Server Blade

Features of the ProLiant BL25p Server Blade include:

- Processor—Up to two AMD Opteron™ 200 Series processors
- Internal storage—Up to two Universal hot-plug SCSI hard drives offer up to 600-GB capacity and are connected to a SCSI Smart Array 6i Controller with optional Battery-Backed Write Cache Enabler.
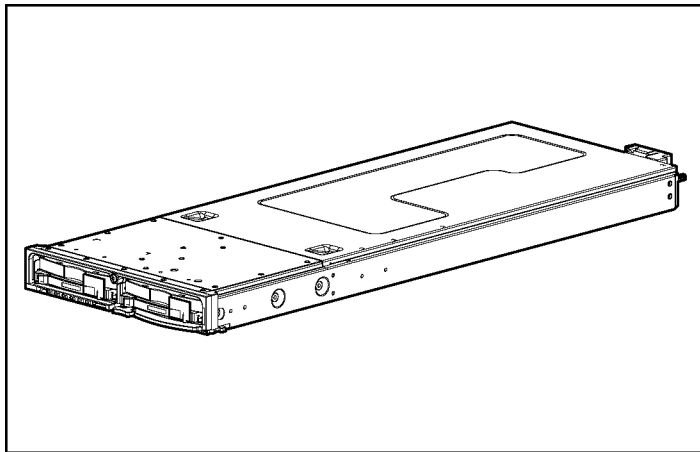- Memory—Eight DIMM slots provide capacity of 16 GB of PC3200, ECC, Registered SDRAM and 2 x 1 memory interleaving for added performance. DIMMs must be added in identical pairs.
- NICs—Four general-purpose Gigabit PCI-X 10/100/1000T NICs with WOL, plus one 10/100T NIC dedicated to iLO. The four general-purpose NC-Series NICs support PXE and HP NIC teaming.
- LEDs—Common with all ProLiant servers, including LEDs for:
  - Power
  - NIC link and activity
  - Disk drive activity
  - Server blade health
  - UID—A blue LED that can be activated remotely to help an on-site user find a specific blade in a loaded rack.
- Density—Up to 8 ProLiant BL25p Server Blades fit the 6U server blade enclosure.

ProLiant BL30p Server Blade

The ProLiant BL30p Server Blade is ideal for enterprise and high-performance computing applications, including:

- High-performance technical computing applications
- Web
- E-commerce
- Server-based computing
- Messaging front-end

Figure 5. ProLiant BL30p Server Blade
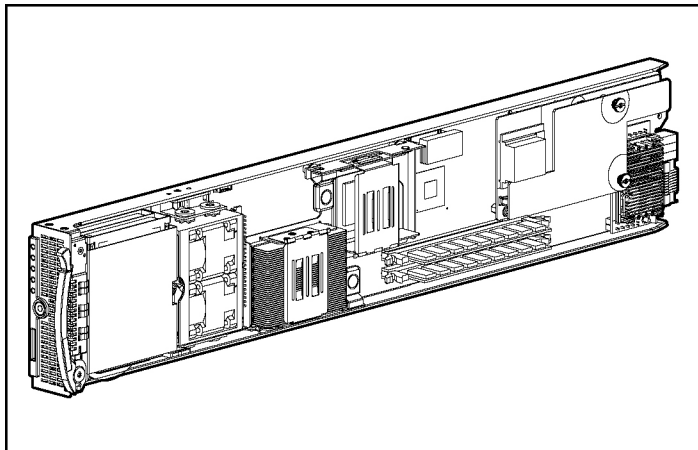
Features of the ProLiant BL30p Server Blade include:

- Processor—Up to two Intel Xeon processors
- Internal storage—Up to two small form factor (SFF) ATA hard drives offer up to 120-GB capacity. BIOS-Enhanced RAID provides additional data availability.
- Memory—Two DIMM slots provide capacity of 4 GB of PC2100, ECC, Registered SDRAM, and 2 x 1 memory interleaving. Also supports single DIMM non-interleaved memory configurations for added flexibility.
- NICs—Two general-purpose NC7781 Gigabit PCI-X 10/100/1000T NICs with WOL plus one 10/100T NIC dedicated to iLO. The two general-purpose NC-Series NICs support PXE and HP NIC teaming.
- LEDs—Common with all ProLiant servers, including LEDs for:
  - Power
  - NIC link and activity
  - Disk drive activity
  - Server blade health
  - UID
- Density—Up to 16 ProLiant BL30p Server Blades fit into the 6U enclosure. Enclosures with enhanced backplane components must be used.

ProLiant BL35p Server Blade

The ProLiant BL35p Server Blade is ideal for enterprise and high-performance computing environments that require optimum two-way compute densities and power efficiencies such as:

- High-performance technical computing applications
- Dynamic Web serving
- High bandwidth, low latency applications
- E-commerce
- Server-based computing
- Messaging front-end

Figure 6. ProLiant BL35p Server Blade

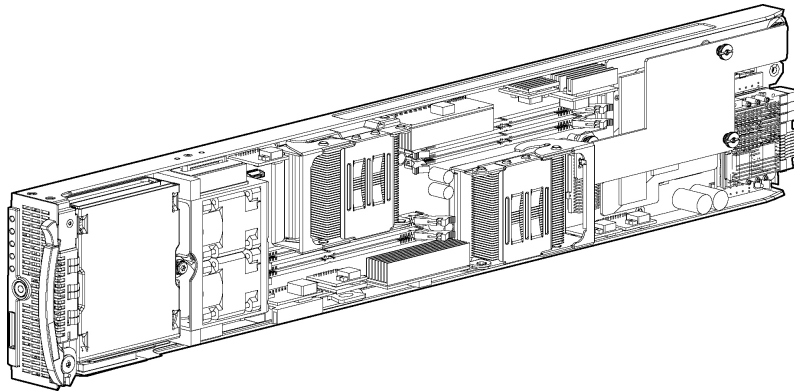Features of the ProLiant BL35p Server Blade include:

- Processor—Up to two AMD Opteron 200 series low-power processors per server blade. Lower power consumption per server (68 W per processor) enables denser rack architectures for a given power envelope.
- Internal storage—Up to two SFF ATA hard drives offer up to 120-GB capacity. BIOS-Enhanced RAID provides additional data availability.
- Memory—Four DIMM slots provide capacity of 8 GB of PC3200 DDR 400MHz, ECC, Registered SDRAM, and 2 x 1 memory interleaving.
- NICs—Two general-purpose NC7781 Gigabit PCI-X 10/100/1000T NICs with WOL plus one 10/100T NIC dedicated to iLO. The two general-purpose NC-Series NICs support PXE and HP NIC teaming.
- LEDs—Common with all ProLiant servers, including LEDs for:
  - Power
  - NIC link and activity
  - Disk drive activity
  - Server blade health
  - UID
- Density—Up to 16 ProLiant BL35p Server Blades fit into the 6U enclosure. Enclosures with enhanced backplane components must be used.

ProLiant BL40p Server Blade

The ProLiant BL40p Server Blade is ideal for the following applications:

- Medium to large enterprise databases
- Messaging and collaboration
- IPC Clustering/Failover Clustering
- Application servers
- Web
- E-commerce
- Server consolidation
- Enterprise Resource Planning (ERP)
- Customer Relationship Management (CRM)
- Data Warehousing
- Large file/print or domain controllers

Figure 7. ProLiant BL40p Server Blade
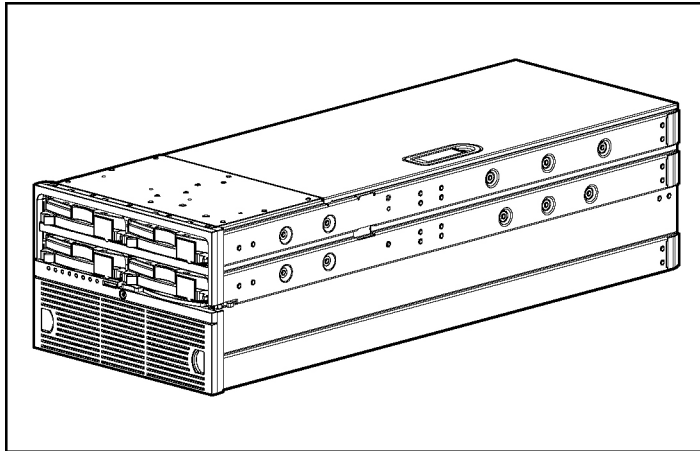
Features of the ProLiant BL40p Server Blade include:

- Processor—Up to four Intel Xeon MP processors.
- Internal storage—Up to four Universal hot-plug SCSI hard drives offer up to 1200-GB capacity and are connected to the Smart Array 6i Controller with Battery-Backed Write Cache Enabler.
- Memory—Six DIMM slots provide capacity of 12 GB of PC2100, ECC, Registered DIMMs, and 2 x 1 memory interleaving and support for online spare memory.
- NICs—Five general-purpose NC7781 Gigabit PCI-X 10/100/1000T NICs with WOL plus one 10/100T NIC dedicated to iLO. All five general-purpose NC-series NICs support PXE and HP NIC teaming.

- PCI-X Slots—Two PCI-X slots for redundant FC host bus adapters and certain Smart Array contollers.
- LEDs—Common to all ProLiant servers, including LEDs for:
  - Power
  - NIC link and activity
  - Disk drive activity
  - Server blade health
  - UID
- Density—Up to 2 ProLiant BL40p Server Blades fit into a server blade enclosure.

ProLiant BL p-Class server blade SAN connectivity

The ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, ProLiant BL35p, and ProLiant BL40p Server Blades are optimized for HP StorageWorks arrays and can attach to select third-party SAN solutions. In addition, the server blades can integrate with "fused" NAS and SAN configurations, providing the ability to work in file and block environments seamlessly. HP StorageWorks arrays include:

- StorageWorks MSA 1000
- StorageWorks Enterprise Virtual Array (EVA)
- StorageWorks EMA/MA arrays
- StorageWorks XP

Select Hitachi and EMC models are compatible.

All StorageWorks models listed support SecurePath for multi-path functionality.

ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, ProLiant BL35p, and ProLiant BL40p Server Blades support redundant FC SAN connections. The ProLiant BL20p G3, ProLiant BL25p, ProLiant 30p, and ProLiant BL35p Server Blades support Dual Port Fibre Channel Mezzanine Card options. The ProLiant BL40p Server Blade has two 64-bit, 100-MHz PCI-X slots that enable redundant FC SAN connectivity using host-bus adapter cards.

FC signals are routed from the configured server blade through the blade enclosure backplane to the interconnect modules. Optical transceivers added to the interconnect modules provide connectivity to the external fabric.

If configuring ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, or ProLiant BL35p Server Blades with Dual Port FC options, either an RJ-45 Patch Panel 2 or GbE2 Interconnect Switch (with optional GbE2 Storage Connectivity Kit) is required to be used as the interconnect option in the server blade enclosure.

The ProLiant BL20p G3 Dual Port FC Mezzanine Card Option Kit, the ProLiant BL25p Dual Port FC Mezzanine Card Option Kit, and the ProLiant BL30p/BL35p Dual Port FC Adapter Option Kit include two SFF transceivers with LC connectors. These SFF transceivers are installed in the RJ-45 Patch Panel 2 transceiver slots. The SFF transceivers are universal and can be used with either the RJ-45 Patch Panel 2 or the GbE2 Interconnect Switch (with GbE2 Storage Connectivity Kit).

Dual port FC options

The ProLiant BL20p G3 Server Blade requires the BL20p Dual Port Fibre Channel Mezzanine Card to support SAN connectivity.

Figure 8. BL20p Dual Port FC Mezzanine Card
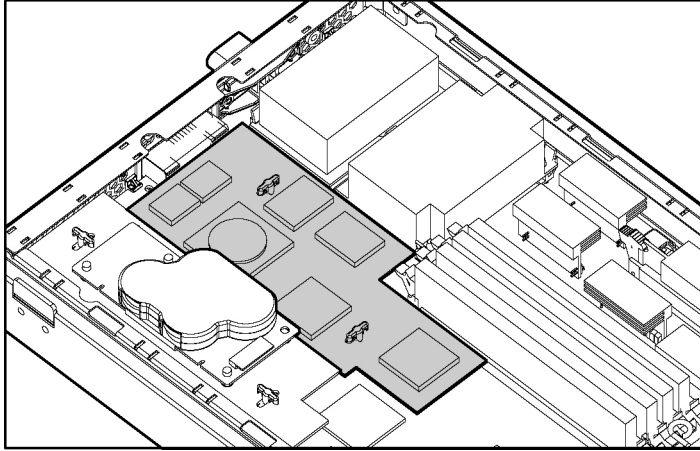
The ProLiant BL25p Server Blade requires the BL25p Dual-Port Fibre Mezzanine Card to support SAN connectivity. Refer to the label on the FC adapter to verify compatibility with the server.

Figure 9. BL25p Dual Port FC Adapter
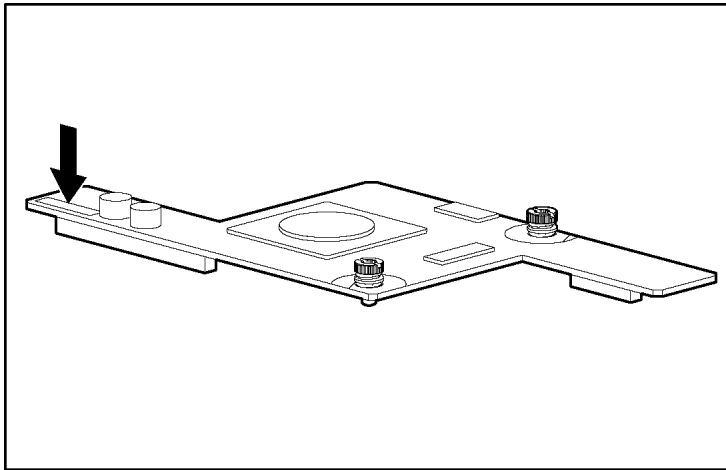
The ProLiant BL30p and BL35p Server Blades require the BL30p/BL35p Dual-Port Fibre Channel Adapter to support SAN connectivity.

Figure 10. BL30p/BL35p Dual Port FC Adapter
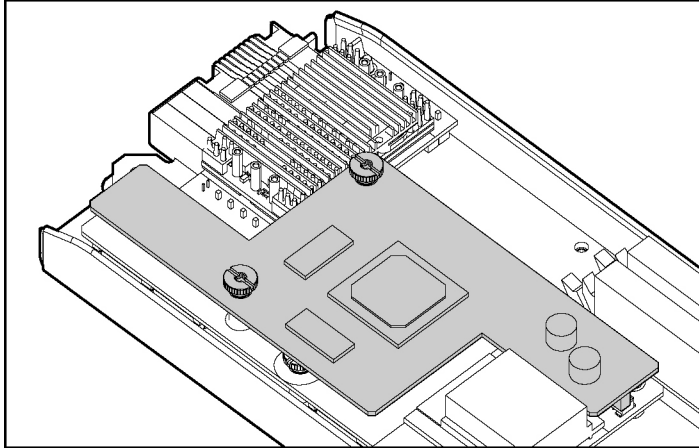
For FC SAN connectivity, all ProLiant BL p-Class server blades require an interconnect kit that provides FC pass-through capability. Both the ProLiant BL p-Class RJ-45 Patch Panel 2 and the ProLiant BL p-Class GbE2 Interconnect Switch with the GbE2 Storage Connectivity Kit option provide FC SAN connectivity.

Figure 11. RJ-45 Patch Panel 2 installed in a server blade enclosure with ProLiant BL40p Server Blades and FC option
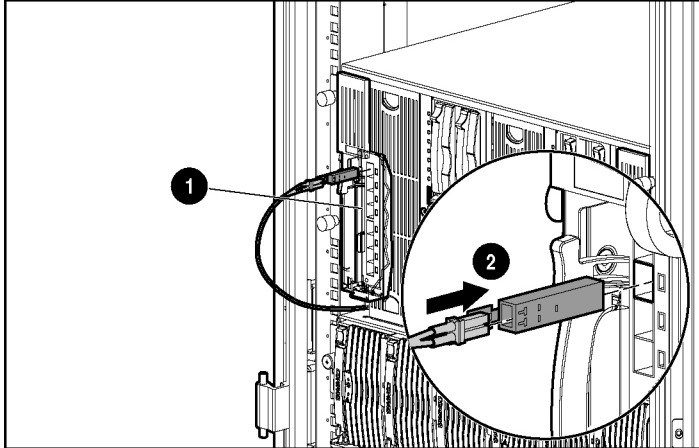
Table 4. Enclosure Components

Component	Description
1	RJ-45 Patch Panel 2
2	SFF transceiver

ProLiant BL30p and ProLiant BL35p Server Blade and FC connectivity

The ProLiant BL30p/BL35p Dual Port Fibre Channel Adapter Option is based on the QLogic ISP2312 chipset. This chipset carries forward all the features of the ProLiant BL20p G3 and ProLiant BL25p Dual Port FC Mezzanine Cards and is an industry standard solution. The features of the Dual Port Fibre Channel Adapter include:

- RDP scripted installation for Microsoft® Windows® and Linux
- Boot capability from SAN disk or LUN
- Blade bay to FC switch compatibility established by the server blade
- High availability through redundant paths

The ProLiant BL30p/BL35p Fibre Channel Adapter has a different subvendor ID than the ProLiant BL20p G3 and ProLiant BL25p Dual Port Fibre Channel Mezzanine Cards. Because the Windows driver is subvendor ID sensitive, a new backward compatible driver was introduced with the ProLiant BL30p and the ProLiant BL35p. Linux drivers are not subvendor ID sensitive, so the currently available Linux drivers are compatible.

FC port aggregation is required to accommodate the increased number of server FC HBA ports and to maintain compatibility with the available enclosure backplane signals and interconnect ports. The HP BladeSystem p-Class Blade Sleeve aggregates the four paths from two ProLiant BL30p or ProLiant BL35p Blades into two physical paths. Up to 16 physical FC ports connect form the Patch Panel 2 or GbE2 Interconnect Switch directly to the customer external FC SAN switch. ProLiant BL30p and ProLiant BL35p FC implementations require the FC SAN switch supports FC-AL public loop login. Most FC switches provide this support.

NOTE: The FC LED on the Patch Panel 2 or GbE2 Interconnect Switch does not display a live link with a BL p-Class server blade enclosure with enhanced backplane components. Port activity information can be obtained from the FC SAN switch or by using Qlogic SANsurfer Blade Management software.

HP BladeSystem p-Class Blade Enclosure

ProLiant BL p-Class server blades and network interconnects are housed in a 6U server blade enclosure. The blades slide into the blade enclosure backplanes for power and network connections.

Each blade enclosure has eight server blade bays in the center of the enclosure and two interconnect bays at each end. The two interconnect bays are populated with either patch panel interconnects (for direct signal pass-through) or interconnect switches (for network cable reduction). The middle eight bays support server blades.

With the introduction of the BL30p, HP introduced a server blade enclosure with enhanced backplane components. The enclosure with enhanced backplanes provides the following:

- A new server blade management module that simplifies management cabling by providing a single physical iLO port for all installed server blades
- New server blade management module firmware that automates blade iLO IP addressing with the Static IP Bay Configuration feature
- Support for ProLiant BL30p and ProLiant BL35p Server Blades, as well as support for all current and future ProLiant BL20p series, ProLiant BL25p, and ProLiant BL40p series server blades
- Support for all current and future patch panel and interconnect switch options

Table 5. HP BladeSystem p-Class Server Blade Enclosure Support Matrix

Server Blade Family/Model	p-Class server blade enclosure 243564-B21 281404-B21	p-Class server blade enclosure w/enhanced backplane components 243564-B22 281404-B22 380625-B22
BL20p		
all models	X	X
BL20p G2		
all models	X	X
BL20p G3		
All 3.2-GHz/1-MB models	X	X
All 3.4-GHz/1-MB models		X
All 3.6-GHz/1-MB models		X
All 3.4-GHz/2-MB models		X
All 3.6-GHz/2-MB models		X
BL25p		
All 2.4-GHz low-power models	X	X
All 2.6-GHz models		X
BL30p		
all models		X
BL35p		
all models		X
GbE Interconnect Switch	X	X
GbE2 Interconnect Switch	X	X
RJ-45 Patch Panel	X	X
RJ-45 Patch Panel 2	X	X

Note1: Server Blade Enclosure Upgrade Kit (354100-B21) contains the enhanced backplane components and enables a field upgrade of existing server blade enclosures to support all p-Class server blades and to provide a single, physical iLO port for the enclosure.

Note2: Assumes all configurations do not have any power/processor throttling technology enabled.

The HP BladeSystem p-Class Blade Enclosure Upgrade Kit Option enables an enclosure to be upgraded to an enclosure with enhanced backplane components.

Figure 12 is a front view of the HP BladeSystem p-Class Blade Enclosure.

Figure 12. Blade enclosure front view
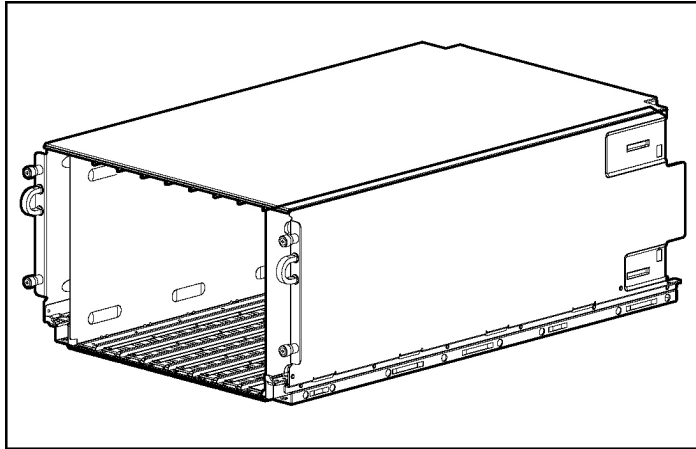
Features of the server blade enclosure include:

- Toolless installation—Easily installed with spring-loaded rack rails and thumbscrews. Rack rails are common between the server blade enclosure and the power enclosure.
- Toolless serviceability—Power backplane, data backplane, and server blade management module are serviceable without tools and without removing the server blades and interconnects from the enclosure or removing the blade enclosure from the rack.
- Inter-enclosure communication—The server blade management module is a hot-pluggable module that reports thermal, power, and protection fuse events to all server blades in the blade enclosure. The management module also provides asset and inventory information, and facilitates power sharing across enclosures. On server blade enclosures with enhanced backplane components, the server blade management module also provides a single RJ-45 connector for accessing all installed server blade iLO interfaces. This feature greatly reduces the number of network cables needed for management.

Figure 10 is a rear view of the HP BladeSystem p-Class Blade Enclosure with enhanced backplane components.

Figure 13. Blade enclosure with enhanced backplane components rear view
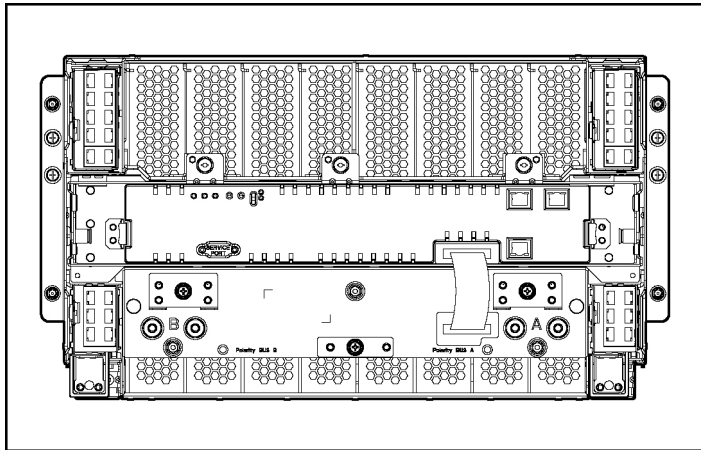
HP BladeSystem p-Class Blade Sleeve

The HP BladeSystem p-Class Blade Sleeve supports ProLiant BL30p and ProLiant BL35p Server Blades in a server blade enclosure with enhanced backplane components. The HP BladeSystem p-Class Blade Sleeve is for use with the ProLiant BL30p and ProLiant BL35p Server Blades only.

Figure 14. HP BladeSystem p-Class Blade Sleeve
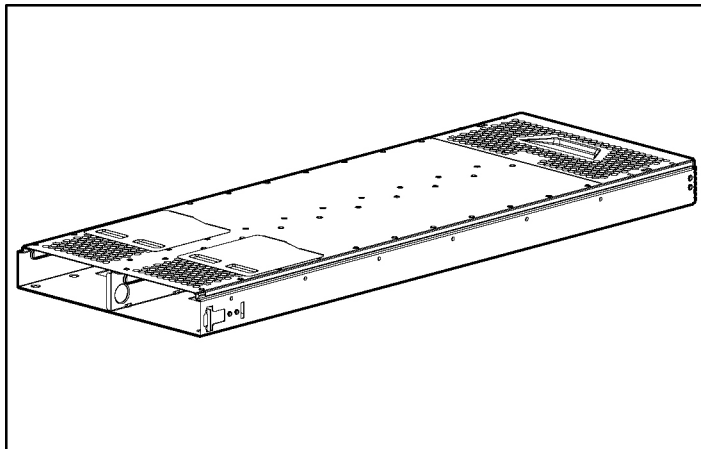
Features of the HP BladeSystem p-Class Blade Sleeve include:

• Holds up to two ProLiant BL30p or BL35p Server Blades
• Installs into any of the eight blade bays in blade enclosures with enhanced-backplane components
• Enables installation of 16 ProLiant BL30p or ProLiant BL35p Server Blades per 6U server blade enclosure

HP BladeSystem p-Class network interconnects

Each blade enclosure must be configured with a pair of network interconnects. These interconnects slide into the front of the blade enclosure and collect Ethernet and FC (ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, and ProLiant BL35p only) signals from all the installed server blades.

Figure 15. HP BladeSystem p-Class enclosure interconnect locations
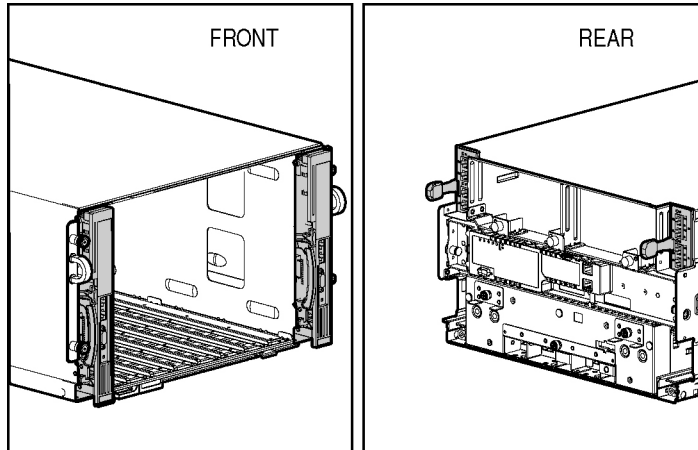
Two general categories of interconnect options are available depending on your preferences and environment:

- RJ-45 Patch Panel interconnects collect Ethernet signals from each server blade and provide an external RJ-45 connector for cabling to each individual server blade NIC. An option is available to allow individual ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, and ProLiant BL35p FC signals to pass through. Benefits of the Patch Panel options include:
  - Enables you to connect signals to your LAN and SAN
  - Offers the lowest blade solution entry price
  - Requires no software or management
  - Provides FC signal pass-through (RJ-45 Patch Panel 2 only)

- Interconnect Switches consolidate the Ethernet signals from the server blades to a smaller set of external copper-based or fiber-based uplink ports for connection to your network. Similar to the RJ-45 Patch Panel 2, an interconnect switch option is also available to pass through individual ProLiant BL20p G3, ProLiant BL25p, ProLiant BL35p, and ProLiant BL35p FC signals. Benefits of the Interconnect Switch options include:
  - Reduces the number of network cables needed for each blade enclosure
  - Reduces the number of ports used on core network switches
  - Enables fully manageable and configurable interconnects
  - Provides investment protection through planned future GbE2 upgrades for layer 3-7 functionality and 10-GbE expandability
  - Provides FC signal pass-through (GbE2 Interconnect Switch only)

The four specific HP BladeSystem p-Class interconnect options are:

- HP BladeSystem p-Class RJ-45 Patch Panel
- HP BladeSystem p-Class RJ-45 Patch Panel 2 (with FC pass-through)
- HP BladeSystem p-Class GbE Interconnect Switch
  - Includes Fast Ethernet uplinks to the your network
  - Available with either fiber-based 1000SX or copper-based 10/100/1000T uplink ports
- HP BladeSystem p-Class GbE2 Interconnect Switch
  - Includes Gigabit Ethernet uplinks to the your network
  - Available with either fiber-based 1000SX or copper-based 10/100/1000T uplink ports and optional ProLiant BL20p G3 FC pass-through

ProLiant BL p-Class RJ-45 Patch Panel

The RJ-45 Patch Panel functions as an Ethernet pass-through and provides maximum flexibility in choosing network components. The RJ-45 Patch Panel brings all server blade NIC signals out as individual RJ-45 connectors.

Figure 16. RJ-45 Patch Panel components
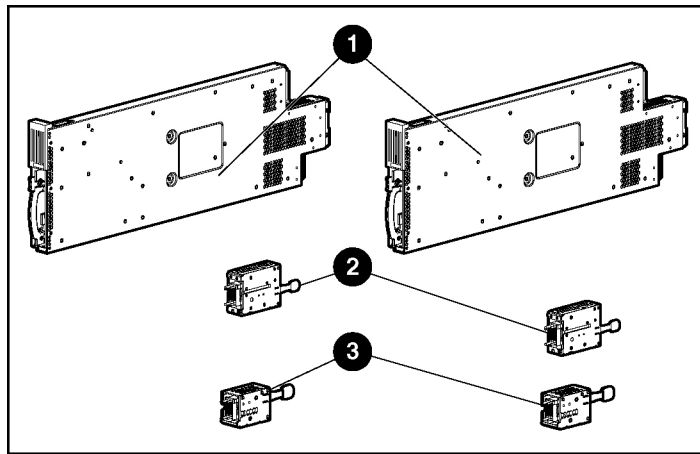
Table 6. RJ-45 Patch Panel Components

Item	Description
1	RJ-45 Patch Panels
2	RJ-45 Interconnect Module (10-connector)
3	RJ-45 Interconnect Module (6-connector)

Features of the RJ-45 Patch panel include:

- Economical solution for providing pass through of up to 32 NIC signals
- Completely passive—requires no software or management
- Fault tolerance—Ethernet signals exit the back of the server blade into the backplane in the server blade enclosure. Half of the signals from the server blade go to the left interconnect and half go to the right interconnect, providing separate redundant paths to the network(s).

ProLiant BL p-Class RJ-45 Patch Panel 2

The RJ-45 Patch Panel 2 functions as an Ethernet pass-through and provides maximum flexibility in choosing network components. The key difference between Patch Panel and Patch Panel 2 is that the Patch Panel 2 also enables pass-through functionality for FC signals from ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, and ProLiant BL35p Server Blades.

Figure 17. RJ-45 Patch Panel 2 components
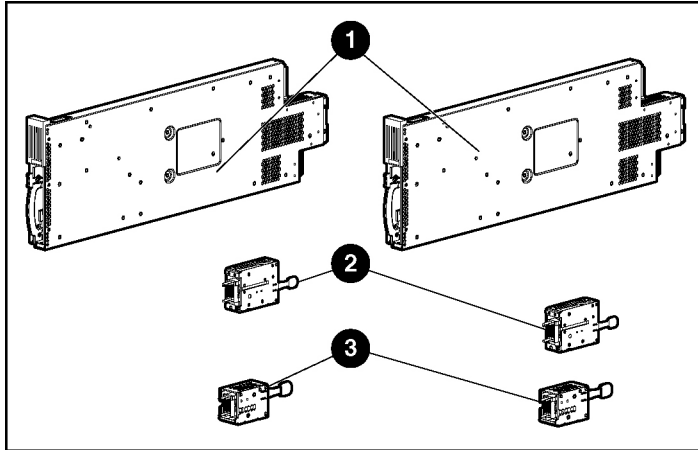
Table 7. RJ-45 Patch Panel 2 Components

Item	Description
1	RJ-45 Patch Panel 2
2	Patch Panel 2 Interconnect Module (10-connector)
3	Patch Panel 2 Interconnect Module (6-connector)

Each RJ-45 Patch Panel 2 Interconnect (a pair is included in each option kit) has eight FC SFF transceiver slots located on the front. Features of the RJ-45 Patch Panel 2 include:

- Economical solution for providing pass through of up to 32 NIC and 32 FC signals.
- Completely passive—requires no software or management.
- Fault tolerance—Ethernet signals exit the back of the server blade into the backplane in the server blade enclosure. Half of the signals from each server blade go to the left interconnect and half go to the right interconnect, providing separate, redundant paths to the network(s).
- A cable channel is located at the bottom of the RJ-45 Patch Panel 2 to allow the optical cables to be routed to the back of the server blade enclosure.
- Design enables correct optical cable bend radius while the rack door is closed.
- The ProLiant BL20p G3 Dual Port FC Mezzanine Card, the ProLiant BL25p Dual Port FC Mezzanine Card, and the ProLiant BL30p/BL35p Dual Port FC Adapter Option Kits include two SFF transceivers with LC connectors. These optical transceivers are universal. The SFF transceivers are installed in the front-panel transceiver slots located on the front of the RJ-45 Patch Panel 2.

The FC signals are routed out of the front of the RJ-45 Patch Panel 2. Each ProLiant BL20p G3 and ProLiant BL25p FC signal has its own individual SFF transceiver slot. For the ProLiant BL30p/BL35p Dual Port FC Adapter option, two FC signals share each SFF transceiver slot.

ProLiant BL p-Class GbE Interconnect Switch

The ProLiant BL p-Class GbE Interconnect Kit is designed to reduce the number of network cables needed for each server blade enclosure consolidating the server blade network adapter signals to 100 Mb/s.

The GbE Interconnect Kit includes two hot-plug, fully managed layer 2 Ethernet switches and two rear-mounted, 4-port LAN interconnect modules. The GbE Interconnect Kit is available in two options:

- C-GbE Interconnect Kit for copper-based networks
- F-GbE Interconnect Kit for fiber-based networks.

These interconnect kits are identical with exception of the LAN interconnect modules.

For more detailed information about the specific set of features supported on this switch, refer to the ProLiant BL p-Class GbE Interconnect Switch website:
http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/bl-p-interconnect-switch.html

Figure 18. GbE Interconnect Switch components
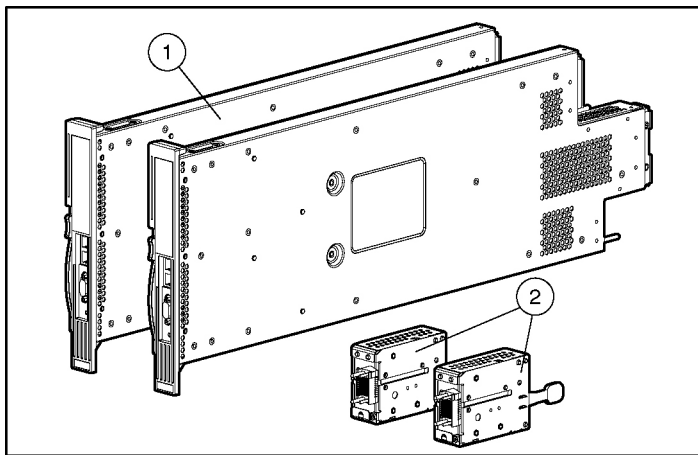
Table 8. GbE Interconnect Switch Components

Item	Description
1	GbE Interconnect Switch
2	GbE LAN Interconnect Module

ProLiant BL p-Class GbE2 Interconnect Switch

The second generation ProLiant BL p-Class GbE2 Interconnect Switch is designed to significantly reduce the number of Ethernet network cables attached to the rear of the server blade enclosure. It is designed for applications that require network adapter consolidation to 1000 Mb/s (Gigabit Ethernet), advanced network functionality, optional ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, and ProLiant BL35p FC signal pass-through, and future upgradeability to layer 3-7 switching and 10-Gb uplink bandwidth.

Figure 19. GbE2 Interconnect Switch components
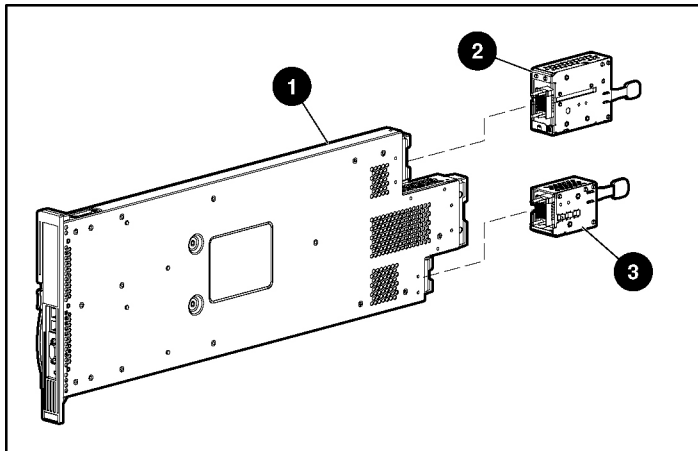
Table 9. GbE2 Interconnect Switch Components

Item	Description
1	GbE2 Interconnect Switch
2	GbE2 SAN (OctalFC) interconnect module (optional) for pass-through of FC
3	GbE2 LAN interconnect module (for Ethernet signal consolidation)

The GbE2 Interconnect Kit contains two hot-plug, fully managed, layer 2 GbE2 Interconnect Switches and two LAN interconnect modules. The GbE2 Interconnect Kit is available in two options:

• C-GbE2 Interconnect Kit for copper-based networks
• F-GbE2 Interconnect Kit for fiber-based networks

These interconnect kits are identical with exception of the LAN interconnect modules.

Each GbE2 Interconnect Switch reduces up to 16 internal server blade network NICs ports to six external Ethernet ports: four (4) ports on the rear-mounted LAN interconnect module and two ports on the switch front panel. The front panel ports are for local switch access, port mirroring, or additional uplinks to the network. Because each external Ethernet port can communicate to all the server blades, a minimum of one to all 12 external ports (per enclosure) may be used to connect to your network.

In addition to providing up to 32-to-1 network cable reduction per server blade enclosure, the GbE2 Interconnect Kit offers the following features:

- Gigabit Ethernet performance on all switch ports to support applications that require network adapter consolidation to 1000 Mb/s. Each GbE2 Kit provides 24 Gb/s full duplex external port (uplink) bandwidth per server blade enclosure.
- A multi-port 10-Gb/s fabric standard on each GbE2 Interconnect Switch supporting future layer 3-7 IP load balancing options and 10 Gb Ethernet uplink upgradeability. The switching layer and the uplink bandwidth can be independently selected within a single switch offering.
- Advanced network feature support and system availability including spanning tree per VLAN, 9k jumbo frames, RADIUS, redundant syslog servers, redundant operating system firmware images and configuration files in memory, and more.
- Optional pass-through of FC signals for ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, and ProLiant BL35p Server Blades using the GbE2 Storage Connectivity Kit.

For more detailed information about the specific set of features supported on this switch, refer to the ProLiant BL p-Class GbE2 Interconnect Switch website:
http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/bl-p-interconnect-switch.html

HP BladeSystem p-Class power subsystem

The HP BladeSystem p-Class power subsystem include the power supplies, power enclosure, and power distribution components. The HP BladeSystem p-Class system can be powered from single-phase or three-phase AC power or from –48 VDC power sources, depending on the power available.

Power supplies

The hot-plug power supplies for the HP BladeSystem p-Class solution are housed in a 3U power enclosure. Power supplies convert 200–240 VAC to –48 VDC to power server blades and interconnect switches. The power supplies are front-accessible, hot-pluggable, and can be configured redundantly. The power enclosures are rack-mounted below the server blade enclosures that they support.

HP offers two models of power enclosure that are designed to meet installation power demand and redundancy requirements, depending on the number and type of server blades you plan to deploy:

- Single-phase HP BladeSystem p-Class Power Enclosure—holds up to four hot-plug power supplies.
- Three-phase HP BladeSystem p-Class Power Enclosure—holds up to six hot-plug power supplies. Three-phase power supports more server blades and interconnect switches than single-phase power and is highly recommended for the HP BladeSystem p-Class solution.

For more detailed information about the specific power enclosure options and power planning tools, refer to the HP BladeSystem p-Class website:
http://h18000.www1.hp.com/products/servers/proliant-bl/p-class/index.html

Figure 20. HP BladeSystem p-Class Power Enclosure (three phase shown) with power supplies
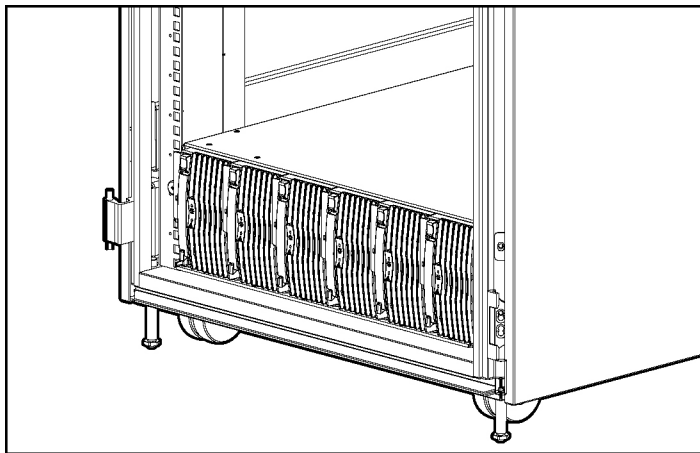
Features of the HP BladeSystem p-Class Power Enclosures and Power Supplies include:

- Availability—The power supplies support high-availability power configurations, including hot-plug redundant power supplies, redundant AC inputs, and a hot-plug power management module. The operation of the hot-plug power management module is independent of the operation of the server blades and interconnect switches.
- Investment protection—The power supplies were designed to power all current and future server blades and interconnect options. HP BladeSystem p-Class Power Supplies can be used for any combination of server blades, interconnect options, and server blade enclosures, including server blade enclosures with enhanced backplane components.
- Toolless installation and serviceability—Power enclosures are easily installed with spring-loaded rack rails and thumbscrews. Rails are common between blade and power enclosures.
- Inter-enclosure communication—The hot-plug power management module monitors the power subsystem components and regulates the power-up sequence of newly-installed server blades and interconnect switches. The power management module is cabled to the server blade enclosure management module(s) to facilitate communication of management information, such as server blade and interconnect location, power supply budget, and health status.

NOTE: When using HP BladeSystem p-Class Server Blade Enclosures with enhanced backplane components, two power enclosures are required for power redundancy.

Power distribution

Power is carried from the power supplies in the power enclosure(s) or from the local –48V facility DC power feed to the server blade enclosures through either bus bars or a bus box. Bus bars are used to support multi-enclosure deployments while the bus box is used to power a single server blade enclosure, such as in a lab or test system environment.

The bus bars are attached directly to the RETMA rails in a rack. Hinges on the bus bars provide easy rear access to the interconnect modules, network cables, server blade management modules, and power management modules.

The three specific HP BladeSystem p-Class power distribution options are:

- Scalable bus bar
- Mini bus bar
- Power bus box

Table 10 summarizes the characteristics of the power distribution solutions for HP BladeSystem p-Class server blades. Deploying a full 42U rack of ProLiant BL p-Class server blades requires using two pairs of mini bus bars.

Table 10. HP BladeSystem p-Class Power Distribution Solutions

Solution	Power Enclosures Supported	Server Blade Enclosures Supported	Maximum Rack Space Occupied
Scalable bus bar	2	5	36U
Mini bus bar	2 [1]	3	24U [2]
Power bus box	1	1	9U

1. To attach two power enclosures to a mini bus bar, the Dual Power Input Kit for Mini Bus Bar option is required.

2. Deploying a full 42U rack of HP BladeSystem p-Class server blades requires stacking two pairs of mini bus bars.

NOTE: When using an HP BladeSystem p-Class Blade Enclosure with enhanced backplane components, two power enclosures are required for power redundancy.

For more detailed information about the specific power distribution options and power planning tools, refer to the HP BladeSystem p-Class website, http://h18000.www1.hp.com/products/servers/proliant-bl/p-class/index.html

Figure 21. Scalable and mini bus bars
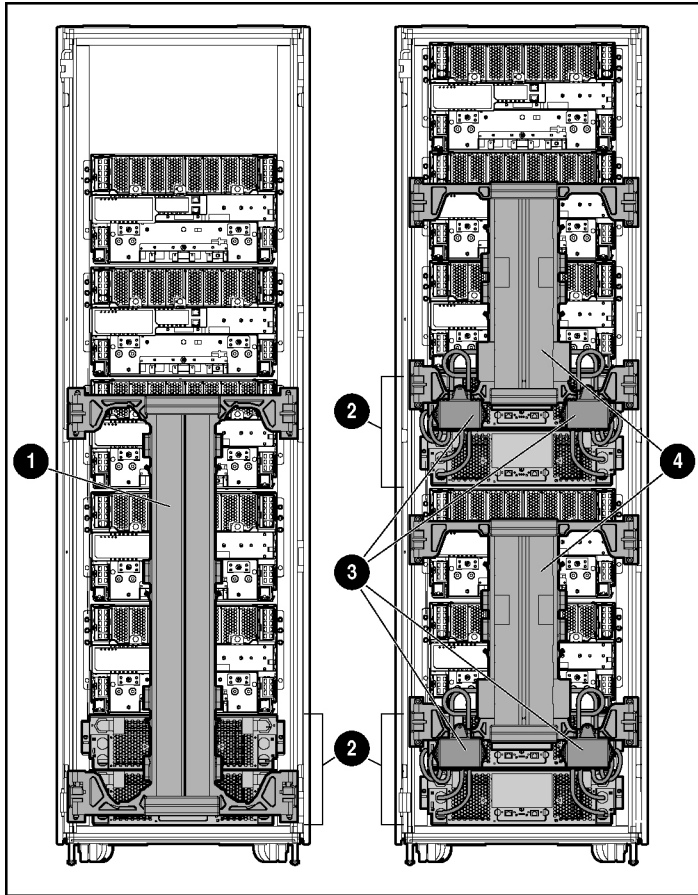
Table 11. Scalable and Mini Bus Bars

Item	Description
1	Scalable bus bars
2	Power supply enclosures
3	Dual Power Input Kit for Mini Bus Bar
4	Mini bus bars

Figure 22. Power bus box
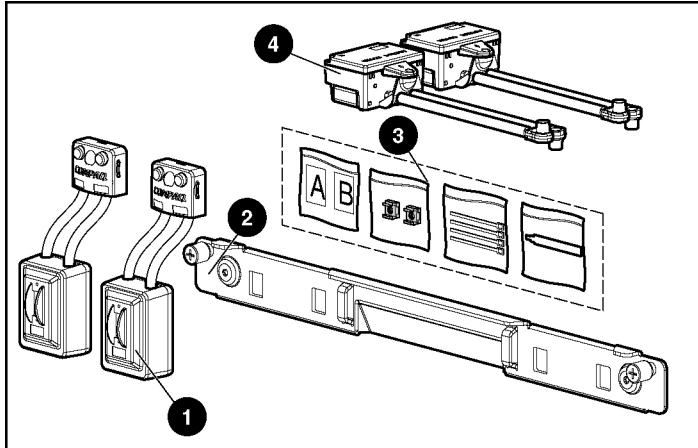
Table 12. Power Bus Box

Item	Description
1	Power bus boxes
2	Cable bracket
3	Miscellaneous hardware bags and labels
4	Dual Power Input Input Kit for Mini Bus Bar

Features

- Individually controlled—DC circuit breakers enable shutting off the power to individual server blade enclosures for safe physical access with interrupting the operation of other blade enclosures. Each server blade bay is individually fused to protect the backplanes and avoid disrupting other server blades in the enclosure. These fuses are self-resetting.
- Flexibility—Different available configurations, depending on the number of server blade enclosures supported and the available input power.

Table 10 summarizes the characteristics of the power distribution solutions for HP BladeSystem p-Class server blades. Deploying a full 42U rack of HP BladeSystem p-Class Server Blades requires using two mini bus bars.

HP BladeSystem p-Class Diagnostic Station

The HP BladeSystem p-Class Diagnostic Station enables a ProLiant BL p-Class server blade or interconnect switch to be powered up outside of a server blade enclosure for testing or diagnostic purposes. The diagnostic station contains a power supply and connectors for data transfer between the server blade or interconnect switch and a client device (such as a PC, notebook, or workstation). The client provides the keyboard, video, mouse, and diskette interface and facilitates the use of the iLO remote console.

Figure 23. Diagnostic Station
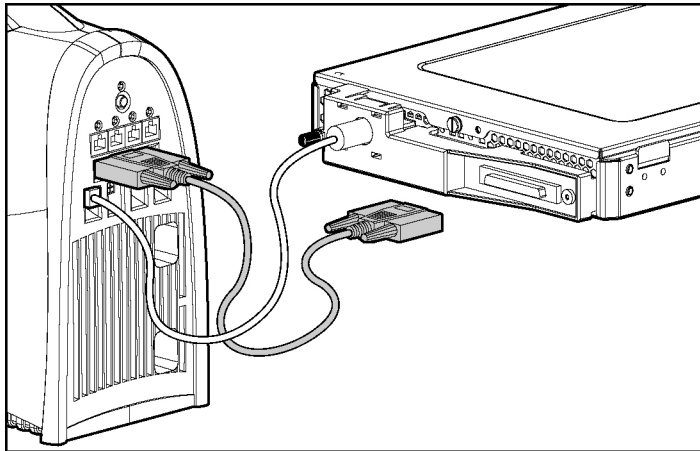
NOTE: If powering up a ProLiant BL40p Server Blade with the diagnostic station, the ProLiant BL40p Server Blade Diagnostic Station Upgrade Kit is required.

NOTE: If powering up a ProLiant BL30p or ProLiant BL35p Server Blade with the diagnostic station, the HP BladeSystem Blade Sleeve is required and only one ProLiant BL30p or ProLiant BL35p Server Blade can be powered up at one time.

The diagnostic station enables the following tasks to be performed outside of a server blade enclosure:

- Power up a server blade or interconnect switch
- Observe external LEDs
- Test NIC and interconnect switch port activity
- Configure a server blade
- Configure an interconnect switch, including VLANs and security
- Load software on a server blade
- Configure an interconnect switch to download an applicable configuration file
- Test a server blade or interconnect switch after installing an option or upgrade
- Diagnose a server blade using iLO
- Diagnose the interconnect switch using the front panel Ethernet and RS-232 ports

HP BladeSystem p-Class diagnostic and local I/O cables

HP BladeSystem p-Class systems are optimized for use with HP ProLiant Essentials RDP for software installation and deployment from a remote centralized console. Local console and I/O connections are available through diagnostic and local I/O cables.

- Diagnostic cable—A diagnostic connector is on the front of the some server blade models. This connector is used to access the iLO of a server blade by connecting a client device directly to the server blade.
- Local I/O cable—A local I/O cable can be used with server blade models that have an I/O cable icon next to the I/O port on the front of the server blade. The I/O connector provides ports for video, up to two USB devices, kernel debug, serial, and iLO Ethernet connectivity.

Figure 24. Diagnostic and Local I/O Cables and I/O cable Icon
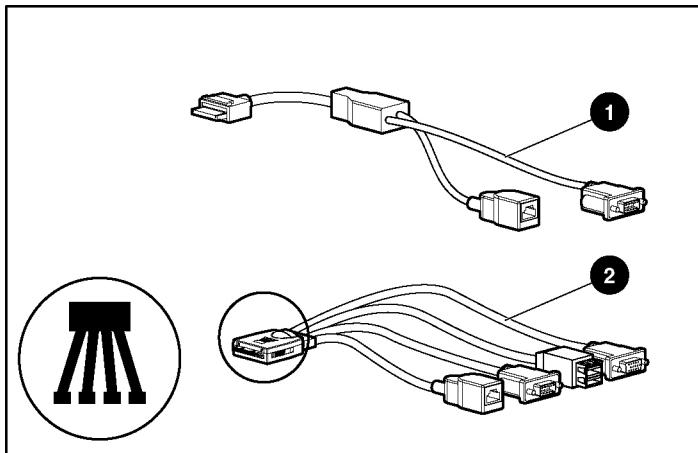
HP BladeSystem Management Software overview

HP highly recommends that you become familiar with the tools shown in Table 13, which are used to set up, configure, and manage the HP BladeSystem solution. This table serves as a getting started checklist and as a pointer to more information about these tools.

Table 13: Key Management Components

Tool	Function	Where to Find
SmartStart software	SmartStart software is used to initialize and configure one or more management servers that make up the HP BladeSystem management environment. For more information, refer to http://www.hp.com/servers/smartstart/	Located in the HP ProLiant Essentials Foundation Pack shipped with each HP BladeSystem blade enclosure
HP ProLiant Essentials Rapid Deployment Pack (RDP)	RDP is used to automate the process of deploying and provisioning server blade software and interconnect switch configuration. This enables management of multiple server blades and interconnect switches, and facilitates the development of pre-tested server builds and interconnect switch configurations. For more information, refer to http://www.hp.com/servers/rdp/	Optional product shipped with HP BladeSystem enclosures, or available for download at the RDP website. A license fee is required for use of this product.
HP Systems Insight Manager (HP SIM)	For more information, refer to http://www.hp.com/go/hpsim/	Located in the HP ProLiant Essentials Foundation Pack, shipped with HP BladeSystem enclosures.
Integrated Lights-Out (iLO)	For ProLiant BL p-Class server blades, iLO provides advanced levels of remote manageability. This guide details iLO functions in various steps of initial configuration, as well as for common operational tasks. For more information, refer to http://www.hp.com/servers/ilo/	Standard with ProLiant BL p-Class server blades.
Array Configuration Utility (ACU)	ACU is used to set up local drive controllers and RAID environments for ProLiant BL20p, ProLiant BL25p, and BL40p Server Blades. ACU is also used with the HP StorageWorks Modular SAN Array 1000 (MSA1000) storage system to set up the SAN drive controller, RAID environment, and logical drives for connection to ProLiant BL server blades. This guide provides instructions for the use of this tool during initial server setup and ProLiant BL system SAN setup.	Located in the HP ProLiant Essentials Foundation Pack, shipped with HP BladeSystem enclosures. Available for download at http://h18004.www1.hp.com/products/servers/proliantstorage/software-management/acumatrix/

Continued…

Tool	Function	Where to Find
HP BladeSystem Interconnect Switch configuration and management software	ProLiant BL Interconnect Switches provide both command line and Web-based interfaces for configuration and management of interconnect switches within server blade enclosures. For more information, refer to: HP BladeSystem p-Class GbE and GbE2 Interconnect Switches at http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch.html	Ships with HP BladeSystem p-Class Interconnect Switch Kits.
F5 Networks Big-IP Blade Controller software	The F5 Big-IP Blade Controller software provides load balancing and L3-7 traffic management functions for the ProLiant BL system environment. The software, once installed on a server blade, converts the server blade into an F5 Big-IP appliance. The *HP BladeSystem System Common Procedures Guide* provides setup instructions and uses the F5 software in several common operational tasks.	Optional software available from F5 Networks, Inc., at http://www.f5.com A license from F5 Networks is required.

HP BladeSystem p-Class operating system installation options

The operating system for a server blade may be deployed using one of the following options:

- RDP for installation of the operating system on one or many blades simultaneously from a centralized deployment console
- iLO with Advanced Pack features enables installation of an operating system using the iLO remote console and virtual floppy or virtual CD-ROM features
- Directly cable KVM and removable media devices to a server blade using the local I/O cable (not supported on all server blade models.)

Operating system support

For the most current versions of operating systems supported on the HP BladeSystem p-Class solution, visit http://www.hp.com/go/ossupport

HP ProLiant Essentials Rapid Deployment Pack

RDP provides a remote console-based method for scalable, automated server deployment without network degradation. RDP can be used to deploy from up to 100 server blades in 30 minutes. In addition, RDP for Windows (version 1.40 or later) includes the added ability to identify and deploy interconnect switches.

RDP maximizes IT resources by providing a full server build from a remote console for initial power on, automated server configuration on the fly, and installation of standard software sets based on server roles. The intuitive interface reduces the level of IT skill sets needed to deploy and redeploy ProLiant BL servers in the data center and throughout the network.

RDP features industry-standard PXE technology and multicasting technology. RDP also includes a modular set of DOS-based utilities for automating many steps in the configuration process, and it provides sample scripts for configuring server blades. A Linux edition of RDP is available and requires an additional management server. Network File System (NFS) is required if performing a Linux scripted installation.

All ProLiant BL server blades have PXE-enabled NICs. The RDP enables administrators to create a configuration script, or "server profile," for target server blades by copying and editing files of a configured source server or server blade. Administrators can then copy that configuration script and Scripting Toolkit utilities to a network share or a bootable server configuration diskette. By combining scripts for server configuration and OS installation, IT administrators can rapidly configure a new server or server blade and install the OS remotely. This remote process shrinks a typical installation time from hours or days to minutes, making it possible to scale server blade deployments to high volumes rapidly.

RDP also enables server blade "rip-and-replace" functionality. An administrator can use RDP to pre-assign a particular server profile to each server blade bay in a server blade enclosure.

For example, in order for a ProLiant BL20p G3 server blade in server blade bay 4 to run Microsoft Windows 2000 with Microsoft Internet Information Server (IIS) and some HTML scripting, the administrator simply builds that server profile for bay 4 and loads the image onto a deployment server. When a new server blade is installed into bay 4, the server blade seeks out the deployment server, downloads the pre-assigned script, and begins working immediately without intervention. If that server blade requires replacement, the new server blade automatically seeks out the deployment server and downloads the pre-assigned script to configure itself identically. In other words, the new server blade automatically takes on the role of the previous server blade, significantly reducing the time and effort needed to keep servers in production.

For more information on HP ProLiant Essentials RDP, refer to
http://www.hp.com/servers/rdp/

HP Systems Insight Manager

HP SIM helps reduce incidence of unplanned server downtime and maximizes IT staff efficiency by providing centralized fault, inventory, and configuration management for your ProLiant BL servers. HP SIM will automatically discover and draw a visual representation of HP BladeSystem enclosures and servers. It associates server blades with the appropriate enclosure and displays health status for each blade. Users can drill down for further information such as system events or detailed system inventory and can access onboard management such as the System Management Home Page and the iLO management processor. Through automated event handling, systems administrators can ensure proactive delivery of system alerts so that component failures or environmental problems do not result in unplanned server downtime.

HP SIM also helps keep blade BIOS, drivers, and agents up to date through system software version control. HP SIM will automatically download the latest firmware components from the HP website and identify systems that require updates, either by comparing target servers to a customer-defined system software baseline or to the latest software published by HP. Users can then deploy single components or collections of components to groups of systems using the "Install Software and Firmware" task.

In addition, HP SIM can manage ProLiant DL and ML servers, HP client systems, printers, storage, and other devices. It also serves as the central launching point for other management capabilities. It discovers the iLO management processor and Remote Insight Lights-Out Edition (RILOE) card, associates them with their host server, and launches their user interface from the device list. It can also perform an in-context launch of tools such as the HP ProLiant Essentials Performance Management Pack, HP WebJetAdmin, and HP Client Manager Software.

For more information on HP SIM, visit the HP website at
http://www.hp.com/go/hpsim

Integrated Lights-Out Advanced Edition

iLO Advanced Edition is included with each HP BladeSystem p-Class server blade. iLO Advanced Edition is a LAN-only, cost-effective method of enabling authorized IT personnel to have full access and control of the system from any location, independent of the state of the server blade operating system or server blade hardware.

iLO Advanced Edition incorporates functionality in its firmware to support the modular architecture of the HP BladeSystem, making it easier to deploy and manage. Because each server blade contains iLO Advanced Edition, it can query and control important aspects of its server blade environment, such as the power allocation mechanisms. Because of its localized intelligence, dedicated management network, and direct connection to the management console, iLO Advanced Edition provides the intelligent communication channels to send alerts and other management information throughout the management infrastructure. In addition to full graphical access to the display, keyboard, and mouse of the host server, the advanced functionality also includes virtual media (diskette and CD-ROM).

For more information on iLO Advanced Edition, refer to
http://www.hp.com/servers/ilo/

Smart Array RAID controllers

The Smart Array 6i Controller is a hardware-based, cost-effective RAID solution used in the ProLiant BL20p G3 and ProLiant BL25p Server Blades. The Smart Array 6i Controller is an intelligent array controller for entry-level, hardware-based fault tolerance with support for Ultra3 SCSI technology and an improved data transfer rate maximum of 160 MB/s per channel. Embedded into the server blade, the Smart Array 6i Controller provides worry-free data protection for all server blade internal storage needs. The Smart Array 5i Controller is the RAID solution used in the ProLiant BL40p.

ProLiant BL20p G3 and ProLiant BL40p Server Blades support drive mirroring (RAID 1) and drive striping (RAID 0). In addition, the ProLiant BL40p Server Blade supports RAID 5. The ProLiant BL20p G3, ProLiant BL25p, and ProLiant BL40p Server Blades also offer a Battery-Backed Write Cache option to prevent data loss during power interruptions.

For more information on the Smart Array 6i Controller, refer to
http://h18006.www1.hp.com/products/servers/proliantstorage/arraycontrollers

BIOS-Enhanced RAID on the ProLiant BL30p and BL35p

BIOS-Enhanced RAID is an availability feature that enables a ProLiant BL30p or BL35p Server Blade to boot from a secondary hard drive when the bootable partition on the primary drive is either inaccessible or is out of sync with a mirror on the secondary drive. Configuration of the BIOS-Enhanced RAID is done with the RBSU of the ProLiant BL30p or BL35p Server Blade. Refer to the *HP ProLiant BL30p Setup and Installation Guide* or *HP ProLiant BL35p Setup and Installation Guide* for more information.

HP BladeSystem p-Class Interconnect Switch Management

The HP BladeSystem p-Class GbE and GbE2 Interconnect Switches are industry-standard managed Ethernet switches that customers configure and manage in the same manner as other industry-standard Ethernet switches. To aid users during initial deployment, the interconnect switch includes a default configuration that is fully operational at initial boot.

A web browser-based interface and a command line interface with scripting capability are pre-installed in the switch firmware to configure, manage, and monitor the interconnect switches. Telnet access is also supported. Any combination of the switch ports can be disabled, enabled, configured, and monitored on a per port basis. Out-of-band and in-band access to the switch management interfaces is supported locally and remotely from anywhere on the network. Administration of the pair of interconnect switches in the server blade enclosure is possible through any uplink port, the serial port, or the two Ethernet ports conveniently located on the front panel of each switch.

The interconnect switch supports industry-standard SNMP management information bases (MIBs), HP enterprise switch MIBs, and environmental traps. The SNMP agents are pre-installed in the interconnect switch firmware. This capability allows the interconnect switch to be monitored remotely from an SNMP network management station such as HP SIM and HP OpenView. The interconnect switch may also be configured through the HP OpenView Network Node Manager.

For rapid deployment from one-to-many interconnect switches, RDP for Windows includes server-side scripting. With server-side scripting, interconnect switch scripts can be integrated in an RDP for Windows job for deployment of both server blade and switches. This is ideal for using RDP for Windows to deploy a server blade and then configure associated switch VLANs, although any scriptable interconnect switch parameter can be integrated.

The interconnect switch supports trivial file transfer protocol (TFTP) allowing a copy of the interconnect switch configuration file to be saved and downloaded either to the original switch or to a different interconnect switch. This provides another method to rapidly deploy multiple systems with similar configurations and to provide backup and restore capabilities. Configuration settings may be modified through the user interfaces or directly within the configuration file. The configuration file has a text-based format, which allows it to be directly viewed, printed, and edited.

Users with Windows or Linux-based deployment stations can perform interconnect switch firmware upgrades by using TFTP through the Ethernet port after boot-up, and by using ZModem (for GbE Interconnect Switch) or XModem (for GbE2 Interconnect Switch) through the serial interface during boot-up. The interconnect switch simplifies system upgrades by retaining its configuration after a firmware upgrade and by supporting the HP Support Paq automated firmware upgrade process for Windows deployment stations.

For more information about HP BladeSystem p-Class Interconnect Switches, refer to
http://h18000.www1.hp.com/products/servers/proliant-bl/p-class/bl-p-interconnect-switch.html

Planning for a HP BladeSystem p-Class installation

The HP BladeSystem p-Class Sizing Utility is a free, flexible, graphical tool that provides valuable information necessary to help plan and prepare a site for delivery and installation of HP BladeSystem p-Class solutions and order the necessary components for the installation. Site planning information, such as power requirements and environmental specifications, is generated based on user-defined system configuration criteria. Simply configure each server blade and blade enclosure with appropriate options, choose interconnects for each server blade enclosure, and enter data center power information.

HP BladeSystem p-Class Sizing Utility

Figure 25. HP BladeSystem p-Class Sizing Utility

Once configuration information is entered, the tool calculates:

- Power specifications
- Heat generation and cooling requirements
- Summary table of server blade components in the rack (server blades, memory, processor, etc.)
- Number of power supplies and power enclosures needed for configuration entered
- System weight
- Equipment list (refer to Figure 26)

Figure 26. HP BladeSystem Equipment List Output Example

Equipment List

This Equipment List can be copied to an excel worksheet or word document. To copy this table, select the table using the mouse.
Copy the selected table using Copy command from the Edit menu.
Go to the destination document and paste it.

Part Description	Qty	Part Number
ProLiant BL20p server blace with ONE Pentium III P1400-512K, 512MB RAM, no drives	4	230040-B21
ProLiant BL40p server blade with ONE Xeon MP1.5GHz-1MB Cache, 512MB RAM (2 x 256MB), no drives	1	293461-B21
ProLiant BL40p server blade with TWO Xeon MP2.0GHz-2MB Cache, 1GB RAM (2 x 512MB), no drives (Not available in NA)	4	293462-B21
ProLiant BL20P G2 server blade with ONE Xeon P2.8GHz, 512MB RAM (2 x 256MB), no drives	7	300876-B21
ProLiant BL20p G2 server blade with TWO Xeon P2.8GHz, 1GB RAM (2 x 512MB), no drives (Not available in NA)	8	300877-B21
ProLiant BL20P G2 server blade with ONE Xeon P2.8GHz, 512MB RAM (2 x 256MB), no drives, with FC Mezz Card	2	300980-B21
ProLiant BL20p G2 server blade with TWO Xeon P2.8GHz, 1GB RAM (2 x 512MB), no drives, with FC Mezz card (Not available in NA)	7	300981-B21
Additional 2 GB (2 x 1 GB) Memory Kit(s)	2	201695-B21
Additional DDR 512 MB (2 x 256 MB) Memory Kit(s)	6	300678-B21
Additional DDR 1 GB (2 x 512 MB) Memory Kit(s)	2	300679-B21
Additional DDR 2 GB (2 x 1 GB) Memory Kit(s)	8	300680-B21
Additional DDR 4 GB (2 x 2 GB) Memory Kit(s)	11	300682-B21
Additional Pentium III 1.4GHz	4	234277-B21
Additional Xeon MP 1.5 GHz	3	309330-B21

For more information about the HP BladeSystem p-Class Sizing Utility, refer to http://www.hp.com/products/servers/proliant-bl/p-class/info

Required input power

The HP BladeSystem has specific AC power requirements. However, DC power may be used instead if the facility has DC power available.

When using an AC power source, the HP BladeSystem requires single-phase or three-phase 200–240 VAC input power. Each power enclosure uses two 30 A.

Note: HP recommends that you use three-phase power to fully take advantage of the density benefits of the HP BladeSystem p-Class solution.

The capacity of an HP BladeSystem p-Class Power Supply varies with the voltage level of the local AC power source. Maximum capacity can only be achieved using a 240-V nominally rated power source. Lower voltages may result in lower server blade capacity. The HP BladeSystem p-Class Sizing Utility takes this into consideration. Refer to Figure 27 for the maximum output power capacity for various input voltages between 200–240 VAC.

Figure 27: Maximum output power capacity

NA/JPN Power Enclosures

80% Plug derating applied

Power Enclosure Model	Number of Power Enclosures	Total Number of Power Supplies per Side	Nominal AC Input Line Voltage (Vac)	Total DC Pwr Available (W)	Number of slots supported at X Watts per slot						
					150	175	200	225	250	275	300
Single-phase	1	1	200-240	2,930	19	16	14	13	11	10	9
		2	200	3,998	26	22	19	17	15	14	13
			208	4,158	27	23	20	18	16	15	13
	2	2	200-240	5,860	39	33	29	26	23	21	19
		4	200	7,997	53	45	39	35	31	29	26
			208	8,317	55	47	41	36	33	30	27
Three-phase	1	3	200	6,925	46	39	34	30	27	25	23
			208	7,202	48	41	36	32	28	26	24
	2	6	200	13,851	60+	60+	60+	60+	55	50	46
			208	14,405	60+	60+	60+	60+	57	52	48

International Power Enclosures

80% Plug derating applied

Power Enclosure Model	Number of Power Enclosures	Total Number of Power Supplies per Side	Nominal AC Input Line Voltage (Vac)	Total DC Pwr Available (W)	Number of slots supported at X Watts per slot						
					150	175	200	225	250	275	300
Single-phase	1	1	200-240	2,930	19	16	14	13	11	10	9
		2	220	4,398	29	25	21	19	17	15	14
			230	4,598	30	26	22	20	18	16	15
			240	4,798	31	27	23	21	19	17	15
	2	2	200-240	5,860	39	33	29	26	23	21	19
		4	220	8,796	58	50	43	39	35	31	29
			230	9,196	60+	52	45	40	36	33	30
			240	9,596	60+	54	47	42	38	34	31
Three-phase	1	3	200-240	8,790	50+	50	43	39	35	31	29
	2	6	200-240	17,580	60+	60+	60+	60+	60+	60+	58

Power Bus Box supports up to 10 slots	1-10
Mini-bus supports up to 30 slots with one Power Enclosure	11-30
Scalable supports up to 50 slots with one or two Power Enclosures	31-50
Though total is 30 slots or less, requires Scalable to support two Power Enclosures	X
Mini-bus x 2 supports up to 60 slots with two Power Enclosures, each connected to one bus	51-60
DC power greater than max required for 50 slots - Scalable with one or two Power Enclosures is max choice	50+
DC power greater than max required for 60 slots - Mini-bus x 2 with two Power Enclosures is max choice	60+

For more information about the HP BladeSystem p-Class Sizing Utility, refer to
http://www.hp.com/products/servers/proliant-bl/p-class/info

Facility DC power connection

Facility DC power requires a Facility DC Power Connection Option Kit to distribute the current through the mini or scalable bus bars to the server blade enclosures. The HP BladeSystem p-Class system requires –48 VDC with no more than ±10% voltage variance. If using facility DC power, power supplies and power enclosures are not needed for operation, because the DC Power Connection Option Kit provides power through a direct connection to the bus bars.

Power phases and power supply enclosures

The HP BladeSystem p-Class solution is designed for AC input power from either single-phase or three-phase power sources. Three-phase power supports maximum density configurations and is highly recommended.

Geography and number of AC phases dictate the appropriate model of power enclosure for the data center. Each model of power enclosure uses a different connector, as detailed in the following chart. Additionally, each power enclosure requires two separate 30 A power feeds.

Figure 28. Power enclosure connectors

AC power enclosure connectors

Table 14 shows the four models of power enclosure connectors that are available.

Table 14. Power Enclosure Connectors and Compatibility

Item	Two Circuits/ Connectors	Model	Typical Electrical Service	Compatibility
1	L6-30	NA 1-phase (239162-001)	Single-phase 208 VAC	NEMA receptacles (NA/Japan)
2	L15-30	NA 3-phase (230769-001)	Three-phase delta 208 VAC	
3	3-pin (2-pole + ground)	Intl. 1-phase (230162-421)	Single-phase 230 VAC	IEC 309 pin & sleeve connectors (International)
4	5-pin (4-pole + ground)	Intl. 3-phase (230769-421)	Three-phase "Y" 380/415 VAC	

Deployment considerations: HP BladeSystem p-Class network interconnects

Each server blade enclosure requires a pair of interconnects to provide network access for data transfer.

The RJ-45 Patch Panel, RJ-45 Patch Panel 2, GbE Interconnect Switches, and GbE2 Interconnect Switches may be mixed within the rack, but not within the same server blade enclosure. The corresponding interconnect modules may also be mixed within the rack, but not within the same server blade enclosure.

Deployment considerations: ProLiant BL p-Class RJ-45 Patch Panel and Patch Panel 2

When using the RJ-45 Patch Panel or RJ-45 Patch Panel 2 interconnects, plan for cable egress according to Table 15.

Table 15. RJ-45 Patch Panel and RJ-45 Patch Panel 2 Cable Requirements

Server Blade Series	Maximum number of Network Cables per Blade
ProLiant BL20p and ProLiant BL25p series	4 *
ProLiant BL30p and BL35p series	2 *
ProLiant BL40p series	6 *

* When using a server blade enclosure with enhanced backplane components, the iLO NIC signals are routed to the sever blade management module through a single RJ-45 connector. ProLiant BL30p and BL35p Server Blades always require the use of server blade enclosures with enhanced backplane components.

As an alternative to using the interconnect switch options, a standard network switch can be mounted above the HP BladeSystem p-Class solution to concentrate cables coming from the server blades.

The RJ-45 Patch Panel and RJ-45 Patch Panel 2 have identical network cable requirements. However, with Patch Panel 2, two optical cables with LC connectors will be required for each ProLiant BL20p G3 and ProLiant BL25p Server Blade with the Dual Port FC Mezzanine Card installed on each **pair** of ProLiant BL30p or BL35p Server Blades each with the Dual-Port FC Adapter installed. LC-to-SC optical connector converters can be used if SC connectors are preferred.

NOTE: When using a server blade enclosure with enhanced backplane components, the iLO NIC signals are routed to the sever blade management module and not to the interconnect module.

Deployment considerations: ProLiant BL p-Class GbE2 Interconnect Switches

The C-GbE2 Interconnect Kit provides 12 10/100/1000T external Ethernet ports all with RJ-45 connectors; one to all twelve ports may be used. Therefore, plan on using a maximum of 12 CAT5 network cables per server blade enclosure.

The F-GbE2 Interconnect Kit provides four 10/100/1000 T/TX/T external Ethernet ports and eight 1000SX external Ethernet ports with LC connectors; one to all twelve ports may be used. Therefore, plan on one to four CAT5 (or better) network cables and one to eight optical network cables per server blade enclosure. LC-to-SC optical connector converters can be used if SC connectors are preferred.

NOTE: When using a server blade enclosure with enhanced backplane components, the iLO NIC signals are routed to the sever blade management module and not to the interconnect module.

The optional GbE2 Storage connectivity kit provides pass-through of ProLiant BL20p G3, ProLiant BL25p, ProLiant BL30p, and BL35p FC signals. This kit includes two OctalFC interconnect module connect modules, each with eight SFF slots. The SFF transceivers with LC connectors shipped with each BL20p G3 or BL25p Dual Port FC Mezzanine Card are installed in the OctalFC SFF slots. Two optical cables with LC connectors will be required for each ProLiant BL20p G3 or ProLiant BL25p Server Blade with the Dual Port FC Mezzanine Card installed or each **pair** of ProLiant BL30p or ProLiant BL35p Server Blades with the Dual-Port FC Adapter installed. LC-to-SC optical connector converters can be used if SC connectors are preferred.

For more specific information on the ProLiant BL30p or ProLiant BL35p, and FC, see "ProLiant BL30p and ProLiant BL35p Server Blade and FC connectivity" in this document.

Table 16 lists the Ethernet and FC cable requirements.

Table 16. Ethernet and FC Cable Requirements

Interconnect	Ethernet	FC
RJ-45 Patch Panel	1 to 3 cables per ProLiant BL20p or ProLiant BL25p G3 server blade 1 to 2 cables per ProLiant BL30p or ProLiant BL35p Server Blade 1 to 4 cables per ProLiant BL40p Server Blade 1 cable for the centralized server blade management module on enclosures with enhanced backplane components	N/A
RJ-45 Patch Panel 2	Same as RJ-45 Patch Panel	2 optical cables with LC connectors for each ProLiant BL20p G3 or ProLiant BL25p Server Blade with the Dual Port FC Mezzanine Card 2 optical cables with LC connectors for each pair of ProLiant BL30p or ProLiant BL35p Server Blades with the Dual-Port FC Adapter
C-GbE Interconnect Kit	1 to 12 cables per server blade enclosure 1 cable for the centralized server blade management module on enclosures with enhanced backplane components	N/A
F-GbE Interconnect Kit	1 to 4 optical cables with LC connectors per server blade enclosure 1 to 8 cables per server blade enclosure 1 cable for the centralized server blade management module on enclosures with enhanced backplane components	N/A
C-GbE2 Interconnect Kit	1 to 12 cables per server blade enclosure 1 cable for the centralized server blade management module on enclosures with enhanced backplane components	Requires GbE2 Storage Connectivity Kit

Continued…

Interconnect	Ethernet	FC
F-GbE2 Interconnect Kit	1 to 8 optical cables with LC connectors per server blade enclosure	Requires GbE2 Storage Connectivity Kit
	1 to 4 cables per server blade enclosure	
	1 cable for the centralized server blade management module on enclosures with enhanced backplane components	
GbE2 Storage Connectivity Kit	N/A	Same as RJ-45 Patch Panel 2

Deployment considerations: ProLiant BL p-Class GbE Interconnect Switches

The C-GbE Interconnect Kit provides eight 10/100T and four 10/100/1000T external Ethernet ports all with RJ-45 connectors; one to twelve ports may be used. Therefore, plan on one to twelve network cables (CAT5 or better) per server blade enclosure.

The F-GbE Interconnect Kit provides eight 10/100T external Ethernet ports with RJ-45 connectors and four 1000SX external Ethernet ports with LC connectors; one to twelve ports may be used. Therefore, plan on one to eight network cables (CAT5 or better) and one to four optical network cables per server blade enclosure. LC-to-SC optical connector converters can be used if SC connectors are preferred.

HP BladeSystem rack specifications

HP BladeSystem enclosures are designed to fit in the following HP ProLiant and third-party racks:

- HP ProLiant 10000 Series Racks (recommended)
- ProLiant 9000 Series Racks
- Telco racks (optional telco rack kit available)

Server blade enclosures fit in 6U of panel height in a standard 19-inch wide rack. The enclosure dimensions are:

- Height–26.7 cm (10.5 in)
- Width–44.5 cm (17.5 in)
- Depth– 71.8 cm (28.25 in) deep

The following minimum rack specifications should be considered when deploying server blade systems in third-party racks and cabinets:

- Compatible with 19-in Standard EIA rail sets
- EIA rail-to-rail depth is 73.66 to 76.20 cm (29 to 30 in)
- Cabinet depth must be at least 91.44 cm (36 in) deep overall [additional minimum 8.89 cm (3.5 in) clearance from rear RETMA rail to rear door, inclusive in the 91.44 cm (36 in) overall depth]
- Ample room for top and bottom cable egress [approximately 20.32 sq cm (8 sq in) for full rack configuration with the patch panel]
- Must be capable of supporting 725.75 kg (1600 lb) for full rack configuration
- Perforated front and rear doors to accommodate front-to-back cooling
- Must have 65% open perforation on server blade enclosure doors to support airflow requirements

Quantity of server blades

For site planning, the assumed quantity of server blades should be the total number of server blades that will be deployed over the life of the installation. Planning for growth is necessary to ensure that you purchase the appropriate power subsystem components (power enclosures and bus bars) and quantities of server blade enclosures. Additionally, growth sizing enables the pre-configuration of ample power to ensure that the HP BladeSystem can be expanded as your business grows.

If you mix server blades in a rack with traditional servers and storage, you should allow for space in the rack, weight, and power of additional devices.

Configuration of server blade options (processors, memory, and hard drives)

For accurate site planning, server blade option entries should be the aggregate total number of all options to be installed in the server blades over the life of the installation. Options such as processors and hard drives can have a significant effect on power consumption, heat generation, and system weight.

For more information about the HP BladeSystem p-Class Sizing Utility, refer to

http://www.hp.com/products/servers/proliant-bl/p-class/info

HP BladeSystem enclosures

The number of server blades determines the required quantity of enclosures. Each enclosure has ten slots; two of these are reserved for interconnects and eight are designated for server blades. Table 17 shows the capacity of a server blade enclosure:

Table 17. Capacity of server blade enclosure

Server Blade Series	Maximum Number of Server Blades per Enclosure
ProLiant BL20p and ProLiant BL25p series	8
ProLiant BL30p and ProLiant BL35p series	16
ProLiant BL40p series	2

To plan for future growth, additional HP BladeSystem enclosures can be installed in advance enabling rapid server deployments as needed. The HP BladeSystem p-Class Sizing Utility summary page indicates the appropriate number of enclosures and required power for the configuration specified by the customer in the tool.

For more information about the HP BladeSystem p-Class Sizing Utility, refer to
http://www.hp.com/products/servers/proliant-bl/p-class/info

Power distribution

The HP BladeSystem p-Class Sizing Utility suggests the optimum power supply distribution method for both redundant and non-redundant power configurations.

For more information about the HP BladeSystem p-Class Sizing Utility, refer to

http://www.hp.com/products/servers/proliant-bl/p-class/info

Site recommendations

The HP BladeSystem p-Class Sizing Utility provides environmental load estimates (total DC and AC power consumption, generated heat in BTU, weight and floor space requirements) based on the configuration. This information can be useful when planning and managing the data center environment.

For more information about the HP BladeSystem p-Class Sizing Utility, refer to

http://www.hp.com/products/servers/proliant-bl/p-class/info

Power requirements

The installation of this equipment shall be in accordance with local and regional electrical regulations governing the installation of information technology equipment by licensed electricians. This equipment is designed to operate in installations covered by NFPA 70, 1999 Edition (National Electric Code) and NFPA 75, 1992 Edition (code for Protection of Electronic Computer/Data Processing Equipment). For electrical power ratings on options, refer to the rating label of the product or the user documentation supplied with that option.

When installing the HP BladeSystem, observe the following guidelines:

- The power load must be balanced between available supply branch circuits.
- The overall system current load must not exceed 80 percent of the branch circuit current rating.

For DC systems, HP BladeSystem p-Class solutions run on –48 VDC ±10%. When power supplies are included in the HP BladeSystem p-Class solution, they require 230 VAC (International) or 208 VAC (US).

Cooling and airflow

HP BladeSystem p-Class server blades use front-to-back ambient air for cooling. Therefore, the front and rear rack doors must be adequately ventilated to allow ambient room air to enter the cabinet, and the rear door must be adequately ventilated to allow the warm air to escape from the cabinet.

When server blades or rack components do not fill the entire vertical space in the rack, the gaps between the components cause changes in airflow through the rack and across the server blades. Cover all gaps in the rack with blanking panels and fill all open bays in the server blade enclosure with blanks to maintain proper airflow. HP 10000 and Compaq 9000 Series Racks provide proper server blade cooling from flow-through perforations in the front and rear doors that provide 65% open area for ventilation.

Total weight

Data on the dimensions and weights of HP BladeSystem p-Class components can be found in the *HP BladeSystem p-Class System Maintenance and Service Guide*. The same data can be determined by using the online HP BladeSystem p-Class Sizing Utility. In general, the raised floor must be capable of withstanding a uniform load of 1,220 kg/m^2 (250 lb/ft^2) or a load of 454 kg (1,000 lb) on any 6.5 cm^2 (1.0 in^2) surface, with a maximum deflection of 2.5 mm (0.1 in). For more information about the HP BladeSystem p-Class Sizing Utility, refer to
http://www.hp.com/products/servers/proliant-bl/p-class/info

Total floor space

To enable servicing and adequate airflow, observe the following spatial requirements when deciding where to install an HP, Compaq, telco, or third-party rack:

- Leave a minimum clearance of 63.5 cm (25 in) in front of the rack.
- Leave a minimum clearance of 76.2 cm (30 in) in the back of the rack.
- Leave a minimum clearance of 121.9 cm (48 in) from the back of the rack to the rear of another rack or row of racks.

System installation planning guides

When planning for an HP BladeSystem installation and setup, HP recommends that you reference the *HP BladeSystem System Common Procedures Guide* and *HP BladeSystem System Best Practices Guide*. These guides provide critical information, including the best practices, helpful hints, and suggestions for:

- Setting up and configuring HP BladeSystems, including enclosures, networks, server blades, and storage connectivity
- Setting up and configuring ProLiant tools needed for common system management tasks, such as deployment, configuration, and monitoring
- Planning and building the management environment
- Planning and building the blade system environment
  - Plan the HP BladeSystem environment
  - Building the HP BladeSystem infrastructure
  - Configuring the enclosure IP address
- Configuring the blade network environment
- Configure the switches and VLANs
- Setting up and configuring the SAN environment (optional)
- Setting up and configuring the first server blade
- Installing the operating system
- Installing and setting up additional server blades
- Configuring the connection for each server blade to SAN virtual drives (optional)

For more information on site planning, or to view the guides referenced in this topic, refer to the HP website,
http://www.hp.com/products/servers/proliant-bl/p-class/info

For more information

For more information on HP server blades, refer to the HP website,

http://www.hp.com/go/bladesystem/

364538-002, 02/2005