COMPAQ

White Paper

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Contents

Compaq ProLiant BL p-Class System Overview and Planning

Abstract: *This white paper provides an overview of the ProLiant™ BL p-Class server blade, infrastructure components, and management tools, as well as providing guidance for establishing a deployment infrastructure and power planning.*

Executive Summary

The ProLiant BL p-Class system is part of the new generation of ProLiant BL server blades and infrastructure portfolio developed for adaptive computing and optimized for rapid deployment and automated provisioning. ProLiant BL p-Class systems are high-performance, high-availability server blades for multi-tiered data center architectures. The ProLiant BL p-Class system enables dynamic scaling with its modular infrastructure. The new system protects your investment with an intelligent infrastructure that can accommodate future blades. The first blade in the ProLiant BL p-Class family is the performance dual-processor server blade designed with enterprise availability. The ProLiant BL20p server blade is ideal for multi-server applications such as dynamic Web-hosting, terminal server farm, and media streaming. The server blade features up to two Intel Pentium III 1.40-GHz processors, 4 GB ECC SDRAM max memory, integrated RAID, and two hot-plug SCSI drives. Using the ProLiant BL20p server blade, IT expenses can be reduced by managing remotely from anywhere in the world with the advanced version of Integrated Lights Out (iLO). In addition, an integrated management system and full-compatibility with the *Compaq Insight Manager™* Suite give you maximum virtual presence and control, management and health monitoring with blade visualization of all your edge-of-the-network applications.

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Notice

Introduction

The purpose of this white paper is to give an overview of the ProLiant BL p-Class system. The paper is divided into two sections:

- Overview of the system components

- Planning the system environment

Note: The ProLiant BL line also contains the ProLiant BL e-Class system architecture which is ideal for static Web-hosting, computational cluster nodes and single function application servers. However, this paper will focus on the ProLiant BL p-Class system architecture only. For information regarding the ProLiant BL e-Class system architecture refer to the *Compaq ProLiant BL e-Class System Overview and Planning white paper* at http://www.compaq.com/products/servers/proliant-bl/e-class/index.html .

The build-out of internet infrastructure and the trend to scale out within the data center have created the need for businesses to deploy greater numbers of servers, particularly for edge-of-the-network applications such as Web serving, media streaming, load balancing, caching, and firewall protection. However, adding servers increases operating costs, requires more power and space, and makes system administration more complex. As a result, requirements for IT staffing, floor space, and power are exceeding available resources.

Compaq has addressed these trends by developing a complete portfolio of modular, blade servers: the ProLiant BL Line. The ProLiant BL Line is specifically designed to address the needs of space-constrained enterprises and service providers for increased server density, rapid deployment and provisioning, and remote manageability.

ProLiant BL servers are optimized for use with the ProLiant Essentials Rapid Deployment Pack enabling automatic configuration and installation of operating systems and applications on tens or hundreds of servers simultaneously. ProLiant BL server blades include industry-leading technologies such as tool-free mechanical designs, hot-plug redundant components, and integrated management functionality.

The ProLiant BL architecture is designed to protect customer investments in two important ways:

- Providing longevity of the ProLiant BL server blade and interconnect infrastructure

- Enabling installation of ProLiant BL server blades in standard racks along with legacy servers and storage

Compaq designed the ProLiant BL line specifically for customers operating in a multi-tiered environment requiring everything from power-efficient, front-end to high-performance SMP blades. ProLiant DL and ProLiant ML servers offer a wide range of industry-standard solutions to meet customer needs. ProLiant BL servers are therefore not a replacement for ProLiant DL and ProLiant ML server solutions, but a complementary addition to the ProLiant product family, targeted at specific customer needs.

Overview of the ProLiant BL p-Class System Components

The following illustration shows a ProLiant BL p-Class system installed in a 42U rack.
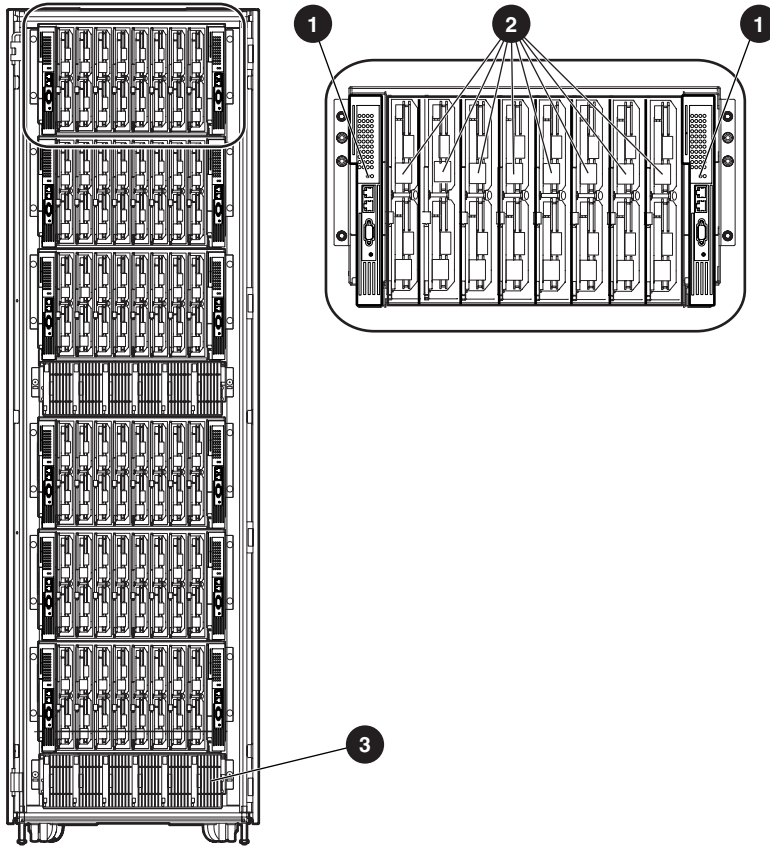
Figure 1. Server and power components in a 42U rack with ProLiant BL p-Class system installed

Table 1. Server and power components

Item	Description
1	ProLiant BL p-Class interconnects (2) in a ProLiant BL p-Class server blade enclosure (interconnect switch shown)
2	ProLiant BL20p server blades (8) in a ProLiant BL p-Class server blade enclosure
3	ProLiant BL p-Class power enclosure with hot-plug power supplies

The ProLiant BL p-Class architecture is comprised of several different components. The following table provides the required component categories.

Note: In order to design a successful configuration, at least one component from each category is required.

Table 2. ProLiant BL p-Class System Required Components

| Required Components	Function	Options
ProLiant BL20p server blade	ProLiant BL20p server blades feature up to two Intel Pentium III 1.4-GHz processors, four DIMM slots for up to 4-GB max memory, two hot-plug Ultra3 SCSI hard drive bays, Smart Array 5i RAID controller with an optional battery-backed write cache, and Integrated Lights-Out Advanced.	SKUs: Single Intel Pentium III 1.4-GHz processor, 512-MB ECC SDRAM -or- Two Intel Pentium III 1.4-GHz processors, 1-GB ECC SDRAM (Model not available in North America) **Note:** Additional options include processors, memory, and NIC
ProLiant BL p-Class server blade enclosure	ProLiant BL p-Class server blade enclosure is 6U and holds up to eight ProLiant BL20p server blades and two interconnects. Server blades and interconnects blind mate into 6U server blade enclosures for network connection and power.	ProLiant BL p-Class server blade enclosure with ProLiant Essentials Rapid Deployment Pack *trial* -or- ProLiant BL p-Class server blade enclosure with, eight ProLiant Essentials Rapid Deployment Pack *licenses*
ProLiant BL p-Class interconnect	Each ProLiant BL p-Class server blade enclosure requires a pair of interconnects for redundancy. The interconnects collect the NIC signals from the servers to the customer network.	ProLiant BL p-Class RJ-45 patch panel (with 32 RJ-45 connectors) -or- ProLiant BL p-Class C-GbE Interconnect Switch (copper) kit (with 4 RJ-45 10/100/1000 T/TX/T and 4 RJ-45 10/100 T/TX uplink connectors) -or- ProLiant BL p-Class F-GbE Interconnect Switch (fiber) kit (with 4 LC 1000 SX and 4 RJ-45 10/100 T/TX uplink connectors) **Note:** Interconnect switches reduce number of network cables per server blade enclosure from 32 to as little as 1

continued

Table 2. ProLiant BL p-Class System Required Components *(continued)*
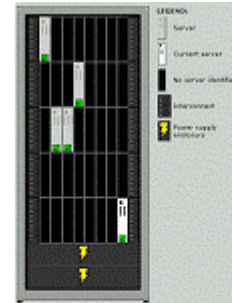
3U power enclosure with power supplies (not needed if using facility -48 V DC +/- 10%)	The ProLiant BL p-Class has shared external, redundant hot-plug power.	Single-phase power enclosure with four power supplies (NA and international versions) -or- Three-phase power enclosure with six power supplies (NA and international versions) **Note:** To deploy a full rack of ProLiant BL p-Class servers two power enclosures are needed and 3-phase power must be used
6U power distribution	Power is distributed from the power enclosure to the server blade enclosures via either scalable or mini bus bars attached to the back of the rack or a power bus box. Both ProLiant BL p-Class bus bars and the ProLiant BL p-Class power bus box come in pairs (A and B) to provide power redundancy.	ProLiant BL p-Class scalable bus bar—supports up to 5 server blade enclosures and 2 power enclosures -or- ProLiant BL p-Class mini bus bar—Supports up to 3 server blade enclosures and 1 power enclosure **Note:** To deploy a full rack of ProLiant BL p-Class servers 2 mini bus bars are needed -or- ProLiant BL p-Class power bus box—connects 1 power enclosure to 1 server blade enclosure **Note:** The power bus box is mainly used for evaluation purposes

Note: Power requirements for a ProLiant BL p-Class system: 200 V – 240 V AC, 30 amp or facility DC –48V +/-10%

Key Benefits

- Rapid deployment/redeployment saves valuable time

    - Once the infrastructure is in place, server blades are installed and ready for automated provisioning within seconds

    - Single-sided easy access to most pluggable components

    - Dynamic scaling—add more server blades or power supplies without powering down the system

- Quickly configure server blades using ProLiant Essentials Rapid Deployment Pack software

    - Configure 2-100 server blades in 30 minutes using multicasting

    - Rip and replace—replace one blade with a new blade and server role is automatically restored to new blade

- Reduces IT headcount by managing remotely

    - Integrated Lights-Out (iLO) Advanced ships standard on every ProLiant BL p-Class server blade. In addition to full graphical access to the host server's display, keyboard, and mouse, the advance functionality also includes virtual diskette capability.

    - Preboot execution environment (PXE) technology enhances remote access by installing and configuring operating systems to boot remotely

    - Fewer IT staff are needed to manage a large number of server blades because of the enhanced management features and ease of deployment.

- Redundant features to provide piece of mind

    - 1+1 redundant power supplies—redundant AC power feeds into power enclosures and redundant DC power feeds from power enclosure to server blade enclosures

    - Two hot-plug SCSI hard drive bays and integrated RAID (Smart Array 5i) on every server blade (Battery-backed write cache is optional.)

    - Redundant NIC capability

    - Redundant ROM on each server blade

    - Redundant hot-pluggable interconnect switch option

- Innovative design cuts cabling up to 80% compared to traditional 1U servers

    - As few as one network cable per eight server blades using the ProLiant BL p-Class GbE Interconnect Switch

    - Designed for headless management—no keyboard, video, or mouse cables

    - Fewer power cables—centralized hot-plug power provides power cable consolidation
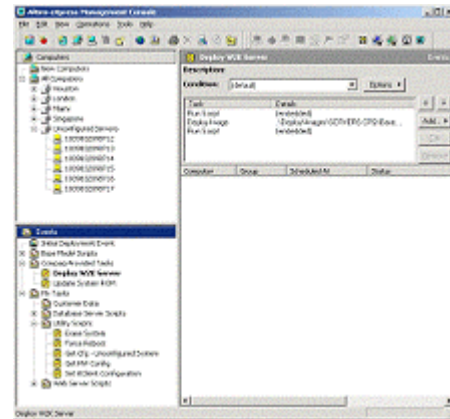
- Increased density to save valuable floor space

    - 48 dual-processor server blades can fit into a 42U rack.

    - Density is increased without sacrificing important high-availability server features like hot-plug SCSI drives and redundant power.

- Take total control with a visualization tool that keeps a pulse on total rack status with graphical location detail

    - Insight Manager 7 is an easy-to-use, flexible, scalable and secure solution for managing Compaq servers, desktops, workstations, and portables. It provides rapid access to detailed fault and performance information

    - Insight Manager 7 provides visualization of all blades at an enclosure and rack level for ProLiant BL blade servers

p-Class rack in Insight Manager 7 with physical detail view

- Fits into your current environment

    - Fits into Compaq, telco, and third-party racks that meet minimum rack requirements Refer to "System Rack" for rack requirements)

    - Mixes with traditional servers and storage

- Designed to protect your investment

    - ProLiant BL p-Class dual-processor and future quad-processor server blades can fit into 6U server blade enclosures and can be mixed in the same enclosure.

    - Power headroom was designed into the p-Class architecture to accommodate future processors so there is no need to repurchase power infrastructure for next generation server blades

    - SAN support will be available on the next generation performance 2P blades and the future 4P blades. These blades will be introduced in the first quarter of 2003.

Hardware Components
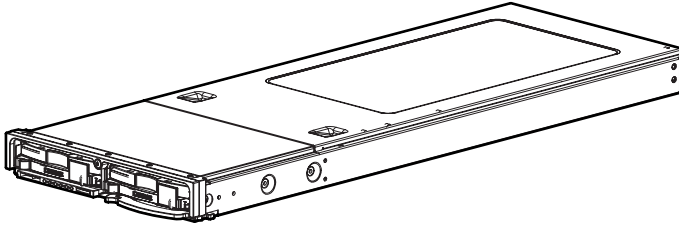
ProLiant BL20p Server Blade

Figure 2. ProLiant BL20p server blade

Description

The ProLiant BL20p server blade is ideal for use as a high-performance front-end server or for:
- Web-hosting
- E-Commerce
- Computational cluster
- Terminal Server Farm
- AV, Streaming Media
- Messaging front-end and mobility

This server has many of the same core features (chipset and architecture) as the ProLiant DL360 G2 server. ProLiant BL20p server blades fit within the 6U server blade enclosure. ProLiant BL20p server blades fit within the 6U 10-bay server blade enclosure, that can hold eight server blades and two interconnects.

Features

- Processor—Server blades include up to two 1.4-GHz Intel Pentium III processors with 512 K Level-2 cache, 133-MHz system bus

- Chipset—Server blades offer the ServerWorks HE Superlite chipset.

- Hard drives and controller—Two universal hot-plug SCSI hard drives offer up to 144-GB capacity and are connected to next-generation SCSI Smart Array 5i controllers with Ultra3 performance and optional battery-backed write cache

- Memory—Four DIMM slots have a maximum capacity of 4 GB of 133-MHz, ECC SDRAM. Server blades feature 2 x 1 interleave memory for added performance. DIMMs must be added in pairs.

- Management—Integrated Lights-Out (iLO) Advanced functionality ships standard on every ProLiant BL p-Class server blade. In addition to full graphical access to the host server's display, keyboard, and mouse, the advance functionality also includes virtual media. Preboot execution environment (PXE) technology enhances remote access by installing and configuring operating systems to boot remotely.

- Network adapters—Each server blade has four 10/100 Ethernet connections, three NC3163 Fast Ethernet NIC PCI 10/100 with full WOL (Wake On LAN) and one additional 10/10000T network adapter dedicated to iLO. One NC3163 is enabled with PXE. Two NC3163 network adapters are upgradeable to 10/100/1000T using the Dual Gigabit Ethernet NC7780 option kit

- LEDs—The ProLiant BL20p server blade has the same front panel LEDs as other ProLiant servers. Each server blade has the following LEDs:

  - 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 densely loaded rack.

- Headless—Keyboard, video, mouse, and diskette drive are available virtually via iLO.

- Density—Up to 48 ProLiant BL20p server blades can fit into a 42U rack.

- Pluggable—Server blades blind mate into the server blade enclosure backplane for network and power connections. One handle locks blade in place.

- Diagnostic cable connector—A diagnostic connector is on the front of each server blade. This connector is used to access iLO by connecting a PC directly to the server blade. Each server blade enclosure ships with two diagnostic cables.
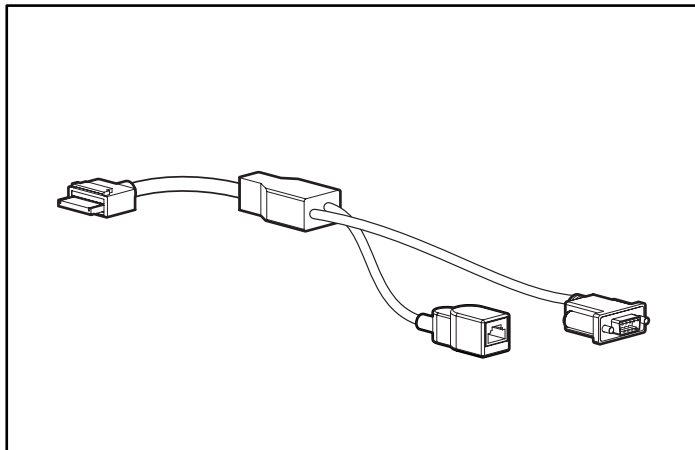

Figure 3.   Diagnostic Cable

- ProLiant BL p-Class diagnostic station—enables you to power up a ProLiant BL p-Class server blade or GbE Interconnect Switch outside of the rack environment. The diagnostic station contains a power supply that provides power to the server blade or interconnect switch and a system board with connectors for data transfer between the server blade, or interconnect switch, and a client PC (a laptop, desktop, or workstation). The client PC provides the keyboard, video, mouse, and diskette interface and facilitates the use of the iLO Remote Console.

  The diagnostic station enables you to perform the following tasks outside of the rack:

  - 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 server blade issues using iLO

  - Diagnose interconnect switch problems using the front panel 10/100 and RS-232 ports or any uplink port
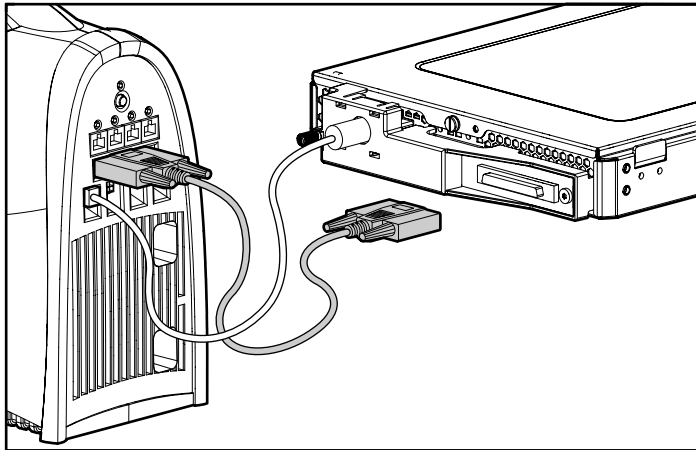

Figure 4.   Diagnostic station
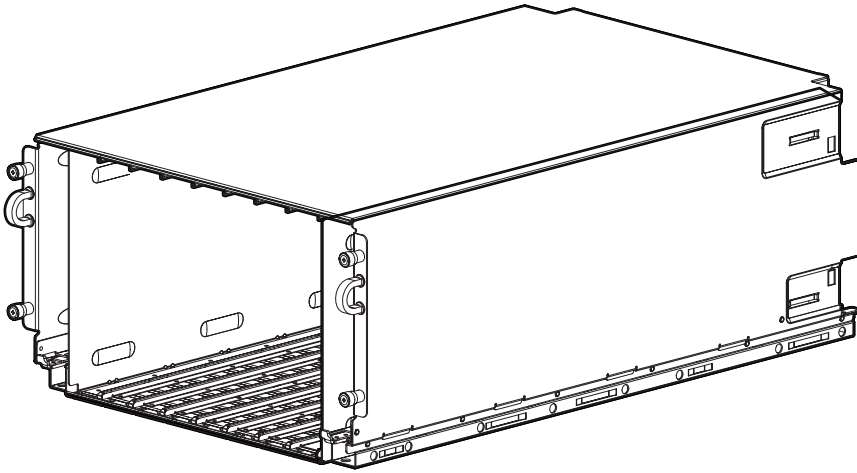
ProLiant BL p-Class Server Blade Enclosure

Figure 5.   Server blade enclosure

Description

ProLiant BL20p server blades are housed in a 6U server blade enclosure. The server blades blind mate into the server blade enclosure backplane for power and data connections.

Each 6U server blade enclosure has eight server blade bays and two interconnect bays. The two interconnect bays are the outermost slots and are occupied either by RJ-45 patch panels or an interconnect switch with two 10/100/1000T uplinks for cable reduction. The remaining eight bays can support up to eight ProLiant BL20p server blades. Up to six server blade enclosures can fit in a 42U rack.

Features

- Dimensions—Server blade enclosures are 6U high, standard 48-cm (19-inch) wide, and 73.30-cm (28.86-inch) deep.

- Toolless installation—Server blade enclosures are easily installed with spring-loaded rack rails and thumbscrews. Rack rails are common between the ProLiant BL p-Class server blade enclosure and the ProLiant BL p-Class power enclosure, as well as with the ProLiant BL e-Class architecture.

- Removable backplanes—Toolless removal of power and data backplane is possible without removing the server blade enclosure from rack or removing blades from the enclosure.

- Forward compatible—Next-generation ProLiant BL p-Class 4P server blades can fit into 6U server blade enclosures and can be mixed in the same enclosure.

- Server blade management module—Attached to the back of each 6U server blade enclosure is a server blade management module. This pluggable microcontroller card polls server blades in the server blade enclosure through the enclosure backplane by communicating with the iLO ASIC on each blade. The management module reports thermal, power, and protection fuse events to all server blades in the server blade enclosure; provides asset and inventory information; and enables each enclosed server blade to communicate with other server blade enclosures.

- Rack requirements:

  - Compaq 10000 Series racks (recommended)

  - Compaq 9000 Series racks

  - Compaq 7000 Series racks with door extension and perforated door panels

  - Telco racks

  - Some third-party racks. Refer to "Planning for a ProLiant BL p-Class Installation" for third-party rack requirements.

ProLiant BL p-Class Interconnects

Each 6U server blade enclosure requires a pair of interconnects. These interconnects blind mate into the 6U server blade enclosure and collect NIC signals from all of the server blades inside of the server blade enclosure and bring them out as RJ-45 connections.

There are several types of interconnects:

- ProLiant BL p-Class RJ-45 patch panels

- ProLiant BL p-Class interconnect switch (available as either fiber-based 1000SX or copper-based 10/100/1000T ports)
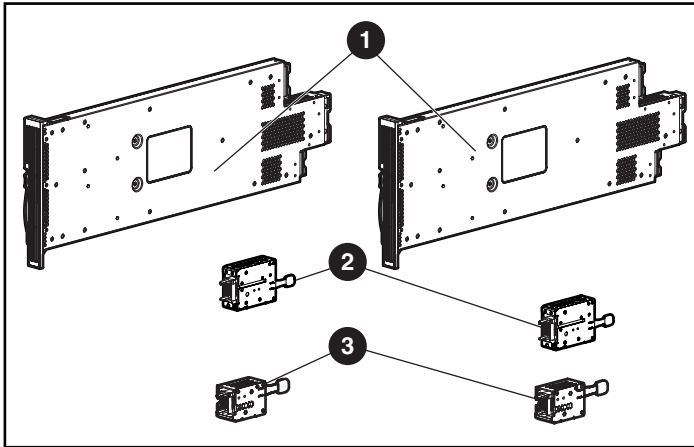
ProLiant BL p-Class RJ-45 Patch Panels

Figure 6. RJ-45 Patch Panel components

Table 3. RJ-45 Patch Panel Components

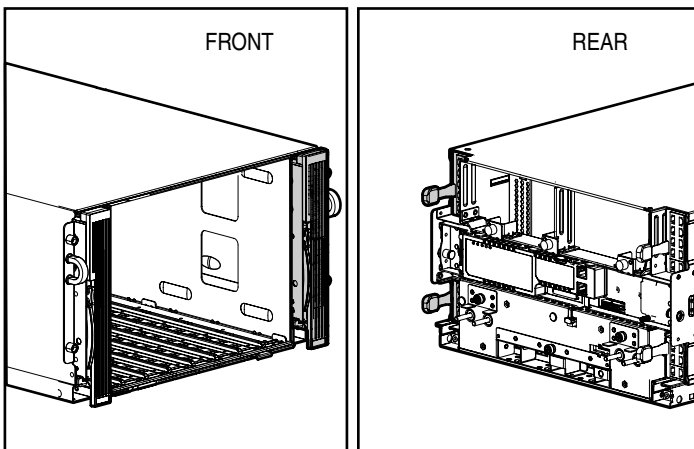| Item	Description
1	RJ-45 Patch Panels
2	RJ-45 Interconnect Module (10-connector)
3	RJ-45 Interconnect Module (6-connector)

Figure 7. RJ-45 Patch Panel locations

Description

The RJ-45 Patch Panels function as an Ethernet pass-through only for customers who want to have flexibility in choosing network switches. The patch panel brings all NIC signals out as separate RJ-45 connections. A server blade enclosure full of ProLiant BL20p server blades has 32 RJ-45 connections.

Features

The RJ-45 Patch Panel offers 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 the other half go to the right interconnect, providing separate paths for the redundant network ports.

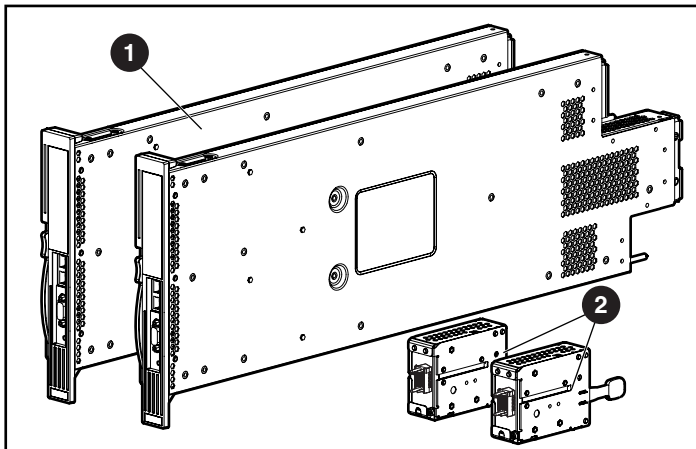## *ProLiant BL p-Class GbE Interconnect Switch*

Figure 8. GbE Interconnect Switch components

Table 4. GbE Interconnect Switch Components

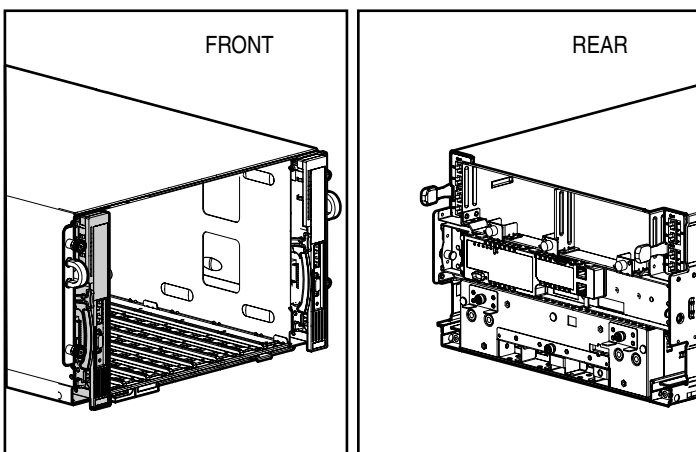| Item	Description
1	GbE Interconnect Switch
2	GbE interconnect module

Figure 9. GbE Interconnect Switch locations

Description

The ProLiant BL p-Class GbE Interconnect Switch is designed to reduce the number of network connections from 32 to as little as 1 per server blade enclosure. The interconnect switch uses switching technology with VLAN capability. The GbE uplinks are available as either fiber-based 1000SX or copper-based 10/100/1000T ports The GbE Interconnect Switch offers several advanced features.

Features

- Pluggable—The GbE Interconnect Switch is a pluggable component of the ProLiant BL p-Class server blade enclosure with the ability to retain the switch configuration. When removing the switch option, there is no need to disconnect the networking connections from the server blades or the uplink ports.

- Reduced cabling—Each GbE Interconnect Switch (total of two per server blade enclosure) reduces sixteen 10/100T ports to two 10/100/1000T and two Gigabit Ethernet uplink ports. The customer is not required to use all uplink ports and may use and configure one or more uplink ports as desired—providing up to a 32 to 1 reduction in the number of networking connections and cables per server blade enclosure.

- Fiber- and copper-based uplinks—The gigabit uplinks are available as either fiber-based 1000SX or copper-based 10/100/1000T Ethernet ports.

- Integrated high availability features including:

  - Pluggable with the capability to retain configuration

  - Redundant GbE Interconnect Switches per server blade enclosure

  - Redundant power inputs and cooling per each GbE Interconnect Switch

  - Redundant data paths to and from each GbE Interconnect Switch to each server blade

  - Redundant data path cross connections between the two GbE Interconnect Switches

  - Two pairs of redundant uplink ports per each GbE Interconnect Switch

  - Spanning tree protocol support to provide loop-free path redundancy

- Pre-configured—The GbE Interconnect Switch is completely pre-configured for immediate use. It plugs directly into the 6U chassis and does not occupy a server blade slot or use any additional rack height

- Industry-standard design—The interconnect switch is industry standard and does not utilize proprietary network protocols. It is compatible with industry standard switches such as those from Cisco, Extreme, 3Com, etc.

- Enterprise-class features—The GbE Interconnect Switch includes a complete set of enterprise-class network features. It offers tagged VLAN capability, EtherChannel compatible trunking, QoS, IGMP snooping, spanning tree protocol, port mirroring, TFTP client, flow control, and many other industry-standard network technologies. The interconnect switch includes a Web-based interface, a menu driven console, and a command line interface (planned for 4Q02 as a free upgrade); Telnet, SNMP, and RMON are further supported.

Note: If using the GbE Interconnect Switch, the supported Ethernet network speed from server blades to the interconnect switch is 10/100 Mbps (the downlink port speed). If the NC7780 Gigabit Upgrade Module is added to a server blade upgrading two of the 10/100 network adapters to gigabit, the interconnect switch automatically auto-negotiates the speed to 10/100 Mbps. Therefore, if gigabit speed from the server blade network adapters is required, it is recommended that the patch panel option be used. This downlink port auto-negotiation is independent of the speed from the interconnect switch to the customer's network (the uplink port speed). In all cases, each interconnect switch provides two 10/100 and two gigabit uplink ports to be used by the customer as desired.

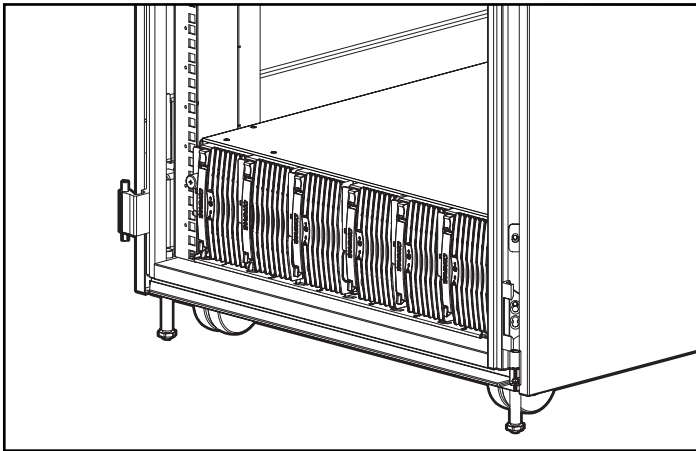## ProLiant BL Power Enclosure with Power Supplies

Figure 10. ProLiant BL power enclosure with power supplies

Description

Hot-plug power supplies for the ProLiant BL p-Class infrastructure are housed in a ProLiant BL power enclosure. Power supplies convert 200VAC-240VAC to -48VDC to power server blade enclosures. The power supplies are front-accessible, hot-plug, and 1 + 1 redundant. The power enclosures must be mounted in a rack below the server blade enclosures that they power.

There are two models of the power enclosure offered:

- Single-phase power enclosure—This enclosure holds a maximum of four hot-plug power supplies and can support up to one-half a rack of ProLiant BL p-Class server blades redundantly.

- Three-phase power enclosure—This enclosure holds a maximum of six hot-plug power supplies. One power enclosure can support up to one-half a rack of ProLiant BL p-Class server blades redundantly. Two power enclosures can support a full 42U rack of ProLiant BL p-Class server blades redundantly.

Features

- Redundant—The ProLiant BL p-Class architecture supports dual power enclosures. Each 3U power enclosure is attached to two power circuits to enable redundant power feeds (the equivalent of dual power cords). Each 3U power enclosure must be able to support the full load of the rack in case of AC failure. Therefore, to ensure redundancy, the draw on each power feed must be limited to half its maximum power rating.

- Built-in power headroom—The power supplies were designed to supply enough power for next generation server blades.

- Toolless installation—Power enclosures are easily installed with spring-loaded rack rails and thumbscrews. Rails are common between the 6U server blade enclosure and the 3U power enclosure.

- Power management module—Each 3U power enclosure includes a self-contained microcontroller that monitors the power supplies and the power supply enclosure. The power management module is responsible for determining that adequate power is available for new server blades during the power-up sequence. The power management module can be connected to the server enclosure management modules to communicate management information, such as blade location, power supply budget, status, etc.

  The power management module is required for the power subsystem to operate in normal mode. Failure of the power subsystem monitor does not cause a power interruption to the server blades.

ProLiant BL P-Class Power Distribution

Description

In the ProLiant BL p-Class infrastructure, redundant -48 VDC power (from the power enclosures or your own –48V DC power) is distributed from the power enclosures to the server blade enclosures through the bus bar system. Hinges attach the ProLiant BL bus bars to the RETMA rails in a rack. The bus bars swing open from the center to enable easy rear access to the server blades and network cables. Power is distributed redundantly through independent A- side and B-side bus bars.

Three different power distribution solutions are available depending on the number of server blade enclosures planned for the rack:

*   ProLiant BL p-Class scalable bus bar

*   ProLiant BL p-Class mini bus bar
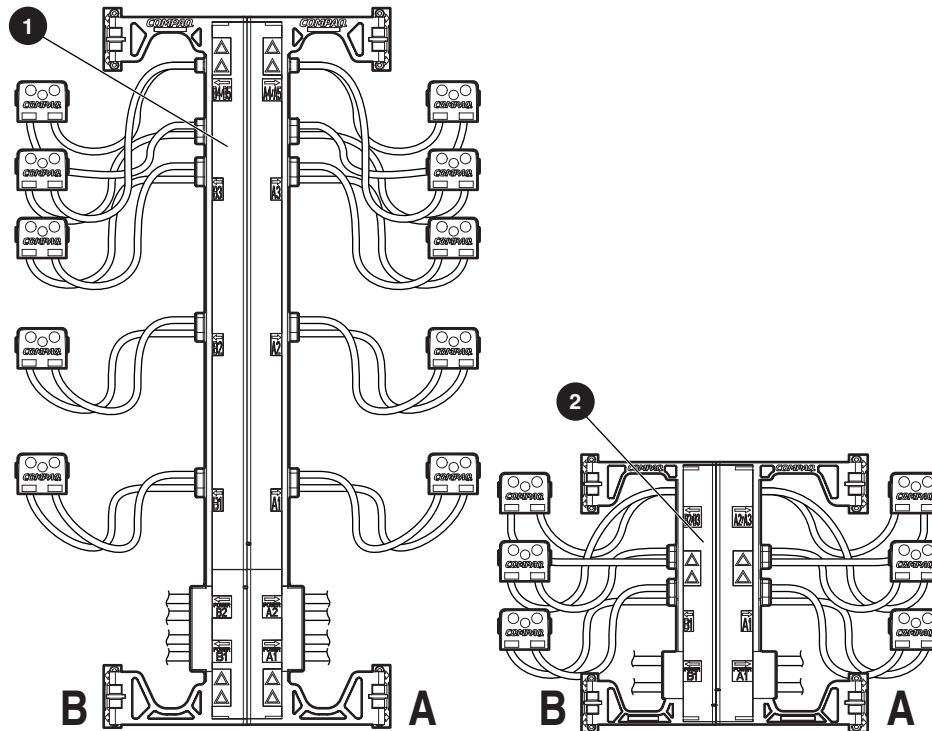
*   ProLiant BL p-Class power bus box

Figure 11.   A- and B-sided scalable and mini bus bars

Table 5. Scalable and Mini Bus Bars

Item	Description
1	Scalable bus bars
2	Mini bus bars
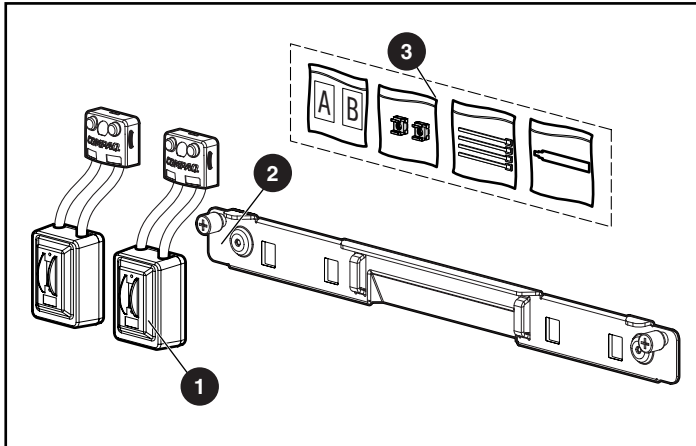
Figure 12. Power bus box

Table 6. Power Bus Box

Item	Description
1	Power bus boxes
2	Cable bracket
3	Miscellaneous hardware bags
Not shown	Rack template

Features

- Completely redundant solution—The ProLiant BL p-Class power infrastructure (power enclosures, bus bars, and cabling) is right-left redundant. The right side, or "A" side, is a mirror image of the left, or "B" side, when facing the rear of the rack. Each side has its own AC feed and DC distribution path. Half of the power supplies in the 3U power enclosure provide power through the B-side bus bar and the other power supplies in the power enclosure provide power through the A-side bus bar.

- Individually controlled—On both the A-side bus bar and the B-side bus bar, there is a DC circuit breaker at each 6U server blade enclosure to enable shutting off the power to individual server blade enclosures for safe physical access. Each ProLiant BL20p server blade is individually fused so that a blown fuse cannot bring down other server blades in the server blade enclosure. These fuses, located on the power backplane of the server blade enclosure, are self-resetting.

- Flexibility—The power distribution solution comes in three configurations, depending on the number of server blade enclosures to be installed and the power input needed:

  - The scalable rack bus bar supports one or two 3U power enclosures and up to five 6U server blade enclosures. This bus bar solution enables future growth and flexibility in two ways: customers can deploy this solution initially with less than the maximum supportable configuration, and then add ProLiant BL p-Class server blades and server blade enclosures as the computing needs grow, or customers can mount other devices (such as switching hardware) in the same rack above the 6U server blade enclosures.

- The mini bus bar supports one 3U power enclosure and up to three 6U end server blade enclosures. This solution also offers flexibility because other devices can be mounted above it in a rack. In fact, a second mini bus bar configuration can be installed in the space above the first one to provide support for a full 42U rack of ProLiant BL p-Class server blades.

- The power bus box solution provides direct connection from one 3U power enclosure to one 6U server blade enclosure (primarily used for evaluating the ProLiant BL architecture).

The following table summarizes the characteristics of the power distribution solutions for ProLiant BL p-Class server blades. Deploying a full 42U rack of ProLiant BL p-Class blades requires using two mini bus bars.

Table 7. ProLiant BL Power Distribution Solutions

Solution	Power Enclosures Supported	Server Blade Enclosures Supported	Max. Rack Space Occupied
Scalable Bus Bar	≤ 2	≤ 5	36U
Mini Bus Bar	1	≤ 3	21U
Power Bus Box	1	1	9U

Software Components

Operating System Support

ProLiant BL products support the most current versions of these top-tier operating systems:

- Microsoft Windows 2000 Advanced Server

- Microsoft Windows .NET Server

- Linux Red Hat

- Linux SuSE

ProLiant Essentials Rapid Deployment Pack

The ProLiant Essentials Rapid Deployment Pack provides a remote console-based method for scalable, automated server deployment without network degradation. IT administrators can use the Rapid Deployment Pack to deploy from one to 100 server blades in 30 minutes.

The ProLiant Essentials Rapid Deployment Pack integrates two powerful software products: Altiris eXpress Deployment Server and *SmartStart*™ Scripting Toolkit. Altiris eXpress Deployment Server features industry-standard PXE technology and multicasting technology. The Scripting Toolkit 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.

All ProLiant BL server blades have PXE-enabled NICs. The Rapid Deployment Pack enables administrators to create a configuration script, or "server profile," for target ProLiant BL 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.

The ProLiant Essentials Rapid Deployment Pack also enables ProLiant BL "rip-and-replace" functionality. An administrator can use the Rapid Deployment Pack to pre-assign a particular function or "role" to each server blade bay in a server blade enclosure.

For example, in order for a ProLiant BL20p server blade in server blade bay number 4 to run Microsoft Windows 2000 with Microsoft Internet Information Server (IIS) and some HTML scripting, the administrator simply builds that image, or profile, for bay 4 and loads the image onto a deployment server. When a 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 local 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.

The ProLiant Essentials Rapid Deployment Pack maximizes customers' 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.

Insight Manager 7 Service Pack 1.1

Insight Manager 7 Service Pack 1.1 is focused on delivering advanced visualization capabilities for the ProLiant BL p-Class server blades. Insight Manager 7 Service Pack 1 extends the capabilities of Insight Manager 7 with new capabilities for managing blade servers, a new reporting engine, and discovery filters.

Insight Manager 7 SP1 delivers fault management and system software maintenance to the blade infrastructure. Systems administrators familiar with Insight Manager 7 will be able to take advantage of the same features used to manage ML and DL servers to manage their new ProLiant BL system.

Insight Manager 7 SP1 delivers the following blade-specific benefits:

- Provides the Blade Server Visual Locator that properly identifies the location of each blade server within its enclosure and rack

- Extends pre-failure alerting, version control, and remote update capabilities to blade server environment.

- Correlates events generated by shared infrastructure components ensuring systems administrators receive a single event from each affected enclosure as opposed to a single event from each affected blade server.

- One click access to virtual presence and control provided by Integrated Lights-Out and Integrated Administrator

Integrated Lights-Out Edition

Once an option, the Integrated Lights-Out (iLO) is now integrated into each server blade. Integrated Lights-Out 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.

Integrated Lights-Out incorporates new functionality in its firmware to support the modular infrastructure of the ProLiant BL p-Class System, making it easier to deploy and manage. For example, Integrated Lights-Out enables complete virtual presence and control through its remote management capabilities. Because each server blade contains Integrated Lights-Out, the server blade can query and control crucial aspects of its environment within the infrastructure, such as the power allocation mechanisms. And because of its localized intelligence, dedicated management network, and direct connection to the management console, Integrated Lights-Out provides the intelligent communication channels to send alerts and other management information throughout the server blade infrastructure.

Remote Management

The ProLiant BL p-Class System is designed for remote and headless operation. There is no way to connect a keyboard, video monitor, or mouse directly to the server blade. However, because the ProLiant BL20p server blades ship from the factory with the iLO Advanced Feature set enabled, administrators have full use of the robust Graphical Remote Console and Virtual Media capabilities. Through these features, customers have the ability to view the server console at all times, to apply software and firmware updates over the network, to access troubleshooting information, to reset the server, and to watch the entire boot sequence from the convenience of a management console. Furthermore, customers are assured that through Integrated Lights-Out, these functions are secure, robust, and always available, regardless of server state or operating system. Thus, ProLiant BL20p server blades provide the cost and security advantages of a headless server blade, and in addition, Integrated Lights-Out provides customers with a "remote head"—an always-available keyboard, mouse, and monitor.

Integrated Lights-Out also provides a consistent management interface—the same "look and feel" —as other ProLiant servers. It is fully integrated with Insight Manager 7 to provide in-depth fault, configuration, and performance monitoring from a single management console.

Integrated Insight Lights-Out provides a virtual power button and a virtual diskette drive, and, through the firmware, it provides an integrated graphics remote console that is easily accessed from any standard Web browser without the need to purchase or install additional software.

iLO accommodates the need for fewer IT personnel, reduced travel time, and the ability to access and manage many server blades from a centralized location. An IT administrator can use the virtual power button to power on or power off a server blade from a remote location. The virtual diskette drive enables an IT administrator to perform remote ROM flash, remote diagnostics, remote IP configuration with DNS/DHCP, and remote loading of operating systems onto a server blade from a diskette inserted in a network client from anywhere on the network.

For more information about how ILO works with the ProLiant BL20p server blade, refer to the *Integrated Lights-Out in the ProLiant BL p-Class System white paper*.

Smart Array 5i Controller

The Smart Array 5i Controller is a hardware-based, cost-effective alternative to software-based RAID. The Smart Array 5i 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 5i Controller provides worry-free data protection for all server blade internal storage needs. The ProLiant BL20p server blade supports drive mirroring (RAID 1) and drive striping (RAID 0). The server blade also offers a battery-backed write cache option to prevent data loss during power interruptions.

ProLiant BL P-Class GbE Interconnect Switch Management

Both a Web-based interface and a menu-driven console interface are provided to configure, manage, and monitor the GbE Interconnect Switch on a per port basis. Any combination of the server network adapter ports, uplink ports, or cross-connection ports can be disabled, enabled, configured, and monitored using the interconnect switch management interfaces. Both interfaces can be configured to require a valid username and password for authentication. For out-of-band local access, use either of the 10/100 Ethernet RJ-45 ports or the serial console port on the front of the interconnect switch. Remote access is possible from any uplink port on the interconnect switch.

The GbE Interconnect Switch supports both SNMP and RMON capabilities. Thus, an administrator can configure the interconnect switch and monitor it remotely from an RMON-based network management console or an SNMP-based management tool such as HP Insight Manager 7 and HP OpenView. The switch modules support industry-standard SNMP management information bases (MIBs), HP Switch MIBs, and RMON groups 1, 2, 3, and 9 for fault detection, configuration, and monitoring of switch functionality.

Multiple interconnect switches can be configured by using the SNMP script utility and saving a customized configuration file to a TFTP server. This allows the rapid deployment of multiple server blade systems and provides robust backup and restore capabilities. The TFTP service also allows you to upgrade the interconnect switch firmware by downloading a new firmware file from a TFTP server to the interconnect switch

Planning for a ProLiant BL p-Class Installation

ProLiant BL Sizing Utility

The ProLiant BL p-Class Sizing Utility is a flexible, graphical tool that provides valuable information necessary to help plan and prepare a site for delivery and installation of ProLiant BL p-Class systems. Site planning information, such as power distribution requirements and environmental specifications, is generated based on entered system configuration criteria. Simply configure each server blade with appropriate options, choose interconnects for each server blade enclosure, and enter power information.

Figure 13. ProLiant BL Sizing Utility

Once the valid information is entered the tool calculates:

- Power specifications
- 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

Summary	Number of Empty Blades	Number of installed blades	Number of installed memory sticks			Number of installed Process.	Number of installed HDD's			Number of installed NIC	
	Empty	BL20p	256 MB	512 MB	1 GB	ntium III, 1.4 G	9 GB	18 GB	36 GB	NC7780	NC3163
Enclosure 6	0	8	32	0	0	15	0	16	0	0	8
Enclosure 5	0	8	32	0	0	16	0	16	0	0	8
Enclosure 4	0	8	32	0	0	16	0	16	0	0	8
Enclosure 3	0	8	32	0	0	16	0	16	0	0	8
Enclosure 2	0	8	28	0	1	16	0	16	0	0	8
Enclosure 1	0	8	32	0	0	16	0	16	0	0	8
Total Rack	0	48	188	0	1	95	0	96	0	0	48
Total per component types			47 Gb	0 Gb	1 Gb		0 Gb	1728 Gb	0 Gb		
Total combined			48 Gb				1728 Gb				

Number of Power Supplies	**8**	
Number of Power Enclosure(s)	**2**	
Total System Input Current [All Power Enclosures(s)]	**48**	**Amp(s)**
Current per Phase (Power Enclosure #1)	**24**	**Amp(s)**
Current per Phase (Power Enclosure #2)	**24**	**Amp(s)**
Total System Input Power	**9874**	**Watt(s)**
Total System VA	**10076**	**Volt-Amp**
Total System BTU-Hr	**33720**	**BTU-Hr**
Total System Leakage Current per Branch	**2.60**	**Miliamp(s)**
Total System Inrush Current per Branch(2 mS)	**140**	**Amp(s)**
Total System Weight	**391**	**Pounds (lbs)**
	177	**Kilograms (Kg)**

Sizing and Planning ProLiant BL Deployment

IMPORTANT: To plan for system growth within the infrastructure, you should size a solution based on the **maximum** number of server blades you plan to deploy into the rack.

Table 8. ProLiant BL Basic Hardware Requirements

Component	Units	Choices
Rack	1	Compaq, telco, or most third-party rack cabinets
ProLiant BL20p server blade	1	Single processor Or Dual processor
ProLiant BL p-Class server blade enclosure	1	With or without ProLiant Essentials Rapid Deployment Pack licenses
Interconnect devices	2	ProLiant BL p-Class RJ-45 patch panels Or ProLiant BL p-Class GbE Interconnect Switches
ProLiant BL p-Class power enclosure Choose this component if you have AC power	1	Single-phase with hot-plug power supplies Or Three-phase with hot-plug power supplies
Facility DC cable kit Choose this kit if you have facility DC power.	1	Facility DC kit
Power distribution devices	1 pair	ProLiant BL p-Class scalable bus bars Or ProLiant BL p-Class mini bus bars Or ProLiant BL p-Class power bus boxes

System Configuration

Required Input Power

The ProLiant BL p-Class system has specific AC power requirements. However, DC power may be used instead if the facility has DC power available.

ProLiant BL p-Class Power (AC)

When using an AC power source, the ProLiant BL p-Class infrastructure requires single-phase or three-phase 200-240 VAC input power. Each power enclosure uses two 30 A circuits for redundant functionality.

Facility DC Power Connection

Facility DC power requires a Facility DC Power Connection option kit to distribute the current through system via A- and B-sided bus bars to the server blade enclosures. A ProLiant BL p-Class system requires –48VDC with no more than +/-10% voltage variance. If you are using facility DC power, power supplies and power enclosures are not necessary for operation as the DC input will provide power through a direct connection to the infrastructure's bus bar.

Power Phases and Power Supply Enclosures

The ProLiant BL p-Class infrastructure is designed for AC input power from either single-phase or three-phase power sources. Three-phase power supports maximum density configurations.

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 chart below. Additionally, each power enclosure requires two separate 30 A power feeds for redundancy.

Figure 14.   Power enclosure connectors

AC Power Enclosure Connectors

There are four models of power enclosures.

Table 9. Power Enclosure Connectors and Compatibility

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

Power supply enclosures and power supplies are not used for configurations using facility DC connections.

ProLiant BL p-Class Interconnects

Each server blade enclosure requires a pair of RJ-45 patch panels or interconnect switches to provide network access for data transfer or remote management. The leftmost and rightmost bays of each server blade enclosure are communication bays for these devices.

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

ProLiant BL p-Class RJ-45 Patch Panel

The RJ-45 Patch Panel is designed to provide a convenient centralized location to connect the network cables to the back of the server blade enclosure. When using the RJ-45 Patch Panel interconnect, plan for cable egress of 1 to 4 CAT5 network cables per server blade. For example, a fully deployed server blade enclosure can have as many as 32 cables; a fully deployed 42U rack (6 full server blade enclosures with 48 server blades) may have as many as 192 cables. Alternatively, a standard network switch can be mounted above the ProLiant BL infrastructure to concentrate cables coming from the server blades.

Interconnect Switch

The interconnect switch is used to consolidate server blade network cables to a more manageable quantity. It provides additional convenience by consolidating the 32 network connections into as little as a single cable per server blade enclosure.

System Rack

The ProLiant BL p-Class infrastructure is optimized for use with the Compaq 10000 and 9000 Series racks. However, telco and third-party racks that meet minimum system specifications and performance requirements may also be used. When using some third-party racks, special mounting equipment and option kits are required; more detailed information about optional kits and enclosure schematics will be available in the product QuickSpecs once the product is available (Q202). The following are minimum rack specifications:

- Compatible with 19" Standard EIA rail sets

- EIA rail-to-rail depth is 29-30"

- Cabinet depth must be at least 36" deep overall (Additional min. 3.5" clearance from rear RETMA rail to rear door, inclusive in the 36" overall depth)

- Ample room for top and bottom cable egress (approximately 8 square inches for full rack configuration with patch panel)

- Must be capable of supporting 1600 lbs (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

To size for site planning, the quantity of server blades should be the total number of servers that will be deployed into the infrastructure over the life of the installation. Planning for growth is necessary to ensure that users purchase the appropriate bus bar and quantities of server blade enclosures. Additionally, growth sizing enables the preconfiguration of ample power to ensure that servers and infrastructure can be fully used. If users mix in a rack with traditional servers and storage, they 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 sizing, 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 affect on power consumption, heat generation and system weight.

Server Blade Enclosures

The number of blades needed for the application drives the quantity of server blade enclosures. Each server blade enclosure has a total of ten slots; two of these are reserved for networking blades and eight are designated for server blades. The ProLiant BL20p server blades consume one slot each, so a total of eight blades fit in each server blade enclosure. To plan for future growth, additional server blade enclosures can be installed in advance enabling rapid server deployments as needed. In the Sizing Utility, the summary page indicates the appropriate number of server blade enclosures for the configuration specified on the previous pages.

Power Distribution

The ProLiant BL Sizing Utility suggests the optimum power supply distribution method for supporting a redundant configuration. This quantity enables the deployment of the specific configuration based on data entries.

ProLiant BL p-Class Scalable Bus Bar

The ProLiant BL p-Class scalable bus bar accommodates up to five server blade enclosures and either one or two power enclosures. This configuration provides maximum flexibility and future growth potential. The scalable bus bar consumes a minimum of 28U of space in the back of the rack; other devices cannot be installed within this space. However, devices may be installed directly above this space.

ProLiant BL p-Class Mini Bus Bar

The ProLiant BL p-Class mini bus bars accommodates one power supply enclosure and up to three server blade enclosures. This bus bar consumes 11U of space in the back of the rack and other devices may not be installed within this area. Two mini bus bar configurations may be stacked in a rack with at least 42U of space to provide maximum density and processing power.

ProLiant BL p-Class Power Bus Box

The ProLiant BL p-Class power bus box connects one server blade enclosure to one power enclosure. The power bus box is typically used for testing, demonstrations, and proof of concept within production environment at data center. To maximize cost and space savings, the power bus box can be replaced with either ProLiant BL p-Class bus bar model.

Site Recommendations

The ProLiant BL 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 used to assist with planning and managing the data center environment. Some additional recommendations for planning the proper data center environment are covered in the sections that follow.

Total Power Consumption

The installation of this equipment shall be in accordance with local/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 product's rating label or the user documentation supplied with that option.

When installing a ProLiant BL p-Class system, 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, ProLiant BL p-Class systems run on 48VDC ±10%. When power supplies are included in the ProLiant BL p-Class system, they will require 230VAC (International) or 208VAC (US).

Total Cooling and Airflow

ProLiant BL p-Class server blades draw in cool air through the front door and expel warm air through the rear door. 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 there is any vertical space in the rack not filled by server blades or rack components, the gaps between the components cause changes in airflow through the rack and across the server blades. Cover all gaps with blanking panels to maintain proper airflow. Compaq 10000 and 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 ProLiant BL p-Class system components can be found in the *Compaq ProLiant BL p-Class System Maintenance and Service Guide*. The same data can be determined by using the online ProLiant BL 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).

Total Floor Space

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

- Leave a minimum clearance of 63.5 cm (25 inches) in front of the rack.

- Leave a minimum clearance of 76.2 cm (30 inches) in the back of the rack.

- Leave a minimum clearance of 121.9 cm (48 inches) from the back of the rack to the rear of another rack or row of racks.