ProLiant BL p-Class Networking Overview

white paper

Abstract

This white paper describes how the Ethernet network signals are routed through the ProLiant BL p-Class system components and provides an overview of the patch panel and Ethernet switch interconnect options for connecting the network signals to the external network infrastructure. For more information about the interconnect switch options, see the *ProLiant BL p-Class GbE Interconnect Overview white paper*[1] and the *ProLiant BL p-Class GbE2 Interconnect Switch Overview* white paper[2].

The intended audience for this paper includes engineers and system administrators familiar with the HP ProLiant BL p-Class system. For readers not familiar with the HP ProLiant BL p-Class system, more information is available at http://h18004.www1.hp.com/products/servers/platforms/index-bl.html.

Introduction

The ProLiant BL p-Class system includes industry-standard server blades, a rack-mountable server blade enclosure, and four interconnect options. The high-performance ProLiant BL p-Class server blades are designed for use in multi-tiered environments. The 2-way ProLiant BL20p and BL20p G2 server blades are ideal for mid-tier applications, and the 4-way ProLiant BL40p server blade is ideal for back-end applications. These server blades contain multiple embedded network interface controllers (NICs)[3].

The BL p-Class enclosure holds up to eight 2-way or two 4-way server blades (or a combination of both) and two interconnects. The enclosure has a signal backplane that routes Ethernet signals from the server blade NICs to the interconnects in a redundant, highly available architecture.

HP offers four interconnect options, including two Gigabit Ethernet (GbE) interconnect switch options for network cable consolidation and two patch panel options for Ethernet signal pass-through to third-party LAN devices.

This white paper:

- Identifies the NICs available with each ProLiant BL p-Class server blade
- Describes how the Ethernet network signals are routed through the p-Class serve blade enclosure
- Provides a decision chart to help customers choose the appropriate interconnect option
- Provides an overview of each interconnect option

ProLiant BL p-Class server NICs

The ProLiant BL p-class server blades include multiple general-purpose ProLiant NC series NICs and one additional NIC dedicated to Remote Insight Lights-out Management (iLO). Table 1 identifies the type and number of embedded NICs available with each ProLiant BL p-Class server blade.

Table 1. ProLiant BL p-Class server blade NICs

ProLiant BL p-Class server blade	NC3163 10/100	NC7780 10/100/1000	NC7781 10/100/1000	iLO 10/100	Total NICs
BL20p	3	0	0	1	4
BL20p with NC7780 Upgrade	1	2	0	1	4
BL20p G2	0	0	3	1	4
BL40p	0	0	5	1	6

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[1] Available at http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch.html
[2] Available at http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch2.html.
[3] An embedded NIC integrates the Ethernet capabilities directly onto the system board to eliminate using an I/O slot for Ethernet connectivity.

Each ProLiant NC series NIC has been designed, developed, and manufactured to meet the needs of ProLiant customers. HP's testing, certification, and validation of NICs within ProLiant servers further enhance this value. Additionally, the NC series NICs provide the following features:

- Preboot eXecution Environment (PXE) and Wake on LAN (WOL) capability
- High-availability teaming including Network Fault Tolerance (NFT), Transmit Load Balancing (TLB), and Switch-assisted Load Balancing (SLB)
- Teaming Configuration GUI for Microsoft® operating systems
- Auto-negotiation for speed and duplex
- Support for management agents and sophisticated management tools such as Insight Manager 7
- TCP Checksum and segmentation offload to reduce the load on the CPU for overall improved system response (NC7780 and NC7781)

ProLiant BL p-Class server blade enclosure

The ProLiant BL p-Class server blade enclosure is a 6U (10.5-inch) chassis with two outside interconnect bays and eight interior server bays that support various combinations of ProLiant BL p-Class server blades (Figure 2). The bays are designed so that the server blades and interconnect blades slide in and blind mate to the server blade enclosure backplane for power and data connections. The signal backplane routes both Ethernet and Fibre Channel signals from the server bays to the interconnect bays while completely isolating these signals from each other.
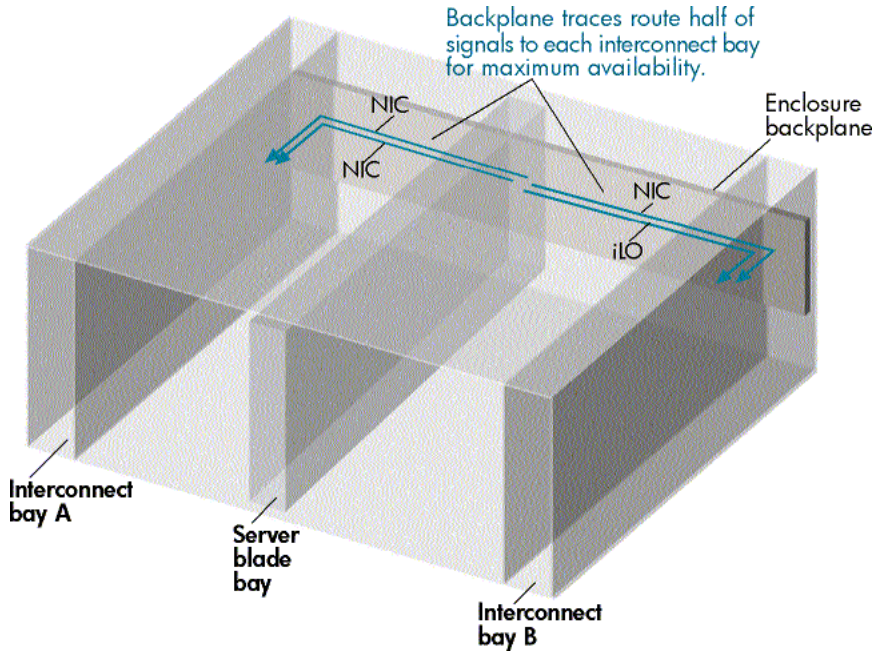
Figure 2. ProLiant BL p-Class server blade enclosure
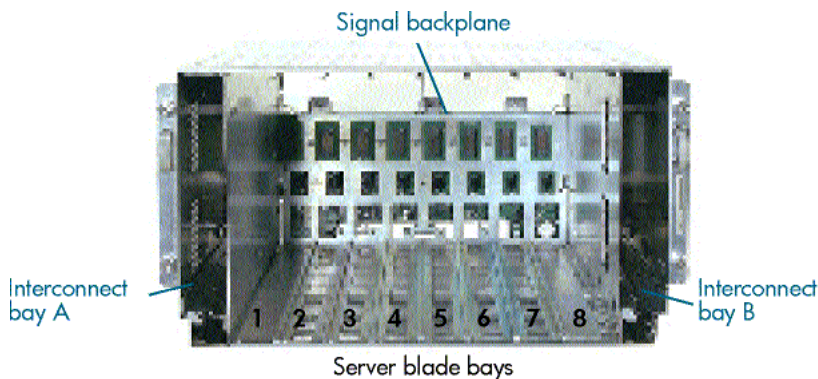
Blade enclosure network signal routing

Each server bay supports up to four Ethernet signals. This is sufficient for the BL20p and BL20p G2 server blades with four NICs each, and it is ample for the BL40p server blade, which has six NICs spread over four server bays.

Figure 3 illustrates the network signal routing from a single server blade bay to the interconnect bays. Individual category 5e specified signal traces on the passive backplane route the network signals as Ethernet from the server blade NICs to the interconnect bays. To provide redundant network connections and maximize network availability, half of the network signals from each server blade bay go to each interconnect bay, regardless of the slot width of the server blade or the number of NICs it supports.

Figure 3. The server blade enclosure backplane routes Ethernet signals from each server blade bay to both interconnect bays.

The network signal routing from the NICs in each ProLiant BL p-Class server blade to the interconnect bays is provided in Table 2.

Table 2. ProLiant BL p-Class server blade NIC signal routing

	Interconnect bay A (left)	Interconnect bay B (right)
BL20p	2x NC3163	1x NC3163, 1x iLO
BL20p with NC7780 Upgrade	1x NC3163, 1x NC7780	1x NC7780, 1x iLO
BL20p G2	2x NC7781	1x NC7781, 1x iLO
BL40p	3x NC7781	2x NC7781, 1x iLO

PXE

Each NC series NIC on the ProLiant BL servers supports PXE, but only one NIC at a time may be PXE enabled. A NIC on each server is pre-selected as the default PXE NIC. This results in all the PXE enabled NICs being routed to the same interconnect. However, the ROM Based Setup Utility (RBSU) for ProLiant BL servers may be used to select any NIC. Thus, system availability can be enhanced by selecting PXE-enabled NICs that are routed to different interconnect blades.

ProLiant BL p-Class interconnects

All network signals from the server bays are routed to the interconnect bays. HP offers four ProLiant BL p-Class interconnect options that allow customers to choose how the networking and storage signals exit the server blade enclosure. These interconnect options include two ProLiant RJ-45 patch panel kits and two ProLiant GbE interconnect kits.

The two patch panel kits provide pass-through of network signals (RJ-45 Patch Panel Kit) or network and storage signals (RJ-45 Patch Panel 2 Kit), thus giving customers the flexibility to choose the switches they prefer. Alternatively, the two GbE interconnect kit options provide different levels of Ethernet switching functionality and Fibre Channel signal pass-through. In general, customers should choose the appropriate interconnect option based on the following criteria:

- The RJ-45 Patch Panel Kit provides Ethernet signal pass-through only.
- The RJ-45 Patch Panel 2 Kit provides both Ethernet and BL20p G2 Fibre Channel signal pass-through.
- The GbE Interconnect Kit consolidates 100 Mbps Fast Ethernet NIC signals.
- The GbE2 Interconnect Kit provides consolidation of 1000 Mbps Gigabit Ethernet NIC signals, advanced network capabilities, and BL20p G2 Fibre Channel signal pass-through.

Figure 4 contains an interconnect decision chart to assist customers in choosing the specific interconnect kit and its orderable part number.

Figure 4. Interconnect decision chart
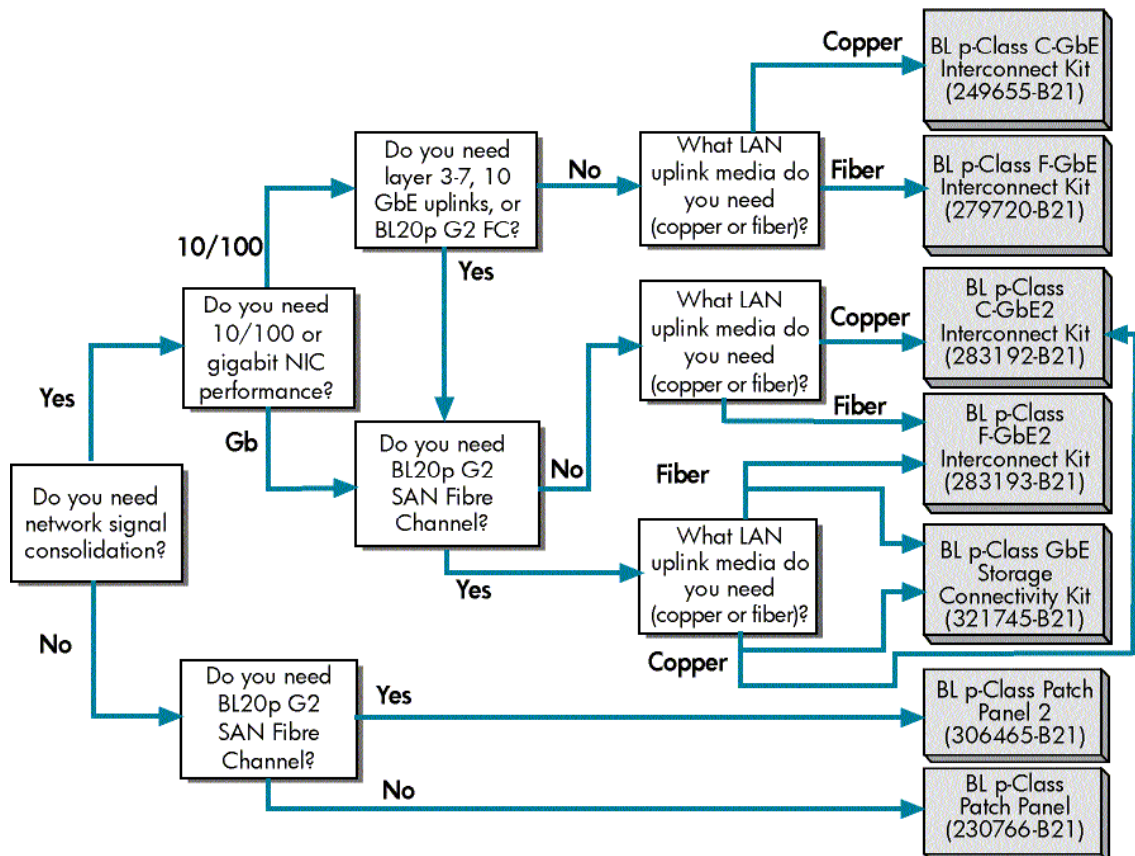
Each interconnect kit includes two interconnects for one server blade enclosure. Each interconnect itself consists of two hot-pluggable components, a front loading interconnect blade and a rear mounted interconnect module that contains the network connectors. This modular design provides two key benefits:

- The interconnect blade can be quickly and easily removed and replaced from the front of the rack without the need for re-cabling.
- Interconnect switch can support copper or fiber Ethernet network uplinks by using different interconnect modules. This design also allows the uplinks to be easily upgraded to future technology.

RJ-45 Patch Panel and RJ-45 Patch Panel 2 Kits

The RJ-45 Patch Panel and RJ-45 Patch Panel 2 Kits each contain two patch panel interconnect blades that allow Ethernet LAN signals to pass through to third-party LAN devices, thus giving customers flexibility in choosing their own network switch, hub, or router. Both the RJ-45 Patch Panel and RJ-45 Patch Panel 2 Kits bring all 32 Ethernet signals out as separate RJ-45 connections through two rear-mounted LAN interconnect modules per patch panel device. Both kits support the BL20p and BL20p G2 server blades (shown in Figure 5), the BL40p server blade, or a combination of these servers.

In addition to Ethernet signal pass-though, the RJ-45 Patch Panel 2 Kit provides 16 Fibre Channel front panel ports to support signal pass-through for up to eight ProLiant BL20p G2 servers with two Fibre Channel ports each[4]. The ProLiant BL40p server blade does not require Fibre Channel signals to be routed to the interconnect bays.
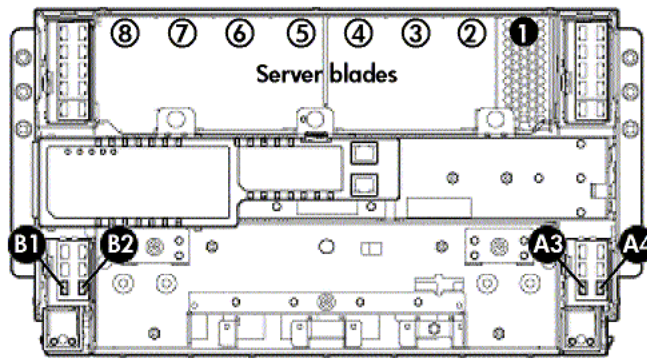
Figure 5. RJ-45 Patch Panel and RJ-45 Patch Panel 2 pass-through Ethernet signal routing with BL20p or BL20p G2 servers

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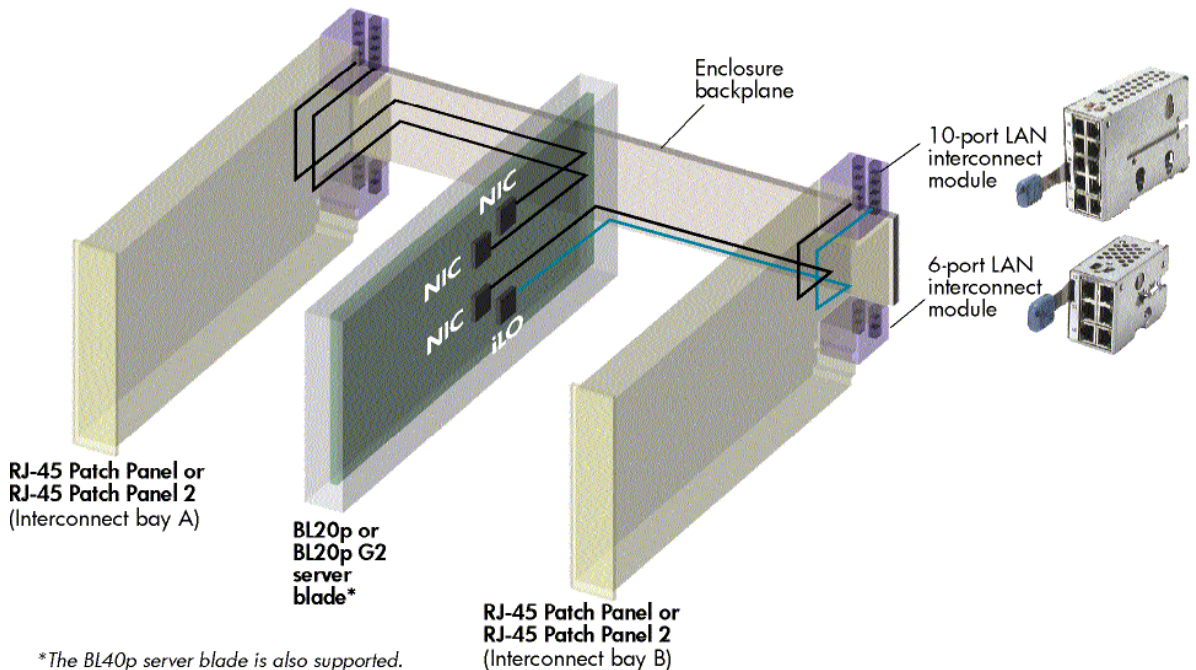
[4] For more information, see the *ProLiant BL p-Class SAN Storage Connectivity* white paper at
http://h71025.www7.hp.com/support/reference_library/viewdocument.asp?countrycode=1000&prodid=5726|ProLiant+BL+p-Class+System&source=TC030803TB.xml&dt=21&docid=20366.

Whether using the RJ-45 Patch Panel or RJ-45 Patch Panel 2 Kit, each RJ-45 connector corresponds to a specific embedded NIC in each server blade. A ProLiant BL20p or BL20p G2 server blade installed in the server bay 1 occupies the bottom row of connectors (Figure 6). Each consecutive server blade occupies the next highest row of connectors.

Figure 6. RJ-45 Patch Panel Kit and RJ-45 Patch Panel 2 Kit network connections for ProLiant BL20p and BL20p G2 server blades


RJ-45 Patch Panel/Patch Panel 2 Ethernet Connections for ProLiant BL20p and BL20p G2 server blades

B1	NIC for iLO
B2	NIC for data
A3	NIC for data (PXE default)
A4	NIC for data

The RJ-45 Patch Panel and RJ-45 Patch Panel 2 Kit network connections for two ProLiant BL40p server blades installed in the p-Class server blade enclosure are shown in Figure 7.

Figure 7. RJ-45 Patch Panel Kit and RJ-45 Patch Panel 2 Kit network connections for ProLiant BL40p server blades
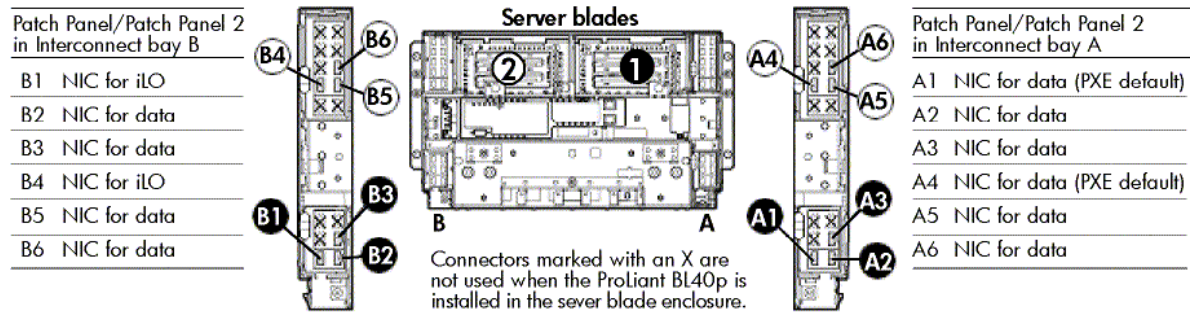
Patch Panel/Patch Panel 2 in Interconnect bay B

B1	NIC for iLO
B2	NIC for data
B3	NIC for data
B4	NIC for iLO
B5	NIC for data
B6	NIC for data

Connectors marked with an X are not used when the ProLiant BL40p is installed in the sever blade enclosure.

Patch Panel/Patch Panel 2 in Interconnect bay A

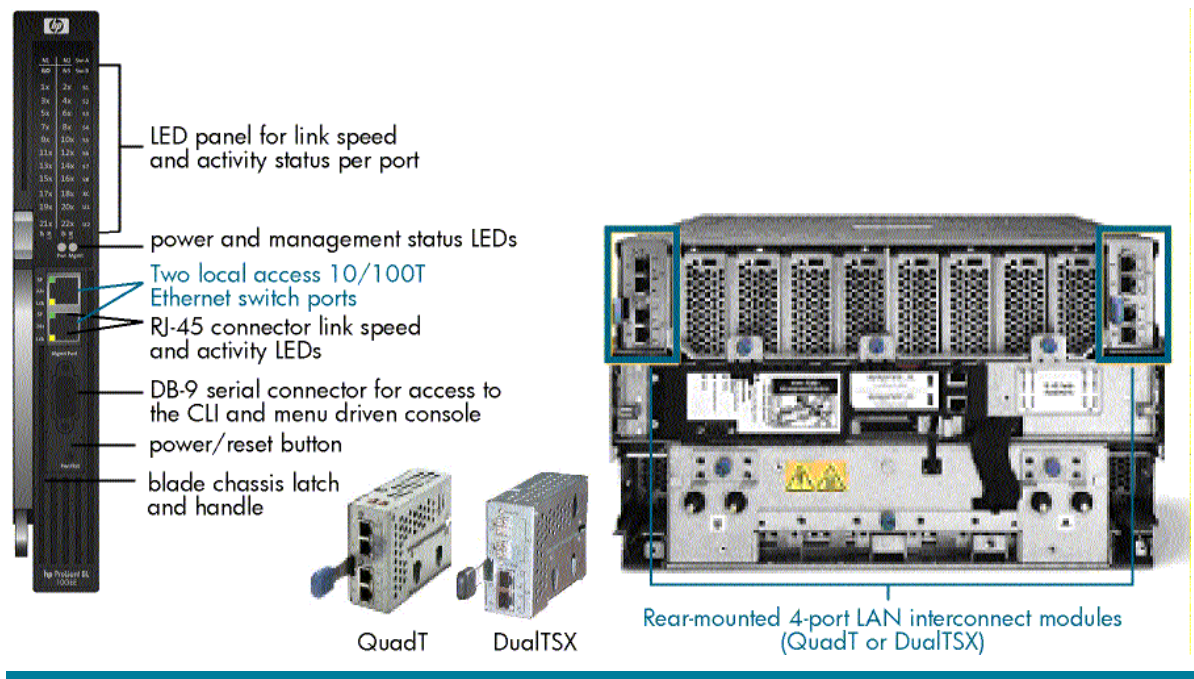|	
A1	NIC for data (PXE default)
A2	NIC for data
A3	NIC for data
A4	NIC for data (PXE default)
A5	NIC for data
A6	NIC for data

ProLiant GbE Interconnect Kit

The ProLiant BL p-Class server enclosure provides eight server blade bays, each supporting up to four Ethernet network adapters. Therefore, a fully configured server blade enclosure can have up to 32 Ethernet cables, and a 42U rack fully configured with BL p-Class server blades can have up to 192 Ethernet cables. As a result, the number of Ethernet network cables within this space can quickly become overwhelming.

For applications that require network cable reduction, the ProLiant GbE Interconnect Kit consolidates the server blade network adapter signals to 100 Mb/s (Fast Ethernet) using two Ethernet switches mounted into the server blade enclosure. The GbE Interconnect Kit includes two hot-swappable, fully managed layer 2 Ethernet switches and two rear-mounted, 4-port LAN interconnect modules (Figure 8). The GbE Interconnect Kit is available in two options: the C-GbE Interconnect Kit for copper-based networks and the F-GbE Interconnect Kit for fiber-based networks. The difference between the kits is the LAN interconnect module that supports the uplink port media. The C-GbE Interconnect kit includes two QuadT interconnect modules, each with two 10/100/1000T and two 10/100T ports, all with RJ-45 connectors. The F-GbE Interconnect Kit includes two DualTSX interconnect modules, each with two 1000SX ports with LC connectors and two 10/100T ports with RJ-45 connectors.

Each GbE Interconnect Switch reduces up to sixteen internal server blade network NICs ports to six external Ethernet ports: four 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, one to twelve external ports (per enclosure) may be used to connect to the network infrastructure.

Figure 8. ProLiant BL p-Class GbE Interconnect Switch front panel and rear view

- LED panel for link speed and activity status per port
- power and management status LEDs
- Two local access 10/100T Ethernet switch ports
- RJ-45 connector link speed and activity LEDs
- DB-9 serial connector for access to the CLI and menu driven console
- power/reset button
- blade chassis latch and handle

QuadT   DualTSX

Rear-mounted 4-port LAN interconnect modules (QuadT or DualTSX)

The two GbE Interconnect Switches are connected across the server blade enclosure backplane through a pair of redundant 10/100 Ethernet crosslinks bundled into a multi-port EtherChannel compatible trunk (see Figure 9). These crosslinks permit communication between the switches for additional management capability, fault tolerance, and cable reduction. As a result, any single uplink port may be used to connect to all 32 NICs for a 32-to-1 network cable reduction.

Figure 9. ProLiant BL p-Class GbE Interconnect Kit architecture

The redundant architecture of the GbE Interconnect Kit allows system administrators to configure the Ethernet network for continued access to each server blade in case of the following failures:

- Interconnect switch failure
- Switch failure within the Ethernet network backbone
- Server blade network adapter failure
- Server blade NIC-to-interconnect switch port failure or connection failure
- Uplink port and uplink port connection or cable failure
- Interconnect switch crosslink port or connection failure
- Power or fan failure

For more information, see the *ProLiant BL p-Class GbE Interconnect Kit Overview* white paper.[5]

[5] Available at http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch.html

ProLiant GbE2 Interconnect Kit

The second generation ProLiant GbE2 Interconnect Kit is also designed to significantly reduce the number of Ethernet network cables attached to the rear of the server blade enclosure. However, it is designed for applications that require network adapter consolidation to 1000 Mb/s (Gigabit Ethernet), advanced network functionality, future upgradeability including layer 3-7 switching and 10 Gigabit Ethernet uplink bandwidth, and BL20p G2 Fibre Channel signal pass-through.

The GbE2 Interconnect Kit contains two hot-swappable, fully managed layer 2 GbE2 Interconnect Switches and two LAN interconnect modules (Figure 10). Like the first generation GbE Interconnect Kit, the GbE2 Interconnect Kit is available for copper-based (C-GbE2) and fiber-based (F-GbE2) networks. These interconnect kits are identical with exception of the interconnect modules. The C--GbE2 Interconnect kit includes two QuadT2 interconnect modules, each with four 10/100/1000T ports with RJ-45 connectors. The F-GbE2 Interconnect Kit includes two QuadSX interconnect modules, each with four 1000SX ports with LC connectors.

Figure 10. ProLiant BL p-Class GbE2 Interconnect Switch front panel and rear view
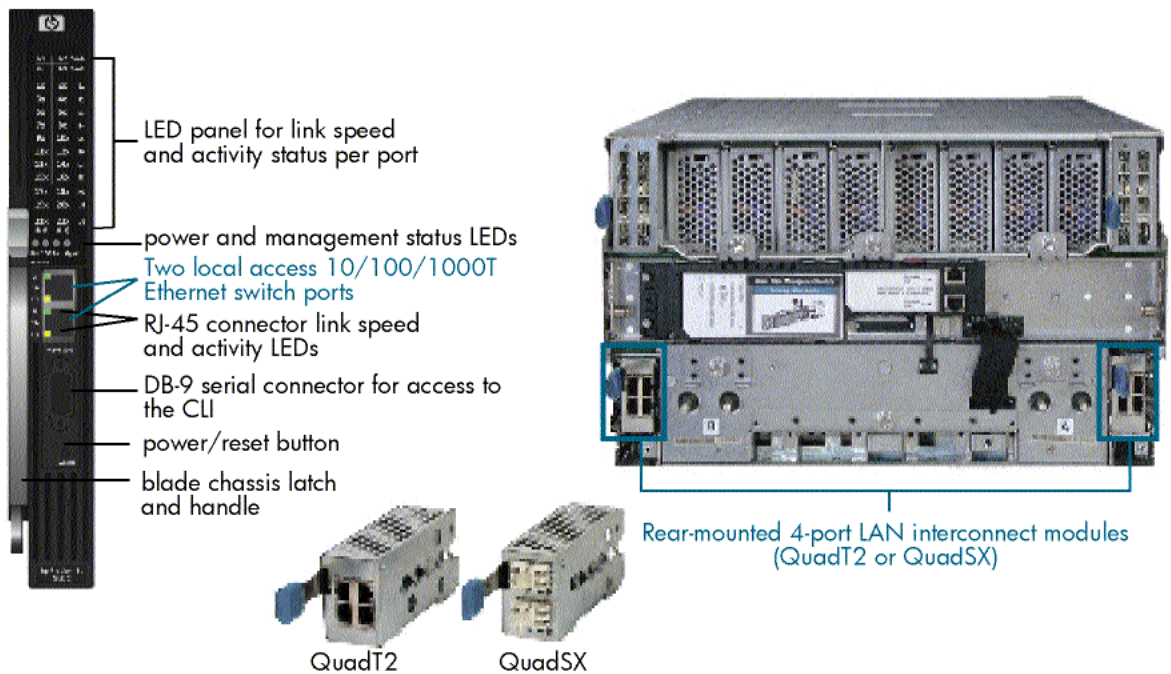

In addition to providing a 32 to 1 server networking cable reduction per server enclosure like the GbE Interconnect Kit, the GbE2 Interconnect Kit offers the following features:

- All switch ports provide Gigabit Ethernet performance 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 option and 10 Gigabit Ethernet uplink upgradeability (Figure 11). 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 ProLiant BL20p G2 Fibre Channel storage signals using the GbE2 Storage Connectivity Kit. Therefore, both Ethernet signal consolidation and Fibre Channel pass-through is now possible using a single interconnect (see the *ProLiant BL p-Class SAN Connectivity* technology brief[6].

Figure 11. ProLiant BL p-Class GbE2 Interconnect Kit architecture
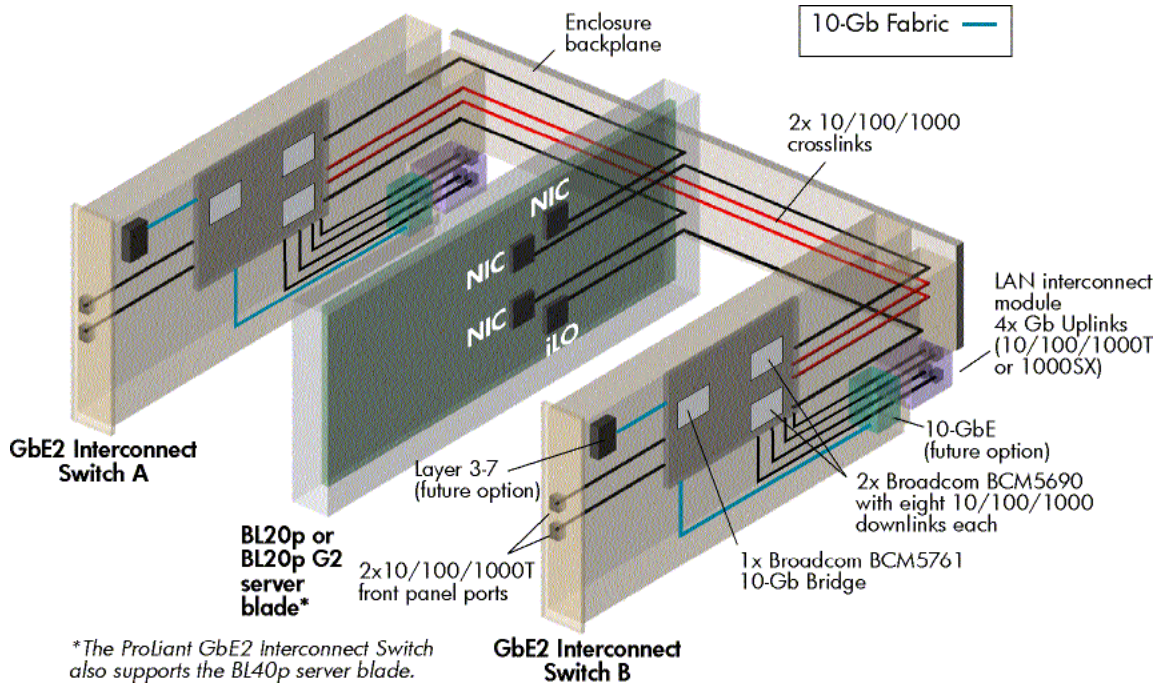
For more information, see the *ProLiant BL p-Class GbE2 Interconnect Switch Overview* white paper[7].

Investment protection

The ProLiant BL p-Class interconnects are designed to support any mix of ProLiant servers. Within the p-Class server blade enclosure, many different configurations of 2-processor and 4-processor server are possible. For example, configurations may exist with only ProLiant BL20p or BL20p G2 servers, a mix of ProLiant BL20p and BL20p G2 servers, only BL40p servers, or a mix of BL40p, BL20p, and BL20p G2 server blades.

Conclusion

The networking design of the ProLiant BL p-Class provides maximum flexibility and significant performance in an end-to-end redundant architecture. The minimum four network adapters included as standard with each server are routed to a pair of fully redundant, hot swappable interconnects. HP offers a wide selection of interconnect kits for a choice of network cable consolidation and Fibre Channel signal pass-through. The patch panel kits allow a user to select the network switches or other components of their preference. The interconnect switches are ideal for reducing Ethernet network cabling and the time required to deploy, manage, and service ProLiant BL p-Class systems.

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[6] Available at http://h71025.www7.hp.com/support/reference_library/viewdocument.asp?countrycode=1000&prodid=5726|ProLiant+BL+p-Class+System&source=TC030803TB.xml&dt=21&docid=20366.
[7] Available at http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch2.html.

For more information

For additional information, refer to the resources detailed below.

Resource description	Web address
ProLiant BL system home page	http://h18004.www1.hp.com/products/servers/platforms/index-bl.html
ProLiant BL p-Class GbE2 Interconnect Switch home page	http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch2.html
ProLiant BL p-Class GbE Interconnect Switch home page	http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch.html
ProLiant BL p-Class GbE2 Interconnect Switch Overview white paper	http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch2.html
ProLiant BL p-Class GbE Interconnect Switch Overview white paper	http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/20p/bl-p-interconnect-switch.html
ProLiant BL p-Class SAN storage connectivity technology brief	http://h71025.www7.hp.com/support/reference_library/viewdocument.asp?countrycode=1000&prodid=5726|ProLiant+BL+p-Class+System&source=TC030803TB.xml&dt=21&docid=20366
ProLiant BL p-Class GbE2 and GbE2 Interconnect Switch user guides	http://h71025.www7.hp.com/support/reference_library/viewreferencelibrary.asp

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