



hp industry
standard servers

august 2002



technology brief

table of contents

integrated lights-out in the ProLiant BL p-class system

executive summary	2
introduction	2
management processor architectures	3
centralized management processor architecture	3
distributed management processor architecture	4
ProLiant BL p-class system infrastructure	4
integrated lights-out functionality specific to the p-class system	5
remote management	5
diagnostic port	6
POST LED indicator	7
power allocation and release	8
infrastructure communication	9
rack configuration and diagnostics	9
infrastructure diagnostics	10
infrastructure event logs	10
location data for rapid deployment	11
conclusion	11
glossary	11
feedback	11

executive summary

Computing demands fueled by the Internet and always-on, global enterprises continue to rise, creating the need for businesses to deploy greater numbers of servers. However, the trend to scale out the datacenter leaves system administrators with the challenge of managing the growing electrical, thermal, cable layout, and space challenges of such large computing facilities, in addition to the complexity of system administration for those systems. The ProLiant BL p-Class System is one of a portfolio of blade servers designed to dramatically increase server density, decrease deployment time, reduce cabling complexities, and provide flawless remote system administration.

The ProLiant BL server blades have varying management architectures based on different system requirements. The ProLiant BL p-Class System incorporates a distributed approach, in which each server blade has its own intelligent and autonomous management processor, capable of full network communication and designed to provide unprecedented manageability of the blade and its environment. The Integrated Lights-Out management processor provides seamless hardware-based virtual presence, intelligent monitoring and diagnostics, and intelligent interaction with the server blade infrastructure. Because the ProLiant BL p-Class system consists of multiple components (server blades, server blade enclosure, power supplies, and power supply enclosure), 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.

Readers of this document should be familiar with Integrated Lights-Out technology. For more information about Integrated Lights-Out, see the technology brief titled [Integrated Lights-Out Technology: Enhancing the Manageability of ProLiant Servers](#), document number TC020404TB. It is also assumed that the reader is familiar with server blade architecture in general and the ProLiant BL p-Class System in particular. For more information about the ProLiant BL p-Class System, see [ProLiant BL p-Class System Overview and Planning](#).

introduction

The ProLiant BL p-Class System is the second product in a portfolio of modular blade servers designed for rapid deployment, increased server density, and remote manageability. The first product, the ProLiant BL e-Class System, contains an ultra-dense, power-efficient, front-end server blade. It is an optimized solution for space-constrained enterprises and service providers. For more information on the ProLiant BL e-Class System, see the technology brief titled [Key Technologies within the ProLiant BL e-Class System](#).

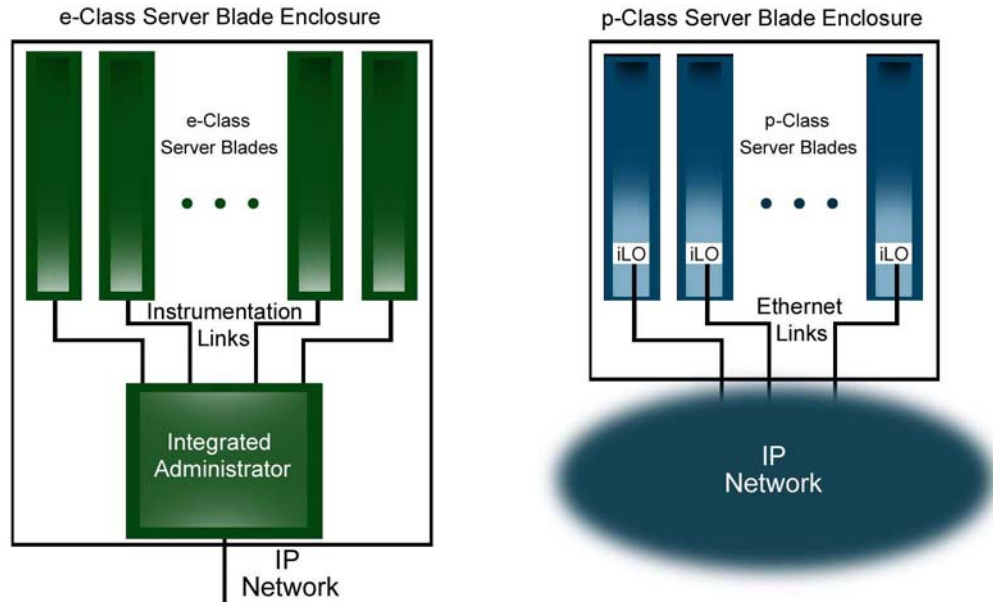
The ProLiant BL p-Class System is designed for use as a mid-tier server in a multi-tier infrastructure such as DISA.¹ The ProLiant BL20p (the server blade itself) is a high-performance, high-availability server blade that is ideal for use in edge-of-the network applications such as web hosting, terminal server farms, computational clustering, or media streaming. To fulfill the requirements of rapid deployment and remote management, the ProLiant BL20p server blade incorporates Integrated Lights-Out in a distributed management processor architecture. Integrated Lights-Out (iLO) is an autonomous management subsystem that resides on the server blade to manage it through any server state, providing virtual presence and control within the modular infrastructure of the ProLiant BL p-Class System.

¹ DISA: Dynamic Internet Solutions Architecture. For more information on the DISA architecture, see <http://www.compaq.com/solutions/internet/disa-summary-faq.html>.

management processor architectures

ProLiant BL server blades employ different management processor topologies, depending on the specific requirements of each class of server blades (Figure 1).

figure 1: different server blade management architectures



Centralized Management Processor Architecture

Distributed Management Processor Architecture

centralized management processor architecture

The ProLiant BL e-Class System is an example of an architecture using a centralized management processor. The centralized management subsystem of the BL e-Class System (the ProLiant BL e-Class Integrated Administrator²) allows an administrator to manage multiple server blades within the server blade enclosure through a single console. Integrated Administrator resides on a removable mezzanine card housed in each of the ProLiant BL e-Class interconnect tray options³. It collects management data from each blade through instrumentation links and presents this information through the Integrated Administrator's command-line or web interfaces. In an ultra-dense server environment that the BL e-Class System is designed for (the BL e-Class System can contain up to 280 server blades in a single 42U rack), optimizing space, power, and management resources is critical. Therefore, the centralized management architecture used in the ProLiant BL e-Class System allows the cost, space, power, and thermal resources used to manage any individual blade to be spread across multiple ultra-dense blades and also greatly reduces the number of network connections needed for managing server blades.

² For more information about Integrated Administrator, see the technology brief titled Key Technologies within the ProLiant BL e-Class System, document number TC020505TB, or the Integrated Administrator web page: <http://www.compaq.com/products/servers/proliant-bl/e-class/integrated-admin.html>

³ The ProLiant BL e-Class system has three interconnect tray options: C-GbE Interconnect Switch, RJ-45 Patch Panel and RJ-21 Patch Panel. Each interconnect tray includes an Integrated Administrator module.

**distributed
management
processor
architecture**

For more diverse and complex server environments, an architecture using distributed management processors provides more extensive access and control. For example, in the ProLiant BL p-Class System, each server blade contains the Integrated Lights-Out management processor that is tightly coupled with the server blade hardware. Through the use of Integrated Lights-Out, the ProLiant BL p-Class System provides the highest level of virtual presence available in any ProLiant server —and delivers it in a highly compact blade environment. Integrated Lights-Out intelligently manages the server blade and communicates directly on the network using a dedicated management network port, regardless of the state or condition of the server blade. Furthermore, the localized intelligence of Integrated Lights-Out enables intelligent interaction of the server blade with the server blade infrastructure. This intelligent interaction ensures a robust system implementation across multiple blades and multiple enclosures within a rack.

**ProLiant BL p-
class system
infrastructure**

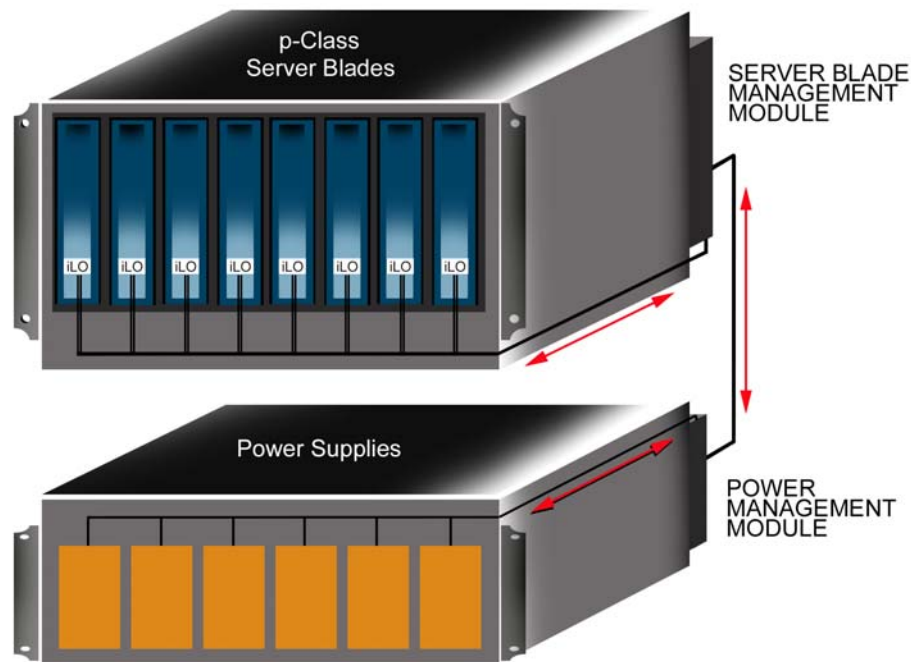
The ProLiant BL p-Class System consists of five key components: the server blades, the server blade enclosure, the power supplies, the power supply enclosure, and the power distribution. Integrated Lights-Out provides not only the ability to manage the server blade remotely, but also an intelligent communication channel to coordinate events, alerts, and location data throughout the entire infrastructure.

Each server blade enclosure houses up to eight ProLiant BL20p blades, each of which contains Integrated Lights-Out. Integrated Lights-Out is composed of hardware and firmware specifically designed to fully monitor the host server blade through any server state: power-on self test (POST), preboot environment, before the operating system (OS) is loaded, while the OS is functional, after an OS failure, or when the server blade is powered down. All features of Integrated Lights-Out are enabled by default on the ProLiant p-Class System so the administrator has full and immediate access to the powerful Graphical Remote Console and Virtual Media capabilities.

Attached to the back of the server blade enclosure is a Server Blade Management Module, a self-contained microcontroller that communicates with Integrated Lights-Out on each blade using a management bus accessible by Integrated Lights-Out and host software.

In the modular ProLiant BL architectures, the power subsystem is decoupled from individual server blades. Power supplies for the ProLiant BL20p blades (up to six) are aggregated into a separate power supply enclosure that contains the Power Management Module. The Power Management Module monitors the power supply enclosure and is responsible for determining that adequate power is available for new server blades during the power-up sequence. The Power Management Module delivers alerts and status data to each attached p-Class Server Blade Management Module.

figure 2: communication hierarchy among the ProLiant BL p-class system components



The Power Management Module communicates to the Server Blade Management Module, which communicates with Integrated Lights-Out on each server blade.

integrated lights-out functionality specific to the p-class system

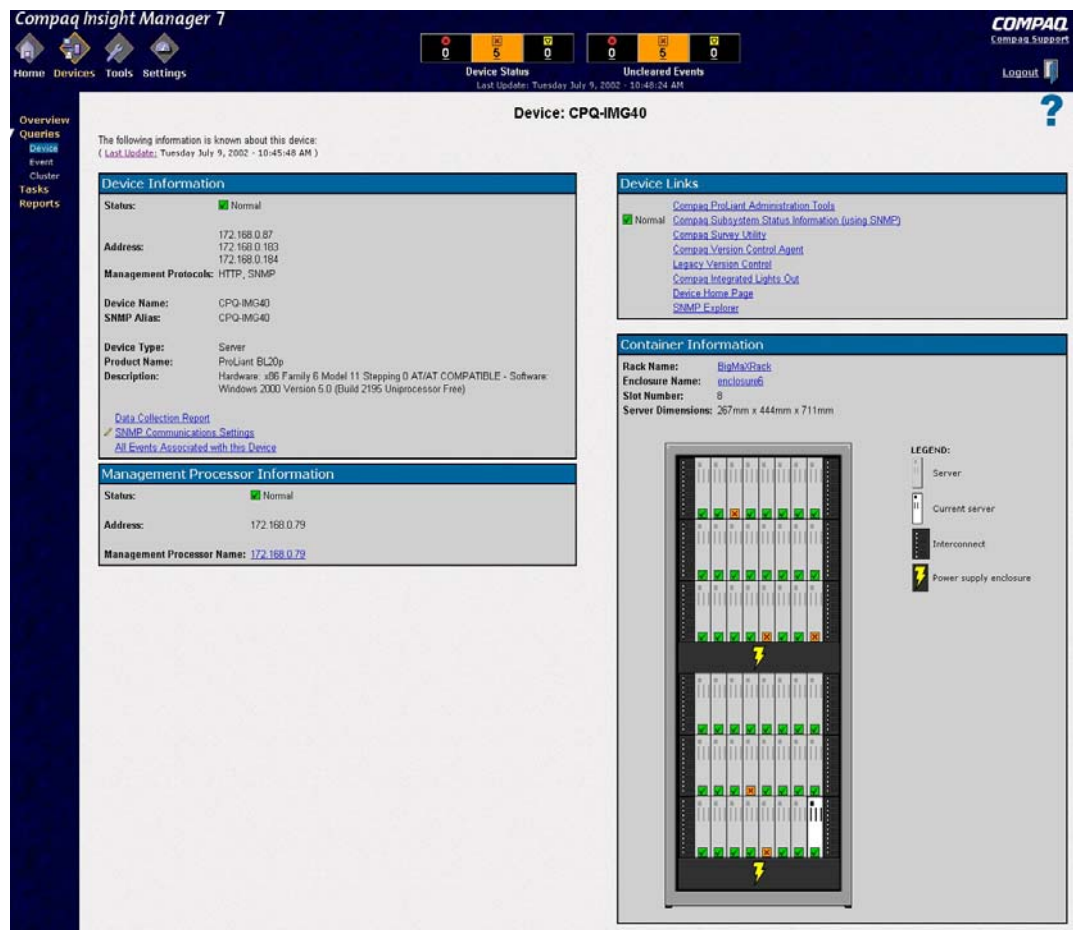
Integrated Lights-Out incorporates new functionality in its firmware to support the modular infrastructure of the ProLiant BL p-Class System, making it easier to deploy and manage. For example, Integrated Lights-Out enables complete virtual presence and control through its remote management capabilities. 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.⁴ Every Integrated Lights-Out device on the network is discovered in Insight Manager 7 as a management processor. The management processor is automatically associated with its host server, without any specific action required by the administrator. Furthermore, Insight Manager 7 includes capabilities for managing server blades and blade infrastructure, new inventory and asset tracking capabilities, and the ability to control device discovery through discovery filters. For example, Insight Manager 7 simplifies server blade management by providing graphical representations of ProLiant BL20p server blades and their locations within server blade enclosures and racks (Figure 3).

figure 3: insight manager 7 provides a graphical layout of the server blade enclosure



diagnostic port

For convenient walk-up access or in the event that some portion of the network is down and the administrator cannot reach Integrated Lights-Out through the network, the ProLiant BL p-Class server blade is equipped with the Integrated Lights-Out Diagnostic Port that guarantees access to Integrated Lights-Out.

⁴ Additional information about Insight Manager 7 is available at <http://www.compaq.com/products/servers/management/cim7-description.html>.

The ProLiant BL20p server blade comes with a unique “y” cable that connects to the Integrated Lights-Out Diagnostic Port and provides two connections: a Windows debug connector (similar to a serial port for OS debugging) and an RJ-45 network connector (Figure 4). The RJ-45 connection allows an administrator to connect a management laptop with its browser directly to the dedicated Integrated Lights-Out Ethernet port. All tasks that can be performed through the main Integrated Lights-Out management network connection may also be performed through the Integrated Lights-Out Diagnostic Port. This gives the administrator a walk-up keyboard/mouse/monitor connection to the server through the standard Integrated Lights-Out web browser interface.

figure 4: the integrated lights-out cable connector inserted into the diagnostic port



While the Diagnostic Port is in use, the server blade firmware disables the connection to the rear Integrated Lights-Out Ethernet port. The Integrated Lights-Out firmware will not switch to the Diagnostic Port if a firmware upgrade, Remote Console session, or XML scripting is in progress through the Integrated Lights-Out Ethernet port. This ensures that critical functions are not interrupted. While any of these functions are occurring, the server’s blue Unit Identification LED flashes to indicate that the Diagnostic Port is unavailable.

POST LED indicator

Integrated Lights-Out firmware has been updated specifically for the ProLiant BL p-Class System to provide feedback during the POST process. Because the ProLiant BL20p server blades are managed remotely and no monitor is directly attached, an onsite technician or administrator who inserts a new blade into a bay lacks the capability to watch memory count and the POST process to ensure that the server is booting up correctly. The Integrated Lights-Out firmware provides an indicator of correct POST operations. Integrated Lights-Out blinks the Server Health LED (green) during the boot process. If the process is completed successfully, the LED will remain green, and control will be returned to the server blade. If the POST process fails, the LED color will change from green to amber.

power allocation and release

One of the primary responsibilities of Integrated Lights-Out in the server blade architecture is to assist in managing the power resources. For a server blade to power on, the necessary power must be available from the infrastructure. Integrated Lights-Out verifies with the Power Management Module that there is sufficient power before powering on the server. Any of the following operations sends a power-on request to Integrated Lights-Out:

- Physical power button on the server blade is pushed on.
- Wake-on-LAN signal is received. Wake-on-LAN enables an operating system and applications to be installed using the Preboot eXecution Environment (PXE). This allows server blades to be installed in a rack but powered-on and deployed later. Using PXE, a server blade can load and execute a boot image from a PXE server on the network before starting the operating system on the local hard drive.
- Virtual Power Button request is made through the standard web browser of Integrated Lights-Out. Through Virtual Power, an administrator can control power to a server remotely — for example, to force a power cycle of a “hung” server. Like other aspects of Integrated Lights-Out, the Virtual Power feature is controlled in an OS-independent fashion and will function regardless of the state of the OS.
- A server blade is inserted into a bay that has the auto-on feature enabled. The Integrated Lights-Out console provides the ability to configure rack settings, such as defining certain bays that will automatically power on if a server blade is inserted.

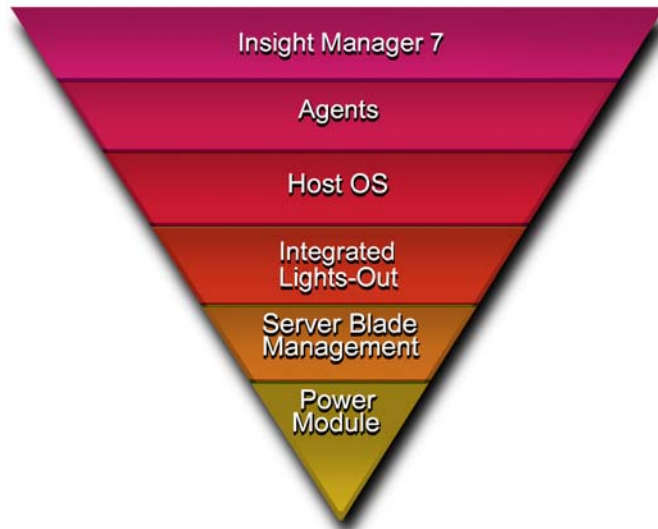
Once Integrated Lights-Out receives a power-on request, it requests permission from the Server Blade Management Module to power on the blade. The Server Blade Management Module, in turn, inquires from the Power Management Module whether adequate power is available. If sufficient power is available without exceeding the maximum power load, the power system signals that the blade may power up. If there is not enough power available, the power subsystem will reply with a “wait and retry” message. To bring the server blade up as quickly as possible, Integrated Lights-Out will retry the power-on request starting with requests at 15-second intervals. After the first minute, Integrated Lights-Out retries the power-on request in five minute intervals to reduce traffic on the communication bus.

Because there may be cases in which an administrator needs to power on a blade even when the Power Management Module indicates there is insufficient power, Integrated Lights-Out allows a power override. This can be done by two methods, either by holding the physical power button on for five seconds, or by selecting the manual override button from the Integrated Lights-Out Virtual Power web page. The manual override must be used very carefully to avoid possible loss of service and data.

infrastructure communication

Integrated Lights-Out provides a direct communication channel between the management agents, the host OS, the Server Blade Management Module, and the Power Management Module (Figure 5). Through the intelligent management capabilities of Integrated Lights-Out, an administrator can more easily configure and manage the entire infrastructure of the ProLiant BL p-Class System.

figure 5: integrated lights-out provides an intelligent communication layer between the OS software and server blade hardware



rack configuration and diagnostics

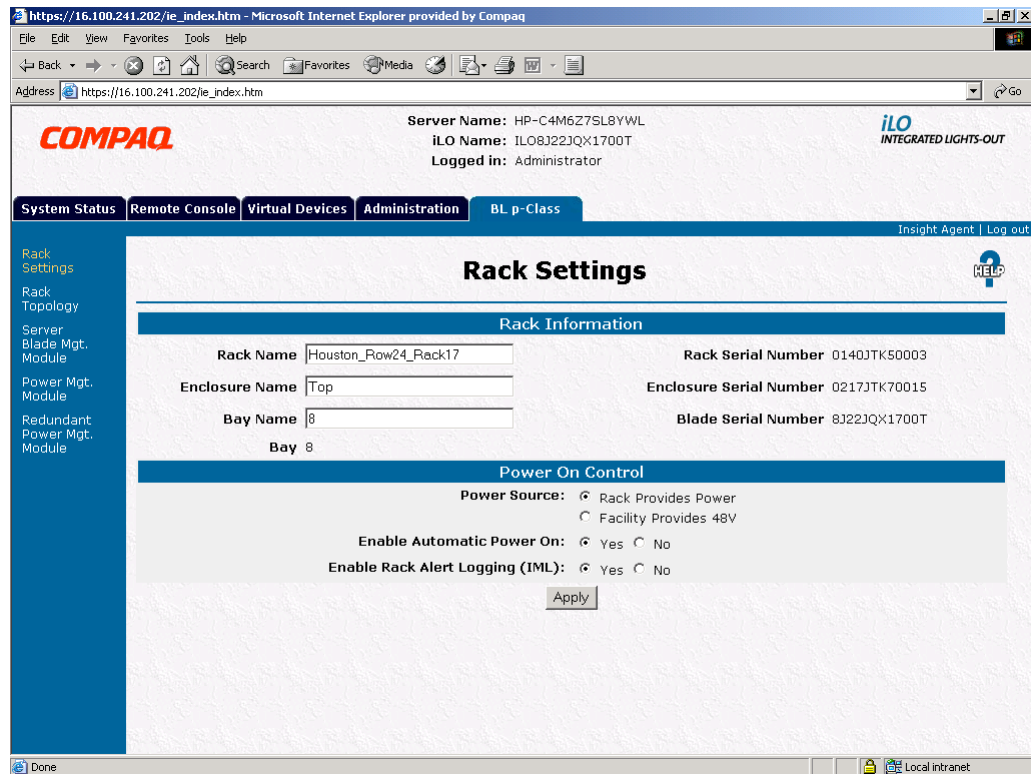
The Integrated Lights-Out web interface provides an additional tab that appears only on ProLiant BL p-Class Systems. This web page provides specific information and configuration abilities applicable to the ProLiant BL p-Class System.

Integrated Lights-Out communicates configuration information to the Server Blade Management Module. The ProLiant BL20p server blades have the ability to report their unique physical location to the user through Insight Manager 7 and the Integrated Lights-Out web interface. The ProLiant BL p-Class System provides the following location data to Integrated Lights-Out:

- Rack name – the human readable name assigned to a rack by the user. If the user has not assigned a name to a given rack, a default name of “Unnamed Rack” will be used.
- Enclosure name – the human readable name given to an enclosure within a rack. If the user has not assigned a name to the enclosure, the enclosure’s serial number will be used as default.
- Server blade bay number – the number of the bay in a server enclosure into which a ProLiant BL20p server blade is installed.

The Integrated Lights-Out stores this blade location information in memory and displays it on its blade-specific web page (Figure 6). When a server blade is inserted into the rack, Integrated Lights-Out queries the rack configuration to update its location. If a rack or blade enclosure name changes, Integrated Lights-Out receives an alert from the Server Blade Management Module and propagates the name change to the other server blades in that affected enclosure.

figure 6: example of the integrated lights-out web interface specific to the ProLiant BL p-class system



infrastructure diagnostics

The Integrated Lights-Out web interface provides user-level diagnostics of the rack infrastructure. This includes information on temperatures, fans, the Unit Identification LED, the presence of power supplies, firmware revisions of the blade and Server Blade Management Modules and blade and enclosure serial numbers. The infrastructure diagnostics may also be used to view all rack components and to confirm the communication between the rack components. An administrator can use the Rack Topology page to verify that all components are communicating on the rack management bus. The Server Blade Management Module and Power Management Module pages provide more detailed information on these management modules.

Integrated Lights-Out also assists in the upgrading of the firmware in the Server Blade Management Module and the Power Management Module. The OS-based firmware update application communicates the updated firmware through Integrated Lights-Out, which provides an intelligent communication channel between the host OS and the rack infrastructure.

infrastructure event logs

The ProLiant BL p-Class System includes all the same event and alert mechanisms that are familiar to users of other ProLiant servers. In the modular blade infrastructure, however, these alerts need to be forwarded from shared resources (such as the power supplies) to any server blades that may be affected. Integrated Lights-Out provides the communication mechanism to propagate alerts throughout the infrastructure. For example, if a power supply were removed from a power supply enclosure, the Power Management Module would send an alert to the Server Blade Management Module. The Server Blade Management Module would then propagate these alerts to all of the Integrated Lights-Out devices on the server blades.

Integrated Lights-Out can also forward SNMP alerts from the infrastructure to the Compaq Agents. These alerts are then forwarded to Insight Manager 7 or other SNMP-based management consoles. The SNMP alerts include server events such as a host server reset and iLO events such as an unauthorized login attempt.

location data for rapid deployment

The ProLiant BL p-Class system is designed for an adaptive infrastructure that may require frequent changes to server blade assignments as business needs change. To facilitate such an adaptive infrastructure, the ProLiant BL p-Class system includes the ProLiant Essentials Rapid Deployment Pack to automate the process of deploying and provisioning server software.

Rapid Deployment Pack enables “rip and replace” functionality specially optimized for the modular ProLiant BL line of servers. An administrator can assign a defined configuration to one or a group of server blade bays in an enclosure. When a server blade is replaced within an enclosure, the deployment server can immediately install a pre-defined configuration onto the newly installed server blade without local intervention. Integrated Lights-Out obtains the rack name, chassis name, and bay number, and communicates the information to Rapid Deployment Pack so the correct operating system configurations are deployed.

Use of the Rapid Deployment Pack maximizes customers' IT resources by providing a full server build from a remote, centralized deployment console for initial power on, automated server configuration on the fly, and installation of standard software sets based on customer-defined server configurations. More information about Rapid Deployment Pack is available at <http://www.compaq.com/manage/rapiddeploy>

conclusion

Because the computing world is moving towards a management model that relies on virtual presence — in which compute resources can be managed securely, at any time, from anywhere — one of the design criteria for the ProLiant BL p-Class system was the ability to comprehensively manage the blade from a remote location. Therefore, each ProLiant BL20p server blade contains the Integrated Lights-Out device to provide critical management functionality. Integrated Lights-Out provides specific functionality to ensure adequate power resources for the server blades, tailored web pages specific to the modular blade architecture, and an intelligent communication channel to provide location data for diagnostics, event reporting, and deployment data.

glossary

SNMP: Simple Network Management Protocol

feedback

Please direct comments regarding this communication to the ISS Technology Communications Group at this Internet address: TechCom@hp.com

The information in this document is subject to change without notice.

Microsoft and Windows are trademarks of Microsoft Corporation in the U.S. and/or other countries.

© Copyright Hewlett-Packard Company 2002

08/2002

TC020801TB