IBM

@server

BladeCenter
Type 8677

Planning and Installation Guide

GA27-4327-00

IBM

@server

BladeCenter
Type 8677

Planning and Installation Guide

GA27-4327-00

Note:

Before using this information and the product it supports, read the general information in Appendix C, "Notices" on page 95.

Preface

This book is intended for anyone who plans for the physical installation and configuration of an IBM® @server BladeCenter™ unit. This book is organized as follows and should be used for these tasks:

- Use Chapter 1, "Introducing the BladeCenter unit" on page 1 to understand the overall purpose and usage of BladeCenter units and blade servers.
- Use Chapter 2, "BladeCenter unit components" on page 9 to learn about the physical components that make up a BladeCenter unit.
- Use Chapter 3, "Deployment considerations" on page 21 to learn about network topology considerations and deployment considerations.
- Use Chapter 4, "Installation considerations" on page 41 and Appendix A, "Planning worksheets" on page 73 to plan for the physical environment for installing BladeCenter units. This includes, space, power, cooling and cabling. The worksheets provide the basis for selecting the features and options for each blade server, where the blade server is installed in a BladeCenter unit and a rack location for each BladeCenter unit.
- Use Chapter 5, "Configuration considerations" on page 61 and Appendix B, "Configuration Worksheets" on page 83 to plan for the configuration of the:
  - management module
  - Ethernet switch modules
  - Fibre channel switch modules
  - Blade servers.

Contents

Chapter 1. Introducing the BladeCenter unit

This manual provides physical planning information for the IBM®® @server BladeCenter™ unit. It describes the BladeCenter unit components, explains deployment and installation considerations, and provides worksheets that you can use to determine your BladeCenter unit hardware configuration. From these worksheets, you can determine the configuration, power, weight, and cabling requirements for your BladeCenter unit. In addition, you can use these worksheets as a basis for placing an order.

Why choose the BladeCenter technology?

The IBM @server BladeCenter™ Type 8677 is based on IBM X-Architecture™ technologies[1]

The BladeCenter unit is a high-density, high-performance rack-mounted server system developed for Enterprise applications. It supports up to 14 two-way blade servers, making it ideally suited for networking environments that require a large number of high-performance servers in a small amount of space. The BladeCenter unit provides common resources that are shared by the blade servers, such as power, cooling, system management, network connections, and I/O (diskette drive, CD-ROM drive, ports for USB, keyboard, video, mouse, and network interfaces). The use of common resources enables small size in the blade servers and minimal cabling.

Performance, ease of use, reliability, and expansion capabilities were key considerations during the design. These features make it possible for you to customize the hardware to meet your needs today, while providing flexible expansion capabilities for the future.

What the BladeCenter unit offers

The design of the BladeCenter unit takes advantage of advancements in server technology. It provides up to 14 functionally separate servers and their shared resources in a single center. The BladeCenter unit combines:

- **IBM X-Architecture technology**

  IBM X-Architecture technology leverages proven innovative IBM technologies to build powerful, scalable, reliable Intel-processor-based servers. X-Architecture technology includes features such as Predictive Failure Analysis® (PFA) and Advanced System Management, and Light Path Diagnostics.

- **Expansion capabilities**

  Blades can be added to the BladeCenter unit as needed, up to a maximum of 14 blades.

  Some blade servers have connectors for options that can be used to add capabilities to the blade, such as an I/O expansion card to add a network interface, or a storage expansion unit to add SCSI hard disk drives.

- **Hot-swap capabilities**

  The front bays on the BladeCenter unit are hot-swap blade bays; the rear bays on the BladeCenter unit are hot-swap module bays. You can add, remove, or

---

1. X-Architecture technology takes full advantage of existing IBM technologies to build powerful, scalable, and reliable Intel processor-based servers. For more information about IBM X-Architecture, go to http://www.ibm.com/pc/us/eserver/xseries/xarchitecture/index.html.

1

replace blades or management, switch, power, or blower modules in hot-swap bays without removing power from the BladeCenter unit.

- **Redundancy capabilities**

  The redundant components in the rear of the BladeCenter unit enable continued operation if one of the components fails. Normally, the redundant power modules and blowers share the load. If one of the power modules or blowers fails, the non-failing power module or blower handles the entire load. You can then replace the failed blower or power module without shutting down the BladeCenter unit.

- **Redundant network connection capabilities**

  Configuring a pair of Ethernet switch modules in switch-module bays 1 and 2 identically provides support for Ethernet failover configured on blade servers. Likewise, configuring blade server I/O expansion options for failover and configuring a pair of switch modules in switch-module bays 3 and 4 identically, provides support for failover on I/O expansion options. See the documentation that comes with your I/O expansion and switch module options for more information about configuring for redundant network connections.

- **System-management capabilities**

  The BladeCenter unit comes with a system-management processor in the management module. This system-management processor, in conjunction with the system-management processor in each blade server, enables you to remotely manage the BladeCenter unit components and the blade servers. The management module also multiplexes the keyboard, mouse, and video ports across all blade servers.

  The system-management processor in each blade server provides blade server monitoring, event recording, and alert capability.

- **Network environment support**

  The BladeCenter unit supports either one four-port 1 Gb Ethernet switch module or two Ethernet switch modules (in switch module bays 1 and 2). Each switch module provides one internal connection to each blade server.

  The BladeCenter unit also supports up to two additional switch modules (in switch module bays 3 and 4), for a total of four switch modules. Each of these additional switch modules provides one internal connection to the optional I/O expansion card installed on one or more blade servers.

  Note: The two additional switch modules must have the same I/O type, such as Fibre Channel, and must match the network interface on the optional I/O expansion cards in the blade servers.

BladeCenter unit features

The following table provides a summary of the features and specifications for the BladeCenter unit.

Table 1. Features and specifications

Media tray (on front):
• Diskette drive: 1.44 MB
• CD-ROM drive: IDE
• Universal Serial Bus (USB) V1.1 port
• Front system LED panel
 	
Module bays (on rear):
• Four hot-swap 200-240 volt power-module bays
• One hot-swap management-module bay
• Four hot-swap switch-module bays
• Two hot-swap blower bays
 	
Blade bays (on front):
 	
14 hot-swap blade bays
 	
Redundant cooling:
 	
Two variable-speed hot-swap blowers
 	
Power modules:
• Standard: Two 1200-watt 200-240 volt hot-swap power modules
• Maximum: Four
  – Power modules 1 and 2 supply 12 V to all modules and to blade bays 1 through 6
  – Power modules 3 and 4 supply 12 V to blade bays 7 through 14
  – Power modules 1 and 2 provide redundancy to each other
  – Power modules 3 and 4 provide redundancy to each other
 	
Switch modules:
• Standard: None
• Maximum: Two hot-swap 1 Gb Ethernet switch modules and two hot-swap switch modules of another network-communication standard, such as Fibre Channel
	Management module: One hot-swap management module providing the following features:
	• System-management processor functions for the BladeCenter unit
	• Video port (analog)
	• PS/2® keyboard port
	• PS/2 mouse port
	• 10/100 Mb Ethernet remote management connection
	
	Upgradeable microcode:
	• Management module firmware
	• Ethernet switch module firmware
	• Blade server system-management processor firmware
	
	Security features:
	• Login password for remote connection
	• Secure socket layer (SSL) security for remote management access
	
	Predictive Failure Analysis (PFA) alerts:
	• Blowers
	• Blade-dependent features
	
	Size (7U):
	• Height: 304.2 mm (12 in. or 7 U)
	• Depth: 711.2 mm (28 in.)
	• Width: 444 mm (17.5 in.)
	• Weight:
	  – Fully configured with modules and blades: Approx. 108.86 kg (240 lb)
	  – Fully configured without blades: Approx. 44.91 kg (99 lb)
		Acoustical noise emissions:
		• Without acoustics module option:
		  – Sound power, idle: 7.4 bels maximum
		  – Sound power, operating: 7.4 bels maximum
		• With acoustics module option:
		  – Sound power, idle: 6.9 bels maximum
		  – Sound power, idle: 6.9 bels maximum
		
		Environment:
		• Air temperature:
		  – BladeCenter unit on: 10° to 35°C (50° to 95°F). Altitude: 0 to 914 m (2998.69 ft)
		  – BladeCenter unit on: 10° to 32°C (50° to 89.6°F). Altitude: 914 m to 2134 m (2998.69 ft to 7000 ft)
		  – BladeCenter unit off: -40° to 60° C (-40° to 140° F).
		• Humidity:
		  – BladeCenter unit on: 8% to 80%
		  – BladeCenter unit off: 8% to 80%
		
		Electrical input:
		• Sine-wave input (50-60 Hz single-phase) required
		• Input power:
		  – Minimum: 0.40 kVA (two power supplies)
		  – Maximum: 2.82 kVA (four power supplies)
		• Input voltage: 200–240 Vac (200-240Vac)
		
		Heat output:
		
		Approximate heat output in British thermal units (BTU) per hour
		• Minimum configuration: 1365 BTU/hour (400 watts)
		• Maximum configuration: 9622 BTU/hour (2820 watts)

Notes:

1. For details about the BladeCenter unit port specifications, see "Input/output connectors" on page 11.
2. Although the keyboard and mouse use PS/2-style connectors, communication with them is through an internal USB bus in the BladeCenter unit. Make sure that each operating system on each blade server recognizes the keyboard and mouse as USB devices.

Why blade servers?

As organizations look to physically consolidate servers, they are looking to replace bulky server towers with 1U or 2U rack systems. These systems take less space and put the enterprise server infrastructure within easy reach of the administrator. However, these rack systems also introduce additional problems.

Each 1U or 2U server requires its own infrastructure, including power cables, Ethernet or Fibre Channel switches, systems management, power distribution units (PDUs), and keyboard/video/mouse (KVM) switches. A rack of 42 1U servers can have hundreds of cables strung throughout the rack, making it difficult to determine where cables are attached and increasing the complexity of adding or removing servers from the rack.

A blade server is a rack-optimized server architecture designed to provide the consolidation benefits of 1U and 2U rack systems while eliminating the complications associated with these systems. A server blade is an independent server containing one or more processors, memory, disk storage, and network controllers. A server blade runs its own operating system and applications.

Each server blade is inserted into a slot at the front of the BladeCenter unit and connects to the midplane. The midplane provides a connection to shared infrastructure components that includes, power, blowers, CD-ROM and diskette drives, integrated Ethernet and Fibre Channel switches, and the management module.

Blade server benefits

The BladeCenter architecture is an efficient solution for adding scalability and capacity in a data center. Benefits of the blade server architecture include:

- Modular scalability. Unlike traditional 8-way or 16-way servers, blade servers are designed to scale out rather than up. Adding a new server typically involves simply sliding a new single or dual-processor blade into an open bay in a BladeCenter unit. There is no need to physically install and cable individual servers.

  Option modules allow shared infrastructure features, such as Gigabit Ethernet switches and Fibre Channel switches, to be included inside the BladeCenter unit rather than externally attached. Power modules are also integrated into the unit eliminating many of the power cables and power distribution units that conventional servers require. This design along with its support for Network Attached Storage (NAS) and Storage Area Networks (SAN) allows the BladeCenter to integrate into a scalable storage solution with enhanced manageability features.

- Versatility. Unlike conventional server designs, blade design does not impose a limit of only one type of processor per server. Advanced chassis designs with sophisticated cooling and power technologies can support a mix of blades containing different types and speeds of processors. Each blade is a self-contained server, running its own operating system and software. This flexibility eliminates the need for standalone servers to perform specific functions. You can consolidate your workloads in one BladeCenter unit, regardless of whether an application requires a high-performance 64-bit processor or a 32-bit processor.

- Performance. You can get the same processing power found in 1U servers, but obtain up to twice the rack density at a potentially lower cost. Blades can be used for collaboration applications (Lotus®Notes™Microsoft®Exchange), Web

commerce applications (IBM WebSphere® Application Servers, WebSphere Commerce Server), computational nodes (Linux clusters, rendering farms), and workgroup infrastructure (Citrix MetaFrame terminal serving, Novell, or Microsoft file/print serving).

- High availability and ease of serviceability. Blade server designs include high-availability features similar to those found in conventional rack servers, such as redundant and hot-swap components (even the hot swapping of the blade servers themselves). Removing a server for maintenance involves simply sliding a blade out of the BladeCenter unit, which makes a policy of ″hot-spare″ servers effective to implement. In addition, you can configure blades to fail over to one another in the event of a failure.
- Systems management and deployment. In blade servers, integrated systems management processors monitor the status of blades and modules all at once. In the event of an alert, the processors can signal the systems management software, which can then notify the administrator by e-mail or pager at any hour of the day or night. In addition, the software is able to run system diagnostics and integrate with enterprise-wide systems management software.

The ability to slide server blades in and out of the BladeCenter unit makes new server deployment more efficient. When you insert a blade into an open bay, it is connected to all infrastructure components in the BladeCenter unit. There is typically no need to plug multiple cables into each server as it is installed. For example, instead of having to attach a KVM cable, power cable, Ethernet cable, and systems management cable per server, you may only need to attach one of each cable per BladeCenter unit, which contains multiple servers. Even if you decide to attach a second set of cables for redundancy you still have to attach many fewer cables than is needed for a similar configuration of standalone servers.

Deployment scenarios

The IBM® BladeCenter unit can be deployed to support a variety of networking goals and environments, such as:

- **Server consolidation**

  The IBM BladeCenter unit can be used by organizations with multiple server locations that need to centralize or physically consolidate servers to increase flexibility, reduce maintenance costs, and reduce human resources.
- **E-business infrastructure**

  The IBM BladeCenter unit can be used by companies that need to deploy new e-commerce and e-business applications and infrastructure quickly to minimize time to market, while at the same time ensuring flexibility, scalability, and availability.
- **Enterprise infrastructure**

  The IBM BladeCenter unit can support Enterprise infrastructure through:
  File and print: For organizations with decentralized/departmental file and print servers that need to reduce the cost of ownership, increase reliability and provide flexibility for growth.
  Collaboration: For customers needing a cost-effective and reliable corporate solution for e-mail, calendar, and other collaboration capabilities.
- **High-performance computing**

  The IBM BladeCenter unit can be used by customers with compute-intensive applications needing highly available clustered solutions to achieve significantly higher degrees of scalability and performance, all managed at a low cost.

Where to go for more information

The following publications and Web sites provide additional information about the installation, configuration, and operation of your IBM BladeCenter unit.

BladeCenter documentation and operating system installation instructions

Publications available for the BladeCenter products are listed below. Unless noted otherwise, all documents are available for download from the IBM Support Web page at http://www.ibm.com/pc/support/. From this Web page, select **Servers**, then select **Online publications** and choose a machine type of BladeCenter or BladeCenter HS20 from the **Family** drop-down list.

You can obtain up-to-date information about the BladeCenter unit, blade server, and other IBM® server products at http://www.ibm.com/eserver/xseries/

Hardware Documentation

Publications available for BladeCenter products include:

- *IBM @server BladeCenter Products Hints and Tips*

  This document contains information based on technical observations and is intended to supplement the IBM @server BladeCenter publications provided with the BladeCenter products.

- *IBM @server BladeCenter Type 8677 Installation and User's Guide*

  This document contains general information about your BladeCenter unit, including information about features, how to configure your BladeCenter unit, and how to get help.

- *IBM @server BladeCenter Type 8677 Hardware Maintenance Manual and Troubleshooting Guide*

  This document contains the information to help you solve BladeCenter problems yourself, and information for service technicians.

- *IBM @server BladeCenter HS20 Type 8678 Installation and User's Guide*

  This document contains instructions for setting up a BladeCenter HS20 Type 8678 blade server and basic instructions for installing some options. It also contains general information about the blade server.

- *IBM @server BladeCenter HS20 Type 8678 Hardware Maintenance Manual and Troubleshooting Guide*

  This document contains the information to help you solve BladeCenter HS20 problems yourself, and information for service technicians.

- *IBM @server BladeCenter Rack Installation Instructions*

  This document contains instructions for installing BladeCenter units in a rack.

- *IBM 4-Port GB Ethernet Switch Module for BladeCenter Installation Guide*

  This document contains setup and installation instructions for the IBM BladeCenter 4-Port Gb Ethernet Switch Module. This publication also provides general information about your Ethernet switch module, including information about getting started, first-time connection to the Ethernet switch module, how to configure your Ethernet switch module, and how to get help.

- *IBM 4-Port GB Ethernet Switch Module for BladeCenter Installation and User's Guide*

  This document contains instructions for setting up and configuring the IBM 4-Port GB Ethernet Switch module for BladeCenter and a description of the switch module features.

- *IBM @server BladeCenter Management Module User's Guide*

  This document contains detailed information about the Management Module that comes with your BladeCenter unit.

- *IBM @server BladeCenter Acoustic Attenuation Module*

  This document contains instructions for installing the optional acoustic attenuation module on a BladeCenter unit.

- *IBM @server BladeCenter HS20 IDE Hard Disk Drive*

  This document contains instructions for installing optional hard disk drive in a blade server.

- *IBM @server BladeCenter HS20 SCSI Storage Expansion Unit*

  This document contains instructions for installing the optional SCSI storage expansion unit on a blade server.

- *IBM @server BladeCenter Microprocessor Option*

  This document contains instructions for installing the optional microprocessor in a blade server.

- *IBM @server BladeCenter Power Supply Modules*

  This document contains instructions for installing the optional power supply modules in a BladeCenter unit.

- *IBM Director 4.0 for BladeCenter products Installation and Configuration Guide*

  This document is available for download from the IBM Support Web page at http://www.ibm.com/pc/support/. From this Web page, select **Servers**, then select **Online publications** and choose IBM Director from the **Online publications by category** drop-down list. This guide contains instructions for using IBM Director 4.0 to perform systems management tasks on BladeCenter products.

Redpapers and redpieces

The following publications are available from the IBM Redbook Web site at http://www.ibm.com/redbooks. From this Web site, search for **BladeCenter**.

- *IBM @server BladeCenter Systems Management* (REDP3582) : This document contains an overview of the IBM @server BladeCenter management tools and describes the management module integrated Web GUI.

- *The Cutting Edge: IBM @server BladeCenter* (REDP3581): This document contains an introduction to the IBM @server BladeCenter unit and presents the advantages of Blade Servers. It also looks at various installation methods that are available and important items to consider before performing an installation.

- *Deploying Microsoft Exchange on IBM @server BladeCenter* (REDP3585): This document describes how to set up and configure Microsoft Exchange 2000 on the IBM @server BladeCenter unit. It also describes BladeCenter functionality in this type of environment.

- *Deploying Lotus Domino™ on IBM @server BladeCenter* (REDP3584): This document helps you set up and configure IBM @server BladeCenter products to run Lotus Domino 6 on Windows® 2000 Advanced Server. It also helps you tune Lotus Domino 6 for better performance while running in an IBM @server BladeCenter environment.

Operating system installation instructions

Instructions for installing operating systems on a blade server are on the IBM Support Web page at http://www.ibm.com/pc/support/. From the IBM Support Web page select **Servers**; then, select **OS installation** and choose the operating system to install from the **Operating system installation by category** drop-down list.

Web sites

You can find information about your BladeCenter unit from this Web site:
http://www.pc.ibm.com/us/eserver/xseries/bladecenter_family.html

These sites provide information related to installation of your BladeCenter unit:

- Information about IBM Director is available at this Web site:
http://www-1.ibm.com/servers/eserver/xseries/systems_management/director_3.html

- Information about Remote Deployment Manager (RDM) is available at this Web site: http://www.pc.ibm.com/us/eserver/xseries/systems_management/rdm.html

- Information about IBM Cluster Systems Management (CSM) for Linux is available at this Web site: http://www-1.ibm.com/servers/eserver/clusters/software/

- Information about installing Linux is available at this Web site: http://www-1.ibm.com/servers/eserver/linux/xseries/

- You can link to configuration tools and information (such as the Rack Configurator and the Configuration Options Guide from this site: http://www.pc.ibm.com/us/eserver/xseries/library/configtools

- You can find out about the training offered by IBM for the BladeCenter unit at this Web site: http://www.pc.ibm.com/ww/eserver/xseries/education/course_catalog.html

Chapter 2. BladeCenter unit components

The following illustration shows the locations of major components in the BladeCenter unit.

Management module
Power module
Blower module
Blade server
USB port
Media tray
Blade server with storage-expansion unit
CD-ROM drive
Diskette drive
Front bezel
Switch module
Filler blade
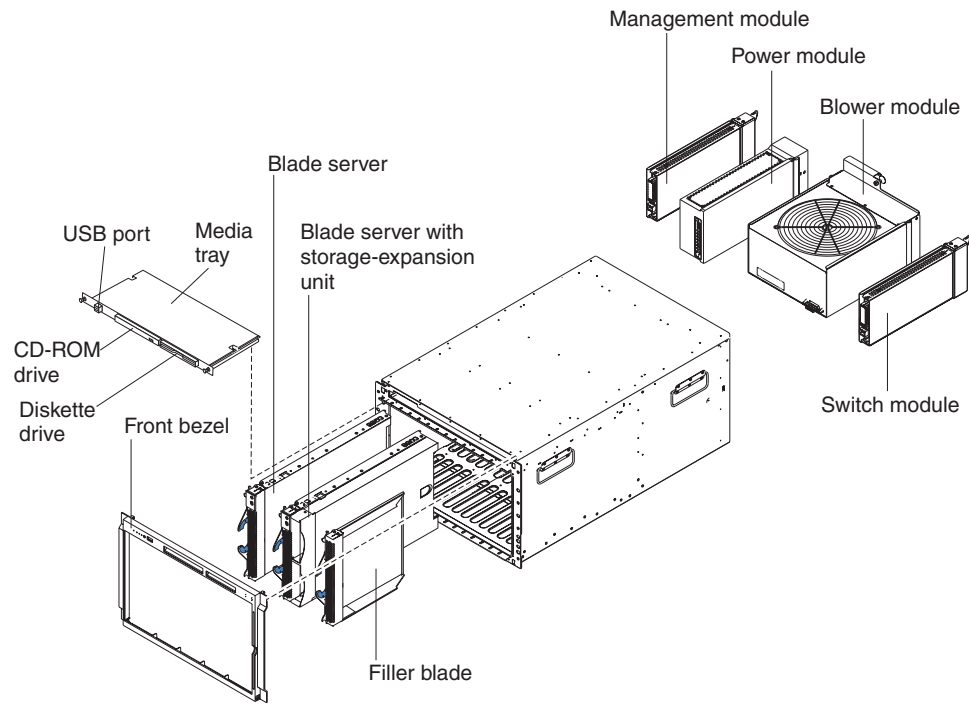
Chassis

The BladeCenter unit houses all components, including:
- Blade servers
- Management module
- Power modules
- Blowers
- Switch modules

It includes a media tray that contains a CD-ROM drive, diskette drive, and USB port.

Front view

This section identifies the components, controls, and LEDs on the front of the BladeCenter unit.

USB port
CD-ROM activity LED
Diskette-drive activity LED
Front system LED panel
CD-eject button
Diskette-eject button
Blade control panel
System service card
Blade servers
Filler blades
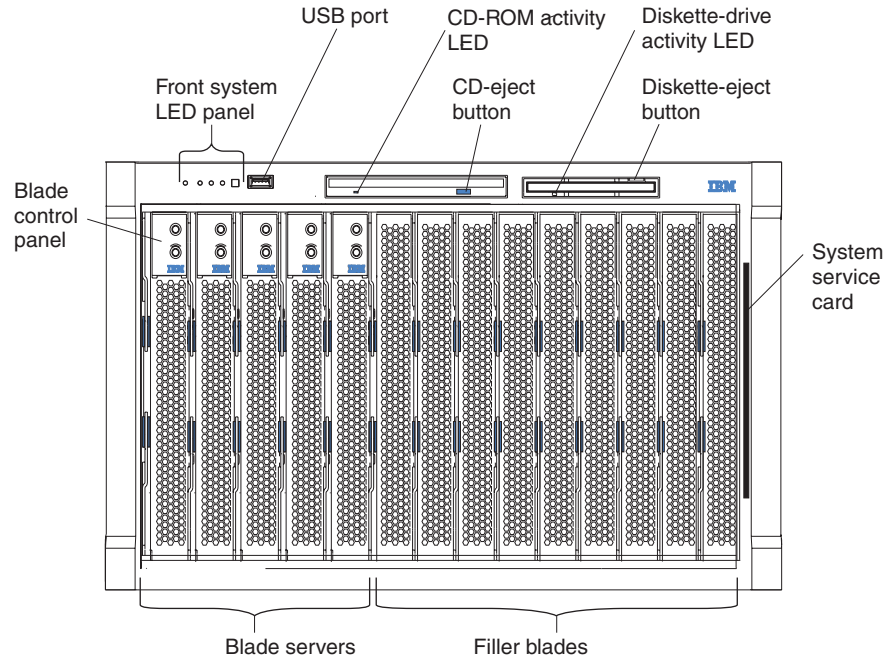
Rear view

This section identifies the components on the rear of the BladeCenter unit.

Switch module bay 3
Switch module 1
Power module bay 3
Blower module 1
Power module 1
Management module
Reserved
Blower module 2
Power module 2
Power module bay 4
Rear system LED panel
Switch module 2
Switch module bay 4
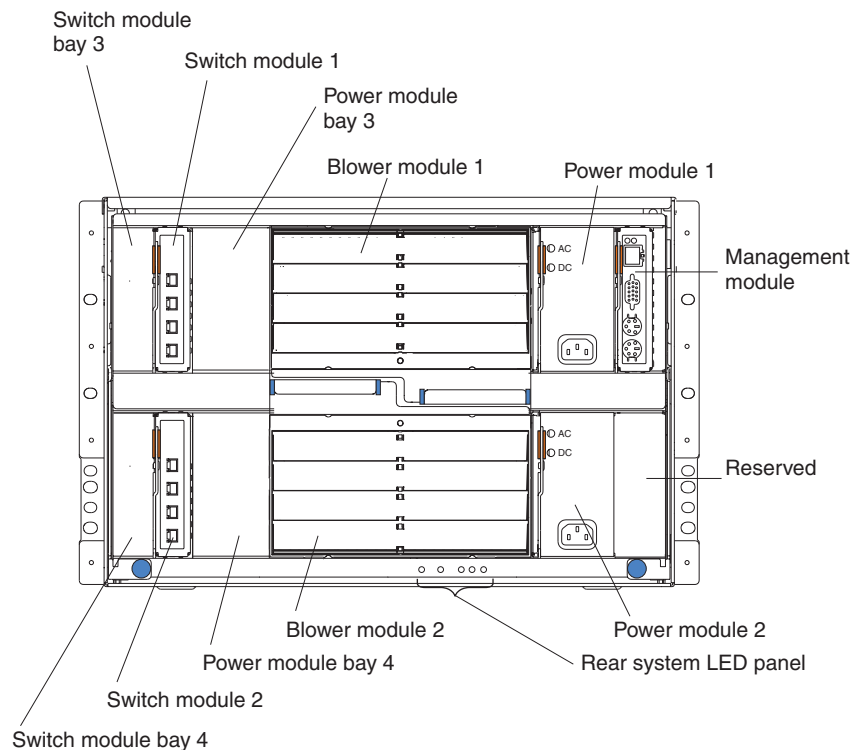
Input/output connectors

The BladeCenter unit has the following ports:

Video

> The BladeCenter management module contains one standard video connector. The integrated video controller on each blade server is compatible with SVGA and VGA and communicates through this video port. Use this connector to connect a video monitor.

Keyboard
Use this connector to connect a PS/2 keyboard to the BladeCenter unit.

PS/2 mouse

> Use this connector to connect a PS/2 mouse to the BladeCenter unit.

One Universal Serial Bus (USB) on the front of the BladeCenter unit

> The BladeCenter unit has one Universal Serial Bus (USB) version 1.1 connector on the front of the BladeCenter unit.

> Use the USB connector to connect a USB device **other than a mouse or keyboard** to the BladeCenter unit. USB technology transfers data at up to 12 Mb per second (Mbps) with a maximum of 127 devices and a maximum signal distance of 5 meters (16 ft) per segment. Using Plug and Play technology, USB devices are configured automatically.

> Use a USB cable to connect a device to the USB connector. If you need to connect more than one USB device, use a USB hub.

One 10/100 Mbps Ethernet for remote console and management

> The BladeCenter management module contains one 10/100 Mb Ethernet port that provides the remote connection to the system management station on the network.

> Use this port for remote management and remote console.

> The network management station, through this port, can access control functions running in the service processor on each blade server or within each switch module. However, it cannot use this port to communicate with application programs running in the blade servers. The system management station must direct those communications through a network connected to the external ports in the switch modules.

Four 10/100/1000 Mbps Ethernet on each Ethernet switch module

> Each Ethernet switch module contains four Ethernet connectors.

> Connect a Category 3, 4, 5, or higher unshielded twisted-pair cable to this connector. The 100BASE-TX and 1000BASE-T Fast Ethernet standards require Category 5 or higher.

The following illustration shows the I/O connectors on the rear of the BladeCenter unit.

Remote management and console (Ethernet)

Video

Mouse

Keyboard

Switch module Ethernet

AC power (220 volts)
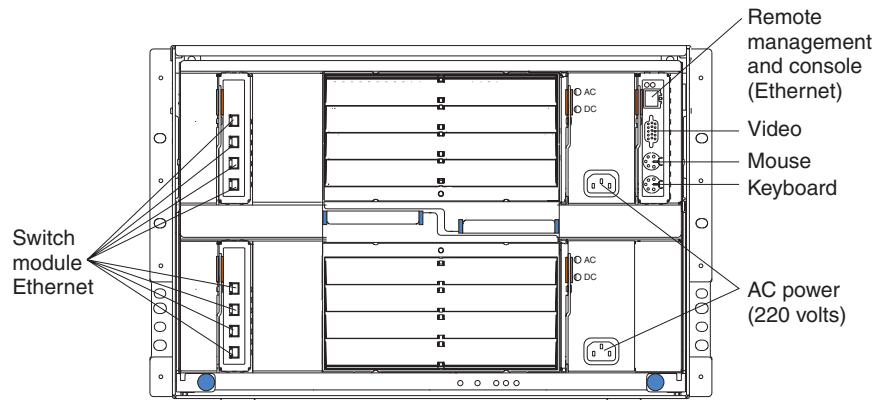
Blade servers

The IBM BladeCenter HS20 Type 8678 blade server is based on the IBM X-Architecture technologies[2]

This high-performance blade server is ideally suited for networking environments that require superior microprocessor performance, efficient memory management, flexibility, and reliable data storage.

Control panel

Release levers
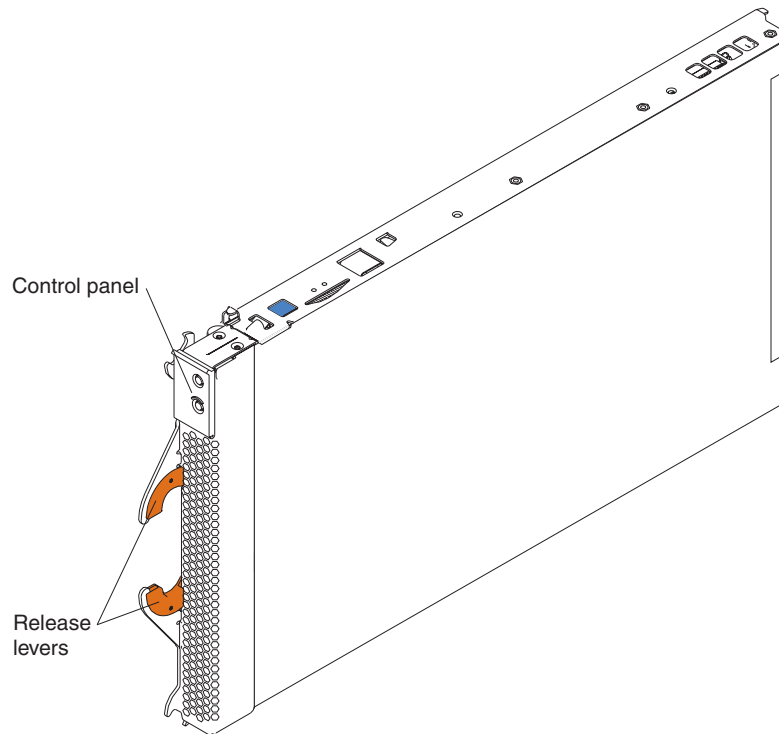
2. Enterprise X-Architecture technology takes full advantage of existing IBM technologies to build powerful, scalable, and reliable Intel processor-based servers. For more information about IBM Enterprise X-Architecture, go to http://www.ibm.com/pc/us/eserver/xseries/xarchitecture/enterprise/index.html.

Features and specifications

The following table provides a summary of the features and specifications of the BladeCenter HS20 Type 8678 blade server.

Microprocessor:	Size:	Environment:

Supports up to 2 microprocessors
• Intel™ Xeon 2.0 GHz or faster
• 512 KB ECC L2 cache
 	
Memory:
• Four double data rate (DDR) PC1600 sockets
• Minimum: 512 MB
• Maximum: 4 GB
• Type: 2-way interleaved, DDR, PC2100, ECC SDRAM registered x4 (Chipkill™) DIMMs only
Note: PC2100 DIMMs are backward-compatible and can function in the PC1600 sockets
• Supports 256 MB, 512 MB, and 1 GB dual inline memory modules (DIMMs)
 	
Drives:
• Support for up to two internal IDE 2.5-inch hard disk drives
• Support for up to two Ultra320 SCSI hot-swap hard disk drives available in the optional SCSI storage expansion unit
	• Height: 24.5 cm (9.7 inches)
	• Depth: 44.6 cm (17.6 inches)
	• Width: 2.9 cm (1.14 inches)
	• Maximum weight: 5.4 kg (12 lb)
	
	Integrated functions:
	• Two Gigabit Ethernet controllers
	• ATI Rage XL video controller
	• Light Path Diagnostics™
	• Local system-management processor
	• IDE hard disk drive controller
	• RS-485 interface for communication with BladeCenter management module
	• USB buses for communication with keyboard, mouse, diskette drive, and CD-ROM drive
	
	Predictive Failure Analysis (PFA) alerts:
	• Microprocessor
	• Memory
	• Hard disk drives
		• Air temperature:
		  – Blade server on: 10° to 35°C (50° to 95°F). Altitude: 0 to 914 m (2998.69 ft)
		  – Blade server on: 10° to 32°C (50° to 95°F). Altitude: 914 m to 2134 m (2998.69 ft to 7000 ft)
		  – Blade server off: -40° to 60°C (-40° to 140° F)
		• Humidity:
		  – Blade server on: 8% to 80%
		  – Blade server off: 5% to 80%
		
		Electrical input:
		• Input voltage: 12 V dc

Management module

The BladeCenter unit comes with one hot-swap management module in the management bay.

The management module functions as a system-management processor (service processor) and keyboard/video/mouse (KVM) multiplexor for the blade servers. The management module is used to configure the BladeCenter unit and modules, configuring such information as the switch IP addresses. The management module provides the following external connections: keyboard, mouse, and video for use by a local console, and one RJ-45 connector for a 10/100 Mbps Ethernet remote management connection.

The network connection for the management module should be to a network that is dedicated to network management tasks. This provides a greater level of security and a different network path to the BladeCenter unit if you experience an outage on the network path to the Ethernet switch modules.

The service processor in the management module communicates with the service processor in each blade server for such functions as:
• Blade server power-on requests
• Blade server error and event reporting
• Requests for keyboard, mouse, and video (KVM) switching
• Requests for diskette drive, CD-ROM drive, and USB port switching

The management module also communicates with the switch modules, power modules, blower modules, and blade servers to detect presence or absence and any error conditions, sending alerts when required.
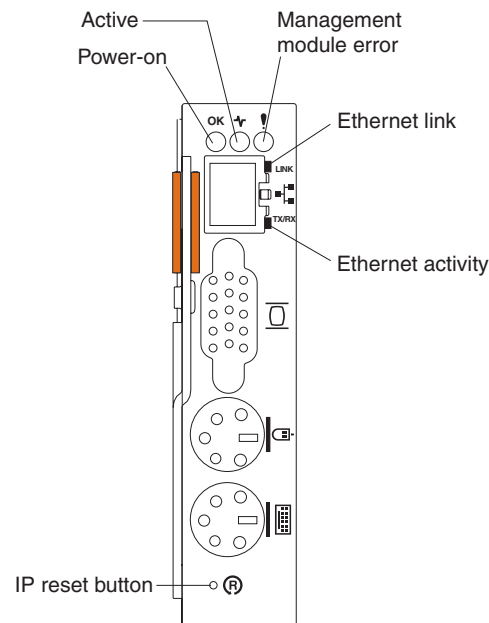
Power modules

The BladeCenter unit comes with one pair of 200–240 volt hot-swap power modules in power bays 1 and 2 that provides power to all the BladeCenter modules and to blade bays 1 through 6. The BladeCenter unit supports a second pair of power modules in power bays 3 and 4 that provides power to blade bays 7 through 14. Each power module supplies 12 volts to the blade bays and modules it services.

Note: If you install in blade bay 6 a blade server that has a storage expansion unit option attached, the option uses blade bay 7; power modules will be required in power bays 3 and 4.

Each pair of power modules is redundant; if a power module fails, the remaining power module continues to supply power. If only one power module of a pair is present, it can be installed in either bay of the pair; there is no redundancy.

Power modules are not needed in bays 3 and 4 until you begin installing blades or options in blade bays 7 through 14.
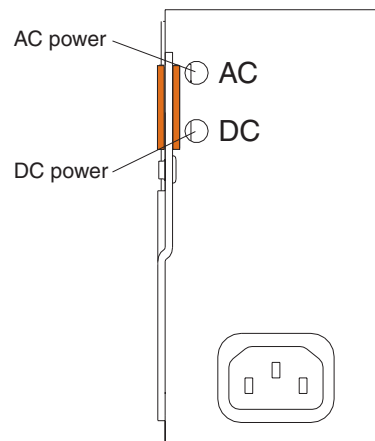
Blowers

The BladeCenter unit comes with two hot-swap blowers for cooling redundancy. The blower speeds vary depending on the ambient air temperature at the front of the BladeCenter unit. If a blower fails, the remaining blower continues to cool the BladeCenter unit. However, a failing blower must be replaced as soon as possible to avoid potential thermal problems.
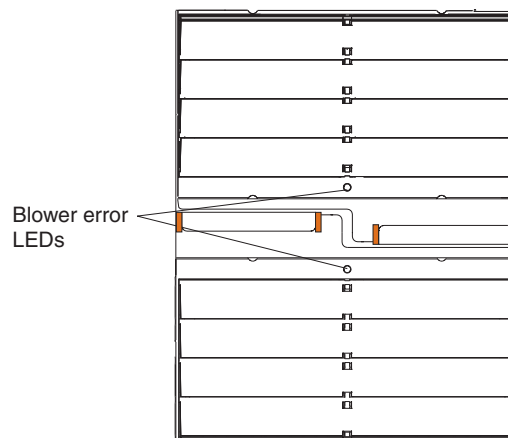
Acoustic attenuation option

For server environments where noise reduction is essential, you might choose to install the BladeCenter Acoustic Attenuation option (acoustic option). The acoustic option is installed on the back of the BladeCenter unit, directly covering the blower modules and partially covering the other modules. The system LED panel is replicated on the acoustic module for visibility.

Switch modules

The BladeCenter unit supports a minimum of one hot-swap Ethernet switch module, in switch-module bay 2. This switch module provides an internal connection to Ethernet Link 1 in all the blade servers in the BladeCenter unit. To provide an internal connection for Ethernet Link 2 in each blade server, install an Ethernet switch module in switch-module bay 2.

Note: Enumeration of the Ethernet controllers is operating-system dependent. for example, the Ethernet controller located nearer the top of the blade server whose communications are routed through Ethernet switch module 1, is designated as the first connection (or Local Area Connection) by Microsoft Windows 2000, but is designated as the second connection (or eth1) by Red Hat Linux Version 7.3. The Ethernet controller located nearer the bottom of the blade server, whose communications are routed through Ethernet Switch module 2, is designated as the second connection (or Local Area Connection 2) by Microsoft Windows 2000, but is designated as the first connection (or eth0) by Red Hat Linux Version 7.3.

If you install an I/O expansion option on any blade server, you must install a hot-swap switch module of the same network interface in switch-module bay 3 to obtain network connection 3 for the option; to provide network connection 4 for the option, install a switch module of that network interface in switch-module bay 4. The switch modules in bays 3 and 4 provide network connections to all the I/O expansion options on the blade servers.

Important: The switch modules in switch-module bays 3 and 4 and all blade server I/O expansion options in the BladeCenter unit must use the same network interface. For example, if you install a Fibre Channel I/O expansion option on a blade server, the switch modules you install in switch-module bays 3 and 4 must be Fibre Channel, and all other I/O expansion options in the BladeCenter unit must also be Fibre Channel I/O expansion options.

The following table summarizes the application for each switch module. See "Rear view" on page 10 for the location of the BladeCenter switch-module bays.

Switch- module bay	Switch-module function
1	Network connection 1 (Ethernet Link 1) for all blade servers in the BladeCenter unit
2	Network connection 2 (Ethernet Link 0) for all blade servers in the BladeCenter unit
3	Network connection 3 (from all blade server I/O expansion options in the BladeCenter unit)
4	Network connection 4 (from all blade server I/O expansion options in the BladeCenter unit)

Ethernet switch module

The following illustration shows the major components of your Ethernet switch module.

Ethernet
switch module

Media access
control (MAC)
address label

Release latch

Serial number label

Information panel
Ethernet ports (4)
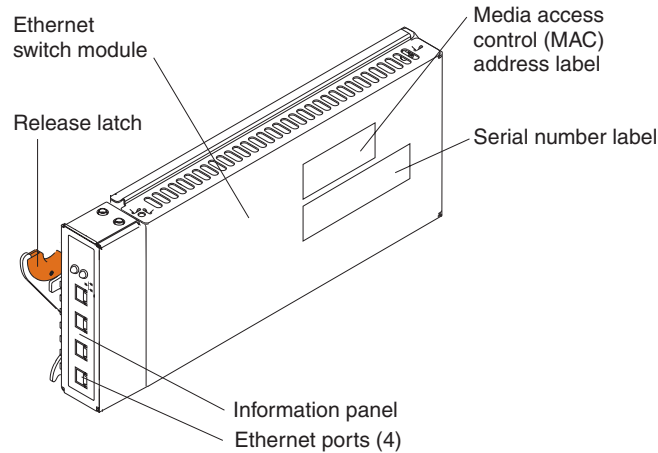
This section provides a summary of the features for your IBM xSeries™ 4-Port Gb Ethernet Switch Module.

The IBM xSeries 4-Port Gb Ethernet Switch Module features include:

Table 2. Ethernet switch module features and specifications

Feature	Specifications
Ports	• Four external 1000BASE-T ports for making 10/100/1000 Mbps connections to a backbone, end stations, and servers • Fourteen internal full-duplex gigabit ports to connect to BladeCenter blade servers

Performance	• Transmission method: Store-and-forward
	• Random-access memory (RAM) buffer: 8 MB per port
	• Packet filtering/forwarding rate:
	  – Full-wire speed for all connections. 148800 packets per second (pps) per port (for 100 Mbps)
	  – 1488100 pps per port (for 1000 Mbps)
	• Media access control (MAC) address learning: Automatic update. Supports 28 000 MAC addresses
	• Priority queues: Four priority queues per port
	• Forwarding table age time: Maximum age: 17 to 2100 seconds. Default = 300 seconds.
	• 802.1D Spanning Tree support. Can be disabled on the entire switch or on a per-port basis
	• 802.1Q Tagged virtual local area network (VLAN) support, including Generic Attribute Registration Protocol (GARP) VLAN Registration Protocol (GVRP)
	• Support for 256 VLANs in total, including 128 static VLANs
	• Internet group management protocol (IGMP) snooping support per switch and per VLAN
	• Link aggregation with 802.3ad support on four external ports for up to two static trunk groups or two link aggregation control protocol (LACP) 802.3ad link aggregation groups

Table 2. Ethernet switch module features and specifications (continued)

Feature	Specifications

Management	• Spanning Tree Algorithm (STA) protocol for creation of alternative backup paths and prevention of network loops
	
	• Simple network management protocol (SNMP) version 1
	
	• Fully configurable either in-band or out-of-band control through SNMP based software
	
	• Flash memory for software upgrades. This can be done through trivial file (TFTP) or hypertext transfer protocol (HTTP) Web interface.
	
	• Built-in SNMP management:
	  – Bridge management information base (MIB) (RFC 1493)
	  – MIB-II (RFC 1213)
	  – 802.1P/Q MIB (RFC 2674)
	  – Interface MIB (RFC 2233)
	  – Mini-RMON MIB (RFC 1757) - four groups. The remote monitoring (RMON) specification defines the counters for the receive functions only. However, the switch provides counters for both receive and transmit functions.
	
	• Supports Web-based management
	
	• TFTP support
	
	• Bootstrap protocol (BOOTP) support
	
	• Dynamic host configuration protocol (DHCP) client support
	
	• Password enabled
	
	• Telnet remote control console

Network cables	• 10BASE-T:
	  – UTP Category 3, 4, 5 (100 meters maximum)
	  – 100-ohm STP (100 meters maximum)
	
	• 100BASE-TX:
	  – UTP Category 5 (100 meters maximum)
	  – EIA/TIA-568 100-ohm STP (100 meters maximum)
	
	• 1000BASE-T:
	  – UTP Category 5e (100 meters maximum)
	  – UTP Category 5 (100 meters maximum)
	  – EIA/TIA-568B 100-ohm STP (100 meters maximum)

Standards

The following standards apply to the Ethernet switch module:
• IEEE 802.3 10BASE-T Ethernet
• IEEE 802.3ad (Link aggregation)
• IEEE 802.3u 100BASE-TX Fast Ethernet
• IEEE 802.3z Gigabit Ethernet
• IEEE 802.1Q Tagged VLAN
• IEEE 802.1p Tagged Priority
• IEEE 802.3ab 1000BASE-T
• IEEE 802.3x Full-duplex Flow Control
• ANSI/IEEE 802.3 NWay auto-negotiation

Fibre Channel switch module

The IBM BladeCenter Fibre Channel switch module features include:

- Ports:
  - Two external ports to connect to storage devices or Storage Area Networks
  - Fourteen internal ports to connect to blade servers
- Fibre Channel Protocols:
  - FC-PH Rev. 4.3
  - FC-PH-2
  - FC-PH-3
  - FC-AL Rev 4.5
  - FC-AL-2 Rev 7.0
  - FC-FLA
  - FC-GS-3
  - FC-FG
  - FC-PLDA
  - FC-Tape FC-VI
  - FC-SW-2
  - Fibre Channel Element MIB RFC 2837
  - Fibre Alliance MIB Version 3.0
- Fibre Channel Classes of Service: Classes 2 and 3
- Modes of Operation: Fibre Channel Classes 2 and 3, connectionless
- External Port Type: GL_Port
- Port characteristics: External ports are auto-discovering and self-configuring.
- Scalability: Maximum 239 switches depending on configuration
- Maximum User Ports: 475,000 ports depending on configuration
- Media Type: Small Form Pluggable (SFP) hot pluggable, optical transceivers.
- Fabric Port Speed: 1.0625 or 2.125 Gigabits/second
- Maximum Frame Size: 2148 bytes (2112 byte payload)
- Fabric Point-to-Point Bandwidth: 212 or 424 MBs full duplex
- Fabric Aggregate Bandwidth: 64 MBs for a single switch
- Fibre Channel Cable Media: 9 micron single mode, 50 micron multi-mode, or 62.5 micron multi-mode

Chapter 3. Deployment considerations

This chapter describes the information you need to plan for your BladeCenter deployment. For additional information about the deployment of your BladeCenter unit, refer to *IBM @server BladeCenter Systems Management*, which is available at http://www.ibm.com/redbooks.

Network topologies

You can deploy the BladeCenter unit in a variety of network topologies. This section describes some of these topologies and explains deployment considerations for each topology. These topologies include:

- Integrated infrastructure
- Network infrastructure
- Linux high performing cluster
- Cluster Virtual LAN (VLAN)
- Small server farm in a central location with one zone
- Large server farm in a central location with one zone
- Small server farm in a remote location with one zone

Integrated infrastructure

The BladeCenter unit can be deployed as part of a single-chassis or multi-chassis solution for an integrated infrastructure.

Single BladeCenter chassis

You can deploy your BladeCenter unit as an integrated solution for your business. Within a single BladeCenter unit, you can mix and match applications and operating systems. In addition, using a spare blade and the redeployment capabilities of IBM Director enables you to implement a ″Blade RAID″ concept. You can set up IBM Director and RDM to automatically image a spare blade to replace a failed server, increasing capacity to handle peak workloads, within seconds.
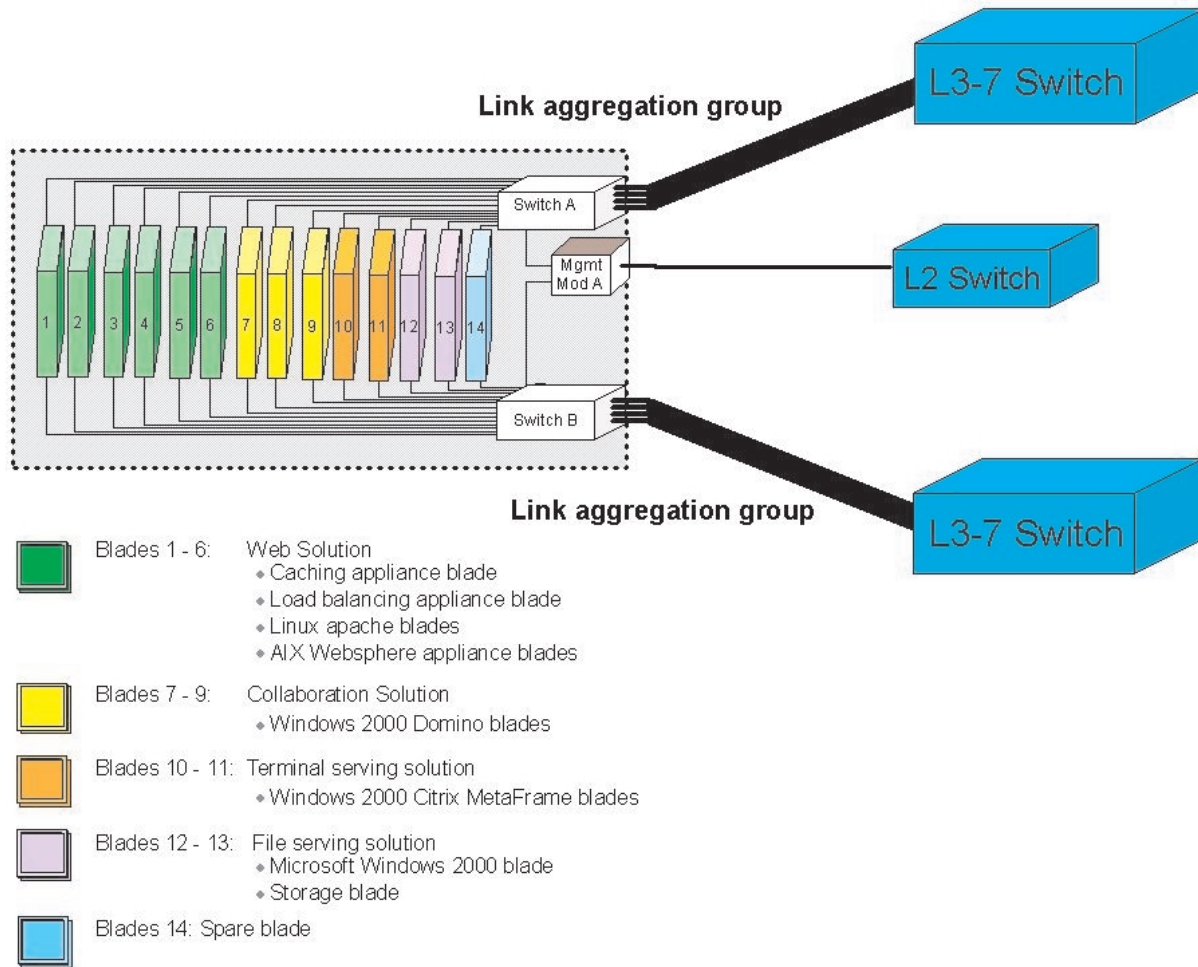
Figure 1. Single BladeCenter chassis

In this solution, the blades are configured as follows:

- Blades 1–6: Web solution consisting of:
  - Caching appliance blade
  - Load balancing appliance blade
  - 2 Linux Apache blades
  - 2 AIX® WebSphere application blades
- Blades 7–9: Collaboration solution consisting of Windows 2000 Domino blades
- Blades 10–11: Terminal Serving solution consisting of Windows 2000 Citrix MetaFrame blades
- Blades 12–13: File serving solution consisting of :
  - Microsoft Windows 2000 blade
  - Storage expansion option
- Blade 14: Spare blade

Multiple BladeCenter chassis
You can deploy a series of BladeCenter units as a network infrastructure solution.
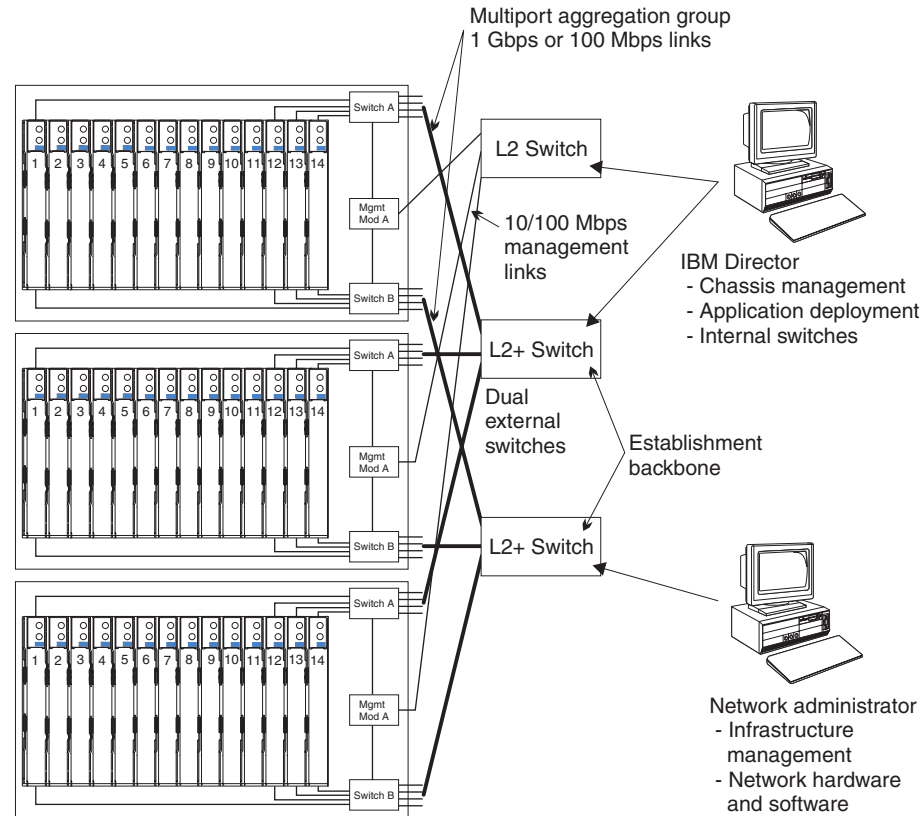
Figure 2. Multiple BladeCenter units as a network infrastructure

In this configuration, each BladeCenter unit contains two Ethernet switch modules and one management module. Both the external ports on the switch modules and the corresponding ports on the attaching external LAN switches are configured for multi-port link aggregation groups (or trunks). All switch module ports in switch bay 1 in the BladeCenter units are connected to the same external LAN switch and all switch module ports in switch bay 2 in the BladeCenter units are connected to the second external LAN switch.

Observe the following guidelines when creating this topology:

1. The external ports on the BladeCenter switch modules are designed for point-to-point, full-duplex operation to a compatible LAN switch or router. Configure a corresponding multi-port link aggregation group, or trunk, in both the switch module and the attaching LAN switch prior to installing the cables. The connection options are as follows, in order of preference:

   - Multi-port Link Aggregation Group or Trunk, 1 Gbps (1000 Mbps) per port
   - Single-uplink port, 1 Gbps
   - Multi-port Link Aggregation Group or Trunk, 100 Mbps per port

2. Connect the management module 10/100 Mbps Ethernet port to a separate network if possible, for security purposes. If a separate network is not available, connect the Ethernet ports of the management modules and switch modules to the same network.

3. Avoid network configurations that could lead to data loops, if possible. Loops are created when you connect multiple ports from the same switch module to

the same network device without first enabling link aggregation. If you implement configurations that include data loops, the spanning tree protocol on the switch module external ports must remain enabled.

Linux high performance cluster

You can also deploy a series of BladeCenter units in a Linux High Performance Cluster (HPC) solution.
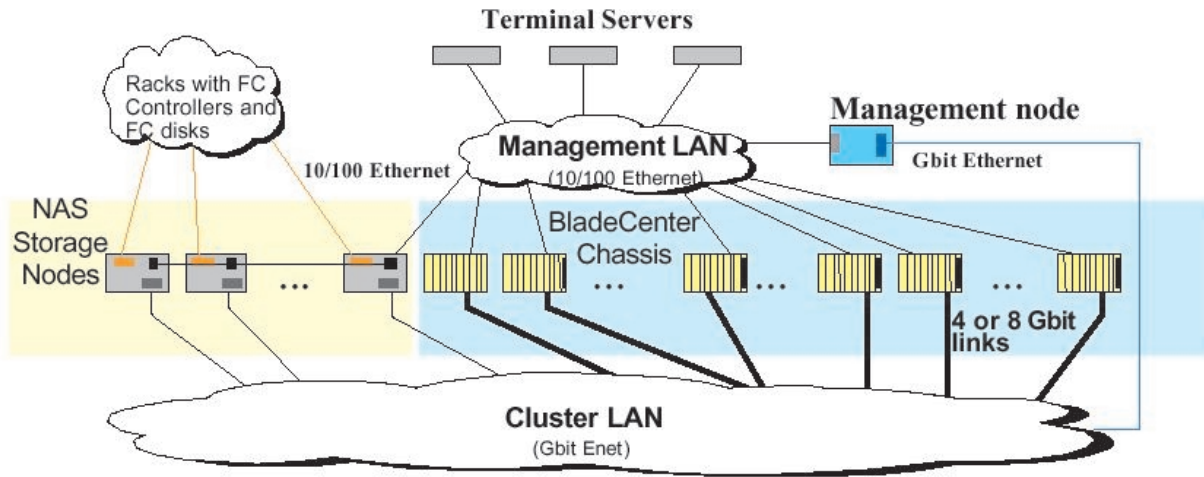
Figure 3. Linux high performance cluster

Cluster VLAN

This example shows four racks containing BladeCenter units implemented in a cluster VLAN. Devices in each rack can communicate directly with devices in another rack through the Ethernet Gb switches in each rack. This solution can support up to 210 processor nodes. It could also be expanded through the use of an additional level of switches.
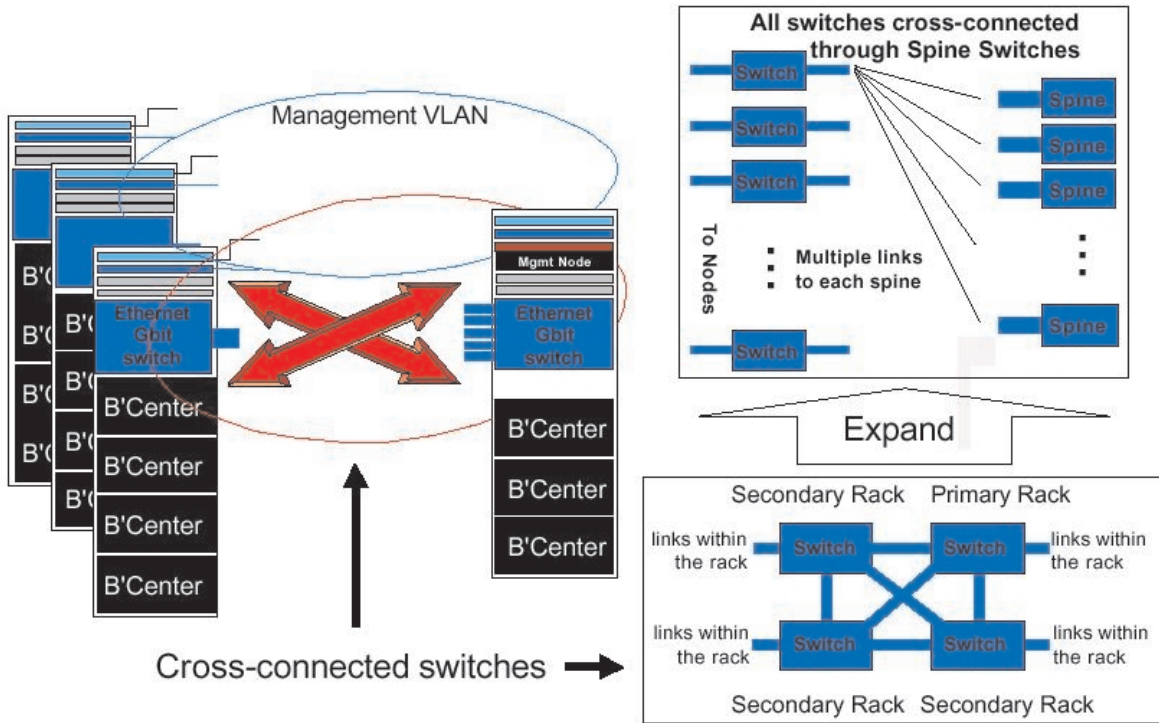
Figure 4. Cluster VLAN

Server Farms

This section describes example server farm topologies in which the BladeCenter unit can be deployed. These include:

- Small server farm in a central location with one zone.
- Large server farm in a central location with three zones.
- Small server farm in remote locations with one zone.

Small server farm-central location-1 zone

In this small server farm solution, two domain controllers have been implemented for redundancy. One of the domain controllers has been implemented in one of the blades with the SCSI option so that RAID 1 capabilities are available for the hard disk drive. Implementing physically separated units for domain controllers reduces the risk of a service outage.
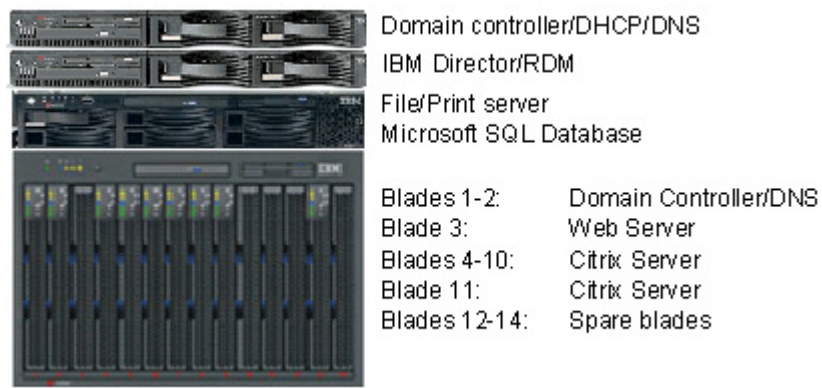
Figure 5. Small server farm-central location-1 zone

Seven blades provide Citrix Metaframe services to the infrastructure. One is designated as the Data Collector and an additional blade is used to install a Web server and Citrix NFuse to provide access through the Web.

A spare blade is included in the configuration, which can be used as:

- Cold spare. The blade is normally powered down and ready to be imaged through RDM to replace any failing blade.
- Oversizing. The blade runs a Citrix server image, providing redundancy by adding more farm capacity than is needed to actually sustain the workload.
- Testing. The blade can be used to test new images.

The remaining slots in the BladeCenter unit are available for future scalability or for other purposes in the infrastructure (such as implementing Secure Gateway).

Large server farm-central location-3 zones

In this example, three zone are used to support more than 100 servers in a single location. One domain controller per zone has been deployed.

In zone 1, two clustered file/print servers relying on external Fibre Channel storage solutions (not pictured) have been installed to support all of the users. One IBM Director/RDM server is included.
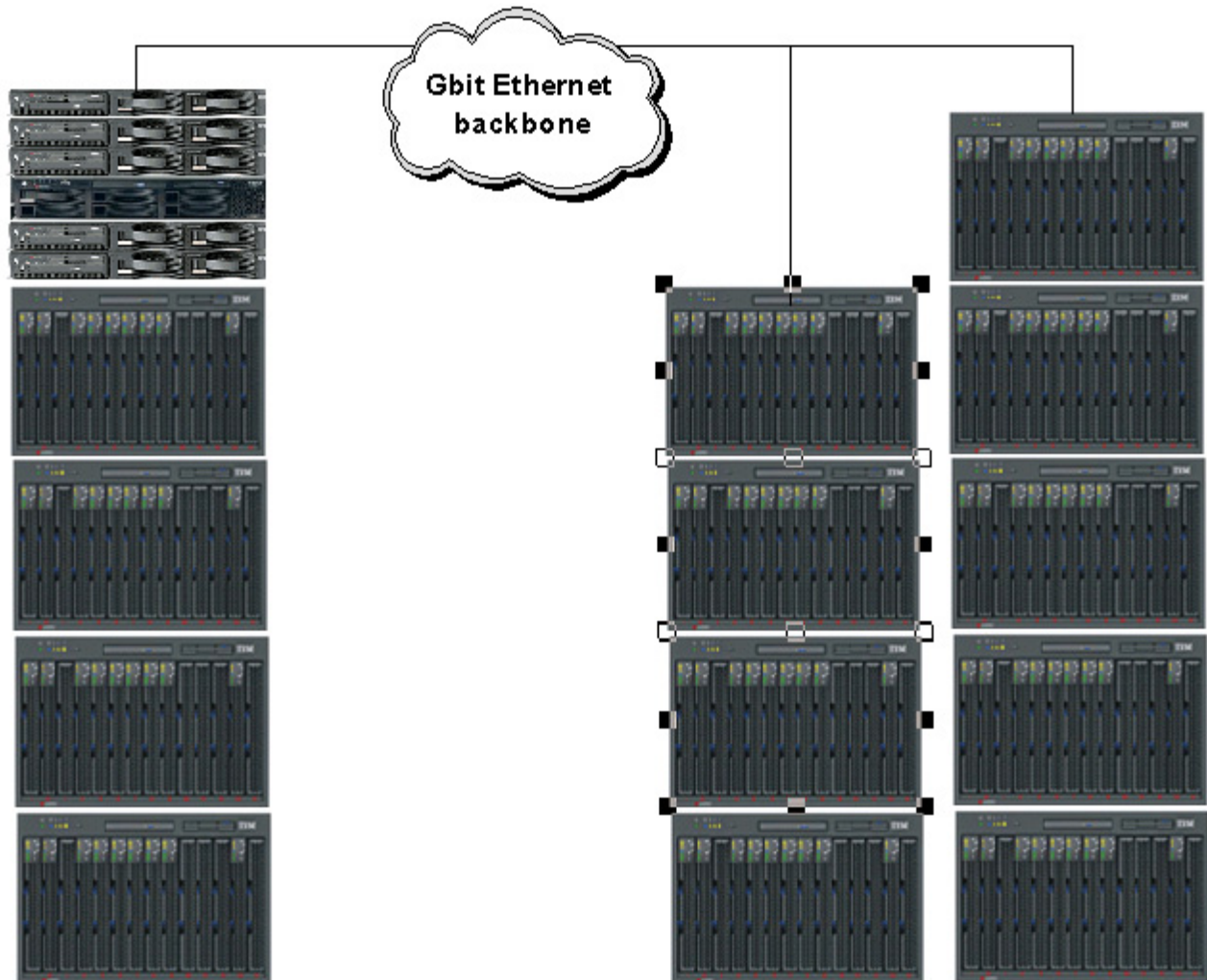
Figure 6. Large server farm-central location-3 zones

Small server farm-remote locations-1 zone

This example shows the configuration for a small server farm with remote sites. The BladeCenter unit is used to concentrate the entire LAN infrastructure in a small 7U form factor.

Each remote location has a domain controller, print server, and RDM server, which is dedicated to hosting only operating system images. The RDM server communicates with the main RDM server in a central location through standard HTTP commands.

Each site has spare capacity. In the central location, this spare capacity can be used for development or testing tasks.

At central location:

Blades 1-2:	Blade Server with SCSI expansion unit Domain Controller/DNS/DHCP
Blades 3-4:	Blade Server with SCSI expansion unit Print server
Blades 5-6:	Blade Server with SCSI expansion unit Microsoft SQL Server/Data Store
Blades 7-11:	Citrix MetaFrame Server
Blades 12:14:	Spare blades

At each remote site:

Blades 1-2:	Blade Server with SCSI expansion unit Domain Controller/DNS/DHCP
Blades 3-4:	Blade Server with SCSI expansion unit Print server
Blades 5-6:	Blade Server with SCSI expansion unit RDM boot server
Blades 7-11:	Citrix MetaFrame Server
Blade 12:	Citrix MetaFrame Server
Blades 13:14:	Spare blades

Figure 7. Small server farm-central location-1 zone

Preparing for BladeCenter deployment

To configure your BladeCenter unit, you need to:

- Determine which deployment tools you are going to use
- Set up your deployment infrastructure
- Configure your BladeCenter unit:
  - Configure the management module
  - Set the chassis policies
  - Configure the switch modules

This section provides information about the available deployment tools and setting up your deployment infrastructure.

Deployment tools

Before you can begin using the BladeCenter unit, you must configure each of the components (management module, switch modules, and blade servers). You have a variety of options available to configure these components. For example, you can access the firmware that is embedded into each of the components to configure the component using either of these options:

- Through a Web browser. To access the components through a Web browser, point the browser to the IP address for the component. The Web browser you use must meet the following requirements:
  - Support for Java™
  - Support for JavaScript™ 1.2
  - Minimum screen resolution of 800x600 with 256 colors.

  If you point to the management module, you will see the System Status menu after logging in. From this menu, you can perform management module configuration, switch module configuration, and blade server configuration. In addition, you can point your browser to the IP address of the switch modules or the blade server to configure those components directly.

- Through a Telnet interface. The Telnet interface provides a command line interface through the Management module, external Ethernet connection (out of band), or external Fibre Channel connection (in band). The command-line interface includes a Help menu, port display and configuration, general switch status and configuration, and Fibre Channel zoning capability.

Instructions for using the Web browser interface and Telnet are provided in the *BladeCenter Type 8677 Installation and User's Guide*.

You can also configure BladeCenter unit components using these deployment tools:

- IBM Director 4.0. You can use IBM Director 4.0, which includes a configuration wizard to guide you step-by-step through the various configuration options that are available. In addition, IBM Director 4.0 enables you to constantly monitor systems and handle alerts that occur in the case of hardware or software outages. For additional information about using IBM Director with the deployment of your BladeCenter unit, refer to *IBM @server BladeCenter Systems Management*, which is available at http://www.ibm.com/redbooks.
- Remote Deployment Manager 3.1.01 (must include Patch 2 or above). RDM provides an easy-to-use interface that allows you to quickly load your Windows operating system images on one or more blade servers. For additional information about using RDM with the deployment of your BladeCenter unit, refer

to *The Cutting Edge: IBM @server BladeCenter* and *IBM @server BladeCenter Systems Management*, which are available at http://www.ibm.com/redbooks.

- IBM Cluster Systems Management for Linux®. CSM allows you to perform Linux installations over a network. An IBM licensed program, CSM provides a distributed systems management solution for nodes of a cluster running Red Hat 7.1 (as distributed and supported by Red Hat). More information about using CSM is available at the following Web site: http://www.ibm.com/servers/eserver/clusters/software/.

IBM Director 4.0 and RDM 3.1.01 provide an easy way to configure the components of the BladeCenter unit and allows you to quickly reconfigure your servers to meet workload and hardware availability requirements. Instructions for using IBM Director 4.0 and RDM 3.1.01 are provided in the *BladeCenter Type 8677 Installation and User's Guide*.

Deployment infrastructure

Although the deployment of the BladeCenter unit does not require you to do so, you should consider setting up a separate management network to configure and manage your BladeCenter unit. By separating the LAN segment used for production from the LAN segment to which the BladeCenter management module (as well as the IBM Director and RDM server, if present) is connected, you can ensure that unauthorized connections are not possible. Only the administrators' systems would be connected to this LAN segment.

You should also consider the use of a DHCP server to lease IP addresses on the management LAN. When powered on, the management module by default searches for a DHCP server and sets a default static IP address if a DHCP server is not found. Because the default static IP address is the same for all management modules, IP address conflicts can result if you do not use a DHCP server.

Figure 8 on page 31 shows an example network that might be used to configure and manage your BladeCenter.
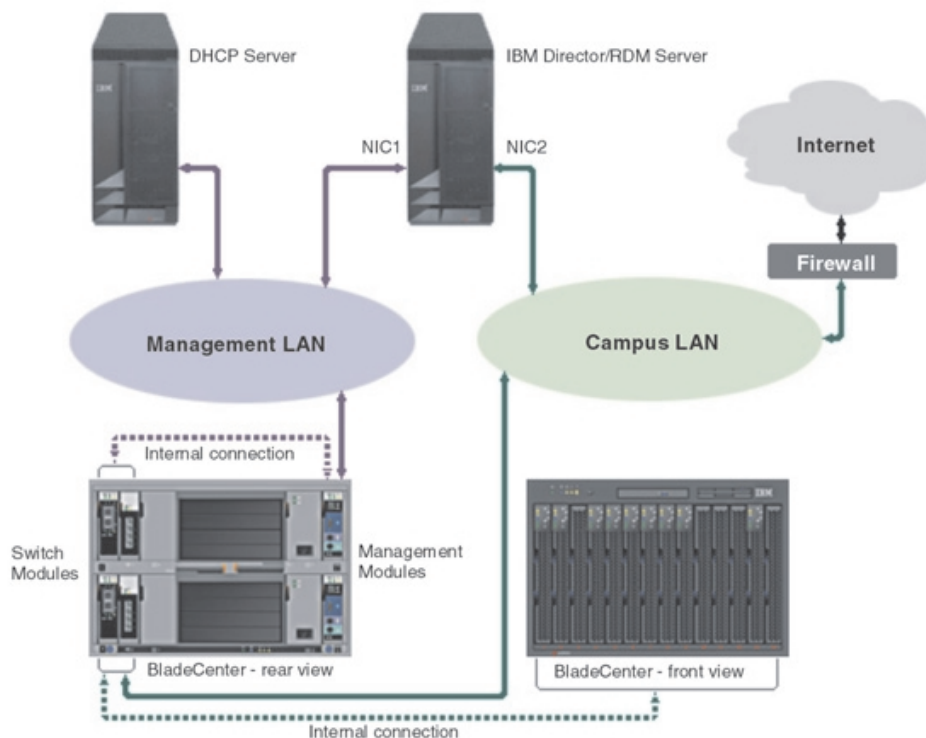
Figure 8. Management network diagram

Setting up the management connection

You can set up a remote management connection by connecting the Ethernet port of the management module to a 10/100 Mbps network with access to a management station or you can connect directly to a management station from the Ethernet port of the management module.

Complete the following steps to connect the Ethernet cable to the management module:

1. Connect one end of a Category 3, 4, 5 or higher Ethernet cable to the Ethernet port on the management module. Connect the other end of the Ethernet cable to the network.

2. Check the Ethernet LEDs to ensure that the network connection is working. The following illustration shows the locations of the Ethernet LEDs.
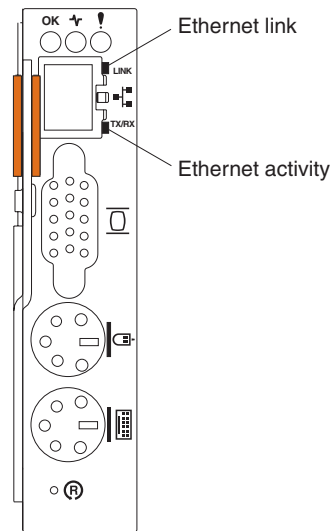
Ethernet link LED
> When this green LED is lit, there is an active connection through the port.

Ethernet activity LED
> When this green LED is flashing, it indicates that there is activity through the port.

After you connect the management module to the network, the Ethernet port connection is configured and enabled in one of the following ways:

- If you have an accessible, active, and configured dynamic host configuration protocol (DHCP) server on the network, the host name, IP address, gateway address, subnet mask, and DNS server IP address are set automatically.
- If the DHCP server does not respond within two minutes after the port is connected, the management module uses the static IP address and subnet address.

If you do not want to use the default static values, you can configure the static IP address, host name, and subnet mask for the management module through the Web interface. The default IP address is 192.168.70.125, the default subnet address is 255.255.255.0, and the default hostname is MM*xxxxxxxxxxxx*, where *xxxxxxxxxxxx* is the burned-in medium access control (MAC) address. The MAC

address is on a label on the management module, below the IP reset button.
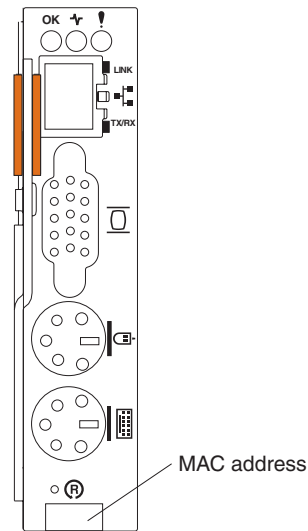
MAC address

Note: If the IP configuration is assigned by the DHCP server, the network administrator can use the MAC address of the management module network interface to find out what IP address and host name are assigned.

If you do not want to use DHCP, configure the static IP address, then disable the DHCP client.

Deployment Examples

This section describes the example procedures for deploying and configuring your BladeCenter unit:

- Using IBM Director and a DHCP server
- Using IBM Director without a DHCP server
- Using the Web-based interface

IBM Director and DHCP

This scenario uses the following assumptions:

- The IBM Director server and console are on the same subnet as the external (management) port of the management module.
- A DHCP server exists on the same subnet as well.
- You have already obtained the IP addresses on the same subnet for:
  - The management module
  - Each switch module
  - Each processor blade (blade server)
- You have obtained a gateway IP address and subnet mask (if needed).

Follow this steps to deploy and configure your BladeCenter unit using IBM Director and a DHCP server:

1. Plug in the BladeServer and check the LED status.
2. From IBM Director, set Chassis Association and select the Chassis & Chassis Members group view.
3. Initiate chassis discovery. The BladeCenter managed object appears on the IBM Director console.

4. Right-click the BladeCenter managed object and select **Request access**.

5. Enter a valid user ID and password for the management module. The default user ID is USERID and the default password is PASSW0RD (numeric 0 and not uppercase O).

6. The BladeCenter managed object and the associated processor blades appear on the IBM Director console.

7. Verify that the processor blade object matches the actual blade.

   Note: Turn on the BladeCenter BlueLight to identify the BladeCenter unit you are managing.

8. Configure the BladeCenter management module. Select the MPA ServerBlade management task and drag-and-drop the task on the BladeCenter managed object.

9. Configure the management module.

   a. Enter a static IP address for NIC 1 if desired.

   b. Enter a static IP address for NIC 2 (in same subnet as NIC 1). When prompted to reboot the management module, click Yes.

10. After the management module has rebooted, complete the configuration of the management module.

    Note: Changes you make during configuration, such as changing the management module name, will not automatically appear on the IBM Director console.

11. Change the user ID and password for the management module.

12. Set the BladeCenter policies. Because you are managing the BladeCenter unit from IBM Director, you should disable local power control, local keyboard/video/mouse (KVM) switching, and local USB media switching.

13. Configure each switch module, which you can perform from the ServerBlade Management task.

    a. Set the IP address, subnet mask, and hostname (if applicable).

       Note: You must make sure that the IP address used for the switch is on the same subnet as the external IP address for the management module if you intend to manage the switch through the management module.

    b. Click the button to launch a Web browser to start the embedded switch configuration task. You must have IP connectivity between the console and the switch.

    c. Make sure you enable SNMP trap forwarding to the IP address of the IBM Director server.

IBM Director without DHCP

This scenario uses the following assumptions:

- The IBM Director server and console are on the same subnet as the external (management) port of the management module. You could also connect directly to the external port on the management module using a laptop or server that has IBM Director installed. If you connect directly, the IP address of the laptop or server must be on the same subnet as the static IP address of the management module.

- You have already obtained the IP addresses on the same subnet for:

  – The management module

– Each switch module
  – Each processor blade (blade server)
- You have obtained a gateway IP address and subnet mask (if needed).

Follow these steps to deploy and configure your BladeCenter unit using IBM Director (but without a DHCP server):

1. Plug in the Blade Server and check the LED status.
2. From IBM Director, set Chassis Association and select the Chassis & Chassis Members group view.
3. Initiate chassis discovery. The BladeCenter managed object appears on the IBM Director console.
4. Right-click the BladeCenter managed object and select **Request access**.
5. Enter a valid user ID and password for the management module. The default user ID is USERID and the default password is PASSW0RD (numeric 0 and not uppercase O).
6. The BladeCenter managed object and the associated processor blades appear on the IBM Director console.
7. Verify that the processor blade object matches the actual blade.

   Note: Turn on the BladeCenter BlueLight to identify the BladeCenter unit you are managing.

8. Configure the BladeCenter management module. Select the MPA ServerBlade management task and drag-and-drop the task on the BladeCenter managed object.
9. Configure the management module.
   a. Enter a static IP address for NIC 1 if desired.
   b. Enter a static IP address for NIC 2 (in same subnet as NIC 1). When prompted to reboot the management module, click Yes.
10. After the management module has rebooted, complete the configuration of the management module.

    Note: Changes you make during configuration, such as changing the management module name, will not automatically appear on the IBM Director console.

11. Change the user ID and password for the management module.
12. Set the BladeCenter policies. Because you are managing the BladeCenter from IBM Director, you should disable local power control, local keyboard/video/mouse (KVM) switching, and local USB media switching.
13. Configure each switch in the chassis, which you can perform from the ServerBlade Management task.
    a. Set the IP address, subnet mask, and hostname (if applicable).

       Note: You must make sure that the IP address used for the switch is on the same subnet as the external IP address for the management module if you intend to manage the switch through the management module.

    b. Click the button to launch a Web browser to start the embedded switch configuration task. You must have IP connectivity between the console and the switch.
    c. Make sure you enable SNMP trap forwarding to the IP address of the IBM Director server.

Web-based interface

This scenario uses the following assumptions:

- A Web browser is installed on a server that is on the same subnet as the external (management) port of the management module. You could also connect directly to the external port on the management module using a laptop or server. If you connect directly, the IP address of the laptop or server must be on the same subnet as the static IP address of the management module.
- You have already obtained the IP addresses on the same subnet for:
  - The management module
  - Each switch module
  - Each processor blade (blade server)
- You have obtained a gateway IP address and subnet mask (if needed).

Follow these steps to deploy and configure your BladeCenter unit using the Web-based interface:

1. Plug in the blade server and check the LED status.
2. Open your browser and point to the external IP address of the management module.
3. Enter a valid user ID and password for the management module. The default user ID is USERID and the default password is PASSW0RD (numeric 0 and not uppercase O).
4. Verify the number of processor blades, switch modules, power modules, and fans against the actual chassis components.

   Note: Turn on the BladeCenter BlueLight to identify the BladeCenter unit you are managing.
5. Configure the management module. Selecting the appropriate links from the Web-based interface.
   a. Enter a static IP address for NIC 1 if desired.
   b. Enter a static IP address for NIC 2 (in same subnet as NIC 1). When prompted to reboot the management module, click Yes.
6. After the Management Module has rebooted, log back into the interface to continue configuration.
7. Change the user ID and password for the management module.
8. Configure each switch in the BladeCenter unit by setting the IP address, subnet mask, and hostname (if applicable).

Preparing for Blade Server deployment

This section describes the considerations for deploying a blade server.

Hardware considerations

You can choose to add the following hardware options to a blade server:

- Up to two microprocessors. With two microprocessors, your blade server can operate as a symmetric multiprocessing (SMP) server. To ensure proper server operation when you install an additional microprocessor, use microprocessors that have the same cache size and type, and the same clock speed. Internal and external clock frequencies must be identical.
- Up to two optional 2.5-inch IDE hard disk drives.

- Memory-module options to increase the amount of memory in your blade server. When you install memory, you must install a pair of matched dual inline memory modules (DIMMs).
- A Fibre Channel I/O expansion option, which will provide the blade server with two additional network connections for communicating on a network. If you add a Fibre Channel I/O expansion option, you must make sure the switch module in switch module bays 3 and 4 on the BladeCenter unit use the Fibre Channel interface. In addition, the I/O expansion option occupies the same location on the blade server as the second 2.5-inch IDE hard drive drive. Therefore, you can install only one 2.5-inch IDE hard disk drive.
- SCSI storage expansion unit to use SCSI hard disk drives with your blade server. With the SCSI storage expansion unit, you can install up to two 1-inch (26 mm) slim-high, 3.5-inch, hot-swap SCSI hard disk drives. If you install the SCSI storage expansion unit, the blade server will occupy two blade bays in the BladeCenter unit.

Firmware considerations

You can download the latest firmware for a blade server at http://www.ibm.com/pc/support/. After downloading the latest firmware, use the BladeCenter management module Web interface to flash the system-management module. The Web interface is described in the *IBM BladeCenter Installation and User's Guide* on the *IBM BladeCenter Documentation* CD.

BIOS

When the BIOS code page jumper (J12) is moved from pins 1 and 2 (the default position) to pins 2 and 3 on the blade server system board, you can boot the blade server from a backup BIOS page. See the blade server *Hardware Maintenance Manual and Troubleshooting Guide* on the *IBM BladeCenter Documentation* CD for complete details.

Note: If you boot from the backup page because the primary BIOS page has become damaged, you need to re-flash the primary BIOS code.

Operating system considerations

The following operating systems are supported on a blade server:
- Microsoft Windows 2000 Server
- Microsoft Windows 2000 Advanced Server
- Red Hat Linux 7.3
- SuSE Professional 8.0

Windows 2000 installation considerations

Information about installing Windows 2000 and Windows XP on a blade server is on the IBM Support Web page at http://www.ibm.com/pc/support/. From the IBM Support Web page select **Servers**; then, select **OS installation** and choose the operating system to install from the **Operating system installation by category** drop-down list.

In addition, you can find redpieces and redpapers about installing Windows 2000 on the BladeCenter unit at http://www.ibm.com/redbooks (search for BladeCenter).

Note the following considerations when installing Windows 2000 Server or Windows 2000 Advanced Server on a blade server:

- You must use an installation image consisting of the Windows 2000 CD-ROM and Service Pack 3 to install the Windows operating system. To create this integrated installation image:
  1. Download Service Pack 3 (w2ksp3.exe) from the Microsoft Web site to your computer.
  2. On the same computer, create a shared folder that contains an i386 subfolder. Make sure that only the Administrator has access to this shared folder.
  3. Copy the contents of the i386 directory on the Windows 2000 CD into the newly created folder.
  4. Extract the Service Pack into another folder using w2ksp3.exe.
  5. Apply the Service Pack to the Windows 2000 installation files using update.exe.
- If you are installing from a network client bootable diskette:
  - You must create a local FAT/FAT32 partition on the blade server hard disk drive for the WIN_NT.~LS and WIN_NT.~BS temporary directories.
  - Boot from a diskette containing a network client to attach to the shared folder containing the integrated installation image you created.
  - After you have completed the installation, make sure that you add the Broadcom NetXtreme Gigabit Ethernet drivers and upgrade the ATI Rage XL video drivers.
- You can perform a ″push″ install using any tool that exploits the PXE boot process. For example, you can use either:
  - Remote Deployment Manager (RDM) 3.1.01. If you use RDM 3.1.01, make sure that you install Patch 2 and that you have a DHCP server in your management infrastructure.
  - Windows Remote Installation Services (RIS)

Linux installation considerations

Detailed instructions for installing Red Hat Linux and SuSE Linux on a blade server is on the IBM Support Web page at http://www.ibm.com/pc/support/. From the IBM Support Web page select **Servers**; then, select **OS installation** and choose the operating system to install from the **Operating system installation by category** drop-down list.

Red Hat Linux: Follow these instructions to install Red Hat Linux 7.3 on a blade server:

1. Create a BladeCenter Red Hat Linux 7.3 boot diskette by downloading the version 7.3 image from http://people.redhat.com/msw/ and boot the server using this diskette.

    Note: Do not switch the KVM from the blade until the installation has proceeded to the installation of the packages (after the About to install window).

2. If you are using the SCSI storage expansion option:
    a. At the Welcome to Red Hat Linux Version 7.3 window, type **linux dd** at the boot prompt.
    b. Create the drvblock.img from the images directory on CD 1 and insert this diskette at the Devices window.

    If you are not using the SCSI storage expansion option, press **Enter**.

3. After rebooting, if IBM BIOS displays a virus warning message, select **Change is expected**.

4. Log in as root and install the 2.4.18–18.7.x or later kernel errata using RPM Package Manager.
5. Create an entry for the floppy drive in the /etc/fstab file.

   Note: The floppy resides on the SCSI device *after* all other devices.
6. Make a directory for the floppy under /mnt
7. Mount the floppy.
8. If you are using the GNOME desktop, remove the magicdev package (to avoid a system hang).

The ability of the remote console applet to accurately track the location of the mouse cursor in a Linux X Window System session depends on the configuration of X Windows. Therefore, you must set the mouse handler with the correct resolution information to track the remote mouse cursor properly.

In addition, set the mouse acceleration and threshold values to 1 to synchronize the remote and local mouse.

SuSE 8.0: Consider the following when installing SuSE on a blade server:
• When you start the server and insert the SuSE Linux Version 8.0 CD 1 into the CD-ROM drive, the CD may not start. In this case, use the SuSE Linux Version 8.0 CD 2 to start.
• You may encounter problems with mouse synchronization if you are installing remotely using the remote control option of the BladeCenter management module. These problems can be resolved after installation. During installation, you may have to double-click to make selections that normally only require a single click.
• When the installer starts, the mouse will not work. To resolve the problem, when the installer starts, use keyboard navigation to ensure that the mouse is listed as a USB mouse.

Device driver considerations

Some of the options available for the BladeCenter unit have device drivers that you need to install. See the documentation that comes with your option for information about installing any required device drivers.

For example, Ethernet controllers are integrated on each blade server system board. The Ethernet controllers provide 1000-Mbps full-duplex capability only, which enables simultaneous transmission and reception of data to the external ports on the Ethernet switches. You do not need to set any jumpers or configure the controller for the blade server operating system. However, you must install a device driver in the blade server to enable the blade server operating system to address the Ethernet controller. For blade server device driver and information about configuring the Ethernet controllers, see the *Broadcom NetXtreme Ethernet Software* CD that comes with the BladeCenter unit.

Application considerations

Information about some of the applications including system management are provided in these redpieces and redpapers available at http://www.ibm.com/redbooks:

- *Deploying Lotus Domino on IBM @server BladeCenter*
- *Deploying Citrix MetalFrame on IBM @server BladeCenter*
- *Deploying Microsoft Exchange IBM @server BladeCenter*
- *The Cutting Edge: IBM @server BladeCenter*

Chapter 4. Installation considerations

This chapter describes the installation site physical requirements that must be in place to be able to complete the installation of a BladeCenter unit. The following topics are discussed:

- "Physical planning" describes chassis dimensions, weight, floor space, and noise considerations.
- "Rack considerations" on page 43 describes weight and space limits of IBM NetBAY racks.
- "Power considerations" on page 45 describes rack and BladeCenter unit power requirements
- "Cooling considerations" on page 48 describes temperature and humidity, air flow, room cooling, and heat output.
- "Power connections" on page 49 provides sample diagrams for power and cabling.
- "Physical installation time" on page 60 shows approximate times for installing BladeCenter units, blade servers, and other components.

For access to configuration tools and additional information, (such as the Rack Configurator and the Configuration Options Guide), go to this site: http://www.pc.ibm.com/us/eserver/xseries/library/configtools

Physical planning

This section describes dimensions, weight, floor space, and noise considerations.

Dimensions

A BladeCenter unit has the following dimensions:

Width 444 mm (17.5 in.)
Height 304.2 mm (12 in.)
Depth 711.2 mm (28 in.)

A BladeCenter unit uses 7U of vertical rack space. The following clearances are required inside the rack:

50 mm (1.96 in.) on each side of the chassis
100 mm (3.93 in.) at the back of the chassis for cables.

Weight considerations

The following factors are important when planning for the physical installation of BladeCenter units:

- Racks have a maximum weight load limit.
- Floors, particularly raised floors have maximum weight limits.

Floor space

Figure 9 on page 42 shows the required floor space for an IBM NetBAY rack. This diagram shows the space needed to allow enough clearance in the front and rear of the rack to be able to open the doors to access the equipment. Front clearance is needed to have access to the blade servers and the BladeCenter media tray. Rear clearance is needed to access power supplies, blowers, network cable connections,

and attachment of a local monitor, keyboard, and mouse to the management
module.
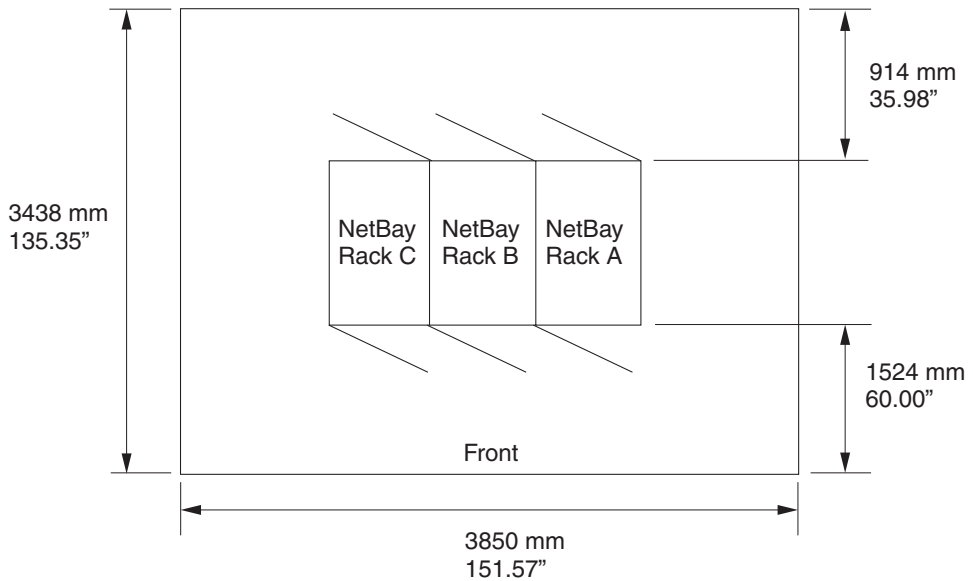
Figure 9. Operational clearances for NetBAY 42 Enterprise rack

Noise considerations

Each BladeCenter unit has two blowers for cooling. An optional Acoustics Module is
available that dampens the noise generated by the blowers. Table 3 shows the
maximum sound levels emitted by BladeCenter units without the Acoustics Module
and with the Acoustics Module. This represents the minimum and maximum number
of BladeCenter units that can be installed in a 42U rack.

Table 3. BladeCenter noise emissions

	Number of BladeCenter units per rack	Maximum sound power idle	Maximum sound power operating
Without Acoustics Module	1	7.4 bels	7.4 bels
With Acoustics Module	1	6.9 bels	6.9 bels
Without Acoustics Module	4	8 bels	8 bels
With Acoustics Module	4	7.5 bels	7.5 bels
Without Acoustics Module	6	8.2 bels	8.2 bels
With Acoustics Module	6	7.7 bels	7.7 bels

Attention: Your server installation may be subject to government regulations, such as those prescribed by OSHA or European Community Directives, that cover noise-level exposure in the workplace. The BladeCenter unit is available with an optional acoustic attenuation module that can reduce the likelihood of exceeding noise-level exposure limits. The actual sound-pressure levels in your installation depends on a variety of factors, including the number of servers in the installation, the size, materials, and configuration of the room where the servers are installed, the noise levels from other equipment, the room ambient temperature, and employees' location in relation to the equipment. It is recommended that a qualified person, such as an industrial hygienist, be consulted to determine whether the sound-pressure levels to which employees may be exposed exceed regulatory limits.

Rack considerations

IBM NetBAY

When planning for IBM NetBAY racks the following factors must be considered:
- floor space that provides adequate access to the front and rear of the rack, and space on both sides of the rack or a row of racks for ventilation and walk through space. See Figure 9 on page 42.
- rack weight load limits and floor weight load limits. See Table 4 on page 44.
- rack height – each BladeCenter unit requires 7U, also consider the space needed for other equipment that might be installed in the same rack with the BladeCenter units. See Table 4 on page 44.

Table 4 on page 44 shows the maximum weight limits for IBM NetBAY racks and expansion cabinets that are recommended for use with BladeCenter units. The table shows the maximum number of BladeCenter units that can be installed in a NetBAY rack when the rack is either:
- installed in placed and sitting on the rack leveling pads
- being relocated and is sitting on the rack casters.
- is being shipped on a pallet.

Note: For the On site relocation, rack on casters, column the maximum number of BladeCenter units (including the PDUs to support the configuration) is based on a 14–degree stability requirement established under IBM safety guidelines.

Table 4. IBM NetBAY rack weight load limits

Rack	Rack weight	Maximum allowable rack weight load	Maximum fully loaded BladeCenter units with rack on leveling pads	On site relocation, rack on casters, maximum number of BladeCenter units	Shipping on pallet, maximum number of BladeCenter units
NetBAY 42 Enterprise Rack	261 kg (575 lb)	932 kg (2050 lb)	6	3	3
NetBAY 42 Enterprise Expansion Cabinet	235 kg (516 lb)	932 kg (2050 lb)	6	3	3
NetBAY 42 Standard Rack	137 kg (301 lb)	909 kg (2000 lb)	6	3	0
NetBAY 42 Standard Expansion Cabinet	105 kg (231 lb)	909 kg (2000 lb)	6	3	0
NetBAY 25 Standard Rack	94 kg (207 lb)	568 kg (1250 lb)	3	3	3
NetBAY 11 Standard Rack	34 kg (75 lb)	185 kg (407 lb)	1	1	1

When determining your floor load limits, use the combined weight of the rack, populated BladeCenter units, power distribution units and other rack mounting hardware to ensure the installation site can safely support the total weight. Consult your local building engineer to understand the weight limits at your site. Worksheets are provided in Appendix A, "Planning worksheets" on page 73.

Moving IBM NetBAY racks safely

It is very important to ensure that you move racks safely. For 42U racks, all equipment installed above 22U in the rack must be removed before a rack can be moved to another location. Before moving a rack, be sure to carefully read the instructions that are provided with your rack.

Using non-IBM racks

If you intend to install BladeCenter units in a rack other than an IBM NetBAY rack, verify that the rack meets these requirements:

- The rack mounting flanges has holes and clearances per EIA-310-D
- Rack with a front to rear spacing of 698.50 mm (27.5 in) to 723.90 mm (28.5 in)

- Sufficient room in front of the front EIA flange to provide bezel clearance. EIA-310-D requires this space to be a minimum of 49 mm deep
- Sufficient room behind the rear of the rear EIA flanges to provide room for cable management arms and cable routing.
- Rack should provide an adequate flow of cooling air and prevent recirculation of warm air from the rear to the front.
- Racks must have perforated front and rear doors.
- Rack weight handling capacity should be sufficient for the aggregate weight of the BladeCenter units, blade servers, power distribution units and power cables.
- Racks need to be stabilized so that the rack does not become unstable when fully loaded.

Power considerations

BladeCenter units have redundant power modules. AC power resources must be adequate to not only supply the required voltage and amperage, but should also be designed to take advantage of the power redundancy provided by the BladeCenter unit. Table 5 shows how power is provided to the BladeCenter components.

Table 5. BladeCenter power modules

Component	Power module bays
Blade Server Bays 1 through 6 Ethernet Switch Modules Management Module Media Tray Fibre Channel Switch Modules Blowers	1, 2
Blade Server Bays 7 through 14	3, 4

To take advantage of the BladeCenter power redundancy, power modules 1 and 3 should be connected to different AC power sources than power modules 2 and 4 including:

- Building AC power sources
- Front end PDUs
- Rack PDUs.

Rack requirements

Depending on how many BladeCenter units are installed in a rack and the total number of power modules, two to sixteen power distribution units (PDUs) are required.

Power distribution units (PDUs)
Each BladeCenter unit has a minimum of 2 or a maximum of 4 1200 watt power modules. Each PDU supports the connection of 2 BladeCenter AC power cords.

When planning for AC rack power distribution be sure to plan for enough individual power feeds and PDUs to take advantage of the redundant BladeCenter power supplies.

Each BladeCenter unit requires:

- 2 to 4 AC power cords, 1 per power module
- Each power module should be powered from separate high voltage AC resources.
- 200 to 240 Vac 50 or 60 Hz

Table 6 and Table 7 show the part numbers and the number of power distribution units required to provide power source for 1 to 6 BladeCenter units in a rack.

Table 6. Power Distribution Units for BladeCenter Units powered from two 200V-240V AC feeds

Number of BladeCenter Units	Two 20 Amp AC Feeds		Two 30 Amp AC Feeds		Two 60 Amp AC Feeds	
	Number of PDUs	PDU Part Number	Number of PDUs	PDU Part Number	Number of PDUs	PDU Part Number
1	2	37L6866	2 each	37L6866 and 37L6884	2 1	37L6866 73P5790
2	4	37L6866	4 each	37L6866 and 37L6884	4 1	37L6866 73P5790
3	6	37L6866	6 each	37L6866 and 37L6884	6 1	37L6866 73P5790
4	8	37L6866	8 each	37L6866 and 37L6884	8 2	37L6866 73P5790
5	10	37L6866	10 each	37L6866 and 37L6884	10 2	37L6866 73P5790
6	12	37L6866	12 each	37L6866 and 37L6884	12 2	37L6866 73P5790

Table 7. Power Distribution Units for BladeCenter Units powered from four 200V-240V AC feeds

Number of BladeCenter Units	Two 20 Amp AC Feeds		Two 30 Amp AC Feeds		Two 60 Amp AC Feeds	
	Number of PDUs	PDU Part Number	Number of PDUs	PDU Part Number	Number of PDUs	PDU Part Number
1	4	37L6866	4 each	37L6866 and 37L6884	4 each	37L6866 and 73P5790
2	4	37L6866	4 each	37L6866 and 37L6884	4 each	37L6866 and 73P5790
3	8	37L6866	8 each	37L6866 and 37L6884	8 4	37L6866 73P5790
4	8	37L6866	8 each	37L6866 and 37L6884	8 4	37L6866 73P5790
5	12	37L6866	12 each	37L6866 and 37L6884	12 4	37L6866 73P5790
6	12	37L6866	12 each	37L6866 and 37L6884	12 4	37L6866 73P5790

For recommended ways of providing power sources to BladeCenter racks see "Power connections" on page 49. This section provides diagrams that show different

ways to provide redundant power sources to one or more BladeCenter units. These diagrams are based on using IBM NetBAY Enterprise racks.

Wall and floor power drop requirements

Figure 10 through Figure 12 shows AC power connectors that can be used for attachment of power feeds to BladeCenter racks.
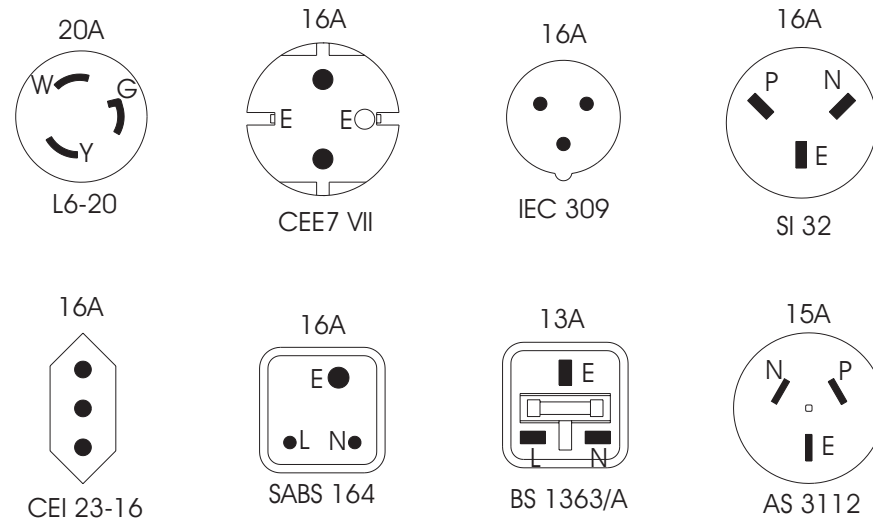
Figure 10. Rack PDU — 20A single phase
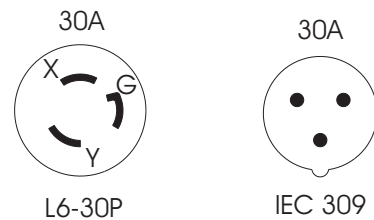
Figure 11. Rack PDU-30A single phase

Figure 12. Rack PDU-60A single phase

Keyboard, video, and mouse

The management module provides a set of connectors for attaching a keyboard, monitor and mouse to the BladeCenter unit. This provides a method for performing local installation tasks, system management tasks, and if necessary problem determination. Either plan for a mobile keyboard, mouse, and monitor that can be attached to a specific BladeCenter unit when needed, or plan for rack space for installing a keyboard, mouse and monitor.

Cooling considerations

The operating environment for BladeCenter units must provide sufficient temperature and humidity control to ensure BladeCenter thermal failures do not occur. Key requirements are:

- Air temperature and humidity
- Air flow
- Installation into a rack
- Prevention of air recirculation
- Room cooling

Air temperature and humidity

The permissible temperatures and humidity limits for a BladeCenter unit are:

Table 8. BladeCenter temperature and humidity limits

BladeCenter Power	Altitude	Temperature range	Humidity range
On	0 to 914m (2998.69 ft)	10°C to 35°C (50°F to 95°F)	8% to 80%
On	914m to 2134m (2998.6 to 7000 ft)	10°C to 32°C (50°F to 89.6°F)	8% to 80%
Off	N/A	−40°C to 60°C (−40°F to 140°F)	5% to 80%

Air flow considerations

Air flow is critical for ensuring the operating air temperature stays within permissible limits:

- Each BladeCenter unit requires 500 cubic feet per minute (CFM) of air circulation
- Each BladeCenter unit has two blowers, each one provides 300 CFM of air circulation.
- Air flow direction is from front to back
- All BladeCenter chassis bays must be populated, either with a module, a blade server, or a filler in place of the component. If a location is left empty for more than one minute while the BladeCenter unit is operating, performance degradation or thermal failures may occur.
- All equipment installed in a rack with a BladeCenter unit must use front to back air flow to prevent warm air recirculation problems. Devices that use back to front air flow causes warm air to enter the front of the BladeCenter unit. This can cause reduced reliability, component failure, data loss, or server shutdown.
- In racks with multiple BladeCenter units, populate the BladeCenter chassis starting with the bottom chassis in the rack and working up towards the top of the rack.
- Any unused rack space must be covered with a blank rack filler panel to ensure proper air circulation.

Prevention of air recirculation

Consider these factors when planning for single or multiple rack installations:

- When racks are positioned adjacent to each other, ensure the racks fit tightly together from side to side to prevent inter-rack air recirculation from the back to the front.

- Air recirculation occurs over the top or around the side of a rack in a room that does not have a cooling system with sufficient airflow volume capacity. Ensure that the cooling system has adequate capacity for the room cooling load.

Room cooling

To prevent possible BladeCenter thermal failures proper room cooling is vital:

- Ensure that the site cooling system has adequate capacity for the room cooling load.
- Ensure that cool air is provided to the front of the BladeCenter unit and rack.
- Ensure that the room cooling system is positioned so warm exhaust air is directed away from all BladeCenter units towards the room cooling system without passing in front of a BladeCenter unit.
- A significant air temperature gradient can occur from the bottom to the top of a rack in a room which has a cooling system that does not have sufficient airflow volume and cooling capacity. This may cause equipment at the top of the rack to run hot resulting in reduced reliability, component failure, data loss, or server shut down.

Heat output

The amount of heat output of a BladeCenter unit in BTU per hour (BTUH) is a variable based on these components:

- Number of power supplies (2 or 4)
- Number of blade servers (1 to 14)
- Internal components of each blade server, including processors, memory, and EIDE hard disk drives
- Number and type of switch modules (1 to 4)
- 1 Management Module
- 1 Media Tray
- SCSI hard disk drive expansion option (with up to 2 disk drives per option).

Power connections

This section provides sample power diagrams. The samples represent various ways of providing redundant power sources to BladeCenter units with four power supplies. All samples assume IBM Enterprise NetBAY racks are being used.

Power layout example 1— single BladeCenter units

Figure 13 shows power distribution for a single BladeCenter unit installed in either a NetBAY 11, a NetBAY 25 or NetBAY 42 standard rack. Power sources A and B represent separate power feeds to the racks.
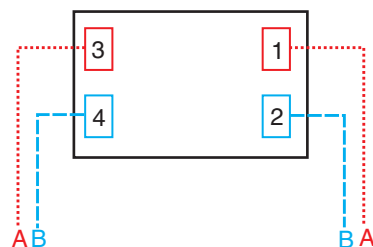
Figure 13. Single BladeCenter installed in a NetBAY 11, 25, or 42U rack

Power layout sample 2– two BladeCenter units in NetBAY 25 to 42U racks

Figure 14 shows power distribution for two BladeCenter units installed in either a NetBAY 25 or NetBAY 42 standard rack. Power sources A and B represent separate power feeds to the racks.

Note: To meet the de-rated amperage requirements shown in this figure, IBM provides the NetBAY Rack power distribution unit (part number 37L6866).
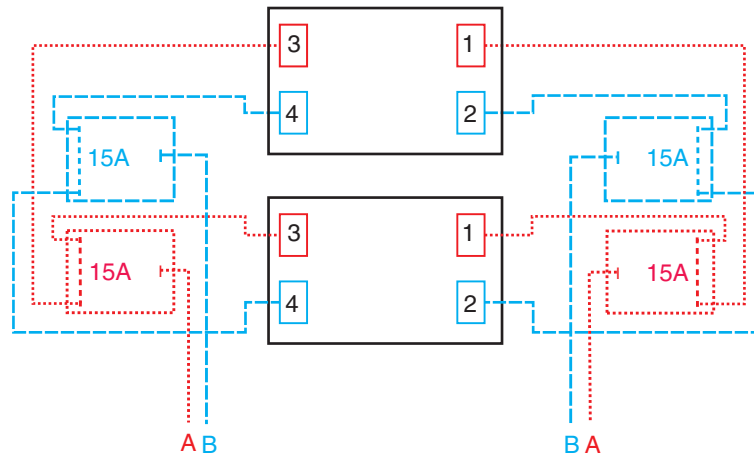
Figure 14. Two BladeCenter units installed in NetBAY 25 to 42U racks

Power layout sample 3– three BladeCenter units in a NetBAY 25 rack

Figure 15 shows power distribution for three BladeCenter units installed in a NetBAY 25 standard rack. Power sources A and B represent separate power feeds to the rack.

Notes:

1. To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:
   - 15A - NetBAY rack power distribution unit (part number 37L6866)
   - 24A - NetBAY single phase 30 amp front-end power distribution unit (part number 37L6884)
   - 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)

2. In this diagram, 24/48A represents two different PDUs. You can use either PDU (24A or 48A) in this position.
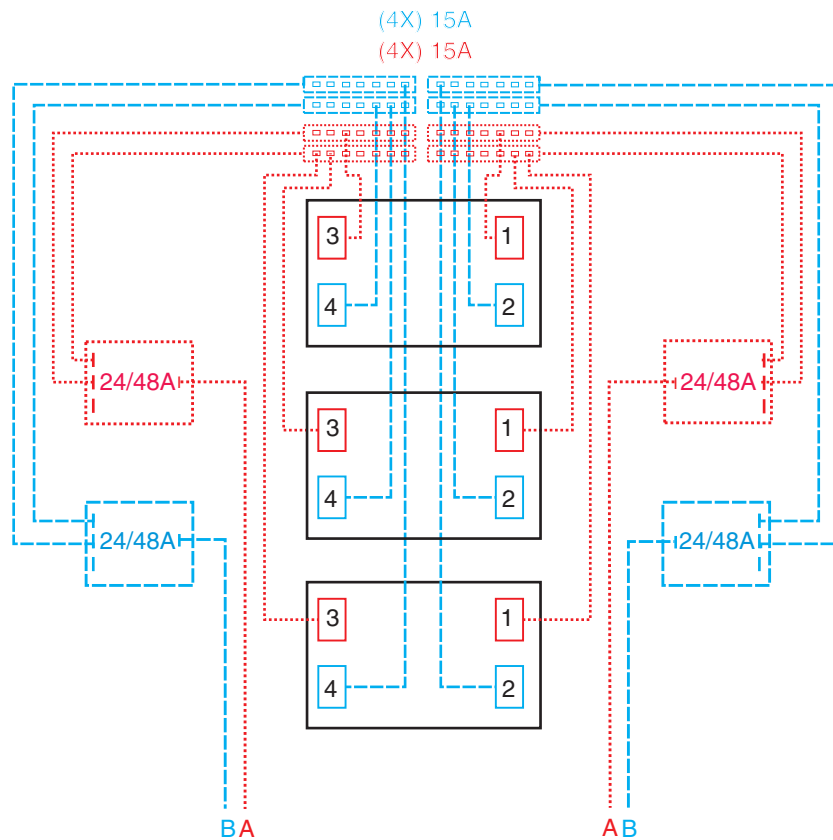
Figure 15. Three BladeCenter units in a NetBAY 25 rack

Power layout sample 4– three BladeCenter units in a NetBAY Standard 42U rack

Figure 16 shows power distribution for three BladeCenter units installed in a NetBAY 42 standard rack. Power sources A and B represent separate power feeds to the rack.

Notes:

1. To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:

   - 15A - NetBAY rack power distribution unit (part number 37L6866)
   - 24A - NetBAY single phase 30 amp front-end power distribution unit (part number 37L6884)
   - 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)

2. In this diagram, 24/48A represents two different PDUs. You can use either PDU (24A or 48A) in this position.
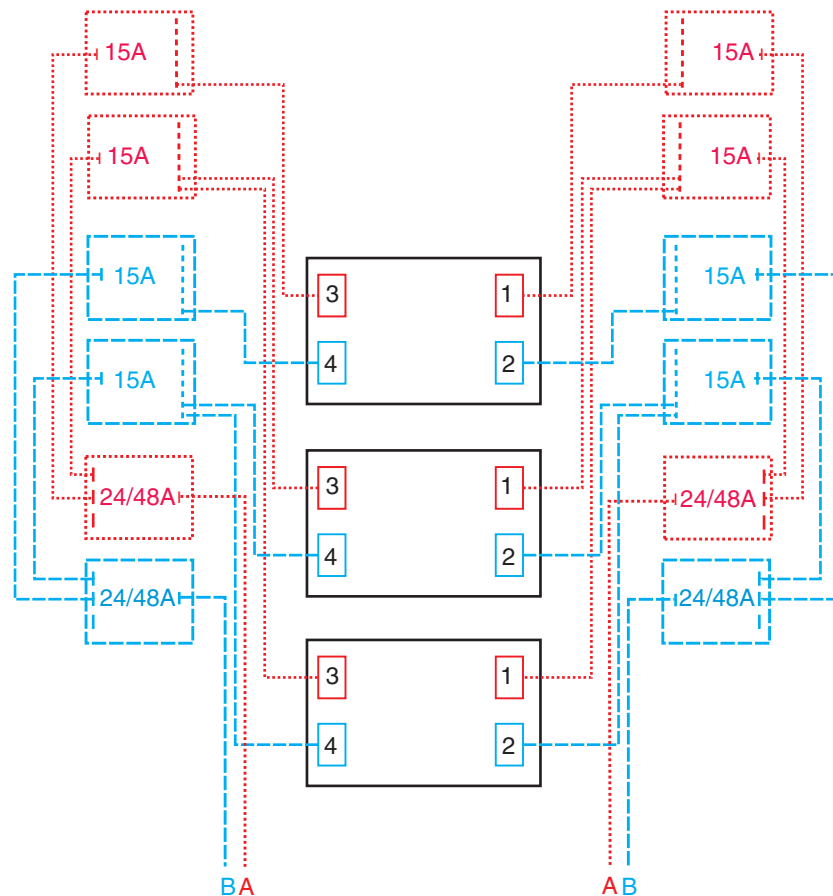
Figure 16. Three BladeCenter units in a NetBAY 42U standard rack

Power layout sample 5– three BladeCenter units in a NetBAY 42 Enterprise rack

Figure 17 shows power distribution for three BladeCenter units installed in a NetBAY 42 Enterprise rack. Power sources A and B represent separate power feeds to the rack.

Notes:

1. To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:
   - 15A - NetBAY rack power distribution unit (part number 37L6866)
   - 24A - NetBAY single phase 30 amp front-end power distribution unit (part number 37L6884)
   - 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)

2. In this diagram, 24/48A represents two different PDUs. You can use either PDU (24A or 48A) in this position.
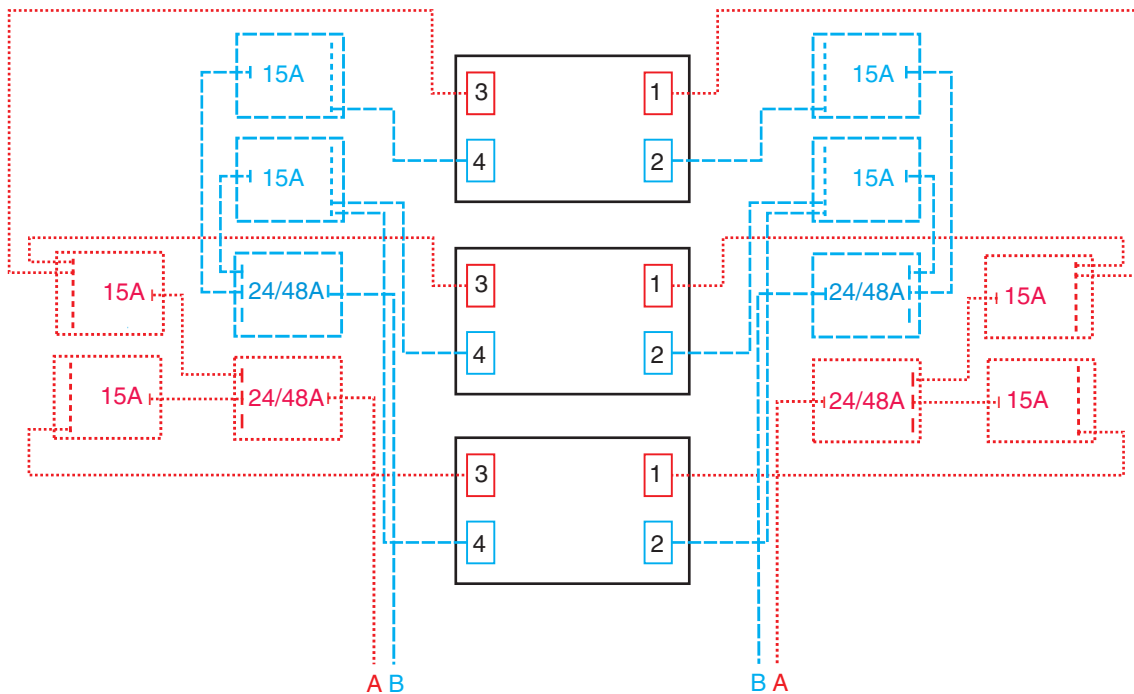
Figure 17. Three BladeCenter units in a NetBAY 42 Enterprise rack

Power layout sample 6– four BladeCenter units in a NetBAY 42U standard rack

Figure 18 shows power distribution for four BladeCenter units installed in a NetBAY 42 standard rack. Power sources A and B represent separate power feeds to the rack.

Note: To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:

- 15A - NetBAY rack power distribution unit (part number 37L6866)
- 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)

Figure 18. Four BladeCenter units in a NetBAY 42U rack

Power layout sample 7– four BladeCenter units in a NetBAY 42 Enterprise rack

Figure 19 shows power distribution for four BladeCenter units installed in a NetBAY 42 standard rack. Power sources A and B represent separate power feeds to the rack.

Note: To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:

- 15A - NetBAY rack power distribution unit (part number 37L6866)
- 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)
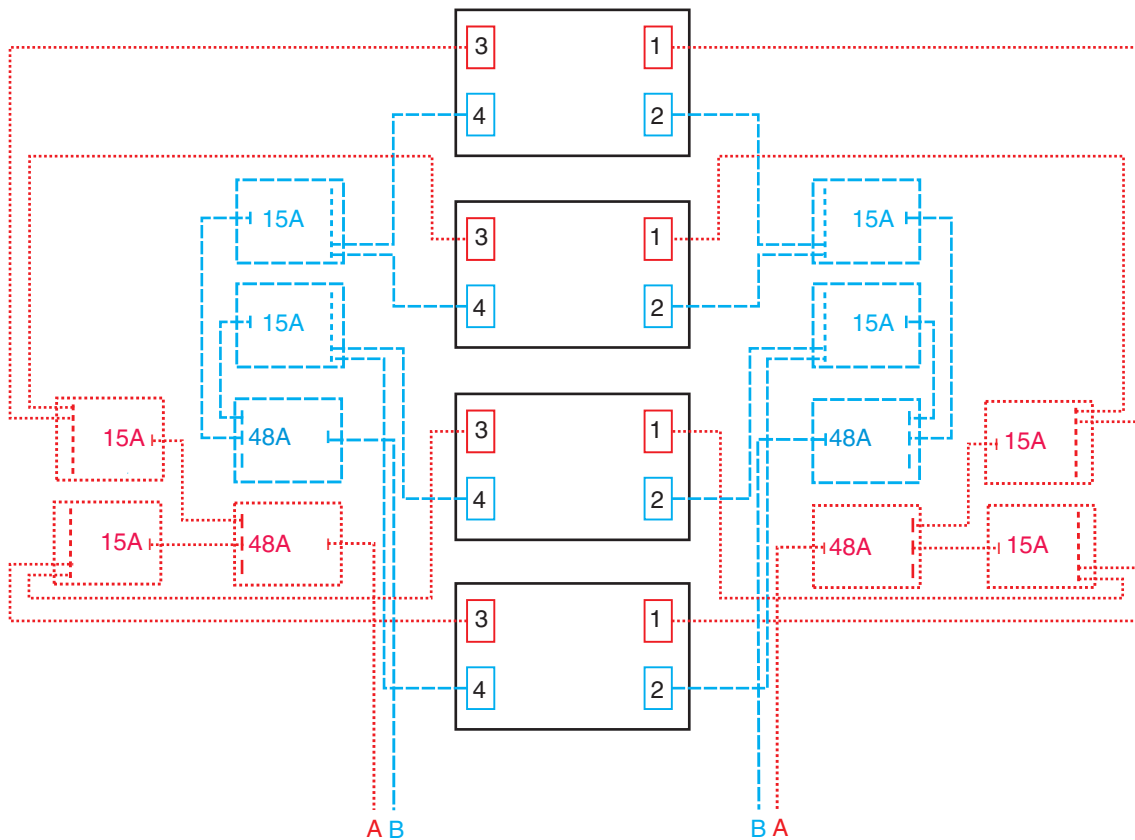
Figure 19. Four BladeCenter units in a NetBAY 42U Enterprise rack

Power layout sample 8– five BladeCenter units in a NetBAY 42U standard rack

Figure 20 shows power distribution for three BladeCenter units installed in a NetBAY 42 standard rack. Power sources A and B represent separate power feeds to the rack.
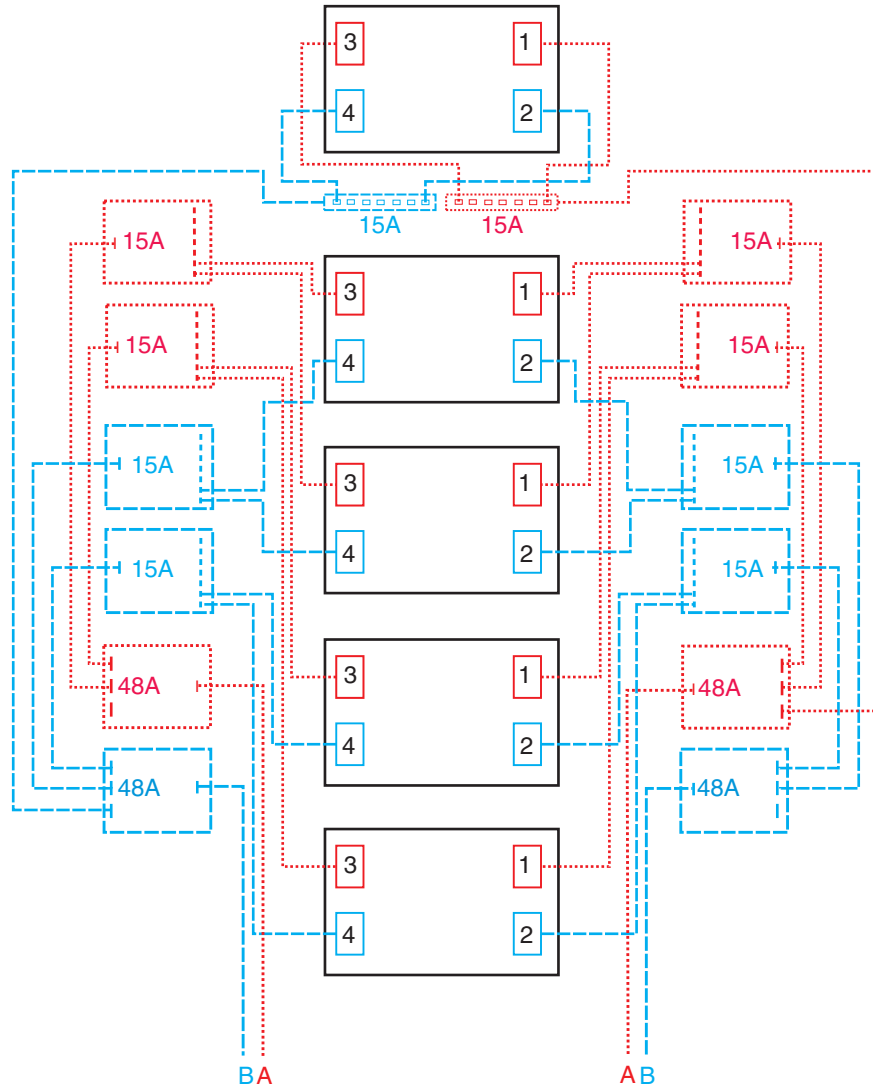
Figure 20. Five BladeCenter units in a NetBAY 42U rack.

Power layout sample 9– five BladeCenter units in a NetBAY 42 Enterprise rack

Figure 21 shows power distribution for five BladeCenter units installed in a NetBAY 42 Enterprise rack. Power sources A and B represent separate power feeds to the rack.

Note: To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:
- 15A - NetBAY rack power distribution unit (part number 37L6866)
- 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)
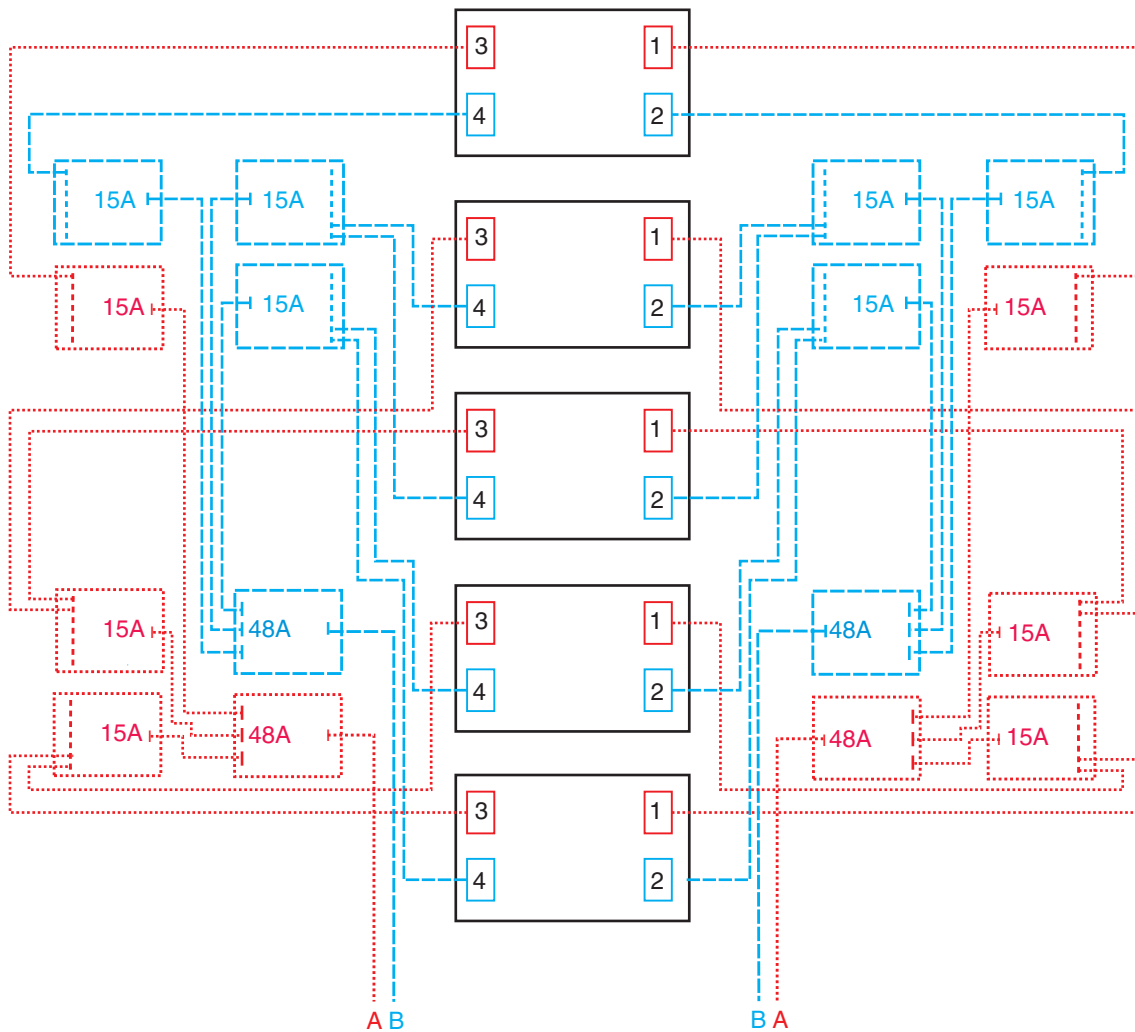
Figure 21. Five BladeCenter units in a NetBAY 42U Enterprise rack

Power layout sample 10– six BladeCenter units in a NetBAY 42 Enterprise rack

Figure 22 shows power distribution for six BladeCenter units installed in a NetBAY 42 Enterprise rack. Power sources A and B represent separate power feeds to the rack.

Note: To meet the de-rated amperage requirements shown in this figure, IBM provides the following PDUs:

- 15A - NetBAY rack power distribution unit (part number 37L6866)
- 48A - NetBAY single phase 60 amp front-end power distribution unit (part number 73P5790)
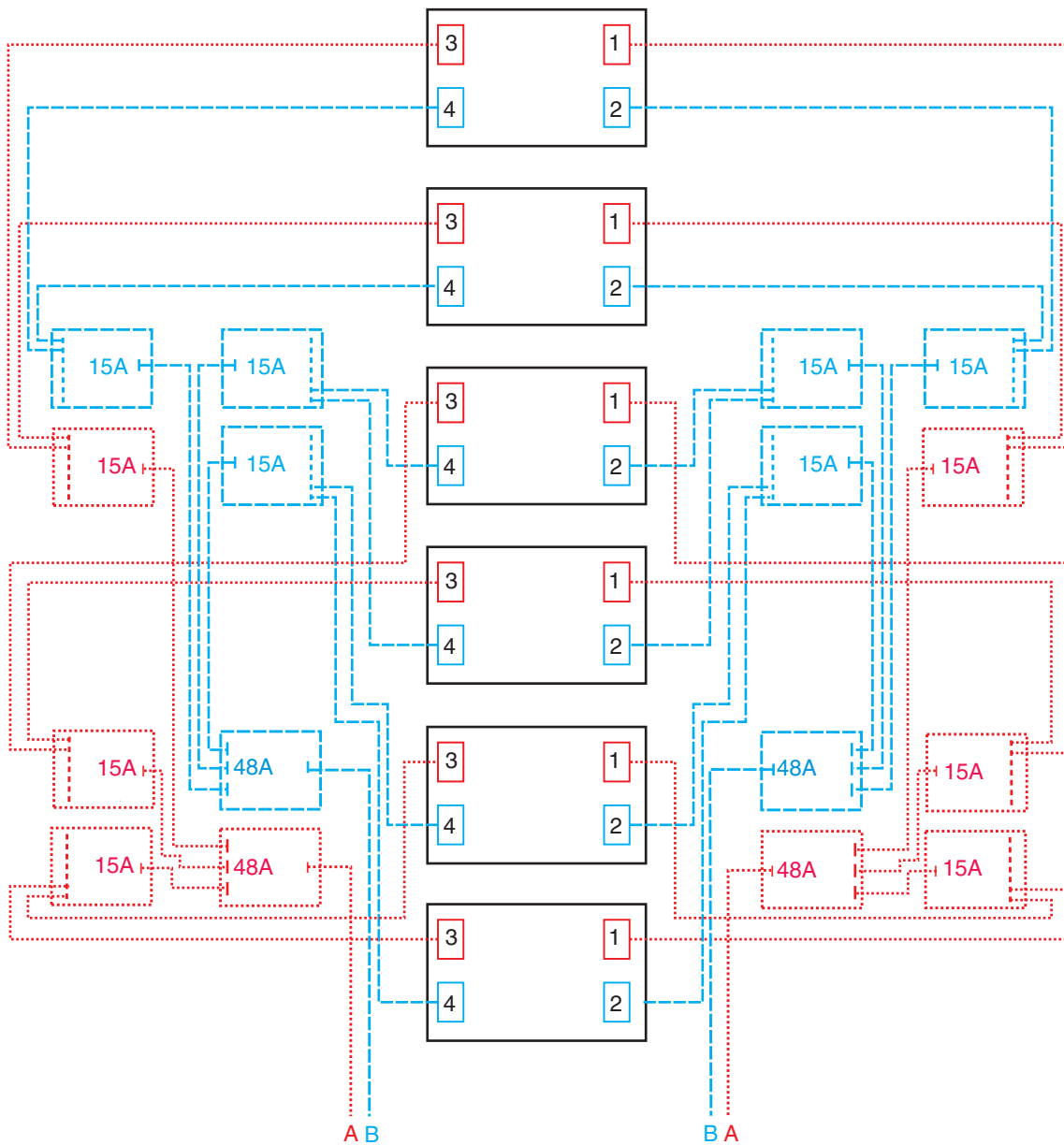
Figure 22. Six BladeCenter units in a NetBAY 42U Enterprise rack

Physical installation time

The following table shows the average installation times required for installing Blade Server components, Blade Servers, and BladeCenter units

Table 9. Average BladeCenter components installation time

Component	Average installation time
Blade Server processor	1 minute 46 seconds
Blade server memory	24 seconds
Blade server disk drive	2 minutes
Blade server SCSI expansion option	38 seconds
Blade server SCSI disk drive	7 seconds
Blade server I/O expansion option	2 minutes
Blade server into BladeCenter unit	9 seconds
BladeCenter rack mounting kit and BladeCenter unit into rack	16 minutes
BladeCenter management module	5 seconds
BladeCenter Ethernet switch module	5 seconds
BladeCenter power module	5 seconds
BladeCenter fibre channel switch module	5 seconds
BladeCenter acoustic module	14 seconds
BladeCenter media tray	27 seconds
BladeCenter diskette drive	1 minute
BladeCenter CD/ROM	1 minute
BladeCenter Blower	9 seconds

Chapter 5. Configuration considerations

This chapter describes the information you need to plan for your BladeCenter hardware configuration. The following hardware requires configuration:

- Management module (see "Management module configuration planning").
- Ethernet switch module (see "Ethernet switch module configuration planning" on page 62).
- Blade server (see "Blade server configuration planning" on page 71).

Management module configuration planning

Your BladeCenter unit comes with one hot-swap management module in the management bay. The management module functions as a system-management processor (service processor) and keyboard/video/mouse (KVM) switch for the multiple blade servers. The management module also communicates with the switch modules, power modules, blower modules, and blade servers to detect presence or absence and any error conditions, sending alerts when required.

Use the information provided in this section along with the worksheet provided (see "Management module configuration worksheet" on page 83) to plan for the configuration of the management module. In addition, complete details for each of the options that you can configure are provided in the *BladeCenter Type 8677 Installation and User's Guide*.

Configure these options for the management module:

- General settings
- Ethernet Network interfaces
- Alerts
- Login profiles
- Network protocols
- Security

General settings

General settings include:

- Management module name
- Name of the person who is responsible for the management module
- Physical location of the management module
- Real-time clock settings

Login Profiles

You can specify up to 12 login profiles. For each login profile, specify the following:

- Login ID
- Password
- Authority. You can specify either read only (R/O) or read/write (R/W).

Ethernet network interfaces

You can configure the following two Ethernet interfaces:

- External network interface, which is the interface for the remote management and console port.

- Internal network interface, which is the interface to the switch modules.

Note: For switch communication through the management module external Ethernet port, the switch module internal network interface and the management module internal and external interfaces must be on the same subnet.

Alerts

For alerts you can configure the following settings:
- Which alerts are monitored (from lists of Critical, Warning, and System alerts)
- Where and to whom alerts are sent
- How alerts are sent (SNMP, e-mail, IBM Director)
- How often to retry alert notification and the delay between retries
- Whether to include the event log with notifications

Network protocols

You can configure settings for the following network protocols:
- Simple Network Management Protocol (SNMP)
- Simple Mail Transfer Protocol (SMTP)
- Domain Name Server (DNS)

Security

Specify whether or not to enable Secure Socket Layer (SSL). If you choose to enable SSL, you can determine whether to use self-signed certificates or certificates provided by a certificate authority (CA).

Ethernet switch module configuration planning

One Ethernet switch module is required in switch module bay 1 of your BladeCenter unit. The switch module provides four external Ethernet ports, which you can use to communicate with an external Ethernet network. In addition, the switch module provides 14 internal Ethernet ports, which are used to communicate with each of the blade servers in your BladeCenter unit.

Note: Enumeration of the Ethernet controllers is operating-system dependent. for example, the Ethernet controller located nearer the top of the blade server whose communications are routed through Ethernet switch module 1, is designated as the first connection (or Local Area Connection) by Microsoft Windows 2000, but is designated as the second connection (or eth1) by Red Hat Linux Version 7.3. The Ethernet controller located nearer the bottom of the blade server, whose communications are routed through Ethernet Switch module 2, is designated as the second connection (or Local Area Connection 2) by Microsoft Windows 2000, but is designated as the first connection (or eth0) by Red Hat Linux Version 7.3.

Options that you can configure for the Ethernet switch module include:
- Switch settings
- Port settings
- SNMP
- User accounts
- TFTP

- VLANs
- Multicasting
- Mirroring
- Spanning tree
- Class of service
- Link aggregation
- Enable external ports for management

Use the information provided in this section along with the worksheet provided (see "Ethernet switch module configuration worksheet" on page 86) to plan for the configuration of the management module. More information about each of these options is provided in *BladeCenter 4-Port Gb Ethernet Switch Module Installation and User's Guide*.

Attention: The BladeCenter unit ships with the external ports of the Ethernet Switch module set to disabled. Before any communication with the ports is possible, the ports must first be enabled using the Management Module configuration panels. These panels are accessed by attaching a workstation to the 10/100 Mbps Ethernet port on the management module or by using the IBM Director Wizard. Once the Ethernet Switch module ports are enabled, a system management workstation can communicate with the Ethernet switch module using the Web GUI or Telnet commands.

Switch settings

For the switch, determine the name, description, and contact. In addition, determine how the switch will obtain an IP address:

- The IP address you specify for the switch when you configure the management module will override any settings you specify here.
- If the switch is going to obtain an IP address manually, you need to enter an IP address, subnet mask, and default gateway. The switch default IP address is based on the switch module bay in which you installed the switch:
  - Switch module bay 1: IP address is 192.168.70.127
  - Switch module bay 2: IP address is 192.168.70.128
  - Switch module bay 3: IP address is 192.168.70.129
  - Switch module bay 4: IP address is 192.168.70.130
- If you specify BOOTP as the method used to obtain an IP address, the switch will send out a BOOTP broadcast request to a BOOTP server when it is turned on. If no server is found, the default or previously entered IP settings are used.

  Note: Before the switch can broadcast a BOOTP request, the external ports on the switch must be enabled through the BladeCenter management module.

- If you specify DHCP as the method used to obtain an IP address, the switch will send out a DHCP broadcast request to a DHCP server when it is turned on. If no server is found, the default or previously entered IP settings are used.

  Note: Before the switch can broadcast a DHCP request, the external ports on the switch must be enabled through the BladeCenter management module.

- Group VLAN Registration Protocol (GVRP) allows members to dynamically join VLANs. You can enable or disable GVRP on the switch module.

- Telnet time out determines the time that the Telnet interface can be idle before the switch automatically logs-out the user. You can choose 2 minutes, 5 minutes, 10 minutes, 15 minutes, or never.
- Telnet sessions determines the maximum number of allowed Telnet sessions.
- MAC address aging timer and time

Port settings

The Ethernet switch module has a total of 14 internal ports (for communication with the blade servers) and 4 external ports (for communication with external devices).

For the internal ports, you can configure these settings:
- State. The port state can be either enabled or disabled. If the internal port is disabled, the blade servers cannot communicate with the port and the switch purges their addresses from its address table after the MAC address aging time elapses.
- Flow Control. Flow control can be enabled or disabled. Selecting enabled in full-duplex mode will implement IEEE 802.3x flow control.

In addition to State and Flow Control, you can configure the Speed and Duplex mode for the external ports.
- Select **Auto** to allow the port to select the best transmission speed, duplex mode, and flow control settings based on the capabilities of the device at the other end.
- You can enable or disable Flow Control in conjunction with all of the Speed/Duplex settings except 10M/Half and 100M/Half. In these cases, back pressure is automatically selected.

SNMP

Determine the management stations that will receive SNMP traps, SNMP community strings, level of access to switch settings by the community, and whether or not the community name is enabled. You can also specify up to 4 management station recipients to receive traps.

User accounts

Determine which user accounts will have access to the switch.
- Default user account:
  - User ID: USERID
  - Password: PASSW0RD (the sixth character is a numeric 0, not an alphabetic O)
- User IDs and passwords are case sensitive.
- Access Level:
  - Root. Read/Write access to all switch module settings.
  - User. Read-only access to all switch module settings.
  - User+. Read-only access to all switch settings, plus the ability to restart the switch module.

TFTP

Determine the location of the TFTP servers (as well as the path and file name) to be used for the download configuration file, firmware code file, upload configuration file, and log file.

- TFTP server software must be running for TFTP services to work.
- For the configuration file uploaded to a TFTP server to be saved correctly, you must first save switch module configurations to NVRAM.
- Before the switch can upload its history log file to the TFTP server, an empty history log file must exist on the TFTP server.

Virtual LANs (VLANs)

VLANs allow multiple blade servers to be part of a logical group and prevents other servers that do not belong to a given group from gaining direct access to the group resources and data. The BladeCenter Ethernet switches can append a 4-byte VLAN tag to ingress frames on a per-port basis, and use the tag on certain frames to permit or block access to those frames at other ports. VLAN traffic can be restricted to a single BladeCenter unit or can extend across multiple BladeCenter units. When VLANs are extended across multiple BladeCenter units, intermediate switches use the VLAN tag to block frames from non-member destinations.

When defining VLANs that span a chassis, consider the following:
- Blade Server ports that are in the same VLAN must have the same VLAN ID
- Define the same VLAN ID on both Ethernet switches for Blade Servers that use both switches to connect to the same external network.
- Ethernet switch ports used to span multiple BladeCenter units must be configured as Tagged, with a specific default VLAN ID for any untagged packets.
- The external ports and Link Aggregation Groups must be members of all VLANs that span multiple BladeCenter units.
- The intermediate network device that interconnects the BladeCenter units must be configured to handle tagged VLAN packets for all applicable VLAN traffic that should be passed through the device.

The BladeCenter unit default VLAN ID is **1** and includes all blade servers in the chassis. If multiple VLANs are required additional VLAN IDs must be configured. Review the following example to understand how VLANs can be configured.

VLAN example
The example shown in Figure 23 on page 66 defines three VLANs within a single BladeCenter unit and multiple VLANs extended to multiple BladeCenter units. Table 10 shows the defined VLAN parameters that are set to support this configuration. Egress packets for internal blade server ports must be Untagged.

Table 10. Sample VLAN configuration definitions

Port Number	VLAN Id	VLAN Name	Tagged/Untagged Egress Packets	Membership Egress/Forbid/None
1	1	Default	U	E 1
2	1	Default	U	E 1
3	1	Default	U	E 1
4	2	VLAN 2	U	E 2
5	2	VLAN 2	U	E 2
6	2	VLAN 2	U	E 2
7	3	VLAN 3	U	E 3
8	3	VLAN 3	U	E 3
9	3	VLAN 3	U	E 3

Table 10. Sample VLAN configuration definitions (continued)

10	3	VLAN 3	U	E 3
11	1	Default	U	E 1
12	1	Default	U	E 1
13	2	VLAN 2	U	E 2
14	2	VLAN 2	U	E 2
Ext 1	1*	Default	T	E (1, 2, 3)
Ext 2	1*	Default	T	E (1, 2, 3)
Ext 3	1*	Default	T	E (1, 2, 3)
Ext 4	1*	Default	T	E (1, 2, 3)
* Untagged packets are tagged as 1 (Default); Tagged packets are not changed.				
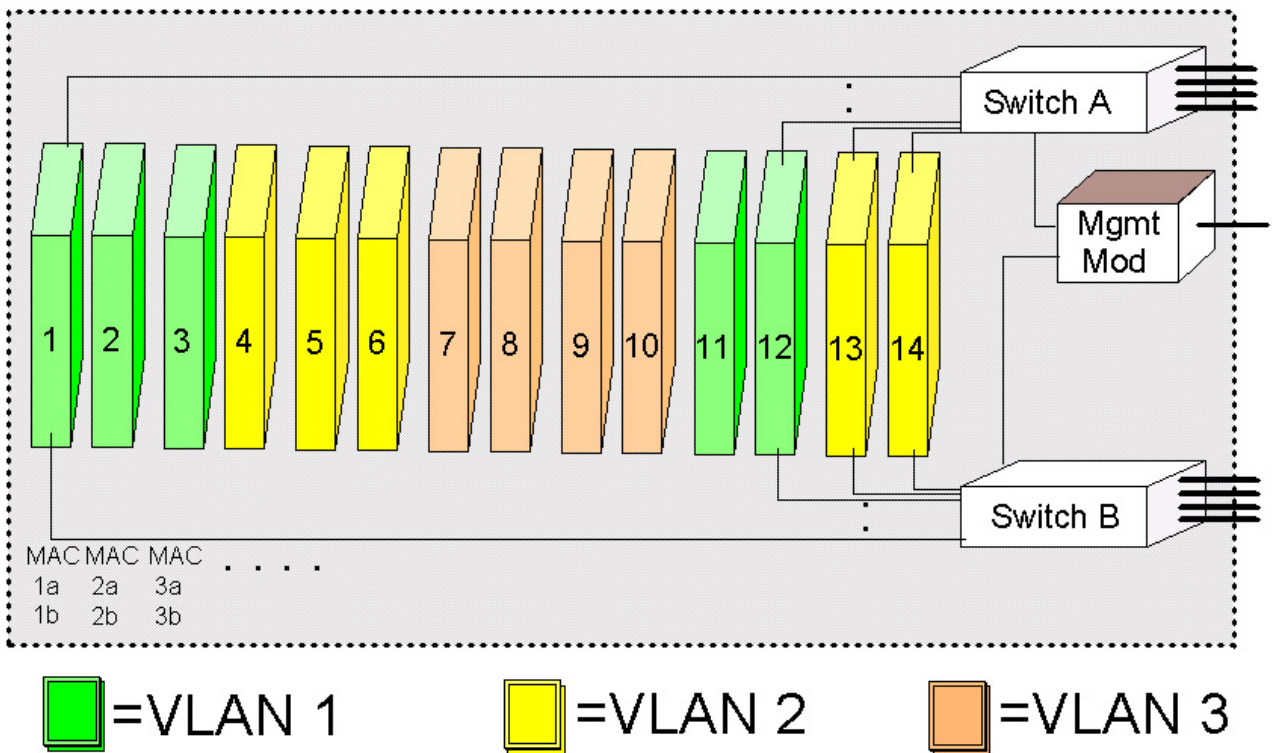
Figure 23. VLAN configuration example on a single BladeCenter unit

Figure 24 shows an example of VLANs that span multiple BladeCenter units. In this example layer 2 VLANs span the BladeCenter units within each rack. Layer 3 subnets separate the VLANs into segments.
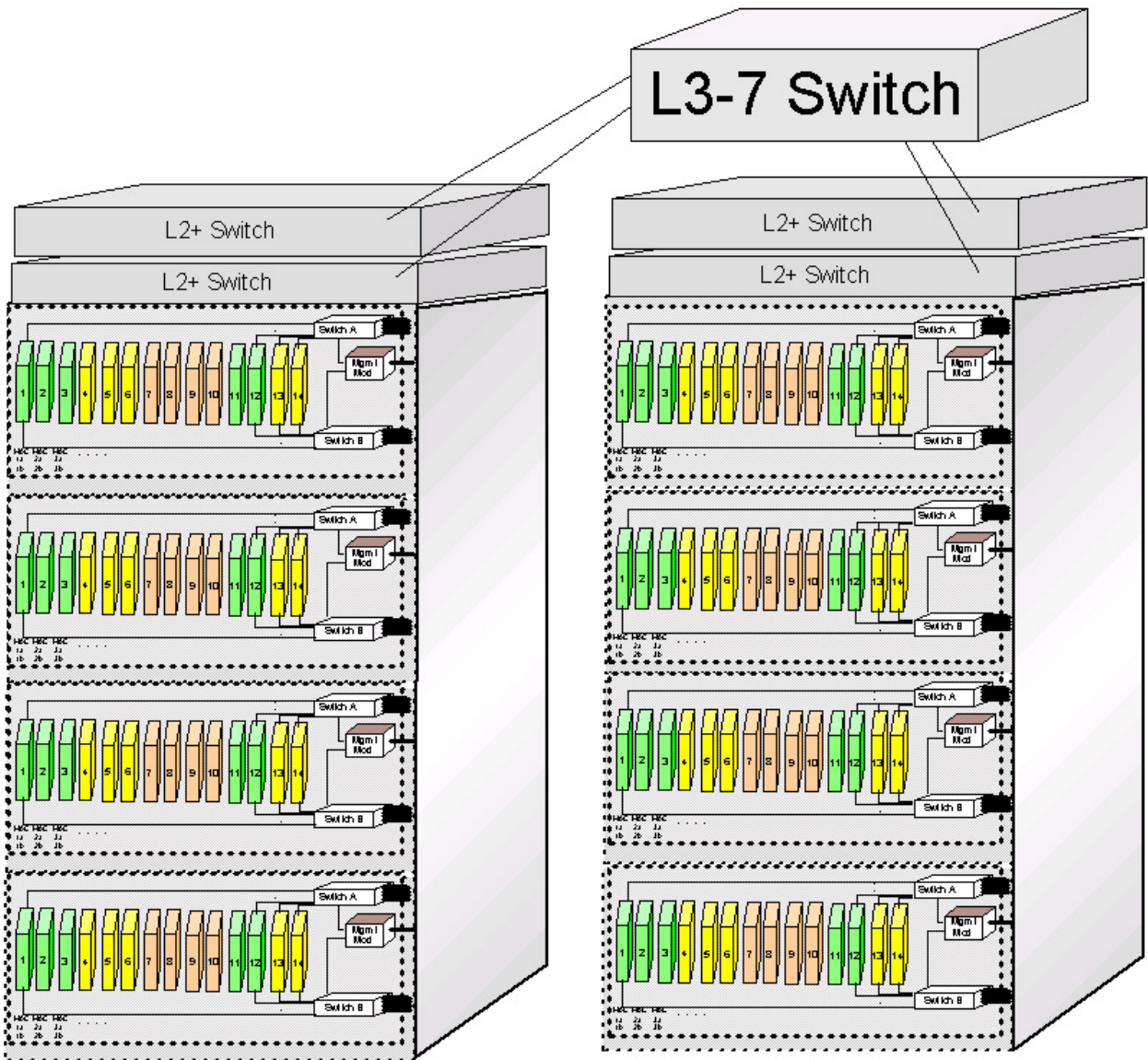
Figure 24. VLAN configuration example for multiple BladeCenter units

Multicasting

To configure multicasting, determine the settings to be used for IGMP snooping and the entries to be included in the multicast forwarding table.

Port mirroring

The switch module provides the capability of copying frames that were transmitted and received on a source port and redirecting the copies to another target port. The source port can be one of the four 10/100/1000 Mbps external ports. The target port is where you will connect a monitoring/troubleshooting device, such as a sniffer or an RMON probe. The target port must be one of the four 10/100/1000 Mbps external ports.

Notes:

1. Do not mirror a faster port or higher traffic ports onto a slower port. For example, trying to mirror the traffic from a 100 Mbps port onto a 10 Mbps port can cause throughput problems. The port that you are copying frames from should always support an equal or lower speed than the port to which you are sending the copies. In addition, the target port cannot be a member of a trunk group.

2. Port mirroring is not possible if you use the same egress and ingress target port.

Spanning tree

The switch module supports 801.2d spanning tree protocol (STP), which allows you to create alternative paths (with multiple switches or other types of bridges) in your network.

Keep in mind the following considerations when configuring ports:

Notes:

1. Port cost can be between 1 and 65535. The lower the cost, the greater the probability that the port will be chosen as the designated port (chosen to forward packets).

2. Port priority can be between 0 and 255. The lower the priority, the greater the probability that the port will be chosen as the root port.

3. You can choose whether to enable or disable fast STP. Enabling fast STP for a port, speeds up the time between link-up and the start of packet forwarding. Enabling the fast STP option causes the port to skip the learning state. Instead, it jumps from the listening state directly to the forwarding state.

4. You can choose whether to enable or disable the STP state for a port.

Class of service

The switch module supports 802.1p priority queuing; four priority queues are supported per port. The switch module provides user-programmable mapping for the eight 802.1p priority classes (0 to 7). For the priority queue feature to take effect, you must first enable Priority Queue Method by setting it to Weighted Round Robin.

Link aggregation

The switch module supports link aggregation (or port trunking), which can be used to increase the bandwidth of a network connection or to ensure fault recovery. You can configure up to two trunk connections (combining two to four ports into one fat pipe) between any two BladeCenter switches or other Layer 2 switches. However, before making any physical connections between devices, you must specify the ports that will belong to the trunking group between switches.

Note the following considerations when planning for link aggregation:

- The ports used in a trunk must all be of the same media type (100 Mbps fiber or 1000 Mbps fiber).
- Each port can be assigned to only one trunk group, whether a static or dynamic group.
- The ports at both ends of the connection must be configured as trunk ports.
- All of the ports in a trunk must be treated as a whole when moved from/to, added, or deleted from a VLAN.

- You must enable the trunk before connecting any cable between the switches to avoid creating a data loop.
- Disconnect all trunk port cables or disable the trunk ports before removing a port trunk to avoid creating a data loop.
- The configuration of the lowest numbered port in the group becomes the configuration for all ports in the port trunking group. This port becomes the Master Port of the group. All configuration options applied to the Master Port are also applied to the entire port trunking group.
- Load balancing is automatically applied to the ports in the trunked group. A link failure within the group causes the network traffic to be directed to the remaining links in the group.
- The spanning tree protocol (STP) will treat a port trunking group as a single link on the switch level. On the port level, the STP will use the port parameters of the Master Port in the calculation of port cost and in determining the state of the port trunking group. If two redundant port trunking groups are configured on the switch, STP will block one entire group in the same way that STP blocks a single port that has a redundant link.
- Use the Distribution Method to specify the method used to differentiate packets that go through your network. The method you choose is used as a hashing function to determine which packets go to which port.

802.3ad link aggregation

Notes:

1. The Mode determines whether or not a port is enabled to join or create a link aggregation group.
2. The Administrator key controls the way that links are aggregated. Use the same Administrator key for all ports to be aggregated together.
3. The Operator key is used by the port to communicate with other LACP switches.

Link aggregation group recommendations

The external ports on a BladeCenter Ethernet switch module can be configured in these ways:

- Multi-port Link Aggregation Group (LAG) using the Link Aggregation Control Protocol (LACP) – 1 Gbps per port
- Multi-port Trunk – 1 Gbps per port
- Single port link – 1 Gbps
- Multi-port LAG using LACP – 100 Mbps per port
- Multi-port Trunk, 100 Mbps per port

The recommended configuration is:

- Define the four ports of each Ethernet switch module as a 4-port IEEE 802.3 Link Aggregation Group (LAG).
- Configure the Link Aggregation Control Protocol (LACP) – define a minimum of 2 ports for an active group within a LAG to provide at least 2 Gbps full-duplex bandwidth.

By defining a LAG port group and configuring LACP, LACP allows a subset of the LAG ports to be active meaning 2, 3, or 4 ports are active which provides 2, 3, or 4 Gbps of bandwidth between the BladeCenter unit and the adjacent router or

external switch. When a LAG group is configured correctly in both the BladeCenter unit and the adjoining device, the spanning tree protocol treats the group as a single link.

Link aggregation example: As shown in Figure 25 the two Link Aggregation Groups from a BladeCenter unit are connected to separate Layer 2 or Layer 3 switches. This provides a redundant path in case of a link or switch failure.

Typically the BladeCenter Ethernet switch module ports are attached to one of the following types of switch:
- A layer 2 stack switch (1 Gbps ports with a high-speed (10 Gbps) link to a layer 3 router.
- A layer 2 or 3 chassis switch with integrated L3 switching or routing. Ports can be grouped through VLANs.
- A layer 3-7 router or load-balancing switch.
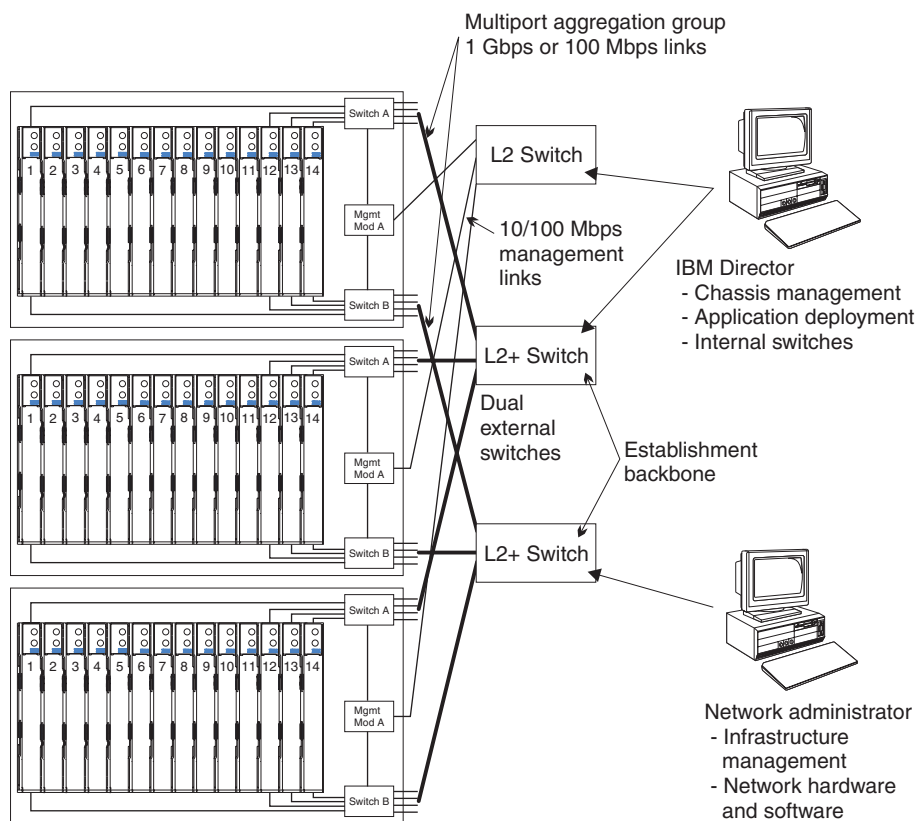
Figure 25. Recommended network topology with multi-port link aggregation groups

Link aggregation control protocol recommendations

LACP exchanges information between a pair of stations on a point-to-point link aggregation group to ensure proper operation. A communication path is not established unless both stations are configured correctly and the port-to-port cables are installed on a subset of configured ports, or all of the configured ports. For the purpose of this discussion, the stations are defined as the BladeCenter Ethernet switch ports and an adjoining layer 3 external switch. These parameters must be correctly defined for both stations:

- Define the ports for the Link Aggregation Group and define the Group ID
- Assign the same Administrative Key to each port within a group

- Assign a Priority to each port within a group (priority can be the same for all ports)
- Assign an Operator Key to each port.

LACP can be used only if both stations sharing the link support the 802.3AD Link Aggregation Protocol.

Blade server configuration planning

Use the information provided in this section along with the worksheet provided (see "Management module configuration worksheet" on page 83) to plan for the configuration of the blade server. In addition, more information about the blade server is provided in the *IBM BladeCenter Type 8677 HS20 Installation and User's Guide*.

You can configure the following options for each blade server:
- Enable or disable the IDE and Ethernet controllers. If you select disable, the system will not configure the disabled device, and the operating system will not detect the device (this is the equivalent of unplugging the device).
- If you disable the on-board IDE controller and no other controller and mass storage device are installed, operating-system startup cannot occur.
- Specify a system date and time. You can specify a time to be added or subtracted from the system time that is sent to the system-management processor each time the blade server is started. If you want the system clock time to be the same as the system-management processor clock time, leave the value set at its default of 0.
- Power-on password. You can use any combination of up to seven alphanumeric characters (A-Z, a-z, and 0–9) for the password.

Note: To use the CD-ROM drive or diskette drive as a boot-record source for a blade, the blade must be designated as the owner of the CD-ROM drive, diskette drive, and USB port. See the *BladeCenter Type 8677 Installation and User's Guide* for more information about specifying ownership.

Appendix A. Planning worksheets

This appendix provides worksheets to help plan for the installation of BladeCenter units. The worksheets are provided in building-block order where:

1. The "8678 Blade Server worksheet" on page 74 helps you plan for one to fourteen 8678 blade servers per BladeCenter unit. Specify software and hardware options on this worksheet.

2. The "8677 BladeCenter worksheet" on page 76 helps you plan for one to six 8677 BladeCenter units per rack. Specify 8677 rack location and weight on this worksheet.

3. The "Rack worksheet" on page 78 helps you aggregate total BladeCenter weight, PDU weight, and mounting kit weight to ensure that:

   - The weight of the BladeCenter units and other hardware does not exceed the rack load limits

   - The combined weight of the BladeCenter units and rack does not exceed floor load limits

4. The "Cabling worksheet" on page 79 helps you plan for external network connections. This section also provides information about cable media and maximum lengths.

5. The "Power worksheet" on page 81 helps you plan for adequate power resources.

For guidance on the amount of time to complete physical installation of components, blade servers, and BladeCenter units, see "Physical installation time" on page 60.

8678 Blade Server worksheet

Fill out one worksheet for each blade server that is being installed; up to 14 for each BladeCenter unit. The following factors drive the choices you make when filling out an 8678 blade server worksheet:

1. What applications will this server provide?
2. Which operating system will the server use?
3. What are my redundancy requirements for this server? Redundancy is handled at multiple levels:
   - Blade server level – a mirror image blade server that resides in the same BladeCenter unit or in a different BladeCenter unit.
   - BladeCenter level – a mirror image BladeCenter unit that resides in the same rack or in a different rack.
   - Rack level – a set of BladeCenter units in a rack that mirrors a set of BladeCenter units in a different rack.
4. What are the network connectivity requirements for this server, including physical connectivity for a redundant path?

How to fill out this worksheet:

1. Record the name and purpose of this server.
2. Select one of the following operating systems, and record it on the worksheet:
   - Windows
   - Linux
3. Select an installation option for the operating system.
4. Record the applications for this server.
5. Chose which internal Ethernet switch module this server uses; circle 1 or 2.
6. Select DHCP or record static IP address information. (The host name can be up to 63 characters.)
7. Circle the number of the BladeCenter bay location for this blade server.

   Note: If this server has a SCSI Storage Expansion option, circle two adjacent BladeCenter bay locations

8. Circle a BladeCenter chassis number. This should match the location of the BladeCenter unit in the rack. For example, BladeCenter number 1 should be installed in the bottom of the rack.

   Location 1 uses U1 to U7
   Location 2 uses U8 to U14
   Location 3 users U15 to U21
   Location 4 uses U22 to U28
   Location 5 user U29 to U35
   Location 6 uses U36 to U42
9. Record the number and physical location of the rack.
10. Select either the 2.0 GHz or the 2.4 GHz blade server chassis.
11. For the remainder of the worksheet, select the components of this server, processors, memory, and so forth. Compute the weight for each component and record it on the worksheet. At the bottom of the worksheet, record the total weight for this blade server. This information is needed for the "8677 BladeCenter worksheet" on page 76.

Table 11. Blade server worksheet

Blade server name and purpose: _____
Operating system: _____
OS installation option:
  ☐ Preloaded
  ☐ Deployed through network management
  ☐ Manual install with product CD.
Applications: _____
_____
Connects to Ethernet switch module 1 or 2
	Blade server IP information:
	 ☐ Automatic through DHCP server
	 ☐ Static:
	  Host name _____
	  Subnet mask_____._____.____._____
	  IP address _____._____.____._____
	  Gateway address _____._____.____._____
	
	  Host name _____
	  Subnet mask_____._____.____._____
	  IP address _____._____.____._____
	  Gateway address _____._____.____._____

BladeCenter bay location 1 2   3   4   5   6   7   8   9   10   11   12   13   14
BladeCenter chassis number 1   2   3   4   5   6
Rack number and location _____

Component	Quantity	Details	Weight	Base or optional feature
8678 blade server	1	Blade server with Xeon 2.0 GHz Processor and 512 MB	3.84 kg (8.49 lb)	Base with two 256 MB memories
	1	Blade server with Xeon 2.4 GHz Processor and 512 MB	3.84 kg (8.49 lb)	Base with two 256 MB memories
Second processor	1	Xeon 2.0 GHz	0.57 kg (1.25 lb)	Optional
	1	Xeon 2.4 GHz	0.57 kg (1.25 lb)	Optional
Optional memory choices for slots 3 and 4	2	☐ 512MB ☐ 1GB	0.03 kg (0.06 lb)	2 256MB base
Memory slots 1 and 2. Select a memory size.	2	☐ 256MB ☐ 512MB ☐ 1GB	0.03 kg (0.06 lb)	Optional
EIDE hard disk drives	1 or 2	40 GB ATA 100; 5400 RPM	Quantity × 0.12 kg (0.28 lb) = _____	Optional
SCSI Storage Expansion option	1	Supports two additional hard drives	1.90 kg (4.19 lb)	Optional
SCSI hard disk drive 1	1		0.95 kg (2.09 lb)	Optional
SCSI hard disk drive 2	1	.	0.95 kg (2.09 lb)	Optional
Fibre Channel I/O Expansion option	1		.08 kg (0.19 lb)	Optional. Required for support of a SAN.
			Total: ____	

8677 BladeCenter worksheet

This worksheet is provided to help you plan for the BladeCenter location in the rack, and rack weight. When completed, the worksheet will provide a total number for weight of up to fourteen 8678 blade servers. Each worksheet applies to one 8677 BladeCenter unit. A copy of this worksheet must be filled out for each BladeCenter unit.

1. Before you can complete this worksheet, Fill out a worksheet for each blade server (1 to 14) that will be installed in this chassis. See "8678 Blade Server worksheet" on page 74.
2. Circle the BladeCenter number and the BladeCenter position in the rack. Position 1 is installed in the bottom of the rack.
3. Circle how many power modules are required for this BladeCenter unit.

    Note: Four power modules are required if you install a blade server or SCSI Storage Expansion option in any one of bay locations 7 through 14 on the BladeCenter unit.

4. If any are to be installed, circle the number of optional Fibre Channel switch modules.
5. If installed on this BladeCenter unit, circle the optional Acoustic attenuation module.
6. Compute and record **Subtotal 1** for the weight of these components.
7. For each blade server (1 through 6), record the weight numbers from the blade server worksheets.
8. Compute and record **Subtotal 2** for blade servers 1 through 6.
9. For each blade server (7 through 14), record the weight from the blade server worksheets.
10. Compute and record **Subtotal 3** for blade servers 7 through 14.
11. Record the subtotals for weight on the bottom of the worksheet. Add the subtotals to derive the total weight for this BladeCenter unit.

Table 12. BladeCenter worksheet

BladeCenter number: 1 2 3 4 5 6 Rack position: **1** (U1-U7) **2** (U8-U14) **3** (U15-U21) **4** (U22-U28) **5** (U29-U35) **6** (U36-U42) Rack number and location: _____			
Component	**Quantity**	**Weight**	**Base or optional feature**
Chassis	1	44.9kg/99lb	Base
Power modules	2 or 4	Quantity × 1.98 kg (4.37 lb) = ____	Modules 1 and 2 are base. Modules 3 and 4 are required if a blade server or SCSI storage expansion option is installed in bay 7 or higher.
Management module	1	.76 kg (1.68 lb)	Base
Ethernet switch modules	1 or 2	Quantity × .82 kg (1.81 lb) = ____	Optional, 1 is required
Fibre Channel switch modules	1 or 2	Quantity × 0.91 kg or 2 lb = ____	Optional. Required if this BladeCenter unit provides network connectivity for an external fibre channel storage device or a SAN.
Blowers	2	5.67 kg (12.6 lb)	Base
Media tray	1	N/A	Base
Acoustic module	1	2.09 kg (4.62 lb)	Optional. Provides noise reduction.
Subtotal 1:		_____	
8678 blade server 1		_____	
8678 blade server 2		_____	
8678 blade server 3		_____	
8678 blade server 4		_____	
8678 blade server 5		_____	
8678 blade server 6		_____	
Subtotal 2 for blade servers 1 through 6		_____	
8678 blade server 7		_____	
8678 blade server 8		_____	
8678 blade server 9		_____	
8678 blade server 10		_____	
8678 blade server 11		_____	
8678 blade server 12		_____	
8678 blade server 13		_____	
8678 blade server 14		_____	
Subtotal 3 for blade servers 7 through 14		_____	
Subtotal 1 **Subtotal 2** **Subtotal 3** **Total**		**Subtotal 1**_____ **Subtotal 2**_____ **Subtotal 3**_____ **Total**_____	

Rack worksheet

This worksheet helps you plan for the rack location of each BladeCenter unit, compute the total weight for the BladeCenter units and other hardware. Each BladeCenter unit is 7U; up to six can be installed in a 42U rack. Fill out one worksheet for each rack.

1. Record the weight totals for each BladeCenter unit in this rack from the "8677 BladeCenter worksheet" on page 76.
2. Record **Subtotal 1** for the weight.
3. Compute the weight of the rack mounting kits and record it on the worksheet.
4. Compute the weight of the power distribution units and record it on the worksheet.
5. Record **Subtotal 2** on the worksheet.
6. Add **Subtotal 1** and **2** to obtain the total rack load and record it on the worksheet.
7. Select a rack and circle the matching rack weight on the worksheet. Verify that the weight load entered in step 6 does not exceed the weight limit for the rack.
8. Add the rack weight to the total rack load and record it on the worksheet. Verify that this weight does not exceed the Floor load limits of the location where the rack is being installed.

Table 13. Rack worksheet

Component	Location	Quantity	Weight
BladeCenter unit 1	1 (U1 to U7)	1	___
BladeCenter unit 2	2 (U8 to U14)	1	___
BladeCenter unit 3	3 (U15 to U21)	1	___
BladeCenter unit 4	4 (U22 to U28)	1	___
BladeCenter unit 5	5 (U29 to U35)	1	___
BladeCenter unit 6	6 (U36 to U42)	1	___
			Subtotal 1 _____
Rack mounting kits	1 through 6	1 2 3 4 5 6	Quantity × 4.58 kg or 10.1 lb = ___
PDUs			Quantity × 4.80 kg or 10.6 lb = ___
Front end PDUs			Quantity × 4.80 kg or 10.6 lb = ___
			Subtotal 2 _____
Total Rack Load			**Subtotal 1** _____ **Subtotal 2** _____ **Total** _____
☐ NetBAY 42 enterprise rack ☐ NetBAY 42 enterprise expansion rack ☐ NetBAY 42 standard rack ☐ NetBAY 42 standard expansion rack ☐ NetBAY 25 standard rack ☐ NetBAY 11 standard rack			260.82 kg (575 lb) 235 kg (516 lb) 137 kg (301 lb) 105 kg (231 lb) 94 kg (207 lb) 34 kg (75 lb)
Total floor load			**Rack weight**___ **Total rack load** ___

Cabling worksheet

This worksheet is used to plan for the external network cables to attach the Management module, Ethernet switch modules, and, if present, Fibre Channel switch modules to external networks. Fill out one worksheet for each BladeCenter unit.

On this worksheet record:
The BladeCenter number (1 through 6)
The BladeCenter location in the rack (1 through 6)
The rack number and location
The **From port:** and **To:** connections. See Table 15 on page 80 for details on cable media types and distances.

Table 14. Cabling worksheet

BladeCenter number: ___
Location in rack (1 through 6): ___
Rack number and location: _____

Component	From port:	To:
Ethernet switch module 1 10/100/1000 Mbps	1	
	2	
	3	
	4	
Ethernet switch module 2 (10/100/1000 Mbps)	1	
	2	
	3	
	4	
Management module (10/100 Mbps)	1	
Fibre Channel switch module 1	1	
	2	
Fibre Channel switch module 2	1	
	2	

Table 15. Cable media and length

Standard	Data transmission rate	Media type	Maximum distance	Connector
Ethernet 1000BASE-T	1000 Mbps	Category 5e UTP Category 5 UTP EIA/TIA-568B 100-Ohm STP	100 meters (328.1 ft)	RJ45
Ethernet 100BASE-TX	100 Mbps	Category 5 UTP EIA/TIA-568 100-Ohm STP	100 meters (328.1 ft)	RJ45
Ethernet 10BASE-T	10 Mbps	Category 3, 4, or 5 UTP 100-Ohm STP	100 meters (328.1 ft)	RJ45
Fibre Channel	1.062 or 2.124 Gigabits	50 micron multimode Fibre Channel	500 meters (1640.42 ft)	Duplex LC
	1.062 or 2.124 Gigabits	62.5 micron multimode Fibre Channel	300 meters (984.25 ft)	Duplex LC
	1.062 or 2.124 Gigabits	9 micron single mode Fibre Channel	2000 meters (6561.68 ft)	Duplex LC

Power worksheet

This section describes how to determine ac power needs and ordering power cords.

1. Record the number of blades to be installed in this BladeCenter unit.
2. Use the following chart to determine the number of required power modules (2 or 4).

Power modules	Number of blades	Required in product order	Maximum ac input power	Number of PDU outlets	Number of power cords
1 and 2	1 to 6	Power modules 1 and 2	1.41 kVA	2 outlets	2 (1 per module)
1, 2, 3, and 4	7 to 14	Power modules 1, 2, 3, and 4	2.82kVA	4 outlets	4 (1 per module)

3. Record the number of power modules per BladeCenter unit = _____
4. Record the number of BladeCenter units to be installed in this rack _____
5. Multiply the number recorded in Steps 3 and 4 to obtain the total number of required power cords and power outlets _____

Appendix B. Configuration Worksheets

Use the worksheets in this appendix to configure the components for your BladeCenter unit. Information about each of the worksheets is provided in Chapter 3, "Deployment considerations" on page 21.

Management module configuration worksheet

Fill out this worksheet to provide the information needed to configure the management module. For information on filling out the worksheet, see "Management module configuration planning" on page 61 and the *BladeCenter Type 8677 Installation and User's Guide*.

General Settings

Management module name	
Contact name	
Physical location	
Clock settings	

Login profiles

Login ID	Password	Authority level	
		R/O	**R/W**

External network interface (eth0)

Interface	__ Enabled
	__ Disabled
DHCP	__ DHCP with rollover to static
	__ DHCP only
	__ Static IP only
Hostname	
Static IP configuration (configure only if DHCP is disabled)	

IP address	_____._____._____._____
Subnet mask	_____._____._____._____
Gateway IP address	_____._____._____._____

Internal network interface (eth1)

Interface IP address	_____._____._____._____
Subnet mask	_____._____._____._____
Locally-administered MAC address	

Alerts

Remote Alert Recipients		
Receives critical alerts only		
	Status	
	Notification method	___ SNMP over LAN ___ e-mail over LAN ___ IBM Director over LAN
	Host name (or IP Address)	
	e-mail address	
Global Remote Alert Settings		
Remote alerts retry limit		
Delay between retries		
Include event log with e-mail alerts		___ Yes ___ No
Alerts to be Monitored		
Critical alerts	Select all critical alerts	
	Hard disk drive	
	Multiple blower failure	
	Power failure	
	Temperature	
	VRM failure	
	Multiple switch module failure	
	Invalid configuration	
Warning alerts	Select all warning alerts	
	Single blower failure	
	Temperature	
	Voltage	
	KVM/media tray switching failure	
	Redundant module failure	
System alerts	Power off	
	Inventory	
	Log 75% full	

Network protocols

SNMP	
SNMP agent	__ Enable
	__ Disable
SNMP traps	__ Enable
	__ Disable
Community name	
Host name (or IP address)	
SMTP	
Host name (or IP address)	
DNS	
DNS	__ Enable
	__ Disable
DNS Server IP address 1	_____._____._____._____
DNS Server IP address 2	_____._____._____._____
DNS Server IP address 3	_____._____._____._____

Security

Secure Socket Layer (SSL)	__ Enabled
	__ Disabled
Certificates	__ Self-signed
	__ Provided by a certificate authority

Ethernet switch module configuration worksheet

Fill out the worksheet in this section for each Ethernet switch module you plan to have in your BladeCenter unit. For information on filling out the worksheet, see "Ethernet switch module configuration planning" on page 62 and the *BladeCenter Ethernet Switch Module Installation and User's Guide*.

Switch settings

Name	
Location	
Local contact	
Get IP from (manual, BOOTP, DHCP)	
IP address	____.____.____.____
Subnet mask	____.____.____.____
Default gateway	____.____.____.____
Switch GVRP (enabled or disabled)	
MAC address aging timer (enabled or disabled)	
Aging time (10 to 1,000,000 seconds)	
Telnet time out	
Telnet sessions (1 to 4)	
Enable external ports for management	

Port settings

Port	State		Speed (Mbps)				Duplex		Flow control	
	E	D	10	100	1000	Auto	H	F	E	D
1					x			x		
2					x			x		
3					x			x		
4					x			x		
5					x			x		
6					x			x		
7					x			x		
8					x			x		
9					x			x		
10					x			x		
11					x			x		
12					x			x		
13					x			x		
14					x			x		
Ex1										
Ex2										
Ex3										
Ex4										

SNMP management station IP settings

IP address	_____._____._____._____
IP address	_____._____._____._____
IP address	_____._____._____._____

SNMP community strings and trap recipients

Community string	Rights		Status		Trap recipient	Status	
	R	R/W	E	D		E	D
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		
					_____._____._____._____		

Ethernet switch module user accounts

User ID	Password	Access level		
		Root	User	User+
USERID	PASSW0RD	x		

TFTP servers

Table 16. TFTP servers

File	TFTP server address	Path and file name
Download configuration	____.____.____.____	
Firmware code	____.____.____.____	
Upload configuration	____.____.____.____	
History log	____.____.____.____	

802.1Q VLANs

VLAN ID (VID): _____

VLAN name: _____

Port	Tag	None	Egress	Forbidden
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
EX1				
EX2				
EX3				
EX4				

802.1Q port settings

Port	Port VLAN ID	Priority	Ingress filter	GVRP
1				
2				
3				
4				
5				
6				
7				

Port	Port VLAN ID	Priority	Ingress filter	GVRP
8				
9				
10				
11				
12				
13				
14				
EX1				
EX2				
EX3				
EX4				

IGMP snooping settings

Switch IGMP Snooping (enabled or disabled)	__ Enabled
	__ Disabled
Querier State	__ Non-Querier
	__ V1–querier
	__ V2–querier
Query Interval (1 to 65,500 seconds)	
Maximum response (1 to 25 seconds)	
Robustness variable (1 to 255)	

Multicast forwarding table entries

Port	MAC address	VID	None	Egress
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
EX1				
EX2				

Port	MAC address	VID	None	Egress
EX3				
EX4				

Port mirroring settings

Source port	Mirroring status (enabled/disabled)	Target port	
		Ingress	Egress
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
EX1			
EX2			
EX3			
EX4			

Spanning tree settings

Status (enabled or disabled)	
Maximum age (6 to 40 seconds)	
Hello time (1 to 10 seconds)	
Forward delay (4 to 30 seconds)	
Priority (0 to 65,535)	

STP port settings

Port	Cost	Priority	Fast STP		STP state	
			E	D	E	D
1						
2						
3						
4						

Port	Cost	Priority	Fast STP		STP state	
			E	D	E	D
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
EX1						
EX2						
EX3						
EX4						

Class of service configuration

Output Priority Method Queue:

__ Enabled

__ Disabled

__ Weighted Round Robin

Class	Weight (0 to 16)	Max latency
High priority		
Med-H priority		
Med-L priority		
Low priority		

802.1p priority mapping

802.1p priority mapping class:

__ Low priority

__ Med-low priority

__ Med-high priority

__ High priority

Priority levels	Low	Med-L	Med-H	High
0				

Priority levels	Low	Med-L	Med-H	High
1				
2				
3				
4				
5				
6				
7				

Diffserv mapping

Diffserv mapping

__ Enabled

__ Disabled

Class

__ Low priority

__ Med-low priority

__ Med-high priority

__ High priority

Code point	Class				Code point	Class			
	Low	M-L	M-H	High		Low	M-L	M-H	High
0					32				
1					33				
2					34				
3					35				
4					36				
5					37				
6					38				
7					39				
8					40				
9					41				
10					42				
11					43				
12					44				
13					45				
14					46				
15					47				
16					48				

Code point	Class				Code point	Class			
	Low	M-L	M-H	High		Low	M-L	M-H	High
17					49				
18					50				
19					51				

Distribution method

Packet type	Src MAC	Dest MAC	Src & Dest MAC	Src IP	Dest IP	Src & Dest IP
Non-IP				N/A	N/A	N/A
IP						

Port trunking

Group ID	Port				Method	
	EX1	EX2	EX3	EX4	Trunk	Disabled

802.3ad link aggregation

Link Aggregation Control Protocol (enabled or disabled): _____
System Priority (LACP switch ID): _____

Port	Priority	Administrator key	Operator key	Mode	
				Enabled	Disabled
EX1					
EX2					
EX3					
EX4					

Blade server configuration planning

Fill out this worksheet for the blade servers in your BladeCenter unit. For information on filling out the worksheet, see "Blade server configuration planning" on page 71 and the *BladeCenter HS20 Installation and User's Guide.*

Bay Num	Blade server name	IDE Controller		Ethernet Controller		Startup (boot) sequence				
		E	D	E	D	IDE drive 1	IDE drive 2	CD- ROM	Diskette	Network
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										

Table 17. Blade server operating systems/applications

Bay Num	Blade server name	Operating system/applications
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Appendix C. Notices

This publication was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

> IBM Director of Licensing
> IBM Corporation
> North Castle Drive
> Armonk, NY 10504-1785
> U.S.A.

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this publication to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product, and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Edition notice

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

Active Memory	Predictive Failure Analysis
Active PCI	PS/2
Active PCI-X	ServeRAID
Alert on LAN	ServerGuide
BladeCenter	ServerProven
C2T Interconnect	TechConnect
Chipkill	Tivoli
EtherJet	Tivoli Enterprise
e-business logo	Update Connector
FlashCopy	Wake on LAN
IBM	XA-32
IntelliStation	XA-64
Light Path Diagnostics	X-Architecture
NetBAY	XceL4
Netfinity	XpandOnDemand
NetView	xSeries
OS/2 WARP	

Lotus, Lotus Notes, SmartSuite, and Domino are trademarks of Lotus Development Corporation and/or IBM Corporation in the United States, other countries, or both.

ActionMedia, LANDesk, MMX, Pentium, and ProShare are trademarks of Intel Corporation in the United States, other countries, or both.

Microsoft, Windows, and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Linux is a registered trademark of Linus Torvalds.

Other company, product, or service names may be trademarks or service marks of others.

Important notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

Maximum memory may require replacement of the standard memory with an optional memory module.

IBM makes no representation or warranties regarding non-IBM products and services that are ServerProven®, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. These products are offered and warranted solely by third parties.

IBM makes no representations or warranties with respect to non-IBM products. Support (if any) for the non-IBM products is provided by the third party, not IBM.

Some software may differ from its retail version (if available), and may not include user manuals or all program functionality.

Electronic emission notices

Federal Communications Commission (FCC) statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Taiwanese Class A warning statement

警告使用者:
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Japanese Voluntary Control Council for Interference (VCCI) statement

　この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に
基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を
引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求
されることがあります。

Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

Index

A

acoustical noise emissions   3
acoustics module   42
airflow   48
auxiliary-device port   11

B

blade server configuration worksheet   94
blade server planning worksheet   74
BladeCenter planning worksheet   76
BladeCenter unit
    components   9
BTU   49

C

cable
    specifications   17
cabling   49
    Ethernet port   32
cabling planning worksheet   79
CD-ROM drive
    specifications   3
Class A electronic emission notice   97
clearances, rack   41
components
    BladeCenter unit   9
    major   17
connector
    input/output   11
    Universal Serial Bus   11
connectors
    Ethernet   11
    Universal Serial Bus   11
cooling   3, 49

D

data transmission rates   17
dimensions   41
DIMMs
    specifications   13
    supported   13
diskette drive
    specifications   3

E

electrical input   3, 13
electronic emission Class A notice   97
environment   3, 13
Ethernet
    cable specifications   17
    configuring settings   32
    port, cabling   32

Ethernet *(continued)*
    standards   17
Ethernet connector   11
Ethernet switch module configuration worksheet   86
Ethernet-link status LED   32

F

FCC Class A notice   97
features   17
    BladeCenter unit   3
    server   1
flash memory   18
floor space   41

G

general requirements   17

H

heat output   3, 49
humidity   48

I

installation times   60
integrated functions   13

K

keyboard port   11

L

LEDs
    Ethernet-link status   32
    front view   10
    rear view   10

M

major components   17
management module configuration worksheet   83
memory
    specifications   13
memory module specifications   13
microprocessor specifications   13

N

noise   42
notes, important   96
notices
    electronic emission   97
    FCC, Class A   97

P

performance requirements   17
physical installation times   60
planning worksheets   73
   8677 BladeCenter   76
   8678 blade server   74
   blade server configuration   94
   cabling   79
   Ethernet switch module configuration   86
   management module configuration   83
   power   81
   rack   78
pointing device port   11
port
   auxiliary-device   11
   keyboard   11
   pointing device   11
   remote management   11
port See connector   11
port specifications   17
power connections   49
   example 1   49
   example 10   59
   example 2   51
   example 3   52
   example 4   53
   example 5   54
   example 6   55
   example 7   56
   example 8   57
   example 9   58
power considerations   45
power cords   99
power distribution units   45
power module
   specifications   3
power planning worksheet   81
power supply
   specifications   3
product
   data   12

R

rack planning worksheet   78
racks   43
remote management port   11

S

size   3
specifications   3
   data transmission rates   17
   network cable   17
   performance requirements   17
   ports   17
   protocols   18
   standards   17
   technical   17
standards   17

status lights   10

T

technical specifications   17
temperature   3, 48
trademarks   96
transmission rates   17

U

United States electronic emission Class A notice   97
United States FCC Class A notice   97
Universal Serial Bus connector   11

V

video controller   3

W

weight   3
weight, BladeCenter unit   41
weight, rack limits   43
worksheets, planning   73
   8677 BladeCenter   76
   8678 blade server   74
   blade server configuration   94
   cabling   79
   Ethernet switch module configuration   86
   management module configuration   83
   power   81
   rack   78

IBM ®

Printed in U.S.A.