



**IBM BladeCenter S**  
Distributed, small office,  
easy to configure



**IBM BladeCenter E**  
Best energy efficiency,  
best density



**IBM BladeCenter T**  
Ruggedized



**IBM BladeCenter H**  
High performance



**IBM BladeCenter HT**  
Ruggedized,  
high performance

# IBM BladeCenter Chassis Product Guide

September 2008

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# Overview

You need to make IT decisions that will drive business success. You face management challenges and technological complexity such as space constraints, power and cooling limitations, heterogeneous environments and I/O connectivity issues. IBM brings together the widest choice of compatible chassis, blade servers, storage and networking offerings and solution providers in the industry to help you build an open and flexible IT environment. And regardless of the size of your business, you want to be up and running 24/7. With built-in redundancy, innovative power and cooling and the latest I/O and management tools, IBM BladeCenter is easy to own—so you can focus on your business demands and stay ahead of the competition.

The **RIGHT** choice, tailored to fit your diverse needs.

- It's flexible and modular. As needs evolve, a one-size-fits-all solution doesn't work.
  - Meet your needs with BladeCenter: everything from a high-performance data center to a small office with limited IT skills—IBM has you covered
  - Get flexibility with 5 compatible chassis and 5 blade types supporting multiple I/O fabrics, all managed from a common point
- It's robust and reliable, providing redundancy throughout and the information you need to keep your business up and running.
  - Provide redundancy for no single point of failure with IBM BladeCenter
  - Preserve application uptime with IBM Predictive Failure Analysis<sup>®</sup> and light path diagnostics
  - Make decisions based on accurate data for quick problem diagnosis with First Failure Data Capture

**OPEN** and innovative, for a flexible business foundation.

- It's comprehensive, providing broad, fast, and reliable networking and storage I/O with BladeCenter Open Fabric.
  - Match your data center needs and the appropriate interconnect using a common management point, and 5 I/O fabrics to choose from
  - Extract the most from your third-party management solutions by utilizing the BladeCenter Open Fabric Manager
- It's collaborative, enabling you to harness the power of the industry to deliver innovation that matters.
  - Get flexibility from a myriad of solutions created by Blade.org members and industry leaders that have downloaded our open specification

**EASY** to deploy, integrate and manage.

- It enables efficient integrated management, which allows you to minimize costs with the tools you need for effective management.
  - Automate OS installation and BIOS updates remotely with IBM Director tools
  - Administer your blades at the chassis or rack level with the Advanced Management Module
  - Plug into your enterprise management software
- It enable deployment simplicity without tradeoffs by speeding the deployment of new hardware in minutes rather than days, using BladeCenter Open Fabric Manager
  - Get significantly faster deployment of servers and I/O than from rack solutions
  - Reduce costly downtime with integrated failover capability
  - Manage from a single point of control via the Advanced Management Module
  - Use with virtually all IBM switches, blades and chassis

**GREEN** today for a better tomorrow.

- It offers control via powerful tools that help you optimize your data center infrastructure so you can be responsive.
  - Understand your power requirements with IBM Power Configurator
  - Monitor, control and virtualize your power with IBM Systems Director Active Energy Manager for x86
  - Reduce data center hot spots with the IBM Rear Door Heat eXchanger
  - Optimize and future-proof your data center with IBM Data Center Energy Efficiency services
- Our eco-friendly servers and services can help you be environmentally responsible.
  - Become more energy efficient with IBM expertise

# BladeCenter Chassis Positioning

## Which BladeCenter Chassis is Right for You?

IBM offers five different BladeCenter chassis built across a consistent architecture. The chassis are targeted to meet your unique requirements, yet all encompass the same commitment to excellence. Remember, BladeCenter blades and switches can be seamlessly moved between chassis. This offers investment protection and incredibly flexible, mix-and-match deployment choices.

### **IBM BladeCenter S**

BladeCenter S is the chassis designed specifically for the mid-market such as small offices, and remote branch locations.. Features include:

- Configurable “business in a box” foundation combines sharable integrated storage with blades and switches
- Comes standard with the BladeCenter Start Now Advisor, which enables easy set up , with “select and click” configurability
- Up to 6 blades, 7U design (convertible to floor-standing configuration using the BladeCenter Office Enablement Kit)
- Up to 12 SAS and/or SATA 3.5-inch HDDs, for an all-in-one chassis containing up to 3.6TB of SAS or 12TB of SATA enterprise-class storage
- Auto sensing 110V or 220V power
- Lowest IT staff requirements
- Lowest total power consumed
- Lowest total heat output



### **IBM BladeCenter E**

BladeCenter E is the core chassis, perfect for mainstream applications, SMBs, data centers and remote sites.

- Up to 14 blades, 7U design
- Highest rack density
- Best energy efficiency per blade
- Best heat efficiency per blade
- Low airflow requirement
- Supports 10Gb Ethernet uplinks and 4Gb Fibre Channel
- Planned availability through 2011



### **IBM BladeCenter H**

BladeCenter H is right for clients looking for next-generation, high-speed I/O—whether InfiniBand , Fibre Channel or 10Gb Ethernet

- Up to 14 blades, 9U design
- Highest available I/O performance
- Greatest I/O flexibility with up to 8 switch bays
- Hardware-based I/O virtualization
- Supports 30mm blades with up to 8 I/O ports
- Supports 10Gb Ethernet and 4X InfiniBand
- Planned availability through 2011



### **IBM BladeCenter T**

BladeCenter T is a NEBS 3-compliant, ruggedized chassis ideal for telecom, military and medical-imaging applications.

- Up to 8 blades, 8U design
- Non-traditional environment support—NEBS 3/ETSI
- Ruggedized chassis
- AC and DC power input
- Planned availability through 2011



### **IBM BladeCenter HT**

BladeCenter HT is a new telecommunications-optimized version of IBM BladeCenter H. It delivers outstanding core network performance and high-speed connectivity.

- Up to 12 blades, 12U design
- Non-traditional environment support—NEBS 3/ETSI (planned)
- Greatest I/O flexibility with up to 8 switch bays
- Supports 30mm blades with up to 8 ports
- Supports 10Gb Ethernet and 4X InfiniBand
- Ruggedized chassis
- AC and DC power input
- Planned availability through 2011



Compare all this flexibility to what HP has to offer:

#### **Customer Need**

#### **IBM Answer**

#### **HP Answer**

Small office or remote location:	BladeCenter S	BladeSystem c-Class 3000
High-efficiency data center:	BladeCenter E	BladeSystem c-Class 7000
Maximum system density:	BladeCenter E	BladeSystem c-Class 7000
Maximum application performance:	BladeCenter H	BladeSystem c-Class 7000
Ruggedized:	BladeCenter T	NA
Telecom NGN:	BladeCenter HT	NA
Back-end database:	System x3850 M2/x3950 M2	BladeSystem c-Class 7000

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# IBM BladeCenter Chassis

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## Product Overview

Today's data center environment is tougher than ever. You are looking to reduce IT cost, complexity, space requirements, power consumption and heat output, while increasing flexibility, utilization and manageability. Moving to innovative **IBM® BladeCenter®** as your IT foundation can help you accomplish all of these goals.

The IBM BladeCenter family tightly integrates servers, storage, networking, I/O and applications, allowing you to build a flexible IT infrastructure that is robust, integrated and virtualized using common building blocks. This modular technology integrates **Intel®** and **AMD®**, as well as **IBM POWER™** or **Cell Broadband Engine™** (Cell/B.E.) processor-based blade servers, supporting many operating systems.

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All BladeCenter chassis offer impressive features and an extreme degree of compatibility with one another. For example, a single **BladeCenter E** or **BladeCenter H** chassis supports up to **14 hot-swappable 30mm-wide blade servers** in only **7U** (BladeCenter E) or **9U** (BladeCenter H) of rack space, up to **8 hot-swappable blades** in the rugged **8U BladeCenter T** chassis, or up to **12** in the **12U BladeCenter HT** high-speed telecommunications chassis. In addition to the blade servers, these chassis also hold up to **4 switches** (BladeCenter E/BladeCenter T), up to **10 switches/bridges** (BladeCenter H), or **8 switches/bridges** (BladeCenter HT) *internally*. The **BladeCenter S**, designed for SMB and mid-market customers, takes integration to a new level, combining up to **12 hot-swap SAS/SATA HDDs** with **6 blade servers** and **4 switches**. Using a BladeCenter E chassis, up to **84 blade servers (168 processors** with multiple cores per processor) can be installed in one **industry-standard 42U** rack.

Not only can this degree of integration save significant data center space (and therefore the cost of floor space and rack hardware) compared to 1U servers, but consolidating switches/bridges and cables reduces complexity and helps lower cabling costs, and it allows clients to manage everything in the solution as one. But the value of BladeCenter extends far beyond high-density data center environments. For small and medium businesses, as well as remote branch offices with significant computing needs, the compact **7U BladeCenter S** houses up to **6 30mm blades**, along with **12 3.5-inch hot-swap SAS or SATA HDDs**, and **4 switches** in one chassis. And the setup wizard; BladeCenter Start Now Advisor makes it extremely easy to get started.

The various BladeCenter chassis are designed to monitor environmental conditions in the chassis and each blade and send alerts to the administrator. Advanced standard features help maintain system availability with increased uptime. These features include **Predictive Failure Analysis™**, **light path diagnostics**, **hot-swap redundant power supplies and blower/fan modules** with **Calibrated Vectored Cooling™**; **IPMI 2.0** support with **highly secure remote power control**; **text-console redirect over LAN**, and an **Advanced Management Module** (upgradeable with a redundant AMM).

If you need a highly manageable, power-efficient, highly compatible family of blade enclosures, BladeCenter is the ideal choice.

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## Selling Features

## Price/Performance

- The **extremely high degree of integration** in the various BladeCenter chassis reduces the need for server components, replacing numerous fans, KVM and Ethernet cables, power supplies, external switches and other components with fewer *shared* hot-swap/redundant components in the BladeCenter chassis themselves. This integration also can greatly **reduce** the amount of **power consumed** and **heat produced**, relative to an equivalent number of 1U servers—or competitive blade systems. This can significantly reduce a data center power bill. The **reduced datacenter footprint** can also save on infrastructure cost.
- **BladeCenter Virtual Fabric** delivers a flexible, open, connected infrastructure to help optimize application performance. BladeCenter supports many different fabrics, including Ethernet, Fibre Channel, InfiniBand, iSCSI, and a new SAS fabric, providing an easy transition to diskless, stateless servers. This helps centralize storage, offering boot capability, which can dramatically reduce the likelihood of a disk outage. Dual SATA-attached solid state drives can greatly improve drive availability.
- **Blade servers communicate directly to switch modules** inside the BladeCenter Virtual Fabric via redundant Ethernet links to help increase the speed and efficiency of data transfers across blade servers and networks. In addition, the midplanes used in all chassis provide **high-speed blade-to-blade** (via high-availability firmware) **and module-to-module communications** internally as well as externally. The midplane used in the BladeCenter H and HT provides **four 10Gb** data channels to each blade, and supports **4X InfiniBand** (HT only) and **10Gb Ethernet** high-speed switch modules.
- IBM Cool Blue technology's web-based **Power Configurator** accurately predicts the power and cooling required for specific configurations, thereby enabling realistic planning of the correct power and cooling infrastructure. The IBM **Systems Director Active Energy Manager for x86** (formerly known as PowerExecutive) tool tracks actual power usage, temperatures and heat emitted, and plots trends over time so you can actively manage power and cooling with real information. Active Energy Manager also will manage through power incidents (e.g., brownouts or supply failures.) to help users avoid outages due to power and cooling issues. IBM's **Rear Door Heat Exchanger** can help address hot spots in the data center. Cool Blue's Active Energy Manager also provides an industry-unique capability to virtualize power (capping) and move it from one server to another, as required. This capability helps maximize server usage within a restricted power envelope.
- The IBM BladeCenter family features the industry's most energy-efficient design. The various BladeCenter chassis use **ultrahigh efficiency power supplies**. Most industry-standard servers use power supplies that are between **65-75% efficient** at converting power from AC wall current to the DC power used inside servers. BladeCenter power modules are up to **91% efficient**. This helps save even more money, as more of the power input you are paying for is used for processing, rather than released into the data center as waste heat.
- BladeCenter also **reduces the number of parts required** to run the system. Sharing fans, systems management, floppy devices and media means fewer parts to buy and maintain, and fewer items that can fail and bring the solution down.

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## Flexibility/Durability

- *Every HS/LS/JS blade server ever released by IBM is supported in BladeCenter H and BladeCenter HT, and most are supported in every BladeCenter chassis ever released, going back to 2002. Every switch module released by IBM is equally compatible. (Ask HP and Dell how far back their compatibility goes.) Future blades and fabric switches are expected to continue to be compatible with previous chassis for the foreseeable future.*
- The optional **Multi-Switch Interconnect Module (MSIM)** installs in a high-speed switch module bay of a BladeCenter H chassis and doubles the number of **Gigabit Ethernet** and **Fibre Channel** connections to every blade in the chassis (up to **8** or **12** ports, depending on the switch).
- A blade server has access to as many as **10 communication switches/bridges** in a **BladeCenter H** or **8** in a **BladeCenter HT** chassis. (Up to **4** switches in a BladeCenter or BladeCenter T chassis.) And the switches can be **Ethernet, InfiniBand, Fibre Channel, Myrinet**, or anything else designed and ServerProven for BladeCenter use. Switches, bridges and interface cards are currently available from such vendors as Brocade, Cisco, Intel<sup>®</sup>, Nortel/Blade Network Technologies, QLogic, Cisco and others, in addition to IBM.
- Nearly **100 vendors** are offering options for the BladeCenter family.

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## Manageability

- IBM **System Director** provides powerful, intelligent solutions management for the BladeCenter family, for rock-solid reliability. System Director exploits the hardware's

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capabilities by “surfacing” pertinent information about your blade server. The easy-to-use **Deployment Wizard** also provides step-by-step installation instructions and offers automated deployment capabilities.

- Each BladeCenter chassis includes an **Advanced Management Module (AMM)**. The AMM boosts administrator productivity and reduces skill level requirements, which can help reduce costs, improve overall productivity and make administration easier. Unlike traditional servers and some competitive blades with a myriad of separate management tools, this management module provides a single point of control for the solution and supports many industry-standard, open protocols. The AMM provides systems management capabilities, including *Web-based out-of-band control; virtual floppy and CD-ROM support; Windows “blue screen” error capture; LDAP and SSL support; and remote redirection of video, text, keyboard and mouse* for the chassis and the components installed in the chassis.
- **IBM Systems Director Active Energy Manager for x86**, an IBM-exclusive, is designed to take advantage of new system power management features, by monitoring *actual* power usage and providing power consumption capping features. More accurate power usage data helps with data center construction planning and the sizing of power and cooling needs, as well as allowing you to use available power more efficiently.
- **IBM System Director** is included for proactive systems management and works with both the blade’s internal BMC and the chassis’ management module. It comes with a portfolio of tools, including *IBM Systems Director Active Energy Manager for x86, Management Processor Assistant, RAID Manager, Update Assistant, and Software Distribution*. In addition, IBM System Director offers extended systems management tools for additional server management and increased availability. When a problem is encountered, IBM System Director can issue administrator alerts via e-mail, pager, and other methods.
- BladeCenter provides real-time hardware event monitoring with **IBM Service Manager**. Service Manager simplifies operations for remote branch users and beginner BladeCenter users by automating notification of service and support so that users will be contacted with resolutions to problems when they occur.

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## Availability and Serviceability

- BladeCenter chassis are designed for operation with **greatly reduced potential for single points of failure**. Most aspects of operation, from blade servers to communication modules, to management modules, to power and blower/fan modules, are **hot-swappable and redundant**. The midplane connections are **redundant** and other features can be made so, when used in pairs.
- **Environmentally tuned blower/fan modules** in the chassis adjust to compensate for changing thermal characteristics. At the lower speeds they draw less power and suffer less wear. Equally important in a crowded data center, temperature-controlled blowers/fans produce less ambient noise in the data center than if they were constantly running at full speed.
- A **standard three-year (parts and labor) limited onsite warranty<sup>1</sup>** affords you peace of mind and greater potential investment protection.

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## BladeCenter Chassis

IBM’s blade architecture offers **five choices** of chassis in which to use various blade servers. Each chassis serves different customer needs. The new **BladeCenter S** is a small, entry-level chassis that offers compatibility and interoperability with the other chassis. The original **BladeCenter E** chassis offers maximum density, great flexibility and a wide variety of expansion options at an entry-level price. The next-generation **BladeCenter H** chassis offers all of BladeCenter’s capabilities, and adds new high-performance features. If you need a **ruggedized** chassis (for example, government/military or telcos), **BladeCenter T** offers special features optimized for those environments. The next-generation **BladeCenter HT** is a high-performance **ruggedized** telecommunications platform. There is a high degree of interchangeability and compatibility of features among the chassis. Any or all of these chassis can be installed in a rack along with other rack-optimized equipment.

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<sup>1</sup> For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.





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**BladeCenter S** provides:

- **A choice of installation methods** — Designed for either **rack** or **deskside** use with the optional **Office Enablement Kit**, it's ideal for offices or remote/branch locations.
  - **Integrated compute blades, SAN storage, and switches in one chassis** — In addition to **six blade servers**, the BladeCenter S also supports **12 shared hot-swap 3.5-inch SAS, SATA, or Nearline SAS HDDs**, and **four** integrated switches (**two** Ethernet, plus **two** Ethernet, Fibre Channel, SAS, or RAID SAS Controllers, which can enable true shared storage).
  - **Six 30mm blade slots** — These **hot-swap** slots are capable of supporting any combination of **6 HC10/HS12/HS20/HS21/HS21 XM** (Intel Xeon), **LS20/LS21/LS22** (AMD Opteron®), and **JS12/JS21/JS22** (IBM PowerPC® 970FX/MP) blade servers, or **3** double-wide (**60mm**) **LS41/LS42** blade servers or a **mixture** of 30mm and 60mm blades. It also supports multiple optional 30mm **Expansion Units** in combination with the blade servers, using the same blade slots. Up to **six** chassis can be installed in an industry-standard **42U** rack, for a total of up to **36** 30mm blade servers and **72** HDDs per rack, plus switches, *with full power redundancy*.
  - **Standard office 110V power or 220V power** — Don't have a data center, but still want to consolidate many servers into a few? No problem. BladeCenter S runs on standard office power (as well as 220V), using an auto-sensing power supply.
  - **Simplified setup and configuration** — BladeCenter S's configurable "business in a box" foundation offers the BladeCenter Start Now Advisor, a wizard-based installation tool on a DVD that is shipped standard with every chassis. You can be up and running in minutes. A user can literally plug the blade servers into the system, plug the system into a power outlet, and launch a management tool that enables easy select-and-click configuration via an "express" install. For businesses operating branch offices—such as retailers or financial institutions—IT administrators at headquarters can easily pre-configure hundreds of blade systems to operate in the same manner and ship them out the door knowing an office employee will be able to simply plug a system in and power it up.
  - **Forward and backward compatibility** — *Most blades, and every switch and passthru module released by IBM for BladeCenter E since 2002, are supported. Many new blades and 1X fabric switches released for IBM BladeCenter E, BladeCenter H, BladeCenter T, or BladeCenter HT are also supported in the BladeCenter S chassis.*
  - **One module bay for hot-swap Advanced Management Module** — The management module provides advanced **systems management and KVM** capabilities for not only the chassis itself, but for all of the blades and other modules installed in the chassis. The management module provides capabilities similar to the **IBM Remote Supervisor Adapter II** used in stand-alone IBM System x™ or IBM eServer™ xSeries® rack and tower servers. The features of the management module can be accessed either **locally** or **remotely** across a network. One module comes standard.
  - **One module bay for hot-swap Serial Passthru Module** — This module provides six RJ45 serial ports (one per blade). The ports are numbered 1 through 6, and correspond to blade slots 1 through six.
  - **Two bays for hot-swap Storage Modules** — Each module supports up to **6 hot-swap SAS, SATA, or Nearline SAS** drives (12 total), for an internal capacity of up to **3.6TB** (using 300GB SAS HDDs) or **12TB** (using 1TB SATA drives). The drives *can* be mixed within a Storage Module. The drives can be shared by one or more blades. If any drives are installed, one or two (for redundancy) **SAS Connectivity Modules or the SAS RAID Controller Modules** must be installed in switch bays 3 and/or 4. (In addition, if you have **BladeCenter Storage and I/O Expansion Unit** blades, which attach to the HS and LS blades, these are supported as well.)
  - **Four module bays for hot-swap communication and I/O switches** — The modules interface with all of the blade servers in the chassis and eliminate the need for external switches or expensive, cumbersome, and error-prone cabling. All connections are done internally via the midplane. All modules, when installed in pairs, offer **load balancing and failover** support. *Integrated* switch modules mean that **no extra "U space"** is required in the rack. The first two bays support Ethernet switches only (one comes standard). The other two bays support Ethernet, Fibre Channel, or SAS switches. Either one or two of a kind is required in Bays 3 and 4. (No mixing and matching between the pair.)
  - **Four module bays for Fan Modules** — Four **hot-swap/redundant** blower modules come standard with the chassis. (Each module contains two fans.) They are capable of providing efficient cooling for all **blades, switches and storage devices**. These modules replace the need for each blade to contain its own fans. The four fan modules are more energy efficient than dozens or hundreds of smaller fans would be, and they offer many fewer points of potential failure.
  - **Four module bays for hot-swap Power Modules** — BladeCenter S ships with two 950W
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/ **1400W high-efficiency hot-swap/redundant** power modules (upgradeable to **four**), capable of handling the power needs of the entire chassis. Many servers use power supplies with an efficiency level of approximately 65-75%. Because BladeCenter S uses power supplies that are at least **90% efficient**, much less power is wasted as heat. Not only is more power available for chassis use, there is less power wasted as excess heat output. Two *additional* power modules must be installed when the second Storage Module is used.

- **Redundant midplane connections** — Each chassis contains a midplane that connects all blades and modules together internally. The midplane provides *two* physical connections to each blade; therefore, a failure of one connector alone cannot bring down the server.
- **A hot-swappable Media Tray** containing a **DVD-RW/CD-RW** drive, **two USB 2.0** port, **two BBU module bays**, and a **light path diagnostic panel**—the media tray is *shared by all the blades* in the server. This eliminates unnecessary parts (and reduces the number of parts than can fail). In the event of a failure of the Media Tray the tray can be swapped for another. While the tray is offline, the servers in the chassis can remotely access the Media Tray in another chassis. The diagnostic LEDs indicate chassis status.

It is extremely important to **include all infrastructure costs** when comparing a BladeCenter S solution to a competitor's offering, not just the cost of the chassis and the blades. The high density and level of integration of the BladeCenter chassis greatly reduces the cost of the overall solution. For example, because up to **six** chassis will fit in a rack, this means that **up to 24 switches can be installed per rack** *without* having to reserve any "U" space for the switches, unlike the competition. (And the integrated switches may be less expensive than external, self-powered switches.) Plus, **the number of power distribution units (PDUs) needed per rack may be reduced**, because there are fewer discrete devices to have to plug in. In addition, because all the blades are connected to all the switches inside the chassis, **there is no need for external Ethernet or other communication cables to connect the blades and switches**. (Only the few cables needed to connect the switches to the external world are required.) This not only saves the cost of numerous cables per rack, but also the clutter and bother of routing that many cables. An added bonus is potentially **much freer airflow** behind the rack, due to fewer cables.

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**BladeCenter E** is a **7U** chassis that provides:

- **Reduced single points of failure** — Many major components (either standard or optionally) are **hot-swappable** and/or **redundant**. Servers and modules can be configured for **automatic failover** to backups.
  - **Forward and backward compatibility** — *Most blades, and every switch and passthru module released by IBM for BladeCenter E since 2002, are supported. Many new blades and fabric switches released for IBM BladeCenter H, BladeCenter T, or BladeCenter HT are also supported in the BladeCenter E chassis.*
  - **Fourteen 30mm blade slots** — These **hot-swap** slots are capable of supporting almost any combination of **14 HC10/HS12/HS20/HS21/HS21 XM, LS20/LS21, and JS12/JS20/JS21, or QS20** (Cell/B.E) blade servers, or **7 double-wide (60mm) HS40 or LS41** blade servers or a **mixture** of 30mm and 60mm blades. (**Note:** The QS20 blade cannot be mixed with other blades.) It also supports multiple optional 30mm **Expansion Units** in combination with the blade servers, using the same blade slots. Up to **six** chassis can be installed in an industry-standard **42U** rack, for a total of up to **84** 30mm blade servers per rack, *with full power redundancy*.
  - **Four module bays for communication and I/O switches** — The modules interface with all of the blade servers in the chassis and eliminate the need for external switches or expensive, cumbersome, and error-prone cabling. All connections are done internally via the midplane. **Two** module slots are reserved for **hot-swap/redundant** Gigabit Ethernet switch modules. The other **two** bays support additional Gigabit Ethernet modules, or **Fibre Channel, InfiniBand**, and other switch modules or pass-through devices. All modules, when installed in pairs, offer **load balancing** and **failover** support. *Integrated* switch modules mean that **no extra "U space"** is required in the rack.
  - **Two module bays for management modules** (IBM BladeCenter Management Module or the newer Advanced Management Module, depending on the model of the BladeCenter chassis) — The management module provides advanced **systems management and KVM** capabilities for not only the chassis itself, but for all of the blades and other modules installed in the chassis. The management module provides capabilities similar to the IBM **Remote Supervisor Adapter II** used in stand-alone IBM System x™ or IBM eServer™ xSeries® rack and tower servers. The features of the management module can be accessed either **locally** or **remotely** across a network. One module comes standard. A second management module can be added for **hot-swap/redundancy** and **failover**.
  - **Two module bays for Blower Modules** — Two **hot-swap/redundant** blower modules
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come standard with the chassis. They are capable of providing efficient cooling for up to **14 blades**. These modules replace the need for each blade to contain its own fans. The two blowers are more energy efficient than dozens or hundreds of smaller fans would be, and they offer many fewer points of potential failure.

- **Four module bays for Power Modules** — BladeCenter E ships with two **2000W high-efficiency hot-swap/redundant** power modules (upgradeable to **four**), capable of handling the power needs of the entire chassis. Many servers use power supplies with an efficiency level of approximately 65-75%. Because BladeCenter E uses power supplies that are at least **90% efficient**, much less power is wasted as heat. Not only is more power available for chassis use, there is less power wasted as excess heat output. Two *additional* power modules must be installed when more than **6** blades are used in a chassis.
- **Redundant midplane connections** — Each chassis contains a midplane that connects all blades and modules together internally. The midplane provides *two* physical connections to each blade; therefore, a failure of one connector alone cannot bring down the server.
- **A hot-swappable Media Tray** containing a **DVD-ROM drive, a floppy drive, one USB 1.1 port, and a light path diagnostic panel** — The media tray is *shared by all the blades* in the server. This eliminates unnecessary parts (and reduces the number of parts that can fail). In the event of a failure of the Media Tray the tray can be swapped for another. While the tray is offline, the servers in the chassis can remotely access the Media Tray in another chassis. The diagnostic panel contains LEDs that indicate chassis status.
- **IBM Airborne Contaminant Filter**, which helps protect the blade server's vital components in non-data center environments.

It is extremely important to **include all infrastructure costs** when comparing a BladeCenter E solution to a competitor's offering, not just the cost of the chassis and the blades. The high density and level of integration of the BladeCenter chassis greatly reduces the cost of the overall solution. For example, because up to **six** chassis will fit in a rack, this means that **up to 84 blade servers/processors can be installed**. (Some competitive blade offerings would require a second rack for this many blades.) Also, because up to **four** Ethernet, Myrinet, Fibre Channel, InfiniBand or other switches can be installed *per chassis*, **up to 24 switches can be installed per rack** *without* having to reserve any "U" space for the switches, unlike the competition. (And the integrated switches may be less expensive than external, self-powered switches.) Plus, **the number of power distribution units (PDUs) needed per rack may be reduced**, because there are fewer discrete devices to have to plug in. In addition, because all the blades are connected to all the switches inside the chassis, **there is no need for external Ethernet or other communication cables to connect the blades and switches**. (Only the few cables needed to connect the switches to the external world are required.) This not only saves the cost of numerous cables per rack, but also the clutter and bother of routing that many cables. An added bonus is potentially **much freer airflow** behind the rack, due to fewer cables.

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**BladeCenter H** is a high-performance **9U** chassis, designed for compute-intensive environments, such as Earth/Life Sciences, commercial analytics and next-generation network (NGN) applications. Think of it as BladeCenter E's big brother, with more speed and more features. It provides:

- **Reduced single points of failure** — Many major components (either standard or optionally) are **hot-swappable** and/or **redundant**. Servers and modules can be configured for **automatic failover** to backups.
- **Forward and backward compatibility** — *Every blade, switch, and passthru module released by IBM for the original BladeCenter E chassis since 2002 is supported in the BladeCenter H chassis.*
- **High-speed redundant midplane connections** — Based on **4X InfiniBand**, the midplane supports up to **40Gb** bandwidth and provides **four 10Gb** data channels to each blade. By giving each blade *two physical connections* to the midplane that connects all blades and modules together internally, a failure of one connector alone cannot bring down the server.
- **Fourteen 30mm blade slots** — These **hot-swap** slots are capable of supporting any combination of **14 HC10/HS12/HS20/HS21/HS21 XM, LS20/LS21, JS20/JS21/JS22, and QS21/QS22** (Cell/B.E), or **7 double-wide (60mm) HS40 or LS41** blade servers, or a **mixture** of 30mm and 60mm blades. It also supports multiple optional 30mm **Expansion Units** in combination with the blade servers, using the same blade slots. Up to **four** chassis can be installed in an industry-standard **42U** rack, for a total of up to **56** 30mm blade servers per rack.
- **Up to ten module bays for communication and I/O switches or bridges** — The



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modules interface with all of the blade servers in the chassis and alleviate the need for external switches or expensive, cumbersome, and error-prone cabling. All connections are done internally via the midplane. **Two** module slots are reserved for **hot-swap/redundant Gigabit Ethernet switch** modules. **Two** slots support either **high-speed bridge modules** or legacy Gigabit Ethernet, **Myrinet, Fibre Channel, InfiniBand** and other **switch** modules. **Two** slots are dedicated for **bridge** modules. **Four** additional slots are dedicated for **hot-swap/redundant high-speed switch** modules. All modules, when in stalled in pairs, offer **load balancing** and **failover** support.

- **Integrated switch and bridge modules** mean that **no additional rack “U” space** is required.
- **Two module bays for Advanced Management Modules** — The management modules provide advanced **systems management and KVM** capabilities for not only the chassis itself, but for all of the blades and other modules installed in the chassis. The Advanced Management Module provides capabilities similar to the **IBM Remote Supervisor Adapter II SlimLine** used in stand-alone System x rack and tower servers. Features include concurrent KVM (cKVM), an external Serial over LAN connection, industry-standard management interfaces (SMASH/CLP/CIM/HPI), USB virtualization, network failover and backward compatibility with the original Management Module, among others. The features of the module can be accessed either **locally** or **remotely** across a network. One module comes standard. A second module can be added for **hot-swap/redundancy** and **failover**. The module uses **USB** ports for keyboard and mouse.
- **Two module bays for Blower Modules** — Two **hot-swap/redundant** blower modules come standard with the chassis. They are capable of providing efficient cooling for up to **14 blades**. These modules replace the need for each blade and switch to contain its own fans. The blowers are more energy efficient than dozens or hundreds of smaller fans would be, and they offer many fewer points of potential failure. BladeCenter H also includes up to four additional hot-swap/redundant fan packs to cool the power supplies and high-speed switch modules.
- **Four bays for Power Modules** — BladeCenter H ships with **two 2900W high-efficiency hot-swap/redundant** power modules (upgradeable to **four**), capable of handling the power needs of the entire chassis, including future higher-wattage processors. Each power module includes a customer-replaceable hot-swap/redundant fan pack (3 fans) for additional cooling capability.
- A **hot-swappable Media Tray** containing an optional **DVD/CD read only or CVD/CD multi-burner** drive, **two USB 2.0** ports, and a **light path diagnostic panel** — The media tray is *shared by all the blades* in the server. This reduces unnecessary parts (and reduces the number of parts that can fail). In the event of a failure of the Media Tray the tray can be swapped for another. While the tray is offline, the servers in the chassis can remotely access the Media Tray in another chassis. The light path diagnostic panel contains LEDs that indicate chassis status.
- **Multi-Switch Interconnect Module (MSIM)** — When installed in a **BladeCenter H** high-speed switch bay, the optional IBM Multi-Switch Interconnect Module (MSIM) doubles the number of ports available to any blade server in the chassis. Depending on the switch, this can mean up to 8 or 12 Gigabit Ethernet or Fibre Channel ports per blade.
- A **serial breakout port with optional cable** — This provides a direct serial connection to each blade server installed in the chassis, as an alternative to Serial over LAN. (**Note:** This applies only to newer blades that include this capability.)
- It is extremely important to **include all infrastructure costs** when comparing a BladeCenter H solution to a competitor's offering, not just the cost of the chassis and the blades. The high density and level of integration of the BladeCenter H chassis can greatly reduce the cost of the overall solution. For example, because up to **four** chassis will fit in a rack, this means that **up to 56 blade servers can be installed**. Also, because up to **10 (1Gb or 10Gb)** Ethernet, Myrinet, Fibre Channel, InfiniBand or other bridges and switches can be installed *per chassis*, **up to 40 switches and bridges can be installed per rack** *without* having to reserve any “U” space for the switches, unlike the competition. (And the integrated switches may be less expensive than external, self-powered switches.) Plus, **the number of power distribution units (PDUs) needed per rack may be reduced**, because there are fewer discrete devices to have to plug in. In addition, because all the blades are connected to all the switches inside the chassis, **there is no need for external Ethernet or other communication cables to connect the blades, bridges and switches**. (Only the few cables needed to connect the switches to the external world are required.) This not only saves the cost of numerous cables per rack, but also the clutter and bother of routing that many cables. An added bonus is potentially **much freer airflow** behind the rack, due to fewer cables.

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**BladeCenter T** is a carrier grade, rugged **8U (20-inch deep)** chassis designed for challenging central office and networking environments. It provides:

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- **NEBS Level 3/ETSI-tested** — Designed for the Network Equipment Provider (NEP)/Service Provider (SP) environment. Also ideal for government/military, aerospace, industrial automation/robotics, medical imaging and finance. Certified testing by Underwriters Laboratories of the BladeCenter HT chassis is in progress; when complete, it will be covered under a UL-certified NEBS Level 3/ETSI test report.
- **Support for Carrier-Grade Linux** — Several distributions are supported, include SUSE and Red Hat.
- **Reduced single points of failure** — Many major components (either standard or optionally) are **hot-swappable** and/or **redundant**. Servers and modules can be configured for **automatic failover** to backups.
- **Backward compatibility** — *Most blades, and every switch and passthru module released by IBM for the original BladeCenter chassis since 2002, are supported in the BladeCenter T chassis.*
- **Eight 30mm blade slots** — These **hot-swap** slots are capable of supporting almost any combination of **8 Low Voltage HC10/HS20/HS21/HS21 XM** blade servers, or **7** standard-voltage **HS20/HS21/HS21 XM, LS20/LS21, and JS12/JS20/JS21** blade servers, or **4** double-wide (**60mm**) **LS41** processor-based blade servers, or a **mixture** of 30mm and 60mm blades. It also supports optional 30mm **Expansion Units** in combination with the blade servers, using the same blade slots. (**Note:** The HC10 blade is supported in a non-NEBS environment only.) Up to **five** chassis can be installed in an industry-standard **42U** rack (or a telco rack), for a total of up to **40** 30mm blade servers per rack.
- **Four module bays for communication and I/O switches** — The modules interface with all of the blade servers in the chassis and eliminate the need for external switches or expensive, cumbersome cabling. All connections are done internally via the midplane. **Two** bays are reserved for **hot-swap/redundant** Gigabit Ethernet switch modules. The other **two** bays support additional Gigabit Ethernet modules, or **Fibre Channel, InfiniBand** and other switch modules. All modules, when installed in pairs, offer **load balancing** and **failover** support. *Integrated* switch modules mean that **no extra “U space”** is required in the rack.
- **Two module bays for Management Modules** — The management module provides advanced **systems management and KVM** capabilities for not only the chassis itself, but for all of the blades and other modules installed in the chassis. The Management Module provides capabilities similar to the IBM **Remote Supervisor Adapter II SlimLine** used in stand-alone System x rack and tower servers. The features of the Management Module can be accessed either **locally** or **remotely** across a network. One module comes standard. A second Management Module can be added for **hot-swap/redundancy** and **failover**. The modules include a light path diagnostics panel containing LEDs that indicate chassis status.
- **Four module bays for Blower Modules** — **All four hot-swap/redundant** blower modules come standard with the chassis. These modules replace the need for each blade to contain its own fans. The blowers are more energy efficient than dozens or hundreds of smaller fans would be, and they offer many fewer points of potential failure.
- **Four module bays for Power Modules** — BladeCenter T ships with **two 1300W high-efficiency hot-swap/redundant DC or AC** (model-specific) power modules (upgradeable to **four**), capable of handling the power needs of up to **four** blade servers. Two *additional* power modules can be installed when more than four blades are needed.
- **Redundant midplane connections** — Each chassis contains a midplane that connects all blades and modules together internally. The midplane provides *two* physical connections to each blade; therefore, a failure of one connector alone cannot bring down the server.
- **A Media Tray** containing a **CD-ROM** drive, **two USB 1.1** ports, and a **light path diagnostic panel** — The media tray is *shared by all the blades* in the server. This eliminates unnecessary parts (and reduces the number of parts that can fail). An external **floppy drive** is optional.
- **Long-life availability** — The BladeCenter T chassis offers an extended product lifecycle (**3** years in production from date of General Availability, plus another **5** years of support). This allows telecom Network Equipment Manufacturers (NEPs) and, Service Providers (SPs) to standardize on a configuration for longer than traditional enterprise platforms. Product availability for periods longer than 3 years will be handled on an individual basis.
- It is extremely important to **include all infrastructure costs** when comparing a BladeCenter T solution to a competitor's offering, not just the cost of the chassis and the blades. The high density and level of integration of the BladeCenter T chassis can greatly reduce the cost of the overall solution. For example, because up to **five** chassis will fit in a rack, this means that **up to 40 blade servers can be installed**. Also, because up to **four** Ethernet, Fibre Channel or other supported switches can be installed *per chassis*, **up to 20 switches can be installed per rack** *without* having to reserve any “U” space for the

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switches. (And the integrated switches may be less expensive than external, self-powered switches.) Plus, **the number of power distribution units (PDUs) needed per rack may be lessened**, because there are fewer discrete devices to have to plug in. In addition, because all the blades are connected to all the switches inside the chassis, **there is no need for external Ethernet or other communication cables to connect the blades and switches**. (Only the few cables needed to connect the switches to the external world are required.) This not only can save the cost of numerous cables per rack, but also the clutter and bother of routing that many cables. An added bonus is potentially **much freer airflow** behind the rack, due to fewer cables.

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**BladeCenter HT** is a carrier grade, rugged **12U** chassis designed for challenging central office and networking environments. It provides:

- **NEBS Level 3/ETSI-tested** — Designed for the Network Equipment Provider (NEP)/Service Provider (SP) environment. Also ideal for government/military, aerospace, industrial automation/robotics, medical imaging and finance. Certified testing by Underwriters Laboratories of the BladeCenter HT chassis is in progress; when complete, it will be covered under a UL-certified NEBS Level 3/ETSI test report.
- **Support for Carrier-Grade Linux** — Several distributions are supported, include SUSE and Red Hat.
- **Reduced single points of failure** — Many major components (either standard or optionally) are **hot-swappable** and/or **redundant**. Servers and modules can be configured for **automatic failover** to backups.
- **Backward compatibility** — Every blade, switch and passthru module released by IBM for the original BladeCenter chassis since 2002, is supported in the BladeCenter HT chassis.
- **High-speed redundant Midplane connections** — Based on **4X InfiniBand**, the midplane supports up to **40Gb** bandwidth and provides **four 10Gb** data channels to each blade. By giving each blade *two physical connections* to the midplane that connects all blades and modules together internally, a failure of one connector alone cannot bring down the server.
- **Twelve 30mm blade slots** — These **hot-swap** slots are capable of supporting any combination of **12 HC10/HS20/HS21/HS21 XM, LS20/LS21, JS20/JS21, and QS21/QS22** or **10 JS22** blade servers, or **6 double-wide (60mm) LS41** blade servers, or a **mixture** of 30mm and 60mm blades. It also supports multiple optional 30mm **Expansion Units** in combination with the blade servers, using the same blade slots. Up to **three** chassis can be installed in an industry-standard **42U** rack, for a total of up to **36** 30mm blade servers per rack.
- **Up to eight module bays for communication and I/O switches or bridges** — The modules interface with all of the blade servers in the chassis and alleviate the need for external switches or expensive, cumbersome cabling. All connections are done internally via the midplane. **Two** module slots are reserved for **hot-swap/redundant** Gigabit Ethernet switch modules. **Two** slots support either **high-speed bridge modules** or **legacy Gigabit Ethernet, Myrinet, Fibre Channel, InfiniBand** and other switch modules. **Four** additional slots are dedicated for **hot-swap/redundant** high-speed **switch** modules. All modules, when installed in pairs, offer **load balancing** and **failover** support.
- *Integrated* switch and bridge modules mean that no additional rack "U" space is required.
- **Two module bays for Advanced Management Modules** — The management modules provide advanced **systems management and KVM** capabilities for not only the chassis itself, but for all of the blades and other modules installed in the chassis. The Advanced Management Module provides capabilities similar to the IBM **Remote Supervisor Adapter II SlimLine** used in stand-alone System x rack and tower servers. Features include concurrent KVM (cKVM), an external Serial over LAN connection, industry-standard management interfaces (SMASH/CLP/CIM/HPI), USB virtualization, network failover and backward compatibility with the original Management Module, among others. The features of the module can be accessed either **locally** or **remotely** across a network. One module comes standard. A second module can be added for **hot-swap/redundancy** and **failover**. The module uses **USB** ports for keyboard and mouse.
- **Four bays for Fan Modules** — **All four hot-swap/redundant** fan modules come standard with the chassis. These modules replace the need for each blade to contain its own fans. The high-availability modules are more energy efficient than dozens or hundreds of smaller fans would be, and there are many fewer points of potential failure.
- **Four bays for Power Modules** — BladeCenter HT ships with **two high-efficiency hot-swap/redundant DC or AC** (model-specific) power modules (upgradeable to **four**), capable of handling the power needs of up to **six** blade servers. *Two additional* power modules are required when *more than 6* blades or high-speed switches are installed.



- **Two hot-swappable Media Trays** each contain **two external USB 2.0** ports, a **light path diagnostic panel**, and support a **1GB/4GB compact flash (CF) option** — The media trays are *shared by all the blades* in the server. This reduces unnecessary parts (and reduces the number of parts that can fail). In the event of a failure of the Media Tray the tray can be swapped for another. While the tray is offline, the servers in the chassis can remotely access the Media Tray in another chassis. The diagnostic panel contains LEDs that indicate chassis status. One media tray comes standard (without compact flash); an optional second one provides redundancy. The CF option can act as a boot device, eliminating the need for HDDs in the blades.
- **Redundant midplane connections** — Each chassis contains a midplane that connects all blades and modules together internally. The midplane provides *two* physical connections to each blade; therefore, a failure of one connector alone cannot bring down the server.
- **Long-life availability** — The BladeCenter HT chassis offers an extended product lifecycle (3 years in production from date of General Availability, plus another 5 years of support). This allows telecom Network Equipment Manufacturers (NEPs) and, Service Providers (SPs) to standardize on a configuration for longer than traditional enterprise platforms. Product availability for periods longer than 3 years will be handled on an individual basis.
- It is extremely important to **include all infrastructure costs** when comparing a BladeCenter HT solution to a competitor's offering, not just the cost of the chassis and the blades. The high density and level of integration of the BladeCenter HT chassis can greatly reduce the cost of the overall solution. For example, because up to **8 (1Gb and 10Gb) Ethernet, Myrinet, Fibre Channel, InfiniBand or other bridges and switches** can be installed *per chassis*, **up to 24 switches and bridges can be installed per rack** *without* having to reserve any "U" space for the switches, unlike the competition. (And the integrated switches may be less expensive than external, self-powered switches.) Plus, **the number of power distribution units (PDUs) needed per rack may be lessened**, because there are fewer discrete devices to have to plug in. In addition, because all the blades are connected to all the switches inside the chassis, **there is no need for external Ethernet or other communication cables to connect the blades, bridges and switches**. (Only the few cables needed to connect the switches to the external world are required.) This not only saves the cost of numerous cables per rack, but also the clutter and bother of routing that many cables. An added bonus is potentially **much freer airflow** behind the rack, due to fewer cables.

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## Key Features

### Management Modules

Each BladeCenter chassis includes an **Advanced Management Module (AMM)** to provide a high level of systems management capabilities that are well-suited to blade environments. The AMM boosts administrator productivity and reduces skill level requirements, which can help reduce costs, improve overall productivity and make administration easier. Unlike traditional servers and some competitive blades with a myriad of separate management tools, this management module provides a single point of control for the solution and supports many industry-standard, open protocols.

The AMM, in combination with the blade server's Baseboard Management Controller (**BMC**), provides industry-standard **Intelligent Platform Management Interface (IPMI) 2.0**-compliant systems management. It provides a number of important system functions, including:

- Monitoring of system and battery voltage, system temperature, fans, power supplies, processor and DIMM status
  - Fan speed control
  - Product ID and Family ID detection
  - Highly secure remote power on/off
  - System reset control
  - NMI/SMI detection and generation
  - System diagnostic LED control (power, HDD, activity, alerts, heartbeat)
  - IPMI over LAN
  - Serial Over LAN
  - Proxy server support
  - LAN messaging and alerting
  - Text console redirection over LAN
  - VLAN support
  - Enhanced authentication and encryption algorithms (RMCP+, SHA-1, AES)
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- Local update of BMC firmware
- Firmware firewall
- Support for IPMI v2.0 compliant management software (e.g., xCAT)
- Other mandatory and optional IPMI BMC functions

Other systems management features offered for the combination of blade server and chassis include:

- Predictive Failure Analysis for system processors, memory and HDDs, as well as chassis switch modules, blower/fan modules and power modules
- Web-based out-of-band control
- Windows “blue screen” capture
- Remote virtual media
- High-speed remote redirection of PCI video, keyboard and mouse
- SSL (Secure Socket Layer) and LDAP (Lightweight Directory Access Protocol) support

**Predictive Failure Analysis (PFA)** enables the MM/AMM and the server’s Baseboard Management Controller (BMC) to detect impending failure of supported components (processors; memory; expansion cards; switch, blower/fan and power supplies; and hard disk drives) before actual failure, and alert the administrator through IBM Director. This gives you the ability to replace the failing component *before* it fails, resulting in increased uptime.

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## Power Modules

The various BladeCenter chassis require only **two** to **four** high-efficiency power supply modules to provide redundant power for every device in the chassis. This means fewer parts to fail and less power consumed than if each blade server had its own power supplies. The power modules are **hot-swap/redundant**, so you don’t have to shut down the BladeCenter chassis to replace a power supply.

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## Blower/Fan Modules

Instead of having hundreds of tiny fans per rack—using power, subject to failure, and creating ambient noise—BladeCenter requires only **two** (BladeCenter/BladeCenter H) or **four** (BladeCenter S, BladeCenter T or BladeCenter HT) **hot-swap/redundant fan** (BladeCenter S or HT) or **blower** (other chassis) **modules** to cool all the blades and other devices in the chassis. In normal operation, fan modules share the cooling in the BladeCenter system. If one fan module fails, the others handle the entire load. You can replace a fan module without shutting down the BladeCenter system. These modules draw only **60W** between them (**100W** in the BladeCenter HT chassis). By contrast, some competing blade designs require *dozens* of *non-hot-swappable* fans per chassis, consuming *hundreds* of watts of power and generating lots of noise. Fewer points of failure and less power consumed can mean greater uptime and lower costs.

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## Key Options

### IBM options for BladeCenter chassis let you take your data center to a higher level

You can rely on BladeCenter options to supply a comprehensive solution for your business needs. Options help create an optimized system to meet your data protection, storage and availability needs. Every IBM option is designed and tested for peak performance and flexibility, helping to maximize your return on investment. The combination of BladeCenter chassis, blade servers and options lets you keep your fingers on the pulse of your e-business.

**Communication Modules** — The various BladeCenter chassis support integrated communication and I/O switches and/or bridges for Gigabit Ethernet, Myricom, Fibre Channel, InfiniBand, iSCSI, and others. Expansion adapters for individual blade servers are available to interface with these modules.

**Rear Door Heat eXchanger** — The unit attaches to the back of an IBM S2 42U Enterprise Rack. It is capable of removing up to 50,000 BTUs (14KVa) from the data center using water lines under the raised floor. The door swings open for servicing.

**Redundant features** — Optional power supply modules, blower/fan modules, management modules, switches and bridges provide redundancy for the various BladeCenter chassis.

**External Storage** — Clients deploying blades are building enterprise infrastructures and/or virtual infrastructures that require end-to-end reliability. Moving to external, shared RAID storage can help increase your data and application availability and make management easier. IBM delivers a wide range of easy-to-install, external storage products to meet your demanding business needs:



- **Network attached storage (NAS)** — Provides a large capacity, highly available and secure environment for storing mission-critical data. The System Storage™ N series attaches to IBM BladeCenter using integrated Ethernet switch modules.
- **Storage area network (SAN)** — Offers iSCSI and Fibre Channel SANs for high-performance, block-level storage solutions. With IBM System Storage DS3000, DS4000, DS6000 and DS8000, IBM can help you create an easy-to-deploy storage solution for your SMB or enterprise needs. The DS portfolio attaches to IBM BladeCenter using integrated Fibre Channel switch modules.
- **iSCSI SAN** — Provides a cost-effective alternative to a Fibre Channel SAN by leveraging an existing Ethernet network. IBM offers a choice of 1Gb hardware or 1Gb and 10Gb software initiators that support iSCSI boot. These SAN offerings are ideally suited for IBM System Storage N series disk systems.
- **Fibre Channel SAN** — Includes integrated storage switches from vendors such as Brocade, Cisco and QLogic, and support for industry-leading host bus adapters from QLogic and Emulex. These Fibre Channel SAN options are ideally suited for IBM System Storage disk systems.

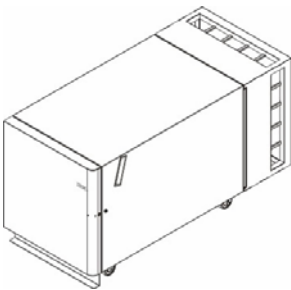
For clients seeking local hard disk drives, IBM offers integrated storage as well as hot-swap options:

- **Internal Solid State Drives** — For OS boot images or primarily random-read-heavy storage (such as Web serving). Provides up to *three times* the availability of traditional spinning disk drives. (Available in HS12, HS21, HS21 XM, LS21, and LS41 blade servers.)
- **Internal SAS drives** — For I/O-intensive workloads.
- **Internal USB Flash** — For OS/boot images.
- **Hot-swap SAS** — For RAID-5 and additional I/O with the BladeCenter Storage and I/O Expansion Unit blade.
- **Hot-swap SATA** — For price/performance-optimized workloads. Available on BladeCenter S.

Additionally, external LAN-attached tape storage is available.

**Office Enablement Kit** — The Office Enablement Kit is an **11U-high rack cabinet** designed to enable the use of the BladeCenter S chassis in a retail or office environment. The rear door of the Office Enablement Kit is an acoustical module that helps to ensure that the BladeCenter chassis is **quiet enough for office environments** while providing easy access to chassis components. It comes with **front and rear locking doors** and lockable wheels so it can be moved where it is needed. The Office Enablement Kit includes 4U of additional space besides the BladeCenter S chassis to leave room for storage, KVM, and future growth.

**Dust Filter** — Specially designed filter to protect your hardware from the airborne particles found in the retail and office environment.



## Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. From the start, IBM programs make it easier for you to plan for, configure and purchase BladeCenter servers, get them running and keep them running long-term. These features include IBM Express Portfolio, IBM ServerProven®, the IBM Standalone Solutions Configuration Tool, IBM Electronic Service Agent™, Product Customization Services and extensive technical support offerings.



The IBM **ServerProven** program provides the confidence that specific options and operating systems have been tested on the blade servers and chassis and are officially supported to work together. It is updated frequently to keep the latest compatibility information at your fingertips.

The IBM **Standalone Solutions Configuration Tool (SSCT)** is a downloadable tool that simplifies the often complex chore of configuring a full rack of servers (including blade servers) and confirming that you have all the cables, power distribution units, KVM (keyboard, video and mouse) switch boxes and other components you need, as well as the proper airflow clearances, electrical circuits and other environmental conditions.

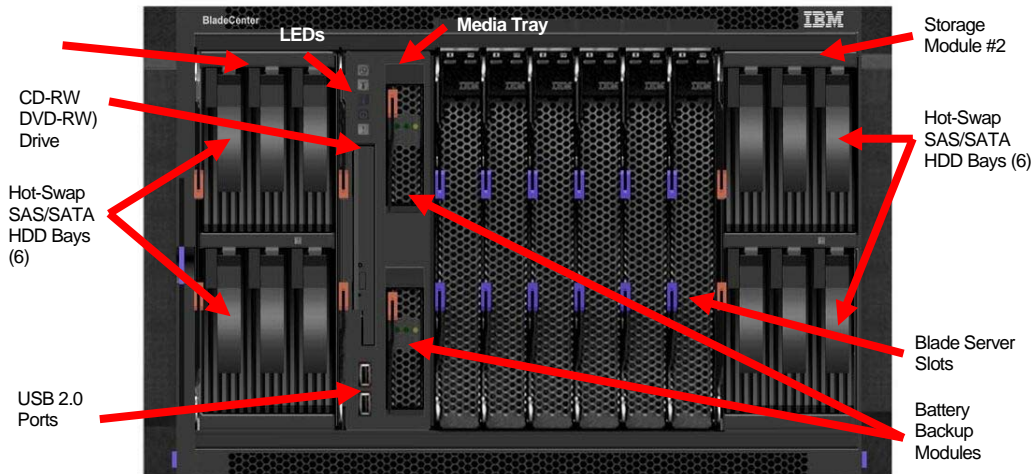
IBM **Electronic Service Agent™** is an innovative “call home” feature that allows System x and BladeCenter servers to automatically report hardware problems to IBM support, which can even dispatch onsite service if necessary to those customers entitled to onsite support under the terms of their warranty or an IBM Maintenance Agreement. Electronic Service Agent resides on a server and provides electronic support and problem management capabilities through a highly secure electronic dialogue between your systems and IBM. It monitors networked servers for hardware errors and it can perform hardware and software inventories and report inventory changes to IBM. All information sent to IBM is stored in a highly secure database and used for improved problem determination.

Additional services include hardware warranty upgrades and factory-installed **Product Customization Services (PCS)**, such as asset tagging, hardware integration, software imaging and operating systems personalization.

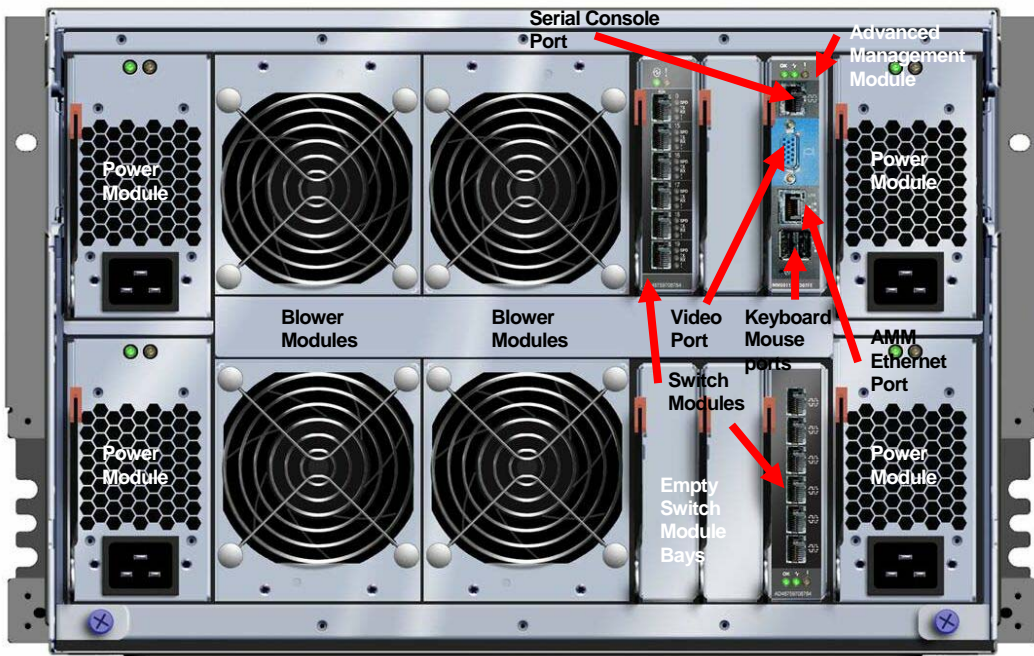
IBM offers extensive **technical support** by phone and via the Web. Support options include links to forums/newsgroups, problem submission, online shopping support, service offerings, device drivers for all IBM product lines, software downloads and even upcoming technical seminar worldwide schedules and registration. Also available are remote installation, configuration and usage support for both System x and BladeCenter hardware and software, as well as onsite custom services to provide the level of expertise you require.

## BladeCenter S Chassis Images

### Front View



### Rear View



## BladeCenter S Chassis Specifications

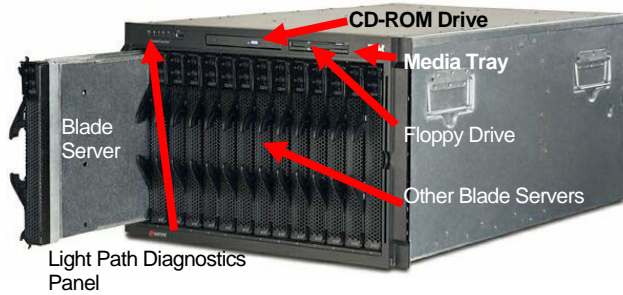
Machine type	8886-1Ex/Y, 1Mx/1MY, AC1	
Rack form factor	7U	
# of DVD/CD drives standard	1 DVD-RW/CD-RW (in Media Tray)	
# of diskette drives standard	None (USB-attached)	
# of internal (chassis-based) H/S SAS HDDs supported	12 (3.5-inch)	
# of Media Tray module bays	2	
Internal tape drives supported	None (SAN-attached)	
Internal hot-swap disk drive support	12 hot-swap SAS/SATA/Nearline SAS (mix-and-match)	
Internal disk storage capacity	3.6TB (using 12 300GB SAS drives)	12TB (using 12 1TB SATA drives)
External disk drive support	NAS/SAN	
# of video ports	1 (on Advanced Management Module)	
# of blade slots / orientation	6 x 30mm or 3 x 60mm (or combinations thereof) / vertical	
# of switch module bays	4 hot-swap/redundant	
Switch modules standard	None	
Fabric bandwidth	1Gbps Ethernet / 3Gbps SAS / 4Gbps Fibre Channel	
# of management modules (std / max)	1 / 1	
Systems management controller	Advanced Management Module	
# of RS485 ports	None	
# of serial breakout ports	None standard (6 using optional Serial Passthru Module)	
# of parallel ports	None	
# of mouse ports	None (USB-attached)	
# of keyboard ports	None (USB-attached)	
# of USB ports	4 (2 in Media Tray, front, 2 in Advanced Management Module, rear)	
Light path diagnostic panel	Yes (on Media Tray)	
Predictive Failure Analysis support	Blades, fan modules	
Power supply size standard	950W/1450W AC (110V/220V)	
Input voltage	110V / 220V autoswitching	
# of power supplies standard / maximum	2 / 4 hot-swap/redundant (110V = N+1, 220V = N+N)	
Heat output	1365 BTUs/hr (400W) min.; 11,942 BTUs/hr. (3500W) max.	
# of fan modules standard / max.	4 / 4 hot-swap/redundant (two fans per module)	
Fan module airflow (front-to-back)	200 CFM (per module) at 25°C; 400 CFM (per module) at 32°C or greater	
Dimensions (HWD) / weight	12.0" (306.3mm) H 17.5" (444mm) W 28.9" (733.4mm) D	90-240 lbs 40.8-108.9 kg
Tape backup options	8765 1UX Tape Drive Enclosure w/ 43W8478 IBM HH LTO Gen 3 SAS Tape Drive, 8767HHX HH Tape Drive Enclosure w/ 43W8478 HH LTO Gen 3 SAS Tape Drive, TS2230, TS2240, TS3100	

## BladeCenter S Chassis Specifications

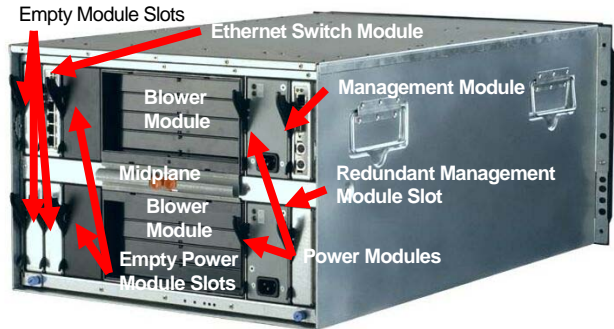
Length of limited warranty	3 years (parts and labor) onsite
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### BladeCenter E Chassis Images

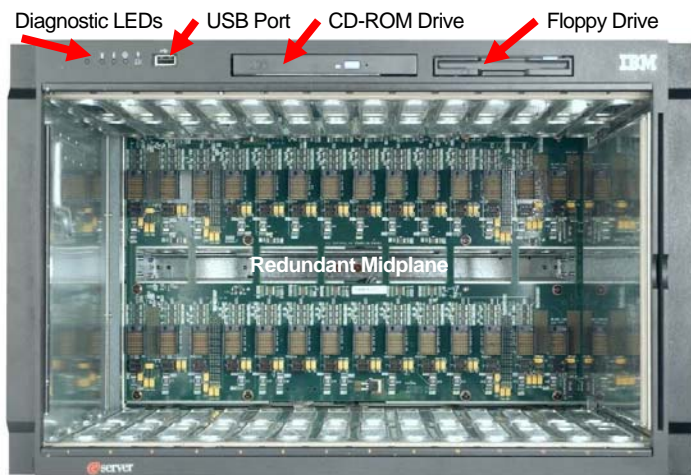
**Front View**



**Rear View**



**Interior View**



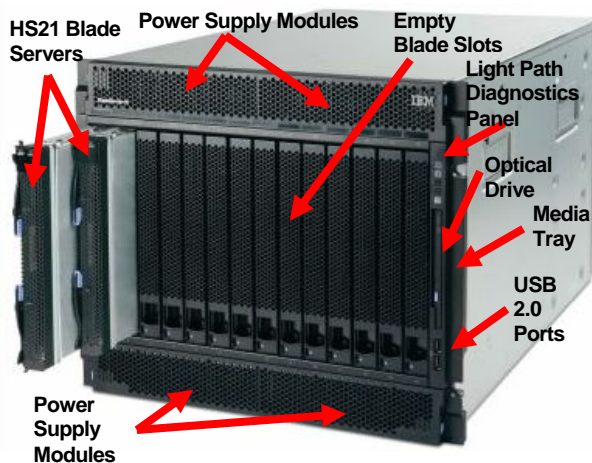
## BladeCenter E Chassis Specifications

Machine type	8677-3RU, 3RX
Rack form factor	7U
# of DVD/CD drives standard	1 DVD-ROM (in Media Tray)
# of diskette drives standard	1 (in Media Tray)
Internal tape drives supported	None (SAN-attached)
External disk drive support	NAS/SAN-attach
# of video ports	1 (on Management Module)
# of blade slots / orientation	14 x 30mm or 7 x 60mm (or combinations thereof) / <b>vertical</b>
# of switch module bays	4 hot-swap/redundant
Switch modules standard	None (in standard chassis offerings)

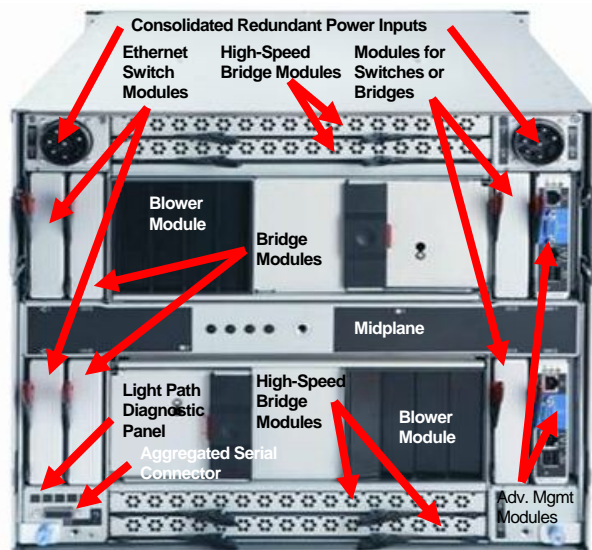
<b>BladeCenter E Chassis Specifications</b>		
# of management modules (std / max)	1 / 2 hot-swap/redundant	
Systems management controller	Management Module	
# of RS485 ports	1 (on Management Module)	
# of serial breakout ports	None (Serial over LAN only)	
# of parallel ports	None	
# of mouse ports	1 (on Management Module)	
# of keyboard ports	1 (on Management Module)	
# of USB ports	2 (1 on Media Tray, one on Management Module)	
Light path diagnostic panel	Yes (in Media Tray)	
Predictive Failure Analysis support	Blades, switch modules, I/O modules, management modules, power modules, blower modules, media tray	
Power supply size standard	2000W AC	
# of power supplies standard / maximum	2 / 4 hot-swap/redundant	
Heat output	<b>2342 BTUs/hr (686W) min.; 18,680 BTUs/hr. (5478W) max.</b>	
# of blower modules standard / max.	2 / 4 hot-swap/redundant	
Blower module airflow (front-to-back)	250 CFM at 25°C; 455 CFM at 32°C or greater	
Dimensions (HWD) / weight	12.0" (305mm) <b>H</b> 17.5" (4429mm) <b>W</b> 28.0" (711mm) <b>D</b>	99-240 <b>lbs</b> 44.9-108.9 <b>kg</b>
Length of limited warranty	3 years (parts and labor) onsite	

### BladeCenter H Chassis Images

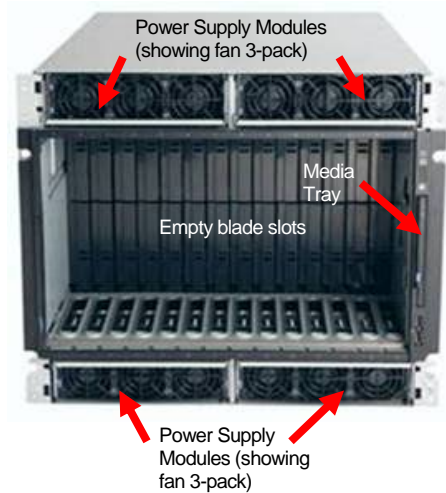
#### Front View



#### Rear View



## Interior View

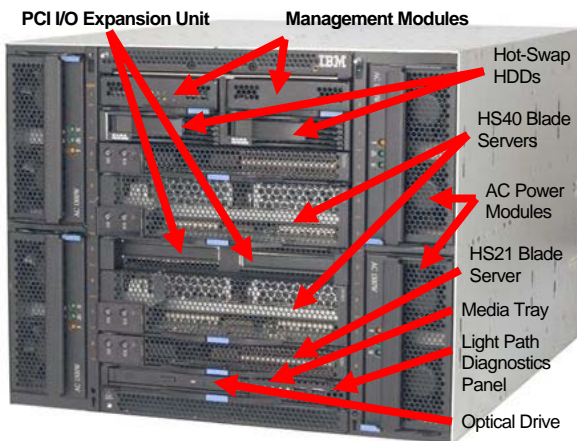


<b>BladeCenter H Chassis Specifications</b>	
Machine type	<b>8852-4XU</b>
Rack form factor	<b>9U</b>
# of DVD/CD drives standard	1 (in Media Tray; can choose to have either a read-only or multi-burner or no DVD/CD drive at all)
# of diskette drives standard	None
Internal tape drives supported	None (SAN-attached)
External disk drive support	NAS/SAN-attach
# of video ports	1 (on Management Module)
# of blade slots / orientation	<b>14 x 30mm or 7 x 60mm (or combinations thereof) / vertical</b>
Fabric bandwidth	10Gbps
Total # of switch/bridge module slots	10 (includes the following)
# of dedicated Gb Ethernet switch module bays	2 hot-swap/redundant
# of dedicated bridge module bays	2 hot-swap/redundant
# of switch / bridge module bays	2 hot-swap/redundant (either 2 switch or 2 bridge modules)
# of dedicated high-speed switch module bays	4 hot-swap/redundant
# of communication / I/O modules standard	None
# of management modules (std / max)	1 / 2 hot-swap/redundant
Systems management controller	Advanced Management Module
# of RS485 ports	1 (on Management Module)
# of serial breakout ports	1
# of parallel ports	None (USB-attach)
# of mouse ports	None (USB-attach)

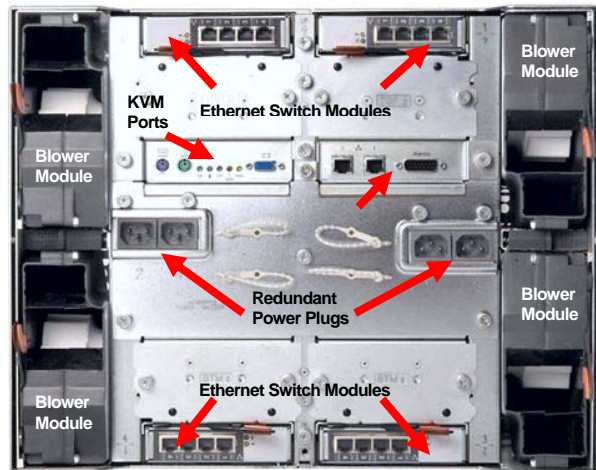
<b>BladeCenter H Chassis Specifications</b>		
# of keyboard ports	None (USB-attach)	
# of USB 2.0 ports	2 (on Management Module)	
Light path diagnostic panel	2 (one on Media Tray, one on Management Module)	
Predictive Failure Analysis support	Blades, bridge/switch modules, I/O modules, management modules, power modules, blower modules, media tray	
Power supply size standard	2900W AC	
# of power supplies standard / maximum	2 / 4 hot-swap/redundant	
Heat output	<b>1700 BTUs/hr</b> , (500W) min.; <b>26,000 BTUs/hr</b> (7600W) max.	
# of blower modules standard / max.	2 / 2 hot-swap/redundant	
Blower module airflow (front-to-back)	430 CFM at 25°C; 800 CFM at 32°C or greater	
Dimensions (HWD) / weight	15.75" (400mm) <b>H</b> 17.4" (442mm) <b>W</b> 28.0" (711mm) <b>D</b>	41-159 <b>kg</b> 90-350 <b>lbs</b>
Length of limited warranty	3 years (parts and labor) onsite	

### BladeCenter T Chassis Images

#### Front View



#### Rear View



<b>BladeCenter T Chassis Specifications</b>	
Machine type	<b>8720-2RX (DC)</b> <b>8730-2RX (AC)</b>
NEBS/ETSI- tested	Yes (NEBS Level 3)
Rack form factor	<b>8U</b>
# of DVD/CD Combo drives standard	1 (in Media Tray)
# of diskette drives standard	None
Internal tape drives supported	None (SAN-attached)
External disk drive support	NAS/SAN-attach

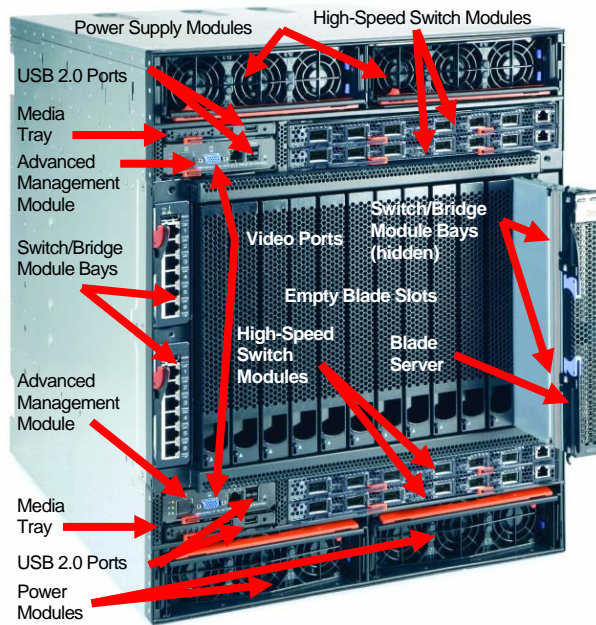
## BladeCenter T Chassis Specifications

# of video ports	1 (in rear KVM module)	
# of blade slots / orientation	8 x 30mm (low-voltage), 7 x 30mm (non-low-voltage), 4 x 60mm, or combinations thereof / <b>horizontal</b>	
Fabric bandwidth	1Gbps	
# of switch module bays	4	
# of management modules std / max	1 / 2	
Systems management controller	BladeCenter T Advanced Management Module	
# of RS485 ports	None	
# of serial breakout ports	None	
# of parallel ports	None (USB-based)	
# of mouse ports	None (USB-based)	
# of keyboard ports	None (USB-based)	
# of USB 2.0 ports	2 (in Media Tray)	
Light path diagnostic panel	Yes (in Media Tray)	
Predictive Failure Analysis support	Blades, switch modules, I/O modules, management modules, power modules, blower modules, media tray	
Power supply size standard	1300W <b>DC</b> (8720-2RX), -48V to -60V (nominal); 1300W <b>AC</b> (8730-2RX) at 208-240V	
# of power supplies standard / maximum	2 / 4	
Heat output	<b>675 BTUs/hr</b> , (197W) min.; <b>11,900 BTUs/hr</b> (3490W) max.	
# of blower modules standard / max.	4 / 4	
Blower module airflow (front-to-back)	330 CFM (per blower)	
Dimensions (HWD) / weight	13.75" (349mm) <b>H</b> 17.4" (442mm) <b>W</b> 20.0" (508mm) <b>D</b>	98-192 <b>lb</b> 44.5-87.4 <b>kg</b>
Extended/Long Life Support	<b>3 yrs</b> production from date of GA, <b>5 yrs</b> post production support (standard)	
Length of limited warranty	3 years (parts and labor) onsite	

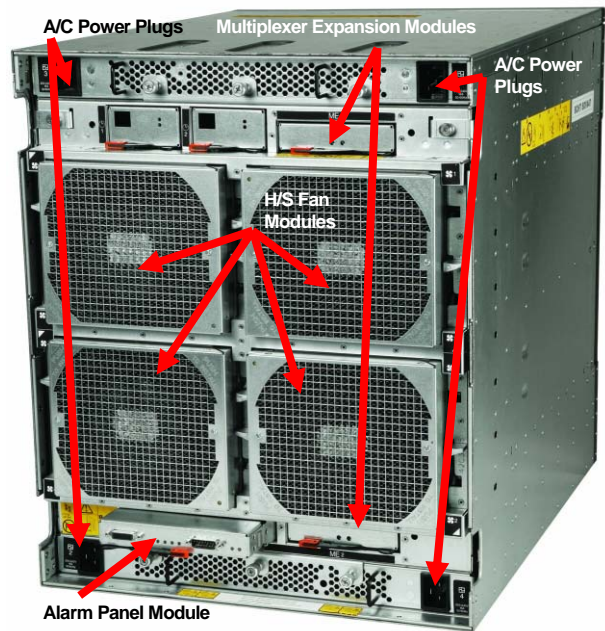


## BladeCenter HT Chassis Images

### Front View



### Rear View



## BladeCenter HT Chassis Specifications

Machine type	8740-1RX (DC) 8750-1RX (AC)
NEBS/ETSI-tested	Yes (NEBS Level 3)
Rack form factor	12U
# of DVD/CD Combo drives standard	None (USB-attach)
# of diskette drives standard	None (USB-attach)
Internal tape drives supported	None (SAN-attached)
External disk drive support	NAS/SAN-attach
# of blade slots / orientation	12 x 30mm, 6 x 60mm, or combinations thereof / vertical
Fabric bandwidth	10Gbps
Total # of switch/bridge module bays	8 (includes the following)
# of legacy switch / bridge module bays	4 hot-swap/redundant (either 4 switch or 4 bridge modules, or 2 of each)
# of high-speed switch module bays	4 hot-swap/redundant
# of management modules std / max	1 / 2
Systems management controller	BladeCenter Advanced Management Module
# of Serial-over-LAN ports	1 (via Management LAN)
# of cKVM ports	1 (via Management LAN)
# of parallel ports	None (USB-attach)

<b>BladeCenter HT Chassis Specifications</b>						
# of mouse ports	None (USB-attach)					
# of keyboard ports	None (USB-attach)					
# of USB 2.0 ports	Up to <b>6</b> ( <b>2</b> in Advanced Management Module, <b>2</b> per Media Tray)					
# of video ports	1 (in Advanced Management Module)					
Light path diagnostic panel	Yes (in Media Tray)					
Predictive Failure Analysis support	Blades, bridge/switch modules, I/O modules, management modules, power modules, fan modules, media tray					
Power supply size standard	2535W <b>DC</b> (8740-1RX), -48V or -60V (nominal); 2880W <b>AC</b> (8750-1RX) at 208V; 3160W at 240V					
# of power supplies standard / maximum	2 / 4					
Heat output	<b>4270 BTUs/hr</b> (1250 watts) min., to <b>21,850 BTUs/hr</b> (6400 watts) max.					
# of fan modules standard / max.	4 / 4					
Dimensions (HWD) / weight	<table border="0"> <tr> <td>21.0" (528mm) <b>H</b></td> <td rowspan="4">150-350 <b>lb</b> 62.8-159 <b>kg</b></td> </tr> <tr> <td>17.4" (442mm) <b>W</b></td> </tr> <tr> <td>25.4" (645mm) <b>D</b></td> </tr> <tr> <td>27.8" (706 mm) <b>D</b> (with deep bezel)</td> </tr> </table>	21.0" (528mm) <b>H</b>	150-350 <b>lb</b> 62.8-159 <b>kg</b>	17.4" (442mm) <b>W</b>	25.4" (645mm) <b>D</b>	27.8" (706 mm) <b>D</b> (with deep bezel)
21.0" (528mm) <b>H</b>	150-350 <b>lb</b> 62.8-159 <b>kg</b>					
17.4" (442mm) <b>W</b>						
25.4" (645mm) <b>D</b>						
27.8" (706 mm) <b>D</b> (with deep bezel)						
Extended/long life support	<b>3 years</b> production from date of GA; <b>5 years</b> post-production support (standard)					
Length of limited warranty	3 years (parts and labor) onsite					

<b>Chassis Side-by-Side Comparison</b>						
	<b>SMB Chassis</b>	<b>Enterprise Chassis</b>			<b>Telecom Chassis</b>	
<b>Chassis name</b>	<b>BladeCenter S</b>	<b>BladeCenter E</b>	<b>BladeCenter H</b>	<b>BladeCenter T</b>	<b>BladeCenter HT</b>	
<b>Rack form factor</b>	<b>7U</b>	<b>7U</b>	<b>9U</b>	<b>8U</b>	<b>12U</b>	
<b>Supports deskside use</b>	<b>Yes</b> (with optional Office Enablement Kit)	Rack-only	Rack-only	Rack-only	Rack-only	
<b># of blades supported</b>	<b>6</b> x 30mm / <b>3</b> x 60mm / <b>2</b> x 90mm / <b>1</b> x 120mm	<b>14</b> x 30mm / <b>7</b> x 60mm / <b>4</b> x 90mm / <b>3</b> x 120mm	<b>14</b> x 30mm / <b>7</b> x 60mm / <b>4</b> x 90mm / <b>3</b> x 120mm	<b>8</b> x 30mm / <b>4</b> x 60mm / <b>2</b> x 90mm / <b>2</b> x 120mm	<b>12</b> x 30mm / <b>6</b> x 60mm / <b>4</b> x 90mm / <b>3</b> x 120mm	
<b>Blade types supported</b>	HC10, HS12, HS20, HS21, HS21 XM, JS12, JS21, JS22, LS20, LS21	HC10, HS12, HS20, HS21, HS21 XM, <b>HS40</b> , JS12, JS20, JS21, LS20, LS21, LS41, <b>QS20</b>	HC10, HS12, HS20, HS21, HS21 XM, <b>HS40</b> , JS20, JS21, JS22, LS20, LS21, LS41, <b>QS21</b> , <b>QS22</b>	HC10, HS20, HS21, HS21 XM, JS12, JS20, JS21, LS20, LS21, LS41	HC10, HS20, HS21, HS21 XM, JS20, JS21, JS22, LS20, LS21, LS41, <b>QS21</b> , <b>QS22</b>	
<b>Fabric bandwidth</b>	1GB	1GB	<b>10GB</b>	1GB	<b>10GB</b>	
<b># of management modules std / max.</b>	<b>1 / 1</b>	1 / 2 hot-swap/redundant with 2 installed	1 / 2 hot-swap/redundant with 2 installed	1 / 2 hot-swap/redundant with 2 installed	1 / 2 hot-swap/redundant with 2 installed	
<b># of power modules std / max</b>	2 / 4 hot-swap/redundant (110V = N+1, 220V = N+N)	2 / 4 hot-swap/redundant (N + N)	2 / 4 hot-swap/redundant (N + N)	2 / 4 hot-swap/redundant (N + N)	2 / 4 hot-swap/redundant (N + N)	
<b>Power module size</b>	<b>1450W AC</b>	<b>2000W AC</b>	<b>2900W AC</b>	<b>1300W</b>	<b>1300W</b>	<b>2535W</b> <b>2880W</b>

## Chassis Side-by-Side Comparison

	SMB Chassis	Enterprise Chassis		Telecom Chassis			
Chassis name	BladeCenter S	BladeCenter E	BladeCenter H	BladeCenter T		BladeCenter HT	
				DC -48V to -60V (nominal)	AC at 208V	DC -48V to -60V (nominal)	AC at 208V; <b>3160W</b> AC at 240V
Power outlets required	110V; 220V	220V	220V	220V		220V	
Heat output	1365 BTUs/hr (400W) min.; 11,942 BTUs/hr. (3500W) max.	2342 BTUs/hr (686W) min.; 18,680 BTUs/hr. (5478W) max.	1700 BTUs/hr, (500W) min.; 26,000 BTUs/hr (7600W) max.	675 BTUs/hr, (197W) min.; 11,900 BTUs/hr (3490W) max.		4270 BTUs/hr (1250W) min.; 21,850 BTUs/hr (6400W) max.	
# of blower/fan modules std / max.	4 / 4 hot-swap/redundant	2 / 4 hot-swap/redundant	2 / 2 hot-swap/redundant	4 / 4 hot-swap/redundant		4 / 4 hot-swap/redundant	
Blower/fan module airflow	200 CFM (per module) at 25°C; 400 CFM (per module) at 32°C or greater	250 CFM (per module) at 25°C; 455 CFM (per module) at 32°C or greater	430 CFM (per module) at 25°C; 800 CFM (per module) at 32°C or greater	330 CFM (per module)		95 CFM (per module) at 25°C; 190 CFM (per module) at 40°C or greater	
Storage methods supported	Shared chassis; server blade; expansion blade	Server blade; expansion blade	Server blade; expansion blade	Server blade; expansion blade		Server blade; expansion blade	
# of internal H/S HDD bays	12	0	0	0		0	
# of legacy switch-only module bays	4	4	4 (2 dedicated to Gb Ethernet)	4		0	
# of legacy switch/bridge module bays	0	0	2 (either 2 switch or bridge 2 modules)	0		4 (either 4 switch or bridge 4 modules)	
# of high-speed switch module bays	0	0	4	0		4	
# of concurrent KVM (cKVM ports)	0	0	0	0		1	
# of USB ports	4 (USB 2.0)	2 (USB 1.1)	2 (USB 2.0)	2 (USB 1.1)		4 (USB 2.0)—with Media Trays	
Embedded Compact Flash option	No	No	No	No		Yes	
Dimensions	12.0" (306.3mm) H 17.5" (444mm) W 28.9" (733.4mm) D	12.0" (305mm) H 17.5" (442mm) W 28.0" (711mm) D	15.75" (400mm) H 17.4" (442mm) W 28.0" (711mm) D	13.75" (349mm) H 17.4" (442mm) W 20.0" (508mm) D		21.0" (528mm) H 17.4" (442mm) W 27.6" (706mm) D	
Weight	90-240 lbs 40.8-108.9 kg	99-240 lbs 44.9-108.9 kg	90-350 lbs 41-159 kg	98-192 lb 44.5-87.4 kg		150-350 lb 62.8-159 kg	

## Chassis / Blades / Management Module Compatibility

Blade Servers	BCS	BCE	BCT <sup>2</sup>	BCH	BCHT <sup>3</sup>
HS20 single/dual-core (8832/8843)	Yes	Yes	Yes	Yes	Yes
HS21 dual-core (8853)	Yes	Yes	Up to 65W processor power draw	Yes	Up to 80W
HS21 quad-core (8853)	Yes	Up to 80W	Up to 7 blades at 80W	Yes	Up to 10 at 120W <sup>3</sup>
HS21 XM dual-core (7995)	Yes	Up to 80W	Up to 65W	Yes	Up to 80W
HS21 XM quad-core (7995)	Yes	Up to 80W	Up to 7 blades at 80W <sup>4</sup>	Yes	Up to 12 at 80W
HS40 single-core (8839)	No	Yes	No	Yes	No
LS20 single/dual-core (8850)	Yes	Yes	Yes	Yes	Yes
LS21 dual-core (7971)	Yes	Up to 68W <sup>5</sup>	Up to 68W	Yes	Yes
LS41 dual-core (7972)	Yes	Up to 68W <sup>6</sup>	Up to 68W	Yes	Yes
JS20 dual-core (8842)	No	Yes	Yes	Yes	Yes
JS21 dual-core (8844)	Yes	Yes	Yes	Yes	Yes
QS20 multi-core (0200-AC1)	No	Yes	No	No	No
QS21 multi-core (????-????)	No	No	No	Yes	Yes
Management Modules					
MM (original Management Module)	No	Yes	No	No	No
AMM (Advanced Management Module)	Yes	Yes	No	Yes	Yes
cMM (Advanced Management Module for Telecom)	No	No	Yes	No	No

Yes = Full density

## I/O Module Compatibility by Chassis and MSIM

P/N	I/O Module	BCS	BCE	BCT	BCH	BCHT	MSIM
Ethernet							
32R1892	Cisco Systems Intelligent Gb Ethernet Switch	No	Yes	Yes	Yes	Yes	1
32R1888	Cisco Systems Intelligent Gb Fiber Ethernet Switch	No	Yes	Yes	Yes	Yes	1
39Y9267	Nortel 10G Ethernet Switch Module for IBM BladeCenter	No	No	No	Yes	Yes	3
32R1783	Nortel 10G Uplink Ethernet Switch	Yes	Yes	Yes	Yes	Yes	1
32R1859	Nortel Layer 2-7 Gb Ethernet Switch	No	Yes	Yes	Yes	Yes	3
32R1860	Nortel Layer 2/3 Copper Gb Ethernet Switch	Yes	Yes	Yes	Yes	Yes	1

<sup>2</sup> Non-NEBS environment.

<sup>3</sup> If fully configured, must leave 1 slot open in power domain 1.

<sup>4</sup> When fully configuring a BladeCenter E (8677) chassis with the maximum possible HS21 XM blade server configuration (fourteen HS21 XM blade servers, each with two 80W processors, eight 4GB memory DIMMs, one SAS HDD, one USB-based flash drive, one I/O card and one cKVM card), there could be periods of time that Power Domain 2 exceeds the 13.5amp rating guidance (Power Domain 1 will not exceed the rating guidance). While this is not violating any safety rules, we recommend that your clients review the electrical infrastructure and power distribution of their installations to account for a peak of 14.4A.

<sup>5</sup> 95W is supported but will throttle performance to fit in power envelope – recommend using in BladeCenter H or HT.

P/N	I/O Module	BCS	BCE	BCT	BCH	BCHT	MSIM
32R1861	Nortel Layer 2/3 Fiber Gb Ethernet Switch	Yes	Yes	Yes	Yes	Yes	1
39Y9324	Server Connectivity Module	Yes	Yes	Yes	Yes	Yes	1
<b>InfiniBand</b>							
43W4419	4x InfiniBand Pass-Thru Module	No	No	No	Yes	Yes	3
32R1756	Cisco Systems 4X InfiniBand Switch Module	No	No	No	Yes	Yes	3
32R1900	Cisco Systems InfiniBand Switch Module	No	Yes	Yes	Yes	Yes	3
39Y9207	QLogic InfiniBand Ethernet Bridge Module	No	No	No	Yes	Yes	3
39Y9211	QLogic InfiniBand Fibre Channel Bridge Module	No	No	No	Yes	Yes	3
<b>Fibre Channel</b>							
43W6723	4Gb Intelligent Pass-thru Module for IBM BladeCenter	Yes	Yes	Yes	Yes	Yes	2
32R1813	Brocade 10 port – 4Gb SAN Switch	Yes	Yes	Yes	Yes	Yes	2
32R1812	Brocade 20 port – 4Gb SAN Switch	No	Yes	Yes	Yes	Yes	2
39Y9284	Cisco Systems 4Gb 10 port Fibre Channel Switch Module	Yes	Yes	Yes	Yes	Yes	3
39Y9280	Cisco Systems 4Gb 20 port Fibre Channel Switch Module	No	Yes	Yes	Yes	Yes	3
32R1904	QLogic 10 port – 4Gb Fibre Channel Switch	No	Yes	Yes	Yes	Yes	2
43W6724	QLogic 10 port – 4Gb Fibre Channel Switch	Yes	Yes	Yes	Yes	Yes	2
43W6725	QLogic 20 port – 4Gb Fibre Channel Switch	No	Yes	Yes	Yes	Yes	2
26R0881	QLogic 20 port – 4Gb Fibre Channel Switch	No	Yes	Yes	Yes	Yes	2
<b>SAS</b>							
39Y9195	SAS Connectivity Module	Yes	Yes	No	Yes	No	3
43W3584	IBM BladeCenter S RAID SAS Controller	Yes	No	No	No	No	3
<b>Other Modules</b>							
39Y9320	Copper Pass-Thru Module	Yes	Yes	Yes	Yes	Yes	N/A
39Y9314	Multi-Switch Interconnect Module (MSIM)	No	No	No	Yes	No	3
39Y9316	Optical Pass-Thru Module	Yes	Yes	Yes	Yes	Yes	4

Note 1: Supported in left I/O Module bay of MSIM

Note 2: Supported in right I/O Module bay of MSIM

Note 3: Not supported or not applicable for use with MSIM

Note 4: OPM is supported in MSIM for Ethernet in left I/O module bay or Fibre Channel in right I/O module bay

**For the latest compatibility data, refer to the BladeCenter Compatibility Guide, found on Systems Sales.**

# BladeCenter I/O Modules

## Ethernet



### Cisco Fiber Intelligent Gigabit Ethernet Switch Module for IBM BladeCenter

External SFP-based ports for fiber connectivity (SFPs available from Cisco). Supports high availability networks through support of advanced STP protocols and trunk failover functionality. Optimizes delivery through support of multicast protocols such as IGMP snooping. Eases network management through support of Cisco IOS, CiscoWorks, and Cluster Management System. Ensures network security through support of RADIUS, TACACS+, 802.1x and other authentication protocols.



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### Nortel 10Gb Ethernet Switch Module for IBM BladeCenter

Delivers high-bandwidth and time-sensitive switching for applications such as VoIP and IPTV with **non-blocking 20-port 10Gbps** fabric for BladeCenter H. Provides **6 external 10Gb ports** and **14 internal 10Gb ports** and a **dedicated 1Gb management port**. Simplifies deployment and help reduce costs by integrating Layer 2-3 LAN switching and routing into a single BladeCenter chassis. Maintain system uptime with high availability and resilience with **L2 failover**, Uplink Fast, Spanning Tree, Multiple and Rapid Spanning Tree, Router Redundancy Protocol (VRRP) and Equal Cost Multiple Routing (ECMP) for OSPF. Standard-based VLANs for traffic segregation. Advanced filtering. Support for RADIUS, TACACS/TACACS+, and 802.1x for port security ensures end-to-end data integrity. Flexible and simple management via web browser or industry-standard CLI. Offers **dual 10Gb Ethernet connections to each server blade** when used in conjunction with the dual-port NetXen 10G Expansion Card for IBM BladeCenter.



### Nortel Layer 2/3 10 Gigabit Uplink Ethernet Switch Module

**Three 10Gb uplinks** at line-speed provide maximum bandwidth to any BladeCenter chassis. Industry-standard ACLs, advanced traffic management, dynamic routing with RIP, OSPF, BGP and VRRP. Unmatched network-wide Quality of Service for time-sensitive applications such as VOIP and IPTV. **High Availability with L2 failover**, Uplink Fast, Spanning Tree, Multiple and Rapid Spanning Tree, Router Redundancy Protocol (VRRP) and Equal Cost Multiple Routing (ECMP) for OSPF. Standard-based VLANs for traffic segregation. Advanced filtering. Support for RADIUS, TACACS/TACACS+, and 802.1x for port security ensures end-to-end data integrity. Flexible and simple management via web browser or industry-standard CLI.



### Cisco Catalyst Switch Module 3012 for IBM BladeCenter

The Cisco Catalyst Switch Module 3012 provides four external 1Gb ports and fourteen internal 1Gb ports, and operates in standard I/O module bay. It supports Layer 2 and basic Layer 3 switching (static routing and RIP) and employs common management with external Cisco switches via IOS Command Line Interface and CiscoWorks LAN Management Solution.



### Nortel 1/10Gb Uplink Ethernet Switch Module for IBM BladeCenter

Perfect investment protection for Clients who require 1Gb today and 10Gb for future growth. It is easy to configure, use and manage via a web-based interface. It provides full Layer 2/3 support and uses next-generation SFP+ modules to migrate to 10Gb on the same switch. It also supports 6 1Gb and 3 10Gb Uplink ports.



### Nortel Layer 2/3 Copper Gigabit Ethernet Switch Module for IBM BladeCenter

Offers **6 six copper uplinks** and strongest price/performance benefits. Delivers complete Layer 2 and 3 functionality: routing, filtering, and traffic queueing. Better serves the processing demands of bandwidth- intensive applications. Provides port flexibility and traffic management to improve maintenance. Provides **upgrade path to full Layer 4-7** services.



### Nortel Layer 2/3 Fiber Gigabit Ethernet Switch Module for IBM BladeCenter

Offers **6 six fiber uplinks** (with SFPs) and strong price/performance benefits. Delivers complete Layer 2 and 3 functionality: routing, filtering, and traffic queueing. Better serves the processing demands of bandwidth- intensive applications. Provides port flexibility and traffic management to improve maintenance. Provides **upgrade path to full Layer 4-7** services.



### Nortel Layer 2-7 Gigabit Ethernet Switch Module for IBM BladeCenter

Increases application availability and performance. Better serves the processing demands of bandwidth- intensive applications. Greater infrastructure scalability. Enhanced server security. Delivers application and server load balancing.



### Server Connectivity Module for IBM BladeCenter

Serves the needs of Small and Medium Business customers. Easy to install, configure and manage through an easy to use browser based interface. Ideal for environments where a separation between the server and networking domains is preferred.

## Fibre Channel



### Brocade 10- and 20-Port SAN Switch Modules

Enables high-performance end-to-end **1, 2 and 4Gbps SAN** solutions for the data center. Affordable 10-port and 20-port offerings available for Small, Medium and Large Enterprise business needs. Easy-to-use **non-disruptive upgrade doubles the 10-port switch connectivity to 20-ports** when your business needs change. Integrates the Brocade SAN fabric to simplify deployment/management and reduce infrastructure complexity and total cost of ownership. Utilizes Brocades proven Silkorm technology and fully backward compatible and interoperable with Silkorm and IBM TotalStorage b-type SAN switches.



### Cisco 4Gb 10- and 20-Port Fibre Channel Switch Module for IBM BladeCenter

Enables high-performance end-to-end **1, 2 and 4Gbps SAN** solutions for the data center. Affordable 10-port and 20-port offerings available for Small, Medium and Large Enterprise business needs. Exciting addition to the Cisco Ethernet and MDS family of products. Includes Tivoli SAN manager enhancements to better manage MDS9000 with integrated IBM SAN Volume Controller. **10-port upgrade available** for on demand **scaling to a 20-port switch**. Cisco SFPs are required: Long-wave, short-wave, or short-wave 4-pack.



### QLogic 10-Port and 20-Port 4Gb Fibre Channel Switch Modules

Enables high-performance end-to-end **1, 2 and 4Gbps SAN** solutions. Provides interoperability in open mode leveraging standards-compliant (FC-SW2 & FC-SW3) SANs. Affordable 10-port and 20-port offerings are available—ideal for Small, Medium and Enterprise business needs. **Easy-to-use software upgrade** doubles your 10-port switch connectivity **to 20-ports for on demand scalability**. Included with every switch, QLogic's SANsurfer Management Suite eases installation, configuration and management of your SAN infrastructure—all from one GUI.

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## SAS



### SAS Connectivity Module

This high-performance, 3Gbps, SAS-based pass-thru module enables broad storage functionality. It enables up to 12 3.5 in. SAS or SATA disks using the Disk Storage Module. It also enables use of entry storage products such as IBM System Storage DS3200. Provides 4 external 3Gb ports. Easy to use IBM Storage Configuration Manager (SCM) or industry standard CLI.



### BladeCenter S SAS RAID Controller Module

Enables a fully redundant SAN within the BladeCenter S chassis. Provides high-performance, fully duplex 3 Gbps speeds. Supports two disk storage modules with up to 12 x 3.5 in. SAS or Nearline SAS drives. Provides 4 external 3Gb ports. Easy to use IBM Storage Configuration Manager (SCM) or industry standard CLI.

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## InfiniBand



### Cisco 4X InfiniBand Switch Module for IBM BladeCenter

Delivers high performance, low-latency server switching required to enable BladeCenter server systems to form high-performance clusters and grids that deliver the performance required to realize the full potential of next-generation applications and systems. Provides **14 ports of 10-Gbps (4X) server connectivity to blades** with less than 200 nanoseconds (ns) port to port latency and **8 equivalent 4X external ports from the BladeCenter H chassis**. Supports Message Passing Interface (MPI), IP over InfiniBand (IPoIB), and Sockets Direct Protocol (SDP), which use InfiniBand Remote Direct Memory Access (RDMA) to support the most demanding high-performance computing applications and high-performance database clusters. Integrated with Cisco's latest release of Vframe—server fabric virtualization software—which offers rapid provisioning and real time re-hosting of server and network interfaces with policy based utilization and high availability rules.

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### Cisco InfiniBand Switch Module for IBM BladeCenter

Allows the scaling out of data centers by interconnecting blades and chassis together with InfiniBand as the interconnect. Leverages high bandwidth and low latency characteristics of the InfiniBand standard with Remote Direct Memory Access (RDMA). Enables consolidation of LAN and SAN connectivity for an entire data cluster to a centralized location. Virtualizes, and shares I/O and storage across an entire BladeCenter or collection of BladeCenter chassis for cost savings and high availability.

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### QLogic InfiniBand Ethernet Bridge Module for IBM BladeCenter

Enables InfiniBand within the chassis while seamlessly connecting the chassis to the external Ethernet network. Used in conjunction with the Cisco 4X InfiniBand Switch module and provides up to **six 1Gb Ethernet connections** to the external network. Bridges enable consolidation of LAN and SAN connectivity for an entire data cluster to a single fabric. Leverages powerful I/O capability of BladeCenter H without any reduction in switching capacity.

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### QLogic InfiniBand Fibre Channel Bridge Module for IBM BladeCenter

Enables InfiniBand within the chassis while seamlessly connecting the chassis to the external Fibre Channel fabric. Used in conjunction with the Cisco 4X InfiniBand Switch module and provides up to **six 4Gb Fibre Channel connections** to the external network. Bridges enable consolidation of LAN and SAN connectivity for an entire data cluster to a single fabric. Leverages powerful I/O capability of BladeCenter H without any reduction in switching capacity.

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# Rack vs. Blades Positioning

Businesses of all sizes continue to struggle with the overwhelming complexity created by the rapid growth of their IT environments. They are running out of room and exceeding power thresholds in their computer rooms and data centers. And, they are increasingly being asked to do more with less. Blade infrastructures offer ways to simplify your IT, increase density and decrease power requirements while lowering total costs.

With BladeCenter<sup>®</sup>, IBM has held the leading full-year market share in the blade segment from 2003 through 2006. (IDC Worldwide Quarterly Server Tracker, December 2006.) As the market leader, IBM has helped many clients migrate from racks to blades and has the experience to help lead a successful transition.

## Why Convert from Rack Servers to Blades?

Unlike a stand-alone server that needs multiple power supplies and fans, individual systems management, numerous cables and a lot of space, IBM BladeCenter is compact and simple. The blade contains all the necessities to run an application—processors, memory, I/O and storage. Components that are duplicated in rack If I have to, I'll publish servers are removed from the individual blade and placed in the BladeCenter chassis instead. Shared N+N redundant power, shared N+N hot-swap cooling, optical media, integrated Ethernet, storage, switching and consolidated powerful management. The beauty of the BladeCenter architecture is that now everything needed for the solution can be housed and managed from a single point of control.

With the BladeCenter Advanced Management Module and IBM Director software, which are both included with a BladeCenter chassis purchase, clients can interact with all the hardware technology within the BladeCenter chassis, so it can be controlled from a single interface—often even if the server is powered down or otherwise non-responsive. The ability to have a single interface to blades, storage and switching is a big advantage for any administrator, but it can be especially helpful to small businesses that might not have dedicated IT staffs.

BladeCenter is an ideal way to replace many uni-, two- or four-socket servers to save space while often reducing power and cooling requirements compared to rack servers. For example, 14 two-socket 1U rack servers can be replaced by 14 two-socket blade servers in a BladeCenter chassis—saving 7U of rack space, helping you save on power and cooling costs and simplifying management. BladeCenter offers higher density and potentially lower total cost of ownership with no sacrifice in performance.

Clients can now combine the IBM BladeCenter Storage and I/O Expansion Blade with any HS21, JS21, LS21 or LS41 blade for a hard-to-beat alternative to many 2U servers. The Storage and I/O Expansion Blade doubles your I/O connectivity, adds hot-swap drive capability and provides the option of adding full RAID-5 capability with battery-backed cache. The resulting blade is 60mm wide, allowing you to install seven inside a BladeCenter E chassis for a solution that uses half the space of seven comparable HP or Dell 2U rack servers.

## Discrete Benefits of Blade Servers over Rack Servers

IBM BladeCenter integrates servers, storage and networking to help you reduce complexity, simplify IT management and reduce costs, through a flexible and highly scalable design. Many features and functions found in BladeCenter can deliver significant advantages over typical rack servers and solutions from competing vendors. Consider the many benefits of moving from rack-based servers to IBM BladeCenter:

Benefit	Description
<b>Infrastructure simplification</b>	Environments today can be very complex. You have to manage and install a variety of servers, switches, storage, cables and management tools. By simplifying IT architecture and integrating these components in a single BladeCenter solution (with up to 14 enterprise blades per chassis), you can significantly reduce the requirements for space, chassis, switches, cables, racks, power supplies and PDUs. This helps you save on power and cooling costs, simplify and speed up deployment and management, and lower IT staff costs. Additionally, a simple infrastructure can mean fewer parts to fail and less time spent at the rack making repairs—freeing your IT staff for other projects.
<b>Investment protection</b>	When you need to upgrade, you don't have to take apart your foundation and reinvest in infrastructure each time technology changes. Instead, you can add a blade or new storage functionality as your needs change or as new technology arrives. BladeCenter blades and switches can be seamlessly moved between chassis. This offers you investment protection and incredibly flexible, mix-and-match deployment choices.
<b>Space savings</b>	BladeCenter can save up to 50% of the floor space of an equivalent rack solution, without sacrificing application performance. This can be a tremendous benefit in power- or cooling-constrained environments, allowing you to fit more processing power into existing power and thermal envelopes.

Benefit	Description
<b>Efficiency</b>	<p>Energy efficiency is a big issue today and for the foreseeable future. Moving from racks to blades can help you optimize your resources. Data centers limited by aging servers can realize efficiencies with BladeCenter over rack-based servers:</p> <ul style="list-style-type: none"> <li>• Up to 50% more servers in the same amount of space</li> <li>• Using as much as 30-40% less power than rack servers</li> <li>• Emitting less heat</li> <li>• Less airflow required per server</li> </ul>
<b>Flexibility and choice</b>	<p>IBM has the broadest ecosystem of solution providers in the blade market. Myriad of software, security, specialized applications, I/O expansion cards, SAN switching, networking and high-performance interconnects let us provide you with comprehensive blade solutions—giving you more choices and flexibility. In fact, the IBM ecosystem is one of the things that sets us apart from the competition. Since IBM opened the BladeCenter specifications in 2004, nearly 100 companies began producing solutions for BladeCenter, ultimately giving you even more choices for the future.</p>
<b>Cable reduction</b>	<p>With BladeCenter, you can have up to 82% fewer cables than with rack servers, which can mean dramatically lower costs and less complexity. Reduced complexity means less to manage during install and fewer components that can potentially cause problems. Remember, each cable has three potential points of failure: two connectors and the cable itself.</p>
<b>Centralized management</b>	<p>Management at the chassis level can save time over managing rack servers individually. A single login to a BladeCenter Management Module gives administrators access to the entire solution, consisting of chassis, blades, and modules, not just one component of it.</p>
<b>Resiliency</b>	<p>BladeCenter was designed to greatly reduce single points of failure. Reliability features include:</p> <ul style="list-style-type: none"> <li>• Redundant, hot-swap cooling, power, management and I/O switches in the chassis.</li> <li>• A high-availability midplane providing redundant paths to the network. (See Availability below.)</li> <li>• Redundant connections for power and I/O on the back of each blade.</li> <li>• Fewer moving parts. Fewer moving parts mean fewer components to fail and potentially better reliability.</li> <li>• Light path diagnostics, which can indicate problems with the chassis, blades, power supplies, switches—and for parts inside the individual blades—even before a problem occurs. It can also light the path to a fix for easy service, even after the blade is removed or power is turned off.</li> </ul> <p>Additionally, BladeCenter has a four-year proven track record of enterprise operation.</p>
<b>Availability</b>	<p>Two connections to the midplane are inherent in the BladeCenter design. This means dual communication paths from the blades to the Ethernet, Fibre Channel, KVM, power and management signals, for higher availability. For example, if something happened to a connector on the blade, all the servers can stay up and running. Bringing the whole solution together means that extra care must be taken to avoid single points of failure. While other blade vendors talk about this concept, IBM has embraced it in the BladeCenter design.</p>
<b>Lower acquisition cost</b>	<p>Equally configured, fourteen blades with servers, switches, HBAs and cables can be substantially less expensive than the 1U alternative.</p>

### **Virtualization**

Consolidation from competitive rack servers to BladeCenter presents the opportunity to create an efficient and optimized infrastructure through virtualization and IBM Virtual Fabric Architecture. With virtualization, individual physical servers can be configured as multiple virtual servers, each capable of running its own operating system and applications. Running more applications per server means placing more demands on the system. IBM BladeCenter is excellent for a virtualized environment because many blades can support up to 12 I/O ports and clients can deploy high-speed 10Gb Ethernet—at up to 65% savings vs. rack servers. This is because compared to rack servers, BladeCenter offers:

- Lower-cost switch ports
- Fewer cables
- Lower HBA costs
- No need for XFPCs

When you migrate from racks to blades, also consider BladeCenter for client consolidation. With IBM's Virtual Client solution, users are able to enjoy all the benefits and personal control of a stand-alone desktop—including print capabilities, USB drive support and audio—while reducing many of the challenges related to current stand-alone desktop environments. These include limiting susceptibility to theft and viruses, ease of new-user deployment, eliminating extended downtime during a hard-drive failure and eliminating the need to rebuild user preferences and settings after each client refresh.

### **Energy Efficiency**

The cost of power has become a huge component of IT operating budgets all around the world. Many clients are facing the critical issue of providing sufficient power and cooling to support their highly dense data center. Clients are demanding solutions that allow them to get their work done, while fitting into an affordable power and cooling envelope. IBM considers energy efficiency and addressing global climate change to be not only a decision that makes economic sense, but also one of the most pertinent issues facing the planet at this time. The good news is that an important part of the solution to these issues is available—it's IBM BladeCenter.

BladeCenter is designed from the ground up to dramatically improve power utilization and reduce energy costs. In fact, aggregate power savings of BladeCenter vs. 1U servers and related external equipment can be as much as 30-40%. This can be attributed to a well-planned system architecture that includes more energy-efficient power supplies and thermals, along with a super-smart power delivery solution. With IBM BladeCenter you get:

- Energy-efficient power supplies that operate at over 90 percent efficiency in converting AC power to DC power, compared to an industry standard of 70 percent
- A shared-cooling approach that can lead to less power consumption by reducing the need for hundreds of fans for the blades and switches
- The ability to add an integrated 10Gb Ethernet switch, which can be up to 95% more energy efficient than external switch offerings
- IBM Systems Director Active Energy Manager for x86, a tool that can help you plan, predict, monitor and actively manage power consumption of your BladeCenter servers

IBM BladeCenter should be part of an energy-efficient data center solution.

### **Storage**

Data is the lifeline of today's businesses. The integrity, availability and protection of data are vital to productivity and success. Storing information is a requirement that's shared by all types of businesses, from large enterprises to small businesses and even single departments. Accordingly, managing data has become one of the biggest challenges managers face today. Every year, the need for data storage capacity grows, with no end in sight.

As you consolidate your IT with BladeCenter, you can also consolidate your storage environments. With BladeCenter, the storage fabric is included in the chassis. In fact, IBM was the first blade vendor to integrate the storage fabric into a blade server architecture. By integrating the storage fabric into the BladeCenter chassis, you can potentially realize a significant reduction in small form factor pluggable (SFP) cards and optical fiber cable costs and increase storage utilization.

It can be much more cost-effective and easier to manage BladeCenter when it is connected to external storage. IBM delivers a wide range of easy-to-install, tested external storage products to meet your demanding business needs.

- **Network-attached storage (NAS)** — IBM System Storage™ N series NAS products provide a large capacity, highly available and secure environment for storing mission-critical data. The N series attaches to BladeCenter using integrated Gigabit Ethernet switch modules.
- **Storage area network (SAN)** — IBM System Storage DS3000™, DS4000™, DS6000™, and DS8000™ series provide integrated SMB and enterprise solutions with multi-protocol local, campus, metropolitan and global storage networking. The DS portfolio attaches to BladeCenter using Fibre Channel switch modules.
- **iSCSI** — BladeCenter offers both a 1Gb hardware and a 1Gb and 10Gb software iSCSI initiator. Both support iSCSI boot. The iSCSI hardware initiator is an adapter with an embedded processor. This solution is beneficial for clients who don't want their server performance impacted. The iSCSI software initiator is embedded in the blade server BIOS and enables iSCSI boot through a standard 1Gb Ethernet connection without the need for an adapter. This is an attractive, lower-cost alternative for clients moving their storage off the blade and is available to BladeCenter clients at no charge. The iSCSI software initiator also enables iSCSI boot through a standard 10Gb Ethernet connection with the NetXen 10Gb adapter. HP and Dell do not offer a software iSCSI initiator. The IBM System Storage N series supports iSCSI server attachment.
- **Fibre Channel** — BladeCenter integrates the storage switches from vendors such as Brocade, Cisco and QLogic. And BladeCenter supports industry-leading Fibre Channel host bus adapters from QLogic and Emulex. These options work well with the IBM System Storage DS3400 and DS4000 series. IBM data tells us that more than 40% of BladeCenter users attach their blades to a SAN. This is likely due to the wide selection and cost savings associated with integrated Fibre Channel.

## **Who Should Consider Blade Servers vs. Rack Servers**

Consider blade servers if you:

- Plan to buy or replace six or more servers within the next twelve months
- Wish to set up a durable, long-term IT infrastructure that will grow with you
- Are running applications like Web serving and online commerce, networking, e-mail consolidated file and print, along with large-scale database applications like data warehousing
- Run high-performance computing (HPC) applications such as digital signal processing, bioinformatics, seismic modeling, crash simulations or digital rendering
- Have old Intel/AMD or SPARC processor-based servers suffering from poor availability and performance, lack of floor space, limited power and cooling capabilities in your data center, and difficulty keeping track of and managing servers
- Are transitioning from UNIX® to Linux®
- Currently use AIX®
- Currently use Solaris 10 or plan to move to Solaris 10 on x86 architectures

- Currently use Solaris and are looking for a low-cost transition to Linux
- Are looking to migrate from Sun T2000 servers
- Face limitations due to an aging data center
- Are looking to integrate Intel, AMD and/or IBM processor-based servers within one infrastructure
- Are looking to reduce system administration costs through consolidation and more efficient remote management

Stay with rack servers if you:

- Have few servers and are not growing your infrastructure
- Require SMP systems with eight or more processors
- Require a large number of PCI slots or a very large memory footprint

# Citrix Solution

Citrix Presentation Server (PS) enables users to potentially save large sums of money on management costs and to minimize data security risks by installing all Windows applications in the data center and virtualizing or streaming them to end users over the network.

It allows you to deliver applications quickly to remote users without leaving the data center, by using state-of-the-art application streaming and application virtualization technologies. It eliminates the need to install or manage applications on individual user devices, helping to make application testing, provisioning, management and support easier and less costly.

Presentation Server helps you prevent data from leaving the data center without explicit authorization, supporting regulatory compliance and security objectives. Built-in endpoint scans and policy controls take into account each user's role, device characteristics, and network conditions to determine which applications and data they are authorized to access. Integrated single sign-on and a secure SSL VPN gateway for remote access enable a "one password, one path" approach to application and data access.

Presentation Server greatly reduces network bandwidth requirements through application virtualization techniques perfected over the past 15 years. PS greatly reduces network bandwidth requirements and mitigates latency issues, because with virtualized applications only mouse movements, keystrokes, and screen updates traverse the network. Even data-laden and graphics-heavy applications perform better, keeping users active and productive.

Thousands of customers currently run mission-critical environments on racks full of aging 1U or 2U dual-processor servers and back-level Presentation Server software. IBM BladeCenter® products, combined with Citrix Presentation Manager v4.5, offer an innovative way to update your environment to the latest technology and help achieve the following:

- Vastly reduced server count—reduce your number of servers by up to two-thirds
- Reduce software licensing costs
- Move to 64-bit technology with Presentation Manager v4.5—at no extra cost from Citrix
- Optimize the heat, power, and space requirements of a Presentation Manager farm
- Reduced management overhead vs. running hundreds of servers

Which method is right for you—scale up or scale out? PS v4.5 supports both scale-up (via the IBM System x3800 or x3850), and scale-out (via BladeCenter blades).

Citrix PS v4.5 offers both 32-bit and 64-bit versions, to support whatever your operating environment is. This provides you with the flexibility to run a mixed environment initially and migrate over time.

If you have large scale-out "farms" of Citrix PS servers, made up of 1U and 2U servers, you know what a massive infrastructure and management headache it can be. The BladeCenter family may be the answer if you're looking to simplify your infrastructure, improve flexibility and speed of deployment, and consolidate your space, heat, and power use.

BladeCenter chassis support a wide variety of 2- and 4-socket server blades. This flexibility is what makes the platform ideal for a customer in a state of transition. If you plan to move to PS x64 in 6-12 months, you might prefer an **HS21**, **HS21 XM**, or **LS21** blade, running in 32-bit mode initially, and then migrate to an x64 environment later (running the same hardware). If you have a mixed PS x32/x64 environment, you might choose **LS21** or an **LS41** 2-socket configuration for your x64 platform, and then later upgrade the **LS41** to a 4-socket blade. For a scale-up configuration in a blade form factor, you might choose a 4-socket/dual-core **LS41** or a 2-socket/quad-core **HS21 XM** right from the start.

The BladeCenter family of products offers you ultimate flexibility and maximum potential investment protection. In addition to the flexibility of processor choice, there are also huge potential infrastructure consolidation benefits to be had: all networking, SAN, KVM connectivity, systems management, and power connectivity is integrated into the chassis, potentially saving large sums of money by requiring fewer cables, PDUs, KVM switches, and other infrastructure hardware. Additionally, BladeCenter chassis and blade servers offer significantly more efficient heat/power characteristics than do dozens of 1U and 2U rack servers.

# IBM Virtualization Solution

Today, the line between scale-up and scale-out servers is blurring. Multicore processors allow all servers to run scale-up workloads to some extent. At the same time, scale-up servers can run multiple virtualized scale-out workloads. Performance becomes about utilization through virtualization, which is crucial to unlocking the value of multicore processors. It's an intelligent sharing of computing, storage or information resources across different disciplines and departments in your organization. System resources are gathered into one pool—and can be allocated dynamically as needed—so servers and storage resources can be utilized more efficiently.

As a result of virtualization, the focus of high-end scalable x86 systems has shifted from a hardware-centric view to one of flexibility and cost-per-virtual-machine. Running 20 or 50 or 100 applications on the same server instead of one task per server is more cost-effective. And it allows the applications to share a dynamically allocated pool of common system resources for improved efficiency.

Businesses of all sizes continue to struggle with the overwhelming complexity created by the rapid growth of their IT environments. A business's increasing IT demands may appear to be a never-ending and costly spiral:

- As the business grows, more computing power is required
- Installation and maintenance costs and data center complexity increase as more servers are added
- Deployment of additional servers and applications may require additional IT personnel

Virtualization is the process of presenting computing resources in ways that allow for *more productive* IT, and IT that is *more responsive* to business goals. Previously, resources were presented only in the ways dictated by their implementation, geographic location or physical packaging. The move toward virtualization helps to improve resource utilization and simplify IT management.

Because Virtualization is a more effective way to run IT, it is IBM's view that soon virtualization will be utilized across all environments, at all levels of server and storage implementation. Our servers, from entry level to high end to blades, are designed to be optimized for virtualization. For example, BladeCenter, with its modular design, provides you with an extremely flexible solution for virtualization and scale-out growth—supporting multiple processors, operating systems and switches all in the same chassis.

With one hardware platform, you can run your heterogeneous interactive business applications by day and your maintenance, inventory or computational programs at night. With our portfolio of System x™ and BladeCenter® servers, your virtualization needs are covered, whether scale-up or scale-out.

## IBM Virtual Client

With IBM's Virtual Client solution, users are able to enjoy all of the benefits and personal control of a stand-alone desktop—functionality including print capabilities, USB drive support, and audio—while reducing many of the challenges related to current stand-alone desktop environments. These include limiting susceptibility to theft and viruses, ease of deployment of new users, extended downtime during a hard drive failure, or having to rebuild their preferences and settings after each client “refresh.”

- Receive highly secure access to your desktop from virtually any client device at any time.
- Centralize management of all desktops for better utilization of resources.
- Simplify infrastructure—now and into the future—with System x and BladeCenter architecture technology.
- Help lower costs with fewer IT staff; application and data are managed centrally.

IBM's Virtual Client solution runs desktop functions on BladeCenter or System x servers in a data center—providing users with remote access to the desktop environment. A full-featured OS such as Windows XP is virtualized using VMware software and accessed via thin client hardware devices or repurposed desktops. Connection broker software connects users to their virtual client machines on the server. While the end user benefits from retaining control over their desktop environment, companies benefit from the cost and management advantages of a centralized computing environment. Virtual Client practically eliminates desk side support resources and is designed to provide much improved levels of security and reliability.

The IBM Virtual Client solution offers companies large and small the capability to improve client efficiency and security for:

- Branch offices
- Call centers
- Outsourced development
- Remote development
- Remote offices
- Retail stores
- Roaming users

The IBM Virtual Client solution is competitively priced with traditional desktop deployments and can be economically deployed for as few as 25 users.

The IBM virtual client solution runs desktop functions on a BladeCenter or System x server in a data center-providing users with remote access to the desktop environment. The solution is designed to eliminate the traditional desktop replacement cycle, enhance system security and availability and improve administrative efficiency.

IBM Virtual Client solution components can include:

#### **IBM System x and BladeCenter Servers**

IBM System x and BladeCenter servers are built on open standards and offer a range of affordable, high performance, easy to manage platforms designed to help optimize your datacenter and lower your cost of ownership.

#### **IBM System Storage**

- **IBM System Storage DS3400** leads the way for organizations to take advantage of consolidating and sharing data within a direct-attach or SAN solution. The DS3400 offers the opportunity to meet the demands of data expansion, data availability and flexibility in a simple, affordable disk system.
- **IBM System Storage DS4000 Series** is well-known for its exceptional performance, robust functionality and unparalleled ease of use. The DS4000 disk systems are designed to allow you to create a system to handle some of the most compute-intensive workloads and provide robust functionality while maintaining availability of your data.

#### **Thin Client Hardware from IBM Business Partners**

- **Neoware** thin client offerings enable end-users to run Windows®, mainframe, midrange, UNIX®, Linux, or Internet applications on smart, solid-state appliances across a wired or wireless network - just choose a thin client platform, operating system and software application that best meets your need.
- **Devon IT** thin clients are more than a cost-effective alternative to standard PCs. End-users can run their Windows and Linux desktops and Windows, UNIX, Linux and mainframe applications directly from data center servers, enabling centralized applications management, network plug-and-play conveniences, higher security and reliability, and much lower IT support costs.
- **Wyse Technology** and its partners delivers the hardware, infrastructure software, and services that comprise thin computing, allowing people to access the information they need using the applications they want, but with better security, manageability, and at a much lower total cost of ownership than a PC.

#### **Middleware**

- **IBM Director** is an integrated, easy-to-use suite of tools that provide customers with flexible systems management capabilities to help realize maximum systems availability and lower IT costs.
- **IBM Virtualization Manager** is an extension to IBM Director that allows you to discover, visualize, and manage both physical and virtual systems from a single console. Virtualization Manager simplifies management of both VMware and Microsoft® Virtual Server environments.
- **IBM Tivoli Provisioning manager (TMP)** helps to enable the process of setting up a virtual client environment on demand by automating the manual tasks of provisioning and configuring physical and virtual servers, operating systems, middleware, applications, storage and network devices (routers, switches, firewalls and load balancers).
- **VMware** applications can virtualize servers, storage and networking, allowing multiple unmodified operating systems and their applications to run independently in virtual machines while sharing physical resources—helping to improve hardware utilization, save space, IT staffing and hardware costs.
- **LeoStream Virtual Connection Broker** software allows a user to connect to their virtual machine with a single user sign on, providing a great benefit to your desktop users. Functionality includes VM pooling, stickiness, labeling, monitoring, and reporting.
- **Microsoft Active Directory and roaming user profiles.** By default, Windows desktop systems store user profile data (personal configuration settings) on the local hard drive. Alternatively, Microsoft Windows 2003 can enable storing per-user profile and settings data on a server.

#### **Services**

- **STG Lab Services** helps bring the skills and experience of the development lab to your enterprise through on-site consulting, classroom training, and skills transfer to your personnel in your System x or BladeCenter environment.



## For More Information

IBM System x Servers

Electronic Service Agent

IBM System x and BladeCenter Power Configurator

Standalone Solutions Configuration Tool

Configuration and Options Guide

ServerProven Program

Technical Support

Other Technical Support Resources

<http://www.ibm.com/systems/x>

<http://www.ibm.com/support/electronic>

<http://www.ibm.com/systems/bladecenter/powerconfig>

<http://www.ibm.com/servers/eserver/xseries/library/configtools.html>

<http://www.ibm.com/servers/eserver/xseries/cog>

<http://www.ibm.com/servers/eserver/serverproven/compat/us>

<http://www.ibm.com/server/support>

<http://www.ibm.com/servers/eserver/techsupport.html>

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Some machines are designed with a power management capability to provide customers with the maximum uptime possible for their systems. In extended thermal conditions, rather than shutdown completely, or fail, these machines automatically reduce the processor frequency to maintain acceptable thermal levels.

MB, GB and TB = 1,000,000, 1,000,000,000 and 1,000,000,000,000 bytes, respectively, when referring to storage capacity. Accessible capacity is less; up to 3GB is used in service partition. Actual storage capacity will vary based upon many factors and may be less than stated.

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will depend on considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

Maximum internal hard disk and memory capacities may require the replacement of any standard hard drives and/or memory and the population of all hard disk bays and memory slots with the largest currently supported drives available. When referring to variable speed CD-ROMs, CD-Rs, CD-RWs and DVDs, actual playback speed will vary and is often less than the maximum possible.

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