



Product Guide

September 2008

IBM System x3850 M2 / x3950 M2

Architecture Overview

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Outstanding performance, superior mainframe-like reliability, and fault-tolerant memory characteristics

IBM® has been designing and implementing chipsets under the X-Architecture™ name since 2001. eX4 technology represents the fourth generation of products based on the same design principle IBM began with in 1997: to offer systems that are expandable, offer “big iron” reliability, availability, and serviceability (RAS) features, with extremely competitive price/performance on an Intel® Xeon® processor-based system.

The eX4 technology is primarily designed around three major workloads. These workloads are database servers, server consolidation using virtualization services, and Enterprise Resource Planning (application and database) servers.

If you are adopting industry-standard Xeon EM64T servers for running business critical applications, the systems that run these applications need the type of technology designed into IBM's eX4 technology systems. The eX4 chipset represents a \$100M+ investment in designing a flagship offering that can harness the power of 4-socket-and-up 64-bit x86 (x64) Xeon processors. The eX4 design includes two **4U 4-socket** rack-optimized chassis (**x3850 M2** and **x3950 M2**) with the ability to scale up to **16 sockets** and up to **96 cores**. In fact, you can start with a single-node x3850 M2 chassis, and by adding a **ScaleXpander Option Kit**, you can turn it into an **x3950 M2**, ready to expand into a multi-node configuration providing more flexibility in deploying your scalable solution than ever before.

The x3850 M2 now offers *selected* models **integrated** with **VMware ESXi 3.5 preloaded** on an **IBM 4GB USB 2.0 Flash Key**. It operates in a diskless configuration, offers a smaller memory footprint, extremely high performance, and stronger security, making getting a system up and running in a virtualized environment faster and easier than ever before.

IBM X-Architecture pioneered XpandOnDemand™ (“pay as you grow”) scalability, which allows chassis to be simply cabled together to form larger scale-up systems. This unique capability allows IBM to sell a large SMP (symmetric multiprocessing) system at entry price points. Other Intel OEMs can't match this capability. If they offer a 16-socket product at all, they require you to start out with a 16-socket chassis, whether you'll ever grow into it or not. With XpandOnDemand, you can start small, with a 4- or 8-socket configuration, and later expand as your needs change, without requiring you to buy more than you need up-front or throw away parts later as you expand.

IBM's eX4 technology-based systems are the ideal solution for scale-up database-serving applications on Microsoft® Windows® with Microsoft SQL Server® or IBM DB2®, as well as Linux® with Oracle 9i RAC and 10g, or IBM DB2. Database hosting demands ultimate server reliability features, and once installed, they grow and grow. The eX4 design offers two strong selling arguments against the competition: lower initial purchase price, and potentially much lower long-term TCO.

Another strong application area for the eX4-based systems is enterprise server consolidation activities. Larger servers have more processor, memory and I/O resources, which make maximum use of any applicable virtual machine software licensing fees and deliver superior system utilization levels. The name of the game in consolidation activities is to deploy the fewest new servers possible and help IT staff manage more images with the same or fewer overall people.

One of the fastest growing application areas for eX4-based systems is ERP workloads, including SAP and Oracle. eX4-based systems can offer considerable savings over UNIX deployments, using our certified solution stacks on either Windows or Linux.

The **4-socket** eX4 servers are designed to protect your data with high performance, high reliability, and high availability. They support the latest **six-, quad- and dual-core** Intel® Xeon™ processors, designed with high-performance **quad 1066MHz** front-side buses (FSB), **64-bit extensions (EM64T)**, and either **8MB (dual-core)**; **4MB, 6MB, or 8MB (quad-core)**; or **9MB of L2 cache; 8MB, 12MB or 16MB (six-core)** of L3 cache, and up to **256MB of L4 cache per chassis** (all models), to help provide you with the computing power you need to match your

business needs and growth. In addition, the x3850 M2 and x3950 M2 use industry-standard **DDR II** memory with **Chipkill™ ECC** (Error Checking and Correcting) protection—for high performance and reliability and lower energy consumption than fully buffered memory. For even higher levels of availability, the eX4 servers also offer **Memory ProteXion™**, **memory scrubbing**, and selectable **memory mirroring**. A **dual-port** integrated high-speed **Gigabit Ethernet** controller with **TOE** (TCP Offload Engine) is standard, as are **seven** high-performance **PCIe x8** adapter slots (two of them **hot-plug**).

The x3850 M2 and x3950 M2 offer industry-leading scalability, including **quad-processor** support (upgradeable to **16 processors/96 cores**), up to **256GB** of memory *per chassis* (upgradeable to **1TB** overall), **256MB** of **L4 cache** *per chassis* (upgradeable to **1GB**), and up to **four 2.5-inch** internal high-performance **Serial-Attach SCSI** (SAS) **hot-swap** hard disk drives with an internal storage capacity of **587.2GB** *per chassis* (up to **16** drives and **2.3TB** overall). Hardware-based **RAID-0/1** support is standard. An optional IBM **ServeRAID-MR10k** SAS RAID controller adds **256MB** of battery-backed cache to the onboard controller to provide **five additional** RAID levels, including **RAID-10/5/50/6/60**. The **4U** size of the chassis helps you maximize your rack investments. Up to **10** of these chassis can be installed in a single 42U rack, for a total of up to **40** processors, **70** PCIe slots (**20** of them hot-plug), and **40** HDDs, offering an ideal balance of performance, storage and I/O slots per rack. Optional Advanced Connectivity Technology (**ACT**) interconnect cabling helps reduce cable clutter and cost and minimizes installation time when interconnecting many rack-mounted servers.

Standard in both the x3850 M2 and the x3950 M2 is the **Remote Supervisor Adapter II** that communicates with the **Baseboard Management Controller (BMC)** to enable the user to manage and control the server easily—both locally and remotely. This high level of manageability is designed to help keep management costs down and the system up. The drop-down **light path diagnostics** panel enables quick servicing of the system if a problem develops. These advanced features help maximize network availability by increasing uptime, as do **hot-swap/redundant HDDs**, **power** and **fans**; **Active Memory™**; **temperature-controlled fans** with **Calibrated Vectored Cooling™**; **IPMI 2.0** support, including **highly secure remote power control** and **Serial over LAN**; as well as **text- and graphics-console redirect over LAN**.

With the inclusion of unique IBM service and support features such as **IBM Systems Director**, **IBM Systems Director Active Energy Manager™ for x86** (formerly known as PowerExecutive), and **IBM ServerGuide™**, the x3850/x950 M2 is designed for maximum uptime.

If you need a balance of high-performance four-socket processing, scalability beyond eight sockets, and large I/O capacity in a rack-dense environment, these are the ideal systems.

Key Highlights

eX4 Design Features

eX4 design offers numerous features per chassis to boost performance and reduce product and operating costs:

- Support for up to four Intel Xeon processors with four **1066MHz** front side buses and **4MB-to-16MB** of integrated **Level 2** cache (model dependant), **8MB**, **12MB**, or **16MB** of external **L3** cache (model dependant), Intel VT technology, and Intel EM64T technology
- Supports **Xeon six-core**, **quad-core** or **dual-core** processors (scalable to **16** processors and **32-to-96** cores, using the **ScaleXpander Option Kit**)
- A built-in **'snoop' filter** to lower the amount of inter-processor communication needed in an SMP system
- Fast **PC2-5300 DDR II** ECC memory with **Chipkill** error correction, **Memory ProteXion™** (redundant bit steering), **memory scrubbing**, selectable **memory mirroring**, and **hot-add/hot-swap** memory protection provides speed and high availability
- **Seven 64-bit** high-speed (**4Gbps**) **PCIe x8** adapter slots offer investment protection by supporting high-performance adapters, such as 10Gb Ethernet, Fibre Channel and InfiniBand cards; the **two Active™ PCIe hot-plug** slots help increase system availability
- Up to **587.2GB** of internal SAS storage using **four 2.5-inch** HDDs per chassis (scalable to **2.3TB** using the ScaleXpander Option Kit)
- **Baseboard Management Controller (BMC)** and **Remote Supervisor Adapter II** standard
- Support for an optional **ServeRAID-MR10k** RAID controller that supports **RAID-0/1/10/5/50/6**, and **60**

IBM System x3850 M2-specific

- A **4U** rack-optimized model (expandable to 16U using a **ScaleXpander Option Kit** and three additional chassis)
- Installing the **ScaleXpander Option Kit** turns the x3850 M2 into an x3950 M2 (including a new bezel, cable management arm, and scalability "key")
- **4GB USB 2.0 Flash Key** with **VMware ESXi preinstalled** (in selected models)

IBM System x3950 M2-specific

- **ScaleXpander Option Kit standard**
 - **Offers physical partitioning at four-socket granularity** allowing you to run multiple operating systems on the same integrated hardware
 - Support for **up to two ServeRAID-MR10k options** if a multi-chassis configuration is used
-

Key Features

High-Performance Xeon Processors

The x3850 M2 and x3950 M2 ship with **two** high-performance Intel **Xeon** processors, and support up to **four**, allowing you to upgrade as business needs require. The eX4 servers also go a step further by allowing you to add additional nodes (chassis) to increase the number of sockets from **4** to as many as **16** (using **four** total chassis). (The **ScaleXpander Option Kit** converts a 4-socket x3850 M2 into an ultra-expandable x3950 M2.) With multiple chassis, you can use physical partitioning to segment the one physical server into multiple logical servers for virtualization.

Processors can be added or replaced through the top cover of the system. The system offers a choice of processor clock rates, FSB speeds and power draw:

- **130W six-core** Xeon processor model **X7460** at 2.67GHz, with 64-bit extensions, *low power draw per core (21.67W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **16MB** of shared **L3** cache
- **130W quad-core** Xeon processor model **X7350** at 2.93GHz, with 64-bit extensions, **32.5W** per core of power draw, quad **1066MHz** FSBs, and **8MB** of **L2** cache (2 x 4MB; 2MB per core)
- **90W six-core** Xeon processor model **E7450** at 2.4GHz, with 64-bit extensions, *extremely low power draw per core (15W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **12MB** of shared **L3** cache
- **90W quad-core** Xeon processor model **E7420** at 2.13GHz, with 64-bit extensions, *low power draw per core (22.5W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **8MB** of shared **L3** cache
- **80W quad-core** Xeon processor model **E7330** at 2.4GHz, with 64-bit extensions, *low power draw per core (20W)*, quad **1066MHz** FSBs, and **6MB** of **L2** cache (2 x 3MB; 1.5MB per core)
- **80W quad-core** Xeon processor models **E7320** at 2.13GHz, with 64-bit extensions, *low power draw per core (20W)*, quad **1066MHz** FSBs, and **4MB** of **L2** cache (2 x 2MB; 1MB per core)
- **80W dual-core** Xeon processor model **E7210** at 2.4GHz, with 64-bit extensions, *40W per core of power draw*, quad **1066MHz** FSBs, and **8MB** of **L2** cache (2 x 4MB; 4MB per core)
- **50W quad-core** Xeon processor model **L7445** at 2.13GHz, with 64-bit extensions, *extremely low power draw per core (12.5W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **12MB** of **L3** cache



Also available via special bid/configure-to-order:

- **90W quad-core** Xeon processor model **E7440** at 2.4GHz, with 64-bit extensions, *extremely low power draw per core (15W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **16MB** of shared **L3** cache
- **90W quad-core** Xeon processor model **E7430** at 2.13GHz, with 64-bit extensions, *extremely low power draw per core (12.5W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **12MB** of shared **L3** cache
- **65W six-core** Xeon processor model **L7455** at 2.13GHz, with 64-bit extensions, *extremely low power draw per core (10.83W)*, quad **1066MHz** FSBs, **9MB** of **L2** processor cache (3 x 3MB; 1.5MB per core), and **12MB** of shared **L3** cache

The **dual-core Xeon** processors contain **two complete processor cores**. Each processor contains **two 4MB L2 caches**, **4MB per core (8MB total per processor)**. The two cores appear to software as separate physical processors. The dual-core processors can offer more than double the performance of a same-speed single-core Xeon processor (depending on workload). Similarly, **quad-core Xeon** processors contain **four processor cores**. The cores share dual **2MB, 3MB, or 4MB L2 caches (4MB, 6MB, or 8MB total per processor)**. That is, **two cores per L2 cache**. They can offer more than double the performance of dual-core Xeon processors (again, depending on workload). The **six-core** processors contain **six processor cores**. The cores share dual **4MB, 6MB, or 8MB L2 caches (8MB, 12MB, or 16MB total per processor)**.

The servers provide **four separate 1066MHz FSBs** (front-side buses), *one per processor*. Each of the four FSBs (which connect memory and I/O to the processor) boasts a peak rate of **8.53GBps (34.1GBps aggregate)**. This contrasts to the **two 667MHz FSBs** (with up to two processors per FSB) provided in the original x3850/x3950 models. In other words, you now have

twice as many FSBs as before and each is **60%** faster than before.

Intel **Extended Memory 64 Technology (EM64T)** 64-bit extensions allow the Xeon processor to use large memory addressing when running with a 64-bit operating system. This in turn lets individual software processes directly access more than 4GB of RAM, which was the limit of 32-bit addressing. This can result in much higher performance for certain kinds of programs, such as database management and CAD. Additional registers and instructions (SSE3) can further boost performance for applications written to use them. Customers should contact their software provider to determine their software support for EM64T.

Intel's **Virtualization Technology (VT)** integrates hardware-level virtualization hooks that allow operating system vendors to better utilize the hardware for virtualization workloads, a key workload for the eX4 platform.

eX4 Chipset 'Snoop' Filtering

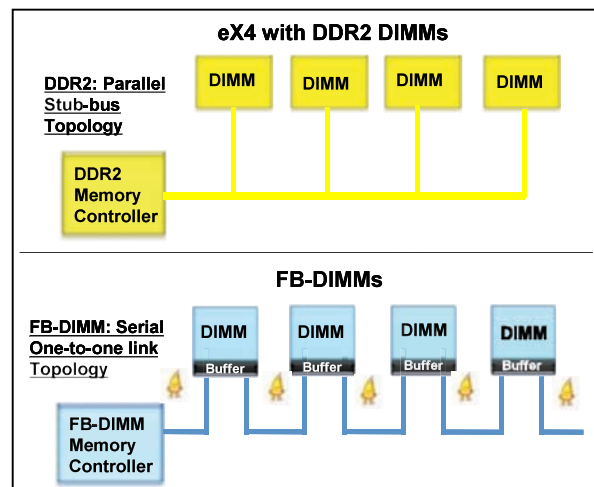
One of the core features of the eX4 chipset that gives the platform a performance advantage is the snoop filter. The Xeon Coherency Protocol or "snoop" is an operation that occurs whenever a processor in an SMP system needs to update a memory address during normal operation. The snoop occurs when the processor getting ready to operate on a piece of data asks the other processors in the SMP complex to verify they have not modified the same piece of data without writing back from their cache. This operation increases traffic on the front side bus.

The eX4 chipset contains **324MB** of EDRAM within the Northbridge chip. This copies all data as it is written to the processor cache, allowing the chipset to respond directly to the snoop requests. This reduces the overall traffic across the FSB and helps to improve system performance over other architectures. (Intel now offers a first-generation snoop filter in their 7300 chipset; however it contains only 64MB of RAM which is **80% smaller** than the eX4 fourth-generation solution.)

Advanced Buffer eXecution

The IBM Advanced Buffer eXecution (ABX) chips (2 per chassis) provide the x3850 M2 / 3950 M2's DDR2 memory with up to **60%** more bandwidth than other vendors can manage using more expensive (and more energy-hungry) Fully Buffered DIMMs (FB-DIMMs). The ABX chip uses two buffers per memory card to re-drive the signals from the eX4 memory controller to the DIMMs, bypassing the latency-adding buffers used on each FB-DIMM. The use of ABX **reduces latency by 20%** vs. FB-DIMMs.

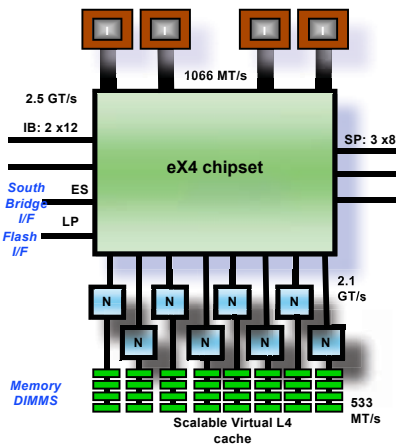
This feature is a unique IBM enhancement, not offered by other x86 server architectures (using either Intel or AMD processors).



XceL4v Dynamic Server Cache

Another performance feature of the eX4 chipset is the XceL4v L4 cache. When using a single node (chassis), the cache works with the snoop filter to help reduce FSB traffic. When *more* than one node is used, **256MB** of virtual cache *per node* (taken from main memory) is used for interprocessor communications between chassis, to keep data in synch. In a 4chassis configuration, this amounts to as much as **1GB** of L4 cache. This not only compensates for any performance hit that might otherwise result from sending data across the distances between processors in multiple chassis, it actually results in a performance improvement versus a single chassis. (IBM X3 and eX4 servers have achieved well over 100 #1 results on industry-standard benchmarks, such as TPC-C, TPC-E, TPC-H, SAP SD, vConsolidate, Vmark, and more.)

This feature is a unique IBM enhancement, not offered by other x86 server architectures (using either Intel or AMD processors).



High-Speed Scalability Ports

When more than one chassis is used, they are simply cabled together via one or more scalability cables. Up to three cables connected to low-latency, **10.24Gbps** full-duplex ports (5.12Gbps in each direction), supported by up to **1GB** of **L4** cache, provide exceptional interchassis throughput (**30.72Gbps** aggregate). Because of this design, an x3950 M2 server has the incredible flexibility of starting out as a 4-socket server with up to 256GB of memory, 256MB of L4 cache, seven PCIe adapter slots, and four HDD bays, and then doubling, tripling, or even quadrupling those numbers while maintaining first-in-class performance.

This feature is another unique IBM enhancement, not offered by other x86 server architectures.

DDR II ECC Memory with Active Memory Protection

The eX4 servers support up to **256GB** of memory per node (chassis) in **32** DIMM sockets (up to **1TB** for a **4-node/16-processor** configuration). It uses **PC5300** double data rate II (DDR II) memory (operating at **533MHz**) for faster access, and provides IBM Active Memory features, including advanced IBM **Chipkill** memory protection, for **up to 16X** better error correction than standard ECC memory, IBM **Memory ProteXion**, hot-add/hot-swap memory support, and optional **memory mirroring**. (**Notes:** Hot-add capability requires operating system support. Hot-add memory and mirroring are mutually exclusive. Conversely, hot-swap requires mirroring.)

The standard configuration includes **two** memory cards, which support up to **eight** DIMMs apiece. The system is upgradeable to **four** memory cards with **eight** DIMMs each. With configurations of 8-to-16 DIMMs, using two memory cards saves cost, but using four cards increases performance. (With more than 16 DIMMs, four memory cards are required.)

The memory architecture of the eX4 chipset provides up to **60%** more aggregate memory bandwidth (up to **34.1GBps** when using four memory cards vs. a maximum of 21.3GBps bandwidth in the previous generation), for exceptional memory performance, and **quadruple** the system memory capacity of the predecessor x3850 server. By performing reads and writes simultaneously, it eliminates the previous memory read-to-write blocking latency. In addition, it also offers innovative data reliability and security features to help improve data integrity, including enhanced CRC protection, data retry on error detect and buffer registers for improved fault isolation. Even running at 533Mhz, with twice the number of channels and twice the DIMM capacity supported, the x3850 M2 and x3950 M2 deliver a memory subsystem with greater throughput than the competition. In addition, the DDR2 DIMMs use up to **37% less energy** than the competition's FB-DIMMs.



Memory scrubbing is an automatic daily test of all system memory. It detects and reports memory errors that might be developing before they cause a server outage. Memory scrubbing and Memory ProteXion work together. When a bit error is detected, memory scrubbing determines whether the error is recoverable. If the error is recoverable Memory ProteXion technology will write the data to new location; if it is not recoverable, scrubbing sends an alert to light path diagnostics, which then notifies IBM Systems Director.

Memory ProteXion technology (also called redundant bit steering) provides *multichip* error protection and works in conjunction with **Chipkill** technology—which provides *multibit* protection per chip—and standard ECC protection, to provide *three-level* memory correction. For increased availability, the eX4 design offers an additional level of Active Memory protection: *memory mirroring*.

Memory mirroring works much like disk mirroring. The total memory is divided into two channels. Data is written concurrently to both channels. If a DIMM fails in one of the DIMMs in the primary channel, it is instantly disabled and the mirrored (backup) memory in the other channel becomes active (primary) until the failing DIMM is replaced. **Note:** Mirroring requires DIMMs to be installed in multiples of *four* (one pair per memory channel).

A secondary benefit of memory mirroring is that the failed DIMM and its memory card can be hot-swapped out to replace the failed DIMM. This is a hardware feature that is operating system independent.

DIMMs must be installed in matching pairs. Memory is available in kits consisting of *two* **1GB**, **2GB**, **4GB** or **8GB** DIMMs.

Flexible Internal Storage Capacity

The eX4 servers offer a choice of internal storage, supporting up to **four** (**2.5-inch**) **hot-swap** high-performance Serial-Attach SCSI (**SAS**) drives per chassis. In addition, selected models of the x3850 M2 include an integrated **4GB USB 2.0 Flash Key** with VMware preloaded as an embedded **virtualization hypervisor**.

2.5-inch SAS

- **10,000** RPMs — 73.4 or **146.8GB** (**587.2GB** maximum *per chassis*; **2.349TB** in a 4-chassis configuration)
- **15,000** RPMs — **73.4GB** (**293.6GB** per chassis; **1.174TB** per 4 chassis)

2.5-inch drives not only require less space than 3.5-inch drives, they *weigh less, consume half the power, produce less noise, seek faster, and offer increased reliability.*

The hot-swap SAS drives use the Converged Tray for interchangeability with other IBM System x™ systems. If you need more storage space, terabyte capacities are possible with external direct-attach NAS and SAN solutions.

Integrated Virtualization

Selected models of the x3850 M2 ship with an **IBM 4GB USB 2.0 Flash Key** installed preloaded with **VMware ESXi 3.5**. This is an embedded version of VMware ESX 3.5, fully contained on the flash drive and requiring no disk space—not an “ESX Lite.” Rather than management through a Service Console based on a Linux operating system, ESXi 3.5 relies on aggregate management tools, including VirtualCenter, the Remote Command Line interface and the introduction of CIM for standards-based and agentless hardware monitoring.

VMware ESXi 3.5 includes all the performance, scalability and compatibility features of ESX 3.5, including full **VMFS** support across FC SAN, iSCSI SAN, and NAS, and **4-way VSMP**. Because it runs from flash memory, it's extremely fast and ideal for diskless configurations. It also offers enhanced security, because it runs without an operating system-based console and is updated/patched much like firmware. Licensing works the same as for “standard” ESX 3.5.

If you prefer **Microsoft Hyper-V™** to VMware, the intent is for the x3850 M2 and x3950 M2 to fully support Microsoft's hypervisor software installed on the system HDD at a future date.



Disk/Tape Controllers

All models include an integrated eight-port **LSI 1078 Serial-Attach SCSI (SAS)** controller. This controller supports up to **four internal SAS LVD** (low-voltage differential) drives.

The integrated SAS controller offers *hardware RAID-0/1* support for those SAS drives. The **ServeRAID-MR10k** option adds additional RAID levels, including **RAID-10, 5, 50, 6** and **60**, along with **256MB** of **battery-backed cache** memory for higher performance and data integrity, *without* consuming a valuable PCIe adapter slot.

The **SAS** controller provides data transfer speeds of up to **300MB** per second¹ in *each* direction (**full-duplex**) across the SAS bus, for an aggregate speed of **600MBps**, nearly double that of Ultra320 SCSI's **320MBps** (half-duplex) bandwidth. The serial design of the SAS bus allows maximum performance to be maintained as additional drives are added.

Additional external SAS/SATA disk storage, as well as tape backup, is available using the **external SAS port** on the system unit, or via one of several supported iSCSI or FC SAN controllers.

Drive Bays

The eX4 servers contain **five** drive bays (per chassis) in all—including **four 2.5-inch** HDD bays that support **hot-swap SAS** drives totaling up to **587.6GB**.

A **24X/10X/24X/8X²** speed (ultraslim, 0.5”) CD-RW/DVD-ROM combo drive with an IDE interface ships standard in all x3850 M2 and x3950 M2 servers. No floppy drive is supplied with any model; an external USB floppy drive may be used, if needed.

For still more storage, a direct-attach, iSCSI, or FC SAN external expansion option can be added, using an optional controller.



High-Performance Adapter Slots

There are **seven physical x8** (“by 8”) **PCIe (PCI Express)** adapter slots standard (per chassis). Each is capable of supporting **x4** or **x8** adapters. All slots are **half-length/full-height**. *Electrically* they are x8 slots as well (meaning that they operate at full **x8 4GBps** speeds). Slots **6** and **7** are **Active PCIe hot-add/hot-swap** slots, offering the capability to add or replace adapters without having to shut down the system.

PCI Express is a high-performance, low-latency, next-generation serial I/O bus that is rapidly replacing the older parallel PCI and PCI-X buses. A **x8** PCIe adapter offers approximately **four**



¹ Data transfer rates depend on many factors and are often less than the maximum possible.

times the maximum throughput of a 133MHz PCI-X adapter³. (A x1 adapter offers throughput similar to a 66MHz PCI-X slot.)

Because the **SAS, ServeRAID-MR10k, dual Gigabit Ethernet, and systems management controllers** are integrated onto the system board, the seven adapter slots are all *available*, which offers you a wide degree of latitude in expansion options.

(Even though the HP DL580G5 has eleven total slots, they offer lower throughput, providing no more aggregate bandwidth than the seven slots of the eX4 servers.)

Dual Gigabit Ethernet Controller

The eX4 systems include one integrated **dual-port Broadcom 5709C** Gigabit Ethernet controller, with **TOE** (TCP Offload Engine) acceleration support (available 1Q/08), as well as **load-balancing** and **failover** capabilities between the two ports.

TOE support helps improve overall system performance by offloading TCP/IP protocol processing from the system microprocessor to the onboard Ethernet TOE processor. **iSCSI** support works similarly for iSCSI workloads.

The controller also supports highly secure remote power management using **IPMI 2.0**, plus **Wake on LAN**[®] and **PXE** (Preboot Execution Environment) flash interface. Optional PCI adapters offering failover and load balancing between adapters are available for added throughput and increased system availability.

Ultra-Efficient Cooling

Six strategically located **hot-swap/redundant fans**, combined with efficient airflow paths, provide highly effective system cooling for the eX4 systems, known as **Calibrated Vectored Cooling**. The fans are arranged to cool **three separate zones**, left, center, and right, with one pair of redundant fans per zone.

The fans automatically adjust speeds in response to changing thermal requirements, depending on the zone, redundancy, and internal temperatures. When the temperature inside the server increases, the fans speed up to maintain the proper ambient temperature. When the temperature returns to a normal operating level, the fans return to their default speed. Why not simply run the fans at 100% capacity all the time? For several good reasons: to reduce the ambient noise, reduce the wear-and-tear on the fans and reduce the server power draw. The reduction in ambient noise and power draw may be relatively minor for a single server, but if you have a larger number of systems the aggregate savings in power and noise pressure can be significant.

In addition, the server uses **hexagonal ventilation holes** in the chassis. Hexagonal holes can be grouped more densely than round holes, providing greater airflow through the system cover.

This cooling scheme is important because newer, more powerful processors generate a significant amount of heat, and heat must be controlled for the system to function properly.

Hot-Swap/Redundant Components

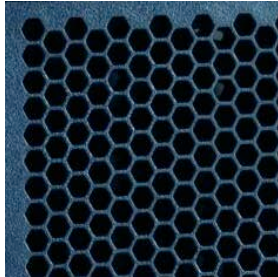
System availability is maximized through the extensive use of hot-swap and redundant components, including:

- **Hot-add/hot-swap redundant memory protection** (with **Chipkill, Memory ProteXion**, and selectable **memory mirroring** capabilities)
 - **Hot-swap redundant hard disk drives** (with standard **LSI 1078** controller and optional **ServeRAID-MR10k** providing multiple levels of RAID support)
 - **Hot-swap PCIe adapter slots** (with optional failover support)
 - **Hot-swap redundant cooling fans** (three redundant pairs)
 - **Hot-swap redundant power supplies**⁴
-

Light Path Diagnostics

Light path diagnostics enables a technician to quickly identify and locate a failed or failing system component, such as a specific memory DIMM. (Monitored components include processors, memory, power supplies, fans, HDDs, adapters, and voltage regulator modules (VRMs), plus system temperature.) This enables quick replacement of the component, which helps increase server uptime and lower operating costs.

The front of the server has an LED indicator light to show possible component failures. If the



² Variable read rate. Actual playback speed varies and is often less than the maximum possible.

³ Actual throughput will depend on the adapter vendor's implementation.

⁴ At 220V both power supplies are redundant; at 110V only the first power supply is redundant.

front LED indicates an error condition, by pressing a button on the front of the server an LED panel will pop out and drop down for easy viewing *without the need to open the server cover* or remove the server from the rack. The light path diagnostics panel tells the servicer which component requires attention. In addition, many components have their own identifying LEDs. For example, each of the memory modules has an LED next to the socket, as do all processors, all adapter slots, all fans, all power supplies, all voltage regulator modules and the service processor, allowing the servicer to easily identify exactly which component needs servicing. By following the "light path," the component can be replaced quickly, and without guesswork. (**Note:** In the event of a failed DIMM, the system will restart and mark the DIMM as bad while offline, thus allowing the system to continue running, with reduced memory capacity, until serviced.)

In addition to the outstanding diagnostic detection, there is a new feature with a digital readout that indicates at what stage of the boot process your system may have experienced trouble. This can reduce the troubleshooting time and help get your system up and running quickly and efficiently.

Other Features

- **Trusted Platform Module standard** — This module provides a highly secure start-up process from power-on through hand-off to the operating system boot loader. ACPI support is provided to allow ACPI-enabled operating systems to access the security features of this module. (TCG V1.2-compliant.)
- **Six USB 2.0 ports** — Provides flexibility to add high-speed external devices. The USB 2.0 specification supports up to 480Mbps transfer rates. (Note: Not all USB 2.0 devices are capable of achieving this rate.) **Two** ports are provided on the front of the server, **three** are on the back, and **one** is internal to support the embedded **4GB USB 2.0 Flash Memory Key** in selected models.
- **Remote Supervisor Adapter II standard** — This full-function systems management adapter provides local and remote management functions in a dedicated PCI-X slot, without consuming one of the seven PCIe adapter slots.
- **Video** — An **ATI Radeon ES1000** SVGA video controller on the Remote Supervisor Adapter II provides up to **1024x768** resolution, with a color depth of **32 bits** at **85Hz** refresh rate, with 16MB of video memory.
- **Toolless slides** — Allows quick rack installation and quicker upgrade and servicing of the server.
- **Toolless chassis** — The cover can be opened without tools, and many components can be removed and replaced without tools, including the CD-RW/DVD combo drive, hot-add/hot-swap memory, hot-swap HDDs, adapters, and the integrated optional ServeRAID-MR10k and Remote Supervisor Adapter II. This can save a servicer significant time.



Rack Cable Management and KVM Console Switching

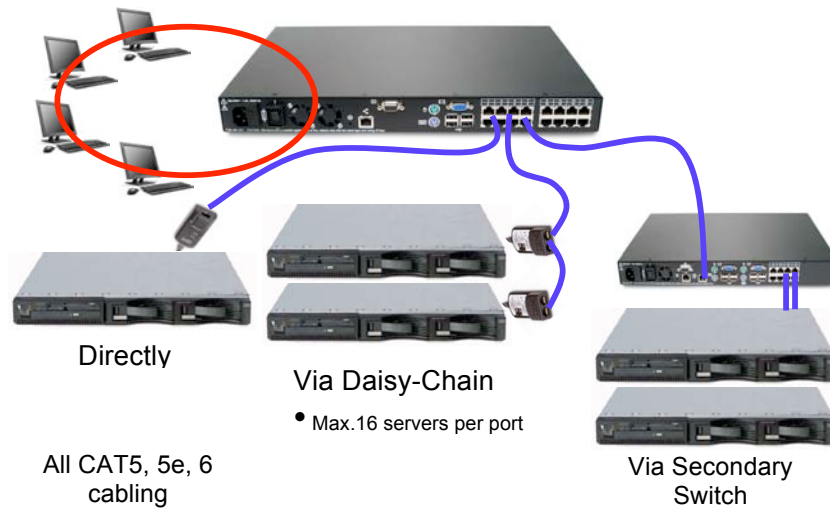
IBM Advanced Cabling Technology (**ACT**) is an optional feature that offers many advantages over standard KVM cabling across the entire System x and xSeries product line. So now you can interconnect all of your servers with one smart cabling architecture. ACT cabling eliminates the need for one-to-one direct connections between each server and a KVM switch by using a daisy-chain approach.

The snarl of cabling behind most racks is at best inconvenient to work around and at worst an expensive logistical nightmare, requiring the rewiring of servers, PDUs, KVM switches, and other equipment whenever a rack server is added or removed. Even worse, the veil of cables blocks rack airflow and can actually contribute to equipment failure due to overheating. ACT cabling is the solution for reducing behind-the-rack cabling by as much as **87%**.

Conventional cabling has bulky KVM cables exiting each server, which then connect to a KVM switch. The cables exiting a series of KVM switches must then be aggregated via additional KVM switches and PDUs, which only increases the number—and cost—of cables, KVM switches and PDUs. Instead, the daisy-chain approach of ACT cabling uses readily available, inexpensive CAT5 and 6 cabling to considerably *reduce* the number of cables, KVM switches, and PDUs needed, rather than increasing them. If a server is removed or added, no complicated rewiring is needed. One cable connects the first server in the rack to the next, and so on. Up to **16** servers form a chain; up to **8** chains can connect to one Local Console Manager (LCM); **16** LCMs can connect to one Global Console Manager (GCM). In this manner, up to **2,048 servers** can be centrally managed. Equally importantly, with ACT—unlike some other offerings—everything is done externally via cabling; *no* special adapters are required.

The illustration below shows a sample ACT configuration:





Advanced Systems Management Capabilities

The x3850 M2 and x3950 M2 have a high level of systems management capabilities that are well-suited to remote locations as well as to stand-alone environments. Features include the Baseboard Management Controller (BMC), IBM Systems Director Active Energy Manager for x86 (formerly known as PowerExecutive), Automatic Server Restart, Wake on LAN[®] support, PXE support, text console redirect, Predictive Failure Analysis, IBM Systems Director, IBM Systems Director Active Energy Manager for x86, and the Remote Supervisor Adapter II.

The 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)
- 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

The BMC alerts IBM Systems Director to anomalous environmental factors, such as voltage and thermal conditions—even if the server has failed.

The IBM **Remote Supervisor Adapter II** provides additional systems management capabilities, including:

- Graphical console redirection over LAN
- Web-based out-of-band control
- Windows “blue screen” capture
- Remote virtual floppy and CD-ROM
- High-speed remote redirection of PCI video, keyboard and mouse

- SSL (Secure Socket Layer) and LDAP (Lightweight Directory Access Protocol) support

Automatic Server Restart (ASR) helps reduce downtime by restarting the server automatically in the event of a system lockup. ASR technology is a combination of hardware circuitry tied into the server's system reset function and a device driver. As long as the server continues running, the ASR watchdog timer will keep being reset, but if the operating system crashes or the hardware freezes somehow the ASR software will be unable to reset the hardware timer. If the timer is not reset within five minutes, it automatically triggers the ASR hardware, which immediately restarts the server (and logs an ASR event with IBM Systems Director). These features are designed so that *no more than five minutes can pass before the server is restarted*.

Wake on LAN permits the server to be remotely powered on if it has been shut off. Once powered up, the server can be controlled across the network, using the **Preboot Execution Environment (PXE)**.

Like Wake on LAN, PXE is system firmware. It enables software such as the optional **IBM Remote Deployment Manager** to take control of a system before the BIOS, operating system or applications are loaded (using Wake on LAN/PXE) and lets an administrator perform many low-level tasks remotely that would otherwise require a visit to each system. These tasks may include such things as formatting a hard disk drive, updating system firmware, or deploying a Windows or Linux operating system.

Text and Graphical Console Redirection support allows the administrator to remotely view system text messages and graphics over serial or LAN.

Predictive Failure Analysis (PFA) is designed to allow the x3850 M2/x3950 M2 to detect impending failure of supported components (processors, memory, PCIe slots, VRMs, power supplies, fans, and hard disk drives) *before* actual failure, and alert the administrator through IBM Systems Director. This gives you the ability to replace the failing component *before* it fails, resulting in increased uptime.

IBM Systems Director software for advanced workgroup management is included with the eX4 servers. IBM Systems Director comes with a portfolio of tools, including *Management Processor Assistant, Rack Manager, RAID Manager, Update Assistant and Software Distribution*. *IBM Systems Director Active Energy Manager for x86, System Availability* (a no-charge download) and *Capacity Manager* (sold separately) are available as add-ons for additional server management and increased availability. IBM Systems Director provides a single uniform graphical interface for all of these systems management functions.

IBM Systems Director enables you to customize thresholds and monitor system components (for things like temperature, voltage regulation, etc.) to help maximize uptime.

IBM developed **IBM Systems Director Active Energy Manager for x86** to put control of system power-saving features at the fingertips of administrators. Active Energy Manager is a combination of hardware and software designed to take advantage of new features, such as monitoring power usage and balancing the performance of the system according to available power input. It provides the ability to plan and predict power consumption based on your hardware configuration. It also helps enable you to reduce the infrastructure required for redundancy, by using fewer servers on smaller power feeds and potentially lowering your overall data center support costs. It does this by inventorying all components, then adding up the total power draw and tracking the usage.

Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. The eX4 servers offers a number of tools and services designed to make ownership a positive experience. From the start, IBM programs make it easier for you to plan for, configure and purchase System x or xSeries 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 System x and BladeCenter Power Configurator, IBM ServerGuide, 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 server and are officially supported to work together. It is updated frequently to ensure that the latest compatibility information is always 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 System x and BladeCenter Power Configurator helps IT managers plan for data center power needs, by providing the following information for specific configurations of System x and

BladeCenter systems: *power input* (watts), *PDU sizing* (amps), *heat output* (BTUs), *airflow requirements through chassis* (CFM), *VA rating*, *leakage current* (mA), and *peak inrush current* (amps).

IBM ServerGuide (installed from CD) simplifies the process of installing and configuring System x and xSeries servers. ServerGuide goes beyond mere hardware configuration by assisting with the automated installation of the Microsoft® Windows® Server 2000 and 2003 operating systems, device drivers and other system components, with minimal user intervention. (Drivers are also included for support of Novell NetWare, Red Hat Linux and SUSE LINUX.) This focus on deployment helps you reduce both your total cost of ownership and the complexity that administrators and technical personnel face.

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 service⁵ 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 System x and xSeries hardware and software, as well as onsite custom services to provide the level of expertise you require.

Key Options

IBM options for System x servers help you take your servers to a higher level

You can rely on System x options to supply a complete solution for your business needs. Options help you create an optimized server 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 System x servers and options lets you keep your fingers on the pulse of your e-business.

Processors — The Intel Xeon processor provides high clock rates, a choice of dual-, quad-, or six cores, 64-bit extensions, a large cache and advanced features for availability and manageability. Large cache size, combined with a fast **1066MHz** front-side bus, reduces memory latency and facilitates the movement of data through the processor and I/O devices. (**Note:** System performance depends not only on the number of processors in the server but also on the power and functionality of each processor.) Adding a second, third, or fourth processor may be a cost-effective way to achieve significant performance improvements.

Memory — Memory is a significant factor in systems application performance. Adding more memory to a System x server is one of the most effective ways to increase application performance. For best performance in a server with dual-core processors, there should be twice as much memory available as for a server using single-core processors. A server with six-core processors should have three times as much memory as a server using dual-core processors. The eX4 servers take memory upgrades in pairs and provide two-way interleaving.

Hard Disk Drives — IBM hard disk drives help you improve the transaction and cost performance of your System x servers. The choice of hard disk drives can be a critical aspect of maximizing the I/O throughput of the system. 2.5-inch **SAS** hard disk drives are available for the eX4 servers with capacities up to **146.8GB** apiece at **10,000 RPMs**, or up to **73.4GB** apiece at **15,000 RPM**.

Remote Supervisor Adapter II — The x3850 M2 and x3950 M2 include a plethora of systems management features built-in. The Remote Supervisor Adapter II not only offers powerful new features, it does so without taking up a valuable PCIe adapter slot, instead using a dedicated PCI-X slot on the motherboard.

ServeRAID Controllers — System x servers using ServeRAID technology allow companies to build a reliable foundation for business-critical computing. IBM ServeRAID technology allows an array consisting of multiple physical hard disk drives to be treated as one logical drive.

⁵ For onsite labor, IBM will attempt to diagnose and resolve the problem remotely before sending a technician.

ServeRAID technology also allows data to be stored redundantly, across multiple hard disk drives— enhancing both the integrity and the availability of the data. SAS and SATA ServeRAID controllers offer enhanced performance due to onboard processors and cache. Because IBM ServeRAID controllers can help significantly improve data transfer rates, this technology is extremely effective when implementing demanding, transaction-oriented applications. By employing the advanced fault tolerance of IBM ServeRAID technology, companies can effectively implement networked business systems that require large amounts of storage space for data and applications that must be available for their businesses to continue operating.

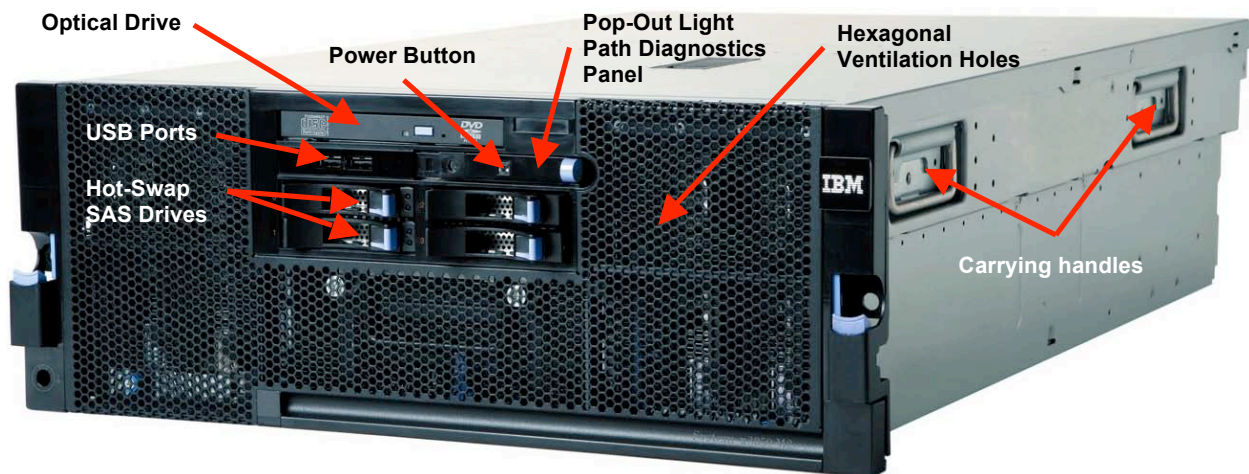
The optional integrated **ServeRAID-MR10k SAS/SATA** controller offers enhanced performance over the integrated LSI 1078 SAS controller, **256MB** of battery-backed cache memory, and supports **seven** RAID levels: **0** (striping), **1** (mirroring), **10** (mirroring and striping), **5** (striping with parity), and **6** (striping with double parity), **50** (striping with parity across multiple arrays) and **60** (striping with double parity across multiple arrays). **Note:** RAID-50 and -60 require external storage, due to the minimum requirement of six or eight drives, respectively.

External SAN, NAS and direct-attach storage is available using one of several IBM System Storage™ and TotalStorage™ host bus adapters.

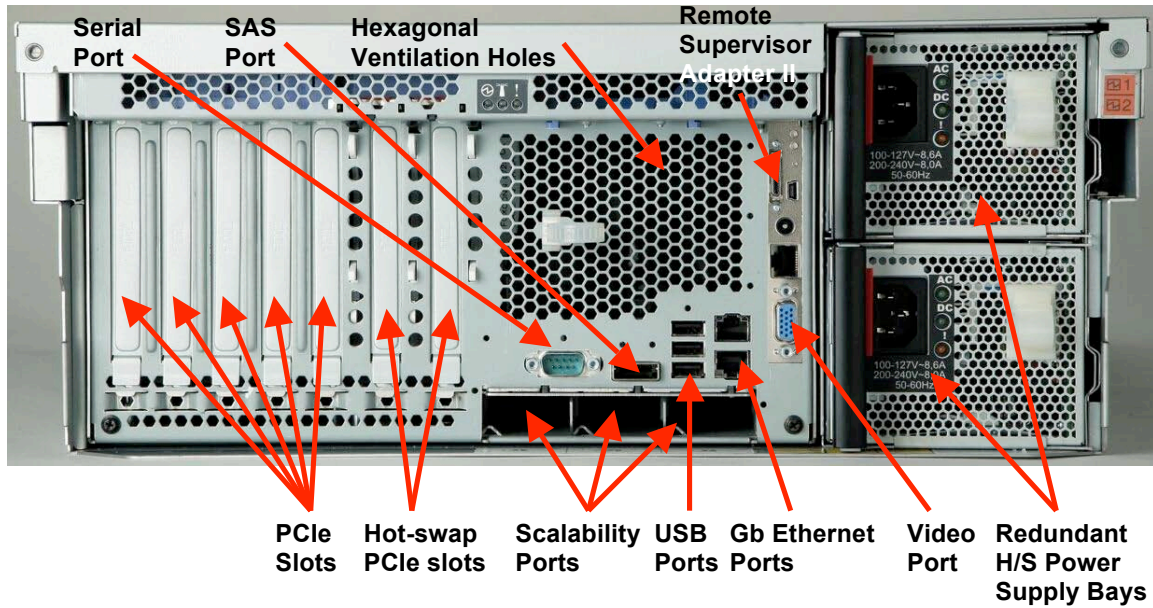
The **IBM TotalStorage DS4000, DS6000, and DS8000** series, as well as the **System Storage DS4000, N3000, N5000, and N7000** series, comprise a powerful and broad shared storage family with integrated management software designed to meet midrange and enterprise needs.

x3850 M2 / x3950 M2 Images

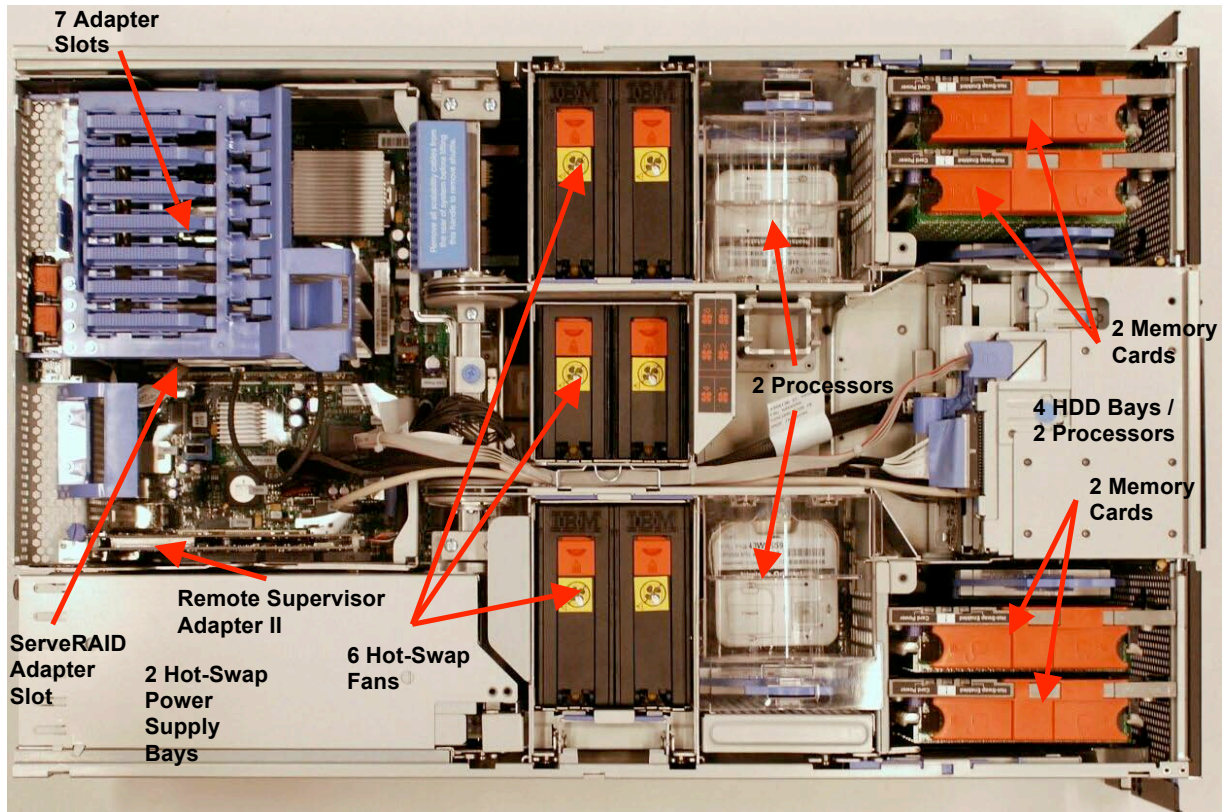
Front View



Rear View



Interior View



| x3850 M2 / x3950 M2 Specifications | | | | |
|--|---|---|---|--|
| Machine type | x3850 M2 7141-1RX/1RY, 2RX/2RY, 3HX/3HY, 3RX/3RY, 4RX/4RY—3 yr. warranty; 7233-2RX/2RY, 5RX/5RY, 6RX/6RY, 7RX/7RY—3 yr. warranty; 7234-6RX/6RY—4 yr. warranty | | x3950 M2 7144-1SX/1SY, 3SX/3SY, 4SX/4SY—3 yr. warranty; 7233-2SX/2SY, 5SX/5SY, 6SX/6SY, 7SX/7SY—3 yr. warranty; 7234-6SX/6SY—4 yr. warranty | |
| Form factor (standard/maximum) | 4U / 16U | | | |
| Processor type | Six-core Xeon (E74xx/L74xx/X74xx) 2.13GHz E7420 (2xX/2xY), 2.13GHz L7445 (7xX/7xY), 2.4GHz E7450 (5xX/5xY), 2.66GHz X7460 (6xX/6xY) | Quad-core Xeon (E73xx/X73xx) 1.6GHz E7310 (1SX/1SY), 2.13GHz E7320 (2xX/2xY), 2.4GHz E7330 (3xX/3xY), 2.93GHz X7350 (4xX/4xY) | Dual-core Xeon (72xx) 2.4GHz E7210 (1RX/1RY) | |
| Maximum processor power draw | 130W (7141/7144-4xX/4xY; 7233-6xX/6xY) | 90W (7233-2xX/2xY, 5xX/5xY) | 80W (7141/7144-1xX/1xY, 2xX/2xY, 3xX/3xY) | 50W (7xX/7xY) |
| Front-side bus (FSB) speed | 1066MHz x 4 FSBs | | | |
| # of independent front-side buses | 4 | | | |
| # of processors standard / maximum | 2 / 4 (per chassis) | | | |
| Internal L2 cache | 9MB (3 x 3MB)—7233/7234 (all) | 8MB (2 x 4MB)—7141/7144-1xX/1xY, 4xX/4xY | 6MB (2 x 3MB)—7141/7144-3xX/3xY | 4MB (2 x 2MB)—7141/7144-2xX/2xY |
| External L3 cache | 16MB shared cache—7233-6xX/6xY | 12MB shared cache—7233-5xX/5xY, 7xX/7xY | 8MB shared cache—7233-2xX/2xY | |
| XceL4v Dynamic Server (L4) cache | Up to 256MB per chassis (1TB max.) | | | |
| Chipset | IBM eX4 | | | |
| ScaleXpander Option Kit | Standard (7144-1SX/1SY, 3SX/3SY, 4SX/4SY) | | Optional (7141-1RX/1RY, 2RX/2RY, 3HX/3HY, 3RX/3RY, 4RX/4RY; 7233-2RX/2RY, 5RX/5RY, 6RX/6RY, 7RX/7RY) | |
| Scalability ports | 3 (per chassis) | | | |
| # of interconnected nodes (chassis) maximum | 4 | | | |
| Standard / maximum memory⁶ (per chassis) | 8GB (4 x 2GB on 2 memory cards) / 256GB (3HX/3HY) | 8GB (8 x 1GB on 4 memory cards) / 256GB (3RX/3RY, 3SX/3SY, 4xX/4xY, 5RX/5RY, 5SX/5SY, 6xX/6xY) | 4GB (4 x 1GB on 2 memory cards) / 256GB (1xX/1xY, 2xX/2xY, 7xX/7xY) | |
| Standard memory type | Registered PC2-5300 (533MHz) DDR II ECC with Chipkill protection | | | |
| Memory interleaving | Yes (two-way using pairs of DIMMs) | | | |
| DIMM capacities supported | 1GB, 2GB, 4GB, 8GB | | | |
| # of DIMM sockets total / available | 32 / 24 (3RX/3RY, 3SX/3SY, 4xX/4xY, 5RX/5RY, 5SX/5SY, 6xX/6xY) | | 32 / 28 (3HX/3HY, 4xX/4xY, 7xX/7xY) | |
| Memory mirroring supported | Yes | | | |

⁶ Maximum memory and disk capacity may require the replacement of standard components with the largest supported component available.

| x3850 M2 / x3950 M2 Specifications | |
|---|---|
| # of drive bays total / available | 5 / 4 |
| # of HDD drive bays total / available | 4 / 4 2.5-inch |
| # of 5.25" bays total / available | 1 / 0 (CD-RW/DVD installed) |
| Maximum HDD capacity | 2.5-inch SAS 587.2B (4 x 146.8GB) hot-swap SAS |
| Internal HDD capacities supported | 2.5-inch SAS 73.4, 146.8GB — 10K RPMs; 73.4GB — 15K RPMs |
| # of HDDs standard | None |
| # of optical drives standard | 1 CD-RW/DVD Combo (24X/10X/24X/8X, in dedicated 5.25" UltraBay) |
| # of diskette drives standard | None (USB-attached) |
| Embedded USB Flash Key standard | 4GB (preloaded with VMware ESXi 3.5 (3HX/3HY)) |
| Disk drive technology | Hot-swap SAS |
| Integrated disk controller | Eight-port LSI 1078 SAS |
| # of disk drives supported <i>per port</i> | 1 |
| External disk drives supported standard | Yes, via external 4-port SAS connector |
| External disk storage devices supported | System Storage DS4100, DS4200, DS4300, DS4400, DS4500, DS4700, DS4800, DS6800, DS8100, DS8300, N3700, N5200, N5300, N5500, N5600, N7600, and N7800 storage subsystems |
| Integrated RAID controller / cache | LSI 1078 (no cache) standard—internal SAS |
| Optional RAID controllers supported | ServeRAID- MR10k (256MB) —internal/external SAS |
| # of adapter slots total / available | 7 / 7 |
| # of PCIe physical x8/electrical x8 slots (4GBps) | 7 full-height/half-length (including 2 Active PCIe hot-plug slots) |
| # of PCI-X slots | None |
| # of legacy PCI slots | None |
| # of video ports | 1 |
| Video controller | ATI Radeon ES1000 |
| Video memory | 16MB SDRAM |
| Maximum video resolution at 32-bit color | 1024 x 758 x 32-bit color at 85Hz |
| Gigabit Ethernet controller | Dual-port Broadcom BCM5709C |
| TOE acceleration | Yes |
| Failover / load-balancing-capable | Yes / Yes |
| # of Gigabit Ethernet ports | 2 (rear) |
| # of RS485 ports | None |
| # of serial ports | 1 (rear) |
| # of parallel ports | None (USB-attached) |
| # of mouse ports | None (USB-attached) |

| x3850 M2 / x3950 M2 Specifications | | |
|---|---|---|
| # of keyboard ports | None (USB-attached) | |
| # of SAS ports | 1 (rear) | |
| # of USB 2.0 ports | 5 external (2 front, 2 rear) ports, plus 1 internal USB connector for flash drive | |
| Integrated systems management controller | Remote Supervisor Adapter II | |
| Light path diagnostics support | Processors, memory, power supplies, fans, HDDs, adapters, voltage regulator modules (VRMs), and system temperature, with external pop-out/drop-down panel | |
| Predictive Failure Analysis support | Processors, memory, PCIe slots, VRMs, power supplies, fans, and hard disk drives | |
| Power supply size | 1440W universal, autoswitching, hot-swap (rear access) | |
| # of power supplies standard / maximum | 2 / 2 | |
| Hot-swap/redundant power supported | Yes | |
| # of fans/blowers standard / maximum | 6 / 6 | |
| Hot-swap/redundant fans supported | Yes | |
| Heat emitted: typical / maximum | 2,730 / 5,527 BTUs; 800 / 1,620 Watts | |
| Rack mount method | Slides and Cable Management Arm (provided standard) | |
| Maximum altitude | 7,000 ft; 2,133 m | |
| Operating temperature range | 50–95° F; 10–35° C (up to 3,000 ft / 914.4 m) | 50–90° F; 10–32° C (3,000 ft to 7,000 ft / 914.4m to 2,133m) |
| Dimensions (HWD) / weight | 6.8" (172.8mm) H 17.5" (444mm) W 28.35" (720.2mm) D | 70-95 lb (maximum) 31.75-43.2 kg |
| Operating systems supported | 7141/7144 Microsoft Windows Server 2003 R2 (Standard/Web/Enterprise Editions) 32/64-bit, RHEL 4 AS/ES 32/64-bit, RHEL 5 Server 32/64-bit, SLES 9/10 32/64-bit, VMware ESX Server 3.0.2+ | 7233/7244 Microsoft Windows Server 2008 (Standard/Web/Enterprise/Datacenter Editions) 64-bit, Microsoft Windows Server 2003 R2 (Standard/Web/Enterprise/Datacenter Editions) 32/64-bit, RHEL 4 AS/ES 64-bit, RHEL 5 Server 32/64-bit (with and without Xen), SLES 9 64-bit, SLES 10 32/64-bit (with and without Xen), VMware ESX 3.5/ESXi 3.5 |
| Length of limited warranty | 3 years (parts and labor) ⁷ (7141/7144/7233) | 4 years (parts and labor) (7234) |

The Bottom Line

The eX4 servers are extremely powerful systems, incorporating leading-edge industry-standard features and adding IBM-unique innovations:

Price/Performance

- **High-throughput processors** — 2.13 to 2.66GHz six-core, 2.13 to 2.93GHz quad-core or 2.4GHz dual-core Xeon processors; up to 24 (six-core), 16 (quad-core) or 8 (dual-core) processor cores per chassis

⁷ 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. IBM makes no representation or warranty regarding third-party products or services including those designated as ServerProven or ClusterProven. 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.

- **Large L2 cache** — **9MB, 8MB, 6MB** or **4MB** of internal processor cache (model-specific)
- **Large L3 cache** — **16MB, 12MB,** or **8MB** of external processor cache (model-specific)
- **Huge L4 cache** — **256GB** per chassis (up to **1GB** in a 4-chassis configuration) of IBM-unique XceL4v Dynamic Server cache
- **64-bit extensions** (EM64T)
- **Fast front-side buses** — **4 x 1066MHz** (one per processor)
- **Fast memory** — **PC2-5300 DDR II** ECC memory standard with **two-way interleaving** and a **low-latency memory controller**
- **Embedded virtualization** (in selected models)
- **Fast disk technology** — Integrated **Serial-Attach SCSI (SAS)** controller and slotless hardware-based **RAID-0** data striping
- **Fast communications** — Integrated **dual-port Gigabit Ethernet** controller, supporting **load-balancing** and **failover**, as well as **TOE, RDMA, and iSCSI**
- **Fast I/O** — **PCIe x8 (4Gbps)** adapter slots

Flexibility

- **Scale up or scale out** — **1 to 4** chassis, with **2 to 16 processors** and **4 to 96** processor cores, scalable on demand (using the **ScaleXpander Option Kit** and four chassis)
- **Large memory capacity** — **256GB** of DDR2 memory, with **32 DIMM slots** per chassis (expandable to **1TB** of RAM, using the **ScaleXpander Option Kit** and four chassis)
- Integrated **4GB flash** drive, preloaded with VMware ESXi 3.5 (selected models) for “instant” virtualization
- A choice of **four 2.5-inch hot-swap SAS** drives internally and **one external SAS port** for optional external storage (per chassis); up to **16 drives** in a 4-chassis configuration)
- **High-performance external I/O expansion** — **Six 480Mbps USB 2.0** ports (two front, three rear, one internal); **one external SAS port**
- Hardware-based **RAID-0/1** support standard; optional slotless RAID support for **RAID-10/5/50/6/60** (up to two **ServeRAID-MR10k** controllers in a multi-chassis configuration)
- **Seven available x8 PCIe slots (4Gbps) per chassis**, including **2 Active PCI** (hot-plug) slots per chassis (**28 total slots**, including **8 Active PCIe** slots, in a 4-chassis configuration)
- Integrated **DVD/CD-RW** combo drive

Manageability, Serviceability and Availability

- **IBM Systems Director** systems management software, including:
 - IBM Systems Director Active Energy Manager for x86
 - IBM Management Processor Assistant
 - IBM Rack Manager
 - IBM RAID Manager
 - IBM Update Assistant
 - IBM Software Distribution
 - IBM System Availability
- **Integrated Baseboard Management Controller (BMC):**
 - IPMI 2.0** compliance, including highly secure remote power control
 - Text console redirection** systems management standard
- **Remote Supervisor Adapter II** daughter card standard (uses dedicated slot)
 - Supports **LDAP** and **SSL** industry standards
- **Active Memory protection:**
 - Advanced **Chipkill** ECC memory correction
 - Memory ProteXion**
 - Memory mirroring**
 - Memory scrubbing**
- Slotless hardware-based **RAID-1** disk mirroring standard; optional slotless **RAID-10/5/50/6/60** highly available arrays
- **Ultra-efficient cooling** incorporating **Calibrated Vectored Cooling** features
- **Hot-swap hard disk drives**
- **Hot-add/hot-swap memory**
- **Hot-swap/redundant power supplies and cooling**

- **Hot-swap/redundant cooling**
- **Light path diagnostics** (front LED panel, drop-down light path panel)
- **Toolless chassis** and **toolless slide** design; integrated **Cable Management Arm** simplify installation and removal of the server from the rack



For More Information

| | |
|---|---|
| IBM System x Servers | http://www.ibm.com/systems/x |
| Electronic Service Agent | http://www.ibm.com/support/electronic |
| IBM System x and BladeCenter Power Configurator | http://www.ibm.com/systems/bladecenter/powerconfig |
| Standalone Solutions Configuration Tool | http://www.ibm.com/servers/eserver/xseries/library/configtools.html |
| Configuration and Options Guide | http://www.ibm.com/servers/eserver/xseries/cog |
| ServerProven Program | http://www.ibm.com/servers/eserver/serverproven/compat/us |
| Technical Support | http://www.ibm.com/server/support |
| Other Technical Support Resources | http://www.ibm.com/servers/eserver/techsupport.html |

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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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