Leadership enterprise server with significantly lower cost of ownership in a highly available and expandable, rack-dense, 1U dual-socket server

Product Guide

March 2010

IBM System x3550 M3

Product Overview

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Outstanding innovation in only 1U

Suggested Uses: *All sectors requiring highly available, energy-efficient, rack-optimized solution for physical and virtual intensive commercial environments like eBusiness/eCommerce, collaboration, virtualization, database, and enterprise resource planning applications.*

Your challenge is to do more with less—serve more Web pages, handle more secure connections, support more e-mail users. You need to reduce the costs of doing business and improve the service you deliver to your customers while lowering your overall risk. The **dual-socket IBM® System x3550 M3** can reduce your costs with its new energy smart design. It can improve service with reduced operational complexity and increased management functionality. It will lower your IT risk with the resiliency that comes from no single point of failure. And like all IBM servers, the x3550 M3 offers you the trust that comes from the IBM global reach, service and support.

The x3550 M3 is a game-changing rack server that uses significantly less power than previous generations, with unified systems management tools, leadership reliability, availability, and serviceability features and broad systems flexibility housed in a compact 1U mechanical package.

The x3550 M3 features **Intel® Xeon® 5600** Series **6-core** and **4-core**, and **5500** Series **4-core** processors, with up to **12MB** of shared **L3 cache**, to provide you with the computing power you need to match your business needs and growth. The new line of Intel processors delivers unprecedented intelligent performance with features like adaptive performance for applications and environments, Turbo Boost Technology and Hyper-Threading Technology, and integrated power gates and automated power management.

The x3550 M3 supports up to **18 DIMMs** / **192GB** of **registered** (RDIMM) **1333MHz DDR3** memory (or up to **12** DIMMs / **24GB** of unbuffered UDIMM memory) and provides **Chipkill™ ECC** (Error Checking and Correcting) protection—for high performance and reliability. For even higher levels of availability, the x3550 M3 also offers **memory mirroring**. Up to **4** integrated high-speed **Gigabit Ethernet** controllers are available (offering **TOE** (TCP Offload Engine) support on Microsoft® Windows®), as are two high-performance adapter slots (**PCIe x16**). The x3650 M3 offers an optional **embedded hypervisor** to manage your virtual workloads.

The x3550 M3 offers a choice of up to supports up to **8** high-performance hot-swap HDDs with an internal storage capacity of **4.0TB** (**2.5-inch hot-swap Serial-Attached SCSI (SAS)** or **Serial-Attached ATA (SATA)** drives). Alternatively, up to **8 solid-state drives (SSDs)** are also available to keep power low, improve resiliency, and offer up to **400GB** of storage. The server includes a choice of several IBM ServeRAID® storage controllers that provide broad levels of *hardware*-based **RAID solutions**. The ultradense **1U** form factor allows businesses to increase their computing power and spread their workload without outgrowing their current data center. Up to **42** of these **1U** servers can be installed in a single 42U rack, for a total of up to **84** processors and **504** processor cores, offering tremendous deployment flexibility.

Standard in the x3550 M3 is the Integrated Management Module (IMM) that enables the user to manage and control the server easily—both locally and remotely. In conjunction with the IMM, the x3550 M3 comes with an **altitude sensor** (**altimeter**) that **governs fan rotation** based on altitude, to help lower your energy consumption. The IMM offers a high level of manageability that is designed to keep costs down and the system up—even when network usage increases. IBM's innovative pop-out/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 **simple-swap solid-state drives**; **hot-swap/redundant SAS** or SATA **HDDs**, redundant ultra-efficient **power supplies** and **fan modules**; **Active Memory™**; integrated **RAID**; **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-console redirect over LAN**.

Another improvement with the new generation of X-Architecture is the replacement of legacy BIOS with a new generation **United Extensible Firmware Interface** (UEFI). UEFI provides a more intuitive user interface and understandable event logs and better management.

With the inclusion of unique IBM service and support features such as the IMM, light path diagnostics, **IBM Systems Director 6.1**, **IBM Systems Director Active Energy Manager™**, **IBM ServerGuide™** and support for the optional Virtual Media Key for remote presence capability, the x3550 M3 is designed for superior uptime.

If you need highly manageable, dual-socket/multi-core computing power in a rack-dense package, the x3550 M3 is the ideal system.

Selling Features

Price/Performance

The x3550 M3 offers numerous features to boost performance and reduce costs:

- Up to **two 6-core** or **4-core** Xeon 5600 Series or **4-core** Xeon 5500 Series processors and **12MB** or **4MB** of cache per processor, offer superior performance capable of tackling the toughest jobs. **64-bit extensions** provide the flexibility to run 32-bit and 64-bit applications concurrently. Xeon 5600 series processors offer up to **43%** better performance than the previous-generation 5500 series processors (depending on workload). For an even lower entry price, a **2-core** 5500 Series processor is available via CTO.
- **Low-voltage processors** draw less energy and produce less waste heat than high-voltage processors, thus helping to reduce data center energy costs. Selected **4-core** Xeon 5600 Series processors use only **40W** and selected **6-core** processors consume only **60W**. This is less than half the wattage consumed by 130W processors.
- **Eighteen** DIMMs of ultra-fast registered **1333MHz DDR3** ECC memory with **Chipkill**[1] protection (optional) provide speed, high availability, and a memory capacity of up **192GB**.
- x3550 M3 servers using the **L5640** and **X56**xx processors support 2 DIMMs per channel (2DPC) at 1333MHz; those using the **X55**xx processors support 2DPC at 1333MHz via the special bid process.
- Optional **50GB solid-state drives (SSD)** use only **2W** of power per drive, vs. **9-10W** for 2.5-inch HDDs. This is as much as **80%** less power than a 2.5-inch HDD would use (with a corresponding reduction in heat output).
- The altimeter works in conjunction with IMM to **govern fan rotation.** which can help **save money at lower altitudes** because the fans do not have to spin at high speed.
- Two **high-speed PCIe x16 adapters (Gen 2) slots** offer investment protection by supporting high-performance adapters, such as 10Gb Ethernet, Fibre Channel and InfiniBand™ cards, none of which will run in older 33MHz and 66MHz conventional PCI slots.
- The integrated **ServeRAID-BR10il v2** controller (model-specific) provides **RAID-0**/**1**/**1E** and full-duplex (**bidirectional 3Gbps**) data transfers for SAS/SATA/SSD drives without consuming a valuable adapter slot. Other server models include the **6Gbps ServeRAID-M1015 (RAID-0**/**1**/**10,** optional **5** with **Self-Encrypting Disk**, or **SED**) or the **ServeRAID-M5014** controller standard, which provide **RAID-0**/**1**/**10**/**5**/**50** (optional **6**/**60 SED**). The ServeRAID-M5014 also offers higher performance, due to 256MB of optional onboard **cache** and **battery backup**.
- Up to **8 2.5-inch hot-swap SAS**/**SATA** hard disk drives offer high-performance with high availability. **SSDs** offer even higher availability, with extremely high IOPS rates.
- The integrated **dual Gigabit Ethernet** controllers with **IPMI 2.0** provide high-speed network communications. Two more NICs can be added to the planar with an additional dual-port Gb Ethernet daughtercard. The TCP Offload Engine (**TOE**) feature offers higher performance for TCP/IP traffic, with less overhead on the system processor.
- A **high degree of device integration**—including SAS/SATA HDDs or SSDs, multiple ServeRAID options, Gigabit Ethernet ports, systems management and video controllers—lowers costs and frees up valuable adapter slots.

Flexibility

The x3550 M3 has the ability to grow with your application requirements, thanks to

- A choice of **4-core** or **6-core** processors with **1.86** to **3.46GHz** clock rates, up to **6.4 gigatransfers per second**, and **40W** to **130W** maximum power draw. (An additional choice, a **2-core** 5500 Series processor, is available via CTO.)
- Up to **192GB** of high-speed registered **DDR3** system memory.
- A choice of either standard **1.5V** DIMMs, or **1.35V** DIMMs that consume **10%** less energy.
- **Two** *available* **high-performance PCIe x16** adapter slots in all models. Optionally, one riser card supporting PCI-X/133 adapters can be exchanged for one PCIe slot.
- Upgrading to the **ServeRAID-M5015** controller provides **512MB** of battery-backed cache to

[1] All models require Chipkill-enabled DIMMs (provided standard) for Chipkill protection.

enable higher-performance hardware RAID support, and allows the x3550 M3 to offer **five** RAID levels standard: **RAID-0**/**1**/**10**/**5**/**50** (and optionally **6**/**60** with **SED)**.

- The **five USB 2.0** ports (two front, two rear, one internal) are up to **40X** faster[2] than older **USB 1.1** ports. This provides speedy access to external HDDs (non-arrayed), optical drives, tape drives, and other USB devices. Two ports are on the front of the unit and two are on the back. The internal port supports a flash drive with embedded hypervisor.
- A choice of up to **eight 2.5-inch hot-swap SAS**/**SATA** HDDs or **solid-state drives**, or **four** 2.5-inch drives and **one** internal optical drive, offer a variety of storage options. The SAS and SATA HDD models provide a maximum of **8.0TB** of internal **hot-swap** storage. The x3550 M3 supports a mix of hot-swap SAS, SATA and SSD drives.
- Alternatively, direct-attach, network-attached storage (NAS), or iSCSI or Fibre Channel-attached storage can be attached using IBM **System Storage™** servers.

Manageability / Security

Powerful systems management features simplify local and remote management of the x3550 M3:

- The x3550 M3 includes an **Integrated Management Module (IMM)** to monitor server availability, perform Predictive Failure Analysis, etc., and trigger IBM **Systems Director** alerts. The IMM performs the functions of both the Baseboard Management Controller (**BMC**) of earlier systems and the **Remote Supervisor Adapter II** and is upgradeable to **remote presence/cKVM.**
- An optional Virtual Media Key provides additional systems management capabilities, including Web-based out-of-band control; virtual floppy and optical drive support; Windows "blue screen" error capture; LDAP and SSL support; and remote redirection of PCI video, text, keyboard and mouse (cKVM). And it does all this without consuming a valuable adapter slot.
- Integrated industry-standard Unified Extensible Firmware Interface (**UEFI**) next-generation BIOS. New capabilities include:
  - Human readable event logs – no more beep codes
  - Complete setup solution by allowing adapter configuration function to be moved into UEFI
  - Complete out-of-band coverage by Advance Settings Utility to simplify remote setup
- Integrated **Trusted Platform Module (TPM) 1.2** support.
- Intel **Trusted Execution Technology** (TXT) support for more secure processing, and industry-standard **AES NI** support for faster, stronger encryption (in 5600 Series processors only).
- Integrated **IPMI 2.0** support alerts IBM Systems Director to anomalous environmental factors, such as voltage and thermal conditions. It also supports **highly secure remote power control** using data encryption.
- **Text Console Redirection** support allows the administrator to remotely view x3550 M3 text messages over Serial or LAN.
- **IBM Systems Director 6.1x** is included for proactive systems management. IBM Systems Director comes with a portfolio of tools, including **IBM Systems Director Active Energy Manager™**, **Service and Support Manager**, and others. In addition, IBM Systems Director offers extended systems management tools for additional server management and increased availability. When a problem is encountered, IBM Systems Director can issue administrator alerts via e-mail, pager, and other methods.
- IBM **Systems Director Active Energy Manager™**, an IBM-exclusive, is designed to take advantage of new system power management features, by providing actual realtime energy monitoring and reporting features.

Availability and Serviceability

The x3550 M3 provides many features to simplify serviceability and increase system uptime:

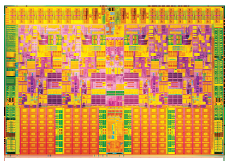
- x3550 M3 servers offer **Chipkill** ECC memory protection[3] (when using x4 DIMMs). Chipkill memory is up to **16X** better than standard ECC memory at correcting memory errors. This can help reduce downtime caused by memory errors.
- The x3550 M3 offers selectable **memory mirroring** for redundancy in the event of a non-correctable memory failure
- **Toolless cover removal** provides easy access to upgrades and serviceable parts. Similarly, the Virtual Media Key and the **ServeRAID** controller can be installed and replaced without tools. This means less time (and therefore less money) spent servicing the x3550 M3.

[2] Data transfer rates may be less than the maximum possible.
[3] Chipkill protection is supported with x4 DDR3 DIMMs, but not x8 DIMMs.

Similarly, **hot-swap/redundant HDDs, fan modules** and **power supplies**, as well as **online mirrored** memory, mean greater system uptime while these components are being serviced.

- New **toolless slides** ship with the server, together with a **Cable Management Arm (CMA)**, that allows the rack server to easily slide into place
- IBM **Thermal Diagnostics** allows the administrator to evaluate thermal data on the server without taking the hardware offline. This can provide greater server uptime.
- The **drop-down light path diagnostics panel** and individual light path LEDs quickly lead the technician to failed (or failing) components. This simplifies servicing, speeds up problem resolution and helps improve network availability.
- **Integrated** 3Gbps or 6 Gbps RAID controller to enhances system availability and data protection without using a valuable PCIe slot.
- **IPMI 2.0** supports highly secure remote system power control using data encryption. This allows an administrator to restart a server without having to visit it in person, saving travel time and getting the server back up and running quickly and securely. It also adds new features to those provided by IPMI 1.5, including **VLAN** support, **Serial over LAN**, enhanced authentication and encryption algorithms (**RMCP+** and **AES**) and a **firmware firewall**.
- **Altitude- and temperature-controlled fans** 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 fans produce less ambient noise in the data center than if they were constantly running at full speed.
- The **three-year (parts and labor) limited onsite warranty**[4] helps afford you peace of mind and greater investment protection than a one-year warranty does.

Key Features



High-Performance Xeon 5600 and 5500 Series Processors

The x3550 M3 supports up to two high-performance Intel **Xeon 5600** Series or **5500** Series processors, allowing you to upgrade to a second processor as your business needs require. The x3550 M3 offers a choice of processor clock rates, memory access speeds and energy draw, including:

- **130W 6-core** Xeon **5600** model **X5680** running at 3.33GHz, with impressive performance/watt (**21.67W** per core; **6.4GTps** QPI speed), **12MB** of L3 processor cache, **1333MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **95W 6-core** Xeon **5600** models **X5650** or **X5670** running at 2.66 or 2.93GHz, respectively, with reduced draw and impressive performance/watt (only **15.83W** per core; **6.4GTps** QPI speed), **12MB** of L3 processor cache, **1333MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **60W** 4-core Xeon **5600 low-voltage** model **L5640** running at 2.26GHz, respectively, with low power draw and impressive performance/watt (only **15W** per core; **5.86GTps** QPI speed), and **12MB** of shared **L3** cache, **1333MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **80W** 4-core Xeon **5600** models **E5620, E5630,** or **E5640** running at 2.26, 2.53, or 2.66GHz, respectively, with reduced power draw and impressive performance/watt (**20W** per core; **5.86GTps** QPI speed), **12MB** of L3 processor cache, **1066MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **40W** 4-core Xeon **5600 low-voltage** model **L5630** running at 2.13GHz, with extremely low power draw and amazing performance/watt (only **10W** per core; **5.86GTps** QPI speed), **12MB** of L3 processor cache, **1066MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **80W** 4-core Xeon 5500 models **E5506** or **E5507** running at 2.13 or 2.26GHz, respectively, with reduced power draw and impressive performance/watt (**20W** per core; **4.8GTps** QPI speed), **4MB** of L3 processor cache, and **800MHz** memory access

Also available, via configure-to-order (CTO):

- **95W 6-core** Xeon **5600** model **X5660** running at 2.8GHz, with reduced draw and impressive performance/watt (only **15.83W** per core; **6.4GTps** QPI speed), **12MB** of L3 processor cache, **1333MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **130W** 4-core Xeon **5600** model **X5677** running at 3.46GHz, with impressive *performance* (**32.5W** per core; **6.4GTps** QPI speed), **12MB** of L3 processor cache, **1333MHz** memory access, 2 threads per core, and Intel Turbo Boost technology

[4] 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.

- **95W** 4-core Xeon **5600** model **X5667** running at 3.06GHz, with reduced draw and impressive performance/watt (**23.75W** per core; **6.4GTps** QPI speed*)*, **12MB** of L3 processor cache, **1333MHz** memory access, 2 threads per core, and Intel Turbo Boost technology
- **40W** 4-core Xeon **5600 low-voltage** model **L5609** running at 1.86GHz, with extremely low power draw and amazing performance/watt (only **10W** per core; **5.86GTps** QPI speed), **12MB** of L3 processor cache, and **1066MHz** memory access
- **95W** 4-core Xeon 5500 models **X5550**, **X5560,** or **X5570** running at 2.66, 2.8, or 293GHz, respectively, with impressive performance/watt (**23.75W** per core; **6.4GTps** QPI speed), **8MB** of L3 processor cache, **1333MHz** memory access, and Intel Turbo Boost technology
- **80W** 4-core Xeon 5500 models **E5520, E5530,** or **E5540** running at 2.26, 2.4, or 2.53GHz, respectively, with reduced power draw and impressive performance/watt (**20W** per core; **5.86GTps** QPI speed), **8MB** of L3 processor cache, **1066MHz** memory access, and Intel Turbo Boost technology
- **80W** 4-core Xeon 5500 model **E5504** running at 2.0GHz, with reduced power draw and impressive performance/watt (**20W** per core; **4.8GTps** QPI speed), **4MB** of L3 processor cache, and **800MHz** memory access
- **80W 2-core** Xeon 5500 model **E5503** running at 2.0GHz, with reduced power draw (**40W** per core; **4.8GTps** QPI speed), **4MB** of L3 processor cache and **800MHz** memory access

With the Xeon 5500 and 5600 Series processors, Intel has diverged from its traditional Symmetric Multiprocessing (SMP) architecture to a Non-Uniform Memory Access (NUMA) architecture. The processors are connected through serial coherency links called QuickPath Interconnect (QPI). QPI is capable of 6.4, 5.6 or 4.8 GTps (gigatransfers per second), depending on the processor model.

2-core Xeon processors contain *two complete processor cores*; **6-core** processors, similarly, contain **six** cores. Each 5600 Series processor contains one **256KB L2** cache **per** core and one **12MB L3** cache shared by all the cores. The shared cache is dynamically allocated between the cores as needed. The multiple cores appear to software as multiple physical processors. The 2-core processors offer considerably higher performance than a same-speed Xeon processor with a single core. Likewise, 4-core processors offer considerably higher performance than a same-speed Xeon processor with 2 cores.

Turbo Boost Technology increases performance by translating the temperature, power and current head room into higher frequency. It will dynamically increase by 133MHz for short and regular intervals until the upper limit is met or the maximum possible upside for the number of active cores is reached. The maximum frequency is dependent on the number of active cores. The amount of time the processor spends in the Turbo Boost Technology state depends on the workload and operating environment, providing the performance you need, when and where you need it. For example, a **3.33GHz 6-core X5680** processor with **3-6** cores active can run the cores at **3.46GHz**. With only **one** or **two** cores active, the same processor can run those cores at **3.6GHz**. Similarly, a **3.46GHz 4-core X5677** processor can run at **3.6GHz** or even **3.73GHz**. When the inactive cores are needed again, they are dynamically turned back on and the processor frequency is adjusted accordingly.

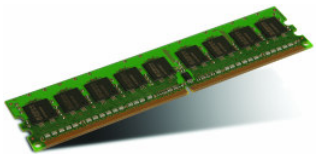
In processors implementing **Intel Hyper-Threading Technology**, each core has two threads capable of running an independent process. Thus, a 6-core processor can run **12** threads concurrently.

Intelligent Power Capability powers individual processor elements on and off as needed, to reduce power draw.

Execute Disable Bit functionality can help prevent certain classes of malicious buffer overflow attacks when combined with a supporting operating system.

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

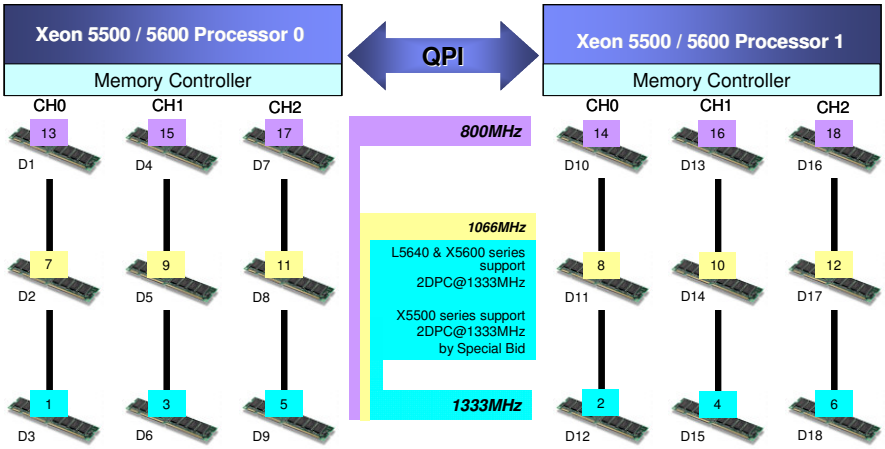
DDR3 Memory with Chipkill ECC Protection



The x3550 M3 ships with registered double data rate III (DDR3) memory and provides Active Memory features, including advanced **Chipkill** memory protection (using x4 DIMMs), for **up to 16X** better error correction than standard ECC memory. In addition to offering better performance than DDR-2 or fully-buffered memory, DDR3 memory also uses less energy. DDR-2 memory already offered up to 37% lower energy use than fully buffered memory. Now, a generation later, DDR3 memory is even more efficient, using **22% less energy** than DDR-2 memory.

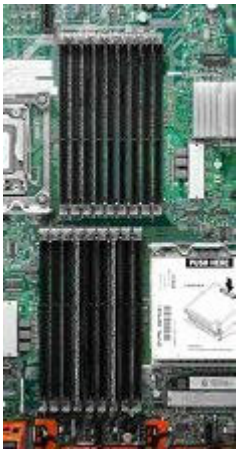
The x3550 M3 currently supports up to **144GB** of **RDIMM** (registered DIMM) memory in **18** DIMM slots (**192GB** in **12** slots, as of 2Q/2010), or up to **24GB** of **UDIMM** (unbuffered DIMM) memory in **12** slots (**48GB** in **12** slots, as of 2Q/2010). The x3550 M3 also supports either standard **1.5V** DIMMs, or **1.35V** DIMMs that consume **10%** less energy. Redesign in the architecture of the

servers. For example, the Xeon 5500 and 5600 series processors **integrate the memory controller inside the processor**, resulting in two memory controllers in a 2-socket system. Each memory controller has three memory channels. Depending on the type of memory, population of memory, and processor model, the memory may be clocked at **1333MHz**, **1066MHz** or **800MHz**.



1-18: DIMM population sequence , D1-D18: DIMM slot assignments

Note: If only one processor is installed, only the first nine DIMM slots can be used. Adding a second processor not only doubles the amount of memory available for use, but also doubles the number of memory controllers, thus doubling the system memory bandwidth. If you add a second processor, but no additional memory for the second processor, the second processor would have to access the memory from the first processor "remotely," resulting in longer latencies and lower performance. The latency to access remote memory is almost *75% higher* than local memory access. So, the goal should be to always populate both processors with memory.



The **X**55xx, **L**5640, and **X**56xx processor models support up to 1333MHz memory clock speed. With new single-rank and dual-rank RDIMMs and UDIMMs, **L5640** and **X56**xx processors support 2 DIMMs per channel (2DPC) at 1333MHz; **X55**xx processors can support 2DPC at 1333MHz via the special bid process, otherwise 2DPC will drop the memory access rate to 1066MHz. The **E**552x/**E**562x-and-up and **L**56xx models support a maximum of **1066MHz** clock speed (and thus memory access rate), and the **E**550x models support **800MHz** clock speed.

Using 1333MHz memory (where supported) versus 1066MHz offers up to **9%** better performance, while 1066MHz memory produces up to **28%** better performance than 800MHz memory. Xeon 5550/5600 Series processors access memory with almost **50% lower latency** than the earlier 5400 Series processors. That can result in faster processing of latency-sensitive workloads.

Regardless of memory *speed*, the Xeon 5500/5600 platform represents a significant improvement in memory *bandwidth* over the previous Xeon 5400 platform. At 1333MHz, the improvement is almost **500%** over the previous generation. This huge improvement is mainly due to the dual integrated memory controllers and faster DDR3 1333MHz memory. Throughput at 800MHz is **25 gigabytes per second** (GBps); at 1066MHz it's **32GBps**; and at 1333MHz it's **35GBps**. This improvement translates into improved application performance and scalability.

Memory interleaving refers to how physical memory is interleaved across the physical DIMMs. A balanced system provides the best interleaving. A Xeon 5500/5600 processor-based system is balanced when all memory channels on a socket have the same amount of memory.

The 5500 and 5600 Series processors support single-, dual-, and quad-rank memory. A memory rank is simply a segment of memory that is addressed by a specific address bit.

- A typical memory DIMM description is 4GB 2Rx4 DIMM
- The 2R designator is the rank count for this particular DIMM (2R = dual-rank)
- The x4 designator is the data width of the rank

It is important to ensure that DIMMs with the appropriate number of ranks are populated in each channel for optimal performance. Whenever possible, **use dual-rank DIMMs** in the system. Dual-rank DIMMs offer better interleaving and hence better performance than single-rank DIMMs. For instance, a system populated with six 2GB *dual*-rank DIMMs outperforms a system populated with six 2GB *single*-rank DIMMs by **7%** for SPECjbb2005. Dual-rank DIMMs are also better than quad-rank DIMMs because **quad-rank DIMMs will cause the memory speed to be down-clocked**.

Another important guideline is to populate equivalent ranks per channel. For instance, **mixing one single-rank DIMM and one dual-rank DIMM in a channel should be avoided**.

Note: It is important to populate all three memory channels in each processor. The relative memory bandwidth decreases as the number of channels populated decreases. This is because the bandwidth of all the memory channels is utilized to support the capability of the processor. So, as the channels are decreased, the burden to support the requisite bandwidth is increased on the remaining channels, causing them to become a bottleneck.

RDIMMs and UDIMMs **cannot** be used in the same server. 1.5V and 1.35V DIMMs **can** be mixed; however, all DIMMs will run at 1.5V. Different brands of DIMMs should **not** be mixed, due to possible timing issues.

In addition to Chipkill error correction, the x3550 M3 offers an additional level of IBM Active Memory protection: **memory mirroring.**

Memory mirroring works much like disk mirroring. The total memory is divided into three channels: a primary channel, a backup channel, and an unused channel. Data is *written concurrently to both the primary and backup channels*. If a DIMM fails in one of the DIMMs in the primary channel, it is instantly disabled and the mirrored memory in the backup channel becomes active (primary) until the failing DIMM is replaced. One-third of total memory is available for use at any one time with mirroring enabled. (***Note:*** Due to the double writes to memory, performance is affected.) Because the third channel is disabled with mirroring active, there is no point in populating it with memory.

Mirroring is handled at the hardware level; no operating system support is required.

DDR3 memory is currently available in **2GB**, **4GB** and **8GB** RDIMMs, or **2GB** UDIMMs. (**16GB** RDIMMs and **4GB** UDIMMs are planned for 2Q/2010.) DIMMs are installed individually (not in pairs). However, for performance reasons, in a 2-processor system, it's best to install a DIMM per processor.

Maximum memory capacity and speed in 2-processor configurations include:

Memory Frequency	DIMMs per Channel	Max. Memory Capacity *	5600 Series	5500 Series
1333MHz	1 (6 DIMMs)	48GB RDIMM 24GB UDIMM	X5650, L5640 and above	X5550 and above
1333MHz	2 (12 DIMMs)	96GB RDIMM 48GB UDIMM	X5650, L5640 and above	X5550 and above (via CTO)
1066MHz	2 (12 DIMMs)	96GB RDIMM 48GB UDIMM	E5620, L5609 and above	E5520 and above
800MHz	3 (18 DIMMs)	144GB RDIMM	E5620, L5609, and above	E5503 - E5507 and above
800MHz	2 (12 DIMMs)	192GB RDIMM 48GB UDIMM	E5620, L5609, and above	E5503 - E5507 and above
800MHz-1333MHz (Mirroring)	3 (12 DIMMs)	96GB RDIMM 16GB UDIMM	E5620, L5609, and above	E5503 - E5507 and above

Integrated Virtualization

All models of the x3550 M3 support a **USB 2.0 Flash Key** installed preloaded with **VMware ESXi 4.0** ESXi is an embedded version of VMware ESX 4.0, 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 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 includes all the performance, scalability and compatibility features of ESX, 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.

Drive Bays

The x3550 M3 supports up to **8** drive bays. Base models include **4 2.5-inch** drive bays and **one 5.25-inch** bay, for an optional DVD-RW drive. Using an expansion kit, the number of 2.5-inch bays can be increased to 8; however, this requires the removal of the 5.25-inch bay. The 2.5-inch bays support a combination of SATA and SAS HDDs, as well as solid-state drives (SSDs)

Hot-swap drives may be inserted or removed through the front of the server without powering off the system. **Simple-swap** solid-state drives can be inserted or removed through the front of the server as well; however, the system power must first be turned off.

For additional storage, a direct-attach, NAS or SAN external expansion option can be added, using an optional controller.

No diskette drive is supplied with any model; an external USB floppy drive may be used, if needed.

Flexible Internal Storage

The x3550 M3 offers flexibility with up to **8** 2.5" HDD bays, supporting high-performance drives that provide high density/high reliability and allow you to scale up as your business grows.

2.5-inch Hot-Swap SAS

- **7,200** RPMs — **500GB** (**8.0TB** maximum capacity, with **8** bays)
- **10,000** RPMs — 73.4, 146.8, or **300GB** (**2.4TB** maximum)
- **15,000 RPMs** — 73.4 or **146.8GB** (**1.17TB** maximum)

2.5-inch Hot-Swap SATA

- **7,200** RPMs — 160 or **500GB** (**4.0TB** maximum)
- **10,000** RPMs — **300GB** (**2.4TB** maximum)

2.5-inch Hot-Swap or **Simple-Swap SSDs**

- **50GB** High IOPS (**400GB** maximum)
  - ❑ **High I/O Performance**
    - Offers up to 8X more IOPS than HDDs (67/33% read/write OLTP transaction base mix)
    - Optimized for heavy mix of read and write operations, such as transaction processing, media streaming, surveillance, file copy, logging, backup/recovery, and business Intelligence
  - ❑ **Lower-Cost IOPS Performance**
    - Yields better $/IOPS: lower capacity (GB) required to achieve higher IOPS
    - Uses less energy and generates less heat than a hard disk drive
  - ❑ **Superior Uptime**
    - 3X the availability of mechanical disk drives
    - No moving parts to fail
    - Enterprise wear-leveling to extend life even further
  - ❑ **Full OS Support**
    - Supports all ServerProven OSes

2-5-inch HDDs 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 IBM System Storage direct-attach, NAS and SAN offerings.

Disk Controllers

All x3550 M3 models include a **ServeRAID-BR10il v2**, **ServerRAID-M1015**, or **ServeRAID-M5014** SAS/SATA controller standard (model-dependent) to enhance system availability and data protection without using a PCI slot.

The 3Gbps[5] (x4 PCIe) **ServeRAID-BR10il v2** controller offers hardware **RAID-0**/**1**/**1E** support (no cache) for up to 4 HDDs or SSDs.

The **6Gbps** (x8 PCIe) **ServeRAID-M1015 SAS**/**SATA** controller supports **RAID-0**/**1**/**10** (no cache) for up to 8 drives. The **IBM ServeRAID M1000 Series Advance Feature Key** adds **RAID-5** with

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

SED support.

The **6Gbps** (x8 PCIe) **ServeRAID-M5014 SAS/SATA** controller offers enhanced performance with **256MB** of cache memory, and supports **RAID-0/1/10/5/50** for up to 8 drives**.**

The **6Gbps** (x8 PCIe) **ServeRAID-M5015 SAS/SATA** controller offers enhanced performance with **512MB** of cache memory and battery backup, and supports **RAID-0/1/10/5/50** for up to 8 drives.

The **IBM ServeRAID M5000 Series Advance Feature Key** adds **RAID-6/60** with **SED** support to the M5014 and M5015. The **IBM ServeRAID M5000 Series Battery Key** adds **battery backup** support to the M5014.

For external storage, the 3Gbps **ServeRAID-MR10M** controller enables connection to up to four IBM System Storage EXP3000 SAS expansion units (48 HDDs total). It provides RAID-0/1/10/5/50 support and 256MB of onboard cache.

High-Performance Adapter Slots

The x3550 M3 provides **two x16** ("by 16") **16GBps PCIe Gen 2 (PCI Express) Gen 2** I/O slots for long-term investment protection. **PCI Express** Gen 2 is the next-generation of high-performance, low-latency, serial I/O bus. Each slot is capable of supporting **x1/x4/x8/x16** Gen 1 or Gen 2 adapters at full speed. One slot is **full**-height, **half**-length. The other is **low profile**. Each is convertible to one PCI-X/133 MHz using an optional riser. High-performance x16 Gen 2 slots are ideal for digital media, 2D graphics environments, and other I/O-intensive applications.

There is also a dedicated riser card in the x3550 M3 that provides a x8 PCIe connector wired with x4 lanes for an internal ServeRAID card.

Dual-Port Gigabit Ethernet Controller

The x3550 M3 includes **one dual-port** integrated **Broadcom 5709S** Gigabit Ethernet controller standard, for up to 10X higher maximum throughput than a 10/100 Ethernet controller, as well as support for **TOE** (TCP Offload Engine), as well as **load-balancing** and **failover** capabilities between the two ports.

TOE helps improve overall system performance by offloading TCP/IP protocol processing from the system microprocessor to the onboard Ethernet TOE processor.

It 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.

Integrated quad Gb Ethernet ports:

- Up to four Gb Ethernet ports, ideal for virtualization and I/O-intensive workloads
- 2 ports standard, plus two additional ports via optional daughtercard
- Improves system performance by offloading protocol processing from CPU to a separate TOE engine
- Primary performance improvement for data copying (CPU) where CPU utilization is 90-100%

Two Broadcom 5709S Gigabit Ethernet controllers (one on-board and one on an *optional* daughter card) provide four Gigabit ports supporting IEEE 802.3 for 1000Base-T, 100Base-TX, and 10Base-T applications (802.3, 802.3u, 802.3ab) through a RJ-45 connector to an Ethernet network over a CAT 5 twisted-pair cable. This controller supports PXE 2.0 remote boot and **TOE**. TOE support on Windows is available today, but requires the Windows Scalable Network Pack (SNP) installed. Linux has no plan to support TOE at this time.

10 Gigabit Ethernet Integrated Virtual Fabric Adapter for IBM

The Emulex Virtual Fabric Adapter for x3550 M3 (part number 49Y4200 with special riser card, support by CTO) is an industry-leading performance and scalability per watt, dual-port network adapter for 10Gbps Ethernet (10GbE) networks. It offers the benefits and flexibility of I/O convergence in a single end-to-end solution. Protocol offload for stateless TCP/IP and TCP Chimney provide maximum bandwidth with minimum use of CPU resources. It achieves line rate 10Gbps performance with support for TCP/IP stateless offloads and TCP Offload Engine (TOE) support. TOE reduces system processor utilization, providing increased system performance and reducing overall system power requirements.

The Emulex 10Gb/s Virtual Fabric Adapter for IBM System x3550 M3 is based on the Emulex OneConnect Universal Converged Network Adapter (UCNA) platform that also includes the capability for future upgrades to Fibre Channel over Ethernet (FCoE) and iSCSI protocol offloads. By using a common infrastructure for Ethernet and storage networks, data centers can reduce capital expense (CapEx) for adapters, switches and cables, and operational expense (OpEx) for

power, cooling and IT administration.

End-to-end data protection with hardware parity, CRC, ECC and other advanced error checking and correcting ensure that data is safe from corruption.

Integrated dual 10Gbps Ethernet ports:

- IPv4/IPv6 TCP, UDP checksum offload; Large Send Offload (LSO); Large Receive Offload; Receive Side Scaling (RSS); IPV4 TCP Chimney Offload
- VLAN insertion and extraction
- Jumbo frames up to 9000 Bytes
- Preboot eXecutive Environment (PXE) 2.0 network boot support
- Interrupt coalescing
- Load balancing and failover support including adapter fault tolerance (AFT), switch fault tolerance (SFT), adaptive load balancing (ALB), teaming support and IEEE 802.3ad.

Ultra-Efficient Cooling

Strategically located fans, combined with efficient airflow paths, provide highly effective system cooling for the x3550 M3, known as **Calibrated Vectored Cooling**. The base server with one power supply includes **one** hot-swap fan module, upgradeable to **six** modules, for redundant cooling. Each module includes two back-to-back fans with counterrotating blades. In addition, each power supply also contains a fan.

The system contains **three cooling zones**. **Zone 1** (incorporating two fan modules) cools all 18 DIMM sockets, **Zone 2** (two fan modules) cools the primary processor, and **Zone 3** (one or two fan modules) cools the second processor (if installed).

The fans automatically adjust speeds in response to changing thermal requirements depending on the zone 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. In addition, the **Bosch BMP085 altimeter** works in conjunction with IMM to govern fan rotation. At high altitudes the air is thinner and doesn't cool as well as at lower elevations. In most servers, the fans run fast all the time to allow for use at high elevations, wasting power. The altimeter allows the IBM fans to run at lower speeds at lower altitudes.

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 put dozens or hundreds in a data center and it can make a big difference!

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.

There are temperature sensors on the planar placed to sense DIMM exhaust temperature, SAS HDD exhaust temperature, and CPU2 exhaust temperature (through the altitude sensor).

Light Path Diagnostics

Light path diagnostics enables a technician to quickly identify and locate a failed or failing system component, such as a specific fan or memory DIMM. 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 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 both processors, all adapter slots, all fan modules, all power supplies, the voltage regulator module 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.)

Hot-Swap/Redundant Components

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

- **Redundant memory protection** (with **Chipkill** protection, and **memory mirroring** enabled)
- **Hot-swap, redundant hard disk drives** and **solid-state drives** (with **RAID** protection)
- **Hot-swap, redundant power supplies**
- **Hot-swap, redundant cooling fan modules**

Other Features

- **Five 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, two on the back, plus one USB connector reserved for a USB flash memory key containing an embedded hypervisor. For pre-boot and normal drive use, use the external ports.
- **Dual video ports** — To simplify local systems management, **one** video port is provided on the front of the unit and **one** on the back.
- **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 optical drive, hot-swap HDDs, plus PCI, PCI-X and PCIe adapters, as well as the integrated ServeRAID card, embedded hypervisor key, and Virtual Media Key. This can save a servicer significant time.

Advanced Systems Management Capabilities

The x3550 M3 has a high level of systems management capabilities that are well-suited to remote locations as well as to stand-alone environments. Features include **UEFI, IMM**, IBM ToolsCenter, IBM Systems Director Active Energy Manager for x86, Automatic Server Restart, Wake on LAN® support, PXE support, text console redirect, Predictive Failure Analysis, and IBM Systems Director.

The **IMM** 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
- Predictive Failure Analysis for system fans
- Web-based out-of-band control
- SSL (Secure Socket Layer) and LDAP (Lightweight Directory Access Protocol) support
- Enhanced authentication and encryption algorithms (RMCP+ and AES)
- VLAN support
- Local update of IMM firmware
- Firmware firewall
- Support for IPMI v2.0 compliant management software (e.g., xCAT)
- Other mandatory and optional IPMI IMM functions

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

The x3550 M3 also supports an optional IBM Virtual Media Key for additional systems management capabilities, including:

- Latest OS failure screen capture

- Graphical console redirection over LAN
- Remote virtual floppy and CD-ROM
- High-speed remote redirection of PCI video, keyboard and mouse

IBM **ToolsCenter** consolidates 42 needed tools for managing servers individually into an integrated suite of 8 tools. They are organized by function: deployment, updates, configuration and diagnostics. Tools are now simpler to access and use with a single webpage for access, a common look and feel and a common command line interface for the scripting tools. The ToolsCenter **Bootable Media Creator** offers significantly more functionality than past tools with the ability to add more tools to the bootable image and to automatically download the bootable environment if needed. Bootable Media Creator allows you to create bootable CDs, DVD, and USB keys for updates customized to your systems.

IBM developed IBM **Systems Director Active Energy Manager** to put control of system power-saving features at the fingertips of administrators. Active Energy Manager is 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. It also includes power management features to help administrators manage or reduce power usage.

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 Console Redirection support allows the administrator to remotely view x3550 text messages over serial or LAN. An optional upgrade to the Virtual Media Key adds graphical console redirection.

Predictive Failure Analysis (PFA) is designed to allow the system to detect impending failure of supported components (processors, memory, HDDs, voltage regulator modules (VRMs), power supplies and fans) *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 x3550 M3. IBM Systems Director comes with a portfolio of tools, including **IBM Systems Director Active Energy Manager**, **Service and Support Manager**, and others. *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.

Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. The x3550 M3 server 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 servers, get them running and keep them running long-term. These features include IBM Express Portfolio, IBM ServerProven®, IBM Standalone Solutions Configuration Tool, IBM System x and BladeCenter Power Configurator, IBM ServerGuide, IBM Systems Director Service and Support Manager, 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 servers. ServerGuide goes beyond mere hardware configuration by assisting with the automated installation of the Microsoft® Windows® Server 2003 and 2008 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 you total cost of ownership and the complexity that administrators and technical personnel face.

IBM Systems Director Service and Support Manager (previously called 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. Service and Support Manager 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 hardware and software, as well as onsite custom services to provide the level of expertise you require.

IBM Maintenance and Technical Support solutions can help you get the most out of your IT investment by reducing support costs, increasing availability and simplifying management with integrated support for your multiproduct, multivendor hardware and software environment. For more information on hardware maintenance, software support, solution support and managed support, visit http://**ibm.com**/services/maintenance.

Key Options

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

You know 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 —Intel Xeon processors provide high clock rates, 2 to 6 cores, 64-bit extensions, and advanced features for performance, availability and power management. Large cache size, combined with fast **1333MHz**, **1066MHz** or **800MHz** memory access and an integrated memory controller reduce memory latency and facilitate the movement of data. (***Note:*** System performance depends not only on the number of processors in the server but also on the frequency and functionality of each processor.) Adding a second processor may be a cost-effective way to achieve significant performance improvements.

Memory — Memory is a major 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 a **4-core** processor, there should be twice as much memory as for a 2-core processor. A **6-core** processor should have three times as much memory as a 2-core processor.

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 x3550 M3 with capacities of **500GB** at **7,200** RPMs, up to **300GB** at **10K** RPMs, and up to **146.8GB** at **15,000** RPMs. 2.5-inch **SATA** HDDs are available in capacities up to **500GB** at **7,200** RPMs and **300GB** at **10K** RPMs.

Solid State Drives — IBM solid-state drives offer high **IOPS** (I/O operations per second) performance and the ultimate in reliability, with 3X the MTBF (mean time between failure) rate of enterprise HDDs. IBM SSDs. are available in **50GB** capacities. They can be used as a highly available boot drive, for storing disk images, or for other uses that stress read performance.

Power Supply — The optional second power supply for the x3550 M3 enables redundancy for hot-swap power. Its **92%-efficient** design helps lower your energy bill for power and cooling.

Virtual Media Key — The x3550 M3 includes a plethora of systems management features built-in; however, sometimes additional management capability is needed. In those situations, the Virtual Media Key not only offers powerful new features, it does so without taking up a valuable PCI-X or PCIe adapter slot, instead using a dedicated 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. 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.

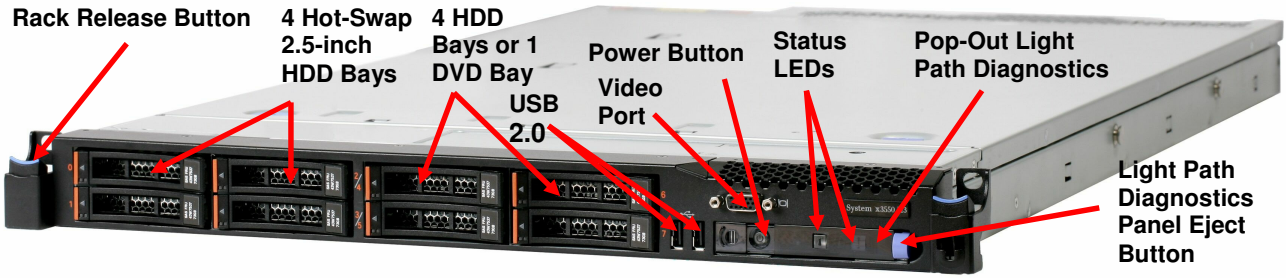
The **ServeRAID-BR10il v2 SAS/SATA Controller** offers **RAID-0/1/1E** support, with up to **3Gbps** per SAS port. The IBM **ServeRAID-M1015**, x8 PCIe and **6Gbps**, offers RAID-0/1/10; optionally RAID-5 with **SED** support. The IBM **ServeRAID-M5014**, x8 PCIe and **6Gbps**, provides **256MB** cache and RAID-0/1/10/5/50; optionally RAID-6/60 with SED, and battery backup). The IBM **ServeRAID-M5015**, x8 PCIe and **6Gbps**, has **512MB** cache and RAID-0/1/10/5/50; optionally RAID-6/60 with SED, and battery backup. For external storage, the **ServeRAID-MR10M** controller provides **RAID-0/1/10/5/50** support and **256MB** of onboard cache and enables connection to up to four IBM System Storage **EXP3000** SAS expansion units (48 HDDs total). The **IBM ServeRAID M1000 Series Advance Feature Key** adds **RAID-5** and **SED** support to the ServeRAID-M1015. Similarly, the **IBM ServeRAID M5000 Series Advance Feature Key** adds **RAID-6/60** with **SED** support to the M5014 and M5015. The **IBM ServeRAID M5000 Series Battery Key** adds **battery backup** support to the M5014.

External Storage — The IBM **System Storage EXP810** expansion unit, as well as the **DS3000, DS4000, and DS8000** series storage subsystems and **N3000**, **N5000**, **N6000**, and **N7000** NAS systems comprise a powerful and broad shared storage family with integrated management software designed to meet midrange and enterprise needs.

External SAN, iSCSI, and direct-attach storage is available using one of several IBM System Storage and TotalStorage host bus adapters. External LAN-attached tape storage is available.

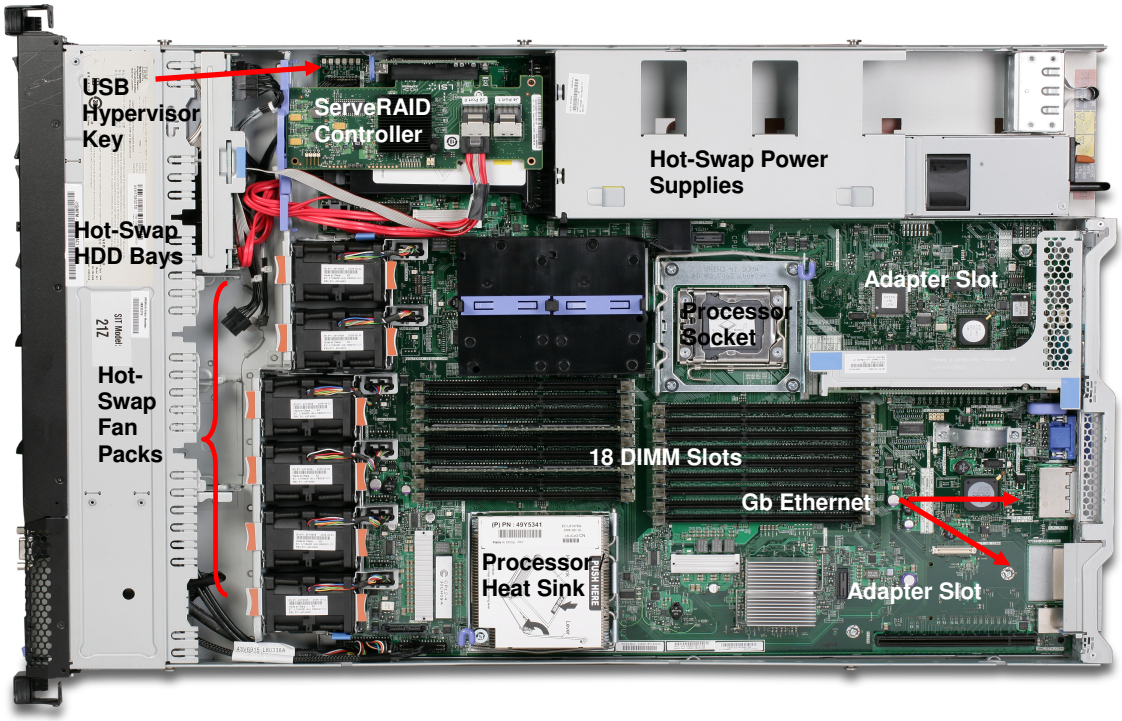
IBM System x3550 M3 Images

Front View

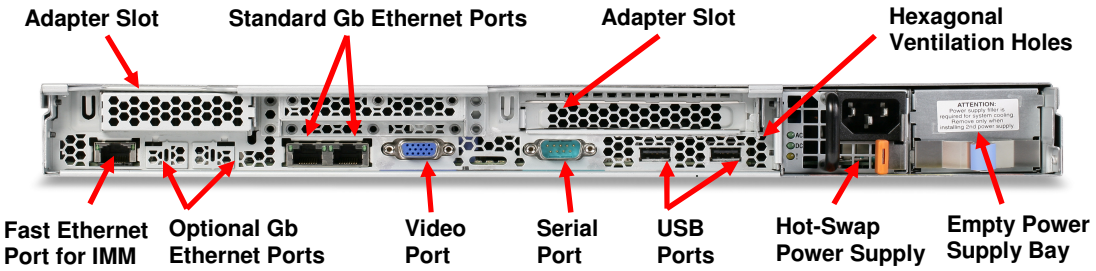


Leadership enterprise server with significantly lower cost of ownership in a highly available and expandable, rack-dense, 1U dual-socket server

Inside View



Rear View



IBM System x3550 M3 Specifications					
Machine type	**7944-A2x, B2x, C2x, D2x, F2x, G2x, H2x, J2x, M2x, N2x**				
Form factor	1U				
Processor type	**6-Core Xeon (L56xx/X56xx)** **2.26GHz** L5640 (H2x), **2.66GHz** X5650 (J2x), **2.93GHz** X5670 (M2x), **3.33GHz** X5680 (N2x), other processors supported via CTO		**4-Core Xeon (E56xx/L56xx)** **2.13GHz** L5630 (C2x), **2.4GHz** E5620 (D2x), **2.53GHz** E5630 (F2x), **2.66GHz** E5640 (G2x), other processors supported via CTO		**4-Core Xeon (E55xx)** **2.13GHz** E5506 (A2x), **2.26GHz** E5507 (B2x), other processors supported via CTO
Maximum processor power draw	**130W**—N2x (3.46GHz X5677 processor supported via CTO)	**95W**—J2x, M2x (X5550, X5560, X5570, X5667 processors supported via CTO)	**80W**—A2x, B2x, D2x, F2x, G2x (E5503, E5504, E5520, E5530, E5540 processors supported via CTO)	**60W**—H2x	**40W**—C2x (L5609 processor supported via CTO)
QuickPath Interconnect (QPI) speed (gigatransfers per second)	**6.4GTps** (J2x, M2x, N2x)		**5.86GTps** (C2x, D2x, F2x, G2x, H2x)		**4.8GTps** (A2x, B2x)
# of processors standard / maximum	2 / 2 (F2x)			1 / 2 (all other models)	
Hyper Threading Technology supported	Yes (2 threads per core) — C2x, D2x, F2x, G2x, H2x, J2x, M2x, N2x			No — A2x, B2x	
Turbo Boost Technology supported	Yes — C2x, D2x, F2x, G2x, H2x, J2x, M2x, N2x			No — A2x, B2x	
Internal L3 cache	**12MB** (1 shared 12MB cache)—(all other models)			**4MB** (1 shared 4MB cache)—(A2x, B2x)	
Chipset	Intel 5520				
Standard memory (192GB maximum)	**12GB** (3 x 4GB) — J2x, M2x, N2x		**8GB** (2 x 4GB) — F2x		**4GB** (1 x 4GB) — A2x, B2x, C2x, D2x, G2x, H2x
# of DIMM sockets total / available	18 / **15** — J2x, M2x, N2x		18 / **16** — F2x		18 / **17** — A2x, B2x, C2x, D2x, G2x, H2x
Standard memory voltage	**1.5V** (A2x, B2x, D2x, F2x, G2x, J2x, M2x, N2x)			**1.35V** (C2x, H2x)	
Standard memory type	**Registered** PC3-10600 (DDR III ECC (**Chipkill** protection standard)—Dual-rank x4				
Maximum memory access speed	**1333MHz** (H2x, J2x, M2x, N2x)			**1066MHz** (A2x, B2x, C2x, D2x, F2x, G2x)	
Memory interleaving	Yes (two-way using pairs DIMMs)				
DIMM types / capacities supported (* When available in 2Q/2010)	**PC3-10600** **1333MHz RDIMM** 2GB **single**-rank **x4**, 1.5V; 2GB single-rank x8 1.5V; 2GB dual-rank x8 1.5V; 2GB dual-rank x8 **1.35V**; 4GB dual-rank **x4** 1.5V; 4GB dual-rank **x4 1.35V**; 8GB dual-rank **x4** 1.5V; *8GB dual-rank **x4 1.35V**		**PC3-10600** **1333MHz UDIMM** 2GB dual-rank x8 1.5V; *4GB dual-rank x8 1.35V		**PC3-8500** **1066MHz RDIMM** *8GB dual-rank **x4** 1.35V; *16GB quad-rank **x4** 1.5V

Leadership enterprise server with significantly lower cost of ownership in a highly available and expandable, rack-dense, 1U dual-socket server

Supports 1333MHz with 2 DIMMs per channel	L5640 and X56xx processors support 2DPC at 1333MHz; X55xx processors support 2DPC at 1333MHz via the special bid process			
Online hot-spare memory supported	No			
Memory mirroring supported / # of DIMM sockets reserved for mirroring	Yes / 1 channel (3 slots per processor) active, 1 spare, 1 unused			
# of HDD drive bays total / available	8 / 8 (2.5-inch)		4 / 4 (2.5-inch) with internal optical drive	
# of 5.25" bays total / available	1 / 1			
Maximum drive capacity	**2.5-inch SAS/SATA 4.0TB** (8 x 500GB) **hot**-swap	**2.5-inch SAS/SATA 2.0TB** (4 x 500GB) **hot**-swap, with internal optical drive	**2.5-inch SSD 400GB** (8 x 50GB) **hot**-swap or **simple**-swap	**2.5-inch SSD 200GB** (4 x 50GB) **hot**-swap or **simple**-swap, with internal optical drive
Drive capacities supported	**2.5-inch HS SAS 500GB** – 7.2K 73.4, 146.8, **300GB – 10K** 73.4, **146.8GB —15K**	**2.5-inch HS SATA** 160, **500GB** – 7.2K **300GB – 10K**	**2.5-inch HS or SS SSD 50GB**	
# of HDDs standard	None (all models open bay)			
# of optical drives standard	None (optional DVD-RW)			
# of diskette drives standard	None (optional)			
Storage technology	Hot-swap SAS/SATA; also hot-swap or simple-swap SSD			
Integrated disk controller	LSI 1068			
# of disk drives supported *per port*	1			
Integrated RAID controller standard	ServeRAID-**BR10il v2** (no cache)—RAID-0/1/1E, 3Gbps; supports 4 drives (A2x)	ServeRAID-**M1015** (no cache) optional battery—RAID-0/1/10; optional RAID-5 with SED, 6Gbps; supports 16 drives (B2x, C2x, D2x, H2x, N2x)	ServeRAID-**M5014** (**256MB cache**) optional battery—RAID-0/1/10/5/50; optional RAID-6/60 with SED, 6Gbps; supports 16 drives (F2x, G2x)	ServeRAID-**M5015** (**512MB cache**) optional battery—RAID-0/1/10/5/50; optional RAID-6/60 with SED, 6Gbps; supports 16 drives (J2x, M2x)
Optional internal RAID controllers supported	ServeRAID-**M1015**—RAID-0/1/10 (A2x)	ServeRAID-**M5014** (A2x, B2x, C2x, D2x, H2x, N2x)	ServeRAID-**M5015** (A2x, B2x, C2x, D2x, F2x, G2x, H2x, N2x)	
External disk drives supported	Yes, via the optional 3Gbps ServeRAID-**MR10M** controller (**256MB** cache standard—SAS/SATA; adds RAID-0/1/10/5/50/6/60)			
# of adapter slots total / available	2 / 2 (2 / 1 when using the CTO Emulex 10GbE Integrated Virtual Fabric Adapter)			
# of PCIe x16 Gen 2 slots (16GBps)	**2** via 2 risers (**1 full**-height/**half**-length, **1 low-profile/full**-length			
# of PCIe x8 Gen 2 slots (8GBps)	None			
# of PCI-X/133 slots (1GBps)	None standard (1 or 2 via optional risers in place of the PCIe risers)			
# of 33MHz legacy PCI slots	None			
# of video ports	2 (one front, one rear)			
Video controller	Matrox G200eV (in IMM) standard (NVIDIA FX580, 1800, or 3800 available for CTO and special-bid models)			

Maximum video resolutions	1280x1024 at 60Hz (32 bits)	1600x1200 at 85Hz (16 bits)
Gigabit Ethernet controller	Broadcom BCM5709S	
TOE/iSCSI/RDMA acceleration	TOE only	
# of Gigabit Ethernet ports	2 standard plus 2 optional	
# of RS485 ports	None	
# of serial ports	1 (rear)	
# of parallel ports	None (USB-attached)	
# of mouse ports	None (USB-attached)	
# of keyboard ports	None (USB-attached)	
# of USB 2.0 ports	**5** (2 front, 2 rear, 1 internal for a USB flash memory key containing an embedded hypervisor)	
Integrated systems management controller	Yes (IMM)	
Optional systems management adapter	Virtual Media Key (optional)	
Light path diagnostics support	Yes, with external pop-out/drop-down panel	
Predictive Failure Analysis (PFA) support	Processors, memory, voltage regulator modules (VRMs), power supplies and fans	
Power supply size	**675W** universal, autoswitching, hot-swap; **92%** efficiency	
# of power supplies standard / maximum	2 / 2 (F2x)	1 / 2 (all other models)
Hot-swap/redundant power supported	Yes (with two power supplies installed)	
# of fans modules standard / maximum	6 / 6 (F2x)	5 / 6 (all other models)
Hot-swap/redundant fans supported	Yes (standard)	
Rack mount method	Slides and Cable Management Arm (provided standard)	
Maximum altitude	7,000 ft; 2,133 m	
Operating temperature range	50 – 95º F; 10 – 35º C (up to 3,000 ft / 914.4 m)	50 – 90º F; 10 – 32º C (3,000 ft to 7,000 ft / 914.4m to 2,133m)
Dimensions (HWD) / weight	1.69” (43mm) **H** 17.3” (440mm) **W** 28.0” (711.4mm) **D**	28 (minimum) – 35.1 **lb** (maximum) 12.7 – 15.9 **kg**
Operating systems supported	Microsoft Windows Server 2008 / 2008 R2, 32/64-bit; Microsoft Windows Server 2003 / 2003 R2 (Standard/Enterprise/Web/Datacenter/Datacenter with UV), 32/64-bit; RHEL 4 (AS/ES/WS) 32-bit without Xen; RHEL 5 32/64-bit, with and without Xen; SLES 10/11 32/64-bit with and without Xen; VMware ESX Server 4.0, ESXi 4.0; Sun Solaris 10[6]	
Length of limited warranty	3 years (parts and labor)[7]	

[6] Support planned for 2Q/2010.

[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.

The Bottom Line

The IBM System x3550 M3 is an extremely energy efficient, powerful system, incorporating significantly redesigned management tools and abundant IBM-unique innovations:

Price/Performance

- **High-throughput processors** — Up to two **2.66** to **3.33GHz 6-core**, **2. 40GHz** to **3.46GHz 4-core**, or **1.86GHz** to **2.13GHz low-voltage 4-core,** or **2.26GHz low-voltage** 6**-core** Xeon **5600** Series processors; or two **2.0GHz** to **2.93GHz 4-core** or **2.0GHz 2-core** Xeon **5500** Series processors
- **Energy-efficient low-voltage processors** — **40W 4-core** and **60W 6-core** Xeon 5600 Series processors
- **Hyper Threading Technology** for up to **12** processor cores and **24** threads total (processor-specific)
- **Turbo Boost Technology** for a performance boost when not all cores are in use (processor-specific)
- **64-bit extensions** (EM64T)
- **Large cache** — **12MB** or **4MB** of L3 processor cache (processor-specific)
- **Fast memory** — Registered **PC3-10600 DDR III** ECC DIMMs standard, operating at **1333MHz**, **1066MHz** or **800Mhz** (depending on processor model and memory configuration); supports 2 DIMMs per channel at 1333MHz
- **Fast disk technology** — Supports high-performance SAS drives that provide high density/high reliability and allow you to scale up as your business grows.
- **High IOPS SSDs** — Solid-state drives offer significantly higher I/O operations per second than HDDs
- **Fast communications** — Integrated **dual Gigabit Ethernet** controllers standard supporting **load-balancing** and **failover; two additional NICs optional**
- **Fast I/O** — Two **PCIe x16** adapter slots (replaceable with two PCI-X/133 slots)

Flexibility

- **Large memory capacity** — Up to **192GB** of registered DDR2 DIMMs, in **18** DIMM slots
- Up to **8 2.5-inch hot-swap** SAS/SATA HDDs or SSDs or **simple-swap** SSDs
- **Choice of disk storage** — Up to **4.0TB** of internal SAS/SATA storage, **800GB** of internal solid-state storage
- **High-performance external expansion** — **Five** 480Mbps **USB 2.0** ports (two front, two rear, one internal for an optional USB key with hypervisor)
- Slotless hardware-based **3Gbps RAID-0/1/1E**, or **6Gbps RAID-0/1/10** or **RAID-0/1/10/5/50** standard
- **Two** *available* adapter slots —
  - **Two x16**[8] **PCIe** slots (Gen2)
  - An optional riser card containing **one 133MHz PCI-X** slot can replace the riser card containing each of the PCIe slots
- Optional **DVD-RW** drive
- **Two video ports** (one on the front and one on the back)

Manageability, Serviceability and Availability

- **IBM Systems Director** systems management software, including (among others:
  - IBM Systems Director Active Energy Manager
  - IBM Service and Support Manager
- **Integrated Management Module** (IMM):
  - **IPMI 2.0** compliance, including highly secure remote power control
  - **Text console redirection** systems management standard
- **Active Memory protection:**
  - Advanced **Chipkill** ECC memory protection support
  - **Memory mirroring**
- Integrated slotless **ServeRAID** controller — enhances system availability and serviceability without using a PCIe slot
- A combination of **hot-swap SAS/SATA** HDDs or **SSDs,** or **simple-swap SSDs**—for quicker servicing than with fixed drives

[8] The x8 slots can accept x1, x4, or x8 adapters running at x1, x4, or x8 throughput, respectively.

- **Solid-state drives** as a high-reliability alternative to internal storage (with up to three times the MTBF of spinning disk drives)
- **Ultra-efficient cooling** incorporating **Calibrated Vectored Cooling** features and **hot-swap/redundant fan modules**
- Standard or optional **hot-swap/redundant power supplies** (model-specific)
- **Light path diagnostics** (front LED panel, pop-out/drop-down light path panel)
- Optional Virtual Media Key daughter card (no slot required)
  - ❑ Supports **LDAP** and **SSL** industry standards
- **Toolless chassis** and **toolless slide** design; integrated **Cable Management Arm**

Server Comparison Chart

The following table shows the suggested uses for the respective IBM System x rack-optimized servers, including comparisons of the uses for which each server is best suited:

Important ■ Nice to Have ■ Can do without □ ● Best ◒ Better ○ Good

Theme	Key Workloads	Requirements: Scalability	Floating Point Performance	Memory Throughput	Integer Performance	I/O and Storage	Density	High Availability	Systems Management	Security	Distributed Deployment	Rack-Optimized Servers: x3250 M3	x3550 M3	x3650 M3	x3690 X5	x3755	x3850 X5	x3950 X5
HPC	Cluster / HPC		■	■			■					◒	●	●	○	◒	○	○
	Modeling & Simulation		■	■	■		■					◒	●	◒	◒	◒	◒	◒
	High Performance DB			■	■	■						○	◒	●	◒	◒	◒	●
	Business Intelligence		■	■	■		■			■		○	◒	◒	◒	●	●	●
Web 2.0 / Web 3D	Search		■	■	■		■			■		○	●	●	○	○	○	○
	Content						■					●	◒	●	○	○	◒	○
	Communities	■				■	■					○	●	●	○	◒	○	○
	Commerce		■	■	■		■	■		■		○	●	●	○	●	◒	○
	Collaboration						■					●	●	●	○	◒	○	○
Business Applications	ERP/SCM	■		■	■	■		■	■	■		○	●	●	◒	●	●	●
	CRM									■		○	●	●	◒	●	●	●
	Hosted Client	■			■			■	■			○	○	○	●	○	○	○
	Point of Sale					■		■	■	■	■							
	Branch Office							■	■		■	●	●	●	○	○	○	○
Infrastructure Applications	Virtualization	■				■		■	■			○	◒	●	●	◒	●	●
	Business Continuity					■			■			○	◒	◒	○	◒	●	●
	Database			■		■		■				○	◒	●	●	●	●	●
	Email/Collaboration				■			■	■			◒	●	●	◒	◒	○	○
	Security						■	■	■	■		●	●	◒	◒	○	○	○
	Web Serving						■		■			●	●	◒	◒	◒	○	○
	File & Print					■			■			●	◒	◒	◒	◒	○	○

For More Information

IBM System x Servers	http://**ibm.com**/systems/x
IBM Systems Director Service and Support Manager	http://**ibm.com**/support/electronic
IBM System x and BladeCenter Power Configurator	http://**ibm.com**/systems/bladecenter/powerconfig
Standalone Solutions Configuration Tool	http://**ibm.com**/servers/eserver/xseries/library/configtools.html
Configuration and Options Guide	http://**ibm.com**/servers/eserver/xseries/cog
ServerProven Program	http://**ibm.co**m/servers/eserver/serverproven/compat/us
Technical Support	http://**ibm.com**/server/support
Other Technical Support Resources	http://**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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