

IBM System x3500 M4

IBM Redbooks Product Guide

The IBM® System x3500 M4 server provides outstanding performance for your business-critical applications. Its energy-efficient design supports more cores, memory, and data capacity in a scalable Tower or 5U Rack package that is easy to service and manage. With more computing power per watt and the latest Intel Xeon processors, you can reduce costs while maintaining speed and availability.

Suggested use: infrastructure applications, collaboration/email, web, and virtualized desktops in a workgroup or distributed environments.



Figure 1. The IBM System x3500 M4

Did you know?

The x3500 M4 offers a flexible, scalable design and simple upgrade path to 32 HDDs, with up to eight PCIe 3.0 slots and up to 768 GB of memory. The Onboard Ethernet solution provides four standard integrated Gigabit Ethernet ports without occupying PCIe slots. Comprehensive systems management tools with the next-generation Integrated Management Module II (IMM2) make it easy to deploy, integrate, service, and manage.

Key features

A high-performance dual-socket tower server, the IBM System x3500 M4, can deliver the scalability, reliable performance, and optimized efficiency for your business-critical applications. Start with the basics and upgrade as your business changes without jeopardizing existing investments. Virtualizing the PC infrastructure into one server can provide access to a powerful server with abundant storage space, while significantly reducing IT costs.

Scalability and performance

The x3500 M4 offers numerous features to boost performance, improve scalability, and reduce costs:

- The Intel Xeon processor E5-2600 product family improves productivity by offering superior system performance with 8-core processors and up to 2.9 GHz core speeds, up to 20 MB of L3 cache, and two QPI interconnect links of up to 8 GT/s.
- Up to two processors, 16 cores, and 32 threads maximize the concurrent execution of multi-threaded applications.
- Intelligent and adaptive system performance with Intel Turbo Boost Technology 2.0 allows CPU cores to run at maximum speeds during peak workloads by temporarily going beyond processor TDP.
- Intel Hyper-Threading Technology boosts performance for multi-threaded applications by enabling simultaneous multi-threading within each processor core, up to two threads per core.
- Intel Virtualization Technology integrates hardware-level virtualization hooks that allow operating system vendors to better utilize the hardware for virtualization workloads.
- Intel Advanced Vector Extensions (AVX) significantly improve floating point performance for compute-intensive technical and scientific applications compared to Intel Xeon 5600 series processors.
- Twenty-four Load Reduced DIMMs (LRDIMMs) of 1333 MHz DDR3 ECC memory provide speed, high availability, and a memory capacity of up to 768 GB.
- The theoretical maximum memory bandwidth of the Intel Xeon processor E5 family is 51.6 GBps, which is 60% more than in the previous generation of Intel Xeon processors.
- Up to 32 drive bays together with internal backup and optical drive at the same time provide a flexible and scalable all-in-one platform to meet increasing demands.
- The server has four integrated Gigabit Ethernet ports that double the network throughput compared with the previous generation of IBM System x® servers.
- The server offers PCI Express 3.0 I/O expansion capabilities that improve the theoretical maximum bandwidth by 60% (8 GT/s per link) compared with the previous generation of PCI Express 2.0.
- With Intel Integrated I/O Technology, the PCI Express 3.0 controller is integrated into the Intel Xeon processor E5 family. This helps to dramatically reduce I/O latency and increase overall system performance.

Availability and serviceability

The x3500 M4 provides many features to simplify serviceability and increase system uptime:

- The server offers memory mirroring and memory rank sparing for redundancy in the event of a non-correctable memory failure.
- Tool-less cover removal provides easy access to upgrades and serviceable parts, such as CPU, memory, and adapter cards.

- The server offers hot-swap drives supporting RAID redundancy for data protection and greater system uptime.
- The server has up to two redundant hot-swap power supplies and up to six simple swap N+N redundant fans to provide availability for business-critical applications.
- The power source independent 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 system availability.
- The Predictive Failure Analysis (PFA) detects when system components (for example, processors, memory, hard disk drives) operate outside of standard thresholds and generates pro-active alerts in advance of possible failure, therefore increasing uptime.
- Built-in Integrated Management Module Version II (IMM2) continuously monitors system parameters, triggers alerts, and performs recovering actions in case of failures to minimize downtime.
- Built-in diagnostics using Dynamic Systems Analysis (DSA) Preboot speeds up troubleshooting tasks to reduce service time.
- Three-year customer replaceable unit and onsite limited warranty, next business day 9x5. Optional service upgrades available.

Manageability and security

Powerful systems management features simplify local and remote management of the x3500 M4:

- The server includes an Integrated Management Module II (IMM2) to monitor server availability and perform remote management.
- Integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- Integrated Trusted Platform Module (TPM) 1.2 support enables advanced cryptographic functionality, such as digital signatures and remote attestation.
- Industry-standard AES NI support for faster, stronger encryption.
- IBM Systems Director is included for proactive systems management. It offers comprehensive systems management tools that help to increase up-time, reduce costs, and improve productivity through advanced server management capabilities.
- Intel Execute Disable Bit functionality can help prevent certain classes of malicious buffer overflow attacks when combined with a supporting operating system.
- Intel Trusted Execution Technology provides enhanced security through hardware-based resistance to malicious software attacks, allowing an application to run in its own isolated space protected from all other software running on a system.

Energy efficiency

The x3500 M4 offers the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to the green environment:

- Energy-efficient planar components help lower operational costs.
- High-efficient 750 W and 900 W power supplies with 80 PLUS Platinum certification.
- The Intel Xeon processor E5-2600 product family offers significantly better performance over the previous generation while fitting into the same thermal design power (TDP) limits.
- Intel Intelligent Power Capability powers individual processor elements on and off as needed, to reduce power draw.

- Low-voltage Intel Xeon processors draw less energy to satisfy demands of power and thermally constrained data centers and telecommunication environments.
- Low-voltage 1.35 V DDR3 memory RDIMMs consume 15% less energy than 1.5 V DDR3 RDIMMs.
- The server uses hexagonal ventilation holes, a part of IBM Calibrated Vectors Cooling™ technology. Hexagonal holes can be grouped more densely than round holes, providing more efficient airflow through the system.
- IBM Systems Director Active Energy Manager™ provides advanced data center power notification and management to help achieve lower heat output and reduced cooling needs.

Locations of key components and connectors

Figure 2 shows the front of the server.

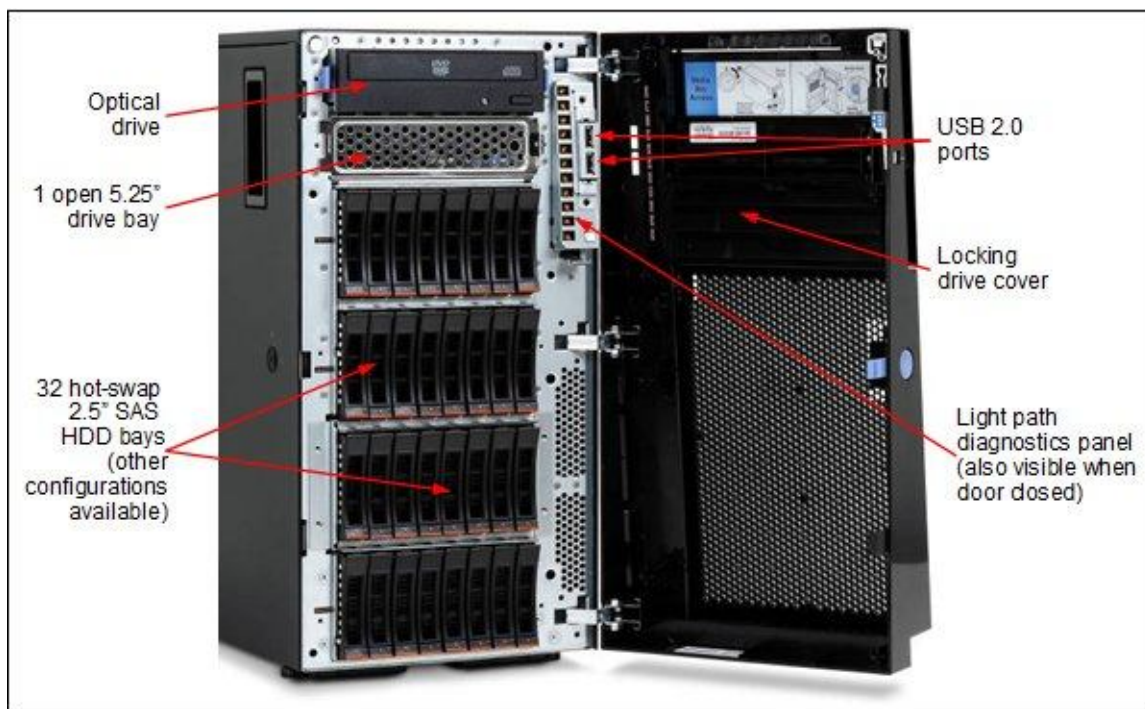


Figure 2. Front view of the IBM System x3500 M4

Figure 3 shows the rear of the server.

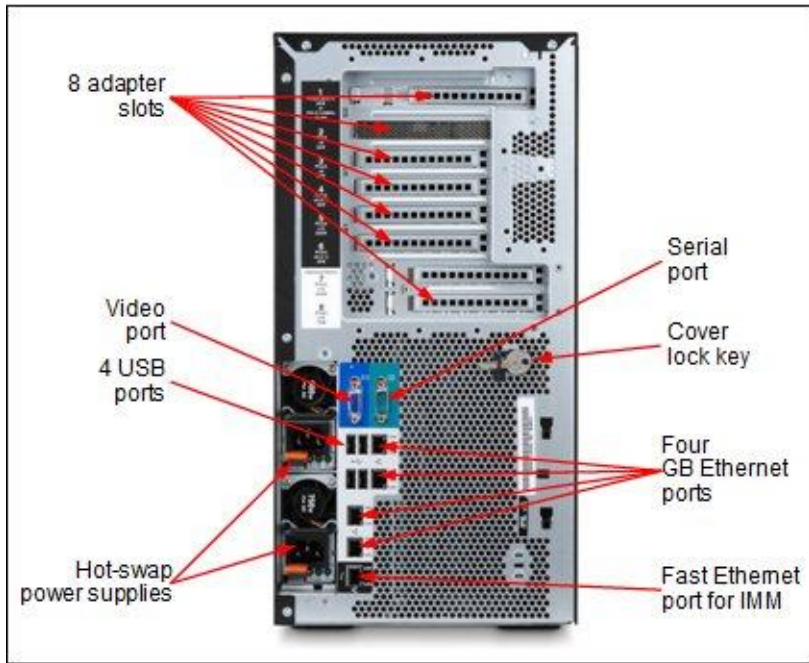


Figure 3. Rear view of the IBM System x3500 M4

Figure 4 shows the locations of key components inside the server.

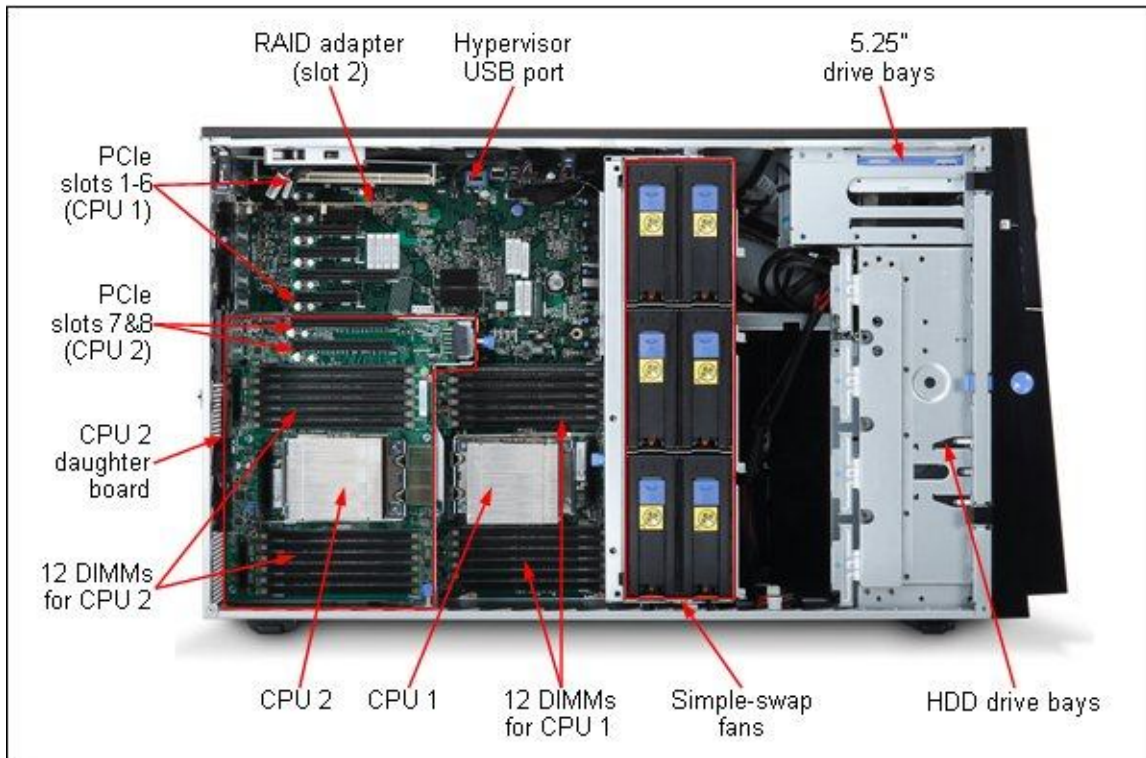


Figure 4. Inside view of the IBM System x3500 M4

Standard specifications

The following table lists the standard specifications.

Table 1. Standard specifications (part 1)

Components	Specification
Form factor	Tower or 5U Rack.
Processor	Up to two Intel Xeon processor E5-2600 product family CPUs with eight cores (up to 2.9 GHz) or six cores (up to 2.9 GHz) or quad-cores (up to 3.3 GHz). Two QPI links up to 8.0 GT/s each. Up to 1600 MHz memory speed. Up to 20 MB L3 cache.
Chipset	Intel C602J.
Memory	Up to 24 DDR3 DIMM sockets (12 DIMMs per processor). RDIMMs, UDIMMs, and LRDIMMs are supported, but memory types cannot be intermixed.
Memory maximums	With LRDIMMs: Up to 768 GB with 24x 32 GB LRDIMMs and two processors. With RDIMMs: Up to 384 GB with 24x 16 GB RDIMMs and two processors. With UDIMMs: Up to 32 GB with 16x 2 GB UDIMMs and two processors.
Memory protection	ECC, Chipkill (for x4-based memory DIMMs), memory mirroring, and memory sparing.
Disk drive bays	Up to thirty-two 2.5" hot-swap SAS/SATA HDDs, or up to eight 3.5" hot-swap SAS/SATA HDDs, or up to eight 3.5" Simple Swap SATA HDDs.
Maximum internal storage	28.8 TB with 900 GB 2.5" SAS HDDs, or 32 TB with 1 TB 2.5" SATA HDDs, or 24 TB with 3 TB 3.5" SATA HDDs. Intermix of SAS/SATA is supported.
RAID support	RAID 0, 1, 10 with M1115 or ServeRAID M5110. Optional upgrade to RAID 5, 50 available for M1115. Optional upgrades to RAID 5, 50 are available for M5110 (zero-cache, 512 MB battery-backed cache, 512 MB or 1 GB flash-backed cache). Optional upgrade to RAID 6, 60 available for M5110.
Optical drive bays	Two half-height 5.25" bays for optical or tape drives. Supports DVD-ROM or Multiburner.
Tape drive bays	Two half-height 5.25" bays for optical or tape drives. Support for one RDX or DDS internal USB tape drive. Supports up to two LTO internal SAS tape drives.
Network interfaces	Four integrated Gigabit Ethernet 1000BASE-T ports (RJ-45) based on Intel I350AM4 Quad Port GbE LAN Controller chip.
PCI Expansion slots	Up to eight slots with two processors and six slots when one CPU is installed. All slots are PCIe 3.0 slots except Slot 1, which is a Gen 2 slot: <ul style="list-style-type: none"> ● Slot 1: PCIe x8 (x4 wired); full-height, half-length (supports optional PCI-X 64 bit/133 MHz interposer card) ● Slot 2: PCIe x8; full-height, half-length ● Slot 3: PCIe x8; full-height, full-length ● Slot 4: PCIe x8 (x4 wired); full-height, full-length ● Slot 5: PCIe x16; full-height, full-length ● Slot 6: PCIe x8 (x4 wired); full-height, full-length ● Slot 7: PCIe x16; full-height, full-length (requires second processor) ● Slot 8: PCIe x16; full-height, full-length (requires second processor)
Ports	Two USB 2.0s on front. Four USB 2.0s, one DB-15 video, one DB-9 serial, one RJ-45 systems management, four RJ-45 GbE network ports on rear. Two internal USB ports (for embedded hypervisor and internal tape drive).

Table 1. Standard specifications (part 2)

Components	Specification
Cooling	IBM Calibrated Vecteded Cooling with up to six simple swap fans (two fans shipped standard on single processor models and three fans shipped on dual processor models) with optional N+N redundancy available .
Power supply	Up to two redundant hot-swap 750 W ac or 900 W ac power supplies (80 PLUS Platinum certification).
Hot-swap parts	Hard drives, power supplies.
Systems management	UEFI, IBM Integrated Management Module II (IMM2), Predictive Failure Analysis, Light Path Diagnostics, Automatic Server Restart, IBM Systems Director and IBM Systems Director Active Energy Manager, IBM ServerGuide. Optional IMM Advanced Upgrade via Feature on Demand (FoD) for remote presence (graphics, keyboard and mouse, virtual media).
Security features	Power-on password, administrator's password, Trusted Platform Module (TPM).
Video	Matrox G200eR2 with 16 MB memory integrated into the IMM2. Maximum resolution is 1600x1200 at 75 Hz with 16 M colors.
Operating systems supported	Microsoft Windows Server 2008 R2 and 2008, Red Hat Enterprise Linux 5 and 6, SUSE Linux Enterprise Server 10 and 11, VMware vSphere 5.
Limited warranty	3-year customer-replaceable unit and onsite limited warranty with 9x5/NBD.
Service and support	Optional service upgrades are available through IBM ServicePacs®: 4-hour or 2-hour response time, 8-hour fix time, 1-year or 2-year warranty extension, remote technical support for IBM hardware and selected IBM and third-party (Microsoft, Linux, VMware) software.
Dimensions	Width: 218 mm (8.6 in), depth: 750 mm (29.5 in), height: 440 mm (17.3 in).
Weight	Minimum configuration: 25.0 kg (55.1 lb), maximum: 39.8 kg (87.7lb).

The x3500 M4 servers are shipped with the following items:

- Statement of Limited Warranty
- Important Notices
- Registration flyer
- Documentation CD that contains the *Installation and User's Guide*
- IBM Systems Director 6.3 Base for x86 DVD-ROM
- One 2.8 m C13 line cord (country-specific)

Note: EMEA models do not contain line cord. It must be purchased separately.

Standard models

The following table lists the standard models.

Table 2. Standard models

Model	Intel Xeon processors† (2 maximum)	Memory	RAID	Disk bays	Disks	GbE	DVD	Power
Models announced March 2012								
7383-A2x	1x E5-2603 4C 1.8GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 750W
7383-B2x	1x E5-2609 4C 2.4GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 750W
7383-C2x	1x E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M1115	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 750W
7383-C4x	1x E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M1115	8x 3.5" HS / 8	Open	4	DVD-ROM	1x 750W
7383-D2x	1x E5-2630 6C 2.3GHz 15MB 1333MHz 95W	1x 8 GB	M1115	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 750W
7383-F2x	1x E5-2640 6C 2.5GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB (f)	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 750W
7383-G2x	1x E5-2650 8C 2.0GHz 20MB 1600MHz 95W	1x 8 GB	M5110 1GB (f)	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 900W
7383-H2x	1x E5-2670 8C 2.6GHz 20MB 1600MHz 115W	1x 8 GB	M5110 1GB (f)	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 900W
7383-J2x	1x E5-2680 8C 2.7GHz 20MB 1600MHz 130W	1x 8 GB	M5110 1GB (f)	8x 2.5" HS / 32	Open	4	DVD-ROM	1x 900W

† Processor detail: Processor quantity and model, number of cores, core speed, L3 cache, memory speed, power consumption.

(f) The ServeRAID M5110 RAID controller in this model includes flash-backed cache. The cache size is 512 MB or 1 GB, as indicated.

Refer to the Specifications section for information about standard features of the server.

Express models

The following table lists the express models.

Table 3. Express models (Part 1)

Model	Processor†	RAM	RAID	Disk bays	Disks	Network	Optical	Power
North America (NA)								
7383-EAU	1x Xeon E5-2609 4C 2.4GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-EBU	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-ECU	1x Xeon E5-2640 6C 2.5GHz 15MB 1333MHz 95W	2x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	2x 750 W
7383-EDU	1x Xeon E5-2650 8C 2.0GHz 20MB 1600MHz 95W	1x 8 GB	M5110 1GB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
Latin America (LA)								
7383-EAU	1x Xeon E5-2609 4C 2.4GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-EBU	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-ECU	1x Xeon E5-2640 6C 2.5GHz 15MB 1333MHz 95W	2x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	2x 750 W
7383-EDU	1x Xeon E5-2650 8C 2.0GHz 20MB 1600MHz 95W	1x 8 GB	M5110 1GB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
Europe Integrated Operating Team (IOT)								
7383-E1G	1x Xeon E5-2603 4C 1.8GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-E2G	1x Xeon E5-2603 4C 1.8GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
7383-E3G	1x Xeon E5-2609 4C 2.4GHz 10MB 1066MHz 80W	1x 4 GB	M5110 512MB(f)	8x 2.5" HS / 32	2x 300GB 10k 2.5" SAS	4x GbE	Multi- burner	1x 750 W
7383-E4G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	2x 750 W
7383-E5G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
7383-E6G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	2x 300GB 10k 2.5" SAS	4x GbE	Multi- burner	1x 750 W

† Processor detail: Processor quantity and model, number of cores, core speed, L3 cache, memory speed, power consumption.

(f) The ServeRAID M5110 RAID controller in this model includes flash-backed cache. The cache size is 512 MB or 1 GB, as indicated.

(b) The ServeRAID M5110 RAID controller in this model includes battery-backed cache. The cache size is 512 MB or 1 GB, as indicated.

Table 3. Express models (Part 2)

Model	Processor†	RAM	RAID	Disk bays	Disks	Network	Optical	Power
Central and Eastern Europe (CEE) and Middle East & Africa (MEA)								
7383-E1G	1x Xeon E5-2603 4C 1.8GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-E2G	1x Xeon E5-2603 4C 1.8GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
7383-E3G	1x Xeon E5-2609 4C 2.4GHz 10MB 1066MHz 80W	1x 4 GB	M5110 512MB(f)	8x 2.5" HS / 32	2x 300GB 10k 2.5" SAS	4x GbE	Multi- burner	1x 750 W
7383-E5G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
7383-E6G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	2x 300GB 10k 2.5" SAS	4x GbE	Multi- burner	1x 750 W
7383-K1G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 2.5" HS / 32	3x 300GB 10k 2.5" SAS	4x GbE	Multi- burner	2x 750 W
7383-K3G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(b)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	2x 750 W
Russia/Commonwealth of Independent States (CIS)								
7383-E1G	1x Xeon E5-2603 4C 1.8GHz 10MB 1066MHz 80W	1x 4 GB	M1115	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	1x 750 W
7383-K2G	1x Xeon E5-2609 4C 2.4GHz 10MB 1066MHz 80W	1x 4 GB	M5110 512MB(b)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	1x 750 W
7383-K3G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(b)	8x 2.5" HS / 32	Optional	4x GbE	Multi- burner	2x 750 W
7383-K4G	1x Xeon E5-2620 6C 2.0GHz 15MB 1333MHz 95W	1x 8 GB	M5110 512MB(f)	8x 3.5" HS / 8	Optional	4x GbE	Multi- burner	2x 750 W

† Processor detail: Processor quantity and model, number of cores, core speed, L3 cache, memory speed, power consumption.

(f) The ServeRAID M5110 RAID controller in this model includes flash-backed cache. The cache size is 512 MB or 1 GB, as indicated.

(b) The ServeRAID M5110 RAID controller in this model includes battery-backed cache. The cache size is 512 MB or 1 GB, as indicated.

Processor options

The x3500 M4 supports the processor options listed in the following table. The server supports up to two processors. This table shows which server models have each processor standard. If there is no corresponding *where-used* model for a particular processor, then this processor is only available through CTO.

Table 4. Processor options

Part number	Description	Standard models where used
Intel Xeon processor E5-2600 product family		
90Y5942	Intel Xeon Processor E5-2603 4C 1.8GHz 10MB 80W Upgrade Kit	A2x
90Y5944	Intel Xeon Processor E5-2609 4C 2.4GHz 10MB 80W Upgrade Kit	B2x
90Y5945	Intel Xeon Processor E5-2620 6C 2.0GHz 15MB 95W Upgrade Kit	C2x, C4x
90Y5946	Intel Xeon Processor E5-2630 6C 2.3GHz 15MB 95W Upgrade Kit	D2x
90Y5953	Intel Xeon Processor E5-2630L 6C 2.0GHz 15MB 60W Upgrade Kit	-
94Y7342	Intel Xeon Processor E5-2637 2C 3.0GHz 5MB 80W Upgrade Kit	-
90Y5947	Intel Xeon Processor E5-2640 6C 2.5GHz 15MB 95W Upgrade Kit	F2x
94Y7341	Intel Xeon Processor E5-2643 4C 3.3GHz 10MB 130W Upgrade Kit	-
90Y5948	Intel Xeon Processor E5-2650 8C 2.0GHz 20MB 95W Upgrade Kit	G2x
90Y5954	Intel Xeon Processor E5-2650L 8C 1.8GHz 20MB 70W Upgrade Kit	-
90Y5949	Intel Xeon Processor E5-2660 8C 2.2GHz 20MB 95W Upgrade Kit	-
94Y7442	Intel Xeon Processor E5-2665 8C 2.4GHz 20MB 115W Upgrade Kit	-
90Y5951	Intel Xeon Processor E5-2667 6C 2.9GHz 15MB 130W Upgrade Kit	-
90Y5955	Intel Xeon Processor E5-2670 8C 2.6GHz 20MB 115W Upgrade Kit	H2x
90Y5950	Intel Xeon Processor E5-2680 8C 2.7GHz 20MB 130W Upgrade Kit	J2x
94Y7343	Intel Xeon Processor E5-2690 8C 2.9GHz 20MB 135W Upgrade Kit	-

Memory options

The IBM System x3500 M4 supports DDR3 memory. The server supports up to 12 DIMMs when one processor is installed and up to 24 DIMMs when two processors are installed. Each processor has four memory channels, and there are three DIMMs per channel. The following rules apply when selecting the memory configuration:

- The server supports UDIMMs, RDIMMs, and LRDIMMs.
- Mixing different types of memory (UDIMMs, RDIMMs, and LRDIMMs) is not supported.
- Mixing 1.5 V and 1.35 V DIMMs in the same server is supported. In such a case all DIMMs operate at 1.5 V.
- The maximum number of ranks per channel is eight (with the exception of Load Reduced DIMMs, where more than eight ranks are supported because one quad-rank LRDIMM provides the same electrical load on a memory bus as a single-rank RDIMM).
- The maximum quantity of DIMMs that can be installed in a server depends on the number of CPUs, DIMM type, rank, and operating voltage, as shown in the "Max. qty supported" row in Table 5.
- All DIMMs in the server operate at the same speed, which is determined as the lowest value of:
 - Memory speed supported by specific CPU
 - Lowest maximum operating speed for the selected memory configuration that depends on rated speed, operating voltage, and quantity of DIMMs per channel, as shown in the "Max. operating speed" section in Table 5

Table 5. Maximum memory speeds

DIMM type DIMM specification	UDIMM		RDIMM						LRDIMM		
	Rank		Single rank		Dual rank		Quad rank		Quad rank		
Rated speed	1333 MHz		1333 MHz		1333 MHz		1600 MHz	1066 MHz		1333 MHz	
Rated voltage	1.35 V		1.35 V		1.35 V		1.5 V	1.35 V		1.35 V	
Operating voltage	1.35 V	1.5 V	1.35 V	1.5 V	1.35 V	1.5 V	1.5 V	1.35 V	1.5 V	1.35 V	1.5 V
Max. qty supported*	16	16	16	24	16	24	24	16	16	24	24
Max. DIMM capacity	2 GB	2 GB	4 GB	4 GB	16 GB	16 GB	4 GB	16 GB	16 GB	32 GB	32 GB
Max. memory capacity	32 GB	32 GB	64 GB	96 GB	256GB	384GB	96GB	256GB	256GB	768GB	768GB
Max. operating speed											
1 DIMM per channel	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1600 MHz	800 MHz	1066 MHz	1333 MHz	1333 MHz
2 DIMMs per channel	1066 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1600 MHz	800 MHz	800 MHz	1066 MHz	1333 MHz
3 DIMMs per channel	NS**	NS**	NS**	1066 MHz	NS**	1066 MHz	1066 MHz	NS**	NS**	1066 MHz	1066 MHz

* The maximum quantity supported is shown for two processors installed. When one processor installed the maximum quantity supported is a half of that shown.

** NS = Not supported.

The following memory protection technologies are supported:

- ECC
- Chipkill (for x4-based memory DIMMs)
- Memory mirroring
- Memory sparing

If memory mirroring is used, then DIMMs must be installed in pairs (minimum of one pair per CPU), and both DIMMs in a pair must be identical in type and size.

If memory rank sparing is used, then a minimum of one quad-rank DIMM or two single-rank or dual-rank DIMMs must be installed per populated channel (the DIMMs do not need being identical). In rank sparing mode, one rank of a DIMM in each populated channel is reserved as spare memory. The size of a rank varies depending on the DIMMs installed.

The following table lists memory options available for the x3500 M4 server.

Table 6. Memory options

Part number	Description	Maximum quantity supported	Standard models where used
UDIMMs			
49Y1403	2GB (1x2GB, 1Rx8, 1.35V) PC3L-10600 ECC DDR3 1333MHz LP UDIMM	16 (8 per CPU)	-
RDIMMs			
49Y1405	2GB (1x2GB, 1Rx8, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP RDIMM	24 (12 per CPU)	-
49Y1406	4GB (1x4GB, 1Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP RDIMM	24 (12 per CPU)	-
49Y1407	4GB (1x4GB, 2Rx8, 1.35V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP RDIMM	24 (12 per CPU)	A2x, B2x
90Y3178	4GB (1x4GB, 2Rx8, 1.5V) PC3-12800 CL11 ECC DDR3 1600MHz LP RDIMM	24 (12 per CPU)	-
49Y1397	8GB (1x8GB, 2Rx4, 1.35V) PC3L-10600 CL9 ECC 1333 MHz LP RDIMM	24 (12 per CPU)	C2x, C4x, D2x, F2x, G2x, H2x, J2x
49Y1400	16GB (1x16GB, 4Rx4, 1.35V) PC3L-8500 CL7 ECC DDR3 1066MHz LP RDIMM	16 (8 per CPU)	-
49Y1563	16GB (1x16GB, 2Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333MHz LP RDIMM	24 (12 per CPU)	-
LRDIMMs			
90Y3105	32GB (1x32GB, 4Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333MHz LP LRDIMM	24 (12 per CPU)	-

Internal disk storage options

The IBM System x3500 M4 server supports the following internal storage configurations:

- 8x 3.5" Simple Swap SATA hard drive bays (only available in CTO)
- 8x 3.5" hot-swap SAS/SATA hard drive bays
- 8x 3.5" hot-swap SAS/SATA drive bays + 8x 2.5" Slim-SFF SAS/SATA hot-swap drive bays (only available in CTO, requires two RAID controllers)
- 8x 2.5" Slim-SFF SAS/SATA hot-swap hard drive bays
- 16x 2.5" Slim-SFF SAS/SATA hot-swap hard drive bays
- 24x 2.5" Slim-SFF SAS/SATA hot-swap hard drive bays
- 32x 2.5" Slim-SFF SAS/SATA hot-swap hard drive bays

Figure 5 shows these configurations.

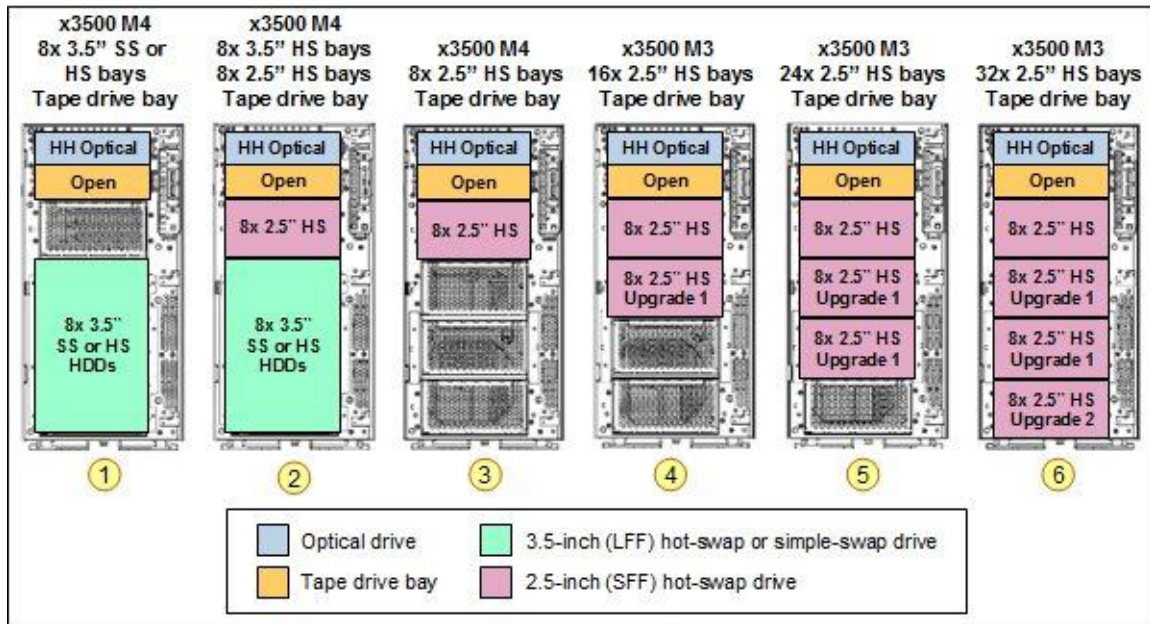


Figure 5. Internal drive configurations

Backplanes

Standard models of x3500 M4 ship with eight (all models except C4x) 2.5" Slim-SFF SAS/SATA hot-swap drive bays. Model C4x ships with eight 3.5" SAS/SATA hot-swap hard drive bays. The following table shows internal storage expansion options available for the x3500 M4 server.

Table 7. Internal storage expansion options

Part number	Name	Maximum quantity supported
94Y5978	Additional 8 x 2.5" Hot-Swap SAS/SATA Upgrade Kit for 16 or 24 HDDs (shown in Figure 5 as an Upgrade 1 used in configurations 4, 5, and 6)	2
81Y7010	Additional 8 x 2.5" Hot-Swap SAS/SATA Upgrade Kit for 32 HDDs (shown in Figure 5 as an Upgrade 2 used in configuration 6)	1

These options have the following descriptions:

- 94Y5978 upgrades models with eight hot-swap 2.5" drive bays to 16 hot-swap 2.5" drive bays or models with 16 hot-swap 2.5" drive bays to 24 hot-swap 2.5" drive bays. This option includes a SAS expander card that is mounted on an HDD backplane, and does not consume a PCIe slot.
- 81Y7010 upgrades models with 24 hot-swap 2.5" drive bays to 32 hot-swap 2.5" drive bays. This option does not include an SAS expander.

As shown in Figure 5, each configuration supports an optical drive and a tape drive. All standard configurations ship with DVD-ROM optical drive. For configure-to-order (CTO) configurations, you can add a tape drive instead of an optical drive if so desired.

Configurations 4, 5, and 6 shown in Figure 5 can be implemented with one or two RAID controllers (M1115 or M5110). Configuration 2 requires two RAID controllers.

RAID controllers

The following table lists the RAID controllers and additional options used for internal disk storage of the x3500 M4 server.

Table 8. RAID controllers for internal storage

Part number	Description	Max quantity supported	Standard models where used
81Y4448	ServeRAID M1115 SAS/SATA Controller for System x	2	A2x, B2x, C2x, C4x, D2x
81Y4542	ServeRAID M1100 Series Zero Cache/RAID 5 Upgrade for IBM System x	2	-
81Y4481	ServeRAID M5110 SAS/SATA Controller	2	F2x, G2x, H2x, J2x
81Y4544	ServeRAID M5100 Series Zero Cache/RAID 5 Upgrade for IBM System x	2	-
81Y4484	ServeRAID M5100 Series 512MB Cache/RAID 5 Upgrade for IBM System x	2	-
81Y4487	ServeRAID M5100 Series 512MB Flash/RAID 5 Upgrade for IBM System x	2	F2x
81Y4559	ServeRAID M5100 Series 1GB Flash/RAID 5 Upgrade for IBM System x	2	G2x, H2x, J2x
81Y4508	ServeRAID M5100 Series Battery Kit for IBM System x	2*	-
81Y4546	ServeRAID M5100 Series RAID 6 Upgrade for IBM System x	2†	-

* The ServeRAID M5100 Series Battery Kit (81Y4508) is only supported with ServeRAID M5100 Series 512MB Cache/RAID 5 Upgrade (81Y4484).

† The ServeRAID M5100 Series RAID 6 Upgrade (81Y4546) requires RAID 5 Upgrade.

The ServeRAID M1115 SAS/SATA Controller has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports
- Two x4 mini-SAS internal connectors (SFF-8087)
- Supports RAID levels 0, 1, and 10
- Supports RAID levels 5 and 50 with optional M1100 Series RAID 5 upgrades
- 6 Gbps throughput per port
- PCIe x8 Gen 3 host interface
- Based on the LSI SAS2008 6 Gbps ROC controller

The ServeRAID M5110 SAS/SATA Controller has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports
- Two x4 mini-SAS internal connectors (SFF-8087)
- Supports RAID levels 0, 1, and 10
- Supports RAID levels 5 and 50 with optional M5100 Series RAID 5 upgrades
- Supports RAID 6 and 60 with the optional M5100 Series RAID 6 Upgrade
- Supports 512 MB battery-backed cache or 512 MB or 1 TB flash-backed cache
- 6 Gbps throughput per port
- PCIe x8 Gen 3 host interface
- Based on the LSI SAS2208 6 Gbps ROC controller

Internal disk drive options

The following table lists hard drive options for internal disk storage of the x3500 M4 server.

Table 9. Disk drive options for internal disk storage

Part number	Description	Maximum quantity supported
2.5" NL SATA Hot-Swap HDDs		
81Y9730	IBM 1TB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	32
2.5" NL SAS Hot-Swap HDDs		
90Y8953	IBM 500GB 7.2K 6Gbps NL SAS 2.5" SFF G2HS HDD	32
81Y9690	IBM 1TB 7.2K 6Gbps NL SAS 2.5" SFF HS HDD	32
2.5" SAS Hot-Swap HDDs		
90Y8926	IBM 146GB 15K 6Gbps SAS 2.5" SFF G2HS HDD	32
90Y8877	IBM 300GB 10K 6Gbps SAS 2.5" SFF G2HS HDD	32
90Y8913	IBM 300GB 10K 6Gbps SAS 2.5" SFF G2HS SED	32
81Y9670	IBM 300GB 15K 6Gbps SAS 2.5" SFF HS HDD	32
90Y8872	IBM 600GB 10K 6Gbps SAS 2.5" SFF G2HS HDD	32
81Y9650	IBM 900GB 10K 6Gbps SAS 2.5" SFF HS HDD	32
3.5" NL SAS Hot-swap HDDs		
90Y8567	IBM 1TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	8
90Y8572	IBM 2TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	8
90Y8577	IBM 3TB 7.2K 6Gbps NL SAS 3.5" G2HS HDD	8
3.5" NL SATA Hot-swap HDDs		
81Y9786	IBM 500GB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	8
81Y9790	IBM 1TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	8
81Y9794	IBM 2TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	8
81Y9798	IBM 3TB 7.2K 6Gbps NL SATA 3.5" G2HS HDD	8
3.5" NL SATA Simple-Swap HDDs		
81Y9802	IBM 500GB 7.2K 6Gbps NL SATA 3.5" G2SS HDD	8
81Y9806	IBM 1TB 7.2K 6Gbps NL SATA 3.5" G2SS HDD	8
81Y9810	IBM 2TB 7.2K 6Gbps NL SATA 3.5" G2SS HDD	8
81Y9814	IBM 3TB 7.2K 6Gbps NL SATA 3.5" G2SS HDD	8

Internal backup units

The server supports the internal tape drive options listed in the following table.

Table 10. Internal tape drives

Part number	Description	Maximum quantity supported
46C5364	IBM RDX Removable Hard Disk System - Internal USB 160 GB Bundle	1
46C5387	IBM RDX Removable Hard Disk System - Internal USB 320 GB Bundle	1
46C5388	IBM RDX Removable Hard Disk System - Internal USB 500 GB Bundle	1
46C5399	IBM DDS Generation 5 USB Tape Drive	1
39M5636	IBM DDS Generation 6 USB Tape Drive	1
43W8478	IBM Half High LTO Gen 3 SAS Tape Drive	2*
44E8895	IBM Half High LTO Gen 4 SAS Tape Drive	2*
49Y9898	IBM Half High LTO Gen 5 Internal SAS Tape Drive	2*

* Note: With standard models, installation of a second tape drive requires removal of DVD-ROM.

USB tape drives are attached to the internal USB connector. SAS tape drives require SAS HBA (sold separately). See Table 13 for list of available SAS HBAs.

For more information, see the following Product Guides:

- *IBM RDX Removable Disk Backup Solution Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0726.html?Open>
- *IBM DDS Generation 5 USB Tape Drive Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0755.html?Open>
- *IBM DDS Generation 6 USB Tape Drive Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0725.html?Open>

Optical drives

The server supports the optical drive options listed in the following table.

Table 11. Optical drives

Part number	Description	Maximum quantity supported	Standard models where used
None*	Half-High SATA DVD-ROM	2	A2x, B2x, C2x, C4x, D2x, F2x, G2x, H2x, J2x
81Y6404	Half-High SATA Multiburner	2	-

* This option is only available via CTO or is already installed in standard models.

The two half-high drives in the table can be installed in any open 5.25" drive bay (Figure 5).

Half-High SATA DVD-ROM supports the following media and speeds for reading:

- CD-ROM 48X
- CD-DA (DAE) 40X
- CD-R 48X
- CD-RW 40X
- DVD-ROM (single layer) 16X
- DVD-ROM (dual layer) 12X
- DVD-R (4.7 GB) 16X
- DVD-R DL 12X
- DVD+R 16X
- DVD+R DL 12X
- DVD-RW (4.7 GB) 12X
- DVD+RW 12X
- DVD-RAM (4.7/9.4 GB) 6X

Half-High SATA multiburner supports the same media and speeds for reading as HH DVD-ROM. In addition, this drive supports the following media and speeds for writing:

- CD-R 24X
- CD-RW 4X
- High Speed CD-RW 10X
- Ultra Speed CD-RW 16X
- DVD-R 8X
- DVD-R DL 8X
- DVD+R 8X
- DVD+R DL 8X
- DVD-RW 6X
- DVD+RW 8X
- DVD-RAM 3X

I/O expansion options

The server supports up to eight PCIe slots: six slots (1 to 6) when one CPU is installed or eight slots when two CPUs are installed. These are the slot form factors:

- Slot 1: PCIe x8 (x4 wired); full-height, half-length (supports optional PCI-X interposer card)
- Slot 2: PCIe x8; full-height, half-length
- Slot 3: PCIe x8; full-height, full-length
- Slot 4: PCIe x8 (x4 wired); full-height, full-length
- Slot 5: PCIe x16; full-height, full-length
- Slot 6: PCIe x8 (x4 wired); full-height, full-length
- Slot 7: PCIe x16; full-height, full-length (requires second processor)
- Slot 8: PCIe x16; full-height, full-length (requires second processor)

All PCIe slots are PCI Express 3.0 slots except Slot 1, which is a PCI Express 2.0 slot. Slot 1 can be converted to a PCI-X slot with the PCI-X Conversion Kit, which is described in the following table.

Table 12. PCI riser card options

Part number	Description	Maximum quantity supported
81Y7012	PCI-X Interposer Conversion Kit	1

Network adapters

x3500 M4 supports four integrated Gigabit Ethernet ports.

Integrated NICs have the following features:

- Intel I350AM4 chip
- Four GbE ports
- TCP Offload Engine (TOE) support
- Wake on LAN support
- 802.1Q VLAN tagging support
- NIC Teaming (load balancing and failover)

The following table lists additional supported network adapters.

Table 13. Network adapters

Part number	Description	Maximum quantity supported†
10 Gb Ethernet		
49Y7910	Broadcom NetXtreme II Dual Port 10GBase-T Adapter for IBM System x	8
95Y3762	Emulex Dual Port 10GbE SFP+ VFA III for IBM System x	8
SBB 95Y3768#	Emulex Dual Port 10GbE SFP+ Integrated VFA III for IBM System x	1
95Y3760	Emulex VFA III FCoE/iSCSI License for IBM System x	8*
49Y7960	Intel X520-DA2 Dual Port 10GbE SFP+ Adapter for IBM System x	8
Converged Network Adapters (CNA)		
42C1800	QLogic 10 Gb Dual Port CNA for IBM System x	8**
42C1820	Brocade 10 Gb Dual-port CNA for IBM System x	8**
Gigabit Ethernet		
39Y6066	NetXtreme II 1000 Express Ethernet Adapter	8
42C1780	NetXtreme II 1000 Express Dual Port Ethernet Adapter	8
49Y4220	NetXtreme II 1000 Express Quad Port Ethernet Adapter	8
42C1750	PRO/1000 PF Server Adapter by Intel	8
49Y4230	Intel Ethernet Dual Port Server Adapter I340-T2 for IBM System x	8
49Y4240	Intel Ethernet Quad Port Server Adapter I340-T4 for IBM System x	8
90Y9352	Broadcom NetXtreme I Quad Port GbE Adapter for IBM System x	8
90Y9370	Broadcom NetXtreme I Dual Port GbE Adapter for IBM System x	8

† The maximum quantity is achieved with two processors installed. With one processor, the maximum quantity is limited to six.

Emulex Dual Port 10GbE SFP+ Integrated VFA III is only available through CTO or Special Bid.

* One license per one Emulex Dual Port 10GbE VFA III (95Y3762) or Emulex Dual Port 10GbE Integrated VFA III (SBB 95Y3768).

** Converged Network Adapters require SFP+ optical transceivers or DAC cables that must be purchased separately.

Storage host bus adapters

The following table lists storage HBAs supported by the x3500 M4 server.

Table 14. Storage adapters

Part number	Description	Maximum quantity supported
Fibre Channel		
39R6525	QLogic 4 Gb FC Single-Port PCIe HBA for IBM System x	8
39R6527	QLogic 4 Gb FC Dual-Port PCIe HBA for IBM System x	8
42C2069	Emulex 4 Gbps FC Single-Port PCI-e HBA for IBM System x	8
42C2071	Emulex 4 Gbps FC Dual-Port PCI-e HBA for IBM System x	8
42D0485	Emulex 8 Gb FC Single-port HBA for IBM System x	8
42D0494	Emulex 8 Gb FC Dual-port HBA for IBM System x	8
42D0501	QLogic 8 Gb FC Single-port HBA for IBM System x	8
42D0510	QLogic 8 Gb FC Dual-port HBA for IBM System x	8
46M6049	Brocade 8 Gb FC Single-port HBA for IBM System x	8
46M6050	Brocade 8 Gb FC Dual-port HBA for IBM System x	8
59Y1987	Brocade 4 Gb FC Single-port HBA for IBM System x	8
59Y1993	Brocade 4 Gb FC Dual-port HBA for IBM System x	8
SAS		
46M0907	IBM 6 Gb SAS HBA Controller	8

PCIe SSD adapters

Currently, the server does not support High IOPS SSD adapters.

Power supplies and redundant cooling

The server supports up to two redundant power supplies. Standard models come with one or two power supplies (model dependent). The server also comes standard with either two (for models with one processor installed) or three (for models with two processors installed) simple swap cooling fans. Optional upgrade is available to provide N+N cooling redundancy. The following table lists the power supplies and redundant cooling upgrade option.

Table 15. Power supplies

Part number	Description	Max quantity supported	Standard models where used
94Y5974	IBM System x 750W High Efficiency Platinum AC Power Supply	2	A2x, B2x, C2x, C4x, D2x, F2x
94Y5973	IBM System x 900W High Efficiency Platinum AC Power Supply	2	G2x, H2x, J2x
81Y7007	Redundant Cooling Upgrade Kit	1	-

An AC power supply ships standard without a line cord, it must be purchased separately. The redundant cooling kit contains three simple swap fans.

Integrated virtualization

The server supports VMware ESXi installed on a USB memory key. The key is installed in a USB socket inside the server. The following table lists the virtualization options.

Table 16. Virtualization options

Part number	Description	Maximum quantity supported
41Y8298	IBM Blank USB Memory Key for VMware ESXi Downloads	1
41Y8300	IBM USB Memory Key for VMware vSphere 5.0	1

Remote management

The server contains IBM Integrated Management Module II (IMM2), which provides advanced service-processor control, monitoring, and an alerting function. If an environmental condition exceeds a threshold or if a system component fails, the IMM2 lights LEDs to help you diagnose the problem, records the error in the event log, and alerts you to the problem. Optionally, the IMM2 also provides a virtual presence capability for remote server management capabilities.

The IMM2 provides remote server management through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3
- Common Information Model (CIM)
- Web browser

The optional IMM Advanced Upgrade (software feature) is required to enable the remote presence and blue-screen capture features. The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel color depths, regardless of the system state
- Remotely accessing the server using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition. The following table lists the remote management option.

Table 17. Remote management option

Part number	Description	Maximum quantity supported
90Y3901	IBM Integrated Management Module Advanced Upgrade	1

Supported operating systems

The server supports the following operating systems:

- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Datacenter x86 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Enterprise x86 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Standard x86 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008, Web x86 Edition
- Microsoft Windows Small Business Server 2008 Premium Edition
- Microsoft Windows Small Business Server 2008 Standard Edition
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- SUSE LINUX Enterprise Server 10 for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 with Xen for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- VMware vSphere 5

See the IBM ServerProven® website for the latest information about the specific versions and service levels supported and any other prerequisites:

<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/nos/matrix.shtml>

Physical and electrical specifications

Dimensions and weight (approximate):

Tower:

- Width: 218 mm (8.6 in)
- Depth: 750 mm (29.5 in)
- Height: 440 mm (17.3 in)
- Weight:
 - Minimum configuration: 25.0 kg (55.1 lb)
 - Maximum configuration: 39.8 kg (87.7 lb)

Rack (using the Tower-to-Rack Conversion Kit, 81Y7006):

- Width: 424 mm (16.7 in)
- Depth: 702 mm (27.6 in)
- Height: 218 mm (8.5 in)
- Weight:
 - 24.5 kg (53.9 lb) (minimum configuration)
 - 39.3 kg (86.6 lb) (maximum configuration)

Supported environment:

- Air temperature
 - Server on: 10 - 35 °C (50 to 95 °F); altitude: 0 - 915 m (3,000 ft)
 - Server on: 10 - 32 °C (50 - 90 °F); altitude: 915 m (3,000 ft) - 2,134 m (7,000 ft)
 - Server on: 10 - 28 °C (50 - 83 °F); altitude: 2,134 m (7,000 ft) - 3,050 m (10,000 ft)
 - Server off (with standby power): 5 - 45 °C (41.0 - 113 °F)
 - Shipping: -40 - 60 °C (-40 - 140 °F)
- Humidity
 - Server on: 20 - 80% , Max. Dew Point 21 °C, Max. rate of change 5 °C/hr
 - Server off: 8 - 80%, Max. Dew Point 27 °C
- Electrical
 - Models with 900 W power supplies:
 - 100 to 127 (nominal) V ac; 50 Hz or 60 Hz; 11 A
 - 200 to 240 (nominal) V ac; 50 Hz or 60 Hz; 5.5 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.6 kVA
 - Maximum configuration: 1.1 kVA
 - Models with 750 W power supplies:
 - 100 to 127 (nominal) V ac; 50 Hz or 60 Hz; 8.9 A
 - 200 to 240 (nominal) V ac; 50 Hz or 60 Hz; 4.5 A
 - Input kilovolt-amperes (kVA) (approximately):
 - Minimum configuration: 0.6 kVA
 - Maximum configuration: 0.9 kVA
- BTU output
 - Minimum configuration: 2013 Btu/hr (590 watts)
 - Maximum configuration: 3610 Btu/hr (1056 watts)

Warranty options

The IBM System x3500 M4 has a 3-year onsite warranty with 9x5/next business day terms. IBM offers the warranty service upgrades through IBM ServicePacs, discussed in this section. The IBM ServicePac is a series of prepackaged warranty maintenance upgrades and post-warranty maintenance agreements with a well-defined scope of services, including service hours, response time, term of service, and service agreement terms and conditions.

IBM ServicePac offerings are country-specific. That is, each country might have its own service types, service levels, response times, and terms and conditions. Not all covered types of ServicePacs might be available in a particular country. For more information about IBM ServicePac offerings available in your country visit the IBM ServicePac Product Selector at:

<https://www-304.ibm.com/sales/gss/download/spst/servicepac>

The following table explains warranty service definitions in more detail.

Table 18. Warranty service definitions

Term	Description
IBM onsite repair (IOR)	A service technician will come to the server's location for equipment repair.
24x7x2 hour	A service technician is scheduled to arrive at your customer's location within two hours after remote problem determination is completed. We provide service around the clock, every day, including IBM holidays.
24x7x4 hour	A service technician is scheduled to arrive at your customer's location within four hours after remote problem determination is completed. We provide service around the clock, every day, including IBM holidays.
9x5x4 hour	A service technician is scheduled to arrive at your customer's location within four business hours after remote problem determination is completed. We provide service from 8:00 a.m. to 5:00 p.m. in the customer's local time zone, Monday through Friday, excluding IBM holidays. If after 1:00 p.m. it is determined that onsite service is required, the customer can expect the service technician to arrive the morning of the following business day. For noncritical service requests, a service technician will arrive by the end of the following business day.
9x5 next business day	A service technician is scheduled to arrive at your customer's location on the business day after we receive your call, following remote problem determination. We provide service from 8:00 a.m. to 5:00 p.m. in the customer's local time zone, Monday through Friday, excluding IBM holidays.

In general, the types of IBM ServicePacs are as follows:

- Warranty and maintenance service upgrades
 - One, 2, 3, 4, or 5 years of 9x5 or 24x7 service coverage
 - Onsite repair from next business day to 4 or 2 hours
 - One or 2 years of warranty extension
- Remote technical support services
 - One or three years with 24x7 coverage (severity 1) or 9x5/next business day for all severities
 - Installation and startup support for System x servers
 - Remote technical support for System x servers
 - Software support - Support Line
 - Microsoft or Linux software
 - VMware
 - IBM Director

Regulatory compliance

The server conforms to the following standards:

- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 4, Class A
- UL/IEC 60950-1
- CSA C22.2 No. 60950-1-07
- NOM-019
- Argentina IEC60950-1
- Japan VCCI, Class A
- Australia/New Zealand AS/NZS CISPR 22:2006, Class A
- IEC-60950-1 (CB Certificate and CB Test Report)
- Taiwan BSMI CNS13438, Class A; CNS14336-1
- China CCC (GB4943-2001), GB9254-2008 class A, GB17625.1-2003
- Korea KN22, Class A; KN24
- CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2, and EN61000-3-3)
- CISPR 22, Class A
- TUV-GS EN60950-1 /IEC60950-1,EK1-ITB2000)
- Russia/GOST ME01, IEC-60950-1, GOST R 51318.22-99, GOST R 51318.24-99, GOST R 51317.3.2-99, GOST R 51317.3.3-99
- IEC 60950-1 (CB Certificate and CB Test Report)

External disk storage expansion

Currently, IBM x3500 M4 does not support external storage expansion like the EXP2500 series. It can be attached to the supported external storage system shown in Table 18, using the supported HBAs listed in Table 13.

External disk storage systems

The following table lists the external storage systems that are supported by the server and can be ordered through the System x sales channel. The server might support other IBM disk systems that are not listed in this table. Refer to IBM System Storage® Interoperability Center for further information.

Table 19. External disk storage systems

Part number	Description
1746A2D	IBM System Storage DS3512 Express Dual Controller Storage System
1746A2S	IBM System Storage DS3512 Express Single Controller Storage System
1746A4D	IBM System Storage DS3524 Express Dual Controller Storage System
1746A4S	IBM System Storage DS3524 Express Single Controller Storage System
181494H	IBM System Storage DS3950 Model 94
181498H	IBM System Storage DS3950 Model 98
181492H	IBM System Storage EXP395 Expansion Unit
1746A2E	IBM System Storage EXP3512 Express Storage™ Expansion Unit
1746A4E	IBM System Storage EXP3524 Express Storage Expansion Unit

External backup units

The server supports the external backup attachment options listed in Table 19.

Table 20. External backup options (part 1)

Part number	Description
External tape expansion enclosures for internal tape drives	
87651UX	1U Tape Drive Enclosure
8767HHX	Half High Tape Drive Enclosure
87651NX	1U Tape Drive Enclosure (with Nema 5-15P LineCord)
8767HNX	Half High Tape Drive Enclosure (with Nema 5-15P LineCord)
Tape enclosure adapters (with cables)	
44E8869	USB Enclosure Adapter Kit
40K2599	SAS Enclosure Adapter Kit
Internal backup drives supported by external tape enclosures	
46C5364	IBM RDX Removable Hard Disk Storage System - Internal USB 160 GB Bundle
46C5387	IBM RDX Removable Hard Disk Storage System - Internal USB 320 GB Bundle
46C5388	IBM RDX Removable Hard Disk Storage System - Internal USB 500 GB Bundle
46C5399	IBM DDS Generation 5 USB Tape Drive
39M5636	IBM DDS Generation 6 USB Tape Drive
43W8478	IBM Half High LTO Gen 3 SAS Tape Drive
44E8895	IBM Half High LTO Gen 4 SAS Tape Drive
49Y9898	IBM Half High LTO Gen 5 Internal SAS Tape Drive

Table 20. External backup options (part 2)

Part number	Description
External backup units*	
362516X	IBM RDX Removable Hard Disk Storage System - External USB 160 GB Bundle
362532X	IBM RDX Removable Hard Disk Storage System - External USB 320 GB Bundle
362550X	IBM RDX Removable Hard Disk Storage System - External USB 500 GB Bundle
3628L3X	IBM Half High LTO Gen 3 External SAS Tape Drive (with US line cord)
3628L4X	IBM Half High LTO Gen 4 External SAS Tape Drive (with US line cord)
3628L5X	IBM Half High LTO Gen 5 External SAS Tape Drive (with US line cord)
3628N3X	IBM Half High LTO Gen 3 External SAS Tape Drive (without line cord)
3628N4X	IBM Half High LTO Gen 4 External SAS Tape Drive (without line cord)
3628N5X	IBM Half High LTO Gen 5 External SAS Tape Drive (without line cord)
3580S3V	System Storage TS2230 Tape Drive Express Model H3V
3580S4V	System Storage TS2240 Tape Drive Express Model H4V
3580S5E	System Storage TS2250 Tape Drive Express Model H5S
3580S5X	System Storage TS2350 Tape Drive Express Model S53
3572S4R	TS2900 Tape Library with LTO4 HH SAS drive & rack mount kit
3572S5R	TS2900 Tape Library with LTO5 HH SAS drive & rack mount kit
35732UL	TS3100 Tape Library Model L2U Driveless
35734UL	TS3200 Tape Library Model L4U Driveless
46X2682†	LTO Ultrium 5 Fibre Channel Drive
46X2683†	LTO Ultrium 5 SAS Drive Sled
46X2684†	LTO Ultrium 5 Half High Fibre Drive Sled
46X2685†	LTO Ultrium 5 Half High SAS Drive Sled
46X6912†	LTO Ultrium 4 Half High Fibre Channel Drive Sled
46X7117†	LTO Ultrium 4 Half High SAS DriveV2 Sled
46X7122†	LTO Ultrium 3 Half High SAS DriveV2 Sled

* Note: The external tape drives listed can be ordered through the System x sales channel. The server might support other IBM tape drives that are not listed in this table. Refer to IBM System Storage Interoperability Center for further information.

† Note: These part numbers are the tape drives options for 35732UL and 35734UL.

External USB tape drives are connected to the external USB ports on the server. External SAS or Fibre Channel tape drives require respective HBA (sold separately, see Table 14).

See the IBM ServerProven website for the latest information about the specific versions and service levels supported and any other prerequisites:

<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/nos/matrix.shtml>

Top-of-rack Ethernet switches

The server supports the top-of-rack Ethernet switches from IBM System Networking listed in the following table.

Table 21. IBM System Networking: Top-of-rack switches

Part number	Description
IBM System Networking - 1 Gb top-of-rack switches	
0446013	IBM System Networking RackSwitch G8000R
7309CFC	IBM System Networking RackSwitch G8000F
7309CD8	IBM System Networking RackSwitch G8000DC
7309G52	IBM System Networking RackSwitch G8052R
730952F	IBM System Networking RackSwitch G8052F
427348E	IBM Ethernet Switch J48E
6630010	Juniper Networks EX2200 24 Port
6630011	Juniper Networks EX2200 24 Port with PoE
6630012	Juniper Networks EX2200 48 Port
6630013	Juniper Networks EX2200 48 Port with PoE
IBM System Networking - 10 Gb top-of-rack switches	
0446017	IBM System Networking RackSwitch G8124R
7309BF9	IBM System Networking RackSwitch G8124F
7309BD5	IBM System Networking RackSwitch G8124DC
7309BR6	IBM System Networking RackSwitch G8124ER
7309BF7	IBM System Networking RackSwitch G8124EF
7309G64	IBM System Networking RackSwitch G8264R
730964F	IBM System Networking RackSwitch G8264F
7309-CR9	IBM System Networking RackSwitch G8264TR
7309-CF9	IBM System Networking RackSwitch G8264TF
0719-410	Juniper Networks EX4500 - Front to Back Airflow
0719-420	Juniper Networks EX4500 - Back to Front Airflow
IBM System Networking - 40 Gb top-of-rack switches	
8036ARX	IBM System Networking RackSwitch G8316R
8036AFX	IBM System Networking RackSwitch G8316F

Uninterruptible power supply units

The server supports attachments to the uninterruptible power supply (UPS) units listed in the following table.

Table 22. Uninterruptible power supply units

Part number	Description
Tower UPS	
53961AX	IBM 1000VA LCD Tower UPS (120V)
53961JX	IBM 1000VA LCD Tower UPS (100V)
53961KX	IBM 1000VA LCD Tower UPS (230V)
53962AX	IBM 1500VA LCD Tower UPS (120V)
53962JX	IBM 1500VA LCD Tower UPS (100V)
53962KX	IBM 1500VA LCD Tower UPS (230V)
Rack-mounted UPS	
21304RX	IBM UPS 10000XHV
53951AX	IBM 1500VA LCD 2U Rack UPS (100V/120V)
53951KX	IBM 1500VA LCD 2U Rack UPS (230V)
53952AX	IBM 2200VA LCD 2U Rack UPS (100V/120V)
53952KX	IBM 2200VA LCD 2U Rack UPS (230V)
53953AX	IBM 3000VA LCD 3U Rack UPS (100V/120V)
53953JX	IBM 3000VA LCD 3U Rack UPS (200V/208V)
53956AX	IBM 6000VA LCD 4U Rack UPS (200V/208V)
53956KX	IBM 6000VA LCD 4U Rack UPS (230V)
53959KX	IBM 11000VA LCD 5U Rack UPS (200V/208V/230V)

For more information, see the following IBM Redbooks Product Guides:

- *IBM 3000VA LCD 3U Rack Uninterruptible Power Supply for IBM System x Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0782.html?Open>
- *IBM 6000VA LCD 4U Rack UPS Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0793.html?Open>

Power distribution units

The server supports attachments to the power distribution units (PDUs) listed in the following table.

Table 23. Power distribution units (part 1)

Part number	Description
Switched and Monitored PDUs	
46M4002	IBM 1U 9 C19/3 C13 Active Energy Manager DPI® PDU
46M4003	IBM 1U 9 C19/3 C13 Active Energy Manager 60A 3 Phase PDU
46M4004	IBM 1U 12 C13 Active Energy Manager DPI PDU
46M4005	IBM 1U 12 C13 Active Energy Manager 60A 3 Phase PDU
46M4167	IBM 1U 9 C19/3 C13 Switched and Monitored 30A 3 Phase PDU
46M4116	IBM 0U 24 C13 Switched and Monitored 30A PDU
46M4119	IBM 0U 24 C13 Switched and Monitored 32A PDU
46M4134	IBM 0U 12 C19/12 C13 Switched and Monitored 50A 3 Phase PDU
46M4137	IBM 0U 12 C19/12 C13 Switched and Monitored 32A 3 Phase PDU
Enterprise PDUs	
71762MX	IBM Ultra Density Enterprise PDU C19 PDU+ (WW)
71762NX	IBM Ultra Density Enterprise PDU C19 PDU (WW)
71763MU	IBM Ultra Density Enterprise PDU C19 3 Phase 60A PDU+ (NA)
71763NU	IBM Ultra Density Enterprise PDU C19 3 Phase 60A PDU (NA)
39M2816	IBM DPI C13 Enterprise PDU without linecord
39Y8923	DPI 60A Three Phase C19 Enterprise PDU with IEC309 3P+G (208 V) fixed line cord
39Y8941	DPI Single Phase C13 Enterprise PDU without line cord
39Y8948	DPI Single Phase C19 Enterprise PDU without line cord
Front-end PDUs	
39Y8934	DPI 32 amp/250 V Front-end PDU with IEC 309 2P+Gnd connector
39Y8935	DPI 63amp/250 V Front-end PDU with IEC 309 2P+Gnd connector
39Y8938	30 amp/125 V Front-end PDU with NEMA L5-30P connector
39Y8939	30 amp/250 V Front-end PDU with NEMA L6-30P connector
39Y8940	60 amp/250 V Front-end PDU with IEC 309 60A 2P+N+Gnd connector

Table 23. Power distribution units (part 2)

Part number	Description
Universal PDUs	
39Y8951	DPI Universal Rack PDU with US LV and HV line cords
39Y8952	DPI Universal Rack PDU with CEE7-VII Europe LC
39Y8953	DPI Universal Rack PDU with Denmark LC
39Y8954	DPI Universal Rack PDU with Israel LC
39Y8955	DPI Universal Rack PDU with Italy LC
39Y8956	DPI Universal Rack PDU with South Africa LC
39Y8957	DPI Universal Rack PDU with UK LC
39Y8958	DPI Universal Rack PDU with AS/NZ LC
39Y8959	DPI Universal Rack PDU with China LC
39Y8962	DPI Universal Rack PDU (Argentina)
39Y8960	DPI Universal Rack PDU (Brazil)
39Y8961	DPI Universal Rack PDU (India)
0U Basic PDUs	
46M4122	IBM 0U 24 C13 16A 3 Phase PDU
46M4125	IBM 0U 24 C13 30A 3 Phase PDU
46M4128	IBM 0U 24 C13 30A PDU
46M4131	IBM 0U 24 C13 32A PDU
46M4140	IBM 0U 12 C19/12 C13 60A 3 Phase PDU
46M4143	IBM 0U 12 C19/12 C13 32A 3 Phase PDU

For more information, see the *IBM 1U Switched and Monitored Power Distribution Units Product Guide* at: <http://www.redbooks.ibm.com/abstracts/tips0775.html?Open>

Rack cabinets

The x3500 M4 server can be installed in the rack with the Tower to Rack Conversion Kit (81Y7006). The server supports the rack cabinets listed in the following table.

Table 24. Rack cabinets and Tower to Rack Conversion Kits

Part number	Description
Tower to rack conversion kits	
81Y7006	Tower to Rack Conversion Kit
Rack cabinets	
201886X	IBM 11U Office Enablement Kit
93072PX	IBM 25U Static S2 Standard Rack
93072RX	IBM 25U Standard Rack
93074RX	IBM 42U Standard Rack
93074XX	IBM 42U Standard Rack Extension
93084EX	IBM 42U Enterprise Expansion Rack
93084PX	IBM 42U Enterprise Rack
93604EX	IBM 42U 1200 mm Deep Dynamic Expansion Rack
93604PX	IBM 42U 1200 mm Deep Dynamic Rack
93614EX	IBM 42U 1200 mm Deep Static Expansion Rack
93614PX	IBM 42U 1200 mm Deep Static Rack
93624EX	IBM 47U 1200 mm Deep Static Expansion Rack
93624PX	IBM 47U 1200 mm Deep Static Rack
99564RX	IBM S2 42U Dynamic Standard Rack
99564XX	IBM S2 42U Dynamic Standard Expansion Rack

Figure 6 shows the server installed in the Tower to Rack Conversion Kit.



Figure 6. The IBM System x3500 M4 with the Tower to Rack Conversion Kit

Rack options

The server supports the rack console switches and monitor kits listed in the following table.

Table 25. Rack options

Part number	Description
Monitor kits and keyboard trays	
172317X	1U 17in Flat Panel Console Kit
172319X	1U 19in Flat Panel Console Kit
Console switches	
1754D2X	IBM Global 4x2x32 Console Manager (GCM32)
1754D1X	IBM Global 2x2x16 Console Manager (GCM16)
1754A2X	IBM Local 2x16 Console Manager (LCM16)
1754A1X	IBM Local 1x8 Console Manager (LCM8)
Console cables	
43V6147	IBM Single Cable USB Conversion Option (UCO)
39M2895	IBM USB Conversion Option (4 Pack UCO)
39M2897	IBM Long KVM Conversion Option (4 Pack Long KCO)
46M5383	IBM Virtual Media Conversion Option Gen2 (VCO2)
46M5382	IBM Serial Conversion Option (SCO)

For more information, see the following IBM Redbooks® Product Guides:

- *IBM 1754 LCM8 and LCM16 Local Console Managers Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0788.html?Open>
- *IBM GCM16 and GCM32 Global Console Managers Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0772.html?Open>
- *IBM 1U 17-inch and 19-inch Flat Panel Console Kits Product Guide*
<http://www.redbooks.ibm.com/abstracts/tips0731.html?Open>

IBM Global Financing

IBM Global Financing can help you obtain the IT solution you need while preserving funding for other strategic investments and optimizing cash flow. Our Fair Market Value (FMV) lease helps ensure that you have the latest IBM technology and with our mid-lease upgrade capability, you can increase the capacity of the system with little to no change in monthly payments. At the end of the lease, take advantage of our flexible end-of-lease options to fit your changing business needs. IBM Global Financing has the breadth and depth of offerings, longevity, proven success and global reach to help you develop a robust financing and asset management strategy that provides you the opportunity to leverage new technologies and turn your ambitious vision into a tangible solution.

Here are some other reasons why working with us makes solid financial sense:

- Expand your purchasing power—Affordable monthly payments allow you to change the technology acquisition discussion from “what can I afford right now” to “what solution is really right for my business.” IBM Global Financing allows you to expand your purchase power to get you the right solution.
- Accelerate your project’s cash flow break-even point—Acquire your IBM technology today and begin to realize its benefits now. An FMV lease can help you get the solution you need now, with low monthly payments that better align upfront costs with the anticipated return on investment from the technology.
- Easy to acquire with affordable rates—We offer one-stop shopping for a total IT solution, so you can acquire IBM hardware, software, services and the financing you need—from one IT provider.

Plus, we provide simple, easy-to-understand contracts and quick approvals. As the world’s largest IT financing provider, with an asset base of US\$35.8 billion and over 125,000 customers, IBM Global Financing offers highly competitive rates that promote low total cost of ownership and low monthly payments.

IBM Global Financing operates in more than 50 countries. Go to <http://ibm.com/financing> for financing options in your country and to contact a local financing specialist.

IBM Global Financing offerings are provided through IBM Credit LLC in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government clients. Rates and availability subject to client’s credit rating, financing terms, offering type, equipment and product type and options, and may vary by country. Non-hardware items must be one-time, non-recurring charges and are financed by means of loans. Other restrictions may apply. Rates and offerings are subject to change, extension or withdrawal without notice and may not be available in all countries. Please contact your local IBM Global Financing representative for additional detail.

Related publications and links

For more information see these resources:

- IBM System x3500 M4 product page
<http://www.ibm.com/systems/x/hardware/rack/x3500m4/index.html>
- IBM System x 3500 M4 Installation and User's Guide
<http://ibm.com/support>
- IBM System x 3500 M4 Problem Determination and Service Guide
<http://ibm.com/support>
- ServerProven hardware compatibility page for the x3500 M4
<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/xseries/7383.html>
- IBM Redbooks Product Guides for IBM System x servers and options
<http://www.redbooks.ibm.com/portals/systemx?Open&page=pgbycat>
- IBM System x DDR3 Memory Configurator
<http://www.ibm.com/systems/x/hardware/ddr3config/>
- Configuration and Option Guide
<http://www.ibm.com/systems/xbc/cog/>
- xRef - IBM System x Reference Sheets
<http://www.redbooks.ibm.com/xref>
- IBM System x Support Portal
<http://ibm.com/support/entry/portal/>
http://ibm.com/support/entry/portal/Downloads/Hardware/Systems/System_x/System_x3500_M4
- IBM System Storage Interoperation Center
<http://www.ibm.com/systems/support/storage/ssic>

Notices

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

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service. IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

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

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you. This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk. IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you. Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurement may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

© Copyright International Business Machines Corporation 2012. All rights reserved.

Note to U.S. Government Users Restricted Rights -- Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

This document was created or updated on April 26, 2012.

Send us your comments in one of the following ways:

- Use the online **Contact us** review form found at:
ibm.com/redbooks
- Send your comments in an e-mail to:
redbook@us.ibm.com
- Mail your comments to:
IBM Corporation, International Technical Support Organization
Dept. HYTD Mail Station P099
2455 South Road
Poughkeepsie, NY 12601-5400 U.S.A.

This document is available online at <http://www.ibm.com/redbooks/abstracts/tips0852.html> .

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (™ or ®), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at <http://www.ibm.com/legal/copytrade.shtml>

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

Calibrated Vecteded Cooling™
Express Storage™
IBM Systems Director Active Energy Manager™
IBM®
Redbooks®
Redpaper™
Redbooks (logo)®
ServerProven®
ServicePac®
System Storage®
System x®

The following terms are trademarks of other companies:

Intel Centrino, Intel Inside, Intel Xeon, Intel, Intel logo, Intel Inside logo, and Intel Centrino logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

LTO, Ultrium, the LTO Logo and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and other countries.

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

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