

# IBM Flex System x220 Compute Node

## IBM Redbooks Product Guide

The IBM® Flex System™ x220 Compute Node is the next generation cost-optimized compute node designed for less demanding workloads and low-density virtualization. The x220 is efficient and equipped with flexible configuration options and advanced management to run a broad range of workloads.

*Suggested use:* For clients looking to deploy an entry virtualization solution as part of a larger data center infrastructure.

The following figure shows the IBM Flex System x220 Compute Node.



Figure 1. The IBM Flex System x220 Compute Node

### Did you know

IBM Flex System is a new category of computing that integrates multiple server architectures, networking, storage, and system management capability into a single system that is easy to deploy and manage. IBM Flex System has full and built-in virtualization support of servers, storage, and networking to speed provisioning and increased resiliency. In addition, it supports open industry standards, such as operating systems, networking and storage fabrics, virtualization, and system management protocols, to easily fit within existing and future data center environments. IBM Flex System is scalable and extendable with multigenerational upgrades to protect and maximize IT investments.

## Key features

The IBM Flex System x220 Compute Node is a high-availability, scalable compute node optimized to support the next-generation microprocessor technology. With a balance between cost and system features, the x220 is an ideal platform for general business workloads. This section describes the key features of the server.

### Scalability and performance

The x220 offers numerous features to boost performance, improve scalability, and reduce costs:

- The Intel Xeon processor E5-2400 product family improves productivity by offering affordable dual-socket system performance with eight-core processors with up to 2.3 GHz core speeds, up to 20 MB of L3 cache, and one QPI interconnect link of up to 8 Gbps.
- Up to two processors, 16 cores total, and 32 threads maximize the concurrent execution of multithreaded applications.
- Intelligent and adaptive system performance with Intel Turbo Boost Technology 2.0 allows processor cores to run at maximum speeds during peak workloads by temporarily going beyond processor Thermal Design Power (TDP).
- Intel Hyper-Threading Technology boosts performance for multithreaded applications by enabling simultaneous multithreading 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 use the hardware for virtualization workloads.
- Intel Advanced Vector Extensions (AVX) improve floating point performance for compute-intensive technical and scientific applications compared to Intel Xeon 5600 series processors.
- There are 12 DIMM sockets supporting low profile (LP) RDIMMs and UDIMMs, with a total capacity of up to 192 GB.
- Supports memory speeds of up to 1600 MHz to maximize memory performance.
- Support for IBM eXFlash solid-state drives to maximize I/O operations per second (IOPS) and significantly improve application performance.
- The theoretical maximum memory bandwidth of the Intel Xeon processor E5-2400 product family is 38.4 GBps, which is 20% more than in the previous generation of Intel Xeon 5600 processors.
- The server offers PCI Express 3.0 I/O expansion capabilities that improve the theoretical maximum bandwidth by 60% (8 Gbps per link) compared to 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 integration reduces I/O latency and increases overall system performance.
- Support for high-bandwidth I/O adapters, up to two in each x220 Compute Node. Support for 10 Gb Ethernet, 16 Gb Fibre Channel, and FDR InfiniBand expansion cards.

### Availability and serviceability

The x220 provides many features to simplify serviceability and increase system uptime:

- Chipkill, 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 processor, memory, and adapter cards.
- Hot-swap drives supporting integrated RAID 1 redundancy for data protection and greater system uptime.

- A light path diagnostics panel and individual light path LEDs lead the technician to failed (or failing) components. These features simplify servicing, speeds up problem resolution, and helps improve system availability.
- Predictive Failure Analysis (PFA) detects when system components (such as processors, memory, and hard disk drives) operate outside of standard thresholds and generates proactive alerts in advance of possible failure, therefore increasing uptime.
- Solid-state drives (SSDs), which offer significantly better reliability than traditional mechanical HDDs for greater uptime.
- A built-in Integrated Management Module II (IMM2) continuously monitors system parameters, triggers alerts, and performs recovery 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 on-site limited warranty, next business day 9x5. Optional service upgrades are available.

### **Manageability and security**

Powerful systems management features simplify local and remote management of the x220:

- The server includes an Integrated Management Module II (IMM2) to monitor server availability and perform remote management.
- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- Integrated Trusted Platform Module (TPM) V 1.2 support enables advanced cryptographic functionality, such as digital signatures and remote attestation.
- Industry-standard AES NI support for faster, stronger encryption.
- Integrates with the IBM® Flex System™ Manager for proactive systems management. It offers comprehensive systems management for the entire IBM Flex System platform, increasing uptime, reducing costs, and improving productivity through advanced server management capabilities.
- IBM Fabric Manager simplifies the deployment of infrastructure connections by managing network and storage address assignments.
- 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 x220 offers the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to a green environment:

- Component-sharing design of the IBM Flex System chassis provides ultimate power and cooling savings.
- The Intel Xeon processor E5-2400 product family offers better performance over the previous generation while fitting into the same 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.
- Solid-state drives (SSDs) consume as much as 80% less power than traditional spinning 2.5-inch HDDs.
- The server uses hexagonal ventilation holes, a part of IBM Calibrated Vektored Cooling™ technology. Hexagonal holes can be grouped more densely than round holes, providing more efficient airflow through the system.
- Active Energy Manager provides advanced power management features with actual real-time energy monitoring, reporting, and capping features.

## Locations of key components and connectors

The following figure shows the front of the server.

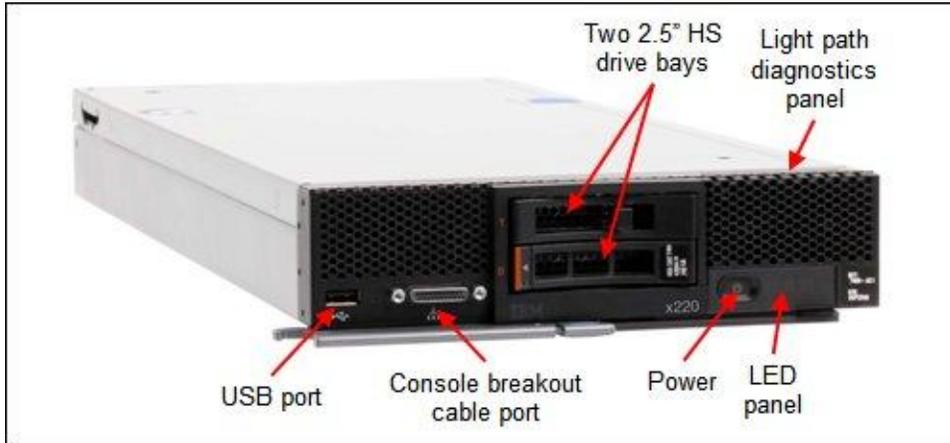


Figure 2. Front view of the IBM Flex System x220 Compute Node

The following figure shows the locations of key components inside the server.

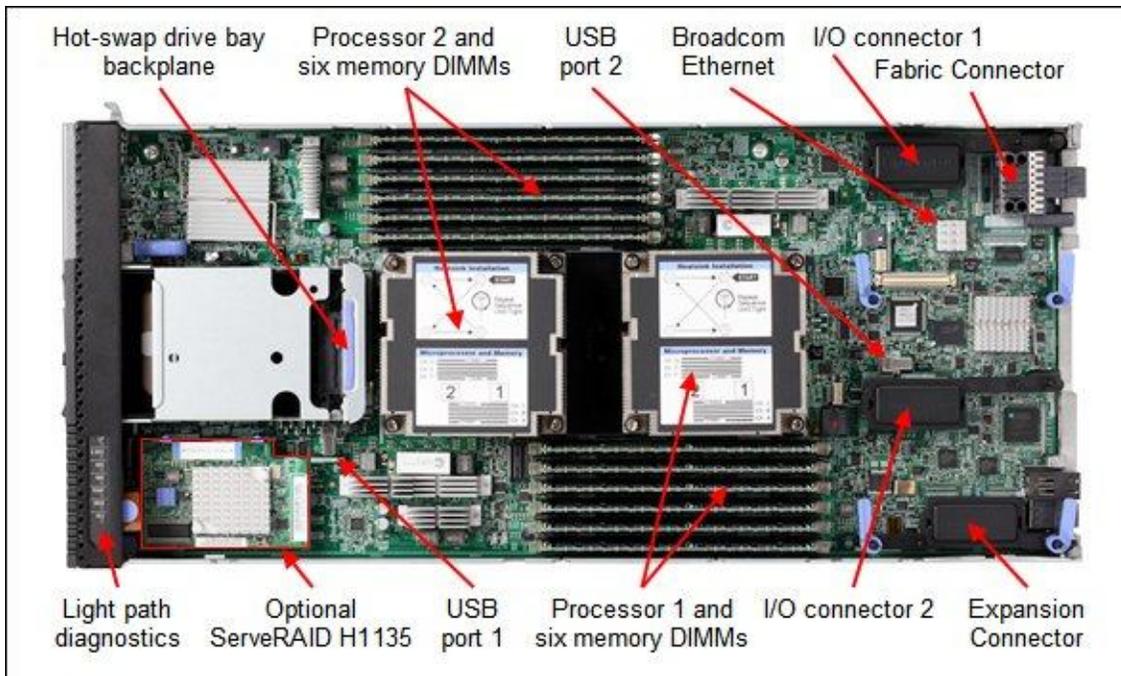


Figure 3. Inside view of the IBM Flex System x220 Compute Node

## Standard specifications

The following table lists the standard specifications.

Table 1. Standard specifications (part 1)

Components	Specification
Form factor	Half-wide compute node.
Chassis support	IBM Flex System Enterprise Chassis.
Processor	Up to two Intel Xeon Processor E5-2400 product family processors with eight-core (up to 2.3 GHz), six-core (up to 2.4 GHz), or quad-core (up to 2.2 GHz), one QPI link running at 8.0 GTps, L3 cache up to 20 MB, and memory speeds up to 1600 MHz. The server also supports one Intel Pentium Processor 1400 product family processor with two cores, up to 2.8 GHz, 5 MB L3 cache, and 1066 MHz memory speeds.
Chipset	Intel C600 series.
Memory	Up to 12 DIMM sockets (six DIMMs per processor) using Low Profile (LP) DDR3 DIMMs. RDIMMs and UDIMMs are supported. 1.5 V and low-voltage 1.35 V DIMMs are supported. Support for up to 1600 MHz memory speed, depending on the processor. Three memory channels per processor (two DIMMs per channel). Supports two DIMMs per channel operating at 1600 MHz (2 DPC @ 1600 MHz) with single and dual rank RDIMMs.
Memory maximums	With RDIMMs: Up to 192 GB with 12x 16 GB RDIMMs and two E5-2400 processors. With UDIMMs: Up to 48 GB with 12x 4 GB UDIMMs and two E5-2400 processors. Half of these maximums and DIMMs counts with one processor installed.
Memory protection	ECC, Chipkill (for x4-based memory DIMMs), and optional memory mirroring and memory rank sparing.
Disk drive bays	Two 2.5-inch hot-swap SAS/SATA drive bays supporting SAS, SATA, and SSD drives. Optional eXFlash support for up to eight 1.8-inch SSDs. Onboard ServeRAID C105 supports SATA drives only.
Maximum internal storage	With two 2.5-inch hot-swap drives: Up to 2 TB with 1 TB 2.5-inch NL SAS HDDs, up to 1.8 TB with 900 GB 2.5-inch SAS HDDs, or up to 2 TB with 1 TB 2.5-inch SATA HDDs, or up to 512 GB with 256 GB 2.5-inch SATA SSDs. An intermix of SAS and SATA HDDs and SSDs is supported. With eXFlash 1.8-inch SSDs and ServeRAID M5115 RAID adapter: Up to 1.6 TB with eight 200 GB 1.8-inch SSDs.
RAID support	Software RAID 0 and 1 with integrated LSI-based 3 Gbps ServeRAID C105 controller; supports SATA drives only. Non-RAID not supported. Optional ServeRAID H1135 RAID adapter with LSI SAS2004 controller, supports SAS/SATA drives with hardware-based RAID 0 and 1. An H1135 adapter is installed in a dedicated PCIe 2.0 x4 connector and does not use either I/O adapter slot. Optional ServeRAID M5115 RAID adapter with RAID 0, 1, 10, 5, 50 support and 1 GB cache. M5115 uses the I/O adapter slot 1. Can be installed in all models, including models with embedded a 1 GbE with Fabric connector. Supports up to eight 1.8-inch SSD with expansion kits. Optional flash-backup for cache, RAID 6/60, and SSD performance enabler.
Network interfaces	Some models (see Table 2): Embedded dual-port Broadcom BCM5718 Ethernet Controller that supports Wake on LAN and Serial over LAN, IPv6. TCP/IP Offload Engine (TOE) not supported. Routes to chassis I/O module bays 1 and 2 through a Fabric Connector to the chassis midplane. The Fabric Connector precludes the use of I/O adapter slot 1, with the exception that the M5115 can be installed in slot 1 while the Fabric Connector is installed. Remaining models: No network interface standard; optional 1 Gb or 10 Gb Ethernet adapters.

Table 1. Standard specifications (part 2)

Components	Specification
PCI Expansion slots	Two connectors for I/O adapters; each connector has PCIe x8+x4 interfaces. Includes an Expansion Connector (PCIe 3.0 x16) for future use to connect a compute node expansion unit. Dedicated PCIe 2.0 x4 interface for ServeRAID H1135 adapter only.
Ports	USB ports: One external and two internal ports for an embedded hypervisor. A console breakout cable port on the front of the server provides local KVM and serial ports (cable standard with chassis; additional cables optional).
Systems management	UEFI, IBM Integrated Management Module 2 (IMM2) with Renesas SH7757 controller, Predictive Failure Analysis, light path diagnostics panel, automatic server restart, and remote presence. Support for IBM Flex System Manager, IBM Systems Director and Active Energy Manager, and IBM ServerGuide.
Security features	Power-on password, administrator's password, and Trusted Platform Module V1.2.
Video	Matrox G200eR2 video core with 16 MB video memory integrated into the IMM2. Maximum resolution is 1600x1200 at 75 Hz with 16 M colors.
Limited warranty	Three-year customer-replaceable unit and on-site limited warranty with 9x5/NBD.
Operating systems supported	Microsoft Windows Server 2008 R2, Red Hat Enterprise Linux 5 and 6, SUSE Linux Enterprise Server 10 and 11, VMware ESX 4.1 and 5. See "Supported operating systems" for details.
Service and support	Optional service upgrades are available through IBM ServicePac® offerings: 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 OEM software.
Dimensions	Width: 217 mm (8.6 in.), height: 56 mm (2.2 in.), depth: 492 mm (19.4 in.)
Weight	Maximum configuration: 6.4 kg (14.11 lb).

The x220 servers are shipped with the following items:

- Statement of Limited Warranty
- Important Notices
- Documentation CD that contains the *Installation and User's Guide*

## Standard models

The following table lists the standard models.

Table 2. Standard models

Model	Intel Processor** E5-2400: 2 maximum Pentium 1400: 1 max	Memory	Disk adapter	Disk bays†	Disks	1 GbE Embedded‡	I/O slots (used/max)
7906-A2x	1x Intel Pentium 1403 2C 2.6 GHz 5 MB 1066 MHz 80 W	1x 4GB 1066 MHz* UDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	Standard	1 / 2‡
7906-B2x	1x Intel Xeon E5-2430L 6C 2.0 GHz 15 MB 1333 MHz 60 W	1x 4GB 1333 MHz UDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	Standard	1 / 2‡
7906-C2x	1x Intel Xeon E5-2403 4C 1.8 GHz 10 MB 1066 MHz 80 W	1x 4GB 1066 MHz* RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	Standard	1 / 2‡
7906-D2x	1x Intel Xeon E5-2420 6C 1.9 GHz 15 MB 1333 MHz 95 W	1x 4GB 1333 MHz RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	Standard	1 / 2‡
7906-G2x	1x Intel Xeon E5-2430 6C 2.2 GHz 15 MB 1333 MHz 95 W	1x 4GB 1333 MHz RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	No	0 / 2
7906-G4x	1x Intel Xeon E5-2430 6C 2.2 GHz 15 MB 1333 MHz 95 W	1x 4GB 1333 MHz RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	Standard	1 / 2‡
7906-H2x	1x Intel Xeon E5-2440 6C 2.4 GHz 15 MB 1333 MHz 95 W	1x 4GB 1333 MHz RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	Standard	1 / 2‡
7906-J2x	1x Intel Xeon E5-2450 8C 2.1 GHz 20 MB 1600 MHz 95 W	1x 4GB 1333 MHz* RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	No	0 / 2
7906-L2x	1x Intel Xeon E5-2470 8C 2.3 GHz 20 MB 1600 MHz 95 W	1x 4GB 1333 MHz* RDIMM	ServeRAID C105	2x 2.5-in. hot-swap	Open	No	0 / 2

\*\* Processor details: Processor quantity and model, cores, core speed, L3 cache, memory speed, and power consumption.

\* For model A2x and C2x, the standard DIMM is rated at 1333 MHz, but operates at up to 1066 MHz to match the processor memory speed. Conversely, for models J2x and L2x, the processor memory speed is rated at 1600 MHz, but operates up to 1333 MHz to match the rated speed of the installed DIMM. Actual memory speed maximums depend on several factors, as described in "Memory options".

† The 2.5-inch drive bays can be replaced and expanded with IBM eXFlash and a ServeRAID M5115 RAID controller to support up to eight 1.8-inch solid-state drives (SSDs).

‡ These models include an Embedded 1 Gb Ethernet controller. Connections are routed to the chassis midplane using a Fabric Connector. The Fabric Connector precludes the use of an I/O adapter in I/O connector 1 (with the exception of the ServeRAID M5115 RAID controller).

## Chassis support

The x220 is supported in the IBM Flex System Enterprise Chassis.

## Processor options

The x220 supports the processor options listed in the following table. The server supports one or two Intel Xeon E5-2400 processors, but the server supports only one Intel Pentium 1403 or 1407 processor. The table also shows which server models have each processor standard. If no corresponding *where used* model for a particular processor is listed, then this processor is available only through configure-to-order (CTO) process.

Table 3. Processor options

Part number	Intel Xeon processor description	Models where used
90Y4793	Intel Xeon E5-2470 8C 2.3 GHz 20 MB 1600 MHz 95 W	L2x
90Y4795	Intel Xeon E5-2450 8C 2.1 GHz 20 MB 1600 MHz 95 W	J2x
90Y4796	Intel Xeon E5-2440 6C 2.4 GHz 15 MB 1333 MHz 95 W	H2x
90Y4797	Intel Xeon E5-2430 6C 2.2 GHz 15 MB 1333 MHz 95 W	G2x, G4x
90Y4799	Intel Xeon E5-2420 6C 1.9 GHz 15 MB 1333 MHz 95 W	D2x
90Y4800	Intel Xeon E5-2407 4C 2.2 GHz 10 MB 1066 MHz 80 W	-
90Y4801	Intel Xeon E5-2403 4C 1.8 GHz 10 MB 1066 MHz 80 W	C2x
90Y4804	Intel Xeon E5-2450L 8C 1.8 GHz 20 MB 1600 MHz 70 W	-
90Y4805	Intel Xeon E5-2430L 6C 2.0 GHz 15 MB 1333 MHz 60 W	B2x
None	Intel Pentium 1403 2C 2.6 GHz 5 MB 1066 MHz 80 W	A2x
None*	Intel Pentium 1407 2C 2.8 GHz 5 MB 1066 MHz 80 W	-

\* The Intel Pentium 1407 is available through CTO or special bid only.

## Memory options

IBM DDR3 memory is compatibility tested and tuned for optimal performance and throughput. IBM memory specifications are integrated into the light path diagnostics for immediate system performance feedback and optimum system uptime. From a service and support standpoint, IBM memory automatically assumes the IBM system warranty, and IBM provides service and support worldwide.

The x220 supports Low Profile (LP) DDR3 memory RDIMMs and UDIMMs. The server supports up to six DIMMs when one processor is installed and up to 12 DIMMs when two processors are installed. Each processor has three memory channels, and there are two DIMMs per channel.

The following rules apply when selecting the memory configuration:

- 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 supported per channel is eight.
- The maximum quantity of DIMMs that can be installed in the server depends on the number of processors, as shown in the "Max. qty supported" row in the following table.

- All DIMMs in all processor memory channels operate at the same speed, which is determined as the lowest value of:
  - Memory speed supported by a specific processor.
  - Lowest maximum operating speed for the selected memory configuration that depends on rated speed, as shown under the "Max. operating speed" section in the following table. The shaded cells indicate that the speed indicated is the maximum that the DIMM allows.

**Table shading:** Tables cells highlighted with a grey background indicate when the specific combination of DIMM voltage and number of DIMMs per channel still allows the DIMMs to operate at rated speed.

Table 4. Maximum memory speeds

Spec	UDIMMs				RDIMMs							
	Single rank		Dual rank		Single rank		Dual rank			Quad rank		
Part numbers	49Y1403 (2 GB)		49Y1404 (4 GB)		49Y1406 (2 GB)		49Y1407 (4 GB) 49Y1397 (8 GB)		90Y3109 (4GB)		49Y1400 (16 GB)	
Rated speed	1333 MHz		1333 MHz		1333 MHz		1333 MHz		1600 MHz		1066 MHz	
Rated voltage	1.35 V		1.35 V		1.35 V		1.35 V		1.5 V		1.35 V	
Operating voltage	1.35 V	1.5 V	1.35 V	1.5 V	1.35 V	1.5 V	1.35 V	1.5 V	1.5 V	1.35 V	1.5 V	
Max quantity*	12	12	12	12	12	12	12	12	12	12	12	
Largest DIMM	2 GB	2 GB	4 GB	4 GB	2 GB	2 GB	8 GB	8 GB	4 GB	16 GB	16 GB	
Max memory capacity	24 GB	24 GB	48 GB	48 GB	24 GB	24 GB	96 GB	96 GB	48 GB	192 GB	192 GB	
Max memory at max speed	12 GB	12 GB	24 GB	24 GB	24 GB	24 GB	96 GB	96 GB	48 GB	192 GB	192 GB	
<b>Maximum operating speed (MHz)</b>												
1 DIMM per channel	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1600 MHz	800 MHz	800 MHz	
2 DIMMs per channel	1066 MHz	1066 MHz	1066 MHz	1066 MHz	1333 MHz	1333 MHz	1333 MHz	1333 MHz	1600 MHz	800 MHz	800 MHz	

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

The following memory protection technologies are supported:

- ECC
- Chipkill (for x4-based memory DIMMs; look for "x4" in the DIMM description)
- Memory mirroring
- Memory sparing

If memory mirroring is used, then DIMMs must be installed in pairs (minimum of one pair per processor), 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 to be 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 the memory options available for the x220 server. DIMMs can be installed one at a time, but for performance reasons, install them in sets of three (one for each of the three memory channels).

Table 5. Memory options for the x220

Part number	Description	Models where used
Registered DIMM (RDIMM) modules		
49Y1406	4 GB (1x 4 GB, 1Rx4, 1.35 V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP RDIMM	J2x, L2x
49Y1407	4 GB (1x 4 GB, 2Rx8, 1.35 V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP RDIMM	C2x, D2x, G2x, G4x, H2x
90Y3109	8 GB (1x 8 GB, 2Rx4, 1.5 V) PC3-12800 CL11 ECC DDR3 1600 MHz LP RDIMM	
49Y1397	8 GB (1x 8 GB, 2Rx4, 1.35 V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP RDIMM	
49Y1400	16 GB (1x 16 GB, 4Rx4, 1.35 V) PC3L-8500 CL7 ECC DDR3 1066 MHz LP RDIMM	
Unbuffered DIMM (UDIMM) modules		
49Y1403	2 GB (1x 2 GB, 1Rx8, 1.35 V) PC3L-10600 ECC DDR3 1333 MHz LP UDIMM	A2x, B2x
49Y1404	4 GB (1x 4 GB, 2Rx8, 1.35 V) PC3L-10600 CL9 ECC DDR3 1333 MHz LP UDIMM	-

## Internal disk storage options

The x220 server has two 2.5-inch hot-swap drive bays accessible from the front of the blade server (Figure 2). The server optionally supports 1.8-inch solid-state drives, as described later in this section.

The x220 supports three disk controllers:

- ServeRAID C105: An onboard SATA controller with software RAID capabilities
- ServeRAID H1135: An entry level hardware RAID controller
- ServeRAID M5115: An advanced RAID controller with cache, backup, and RAID options

These three controllers are mutually exclusive. The following table lists the ordering information.

Table 6. Internal storage controller ordering information

Part number	Description	Maximum quantity supported
Standard	ServeRAID C105	1
90Y4750	ServeRAID H1135 Controller for IBM Flex System and IBM BladeCenter®	1
90Y4390	ServeRAID M5115 SAS/SATA Controller	1

## ServeRAID C105 controller

On standard models, the two 2.5-inch drive bays are connected to a ServeRAID C105 onboard SATA controller with software RAID capabilities. The C105 functionality is embedded in the Intel C600 chipset.

The C105 has the following features:

- Support for SATA drives (SAS is not supported)
- Support for RAID 0 and RAID 1 (non-RAID is not supported)
- 6 Gbps throughput per port
- Support for up to two volumes
- Support for virtual drive sizes greater than 2 TB
- Fixed stripe unit size of 64 KB
- Support for MegaRAID Storage Manager management software

**Note:** There is no native (in-box) driver for Windows and Linux; the drivers must be downloaded separately. There is no support for VMware, Hyper-V, Xen, or solid-state drives (SSD).

## ServeRAID H1135

The x220 also supports an entry level hardware RAID solution with the addition of the ServeRAID H1135 Controller for IBM Flex System and BladeCenter. The H1135 is installed in a dedicated slot (see Figure 3 ). When the H1135 adapter is installed, the C105 controller is disabled.

The H1135 has the following features:

- Based on the LSI SAS2004 6 Gbps SAS 4-port controller
- PCIe 2.0 x4 host interface
- CIOv form factor (supported in the x220 and BladeCenter HS23E)
- Support for SAS, SATA, and SSD drives
- Support for RAID 0, RAID 1, and non-RAID
- 6 Gbps throughput per port
- Support for up to two volumes
- Fixed stripe size of 64 KB
- Native driver support in Windows, Linux, and VMware
- S.M.A.R.T. support
- Support for MegaRAID Storage Manager management software

## ServeRAID M5115

The ServeRAID M5115 SAS/SATA Controller (90Y4390) is an advanced RAID controller supporting RAID 0, 1, 10, 5, 50, and optional 6 and 60. It includes 1 GB of cache, which can be backed up to flash memory when attached to an optional supercapacitor. The M5115 attaches to the I/O adapter 1 connector and can be attached even if the Fabric Connector is installed (used to route the Embedded Gb Ethernet to chassis bays 1 and 2). The ServeRAID M5115 cannot be installed if an adapter is installed in I/O adapter slot 1. When the M5115 adapter is installed, the C105 controller is disabled.

The ServeRAID M5115 supports combinations of 2.5-inch drives and 1.8-inch solid-state drives:

- Up to two 2.5-inch drives only
- Up to four 1.8-inch drives only
- Up to two 2.5-inch drives, plus up to four 1.8-inch solid-state drives
- Up to eight 1.8-inch solid-state drives

We describe these configurations in the following section.

The ServeRAID M5115 controller has the following specifications:

- Eight internal 6 Gbps SAS/SATA ports.
- PCI Express 3.0 x8 host interface.
- 6 Gbps throughput per port.
- 800 MHz dual-core IBM PowerPC® processor with an LSI SAS2208 6 Gbps RAID on Chip (ROC) controller.
- Support for RAID levels 0, 1, 10, 5, 50 standard; support for RAID 6 and 60 with optional upgrade using 90Y4411.
- Optional onboard 1 GB data cache (DDR3 running at 1333 MHz) with optional flash backup (MegaRAID CacheVault technology) as part of the Enablement Kit 90Y4342.
- Support for SAS and SATA HDDs and SSDs.
- Support for intermixing SAS and SATA HDDs and SSDs. Mixing different types of drives in the same array (drive group) is not recommended.
- Support for self-encrypting drives (SEDs) with MegaRAID SafeStore.
- Optional support for SSD performance acceleration with MegaRAID FastPath and SSD caching with MegaRAID CacheCade Pro 2.0 (90Y4447).
- Support for up to 64 virtual drives, up to 128 drive groups, up to 16 virtual drives per one drive group, and up to 32 physical drives per one drive group.
- Support for logical unit number (LUN) sizes up to 64 TB.
- Configurable stripe size up to 1 MB.
- Compliant with Disk Data Format (DDF) configuration on disk (COD).
- S.M.A.R.T. support.
- MegaRAID Storage Manager management software.

## ServeRAID M5115 configurations and options

The x220 with the addition of the M5115 controller supports 2.5-inch drives or 1.8-inch eXFlash solid-state drives or combinations of the two.

At least one hardware kit is required with the ServeRAID M5115 controller, and there are three hardware kits that are supported that enable specific drive support:

- ServeRAID M5100 Series Enablement Kit for IBM Flex System x220 (90Y4424) enables support for up to two 2.5-inch HDDs or SSDs in the hot-swap bays in the front of the server. It includes a CacheVault unit, which enables MegaRAID CacheVault flash cache protection. This enablement kit replaces the standard two-bay backplane (which is attached through the planar to an onboard controller) with a new backplane that attaches to an included flex cable to the M5115 controller. It also includes an air baffle, which also serves as an attachment for the CacheVault unit.

MegaRAID CacheVault flash cache protection uses NAND flash memory powered by a supercapacitor to protect data stored in the controller cache. This module eliminates the need for a lithium-ion battery commonly used to protect DRAM cache memory on PCI RAID controllers. To avoid the possibility of data loss or corruption during a power or server failure, CacheVault technology transfers the contents of the DRAM cache to NAND flash using power from the supercapacitor. After the power is restored to the RAID controller, the saved data is transferred from the NAND flash back to the DRAM cache, which can then be flushed to disk.

**Tip:** The Enablement Kit is only required if 2.5-inch drives are to be used. If you plan to install four or eight 1.8-inch SSDs only, then this kit is not required.

- ServeRAID M5100 Series IBM eXFlash Kit for IBM Flex System x220 (90Y4425) enables eXFlash support for up to four 1.8-inch SSDs. This kit replaces the standard two-bay backplane with a four-bay eXFlash backplane that attaches to an included flex cable to the M5115 controller. Because only SSDs are supported, a CacheVault unit is not required, and therefore this kit does not have a supercapacitor.
- ServeRAID M5100 Series SSD Expansion Kit for IBM Flex System x220 (90Y4426) enables support for up to four internal 1.8-inch SSDs. This kit includes two air baffles, left and right, which can attach two 1.8-inch SSD attachment locations and flex cables for attachment to up to four 1.8-inch SSDs.

The following table shows the kits required for each combination of drives. For example, if you plan to install eight 1.8-inch SSDs, then you need the M5115 controller, the eXFlash kit, and the SSD Expansion kit.

Table 7. ServeRAID M5115 hardware kits

Desired drive support			Components required			
Maximum number of 2.5-inch drives	Maximum number of 1.8-inch SSDs		ServeRAID M5115 90Y4390	Enablement Kit 90Y4424	eXFlash Kit 90Y4425	SSD Expansion Kit 90Y4426
2	0	=>	Add this	... and this		
0	4 (front)	=>	Add this		... and this	
2	4 (internal)	=>	Add this	... and this		... and this
0	8 (both)	=>	Add this		... and this	... and this

The following figure shows how the ServeRAID M5115 and the Enablement Kit are installed in the server to support two 2.5-inch drives with MegaRAID CacheVault flash cache protection (row 1 of the preceding table).

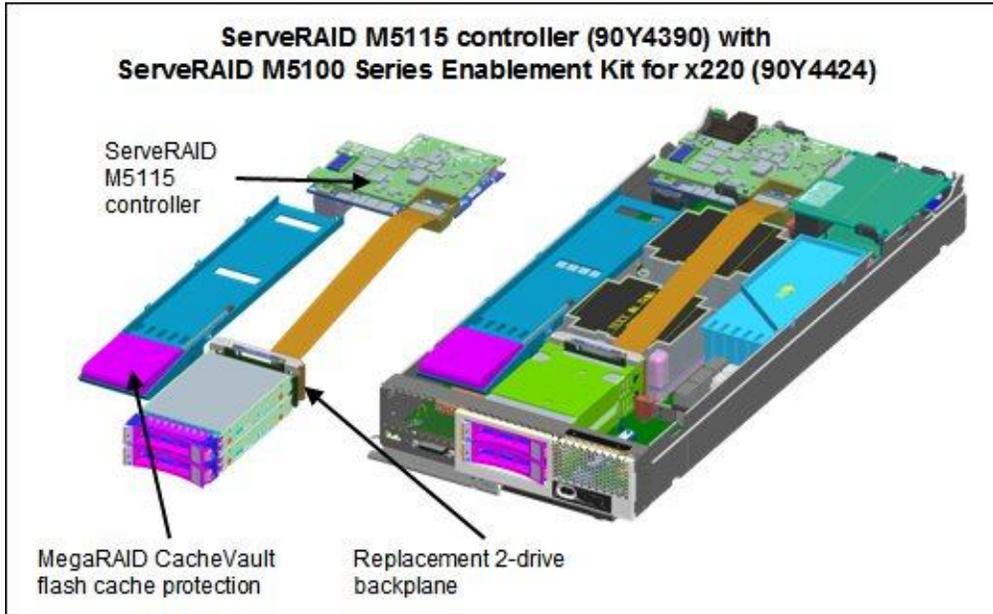


Figure 4. The ServeRAID M5115 and the Enablement Kit installed

The following figure shows how the ServeRAID M5115 and eXFlash and SSD Expansion Kits are installed in the server to support eight 1.8-inch solid-state drives (row 4 of the preceding table).

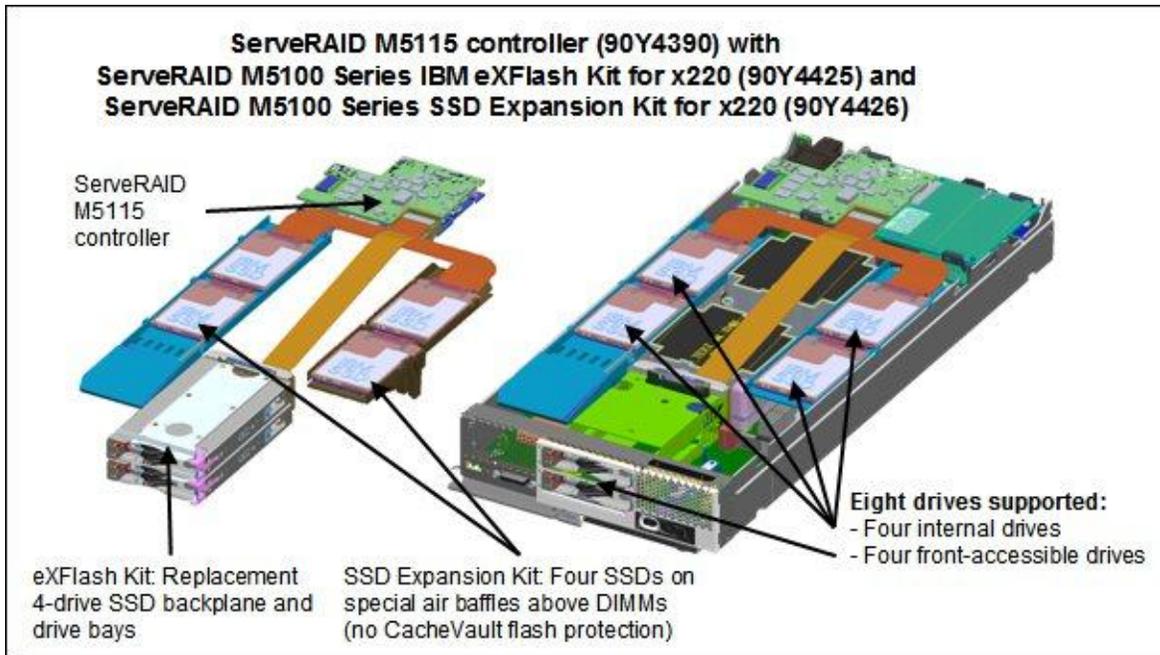


Figure 5. ServeRAID M5115 with eXFlash and SSD Expansion Kits installed

The eight SSDs are installed in the following locations:

- Four in the front of the system in place of the two 2.5-inch drive bays
- Two in a tray above the memory banks for processor 1
- Two in a tray above the memory banks for processor 2

Optional add-ons to the ServeRAID M5115 controller are RAID 6 support, SSD performance accelerator, and SSD caching enabler. The feature upgrades are as listed in the following table. These are all Feature on Demand (FoD) license upgrades.

Table 8. Supported upgrade features

Part number	Description	Maximum quantity supported
90Y4410	ServeRAID M5100 Series RAID 6 Upgrade for IBM Flex System	1
90Y4412	ServeRAID M5100 Series Performance Accelerator for IBM Flex System (MegaRAID FastPath)	1
90Y4447	ServeRAID M5100 Series SSD Caching Enabler for IBM Flex System (MegaRAID CacheCade Pro 2.0)	1

These features are described as follows:

- RAID 6 Upgrade (90Y4410)  
Adds support for RAID 6 and RAID 60. This is a Feature on Demand license.
- Performance Accelerator (90Y4412)  
The Performance Accelerator for IBM Flex System (implemented using the LSI MegaRAID FastPath software) provides high-performance I/O acceleration for SSD-based virtual drives by using an extremely low-latency I/O path to increase the maximum I/O per second (IOPS) capability of the controller. This feature boosts the performance of applications with a highly random data storage access pattern, such as transactional databases. Part number 90Y4412 is a Feature on Demand license.
- SSD Caching Enabler for traditional hard drives (90Y4447)  
The SSD Caching Enabler for IBM Flex System (implemented using the LSI MegaRAID CacheCade Pro 2.0) is designed to accelerate the performance of hard disk drive (HDD) arrays with only an incremental investment in solid-state drive (SSD) technology. The feature enables the SSDs to be configured as a dedicated cache to help maximize the I/O performance for transaction-intensive applications, such as databases and web serving. The feature tracks data storage access patterns and identifies the most frequently accessed data. The hot data is then automatically stored on the SSDs that are assigned as a dedicated cache pool on the ServeRAID controller. Part number 90Y4447 is a Feature on Demand license. This feature requires that at least one SSD drive be installed.

### Supported 1.8-inch drives

The 1.8-inch solid-state drives supported with the ServeRAID M5115 are listed in the following table.

Table 9. Supported 1.8-inch solid-state drives

Part number	Description	Maximum quantity supported
43W7746	IBM 200 GB SATA 1.8-inch MLC SSD	8
43W7726	IBM 50 GB SATA 1.8-inch MLC SSD	8

## Supported 2.5-inch drives

The 2.5-inch drive bays support SAS or SATA hard disk drives (HDDs) or SATA solid-state drives (SSDs). The following table lists the supported 2.5-inch drive options. The maximum quantity supported is two.

Table 10. 2.5-inch drive options for internal disk storage

Part number	Description	Supported by ServeRAID controller		
		C105	H1135	M5115
<b>10 K SAS hard disk drives</b>				
42D0637	IBM 300 GB 10 K 6 Gbps SAS 2.5-inch SFF Slim-HS HDD	No	Supported	Supported
49Y2003	IBM 600 GB 10 K 6 Gbps SAS 2.5-inch SFF Slim-HS HDD	No	Supported	Supported
81Y9650	IBM 900 GB 10 K 6 Gbps SAS 2.5-inch SFF HS HDD	No	Supported	Supported
<b>15 K SAS hard disk drives</b>				
42D0677	IBM 146 GB 15 K 6 Gbps SAS 2.5-inch SFF Slim-HS HDD	No	Supported	Supported
81Y9670	IBM 300 GB 15 K 6 Gbps SAS 2.5-inch SFF HS HDD	No	Supported	Supported
<b>NL SATA</b>				
81Y9722	IBM 250 GB 7.2 K 6 Gbps NL SATA 2.5-inch SFF HS HDD	Supported	Supported	Supported
81Y9726	IBM 500 GB 7.2 K 6 Gbps NL SATA 2.5-inch SFF HS HDD	Supported	Supported	Supported
81Y9730	IBM 1 TB 7.2 K 6 Gbps NL SATA 2.5-inch SFF HS HDD	Supported	Supported	Supported
<b>NL SAS</b>				
42D0707	IBM 500 GB 7200 6 Gbps NL SAS 2.5-inch SFF Slim-HS HDD	No	Supported	Supported
81Y9690	IBM 1 TB 7.2 K 6 Gbps NL SAS 2.5-inch SFF HS HDD	No	Supported	Supported
<b>Solid-state drives</b>				
43W7718	IBM 200 GB SATA 2.5-inch MLC HS SSD	No	No	Supported
90Y8643	IBM 256 GB SATA 2.5-inch MLC HS Enterprise Value SSD	No	No	Supported
90Y8648	IBM 128 GB SATA 2.5-inch MLC HS Enterprise Value SSD	No	No	Supported

## Internal tape drives

The server does not support an internal tape drive. However, it can be attached to external tape drives using Fibre Channel connectivity.

## Optical drives

The server does not support an internal optical drive option. However, you can connect an external USB optical drive, such as the IBM and Lenovo part number 73P4515 or 73P4516, or use the remote media feature of the IMMv2 and the Chassis Management Module.

## Embedded 1 Gb Ethernet controller

Some models of the x220 include an Embedded 1 Gb Ethernet controller (also known as LAN on Motherboard or LOM) built into the system board. Table 2 lists what models of the x220 include the controller. Each x220 model that includes the controller also has the Compute Node Fabric Connector installed in I/O connector 1 (and physically screwed onto the system board) to provide connectivity to the Enterprise Chassis midplane. Figure 3 shows the location of the Fabric Connector.

The Fabric Connector enables port 1 on the controller to be routed to I/O module bay 1 and port 2 to be routed to I/O module bay 2. The Fabric Connector can be unscrewed and removed, if required, to allow the installation of an I/O adapter on I/O connector 1.

The Embedded 1 Gb Ethernet controller has the following features:

- Broadcom BCM5718 based
- Dual-port Gigabit Ethernet controller
- PCIe 2.0 x2 host bus interface
- Supports Wake on LAN
- Supports Serial over LAN
- Supports IPv6

**Note:** TCP/IP Offload Engine (TOE) is not supported.

## I/O expansion options

The x220 has two I/O expansion connectors for attaching I/O adapter cards. There is a third expansion connector designed for future expansion options. The I/O expansion connectors are a very high-density 216-pin PCIe connector. Installing I/O adapter cards allows the server to connect with switch modules in the IBM Flex System Enterprise Chassis. Each slot has one PCI Express 3.0 x8 and one PCI Express x4 interface and both slots support the same form-factor adapters.

The following figure shows the location of the I/O expansion connectors.

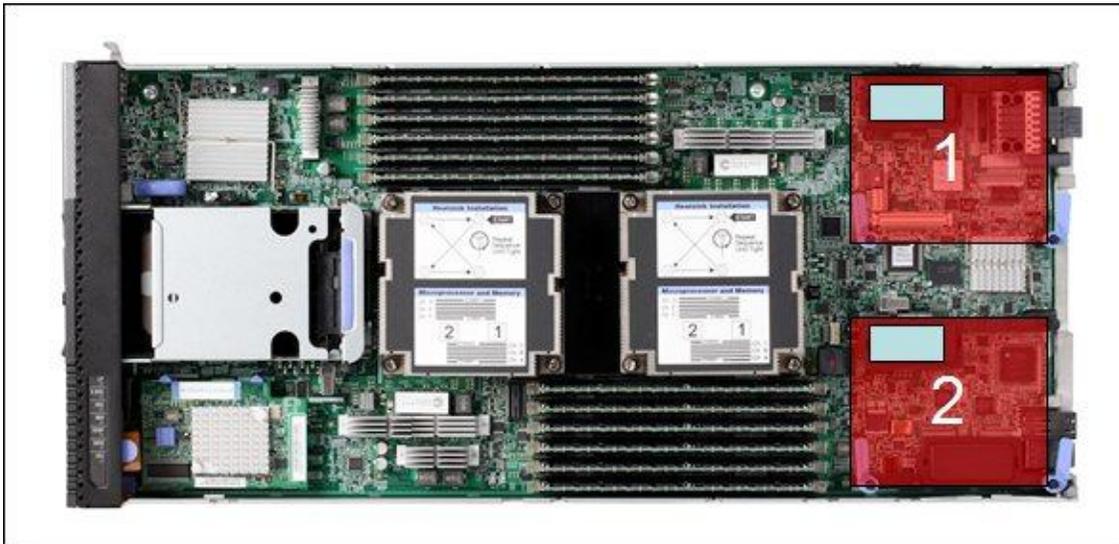


Figure 6. Location of the I/O adapter slots in the IBM Flex System x220 Compute Node

All I/O adapters are the same shape and can be used in any available slot.. A compatible switch or pass-through module must be installed in the corresponding I/O bays in the chassis, as indicated in the following table. Installing two switches means that all ports of the adapter are enabled, which improves performance and network availability.

Table 11. Adapter to I/O bay correspondence

I/O adapter slot in the server	Port on the adapter	Corresponding I/O module bay in the chassis
Slot 1	Port 1	Module bay 1
	Port 2	Module bay 2
	Port 3 (for 4-port cards)	Module bay 1
	Port 4 (for 4-port cards)	Module bay 2
Slot 2	Port 1	Module bay 3
	Port 2	Module bay 4
	Port 3 (for 4-port cards)	Module bay 3
	Port 4 (for 4-port cards)	Module bay 4

The following figure shows the location of the switch bays in the IBM Flex System Enterprise Chassis.

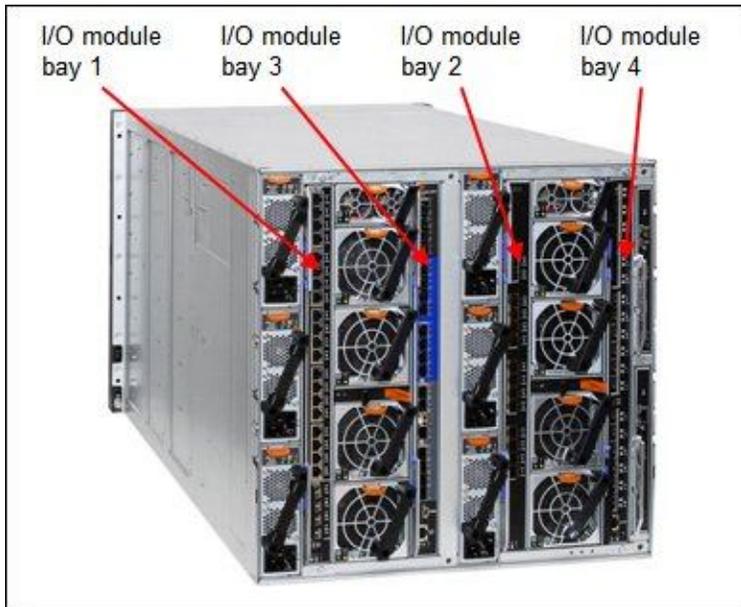


Figure 7. Location of the switch bays in the IBM Flex System Enterprise Chassis

The following figure shows how two-port adapters are connected to switches installed in the chassis.

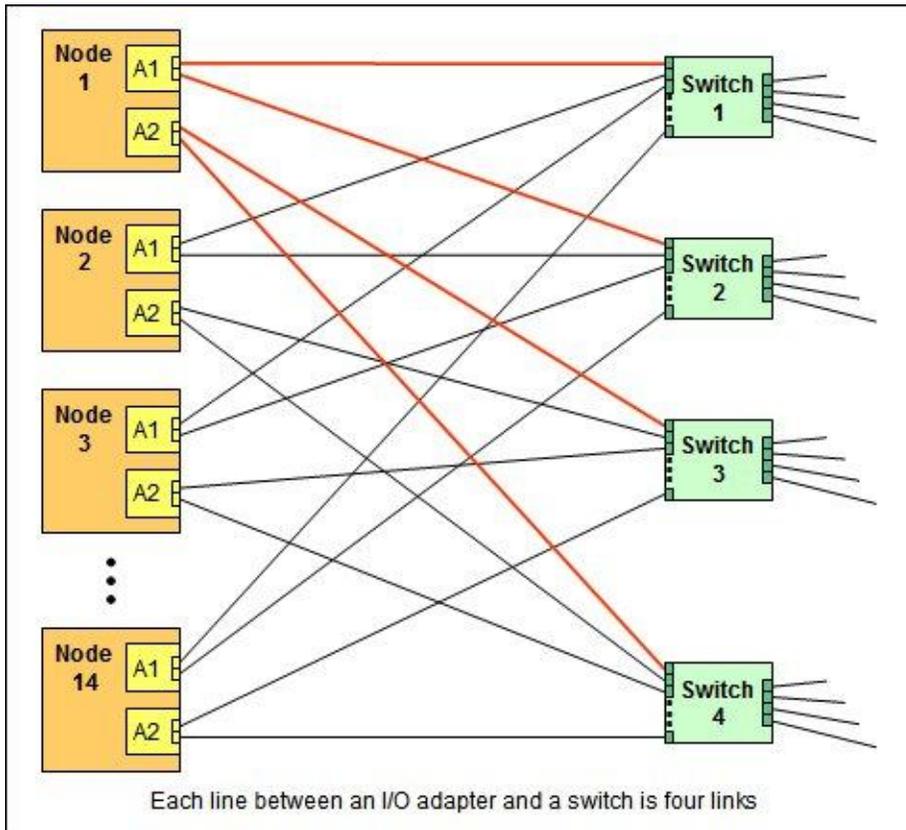


Figure 8. Logical layout of the interconnects between I/O adapters and I/O modules

## Network adapters

As described in "Embedded 1 Gb Ethernet Adapter," certain models have a Embedded 1 Gb Ethernet controller on the system board, and its ports are routed to the midplane and switches installed in the chassis through a Compute Node Fabric Connector that takes the place of an adapter in I/O slot 1.

Models without the Embedded 1 Gb Ethernet controller do not include any other Ethernet connections to the Enterprise Chassis midplane as standard. Therefore, for those models, an I/O adapter must be installed in either I/O connector 1 or I/O connector 2 to provide network connectivity between the server and the chassis midplane and ultimately to the network switches.

The following table lists the supported network adapters and upgrades. Adapters can be installed in either slot. However, compatible switches must be installed in the corresponding bays of the chassis.

Table 12. Network adapters

Part number	Description	Number of ports	Maximum supported*
10 Gb Ethernet			
90Y3554	IBM Flex System CN4054 10 Gb Virtual Fabric Adapter	4	2
90Y3558	IBM Flex System CN4054 Virtual Fabric Adapter (SW Upgrade) (Feature on Demand to provide FCoE and iSCSI support)	License	2
90Y3466	IBM Flex System EN4132 2-port 10 Gb Ethernet Adapter	2	2
1 Gb Ethernet			
49Y7900	IBM Flex System EN2024 4-port 1 Gb Ethernet Adapter	4	2
InfiniBand			
90Y3454	IBM Flex System IB6132 2-port FDR InfiniBand Adapter	2	2

\* For models with the Embedded 1 Gb Ethernet controller standard, the Compute Node Fabric Connector occupies the same space as an I/O adapter in I/O slot 1, so you have to remove the Fabric Connector if you plan to install an adapter in I/O slot 1.

For more information, see the list of IBM Redbooks Product Guides in the Adapter cards category: <http://www.redbooks.ibm.com/portals/puresystems?Open&page=pg&cat=adapters>

## Storage host bus adapters

The following table lists storage HBAs supported by the x220 server.

Table 13. Storage adapters

Part number	Description	Number of ports	Maximum supported*
Fibre Channel			
88Y6370	IBM Flex System FC5022 2-port 16 Gb FC Adapter	2	2
69Y1938	IBM Flex System FC3172 2-port 8 Gb FC Adapter	2	2
95Y2375	IBM Flex System FC3052 2-port 8 Gb FC Adapter	2	2

\* For models with the Embedded 1 Gb Ethernet controller standard, the Compute Node Fabric Connector occupies the same space as an I/O adapter in I/O slot 1, so you have to remove the Fabric Connector if you plan to install an adapter in I/O slot 1.

For more information, see the list of IBM Redbooks Product Guides in the Adapter cards category:  
<http://www.redbooks.ibm.com/portals/puresystems?Open&page=pg&cat=adapters>

## Power supplies

Server power is derived from the power supplies installed in the chassis. There are no server options regarding power supplies.

## Integrated virtualization

The x220 offers USB flash drive options preloaded with versions of VMware ESXi. This is an embedded version of VMware ESXi and is fully contained on the flash drive, without requiring any disk space. The USB memory key plugs into one of the two internal USB ports on the x220 system board (see Figure 3). If you install USB keys in both USB ports, both devices are listed in the boot menu, which allows you to boot from either device or to set one as a backup in case the first one gets corrupted.

The supported USB memory keys are listed in the following table.

Table 14. Virtualization options

Part number	Description	Maximum quantity supported
41Y8300	IBM USB Memory Key for VMware ESXi 5.0	2
41Y8298	IBM Blank USB Memory Key for VMware ESXi Downloads	2

## Light path diagnostics

For quick problem determination when you are physically at the server, the x220 offers a three-step guided path:

1. The Fault LED on the front panel
2. The light path diagnostics panel, shown in the following figure.
3. LEDs next to key components on the system board

The x220 light path diagnostics panel is visible when you remove the server from the chassis. The panel is located at the upper right side of the compute node, as shown in the following figure.



Figure 9. Location of x220 light path diagnostics panel

To illuminate the light path diagnostics LEDs, power off the compute node, slide it out of the chassis, and press the power button. The power button doubles as the light path diagnostics remind button when the server is removed from the chassis.

The meanings of the LEDs in the light path diagnostics panel are listed in the following table.

Table 15. Light path diagnostic panel LEDs

LED	Meaning
LP	The light path diagnostics panel is operational.
S BRD	A system board error is detected.
MIS	A mismatch has occurred between the processors, DIMMs, or HDDs within the configuration (as reported by POST).
NMI	A non-maskable interrupt (NMI) has occurred.
TEMP	An over-temperature condition occurs that was critical enough to shut down the server.
MEM	A memory fault has occurred. The corresponding DIMM error LEDs on the system board are also lit.
ADJ	A fault is detected in the adjacent expansion unit (if installed).

## Remote management

The server contains an IBM Integrated Management Module II (IMM2), which interfaces with the advanced management module in the chassis. The combination of these features provides advanced service-processor control, monitoring, and an alerting function. If an environmental condition exceeds a threshold or if a system component fails, LEDs on the system board are lit to help you diagnose the problem, the error is recorded in the event log, and you are alerted to the problem. A virtual presence capability comes standard for remote server management.

Remote server management is provided 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 server also supports virtual media and remote control features, which provide the following functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel, 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 IMM2 memory and mapping it to the server as a virtual drive
- Capturing blue-screen errors

## 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, Enterprise x64 Edition
- Microsoft Windows Server 2008 HPC Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- SUSE Linux Enterprise Server 10 for AMD64/EM64T
- SUSE Linux Enterprise Server 11 for AMD64/EM64T
- SUSE Linux Enterprise Server 11 with Xen for AMD64/EM64T
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- VMware ESX 4.1
- VMware ESXi 4.1
- VMware vSphere 5

**Note:** Support by some of these operating system versions will be after the date of initial availability. Check the IBM ServerProven® website for the latest information about the specific versions and service levels supported and any other prerequisites. The website can be found at the following address:  
<http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/nos/matrix.shtml>

## Physical specifications

Dimensions and weight (approximate):

- Width: 217 mm (8.6 in.)
- Height: 56 mm (2.2 in.)
- Depth: 492 mm (19.4 in.)
- Maximum weight: 6.4 kg (14.11 lb)

Shipping dimensions and weight (approximate):

- Height: 197 mm (7.8 in.)
- Depth: 603 mm (23.7 in.)
- Width: 430 mm (16.9 in.)
- Weight: 8 kg (17.6 lb)

## Supported environment

The IBM Flex System x220 compute node complies with ASHRAE Class A3 specifications.

This is the supported operating environment:

Power on:

- Temperature: 5 - 40 °C (41 - 104 °F)
- Humidity, non-condensing: -12 °C dew point (10.4 °F) and 8 - 85% relative humidity
- Maximum dew point: 24 °C (75 °F)
- Maximum altitude: 3048 m (10,000 ft)
- Maximum rate of temperature change: 5 °C/hr (41 °F/hr)

Power off:

- Temperature: 5 - 45 °C (41 - 113 °F)
- Relative humidity: 8 - 85%
- Maximum dew point: 27 °C (80.6 °F)

Storage (non-operating):

- Temperature: 1 - 60 °C (33.8 - 140 °F)
- Altitude: 3050 m (10,006 ft)
- Relative humidity: 5 - 80%
- Maximum dew point: 29 °C (84.2 °F)

Shipment (non-operating):

- Temperature: -40 - 60 °C (-40 - 140 °F)
- Altitude: 10,700 m (35,105 ft)
- Relative humidity: 5 - 100%
- Maximum dew point: 29 °C (84.2 °F)

## Warranty options

The IBM Flex System x220 Compute Node has a three-year on-site warranty with 9x5 next-business-day terms. IBM offers the warranty service upgrades through IBM ServicePac, described 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. Each country might have its own service types, service levels, response times, and terms and conditions. Not all covered types of ServicePac might be available in a particular country. For more information about IBM ServicePac offerings available in your country, see 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 16. Warranty service definitions

Term	Description
IBM on-site repair (IOR)	A service technician comes 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 24-hour service, 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 24-hour service, 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. - 5:00 p.m. in the customer's local time zone, Monday through Friday, excluding IBM holidays. If it is after 1:00 p.m., and it is determined that on-site 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 arrives 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. - 5:00 p.m. in the customer's local time zone, Monday through Friday, excluding IBM holidays.

In general, here are the types of IBM ServicePac offerings:

- Warranty and maintenance service upgrades:
  - One, two, three, four, or five years of 9x5 or 24x7 service coverage
  - On-site repair from the next business day to four or two hours
  - One or two 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 IBM System x® servers
  - Remote technical support for System x servers
  - Software support - Support Line:
    - Microsoft or Linux software
    - VMware
    - IBM Systems Director

## Regulatory compliance

The server conforms to the following standards:

- ASHRAE Class A3
- FCC - Verified to comply with Part 15 of the FCC Rules Class A
- Canada ICES-004, issue 3 Class A
- UL/IEC 60950-1
- CSA C22.2 No. 60950-1
- NOM-019
- Argentina IEC 60950-1
- Japan VCCI, Class A
- IEC 60950-1 (CB Certificate and CB Test Report)
- China CCC (GB4943); (GB9254, Class A); (GB17625.1)
- Taiwan BSMI CNS13438, Class A; CNS14336
- Australia/New Zealand AS/NZS CISPR 22, Class A
- Korea KN22, Class A, KN24
- Russia/GOST ME01, IEC 60950-1, GOST R 51318.22, GOST R 51318.249, GOST R 51317.3.2, GOST R 51317.3.3
- IEC 60950-1 (CB Certificate and CB Test Report)
- CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2, and EN61000-3-3)
- CISPR 22, Class A
- TUV-GS (EN60950-1/IEC 60950-1, EK1-ITB2000)

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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 use 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 purchasing 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 (ROI) 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 (TCO) and low monthly payments.

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## Related publications and links

For more information, see the following resources:

- IBM US Product Announcement:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-096>
- IBM Flex System x220 Compute Node product page:  
<http://ibm.com/systems/flex/compute-nodes/x86/>
- IBM Flex System Information Center:  
<http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>
- *IBM Flex System x220 Compute Node Installation and Service Guide*:  
[http://publib.boulder.ibm.com/infocenter/flexsys/information/topic/com.ibm.acc.7906.doc/printable\\_doc.html](http://publib.boulder.ibm.com/infocenter/flexsys/information/topic/com.ibm.acc.7906.doc/printable_doc.html)
- ServerProven for IBM Flex System:  
<http://ibm.com/systems/info/x86servers/serverproven/compat/us/flexsystems.html>
- ServerProven hardware compatibility page for the x220:  
<http://ibm.com/systems/info/x86servers/serverproven/compat/us/blade/7906.html>
- ServerProven compatibility page for operating system support:  
<http://ibm.com/systems/info/x86servers/serverproven/compat/us/nos/flexmatrix.shtml>
- IBM Redbooks® Product Guides for IBM Flex System servers and options:  
<http://www.redbooks.ibm.com/portals/puresystems?Open&page=pgbycat>
- *IBM Flex System Interoperability Guide*:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=sa&subtype=wh&htmlfid=WZL12345USEN>
- *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/>
- IBM System Storage® Interoperability Center:  
<http://www.ibm.com/systems/support/storage/ssic>

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