IBM Flex System x440 Compute Node

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At a glance

The IBM Flex System™ x440 Compute Node is an Intel-processor based server optimized for high-end virtualization, mainstream database deployments, and memory-intensive high performance environments.

Overview

The IBM Flex System x440 Compute Node is an Intel-processor based server optimized for high-end virtualization, mainstream database deployments, and memory-intensive high performance environments.

Versatile

- Designed to run a variety of workloads, including high-end virtualization and mainstream databases
- A great choice of processors, memory, internal storage, and I/O options, allowing for flexible configurations
- Supported in the IBM Flex System Enterprise Chassis

Easy to use

- Two hot-swapped storage bays that support SAS/SATA drives, enabling drives to be removed easily for replacement or upgrade
- An optional embedded hypervisor that helps enable "instant virtualization"
- Light path diagnostics and Predictive Failure Analysis to help enable quick serviceability and maintenance
- Real-time management of the system day one out of the box via the Flex System Management, with a preconfigured and preinstalled interface

Performance optimized

- Next-generation Intel Xeon™ E5-4600 family processors, up to four processors, 130 W each
- Memory capacity with 48 DDR3 DIMM slots supporting up to 1,536 GB using 32 GB LRDIMMs
- Support for running 2DPC at 1600 MHz
- High-speed I/O that supports up to a total of eight physical 10 Gb ports or up to 64 ports of Virtual Fabric

### Power and cooling
- Low-power processors and low-power memory DIMMs
- Energy-efficient 1.35 V DIMM support
- Active Energy Manager to help monitor and cap power consumption
- Advanced management that supports limiting power consumption and real-time power and thermal management
- Innovative and robust design to help keep the compute node performing under demanding conditions

### Key prerequisites
- IBM Flex System Enterprise Chassis
- IBM network switch
- Appropriate PDUs and main power distribution
- VGA monitor, USB keyboard, and USB mouse for setup

### Planned availability date
August 24, 2012, for all except:
- October 18, 2012
- 46C9031 A3DT ServeRAID M5100 Series IBM Flex System Flash Kit for x440

### Description

**IBM Flex System compute nodes**

Compute nodes typically contain the number and type of microprocessors, memory modules, and hard disk drives that are needed to support a specific workload environment. These nodes use integrated network ports or optional network adapters to connect to external devices through the switches or modules that are installed in the chassis.

**Note:** The network adapters and ports in the nodes must be compatible with the network switches or modules in the chassis.

These compute nodes come with Intel Xeon microprocessors and provide the function, reliability, and performance in a small form factor design. They support a variety of Microsoft Windows, Linux, and VMware operating systems and are ideally suited for high-performance and virtualized environments such as memory-intensive computing, collaboration, general and mission-critical processing, and enterprise application workloads. All models come with an integrated management module (IMM2) that connects to the Chassis Management Module to provide the integrated systems-management functions for the node.

**Flex System x440 Compute Node**

The IBM Flex System x440 Compute Node is a high-density server optimized for high-end virtualization, mainstream database deployments, and memory-intensive high performance environments.

The Flex System x440 Compute Node provides support for optional devices, such as the following devices:
- Up to four multicore microprocessors
- Up to 48 low profile dual inline memory modules (DIMMs)
- Up to two hot-swap storage drives
- Up to four I/O expansion adapters (model dependent)
- Up to two internal bootable USB flash keys

The Flex System x440 Compute Node is supported in the IBM Flex System Enterprise Chassis only.

The IBM Flex System x440 Compute Node supports memory mirroring. Chipkill is supported in any mode when x4-based DIMM memory is used. Chipkill memory correction for up to four bits per DIMM helps to keep your server up and running.

**Standard IBM Flex System x440 Compute Node configuration**

**Model information**

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**Additional features**

- The IBM Flex System x440 Compute Node system board contains 48 DIMM connectors.
  - Each DIMM connector supports 4 GB, 8 GB, 16 GB, or 32 GB low-profile (LP) double date rate (DDR3) DRAM.
  - Chipkill is supported in x4 DIMM memory configurations only.
- Support is provided for up to two hot-swap, Small Form Factor (SFF) Serial Attached SCSI (SAS), Serial ATA (SATA), or Solid State (SSD) storage drives.
- Dual 10-Gigabit Ethernet connections are provided on select models.

IBM Flex System x440 Compute Node servers are designed for high throughput from processor to memory, and to bus I/O.

These features, combined with SMP capability and blade-thin density, make it an excellent choice for space- and power-constrained environments used for:

- Database
- Virtualization
- General enterprise applications such as ERP and SCM
- Simulations
High-availability and serviceability features

- Hot-swap capability
  Hot-swap compute nodes enable easy access to each node server.

- Management module
  The management module interfaces with each node server for single systems management control.

- Dynamic System Analysis (DSA)
  IBM Dynamic System Analysis (DSA) collects and analyzes system information to aid in diagnosing compute node problems. DSA collects the following information about the compute node:
  - Drive health information
  - Event logs for ServeRAID controllers and service processors
  - Hardware inventory, including PCI and USB information
  - Installed applications and hot fixes
  - Kernel modules
  - Light path diagnostics status
  - Network interfaces and settings
  - Performance data and details about processes that are running
  - RAID and controller configuration
  - Integrated management module 2 status and configuration
  - System configuration
  - Vital product data and firmware information
  DSA creates a DSA log, which is a chronologically ordered merge of the system-event log (as the IPMI event log), the IMM event log (as the ASM event log), and the operating-system event logs. You can send the DSA log as a file to a support representative or view the information as a text file or HTML file.

- Flexible network support
  The compute node provides flexible network capabilities:
  - The integrated Emulex BE3 dual-port Gigabit Ethernet (select models) controller supports connections to a 1 Gbps or 10 Gbps network through an Ethernet-compatible switch module in the chassis. The controller also supports Wake on LAN technology.
  - The compute node has connectors on the system board for optional expansion adapters for adding network communication capabilities to the compute node. Depending on the model, you can install up to four I/O expansion adapters for network support. This provides the flexibility to install expansion adapters that support a variety of network communication technologies.

- Hard disk drive support
  The compute node supports up to two hot-swap hard disk drives. You can implement RAID 0 or RAID 1 for the drives.

- IBM ServerGuide Setup and Installation CD
  The ServerGuide Setup and Installation CD, which you can download from the web, provides programs to help you set up the compute node and install a Windows operating system. The ServerGuide program detects installed optional hardware devices and provides the correct configuration programs and device drivers.

- Integrated management module 2 (IMM2)
  The integrated management module 2 (IMM2) combines systems-management function, video controller, the remote presence, and blue-screen capture features in a single chip. The IMM2 provides advanced systems-management control,
monitoring, and 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 IMM event log, and alerts you to the problem.

Optionally, the IMM2 also provides a virtual presence capability for remote systems management capabilities. The IMM2 provides remote systems management through industry-standard interfaces:

- Common Information Model (CIM)
- Intelligent Platform Management Interface (IPMI) version 2.0
- Simple Network Management Protocol (SNMP) version 3.0
- Web browser

• Large system-memory capacity

The compute node supports up to 1,536 GB of system memory. The IBM Flex System x440 Compute Node provides support for up to 48 industry-standard registered or LRDIMM ECC DDR3 on low-profile (LP) DIMMs on the system board.

• Light path diagnostics

Light path diagnostics provides light-emitting diodes (LEDs) to help diagnose problems.

• Microprocessor technology

The compute node supports up to four multicore Intel Xeon microprocessors.

• Peripheral Component Interconnect Express® (PCIe)

PCIe is a computer expansion bus that is used for chip-to-chip interconnect and expansion adapter interconnect. You can add optional I/O and storage devices.

• Power throttling

By enforcing a configurable power policy known as power-domain oversubscription, the IBM Flex System chassis will allow for a larger overall chassis power budget depending on the number of power supplies installed. When a fault occurs in one or more power supplies, the power supplies can run oversubscribed for a short period of time. During this time period the compute nodes will throttle to safe power level in order to allow all components in the chassis to stay operational and survive the power supply failure. This policy is enforced by the Chassis Management Module in cooperation with every installed compute node in the IBM Flex System chassis. The policy is in effect when initial power is applied to the IBM Flex System chassis or when an administrator changes the policy.

The following settings for this policy are available:

- Basic power management
- Power module redundancy (N+N or N+1)
- Power module redundancy with compute node throttling allowed (N+N or N+1)

An administrator can configure the policy and monitor the overall chassis power environment by using the Chassis Management Module user interface.

• Systems-management support

The compute node supports the IBM Flex System Chassis Management Module (CMM) and IBM Flex System Manager management software.

- CMM is a hot-swap module that provides system-management functions for all components in an IBM Flex System chassis. It controls a serial port for remote connection and a 10/100 Mbps Ethernet remote-management connection.
- IBM Flex System Manager management software is a platform-management foundation that streamlines the way you manage physical and virtual systems in a heterogeneous environment. By using industry standards, IBM Flex
System Manager management software supports multiple operating systems and virtualization technologies.

**Flex System networking portfolio**

Networking in datacenters today is undergoing a transition from a discrete traditional model to a more flexible, optimized model or the "smarter" model. Clients are looking to support more workloads with decreasing or flat IT budget. The network architecture on the Flex System platform has been designed to address the key challenges clients are facing today in their datacenters. The key attributes of the network architecture on this platform are:

- **Integrated**
  - Efficient integrated management as part of the management appliance
  - Move from physical network management to logical network management in a virtualized environment
- **Automated**
  - Seamless provisioning, management, and deployment of both physical and virtual network parameters using tools like Virtual Fabric Manager, IBM SoftSwitch (5000v), and VMready®
- **Optimized**
  - Creation of a flat logical network so there are fewer elements to manage
  - Reduced cost and complexity by leveraging IBM Virtual Fabric and I/O convergence
  - Reduced risk and cost by leveraging scalable switches that can provide both port and bandwidth flexibility

One of the key attributes of the products on this platform is scalability. When modules are marked "Scalable" this means that clients can buy the base product with a certain number of ports and when they need to scale up for more ports, they can just buy the license to enable the extra ports without having to provision any new hardware.

**The Flex System networking portfolio includes:**

- **IBM Flex System EN2092 1Gb Ethernet Scalable Switch**
  This 1 Gb scalable switch is for clients looking to use the value of Flex System without moving to a 10 Gb environment. Key features of this switch module are:
  - The switch supports up to two logical partitions per physical switch.
  - It is a 52-port switch with 28 internal 1 Gb ports, 20 external 1 Gb ports, and 4 external 10 Gb ports.
  - The base switch provides 14 internal 1 Gb ports and 10 external 1 Gb RJ45 ports.
  - Upgrade 1 offers 14 additional internal 1 Gb ports and 10 additional external 1 Gb RJ45 ports.
  - Upgrade 2 enables the four 10 Gb uplink ports.
  - Upgrade 1 can be applied to the base switch or to Upgrade 2.
  - 10 Gb SFP+ ports can function at 1 Gb or 10 Gb.
  - The switch provides support for full L2/L3 Ethernet functionality.

The IBM Flex System EN2092 1Gb Ethernet Scalable Switch offers 14 internal 1 Gb ports to each compute node and ten external 1 Gb ports as uplinks. The external ports are RJ45.

- **IBM Flex System EN2092 1 Gb Ethernet Scalable Switch (Upgrade 1)**
  Clients who require either more than two 1 Gb ports per server or more bandwidth can enable additional ports by using this switch upgrade. This option
enables another 14 internal 1 Gb ports to each compute node and 10 additional external 1 Gb uplinks.

- **IBM Flex System EN2092 1Gb Ethernet Scalable Switch (10 Gb Uplinks) (Upgrade 2)**
  This option enables the four 10 Gb uplinks on this switch module for clients who require higher performance and bandwidth to connect to 10 Gb Top-of-Rack (ToR) switch modules. Clients need to purchase at least the base switch before they can enable these uplinks. These uplinks can be enabled on either partition of the switch.

- **IBM Flex System Fabric EN4093 10Gb Scalable Switch**
  This 10 Gb scalable switch offers uncompromised scalability, throughput, and performance. This switch can help clients migrate to 10 Gb infrastructure and offers virtualization features like Virtual Fabric and VMready. Clients should consider this switch if they:
  - Are building a 10 Gb Ethernet infrastructure or migrating from 1 Gb to 10 Gb (mixed environment)
  - Are deploying virtualization
  - Want investment protection to upgrade to more ports and bandwidth (40 Gb)

  Some of the key features of this switch are:
  - This is a triple-density switch with the ability to scale based on your needs.
  - It offers a total 64 ports with 42 internal 10 Gb ports and 22 external 10 Gb ports.
  - The base switch provides 14 internal 10 Gb ports and 10 external SFP+ 10 Gb ports.
  - Upgrade 1 provides 14 additional internal 10 Gb ports and enables two 40 Gb QSFP ports that can be used as four 10 Gb ports.
  - Upgrade 2 offers 14 additional internal 10 Gb ports and enables 4 external SFP +10 Gb ports.
  - Upgrade 1 is required to apply Upgrade 2.
  - 10 Gb SFP+ ports can function at 1 Gb or 10 Gb.
  - 40 Gb QSFP ports can function at 10 Gb or 40 Gb.
  - The switch provides full Layer 2/3 Ethernet function.
  - The switch offers Virtual Fabric support and management.

  This base switch model will enable 14 internal 10 Gb ports, one to each compute node, and 10 external 10 Gb ports to connect to a ToR switch module. All external 10 Gb ports are SFP+ based connections.

- **IBM Flex System Fabric EN4093 10Gb Scalable Switch (Upgrade 1)**
  This switch upgrade can be applied on the base switch when you require support for four ports of 10 Gb on the server or if you just want more uplink bandwidth on the base switch. The upgrade will enable 14 additional internal 10 Gb ports, one to each compute node, and two 40 Gb uplinks. These 40 Gb uplinks are QSFP connectors but can be converted to four 10 Gb uplinks using fan out cable. This upgrade can be applied if you already have the base switch model.

- **IBM Flex System Fabric EN4093 10Gb Scalable Switch (Upgrade 2)**
  This switch upgrade can be applied on top of Upgrade 1 when you want to support six ports of 10 Gb on the server or if you just want more uplink bandwidth on the base switch. The upgrade will enable 14 additional internal 10 Gb ports, one to each compute node, and four 10 Gb uplinks. These uplinks are SFP+ ports.

- **IBM Flex System EN4091 10Gb Ethernet Pass-thru**
  This module offers easy connectivity of the Flex System Chassis to an external network infrastructure. This is an unmanaged device enabling direct connectivity of a compute node in the chassis to an external Top-of-Rack switch. This module
can function at both 1 Gb and 10 Gb speeds. It has 14 internal links and 14 external SFP+ uplinks.

- **IBM Flex System EN2024 4-port 1Gb Ethernet Adapter**
  This four-port 1 Gb adapter can provide 1 Gb connectivity to clients. When it is combined with the IBM Flex System EN2092 1Gb Ethernet Scalable Switch, clients can leverage an end-to-end 1 Gb solution on Flex System Chassis. This adapter is based on Broadcom 5718 ASIC and supports a PCIe Gen2 x4 interface with MSI/MSI-X. It also supports I/O virtualization features like VMware NetQueue and Microsoft VMQ technologies.

- **IBM Flex System CN4054 10Gb Virtual Fabric Adapter and IBM Flex System CN4054 Virtual Fabric Adapter (software upgrade)**
  This is a four-port 10 Gb adapter that can scale up to 16 virtual ports and support multiple protocols like Ethernet, iSCSI, and FCoE. This adapter uses the third generation of Emulex ASIC (BE3) that supports hardware offload and acceleration for network and storage protocols. By using a common infrastructure for Ethernet and storage networks, datacenters can reduce capital expenses (CAPEX) and operating expenses (OPEX). Key features of this adapter are:
  - Each 10 Gb physical port can support up to four virtual ports (vNIC).
  - Each vNIC appears as an individual adapter to the operating system.
  - Each vNIC allocates bandwidth at increments of 100 Mb.
  - Clients can run advanced protocols like HW iSCSI or FCoE on one of the vNICs per physical port via the software upgrade key.
  - The adapter can connect at 1 Gb or 10 Gb speed.

  This adapter will support the following modes of operations:
  - Physical Mode (pNIC): In this mode the adapter will present four ports of 10 Gb and clients can upgrade to run either FCoE or HW iSCSI to connect to a storage target.
  - IBM Virtual Fabric Mode: In this mode each of the physical 10 Gb ports can present up to four virtual ports to the operating system. Therefore on this card, users can get up to 16 virtual ports. Clients can set the bandwidth of each of these virtual ports at increments of 100 Mb. Additionally they can apply the software upgrade to run storage protocols (HW iSCSI or FCoE) on four of the 16 virtual ports. This mode works with the IBM 10Gb Virtual Fabric Switch to provide end-to-end I/O virtualization. This adapter ships by default in this mode.
  - Switch Independent Mode: This functions like the IBM Virtual Fabric Mode except no setting or changes are required on the switch side. The adapter presents four virtual ports per physical port but on the switch side it is still a single 10 Gb port. This mode will enable clients to leverage the IBM Virtual Fabric capability with the 10Gb Pass-thru module also.

  Key benefits of this adapter are:
  - Ability to maximize I/O consolidation with high-performance 10 Gb ports
  - One adapter to run multiple protocols
  - Simplified setup and management options like CLI, Switch Interface, or Virtual Fabric Manager

- **IBM Flex System EN4132 2-port 10Gb Ethernet Adapter**
  This two-port 10 Gb adapter is based on Mellanox Connect X3 ASIC. This is a PCIe Gen 3 adapter that supports next-generation technology like RDMA and RoCE. Other key features of this adapter are:
  - Application acceleration
  - Low latency for specialized apps
This adapter will work with the 10 Gb Flex System Fabric Switch and 10 Gb Pass-thru modules.

**Fibre Channel Switch and Adapters**

- **IBM Flex System FC3171 8Gb SAN Switch and IBM Flex System FC3171 8Gb SAN Pass-thru**
  
  These SAN modules enable 8 Gb connectivity to storage from the Flex System Chassis. These SAN modules offer enhanced Fibre Channel functions like Port Aggregation, Auto-StreamGuard, Enhanced N_Port ID Virtualization (NPIV), and Automatic Failover.

  Both of these modules run at high-performance 8 Gb speed. Two part numbers are offered to meet clients’ requirements whether they need full switching function in the chassis or just a simple pass-thru solution.

- **IBM Flex System FC5022 24-port 16Gb ESB SAN Scalable Switch, IBM Flex System FC5022 16Gb SAN Scalable Switch, and IBM Flex System FC5022 2-port 16Gb FC Adapter**

  These SAN switch modules and HBA deliver an embedded option for IBM Flex System users deploying storage area networks in their enterprise. They offer end-to-end 16 Gb and 8 Gb connectivity. These scalable switches enable Dynamic Ports on Demand (DPOD) and grow with the needs of the clients. The N-Port Virtualization mode streamlines the infrastructure by reducing the number of domains to manage while enabling the ability to add or move servers without impact to the SAN. Management is simplified via an integrated management appliance, or clients using end-to-end Brocade SAN can leverage the Brocade management tools.

  Key features of this switch:

  - Superior scalability to allow greater intrachassis connectivity
  - Extension, encryption, and compression capable
  - Diagnostic Port (D-Port) for superior validation and serviceability of network
  - Total of 48 ports wired with 28 ports internal and 20 external
  - Based on Brocade's seventh-generation Fibre Channel Switch ASIC

  Two versions of this switch are available:

  - **IBM Flex System FC5022 16Gb SAN Scalable Switch**
    
    This switch comes with 12 Dynamic Ports on Demand (DPOD) licenses that can be applied to either internal or external links on this switch. Clients who do not fully populate the chassis can leverage this switch without having to pay for ports they are not using.

  - **IBM Flex System FC5022 24-port 16Gb Enterprise SAN Scalable Switch**
    
    This switch comes with 24 DPOD licenses that can be applied to either internal or external links on this switch. This switch will also include these enhanced software licenses installed:

    -- ISL Trunking (up to 128Gb ISL Trucks)
    -- Adaptive Networking
    -- Advanced Performance Monitoring
    -- Fabric Watch
    -- Extended Fabrics
    -- Server Application Optimization

    To complement the 16Gb switches, we will offer a two-port 16 Gb adapter based on Brocade architecture to offer end-to-end 16 Gb connectivity to a SAN. This adapter can autonegotiate and work at 8 Gb speed also. It offers
enhanced features like storage Target Rate Limiting (TRL), VM aware Quality of Service (QoS) and 1M+ IOPS performance.

Clients can manage these devices via the integrated Flex System Manager or for advanced monitoring they can use the Brocade Network Advisor.

In summary, these SAN switches and adapter offer these key values:

-- First 16 Gbps embedded switch with up to 640 Gb bandwidth
-- Investment protection; growth in ports and bandwidth
-- Superior scalability to allow greater intrachassis connectivity
-- ISL Trunks up to 128 Gb for superior performance, resiliency, and management
-- Extension, encryption, and compression capable
-- Diagnostic Port (D-Port) for superior serviceability
-- VM aware Quality of Service from adapter through entire network

- IBM Flex System FC3172 2-port 8Gb FC Adapter
  The QLogic 8Gb Fibre Channel adapter enables high-speed access for Flex System compute nodes to connect to a Fibre Channel storage area network (SAN). This adapter is based on the proven QLogic 2532 8 Gb ASIC design and works with any of the 8 Gb or 16 Gb Flex System Fibre Channel switch modules. When compared to the previous-generation 4 Gb adapters, the new-generation 8 Gb adapters double the throughput speeds for Fibre Channel traffic. As a result, you can manage increased amounts of data and possibly benefit from a reduced hardware expense.

- IBM Flex System FC3052 2-port 8Gb FC Adapter
  The Emulex 2-port 8Gb Fibre Channel adapter enables high-speed access for Flex System compute nodes to an external storage area network (SAN). This adapter is based on the proven Emulex Fibre Channel stack and works with any of the 8 Gb or 16 Gb Flex System Fibre Channel switch modules. When compared to the previous-generation 4 Gb adapters, the new-generation 8 Gb adapters double the throughput speeds for Fibre Channel traffic. As a result, you can manage increased amounts of data and possibly benefit from a reduced hardware expense.

InfiniBand switch and adapters

- IBM Flex System IB6131 InfiniBand Switch, IBM Flex System IB6132 2-port QDR InfiniBand Adapter, and IBM Flex System IB6132 2-port FDR InfiniBand Adapter

InfiniBand is a high-speed server-interconnect technology that is ideally suited as the interconnect technology for access layer and storage components specifically for application and back-end IPC applications, for connectivity between application and back-end layers, and from back-end to storage layers. Through use of host channel adapters (HCAs) and switches, InfiniBand technology is used to connect servers with remote storage and networking devices, and other servers. It can also be used inside servers for interprocessor communication (IPC) in parallel clusters.

The IBM Flex System IB6131 InfiniBand Switch is an upgradable device that can scale with your needs. The base switch enables 14 internal QDR links to each server and 18 QSFP uplink ports for interswitch links or to connect to external servers. Clients can upgrade to FDR speed (56 Gb) via the Feature On Demand (FOD) process.

The InfiniBand QDR and FDR switches based on Mellanox technology are unmanaged switches. A subnet manager is required to establish an InfiniBand fabric. This module supports switch-embedded subnet managers and host-based subnet managers.
Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at


Product positioning

IBM Flex System suits multiple delivery models, from highly customizable hardware platforms to a fully integrated and optimized system.

- IBM Flex System hardware ‘building blocks’ made up of individual components that can be mixed and matched, and are fully customizable with optional management
- IBM Flex System solutions made up of a chassis with an integrated management appliance, IBM networking, and storage standard
- IBM Flex System optimized offerings made up of preconfigured, highly customized systems - focused on selected workloads or single-purpose applications such as PureFlex™ or Cloudburst

Product number

<table>
<thead>
<tr>
<th>Description</th>
<th>Machine Models</th>
<th>Part number</th>
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<tbody>
<tr>
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<td>7917F4G</td>
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<td>7917 F2G</td>
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Starting Point models:

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90Y9186 Intel Xeon Processor E5-4650L 8C 2.6GHz 20MB Cache 1600MHz 115W
46C9030 ServeRAID M5100 Series Enablement Kit for IBM Flex System x440
46C9031 ServeRAID M5100 Series IBM Flex System Flash Kit for x440
46C9032 ServeRAID M5100 Series SSD Expansion Kit for IBM Flex System x440

Pseudo part numbers

**Note:** The following Pseudo part numbers cannot be ordered as stand-alone parts and can only be ordered via configurator.

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<td>IBM Flex System x440 Compute Node Center Air Baffle</td>
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<td>System Documentation and Software-Italian</td>
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**Publications**

The *Installation and Service Guide* for IBM Flex System x440 Compute Node solutions, in US English, is available from


Under "Product Support," select "System x®," and under "Choose your page" select "Documentation."

IBM Systems Information Centers provide you with a single site where you can access product documentation for IBM systems hardware, operating systems, and server software. Through a consistent framework, you can efficiently find information and personalize your access. The IBM Systems information Centers are at


Multilingual support is provided for many of the IBM Flex System x440 Compute Node components in the following languages:

- Brazilian Portuguese
- Chinese (Simplified and Traditional)
The multilingual support includes national language keyboard support, multilingual nomenclature, and translated documentation as required by the individual countries.

**Services**

**Global Technology Services**

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For details on available services, contact your IBM representative or visit [http://www.ibm.com/services/](http://www.ibm.com/services/)

For details on available IBM Business Continuity and Recovery Services, contact your IBM representative or visit [http://www.ibm.com/services/continuity](http://www.ibm.com/services/continuity)


Select your country, and then select the product as the category.

**Technical information**

**Specified operating environment**

**Physical specifications**

**IBM Flex System x440 Compute Node**

7917-F4G

<table>
<thead>
<tr>
<th>Processor</th>
<th>Intel Xeon E5-4650</th>
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<tr>
<td>Internal speed</td>
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<tr>
<td>Maximum memory speed</td>
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<tr>
<td>CPU interconnect speed</td>
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<td>Number standard</td>
<td>8.0 GT/s</td>
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<tr>
<td>L3 cache (full speed)</td>
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<tr>
<td>Memory (LP ECC DDR3)</td>
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<tr>
<td>DIMMs (Standard)</td>
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<tr>
<td>DIMM sockets</td>
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<tr>
<td>Capacity</td>
<td>48</td>
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<tr>
<td>Mezzanine Card</td>
<td>1,536 GB (1)</td>
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<tr>
<td>Optional</td>
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</table>
Standard                      0
Maximum                       2
Video                          SVGA
Memory                         16 MB
Disk controller                 SAS
Channels                      4
Connector internal             2
Connector external             0
RAID                          Standard integrated 0, 1
Internal capacity             2 TB (2)
Total HDD or SSD bays         Up to 2
Management processor          Standard
Ethernet controller            2 x Dual 10Gb
Front access connectors       
KVM connector                  1 (3)
USB connector                  1

7917-F2G

Processor                     Intel Xeon E5-4650
Internal speed                8 core 130w
2.7 GHz
Maximum memory speed          1600 MHz
CPU interconnect speed        8.0 GT/s
Number standard               1
Maximum                       4
L3 cache (full speed)         20 MB
Memory (LP ECC DDR3)          8 GB (1.5v)
DIMMs (Standard)              1 x 8 GB
DIMM sockets                  48
Capacity                      1,536 GB (1)
Mezzanine Card                Optional
Standard                      0
Maximum                       4
Video                         SVGA
Memory                        16 MB
Disk controller                SAS
Channels                      4
Connector internal             2
Connector external             0
RAID                          Standard integrated 0, 1
Internal capacity             2 TB (2)
Total HDD or SSD bays         Up to 2
Management processor          Standard
Ethernet controller            0
Front access connectors       
KVM connector                  1 (3)
USB connector                  1

7917-D4G

Processor                     Intel Xeon E5-4620
Internal speed                8 core 95w
2.2 GHz
Maximum memory speed          1333 MHz
CPU interconnect speed        7.2 GT/s
Number standard               1
Maximum                       4
L3 cache (full speed)         16 MB
Memory (LP ECC DDR3)          8 GB (1.35v)
DIMMs (Standard)              1 x 8 GB
DIMM sockets                  48
Capacity                      1,536 GB (1)
Mezzanine Card                Optional
7917-d2G

Processor: Intel Xeon E5-4620
- Internal speed: 2.2 GHz
- Maximum memory speed: 1333 MHz
- CPU interconnect speed: 7.2 GT/s
- Number standard: 1
- Maximum: 4
- L3 cache (full speed): 16 MB
- Memory (LP ECC DDR3): 8 GB (1.35v)
- DIMMs (Standard): 1 x 8 GB
- DIMM sockets: 48
- Capacity: 1,536 GB (1)
- Mezzanine Card: Optional
  - Standard: 0
  - Maximum: 4
- Video: SVGA
- Memory: 16 MB
- Disk controller: SAS
- Channels: 4
- Connector internal: 2
- Connector external: 0
- RAID: Standard integrated 0, 1
- Internal capacity: 2 TB (2)
- Total HDD or SSD bays: Up to 2
- Management processor: Standard
- Ethernet controller: 2 x Dual 10Gb
- Front access connectors: 1 (3)
- KVM connector: 1
- USB connector: 1

7917-c4G

Processor: Intel Xeon E5-4610
- Internal speed: 2.4 GHz
- Maximum memory speed: 1333 MHz
- CPU interconnect speed: 7.2 GT/s
- Number standard: 1
- Maximum: 4
- L3 cache (full speed): 15 MB
- Memory (LP ECC DDR3): 8 GB (1.35v)
- DIMMs (Standard): 1 x 8 GB
- DIMM sockets: 48
- Capacity: 1,536 GB (1)
- Mezzanine Card: Optional
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<th>Value</th>
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<td>Internal capacity</td>
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<tr>
<td>Total HDD or SSD bays</td>
<td>Up to 2</td>
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<tr>
<td>Management processor</td>
<td>Standard</td>
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<td>Ethernet controller</td>
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<td>Front access connectors</td>
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**7917-C2G**

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**7917-B4G**

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### 7917-B2G

**Processor** | Intel Xeon E5-4607  
---|---  
**Internal speed** | 6 core 95W  
**Maximum memory speed** | 1066 MHz  
**CPU interconnect speed** | 6.4 GT/s  
**Number standard** | 1  
**Maximum** | 4  
**L3 cache (full speed)** | 12 MB  
**Memory (LP ECC DDR3)** | 8 GB (1.35v)  
**DIMMs (Standard)** | 1 x 8 GB  
**DIMM sockets** | 48  
**Capacity** | 1,536 GB (1)  
**Mezzanine Card** | Optional  
**Standard** | 0  
**Maximum** | 4  
**Video** | SVGA  
**Memory** | 16 MB  
**Disk controller** | SAS  
**Channels** | 4  
**Connector internal** | 2  
**Connector external** | 0  
**RAID** | Standard integrated 0, 1  
**Internal capacity** | 2 TB (2)  
**Total HDD or SSD bays** | Up to 2  
**Management processor** | Standard  
**Ethernet controller** | 0  
**Front access connectors** |  
**KVM connector** | 1 (3)  
**USB connector** | 1

### 7917-A4G

**Processor** | Intel Xeon E5-4603  
---|---  
**Internal speed** | 4 core 95W  
**Maximum memory speed** | 1066 MHz  
**CPU interconnect speed** | 6.4 GT/s  
**Number standard** | 1  
**Maximum** | 4  
**L3 cache (full speed)** | 10 MB  
**Memory (LP ECC DDR3)** | 8 GB (1.35v)  
**DIMMs (Standard)** | 1 x 8 GB  
**DIMM sockets** | 48  
**Capacity** | 1,536 GB (1)  
**Mezzanine Card** | Optional
Processor                     Intel Xeon E5-4603
Internal speed               4 core 95w
Maximum memory speed         2.0 GHz
CPU interconnect speed       1066 MHz
Number standard              6.4 GT/s
Maximum                      1
L3 cache (full speed)        4
Memory (LP ECC DDR3)          10 MB
DIMMS (Standard)             8 GB (1.35v)
DIMM sockets                 1 x 8 GB
Capacity                     48
Mezzanine Card               Optional
Standard                     1,536 GB (1)
Maximum                      Standard
Video                        4
Memory                       10 MB
Disk controller               4 MB
Channels                     SAS
Connector internal           2
 Connector external           0
RAID                         Standard integrated 0, 1
Internal capacity            2 TB (2)
Total HDD or SSD bays        Up to 2
Management processor         1
Ethernet controller           4
Front access connectors
KVM connector                2 x Dual 10Gb
USB connector                1
(3)

(1) Total system memory capacity is based on using 32 GB memory DIMMs.
(2) Capacities are based on installation of two 1 TB drives.
(3) Use of the IBM Flex System Console Breakout Cable provided with each chassis and sold separately allows connection of standard KVM options.

For latest information on supported HDD options, visit

**IBM Flex System x440 Compute Node specifications**

**Video subsystem**
- 16 MB DDR3
Integrated on the IMM2

Supported IBM Flex System x440 Compute Node video resolutions

<table>
<thead>
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<th>Resolution</th>
<th>Maximum Refresh Rate Supported</th>
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<td>800 x 600</td>
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<td>1024 x 768</td>
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<td>8, 16, 24</td>
</tr>
<tr>
<td>1280 x 1024</td>
<td>60, 75</td>
<td>8, 16, 24</td>
</tr>
<tr>
<td>1440 x 900</td>
<td>60, 60 RB</td>
<td>8, 16, 24</td>
</tr>
<tr>
<td>1600 x 1200</td>
<td>60, 75</td>
<td>8, 16, 24</td>
</tr>
<tr>
<td>1680 x 1050</td>
<td>60, 60 RB</td>
<td>8, 16, 24</td>
</tr>
</tbody>
</table>

Note: 24 Bpp (16.7 million colors) aligned on a 32-bit boundary for performance

Note: Each resolution supports both CRT and flat panel monitors. For CRT monitors, each resolution complies with CRT ISO 9241.3.

- 1440 x 900 and 1680 x 1050 are typically wide screen flat panel (non-CRT) settings so they are only available at 60 Hz.
- 1440 x 900 and 1680 x 1050 are available at 60 Hz with support for 60 Hz Reduced Blanking Mode.
- For the resolutions supported by different operating systems, refer the operating system documentation.

Dimensions - IBM Flex System x440 Compute Node

- Height: 55.5 mm (2.19 in)
- Depth: 492.7 mm (19.4 in)
- Width: 453.3 mm (17.4 in)
- Maximum weight: 12.25 kg (27 lb) (depending on the configuration when options are added)

Electrical

IBM Flex System x440 Compute Node: 12.2 (nominal) V dc

Note: All weights and measurements are approximate.

Standards

Equipment approvals and safety

- 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, EN61000-3-3)
- CISPR 22, Class A
- TUV-GS (EN60950-1/IEC 60950-1, EK1-ITB2000)

Operating environment

The IBM Flex System x440 Compute Node complies with ASHRAE Class A3 specifications.

- Power on:
  - Temperature: 5° - 40°C (41° - 104°F)
  - Humidity, noncondensing: -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°C to 45°C (41°F - 113°F)
  - Relative humidity: 8% - 85%
  - Maximum dew point: 27°C (80.6°F)
- **Storage (nonoperating):**
  - Temperature: 1°C to 60°C (33.8°F - 140°F)
  - Altitude: 3050 m (10,006 ft)
  - Relative humidity: 5% - 80%
  - Maximum dew point: 29°C (84.2°F)
- **Shipment (nonoperating):**
  - Temperature: -40°C to 60°C (-40°F - 140°F)
  - Altitude: 10,700 m (35,105 ft)
  - Relative humidity: 5% - 100%
  - Maximum dew point: 29°C (84.2°F)
  - Particulate contamination

**Hardware requirements**

For service, the IBM Flex System x440 Compute Node requires a compatible:

- Monitor
- Combination USB keyboard and pointing device such as IBM part number 40K5372
- USB CD-RW/DVD drive such as the IBM and Lenovo part number 73P4515 or 73P4516

**Software requirements**

The following network operating systems are supported in the IBM Flex System x440 Compute Node.

- **Microsoft:**
  - Microsoft Windows Server 2008 R2 with Service Pack 1
  - Microsoft Windows Server 2008, Datacenter x64 Edition with Service Pack 2
  - Microsoft Windows Server 2008, Enterprise x64 Edition with RA Service Pack 2
  - Microsoft Windows Server 2008, Standard x64 Edition with RA Service Pack 2
- **Linux:**
  - SUSE Linux Enterprise Server 10 for AMD64/EM64T, Service Pack 4
  - SUSE Linux Enterprise Server 11 for AMD64/EM64T, Service Pack 2
  - SUSE Linux Enterprise Server 11 with Xen for AMD64/EM64T, Service Pack 2
  - Red Hat Enterprise Linux 5 Server x64 Edition, U8
  - Red Hat Enterprise Linux 5 Server with Xen x64 Edition, U8
  - Red Hat Enterprise Linux 6 Server x64 Edition, U3
- **VMware:**
  - VMware ESX 4.1, U2
  - VMware ESXi 4.1, U2
  - VMware vSphere 5, U1

**Note:** For additional support, certification, and version information on network operating systems, visit http://www-03.ibm.com/systems/info/x86servers/serverproven/compat/us
Compatibility
The IBM Flex System x440 Compute Node contains licensed system programs that include set configuration, set features, and test programs. IBM system BIOS is loaded from a "flash" EEPROM into system memory. This BIOS provides instructions and interfaces designed to support the standard features of the x440 Compute Node and to maintain compatibility with many current software programs.

Contact your IBM representative or IBM Business Partner, or refer to the IBM Sales Manual for information on the compatibility of hardware and software for System x servers. The Sales Manual is updated periodically as new features and options are announced that support these servers.

Limitations
- The Flex System x440 Compute Nodes contain 48 DIMM sockets. A maximum of 1,536 TB of system memory is supported by using a 32 GB DIMM of ECC DDR3 memory in each of the DIMM sockets. A minimum of one memory feature must be installed. All memory installed must be of the same type (RDIMM or LRDIMM).
- Processor modules must be of the same type, power level, and clock speed on each Flex System x440 Compute Node. Mixing processor modules of different speeds, power levels, or cache sizes or upgrading the base processors is not supported. Mixing processor speeds and memory speeds will result in the system running at the lower of rated speeds.
- The Flex System x440 Compute Node is supported only in the IBM Flex System Enterprise Chassis.
- Four mezzanine expansion cards may be installed on the Flex System x440 Compute Node.
- Mezzanine expansion cards installed in the Flex System x440 Compute Node require a switch module in the Flex System Enterprise Chassis of the same connectivity type.
- Regarding the use of solid state disk drives, solid-state memory cells have an intrinsic, finite number of write cycles that each cell can incur. As a result, each solid-state device has a maximum amount of write cycles to which it can be subjected, documented as TBW (Total Bytes Written). IBM is not responsible for replacement of hardware that has reached the maximum guaranteed number of write cycles. This limit may be revealed as the device failing to respond to system-generated commands or becoming incapable of being written to. Additional information is available at http://www-03.ibm.com/systems/x/options/storage/solidstate/index.html

Planning information

Customer responsibilities
The IBM Flex System x440 Compute Node server is designated as customer setup. Customer setup instructions are shipped with each system.

Supported memory options

<table>
<thead>
<tr>
<th>Option number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>90Y3105</td>
<td>32GB (4Gb, 4Rx4, 1.35V) PC3L-10600 DDR3-1333 LP LR-DIMM</td>
</tr>
<tr>
<td>49Y1567</td>
<td>16GB (2Gb, 2Rx4,1.35V) (LR from 4Rx4) PC3L-10600 DDR3-1333 LP LR-DIMMM</td>
</tr>
<tr>
<td>00D4968</td>
<td>16GB (4Gb, 2Rx4, 1.35V) PC3L12800 DDR3-1333 LP RDIMM</td>
</tr>
<tr>
<td>49Y1563</td>
<td>16GB (4Gb, 2Rx4, 1.35V) PC3-10600 DDR3-1333 LP RDIMM</td>
</tr>
<tr>
<td>49Y1559</td>
<td>4GB (2Gb, 1Rx4, 1.5V) PC3-12800 ECC LP RDIMM</td>
</tr>
<tr>
<td>49Y1406</td>
<td>4GB (2Gb, 1Rx4, 1.35V) PC3L-10600K ECC LP RDIMM</td>
</tr>
<tr>
<td>49Y1407</td>
<td>4GB (2Gb, 2Rx8, 1.35V) PC3L-10600K ECC LP RDIMM</td>
</tr>
<tr>
<td>90Y3109</td>
<td>8GB (2Gb, 2Rx4,1.5V) PC3-12800 DDR3-1600 LP RDIMM</td>
</tr>
<tr>
<td>49Y1397</td>
<td>8GB 2Rx4 2Gb PC3L-10600R LP RDIMM 1.35V Capable</td>
</tr>
</tbody>
</table>

Cable orders
All cables are supplied with the IBM Flex System x440 Compute Node. Depending on the applications, the cables may be fully installed, partially installed (plugged at one end and packaged for shipping), or included as part of a shipment group.

Packaging

Ship group

The system carton contains the system unit and a ship-group kit containing the following documents and CDs:

- Important Notices booklet
- IBM Warranty Information booklet
- Product Documentation CD that includes the following documents:
  - Installation and Service Guide
  - IBM Safety Information
  - Product machine code license and other licenses and notices
- Environmental Notice and User Guide Documentation CD

The Installation and Service Guide on the Product Documentation CD contains the installation, use, and troubleshooting information necessary to use and service the product.

Supplies

None

Security, auditability, and control

Three of the most important features in compute node design are reliability, availability, and serviceability (RAS). These RAS features help to ensure the integrity of the data that is stored in the compute node, the availability of the compute node when you need it, and the ease with which you can diagnose and correct problems.

The compute node has the following RAS features:

- Advanced Configuration and Power Interface (ACPI)
- Automatic server restart (ASR)
- Built-in diagnostics using DSA Preboot, which is stored NAND Flash memory
- Built-in monitoring for temperature, voltage, and hard disk drives
- Customer support center 24 hours per day, 7 days a week
- Customer upgrade of flash ROM-resident code and diagnostics
- Customer-upgradeable Unified Extensible Firmware Interface (UEFI) code and diagnostics
- ECC protected DDR3 memory
- ECC protection on the L2 cache
- Error codes and messages
- Integrated management module II (IMM2) that communicates with the Chassis Management Module to enable remote systems management
- Light path diagnostics
- Memory parity testing
- Microprocessor built-in self-test (BIST) during power-on self-test (PST)
- Microprocessor serial number access
- PCI Express 2.0 and PCI Express 3.0
- PCI PMI 2.2
- POST
• Power policy 24-hour support center
• Processor presence detection
• ROM-resident diagnostics
• System-error logging
• Vital product data (VPD) on memory
• Wake on LAN capability
• Wake on PCI (PME) capability
• Wake on USB 2.0 capability
• Processor failover upon failure of primary (boot) processor (requires two processors to support)

This offering uses the security and auditability features from standard IBM offerings and supported Linux distributions.

The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.

**Global Technology Services**

Contact your IBM representative for the list of selected services available in your country, either as standard or customized offerings, for the efficient installation, implementation, and/or integration of this product.

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**Terms and conditions**

To obtain copies of the IBM Statement of Limited Warranty, contact your reseller or IBM.

**Warranty period**

• Three years
• Optional features - One year

**Note:** For configurations that support the RAID Battery, the RAID battery will be warranted for one year effective on its "Date of Installation." All other product warranty terms for the machine remain unchanged.

An IBM part or feature installed during the initial installation of an IBM machine is subject to a full warranty effective on the date of installation of the machine. An IBM part or feature which replaces a previously installed part or feature assumes the remainder of the warranty period for the replaced part or feature. An IBM part or feature added to a machine without replacing a previously installed part or feature is subject to a full warranty effective on its date of installation. Unless specified otherwise, the warranty period, type of warranty service, and service level of a part or feature are the same as those for the machine in which it is installed.

The following have been designated as consumables, supply items, or structural parts and therefore not covered by this warranty:

• Baffles and fillers
• Miscellaneous parts kit
• Mezzanine retention kit
• Top cover assembly
• Cam handle kit
• HDD cage
• Rear bulkhead
Warranty service

If required, IBM provides repair or exchange service, depending on the type of warranty service specified below for the machine. IBM will attempt to resolve your problem over the telephone or electronically by access to an IBM website. Certain machines contain remote support capabilities for direct problem reporting, remote problem determination, and resolution with IBM. You must follow the problem determination and resolution procedures that IBM specifies. Following problem determination, if IBM determines On-site Service is required, scheduling of service will depend upon the time of your call, machine technology and redundancy, and availability of parts. Service levels are response-time objectives and are not guaranteed. The specified level of warranty service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country- and location-specific information.

The type of service is Customer Replaceable Unit (for example, keyboard, mouse, speaker, memory, or hard disk drive) Service and On-site Service.

Customer Replaceable Unit (CRU) Service

IBM provides a replacement CRU to you for you to install. CRU information and replacement instructions are shipped with your machine and are available from IBM at any time on your request. A CRU is designated as being either a Tier 1 (mandatory) or a Tier 2 (optional) CRU. Installation of Tier 1 CRUs, as specified in this announcement, is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation. You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service designated for your machine.

Based upon availability, a CRU will be shipped for next business day (NBD) delivery. IBM specifies in the materials shipped with a replacement CRU whether a defective CRU must be returned to IBM. When return is required, return instructions and a container are shipped with the replacement CRU, and you may be charged for the replacement CRU if IBM does not receive the defective CRU within 15 days of your receipt of the replacement.

The following parts or features have been designated as Tier 1 CRUs:

- System service label
- Cables
- HDDs
- HDD backplane
- Memory DIMMs
- Storage drives
- 3x8 double ended periscope receptacle
- Indicator panel
- RAID battery (one year warranty)
- RFID label tag assembly
- 2 GB USB memory flash key
- Mezzanine adapters and cards
- Front bezel with power button
- KVM dongle cable

On-site Service

At IBM's discretion you will receive CRU service or IBM or your reseller will repair the failing machine at your location and verify its operation. If required, On-site Repair is provided, 9 hours per day, Monday through Friday excluding holidays, NBD response. You must provide a suitable working area to allow disassembly and
reassembly of the IBM machine. The area must be clean, well lit, and suitable for the purpose. On-site Service is not available in all countries, and some countries have kilometer or mileage limitations from an IBM service center. In those locations where On-site Service is not available, the normal in-country service delivery is used.

**International Warranty Service**

International Warranty Service (IWS) is available in selected countries or regions.

The warranty service type and the service level provided in the servicing country may be different from that provided in the country in which the machine was purchased.

Under IWS, warranty service will be provided with the prevailing warranty service type and service level available for the IWS-eligible machine type in the servicing country, and the warranty period observed will be that of the country in which the machine was purchased.

To determine the eligibility of your machine and to view a list of countries where service is available, visit


For more information on IWS, refer to Services Announcement ZS01-0168, dated September 25, 2001.

**Licensing**

Programs included with this product are licensed under the terms and conditions of the License Agreements that are shipped with the system.

**Warranty service upgrades**

**IBM hourly service rate classification**

Two

**Field-installable features**

Yes

**Model conversions**

No

**Machine installation**

Customer setup. Customers are responsible for installation according to the instructions IBM provides with the machine.

**Licensed Machine Code**

IBM Machine Code is licensed for use by a customer on the IBM machine for which it was provided by IBM under the terms and conditions of the IBM License Agreement for Machine Code, to enable the machine to function in accordance with its specifications, and only for the capacity authorized by IBM and acquired by the customer. You can obtain the agreement by contacting your IBM representative or visiting

IBM may release changes to the Machine Code. IBM plans to make the Machine Code changes available for download from the IBM System x technical support website

http://www-304.ibm.com/systems/support/

If the machine does not function as warranted and your problem can be resolved through your application of downloadable Machine Code, you are responsible for downloading and installing these designated Machine Code changes as IBM specifies. If you would prefer, you may request IBM to install downloadable Machine Code changes; however, you may be charged for that service.

Access to IBM Flex System fix downloads will be granted upon entitlement validation. The terms and conditions for fixes will be covered under the License Agreement for Machine Code, International Program License Agreement, International License Agreement for Non-Warranted Programs and/or other terms provided with the fix, as applicable.

**Pricing**

For all local charges, contact your IBM representative.

**ServicePac service upgrades**

The announced hardware products may also be eligible for ServicePac® warranty upgrades. ServicePac provides a higher level of service to enhance the base IBM Machine Warranty and a selection of software Support Services.

ServicePacs can be purchased from your IBM Business Partner and are specific to the machines/products listed.

The upgrade level of service is dependent on country.

For a full list of ServicePac offerings and prices, refer to the IBM ServicePac Product Selector Tool


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Announcement is restricted to the following countries:

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- Angola
- Austria
- Bahrain
- Belgium
- Botswana
- Bulgaria
- Croatia
- Czech Republic
- Denmark
- Egypt
- Estonia (1)
- Finland
- France (except overseas territories)
- Germany
• Greece
• Hungary
• Ireland
• Israel
• Italy
• Jordan
• Kazakhstan
• Kenya
• Kuwait
• Latvia (1)
• Lebanon
• Lithuania (1)
• Libya
• Luxembourg
• Mauritius
• Morocco
• Mozambique
• Netherlands
• Nigeria
• Norway
• Oman
• Pakistan
• Poland
• Portugal
• Qatar
• Romania
• Russia
• Saudi Arabia
• Serbia
• Slovakia
• Slovenia
• S. Africa
• Spain
• Sweden
• Switzerland
• Tanzania
• Tunisia
• Turkey
• UK (Mainland only)
• Ukraine
• United Arab Emirates

**Note:** (1) Order and registration via Finland

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The products in this document are also covered by Maintenance Agreements and ServiceSuite® contracts.
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