IBM Ethernet Switch B24X delivers a top-of-rack switch for data center and high-performance computing

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At a glance

IBM® Ethernet Switch B24X combines performance with rich functionality in the data center and it is designed to deliver:

- 24x ports of dual-speed 10/1 GbE SFP+/SFP ports plus 4x 10/100/1000 MbE RJ45 ports
- Full-duplex throughput on all ports, 488 Gbps total switch capacity and ultra-low latency
- Hot-swappable, 1+1 redundant power supplies
- Resilient and hot-swappable triple-fan assembly
- Layer 2 industry-standard Ethernet protocols, including multiple varieties of Spanning Tree Protocol (STP) and link aggregation as well as fault detection and correction features
- Quality of service (QoS) features designed to ensure high-reliability services throughout the data center

Overview

The IBM Ethernet Switch B24X, a powerful 10 Gigabit Ethernet (GbE) switch in a compact form factor, helps to meet the needs of demanding data centers, large enterprises, and high-performance computing (HPC) networks. The 1U form factor, high-density top-of-rack data center switch is designed to deliver:

- 10 GbE server access and aggregation with 24x 10 GbE/1 GbE dual-speed (SFP+/SFP) ports plus 4x 10/100/1000 Megabit Ethernet (RJ45) ports
- Flexibility to mix 10 GbE and 1 GbE servers, protecting investments and streamlining migration to 10 GbE-capable server farms
- Wire-speed performance with an ultra low-latency, cut-through, non-blocking architecture that is well suited for HPC environments
- Highly efficient power and cooling with front-to-back airflow, automatic fan speed adjustment, and use of SFP+ and RJ45 ports for maximum flexibility
• High availability with redundant, load-sharing, hot-swappable, auto-sensing/switching power supplies and a resilient triple-fan assembly
• End-to-end quality of service (QoS) with hardware-based marking, queuing, and congestion management
• Embedded per-port sFlow capabilities to support scalable hardware-based traffic monitoring

Key prerequisites

IronWare operating system level R4.1.00, or later.

For a list of supported servers, refer to the Hardware requirements section.

Planned availability dates

September 4, 2009
• US and Canada
• All European, Middle Eastern, and African countries except:
  Algeria, Bahrain, Benin, Botswana, Burundi, Cameroon, Chad, Djibouti, Eritrea, Belarus, Ethiopia, Gabon, Gambia, Ghana, Guinea, Jordan, Kuwait, Lesotho, Liberia, Malawi, Mali, Mauritania, Moldavia, Montenegro, Mozambique, Niger, Nigeria, Oman, Qatar, Russia, Rwanda, Serbia, Somalia, Tanzania, Togo, Uganda, Zambia, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, South Africa, Turkmenistan, Ukraine, Uzbekistan, Iraq, Lebanon, Burkina Faso, Cape Verde, Central African Republic, Congo, Reubuplic of the, Cote d’Ivoire, Sierra Leone, United Arab Emirates, Yemen, and West Bank.
  All Latin American countries except:
  Belize, Brazil, Dominican Republic, Nicaragua, Argentina, Mexico, Suriname, Haiti, and Venezuela.
  All Asia Pacific countries except:
  Brunei, Laos, Maldives, Mongolia, Myanmar (Burma), Cambodia, China, Vietnam, Nepal, Papua New Guinea, Samoa, and Wallis and Futuna.

October 30, 2009
• Argentina

Description

The IBM Ethernet Switch B24X is a compact, high-performance, high-availability, and high-density 1 RU switch specifically designed for mission-critical data centers and high-performance computer (HPC) requirements. This switch can provide 24x 10/1 GbE (SFP+/SFP) ports plus 4x 10/100/1000 MbE (RJ45) ports of connectivity in an ultra-low-latency, cut-through, non-blocking architecture.

This switch is designed to offer a cost-effective solution for server or compute-node connectivity. It can support 1 GbE servers until they are upgraded to 10 GbE-capable Network Interface Cards (NICs), simplifying migration to 10 GbE server farms. In addition, the switch can be positioned as a 10 GbE aggregation behind 1 GbE access switches.

Each dual-speed port on the IBM Ethernet B24X can function as a 1 GbE port by plugging in a 1 GbE SFP transceiver, making it a flexible solution for environments where some servers have not yet been upgraded to 10 GbE-capable NICs. In data center environments where all servers are still at 1 GbE, organizations can deploy the switch as a compact and cost-effective 10 GbE aggregation switch and move it to the access layer when servers are upgraded to 10 GbE.
When organizations upgrade a server's NICs to 10 GbE, they will only need to replace the 1 GbE SFPs with 10 GbE SFP+/SFP transceivers or direct attached 10 GbE SFP+ copper (twinax) transceivers. This approach protects Ethernet-based investments and streamlines migration to 10 GbE. The switch also includes four 10/100/1000 MbE RJ45 ports for additional server connectivity or separate management network connectivity.

The high density of dual-speed ports in a 1U space can help organizations to design highly flexible and cost-effective networks. In addition, organizations can utilize various combinations of short-range and long-range transceivers for a variety of connectivity options.

In any deployment scenario, this switch is designed to save valuable rack space, power, and cooling in the data center while delivering 24x7 service through its high-availability design.

The Ethernet Switch B24X combines a wide range of unique features that can help organizations overcome the most challenging business requirements.

To provide self-healing topologies in Layer 2 configurations, the switch supports an array of Layer 2 features, including multiple varieties of Spanning Tree Protocol (STP/MSTP/RSTP and PVST/PVST+ compatibility) and IEEE 802.3ad link aggregation, as well as optic-level, link-level, and switch-level fault detection and correction features.

Security is a critical requirement in today's data centers, and the B24X provides robust security through a wide range of advanced features. Organizations can use both regular and extended Access Control Lists (ACLs) to control access to and through data center networks. Control policies can be configured to permit or deny traffic based on a wide variety of identification characteristics, such as source/destination MAC addresses, source/destination IP addresses, TCP/UDP ports/sockets, and well-known port numbers, further protecting and restricting network access.

The IBM Ethernet Switch B24X implements ACL lookup at the hardware level, so security does not adversely affect switching performance. In addition, BPDU Guard and Root Guard prevent rogue hijacking of the spanning tree root and maintain a contention-free and loop-free environment, especially during dynamic network deployments.

The IBM Ethernet Switch B24X offers superior quality of service (QoS) features designed to provide high-reliability services throughout the data center including support for IEEE 802.1p. The switch can identify, mark, classify, reclassify, and manage traffic based on specific criteria. This enables organizations to classify bandwidth-critical application traffic, discriminating among various traffic flows and enforcing bandwidth policies. After the traffic is classified, organizations have complete control over the method the system uses to service the queues: Weighted Round Robin (WRR), Strict Priority (SP), or a mix of both. For granular control to regulate bandwidth utilization, ingress rate limiting and egress rate shaping can also be applied.

The use of video, financial, and other applications requires support for scalable multicast services. The switch supports IGMPv1, IGMPv2, IGMPv3, and PIM-SM Snooping for optimized multicast forwarding. In addition, the switch provides storm control features to contain and intelligently switch rather than broadcast multicast traffic.

The IBM Ethernet Switch B24X combines strategic performance, availability, and scalability advantages with investment protection for existing LAN environments. It utilizes the same Brocade IronWare operating system used by other IBM Ethernet/IP products. This helps ensure full forward and backward compatibility among the product family while simplifying software maintenance and field upgrades.

While deploying more switches in a data center infrastructure increases overall network capacity, it often inhibits the ability to receive a complete view of network resources such as bandwidth consumption, utilization, and overall health. To
overcome this challenge, the switch utilizes sFlow, a unique solution that helps simplify network management and monitoring by providing real-time network visibility. Organizations can leverage a wide range of management, monitoring, and trending utilities to help take advantage of this feature.

The switch also supports the IEEE 802.1AB LLDP standard, enabling organizations to build open, converged, and advanced multivendor networks. LLDP greatly simplifies and enhances network management, asset management, and network troubleshooting. Along with support for SNMPv1, SNMPv2, SNMPv3, organizations can use the resulting intelligence to quickly and accurately review overall data center operations, identify hot spots, and quickly diagnose and troubleshoot issues before they develop into widespread problems.

As application data and storage requirements continue to rise exponentially, demand for higher port density and bandwidth grows, as do the number of connected network devices and with it power consumption. Organizations looking to reduce total cost of ownership need solutions with higher scalability and density per rack unit that consume less power and dissipate less heat.

The IBM Ethernet Switch B24X addresses those needs with a state-of-the-art ASIC, front-to-back airflow, automatic fan speed control, and power-efficient optics to ensure the most efficient use of power and cooling. For low-cost, low-latency, and low-energy-consuming (0.1 watts) cabling within and between the racks, the switch supports direct attached SFP+ copper (twinax) cabling at up to 10 meters. For switch-to-switch connectivity, the switch supports low-power-consuming (1.0 watts) SFP+ optics at up to 300 meters. In high-port-density deployments, these features save significant operating costs.

If any servers in the rack have only 1 GbE-capable NICs, organizations can connect them to the same switch by using a 10 GbE port as a 1 GbE port by inserting a 1 GbE SFP transceiver, or use one of the four 10/100/1000 MbE RJ45 ports. Some of the 10 GbE ports on the switch can also be used to connect to a data center middle-of-row/end-of-row aggregation chassis, usually utilizing link aggregation for increased efficiency.

In data center environments where most servers are only 1 GbE-capable, the IBM Ethernet Switch B24X can be deployed as a compact and cost-effective 10 GbE aggregation switch. It connects to the data center core through its wire-speed, 10 GbE ports. It can aggregate connections from IBM Ethernet switches g-series or c-series acting as 1 GbE top-of-rack access switches. These access switches can connect to 1 GbE servers while utilizing 10 GbE uplinks to the IBM Ethernet Switch B24X.

HPC cluster connectivity has entered the mainstream with Ethernet switching as the technology of choice. Ultra low-latency and high-density Ethernet switching are required for successful deployment, making the IBM Ethernet Switch B24X ideal for this type of environment.

The high performance, density, and reliability of this switch is designed for the most demanding HPC environments. In environments where high-speed inter-cluster connectivity is required over distance, organizations can use Brocade Metro-Ring Protocol (MRP)-supporting devices, such as the IBM Ethernet routers m-series, or IBM Ethernet switches r-series, s-series, and g-series in conjunction with the IBM Ethernet Switch B24X to provide dual-ring, fault-tolerant connectivity.

**Optional features**

**4002-X2A Firmware upgrade renewal, one year (#45W4274):** The initial purchase of an IBM Ethernet Switch B24X includes one year of firmware upgrade entitlement. This feature provides you with one additional year of renewal for upgrades included in future releases of the IronWare firmware. You are not eligible to access new features and functions without the purchase of this feature.
300 W ac power supply (#45W4276): One 300 W ac power supply is offered for the IBM Ethernet Switch B24X. These systems accommodate two power supplies with one required and one redundant.

Transceivers
You must install a SFP+ or SFP transceiver into each 10/1-Gigabit Ethernet SFP+/SFP port you want to use. Only IBM supplied transceivers can be used populate the ports on these products.

SFP Transceiver 1GE SX MMF with OM (#45W2815): Provides 1 Gbps Short wavelength (850 nm) SFP transceiver (1000BASE-SX) capable of 550 m over multimode fiber with optical monitoring capabilities. Receives LC connector.

SFP Transceiver 1GE LX SMF with OM (#45W2816): Provides 1 Gbps Long wavelength (1310 nm) SFP transceiver (1000BASE-LX) capable of 10 km over single-mode fiber with optical monitoring capabilities. Receives LC connector.

SFP Transceiver 1GE LHA SMF with OM (#45W2817): Provides 1 Gbps Long wavelength (1550 nm) SFP transceiver (1000BASE-LHA) capable of 70 km over single-mode fiber with optical monitoring capabilities. Receives LC connector.

SFP+ Transceiver 10 GbE SR 300m MMF (#45W4262): Provides 10 Gbps Short-Reach (850 nm) SFP+ transceiver (10GBASE-SR) capable of 300m over multimode fiber. Receives LC connector.

SFP+ Transceiver 10 GbE LR 10Km SMF (#45W4264): Provides 10 Gbps Long-Reach (1310 nm) SFP+ transceiver (10GBASE-LR) capable of 10 km over single-mode fiber. Receives LC connector.

Accessibility by people with disabilities
A U.S. Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

Line Cord, China                        4002  AX2       39Y7928 *
Line Cord, Brazil                       4002  AX2       39Y7929 *
Line Cord, Uruguay/Argentina            4002  AX2       39Y7930 *
Line Cord, US/Canada                    4002  AX2       39Y7931 *

*These part numbers have been previously announced on other machine-type models.

**Model conversions**

Not applicable.

**Feature conversions**

Not applicable.

**Publications**

The following publication is shipped as hardcopy with the product.

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<th>Title</th>
<th>Order number</th>
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<tbody>
<tr>
<td>IBM x-series of Ethernet Switches Installation and User Guide</td>
<td>GC27-2267</td>
</tr>
</tbody>
</table>

Additional copies of the above listed publications will be available on August 25, 2009.

The following publication will be available on **August 25, 2009**.

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</tbody>
</table>

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- To directly download publications in PDF format, visit the IBM product support Web site
  
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- Contact your IBM representative

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Publications are shipped with the product and have been revised to reflect this announcement. To directly download translated publications in PDF format, visit the IBM Publications Center at

Services

Global Technology Services

IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

These services help you learn about, plan, install, manage, or optimize your IT infrastructure to be an On Demand Business. They can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

For details on available services, contact your IBM representative or visit

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

For details on education offerings related to specific products, visit


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

Technical information

Specified operating environment

Physical specifications

The IBM Ethernet Switch B24X provides a high-performance, cost-effective solution for many types of data center environments, including top-of-rack server connectivity, 10 GbE aggregation, and HPC environments.

The IBM Ethernet Switch B24X is designed to fit in server racks and consume only one rack unit. To simplify cabling, the 10 GbE NICs in the servers connect to the switch 10 GbE ports by using 10 GbE SFP+/SFP or direct attached 10 GbE SFP+ copper transceiver.

IBM Ethernet Switch B24X can be mounted in a 19-inch Electronic Industries Association (EIA310-D), two-post Telco rack using the mounting kit provided.

4002AX2

width: 435 mm (17.1 in)
Height: 42.8 mm (1.7 in)
Depth: 393.7 mm (15.5 in)
weight: 7.4 kg (16.3 lb) with two power supplies

Operating environment

• Temperature:
  – Operating: 0 to 40 degrees C (32 to 104 degrees F)
  – Non-operating: -25 to 70 degrees C (-23 to 158 degrees F)
• Humidity:
  – Operating: 5% to 95%, noncondensing at 40 C (104 F)
  – Non-operating: 5% to 80%, noncondensing at 70 C (158 F)
• Altitude:
- Operating: Up to 3030 m (10,000 ft)
- Storage altitude: Up to 4.5 km (15,000 ft)

- **Airflow:**
  - Maximum: 36.4 CFM
  - Nominal (65% speed): 23.5 CFM

- **Heat dissipation:** 600 BTU/hour
- **Input voltage:** 100 to 250 V ac, nominal
- **Input-line frequency:** 50 to 60 Hz
- **Maximum output:** 200 watts per power supply
- **Power consumption:** 176 watts per 24x 10/1 GbE ports (7.3 watts per 10/1 GbE port)
- **Inrush current:** 70 amps peak
- **Maximum current:**
  - Input current: 5 amps
  - 1.76 amps maximum at 100 V ac
  - 0.73 amps maximum at 240 V ac

**EMC conformance**
- **FCC Class A** (Part 15)
- **EN 55022/CISPR-22 Class A**
- **VCCI Class A**

**Product safety/Country testing/Certification:**

- **CAN/CSA-C22.2 No. 60950-1-03/UL60950-1 - First Edition, Safety of Information Technology Equipment**
- **EN 60950-1:2001\IEC 60950-1 Safety of Information Technology Equipment**

The IBM Ethernet products in this announcement are not approved to be sold for connecting to the public telecommunication networks in all countries. IBM continues working to obtain approval to connect to public telecommunication networks in the currently restricted countries. Availability will be published in the future. At this time, these products are not available in the following countries:

- Algeria
- Belarus
- Bahrain
- Belize
- Benin
- Botswana
- Brazil
- Brunei
- Burundi
- Cameroon
- Chad
- Djibouti
- Eritrea
- Ethiopia
- Gabon
- Georgia
- Armenia
- Azerbaijan
- Cambodia

In Japan, customers need to notify their telecommunication service provider of their intent to attach any of the networking products in this announcement to the...
public telephone network. Such notification should include a detailed description of the product to be used, date and time of installation, and a completed public telecommunications networks service request form.

**Hardware requirements**
The IBM Ethernet Switch B24X are designed to support network connectivity for the following servers:

- IBM Power® Systems
- IBM System p® servers
- IBM System i® servers
- IBM System x® servers
- IBM System z® servers

**Compatibility**
The IBM Ethernet Switch B24X supports the following RFC compliance and features:

**General:**

- Jumbo Frame
- IEEE 802.3x Flow Control
- IEEE 802.3ad Link Aggregation
- IEEE 802.1D MAC Bridging/STP
- IEEE 802.1Q VLAN Tagging
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)
- IEEE 802.3AB LLDP

**IP protocols:**

- RFC 791 IP
- RFC 768 UDP
- RFC 783 TFTP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 894 IP over Ethernet
- RFC 903 RARP
- RFC 906 TFTP Bootstrap
- RFC 1027 Proxy ARP
- RFC 1519 CIDR
- RFC 1541 and 2131 DHCP
- RFC 1591 DNS (client)

**Multicast:**

- RFC 1112 IGMP
- RFC 2236 IGMPv2
- RFC 3376 IGMPv3
- IGMP Proxy
- RFC 1122 Host Extensions

**Quality of service:**
• Rate Limiting
• Traffic Shaping
• MAC Address Mapping to Priority Queue
• ACL Mapping to Priority Queue
• ACL Mapping to ToS/DSCP
• ACL Mapping and Marking of ToS/DSCP
• QoS Queue Management using Weighted Round Robin (WRR), Strict Priority (SP), and a combination of WRR and SP

Security:
• Access Control Lists
• AES Encryption for SSHv2, SNMPv3
• Port Mirroring
• sFlow
• Authentication, Authorization, and Accounting (AAA)
• Username/Password (Challenge and Response)
• Bi-Level Access Mode (Standard and EXEC Level)
• Secure Copy (SCP)
• Secure Shell (SSHv2)
• RFC 2865 RADIUS
• TACACS/TACACS+

Management:
• Configuration logging
• LLDP
• sFlow
• IEEE 802.3 MAU MIB (RFC 2239)
• RFC 2571 Architecture for D Describing SNMP Framework
• RFC 951 BootP
• RFC 1542 BootP Extensions
• RFC 2131 DHCP
• RFC 854 TELNET
• RFC 2865 RADIUS
• RFC 1493 Bridge MIB
• RFC 1643 Ethernet-like Interface MIB
• RFC 3176 sFlow
• RFC 1213 MIB-II
• RFC 1516 Repeater MIB
• RFC 1354 IP Forwarding Table MIB
• RFC 1757 RMON MIB
• RFC 2572 SNMP Message Processing and Dispatching
• RFC 1573 SNMP MIB II
• RFC 1157 SNMPv1/v2c
• RFC 3411 SNMPv3 Framework
• RFC 2570 SNMPv3 Intro to Framework
• RFC 3412 SNMPv3 Processing
• RFC 3414 SNMPv3 USM
• RFC 2574 SNMPv3 User-Based Security Model (USM)
• RFC 2573 SNMPv3 Applications
• RFC 2575 SNMP View-Based Access Control Model (VACM)
• RFC 3415 SNMPv3 VACM

**System management:**
• Industry Standard Command Line Interface (CLI)
• IronView Network Manager (INM) Web-based Graphical User Interface (GUI)
• SNMP v1, v2c, v3
• RMON
• HP OpenView for Sun Solaris, HP-UX, IBM AIX®, and Windows NT®
• IBM Tivoli® Netcool/OMNibus™

**Performance:**
• 488 Gbps line speed full-duplex throughput
• 363 MPPS forwarding capacity
• 1.5 micro-second latency

**Scalability:**
• VLANs: 4000
• MAC addresses: 32,000
• ACLs: 2000
• QoS queues per port: 8
• Link aggregation: 8 links per group, 128 link groups per switch

**Maximum frame size:** 9216 byte Ethernet frame

**Data traffic types:** Unicast, multicast, and broadcast IP traffic

**Limitations**

**Notice:** Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your system installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation, the size, materials, and configuration of the room, the noise levels from other equipment, the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

**Planning information**

**Customer responsibilities**
Planning information, including customer responsibilities, physical planning, and installability is available in the specific product planning manuals on the following Web site

http://www.ibm.com/systems/networking

You are responsible for downloading or obtaining from IBM, and installing designated machine code (microcode, basic input/output system code (called BIOS), utility programs, device drivers, and diagnostics delivered with an IBM machine) and other software updates in a timely manner from an IBM Internet Web site or from other
electronic media, and following the instructions that IBM provides. You may request IBM to install machine code changes; however, you may be charged for that service.

**Cable orders**

The media installed in the chassis require appropriate cables for connectivity. Cables must be supplied by the customer. 10 Gbps optical SFP+ or 1 Gbps optical SFP transceivers require single-mode fiber (SMF) or multimode fiber (MMF) terminating in a LC connector. Refer to the media description for proper cable type. The RJ-45 ports require CAT5e or higher cabling.

**Installability**

Hardware installation time for the IBM Ethernet Switch B24X (4002-X2A or 4002AX2) is estimated at less than one hour.

**Packaging**

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**Security, auditability, and control**

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, or integration of this product.

**Terms and conditions**

**Volume orders:** Contact your IBM representative.
Warranty period

- One year
- Optional features - One year

Optional IBM features initially installed in an IBM machine carry the same warranty period as the machine. If installed after the initial machine installation, they carry the balance of the machine warranty or the optional feature warranty, whichever is greater.

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 Web site. 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 for country-specific and location-specific information.

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

**CRU and On-site Service**

**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 specified below, On-site Service.

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 have been designated as a Tier 1 CRUs:

- Interface module
- Fans
- Power supplies

**On-site Service**

This provides On-site Repair, 9 hours per day, Monday through Friday excluding holidays, NBD response. IBM will repair the failing machine at your location and verify its operation. 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-county service delivery is used.
**Licensing**

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

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**Pricing**

For additional information and current prices, contact your local IBM representative.

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**Announcement countries**

All European, Middle Eastern, and African countries except:

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