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IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules
IBM Redbooks Product Guide

As business applications become more and more demanding, data centers have become more complex, cumbersome, and expensive to manage. IBM BladeCenter offers solutions to help lower costs while enhancing performance by accommodating many integration technologies.

The IBM BladeCenter Layer 2/3 Switch offers all the switching features in a BladeCenter chassis at a competitive price. This switch is offered in two versions: Copper and Fiber. These versions provide reliability and flexibility and meet all the stringent requirements of both enterprise and telecom environments. Figure 1 shows the two switch modules.

Figure 1. IBM BladeCenter Layer 2/3 Copper (left) and Fiber (right) Gigabit Ethernet Switch Modules

Did you know?

Clients do not need the most expensive switches to manage their virtualization requirements. These low cost switches offer the maximum uplink bandwidth and a low blocking ratio for maximum performance, while consuming extremely lower power at only 27W. The fiber model is ideal for those who need to carry data greater distances, want better security since it is difficult to tap and does not radiate data, or look for better reliability because it is immune to electromagnetic interference.

Part number information

Table 1 shows the part numbers to order these modules.

Table 1. Part number and feature code for ordering

Description	Part number	Feature codes*
IBM BladeCenter Layer 2/3 Copper Gigabit Ethernet Switch Module	32R1860	1495 / 3212 / 3212
IBM BladeCenter Layer 2/3 Fiber Gigabit Ethernet Switch Module	32R1861	1496 / 3213 / 3213

* Feature codes are listed in the form of three codes separated by a forward slash mark (/). The first feature code is for BladeCenter E-, T-, H-, and HT-based configurations that are available through the IBM System x server. The second feature code is for BladeCenter S-based configurations that are available through the System x sales channel. The third feature code is for BladeCenter S- and BladeCenter H-based configurations that are available through the IBM Power Systems sales channel when applicable.

The part numbers include the following items:

- One IBM BladeCenter Layer 2/3 Copper Gigabit Ethernet Switch Module or IBM BladeCenter Layer 2/3 Fiber Gigabit Ethernet Switch Module with six small form-factor pluggable (SFP) transceivers
- 3-meter Universal Serial Bus (USB)-to-DB9 serial console cable
- Printed documentation
- Documentation CD-ROM

Benefits

The IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules offer the following benefits:

- **Integration and consolidation**: These switches offer integration within the BladeCenter chassis, enabling clients to consolidate full Layer 2-3 LAN switching and routing capabilities into a single chassis. This consolidation helps flatten the data center infrastructure and reduces the number of discrete devices, management consoles, and equipment that administrators must deal with, helping to lower costs and simplify deployment.

- **Layer 3 functionality**: The switches are two of only a few switch modules in the blade market that include Layer 3 functionality standard, which provides security and performance benefits as inter-VLAN traffic stays within the chassis. These switches also provide the full range of industry-standard Layer 3 protocols from static routes for small and medium business (SMB) customers to technologies, such as Open Shortest Path First (OSPF) and Border Gateway Protocol (BGP).

- **Fiber offering**: The fiber switch module is ideal for those clients who require fiber for high data rate systems that demand high bandwidth over long distances and require complete immunity to electrical interference.

- **Interoperability**: These switches interoperate seamlessly with the upstream switches of other vendors.

- **Management**: These switches are designed to support industry based CLI (Cisco-like) for those who are familiar with IOS, and a full-function Web-based GUI for the latest in simplicity.

- **Fault tolerance**: These switches automatically learn alternate routes and perform faster convergence in the unlikely case of a link, switch, or power failure. The switch uses proven technologies such as L2 trunk failover, advanced VLAN-based failover, Virtual Router Redundancy Protocol (VRRP), IGMP V3 snooping, and OSPF.

Features and specifications

The IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules for standard mode of operation includes the following features and functions:

- Internal ports
    - 14 internal full-duplex Gigabit ports, one connected to each of the blade servers in the BladeCenter unit
    - Two internal full-duplex 10/100 Mbps ports connected to the management module
- External ports
    - Copper switch: Six 1000BASE-T copper RJ-45 connections for making 10/100/1000 Mbps connections
    - Fiber switch: Six 1000BASE-SX SFP transceiver-based LC fiber connections for making 1000 Mbps connections
    - An RS-232 serial port that provides an additional means to install software and configure the switch module
- Scalability and performance
    - Autosensing 10/1000/1000 Mbps external Ethernet ports for bandwidth optimization
    - Non-blocking architecture with wire-speed forwarding of traffic

- Media access control (MAC) address learning: automatic update, supports up to 16 K MAC addresses

- Up to 128 IP interfaces per switch

- Static, EtherChannel, and LACP (IEEE 802.3ad) link aggregation, up to 6 Gb of total bandwidth per switch, up to three trunk groups, and up to six ports per group

- Support for jumbo frames (up to 9216 bytes)

- Broadcast/multicast storm control

- IGMP snooping for limit flooding of IP multicast traffic (IGMP V1, V2, and V3)

- IGMP filtering to control multicast traffic for hosts participating in multicast groups (IGMP V1, V2, and V3)

- Configurable traffic distribution schemes over trunk links based on source/destination IP addresses, MAC addresses, or both

- Fast port forwarding and fast uplink convergence for rapid STP convergence

- Availability and redundancy

  - VRRP for Layer 3 router redundancy

  - IEEE 802.1D STP for providing Layer 2 redundancy with PVRST+

  - IEEE 802.1s Multiple STP (MSTP) for topology optimization, up to 128 STP instances are supported by single switch

  - IEEE 802.1w Rapid STP (RSTP) provides rapid STP convergence for critical delay-sensitive, traffic-like voice or video

  - Layer 2 Trunk Failover to support active/standby configurations of network adapter teaming on blades

  - Interchassis redundancy (Layer 2 and Layer 3)

- VLAN support

  - Up to 1024 VLANs supported per switch; VLAN numbers ranging from 1 to 4095 (4095 is used for the management module's connection only)

  - 802.1Q VLAN tagging support on all ports

  - Private VLANs

- Security

  - VLAN-based, MAC-based, and IP-based access control lists (ACLs)
  - 802.1X port-based authentication
  - Multiple user IDs and passwords
  - User access control
  - Radius/TACACS+

- Quality of Service (QoS)

  - Up to eight queues per port

  - Support for IEEE 802.1p, IP ToS/DSCP, and ACL-based (MAC/IP source and destination addresses, VLANs) traffic classification and processing

  - Traffic shaping and re-marking based on defined policies

  - Eight Weighted Round Robin (WRR) priority queues per port for processing qualified traffic

- Layer 3 functions

  - IP forwarding

- IP filtering with ACLs (up to 4096 ACLs supported)

- VRRP for router redundancy

- Support for up to 128 static routes

- Routing protocol support (Router Information Protocol (RIP) v1, RIP v2, OSPF v1, v2, and v3, BGP-4), up to 1024 entries in routing table

- Support for DHCP Relay

- Manageability

  - Simple Network Management Protocol (SNMP; V1, V2, and V3)
  - HTTP/HTTPS browser GUI
  - Industry standard CLI and BLADEOS/AlteonOS CLI
  - Telnet interface for CLI
  - SSH
  - Serial interface for CLI
  - Scriptable CLI
  - Firmware image update (TFTP and FTP)
  - Network Time Protocol (NTP) for switch clock synchronization
  - IBM System Networking Element Manager support

- Monitoring

  - Switch LEDs for external port status and switch module status indication
  - Port mirroring for analyzing network traffic passing through switch
  - Change tracking and remote logging with syslog feature
  - POST diagnostics

- Serial over LAN (SOL)

The switch module supports the following IEEE standards:

- IEEE 802.1D STP with PVRST+
- IEEE 802.1s MSTP
- IEEE 802.1w RSTP
- IEEE 802.1p Tagged Packets
- IEEE 802.1Q Tagged VLAN (frame tagging on all ports when VLANs are enabled)
- IEEE 802.1x port-based authentication
- IEEE 802.2 Logical Link Control
- IEEE 802.3ad Link Aggregation Control Protocol
- IEEE 802.3x Full-duplex Flow Control
- For the copper switch module:
  - IEEE 802.3 10BASE-T Ethernet
  - IEEE 802.3u 100BASE-TX Fast Ethernet
  - IEEE 802.3ab 1000BASE-T Gigabit Ethernet
  - IEEE 802.3z 1000BASE-X Gigabit Ethernet
- For the fiber switch module:
  - IEEE 802.3z 1000BASE-X Gigabit Ethernet
  - 1000BASE-SX Gigabit Ethernet

Supported BladeCenter chassis and expansion cards

The IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules are supported in the IBM BladeCenter chassis listed in the following table.

Table 2. IBM BladeCenter chassis that support the IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules

I/O module	Part number	BladeCenter S	BladeCenter E	BladeCenter H	BladeCenter T	BladeCenter HT	MSIM	MSIM-HT
IBM BladeCenter Layer 2/3 Copper Gigabit Ethernet Switch Module	32R1860	Y	Y	Y	Y	Y	Y	Y
IBM BladeCenter Layer 2/3 Fiber Gigabit Ethernet Switch Module	32R1861	Y	Y	Y	Y	Y	Y	N

The IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules support the expansion cards listed in the following table.

Table 3. Supported expansion cards

Description	Part number	Feature code	Supported by the 1/10Gb Uplink Ethernet Switch Module
Gigabit Ethernet			
Gigabit Ethernet integrated on the server system board	None	None	Supported
Ethernet Expansion Card (CFFv)	39Y9310	2969	Supported
Ethernet Expansion Card (CIOv)	44W4475	1039	Supported
2/4 Port Ethernet Expansion Card (CFFh)	44W4479	5476	Supported
QLogic Ethernet and 8 Gb Fibre Channel Expansion Card	44X1940	5485	Supported
10 Gigabit Ethernet			
Broadcom 10 Gb Gen 2 4-port Ethernet Expansion Card	46M6164	0098	No
Broadcom 10 Gb Gen 2 2-port Ethernet Expansion Card	46M6168	0099	No
Broadcom 2-port 10Gb Virtual Fabric Adapter	81Y3133	A1QR	No
Brocade 2-port 10GbE Converged Network Adapter	81Y1650	5437	No
Emulex 10GbE Virtual Fabric Adapter	49Y4235	5755	No
Emulex 10GbE Virtual Fabric Adapter Advanced	49Y4275	2435	No
Emulex Virtual Fabric Adapter II (CFFh)	90Y3550	A1XG	No
Emulex Virtual Fabric Adapter Advanced II (CFFh)	90Y3566	AIXH	No
Emulex 10GbE VFA II for IBM BladeCenter HS23	81Y3120	A287	No
Emulex 10GbE VFA Advanced II for IBM BladeCenter HS23	90Y9332	A2ZN	No
Intel 2-port 10 Gb Ethernet Expansion Card (CFFh)	42C1810	3593	No
Mellanox 10 Gb Ethernet Expansion Card (CFFh)	90Y3570	A1NW	No
QLogic 2-port 10Gb Converged Network Adapter (CFFh)	42C1830	3592	No

The five BladeCenter chassis have the following bays:

- BladeCenter S, E, and T have four standard I/O bays (1, 2, 3, and 4)

- BladeCenter H has six standard I/O bays (1, 2, 3, 4), two bridge bays (5 and 6) and four high-speed bays (7, 8, 9, and 10)

- BladeCenter HT has four standard I/O bays (1, 2, 3, 4) and four high-speed bays (7, 8, 9, and 10).

The IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules fit in a standard I/O bay (bays 1-4). The IBM BladeCenter Layer 2/3 Copper Ethernet Switch Module, with the addition of the Multi-Switch Interconnect Module (MSIM) in the BladeCenter H and HT chassis, can also fit in a high-speed I/O bay (bays 7-10). The IBM BladeCenter Layer 2/3 Fiber Gigabit Ethernet Switch Module is supported in the BladeCenter H chassis with MSIM (bays 7-10) but is not supported with MSIM-HT in the high-speed bays of the BladeCenter HT chassis. Supported bays are listed in the following table.

Table 4. IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules and BladeCenter chassis I/O bays support

Description	Part number	Bay 1 (Standard)	Bay 2 (Standard)	Bay 3 (Standard)	Bay 4 (Standard)	Bay 5 (Bridge)	Bay 6 (Bridge)	Bay 7 (High-speed)	Bay 8 (High-speed)	Bay 9 (High-speed)	Bay 10 (High-speed)
Gigabit Ethernet integrated on the server system board	None	Y	Y	N	N	N	N	N	N	N	N
Ethernet Expansion Card (CFFv)	39Y9310	N	N	Y	Y	N	N	N	N	N	N
Ethernet Expansion Card (CIOv)	44W4475	N	N	Y	Y	N	N	N	N	N	N
QLogic Ethernet and 4 Gb FC Card (CFFh)	39Y9306	N	N	N	N	N	N	Y	N	Y	N
2/4 Port Ethernet Expansion Card (CFFh)	44W4479	N	Y*	N	N	N	N	Y	Y	Y	Y
QLogic Ethernet and 8 Gb FC Card (CFFh)	44X1940	N	N	N	N	N	N	Y	N	Y	N

* The 2/4 Port Ethernet Expansion Card supports I/O bay 2 connections only when installed into a blade server that is installed in the BladeCenter S chassis.

Popular configurations

The IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules can be used in various configurations.

Basic two-port configuration

Figure 2 shows a basic use of the switch to route the two-port Ethernet controller that is integrated onto the blade server. Two switches are installed in bay 1 and bay 2 of the BladeCenter chassis. The connections between the controller and the switch modules are internal to the chassis. No wiring is needed.
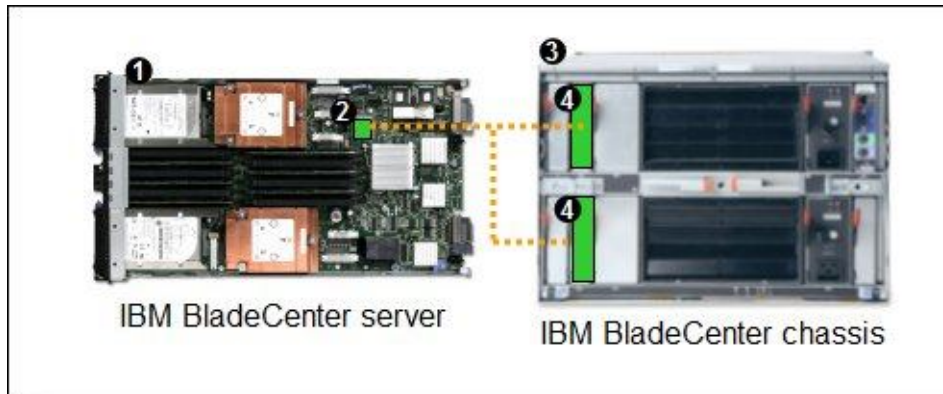

Figure 2. Using IBM BladeCenter Ethernet Switch Modules to route the integrated Ethernet ports

The following table lists the components that are used in this configuration.

Table 5. Components used in two-ports-per-server configuration

Diagram reference	Part number / machine type	Description	Quantity
❶	Varies	IBM BladeCenter HS23 or other server	1 to 14
❷	None	Ethernet controller on the system board of the server	1 per server
❸	Varies	Any BladeCenter server (see Table 2)	1
❹	32R1860 or 32R1861	IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Module	2

Four-port configuration

Figure 3 shows the use of switch to route four Ethernet ports from each server: the two integrated ports plus two ports supplied by a compatible CFFv or CIOv expansion card. Four Ethernet Switch Modules are installed in bay 1, bay 2, bay 3, and bay 4 of the BladeCenter chassis. All connections between the controller, card, and the switch modules are internal to the chassis. No wiring is needed.
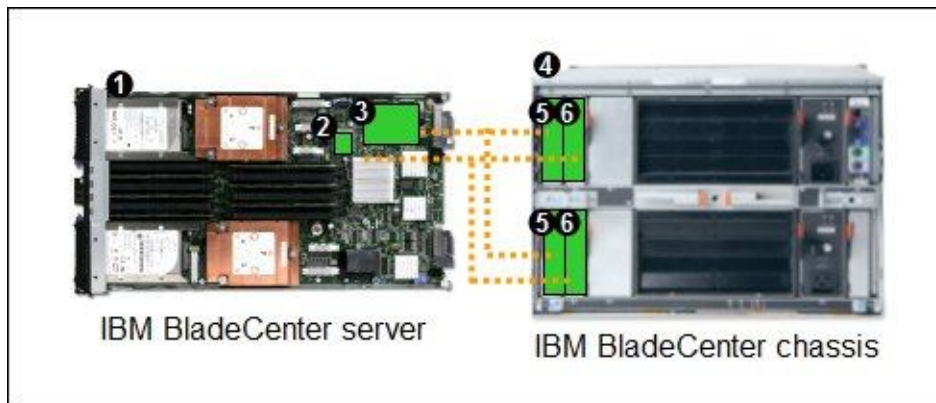
Figure 3. Using IBM BladeCenter Ethernet Switch Modules to route the four Ethernet ports from the integrated controller and a CFFv or CIOv expansion card

The following table lists the components that are used in this configuration.

Table 6. Components used in the four ports-per-server configuration

Diagram reference	Part number / machine type	Description	Quantity
❶	Varies	IBM BladeCenter HS23 or other supported server	1 to 14
❷	None	Ethernet controller on the system board of the server	1 per server
❸	Varies	Compatible CFFv or CIOv expansion card (see Table 3)	1 per server
❹	Varies	Any BladeCenter chassis (See Table 2)*	1
❺	32R1860 or 32R1861	IBM BladeCenter Ethernet Switch Modules routing signals from the CFFv or CIOv card ❸	2
❻	32R1860 or 32R1861	IBM BladeCenter Ethernet Switch Modules routing signals from the integrated controller ❷	2

* The expansion card can be installed in servers in the BladeCenter S (8886). However, by doing so, you lose the ability to connect to the BladeCenter S Disk Storage Modules (DSMs). The Ethernet expansion card goes in the place of the SAS expansion card that is needed to connect to the DSMs. Instead, use the 2/4 Port Ethernet Expansion Card (CFFh), part number 44W4479.

Maximum configuration: Eight Ethernet ports per server

Since BladeCenter servers support both a CFFh expansion card, plus either a CFFv or CIOv card (depending on the model of the server), you can install up to eight IBM BladeCenter Layer 2/3 Copper or Fiber Gigabit Ethernet Switch Modules in a BladeCenter H chassis and up to eight IBM BladeCenter Layer 2/3 Copper ESM in a BladeCenter HT. Figure 4 shows this 8-port solution. All connections between the cards and the switch modules are internal to the chassis. No wiring is needed.
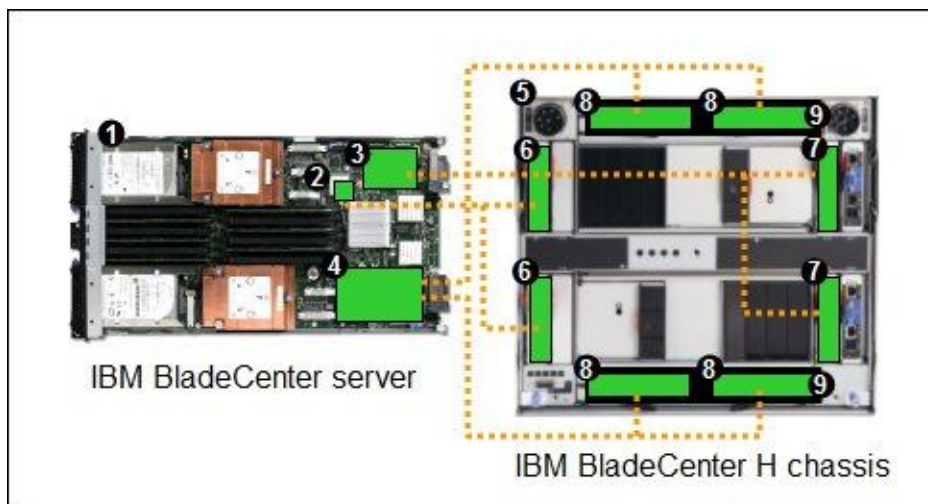
Figure 4. Using IBM BladeCenter Ethernet Switch Modules to route eight Ethernet ports per server

The following table lists the components that are used in this configuration.

Table 7. Components used in the eight-ports-per-server configuration

Diagram reference	Part number / machine type	Description	Quantity
1	Varies	IBM BladeCenter HS23 or other supported server	1 to 14
2	None	Ethernet controller on the system board of the server	1 per server
3	Varies	Compatible CFFv or CIOv expansion card (see Table 3)	1 per server
4	44W4479	2/4 Port Ethernet Expansion Card (CFFh)	1 per server
5	8852	BladeCenter H chassis	1
6	32R1860 or 32R1861	IBM BladeCenter Ethernet Switch Modules routing signals from the integrated controller **2**	2
7	32R1860 or 32R1861	IBM BladeCenter Ethernet Switch Modules routing signals from the CFFv or CIOv card **3**	2
8	32R1860 or 32R1861	IBM BladeCenter Ethernet Switch Modules routing signals from the CFFh card **4**	4
9	39Y9314	Multi-switch Interconnect Module	2

Connectors and LEDs

Figure 5 shows the front panel of the IBM BladeCenter Layer 2/3 Copper and Fiber Gigabit Ethernet Switch Modules.
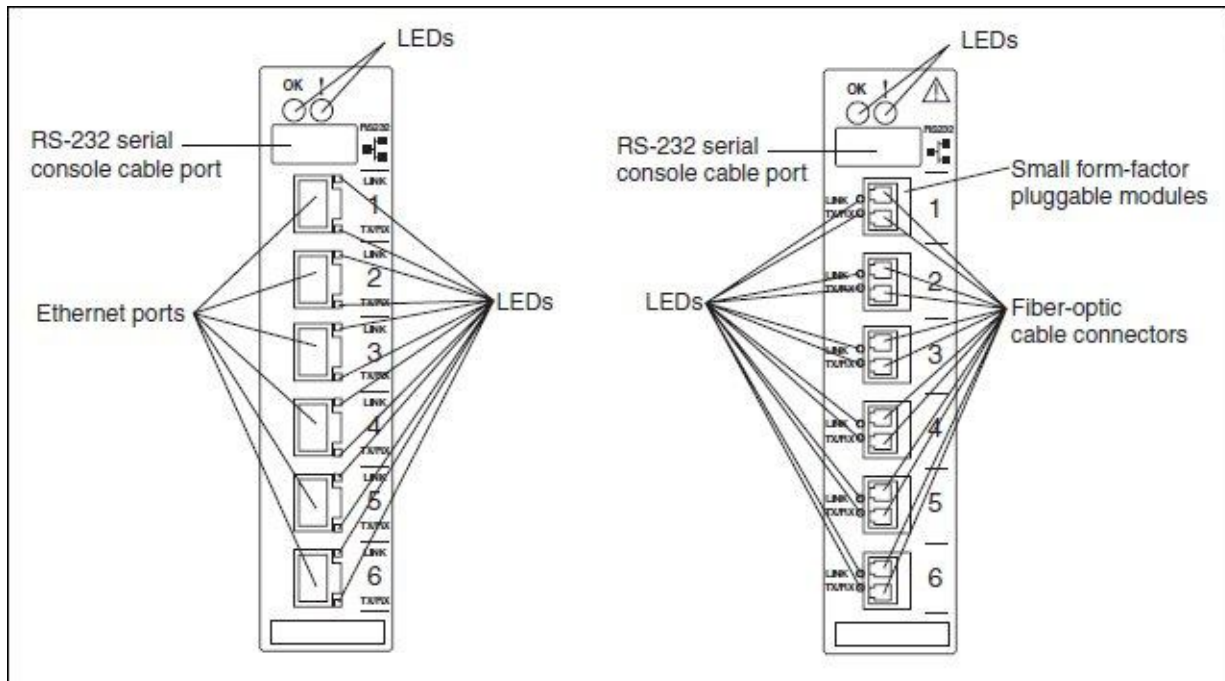

Figure 5. Front panel of the IBM BladeCenter Layer 2/3 Copper (left) and Fiber (right) Gigabit Ethernet Switch Modules

The front panel contain the following components:

- LEDs display the status of the switch module and the network: OK (indicating that the switch module has passed the power-on self-test (POST) with no critical faults and is operational) and switch module error (indicating that the switch module has failed the POST or detected an operational fault).

- One USB RS-232 console port provides an additional means to install software and configure the switch module. This USB-style connector enables connection of a special serial cable that is supplied with the switch module.

- The copper model of the switch module has six external 1000BASE-T Ethernet ports for 10/100/1000 Mbps connections to external Ethernet devices.

- The fiber model of the switch module has six external 1000BASE SX SFP transceiver ports for 1000 Mbps connections to external Ethernet devices.

- Each external port on the switch module contains an Ethernet link OK LED and an Ethernet Tx/Rx LED.

Network cabling requirements

The following network cable is required for the fiber switch module:

- 1000BASE-SX: 850 Nm wavelength, multimode fiber, 50 μ or 62.5 μ (550 meters maximum), with LC duplex connector

Note: Fiber connections use SFP transceivers that provide 1000BASE-SX (850 nm wavelength)

communications over multimode fiber cables (50μ or 62.5μ) for distances of up to 550 meters. 1000BASE-LX is not supported.

The following network cables are required for the copper switch module:

- 10BASE-T:
    - UTP Category 3, 4, 5 (100 meters (328 feet) maximum)
    - 100-ohm STP (100 meters maximum)

- 100BASE-TX:
    - UTP Category 5 (100 meters maximum)
    - EIA/TIA-568 100-ohm STP (100 meters maximum)

- 1000BASE-T:
    - UTP Category 6
    - UTP Category 5e (100 meters maximum)
    - UTP Category 5 (100 meters maximum)
    - EIA/TIA-568B 100-ohm STP (100 meters maximum)

Related publications

For more information, see the following documents:

- IBM Redbooks publication *Nortel Networks L2/3 Ethernet Switch Module* , REDP-3586
  http://www.redbooks.ibm.com/abstracts/redp3586.html

- Nortel Networks Layer 2-3 GbE Switch Module Installation Guide
  http://ibm.com/support/entry/portal/docdisplay?lndocid=MIGR-58334

- OFM with Nortel/IBM Extensions User's Guide for Nortel L2-3 GbESM
  http://ibm.com/support/entry/portal/docdisplay?lndocid=MIGR-5074970

- Alteon OS Application Guide
  http://www.bladenetwork.net/userfiles/file/PDFs/IBM_GbE_L2-3_Applicat_Guide.pdf

- Alteon OS Command Reference
  http://www.bladenetwork.net/userfiles/file/PDFs/IBM_GbE_L2-3_Command_Ref.pdf

- Alteon OS Release Notes
  http://www.bladenetwork.net/userfiles/file/PDFs/IBM_GbE_L2-3_Release_Notes.pdf

- Alteon OS Browser-Based Interface (BBI) Quick Guide
  http://www.bladenetwork.net/userfiles/file/PDFs/IBM_GbE_L2-3_BBI_QuickGuide.pdf

- Alteon OS ISCLI Reference
  http://www.bladenetwork.net/userfiles/file/PDFs/IBM_GbE_L2-3_ISCLI_Ref.pdf

- Switch interoperability certifications by The Tolly Group
  http://www.thetollygroupinc.com/TVDetail.aspx?ProductID=296

- IBM US Announcement Letter
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS105-011

- *IBM BladeCenter Interoperability Guide*
  http://ibm.com/support/entry/portal/docdisplay?lndocid=MIGR-5073016

- IBM Redbooks publication *IBM BladeCenter Products and Technology*, SG24-7523
  http://www.redbooks.ibm.com/abstracts/sg247523.html

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