Lenovo Flex System EN6131 40Gb Ethernet Switch
Product Guide (withdrawn product)

The Lenovo Flex System™ EN6131 40Gb Ethernet Switch in conjunction with the EN6132 40Gb Ethernet Adapter offer the performance that you need to support clustered databases, parallel processing, transactional services, and high-performance embedded I/O applications, which reduces task completion time and lowers the cost per operation.

This switch offers 14 internal and 18 external 40 Gb Ethernet ports that enable a non-blocking network design. It supports all Layer 2 functions so servers can communicate within the chassis without going to a Top-of-Rack (ToR) switch, which helps improve performance and latency.

The EN6131 40Gb Ethernet Switch is shown in Figure 1.

Figure 1. Lenovo Flex System EN6131 40Gb Ethernet Switch

Did you know?

The 40 Gb Ethernet solution that is offered by Lenovo Flex System can deploy more workloads per server without running into I/O bottlenecks. If there are failures or server maintenance, clients can also move their virtual machines much faster by using 40 Gb interconnects within the chassis.

The 40 GbE switch and adapter are designed for low latency, high bandwidth, and computing efficiency for performance-driven server and storage clustering applications. They provide extreme scalability for low-latency clustered solutions with reduced packet hops.

The Flex System 40 GbE solution offers the highest bandwidth without adding any significant power impact. It can also help increase the system usage and decrease the number of network ports for further cost savings.

Part number information

Table 1 shows the part numbers for ordering the EN6131 switch.

Table 1. Part numbers and feature codes for ordering

Description	Part number	Feature code
Lenovo Flex System EN6131 40Gb Ethernet Switch	90Y9346	A3HJ

The part number for the EN6131 switch includes the following items:

- One Lenovo Flex System EN6131 40Gb Ethernet Switch
- Documentation package

Note: No QSFP+ (quad small form-factor pluggable plus) transceivers or cables are included with the switch. They must be ordered separately (see Table 2).

The switch does not include a serial management cable. However, Flex System Management Serial Access Cable, 90Y9338, is supported and contains two cables, a mini-USB-to-RJ45 serial cable and a mini-USB-to-DB9 serial cable, either of which can be used to connect to the switch module locally for configuration tasks and firmware updates.

Supported cables and transceivers

Table 2 lists the supported cables and transceivers.

Table 2. Supported transceivers and direct-attach cables

Description	Part number	Feature code	Maximum quantity supported
Serial console cables			
Flex System Management Serial Access Cable Kit	90Y9338	A2RR	1
QSFP+ transceiver and cables - 40 GbE			
Lenovo 40GBASE-SR4 QSFP+ Transceiver	49Y7884	A1DR	18
Optical cables for 40 GbE QSFP+ SR4 transceivers			
Lenovo 10m QSFP+ MTP-MTP OM3 MMF Cable	90Y3519	A1MM	18
Lenovo 30m QSFP+ MTP-MTP OM3 MMF Cable	90Y3521	A1MN	18
Lenovo 10m QSFP+ MTP-MTP OM3 MMF Cable (replaces 90Y3519)	00VX003	AT2U	18
Lenovo 30m QSFP+ MTP-MTP OM3 MMF Cable (replaces 90Y3521)	00VX005	AT2V	18
QSFP+ direct-attach cables - 40 GbE			
3m FDR InfiniBand Cable	90Y3470	A227	18
Lenovo 3m Passive QSFP+ DAC Cable	49Y7891	A1DQ	18
Lenovo 5m Passive QSFP+ DAC Cable	00D5810	A2X8	18
Lenovo 7m Passive QSFP+ DAC Cable	00D5813	A2X9	18

Benefits

The EN6131 40Gb Ethernet Switch offers the following benefits:

- End-to-end 40 Gb connectivity with non-blocking throughput and 230 ns latency
- Ideal for clients running Ethernet infrastructure in high speed trading, Web 2.0, virtualization, and cloud computing
- Enables clients to maximize compute usage by removing an I/O bottleneck
- Low power consumption with less than 0.1 watts per Gbps
- Can linearly scale to larger node counts to create a low latency clustered solution and reduce packet hops
- Reduces cabling up to four times, which simplifies deployment and maintenance

Features and specifications

The EN6131 40Gb Ethernet Switch has the following features and specifications:

- MLNX-OS operating system
- Internal ports
    - Fourteen internal full-duplex 40 Gigabit ports (10, 20, or 40 Gbps auto-negotiation).
    - One internal full-duplex 1 GbE port that is connected to the chassis management module.
- External ports
    - Eighteen ports for 40 Gb Ethernet QSFP+ transceivers or QSFP+ DAC cables (10, 20, or 40 Gbps auto-negotiation). QSFP+ modules and DAC cables are not included and must be purchased separately.
    - One external 1 GbE port with RJ-45 connector for switch configuration and management.
    - One RS-232 serial port (mini-USB connector) that provides an additional means to configure the switch module.
- Scalability and performance
    - 40 Gb Ethernet ports for extreme bandwidth and performance.
    - Non-blocking architecture with wire-speed forwarding of traffic and an aggregated throughput of 1.44 Tbps.
    - Support for up to 48,000 unicast and up to 16,000 multicast media access control (MAC) addresses per subnet.
    - Static and LACP (IEEE 802.3ad) link aggregation, up to 720 Gb of total uplink bandwidth per switch, up to 36 link aggregation groups (LAGs), and up to 16 ports per LAG.
    - Support for jumbo frames (up to 9,216 bytes).
    - Broadcast/multicast storm control.
    - IGMP v1 and v2 snooping to limit flooding of IP multicast traffic.
    - Fast port forwarding and fast uplink convergence for rapid STP convergence.
- Availability and redundancy
    - IEEE 802.1D STP for providing L2 redundancy.
    - IEEE 802.1w Rapid STP (RSTP) provides rapid STP convergence for critical delay-sensitive traffic such as voice or video.
- VLAN support
    - Up to 4094 VLANs are supported per switch, with VLAN numbers 1 - 4094.
    - 802.1Q VLAN tagging support on all ports.
- Security
    - Up to 24,000 rules with VLAN-based, MAC-based, protocol-based, and IP-based access control lists (ACLs).
    - User access control.
        - Multiple user IDs and passwords
        - RADIUS, TACACS+, and LDAP authentication and authorization

- Quality of service (QoS)
  - Support for IEEE 802.1p traffic processing.
  - Traffic shaping that is based on defined policies.
  - Four Weighted Round Robin (WRR) priority queues per port for processing qualified traffic.
  - Priority-Based Flow Control (PFC) (IEEE 802.1Qbb) extends 802.3x standard flow control to allow the switch to pause traffic based on the 802.1p priority value in each packet's VLAN tag.
  - Enhanced Transmission Selection (ETS) (IEEE 802.1Qaz) provides a method for allocating link bandwidth based on the 802.1p priority value in each packet's VLAN tag.
- Manageability
  - IPv4 and IPv6 host management.
  - Simple Network Management Protocol (SNMP V1, V2, and V3).
  - WebUI graphical user interface.
  - Industry standard command-line interface (IS-CLI) through Telnet, SSH, and serial port.
  - Link Layer Discovery Protocol (LLDP) to advertise the device's identity, capabilities, and neighbors.
  - Firmware image update (TFTP, FTP, and SCP).
  - Network Time Protocol (NTP) for clock synchronization.
- Monitoring
  - Switch LEDs for external port status and switch module status indication.
  - Port mirroring for analyzing network traffic passing through the switch.
  - Change tracking and remote logging with the syslog feature.
  - Support for sFLOW agent for monitoring traffic in data networks (separate sFLOW collector/analyzer is required elsewhere).
  - POST diagnostic tests.

Standards supported

The switch supports the following Ethernet standards:

- IEEE 802.1AB Link Layer Discovery Protocol
- IEEE 802.1D Spanning Tree Protocol (STP)
- IEEE 802.1p Class of Service (CoS) prioritization
- IEEE 802.1Q Tagged VLAN (frame tagging on all ports when VLANs are enabled)
- IEEE 802.1Qbb Priority-Based Flow Control (PFC)
- IEEE 802.1Qaz Enhanced Transmission Selection (ETS)
- IEEE 802.1w Rapid STP (RSTP)
- IEEE 802.3ab 1000BASE-T copper twisted pair Gigabit Ethernet
- IEEE 802.3ad Link Aggregation Control Protocol
- IEEE 802.3ba 40GBASE-SR4 short range fiber optics 40 Gb Ethernet
- IEEE 802.3ba 40GBASE-CR4 copper 40 Gb Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE 802.3x Full-duplex Flow Control

Supported chassis and adapters

The EN6131 switches are installed in the I/O module bays in the rear of the Flex System chassis, as shown in Figure 2. Switches are normally installed in pairs because ports on the I/O adapters that are installed in the compute nodes are routed to two I/O bays for redundancy and performance.

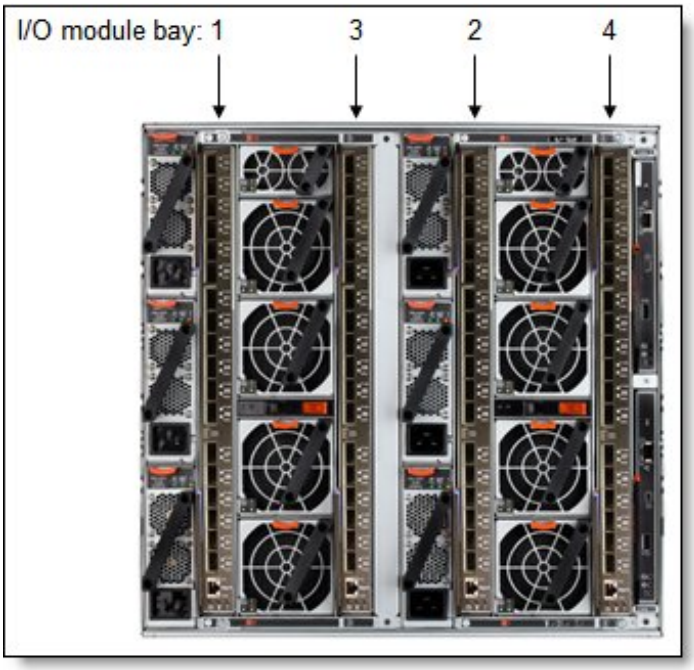

Figure 2. Location of the I/O module bays in the Flex System chassis

The Flex System EN6131 40Gb Ethernet Switch can be installed in bays 1, 2, 3, and 4 of the Enterprise Chassis. A supported Ethernet adapter must be installed in the corresponding slot of the compute node.

In the compute nodes that have an integrated dual-port 10 GbE network interface controller (NIC), NIC ports are routed to bays 1 and 2 with a specialized periscope connector, and the adapter is not required. However, when needed, the periscope connector can be replaced with the adapter. In such a case, the integrated NIC is disabled.

4-port 10 GbE adapters: With 4-port 10 GbE adapters, only up to two adapter ports can be used with the EN6131 switches (one port per switch).

8-port 10 GbE adapters: 8-port 10 GbE adapters are not supported by the EN6131. See Table 5 for a list of supported adapters.

Table 3 shows compatibility information for the EN6131 and Flex System chassis.

Table 3. Flex System chassis compatibility

Description	Part number	Enterprise Chassis with CMM	Enterprise Chassis with CMM2	Carrier-Grade Chassis with CMM2
Lenovo Flex System EN6131 40Gb Ethernet Switch	90Y9346	Yes	Yes	No

The connections between the adapters that are installed in the compute nodes to the EN6131 switches that are installed in the chassis I/O bays are shown in Figure 3. The figure also shows both half-wide compute nodes, such as the x240 with two adapters, and full-wide compute nodes, such as the x440 with four adapters.

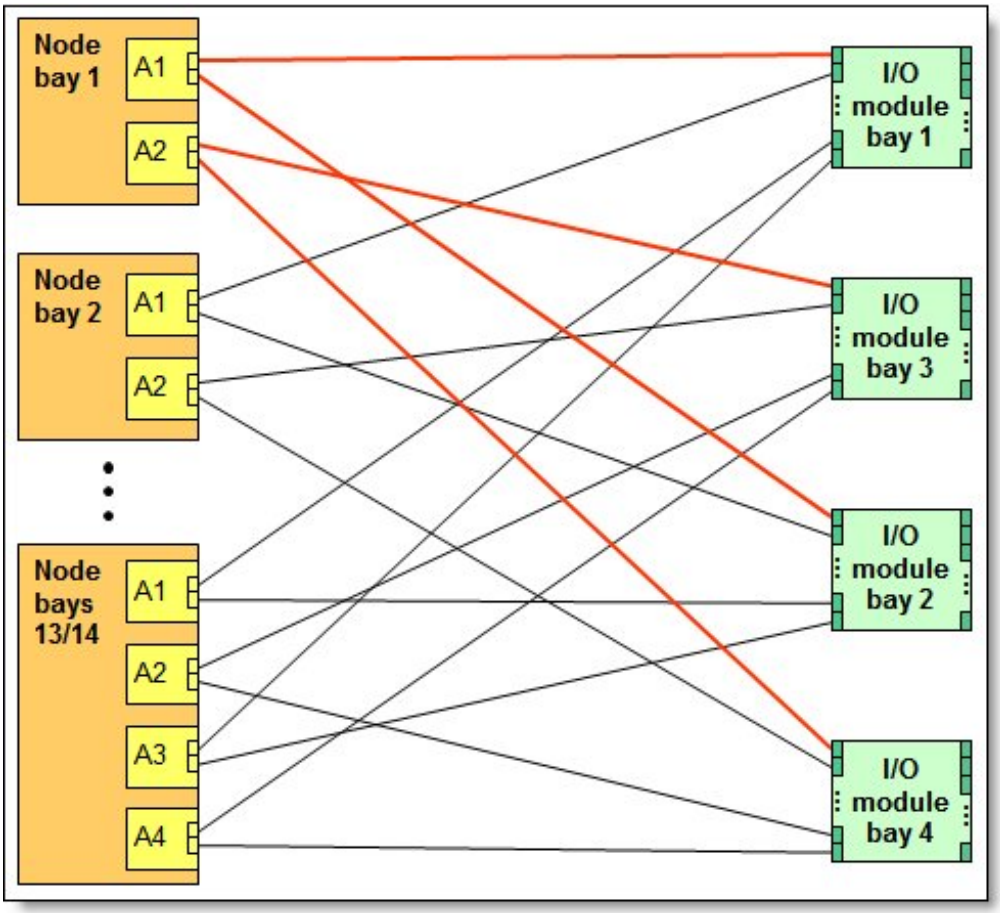

Figure 3. Logical layout of the interconnects between I/O adapters and EN6131 modules

Table 4 shows the connections between the adapters that are installed in the compute nodes to the EN6131 switches that are installed in the chassis.

Table 4. Adapter to EN6131 I/O bay correspondence

I/O adapter slot in the server	Port on the adapter	Corresponding I/O module bay in the chassis			
		Bay 1	Bay 2	Bay 3	Bay 4
Slot 1	Port 1	Yes			
	Port 2		Yes		
Slot 2	Port 1			Yes	
	Port 2				Yes
Slot 3 (full-wide compute nodes only)	Port 1	Yes			
	Port 2		Yes		
Slot 4 (full-wide compute nodes only)	Port 1			Yes	
	Port 2				Yes

Table 5 lists the Ethernet I/O adapters that are supported by the EN6131 40Gb Ethernet Switch.

Table 5. Supported Ethernet I/O adapters

Description	Part number	Feature code
40 Gb Ethernet		
Flex System EN6132 2-port 40Gb Ethernet Adapter	90Y3482	A3HK
10 Gb Ethernet		
Embedded 10Gb Virtual Fabric Adapter (2-port)	None*	None*
Flex System CN4022 2-port 10Gb Converged Adapter	88Y5920	A4K3
Flex System CN4052 2-port 10Gb Virtual Fabric Adapter	00JY800	A5RP
Flex System CN4054 10Gb Virtual Fabric Adapter (4-port)#	90Y3554	A1R1
Flex System CN4054R 10Gb Virtual Fabric Adapter (4-port)#	00Y3306	A4K2
Flex System EN4132 2-port 10Gb Ethernet Adapter	90Y3466	A1QY
Flex System EN4172 2-port 10Gb Ethernet Adapter	00AG530	A5RN

* The Embedded 10Gb Virtual Fabric Adapter is included in some models of the x240, x440, and X6 compute nodes.
# With 4-port 10 GbE adapters, only up to two adapter ports can be used with the EN6131 switches (one port per switch).

The adapters are installed in slots in each compute node. Figure 4 shows the locations of the slots in the x240 Compute Node. The positions of the adapters in the other supported servers are similar.

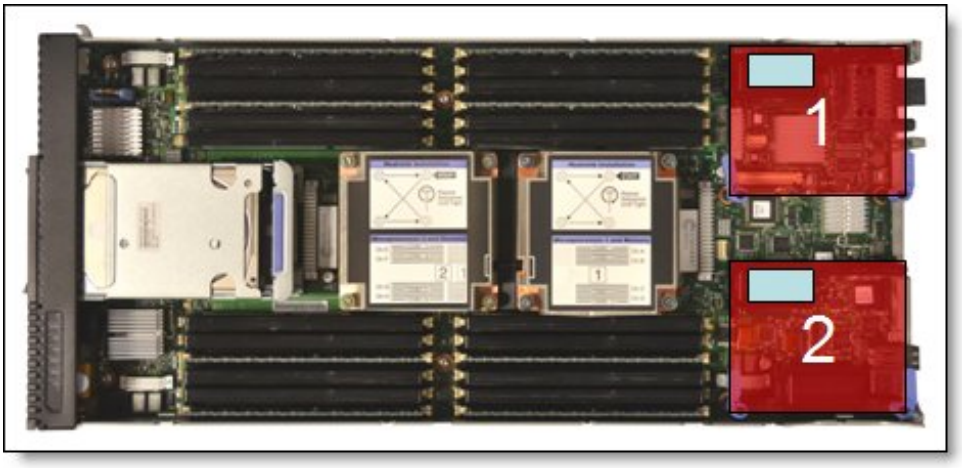

Figure 4. Location of the I/O adapter slots in the Flex System x240 Compute Node

Connectors and LEDs

Figure 5 shows the front panel of the Flex System EN6131 40Gb Ethernet Switch.

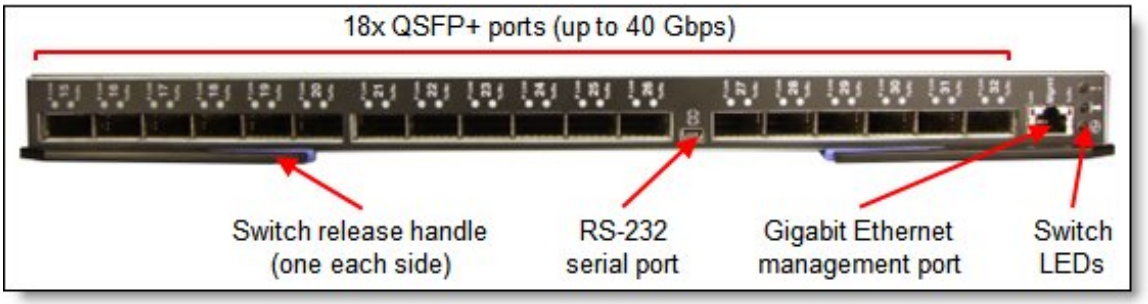

Figure 5. Front panel of the Flex System EN6131 40Gb Ethernet Switch

The front panel contains the following components:

- LEDs that display the status of the module and the network:
  - Green power LED indicates that the module passed the power-on self-test (POST) with no critical faults and is operational.
  - Identify LED: This blue LED can be used to identify the module physically by illuminating it through the management software.
  - The fault LED (switch error) indicates that the module failed the POST or detected an operational fault.
- Eighteen external QSFP+ ports for 10 Gbps, 20 Gbps, or 40 Gbps connections to the external network devices.
- An Ethernet physical link LED and an Ethernet Tx/Rx LED for each external port on the module.
- One mini-USB RS-232 console port that provides an additional means to configure the switch module. This mini-USB-style connector enables the connection of a special serial cable (the cable is optional, and it is not included with the switch. See the "Part number information" section for details).

Network cabling requirements

The network cables that can be used with the EN6131 40Gb Ethernet Switch are shown in Table 6.

Table 6. EN6131 40Gb Ethernet Switch network cabling requirements

Transceiver	Standard	Cable	Connector
40 Gb Ethernet			
40GBASE-SR4 QSFP+ Transceiver (49Y7884)	40GBASE-SR4	Lenovo 10 m or 30 m MTP fiber optics cables (see Table 2); support for up to 100 m with OM3 multimode fiber or up to 150 m with OM4 multimode fiber	MTP
Direct attach cable	40GBASE-CR4	Lenovo QSFP+ to QSFP+ DAC cables up to 7 m (see Table 2)	QSFP+
Management ports			
External 1 GbE management port	1000BASE-T	UTP Category 5, 5E, and 6 up to 100 meters	RJ-45
External RS-232 management port	RS-232	DB-9-to-mini-USB or RJ-45-to-mini-USB console cable (comes with optional Management Serial Access Cable, 90Y9338)	Mini-USB

Warranty

There is a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a chassis, these I/O modules assume your system's base warranty and any Lenovo warranty service.

Physical specifications

The EN6131 40Gb Ethernet Switch has the following physical specifications:

Dimensions and weight (approximate):

- Height: 30 mm (1.2 in.)
- Width: 401 mm (15.8 in.)
- Depth: 317 mm (12.5 in.)
- Weight: 3.7 kg (8.1 lb)

Shipping dimensions and weight (approximate):

- Height: 114 mm (4.5 in.)
- Width: 508 mm (20.0 in.)
- Depth: 432 mm (17.0 in.)
- Weight: 4.1 kg (9.1 lb)

Agency approvals

The EN6131 40Gb Ethernet Switch conforms to the following standards:

- Safety:
  - US/Canada: cULus
  - EU: IEC60950
  - International: CB
- Environmental:
  - Type I / II
  - EU: IEC 60068-2-32: Fall Test

Typical configurations

A typical application of the end-to-end 40 Gb Ethernet connectivity includes high performance computing (HPC) interconnects and an enterprise data center's highly available production network.

HPC interconnect

In this configuration, there are two networks: a production network and an interconnect network. The production network consists of EN4093R 10Gb Scalable Switches that are connected to the RackSwitch™ G8264 10 GbE switches through redundant aggregated 10 Gb uplinks. The interconnect network consists of EN6131 switches connected to each other through 40 Gb aggregated uplinks. The topology is shown in Figure 6.

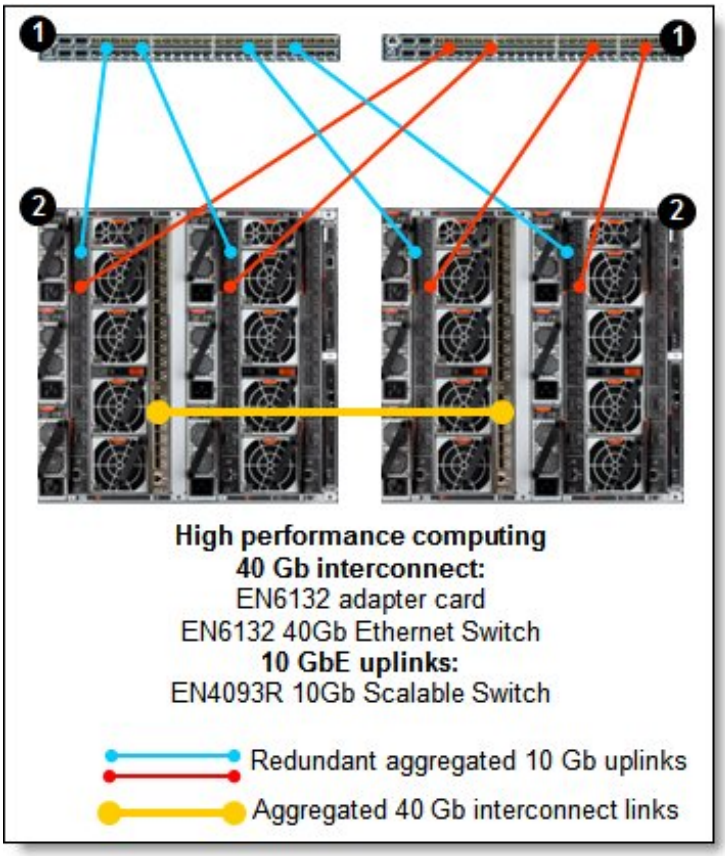

Figure 6. HPC interconnect network with the EN6131 40Gb Ethernet Switch

The solution components that are used in the HPC configuration that is shown in Figure 6 are listed in Table 7.

Table 7. Components that are used in the HPC interconnect with the EN6131 switch

Diagram reference	Description	Part number	Quantity
1	**RackSwitch G8264**		
2	**Flex System 10 Gb Virtual Fabric solution**		
	Flex System Enterprise Chassis	8721-A1x	Varies
	Flex System x240 Compute Node with Embedded 10Gb Virtual Fabric Adapter	8737-x2x	Up to 14 per chassis
	Flex System Fabric EN4093R 10Gb Scalable Switch	95Y3309	2 per chassis
	Flex System 40 Gb HPC interconnect		
	Flex System EN6131 40Gb Ethernet Switch	90Y9346	1 per chassis
	Flex System EN6132 2-port 40Gb Ethernet Adapter	90Y3482	1 per server

Note: You also need QSFP+ modules and optical cables or QSFP+ DACs (not shown in Table 6; see Table 2 for details) for the external connectivity.

40 Gb production network

In this configuration, a production network consists of EN6131 40Gb Ethernet Switches that are connected to the G8332 40 GbE upstream network switches through redundant aggregated 40 Gb uplinks (Figure 7).

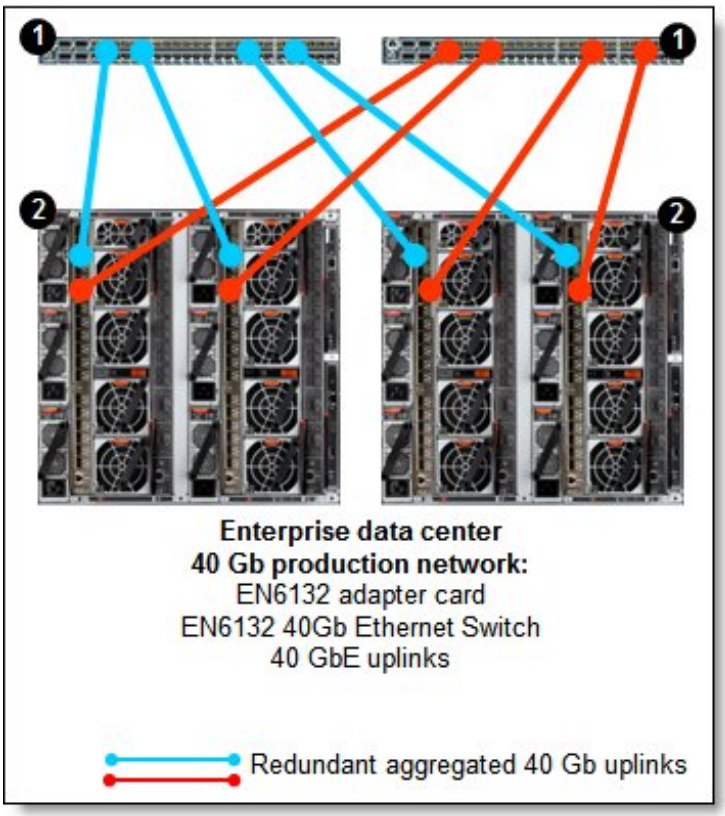

Figure 7. Enterprise data center network with the EN6131 40Gb Ethernet Switch

The solution components that are used in the enterprise data center network configuration that is shown in Figure 7 are listed in Table 8.

Table 8. Components that are used in the enterprise data center network with the EN6131 switch

Diagram reference	Description	Part number	Quantity
1	**RackSwitch G8332**		
2	**Flex System 40 Gb solution**		
	Flex System Enterprise Chassis	8721-A1x	Varies
	Flex System x240 Compute Node	8737-x1x	Up to 14 per chassis
	Flex System EN6131 40Gb Ethernet Switch	90Y9346	2 per chassis
	Flex System EN6132 2-port 40Gb Ethernet Adapter	90Y3482	1 per server

Note: You also need QSFP+ modules and optical cables or QSFP+ DACs (not shown in Table 7; see Table 2 for details) for the external 40 Gb Ethernet connectivity.

Related publications

For more information, see the following EN6131 40Gb Ethernet Switch product publications, available from the Flex System Information Center at the following website:
http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp

- *Installation and User's Guide*

Here are other useful references:

- Mellanox MLNX-OS User Manual for Lenovo
  http://delivery04.dhe.ibm.com/sar/CMA/XSA/MLNX-OS_LEN_ETH_v3_4_3002_UM.pdf
- *Lenovo Flex System EN4091 10Gb Ethernet Pass-thru Module*
  http://lenovopress.com/tips0865
- Lenovo Press publication *Flex System Products and Technology*, SG24-8255
  http://lenovopress.com/sg248255
- Flex System Interoperability Guide
  http://lenovopress.com/fsig
- Lenovo Press Product Guides for Flex System servers and options
  http://lenovopress.com/flexsystem

Related product families

Product families related to this document are the following:

- 40 Gb Embedded Connectivity
- Blade Networking Modules

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