

Lenovo Flex System Fabric SI4093 System Interconnect Module

Product Guide (withdrawn product)

The Lenovo® Flex System Fabric SI4093 System Interconnect Module enables simplified integration of Flex System™ into networking infrastructure and provides the capability of building simple connectivity for points of delivery (PODs) or clusters up to 126 nodes.

The SI4093 requires no management for most data center environments, which eliminates the need to configure each networking device or individual ports, thus reducing the number of management points. It provides a low latency, loop-free interface that does not rely upon spanning tree protocols, which removes one of the greatest deployment and management complexities of a traditional switch. The SI4093 offers administrators a simplified deployment experience while maintaining the performance of intra-chassis connectivity.

The SI4093 System Interconnect Module is shown in the following figure.



Figure 1. Lenovo Flex System Fabric SI4093 System Interconnect Module

Did you know?

The base switch configuration comes standard with 24x 10 GbE port licenses that can be assigned to internal connections or external SFP+ or QSFP+ ports with flexible port mapping. For example, by using this feature customers can trade off four 10 GbE ports for one 40 GbE port (or vice versa) or trade off one external 10 GbE SFP+ port for one internal 10 GbE port (or vice versa). Customers then have the flexibility of turning on more ports when needed by using Features on Demand upgrade licensing capabilities that provide “pay as you grow” scalability without the need to buy more hardware.

The SI4093 provides transparent Flex System connectivity to your Cisco, Juniper, or other vendor network. The SI4093 aggregates compute node ports by appearing as a simple pass-thru device. The upstream network sees a “large pipe” of server traffic coming to and from the chassis, with the main difference being that intra-chassis switching is supported. With the SI4093, a network administration team uses the same network management tools that are deployed in the network to manage the connectivity from the physical servers in the chassis to the upstream network.

The SI4093 can be used in the Flex System Interconnect Fabric solution that reduces networking management complexity without compromising performance by lowering the number of devices that must be managed by 95% (managing one device instead of 20). Interconnect Fabric simplifies POD integration into an upstream network by transparently interconnecting hosts to a data center network. It also represents the POD as a large compute element, which isolates the POD’s internal connectivity topology and protocols from the rest of the network.

With support for Converged Enhanced Ethernet (CEE), the SI4093 can be used as an FCoE transit device and is ideal for network-attached storage (NAS) and iSCSI environments.

Key features

The SI4093 interconnect module is considered particularly suited for the following customers:

- Customers who want simple 10 GbE network connectivity from the chassis to the upstream network without the complexity of spanning tree and other advanced Layer 2 and Layer 3 features.
- Customers who want to manage physical compute node connectivity in the chassis by using the network management tools.
- Customers who want to build PODs or clusters of up to 252 nodes, but must configure once only and then can easily scale quickly as needs require.
- Customers who require investment protection for 40 GbE external ports.
- Customers who want to reduce total cost of ownership (TCO) and improve performance while maintaining high levels of availability and security.
- Customers who want to avoid or minimize oversubscription, which can result in congestion and loss of performance.
- Customers who want to implement a converged infrastructure with NAS, iSCSI, or FCoE. For FCoE implementations, the SI4093 passes through FCoE traffic upstream to other devices, such as the RackSwitch™ G8264CS, Brocade VDX, or Cisco Nexus 5548/5596, where the FC traffic is broken out.

The SI4093 offers the following key features and benefits:

- **Increased performance**
With the growth of virtualization and the evolution of cloud computing, many of today's applications require low latency and high-bandwidth performance. The SI4093 supports sub-microsecond latency and up to 1.28 Tbps throughput, while delivering full line rate performance. In addition to supporting 10 GbE ports, the SI4093 can support 40 GbE external ports, thus enabling forward-thinking customers to connect to their advanced 40 GbE network or as investment protection for the future.

The SI4093 also offers increased security and performance advantage when configured in VLAN-aware mode; it does not force communications upstream into the network, thus reducing latency and generating less network traffic.
- **"Pay as you grow" investment protection and lower total cost of ownership**
The SI4093 flexible port mapping allows customers to buy only the ports that they need, when they need them to lower acquisition and operational costs. The base module configuration includes 24x 10 GbE port licenses that can be assigned to internal connections and 10 GbE or even 40 GbE (by using four 10 GbE licenses per 40 GbE port) external ports. Customers then have the flexibility of turning on more 10 GbE internal connections and more 10 GbE or 40 GbE external ports when needed by using Lenovo Features on Demand licensing capabilities that provide "pay as you grow" scalability without the need for more hardware.
- **Cloud ready, optimized network virtualization with virtual NICs**
With most IT organizations implementing virtualization, there is an increased need to reduce the cost and complexity of their environments. Lenovo is helping to address these requirements by removing multiple physical I/O ports. Lenovo Virtual Fabric provides a way for companies to carve up 10 GbE ports into virtual NICs (vNICs) to meet those requirements with Intel processor-based compute nodes.

To help deliver maximum performance per vNIC and to provide higher availability and security with isolation between vNICs, the switch uses the capabilities of its Networking Operating System. For large-scale virtualization, the Flex System solution can support up to 48 vNICs by using a pair of CN4058S 10Gb Virtual Fabric Adapters in each compute node and four SI4093 modules in the chassis.

The SI4093 switch offers the benefits of next-generation vNIC - Unified Fabric Port (UFP). UFP is an advanced, cost-effective solution that provides a flexible way for clients to allocate, reallocate, and adjust bandwidth to meet their ever-changing data center requirements.

- **Cloud ready, VM-aware networking**
VMready software on the module simplifies configuration and improves security in virtualized environments. VMready automatically detects virtual machine movement between physical servers and instantly reconfigures each VM's network policies across VLANs to keep the network up and running without interrupting traffic or affecting performance. VMready works with all leading VM providers, such as VMware, Citrix Xen, and Microsoft Hyper-V.

Support for Edge Virtual Bridging (EVB) that is based on the IEEE 802.1Qbg standard enables scalable, flexible management of networking configuration and policy requirements per VM and eliminates many of the networking challenges that were introduced with server virtualization.

- **Simplified network infrastructure**
The SI4093 simplifies deployment and growth because of its innovative scalable architecture. This architecture helps increase return on investment (ROI) by reducing the qualification cycle while providing investment protection for more I/O bandwidth requirements in the future. The extreme flexibility of the interconnect module comes from its ability to turn on more ports as required, both down to the compute node and for upstream connections (including 40 GbE). Also, as customers consider migrating to a converged LAN and SAN, the SI4093 can support the newest protocols, including Data Center Bridging/Converged Enhanced Ethernet (DCB/CEE), which can be used in a converged iSCSI, Fibre Channel over Ethernet (FCoE), or NAS environment.

The SI4093 can be used in the Flex System Interconnect Fabric solution that reduces networking management complexity without compromising performance by lowering the number of devices that need to be managed by 95% (managing one device instead of 20). Interconnect Fabric simplifies POD integration into an upstream network by transparently interconnecting hosts to a data center network and representing the POD as a large compute element that isolates the POD's internal connectivity topology and protocols from the rest of the network. Flex System Interconnect Fabric provides simplified and scalable networking infrastructure of up to nine Flex System chassis to build up to a 126 nodes POD or cluster.

The default configuration of the SI4093 requires little or no management for most data center environments, which eliminates the need to configure each device or individual ports, thus reducing the number of management points.

Support for Switch Partition (SPAR) allows clients to virtualize the module with partitions that isolate communications for multi-tenancy environments.

- **Transparent networking**
The SI4093 is a transparent network device that is invisible to the upstream network and eliminates network administration concerns of Spanning Tree Protocol configuration and interoperability, VLAN assignments, and avoidance of possible loops.

By emulating a host NIC to the data center core, it accelerates the provisioning of VMs by eliminating the need to configure the typical access switch parameters.

- **Advanced network management**
Switch Center application is used for advanced levels of provisioning, management, and control, which can significantly reduce deployment and day-to-day maintenance times while providing in-depth visibility into the network performance and operations of Lenovo switches. When using tools, such as VMware vRealize product suite, vCenter Server (formerly VMware Virtual Center) or vSphere, Switch Center provides more integration for better optimization.

The Lenovo Networking Content Pack for VMware vRealize Log Insight enables administrators to use VMware vRealize Log Insight with their Lenovo Networking deployments. This applies to VMware administrators, system administrators, and network administrators. This capability delivers automated log management that helps to provide operational efficiency in dynamic, hybrid cloud environments.

The Lenovo Networking Content Pack for VMware vRealize Log Insight is custom-designed by Lenovo Networking to provide information specific to Lenovo Networking switches and switch configurations. When used with Log Insight, the Lenovo Networking Content Pack provides monitoring and analyses of syslogs that are issued by Lenovo Networking switches and switch configurations.

Components and connectors

The front panel of the Flex System Fabric SI4093 System Interconnect Module is shown in the following figure.

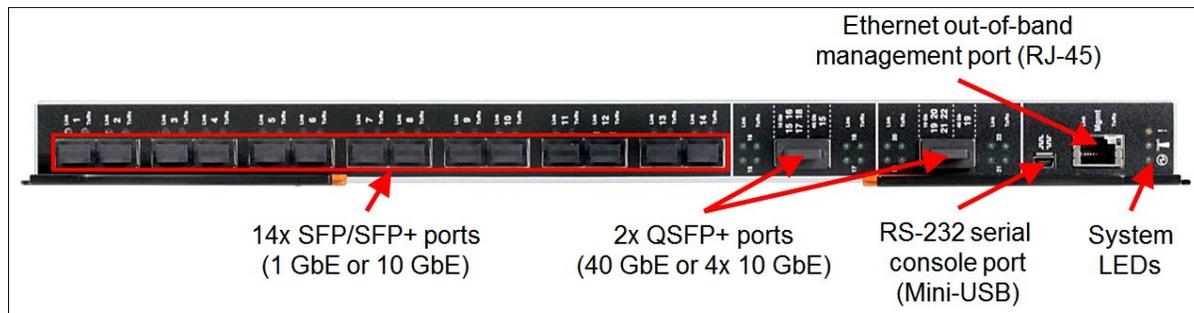


Figure 2. Front panel of the Lenovo Flex System Fabric SI4093 System Interconnect Module

The front panel includes the following components:

- System LEDs that display the status of the interconnect module and the network.
- One mini-USB RS-232 console port that provides another means to configure the interconnect module.
- 14x SFP+ ports to attach SFP/SFP+ transceivers for 1 GbE or 10 GbE connections or SFP+ DAC cables for 10 GbE connections.
- 2x QSFP+ ports to attach QSFP+ transceivers or DAC cables for 40 GbE or 4x 10 GbE connections.
- 1x RJ-45 10/100/1000 Mb Ethernet port for out-of-band management.

System specifications

The following table lists the SI4093 system specifications.

Table 1. System specifications

Component	Specification
Form factor	Flex System embedded I/O module
Ports	Internal ports: 42x 10 Gb Ethernet ports External ports: <ul style="list-style-type: none"> • 14x SFP/SFP+ ports • 2x QSFP+ ports
Media types (external ports)	40 Gb Ethernet QSFP+: <ul style="list-style-type: none"> • 40 GbE short-range (SR) QSFP+ bi-directional (BiDi) transceivers • 40 GbE short-range (SR4/iSR4/eSR4) QSFP+ transceivers • 40 GbE long-range (LR4) QSFP+ transceivers • 40 GbE QSFP+ to QSFP+ active optical cables (AOCs) • 40 GbE QSFP+ to 4x 10 GbE SFP+ active optical breakout cables • 40 GbE QSFP+ to QSFP+ direct attach copper (DAC) cables • 40 GbE QSFP+ to 4x 10 GbE SFP+ DAC breakout cables 10 Gb Ethernet SFP+: <ul style="list-style-type: none"> • 10 GbE short-range (SR) SFP+ transceivers • 10 GbE long-range (LR) SFP+ transceivers • 10 GbE RJ-45 SFP+ transceivers • 10 GbE SFP+ active optical cables • 10 GbE SFP+ DAC cables 1/10 Gb Ethernet SFP+: <ul style="list-style-type: none"> • 1/10 GbE SX/SR SFP+ transceivers 1 Gb Ethernet SFP: <ul style="list-style-type: none"> • 1 GbE short-wavelength (SX) SFP transceivers • 1 GbE long-wavelength (LX) SFP transceivers • 1 GbE RJ-45 SFP transceivers
Port speeds	<ul style="list-style-type: none"> • Internal 10 GbE ports: 1 Gbps or 10 Gbps • 40 GbE QSFP+ SR BiDi/SR4/LR4 transceivers: 40 GbE • 40 GbE QSFP+ iSR4/eSR4 transceivers, DAC cables and AOCs: 40 GbE or 4x 10 GbE • 10 GbE SFP+ transceivers, DAC cables and AOCs: 10 Gbps • 1/10 GbE SFP+ transceivers: 1 Gbps or 10 Gbps • 1 GbE SFP transceivers: 1 Gbps
Switching method	Cut-through.
Data traffic types	Unicast, multicast, broadcast.
Software features	Lenovo Networking OS: Layer 2 switching, virtual local area networks (VLANs), VLAN tagging, link aggregation (trunk) groups (LAGs), Hot Links, Layer 2 failover, Quality of Service (QoS), Edge Virtual Bridging (EVB), VMready, Switch Partitioning (SPAR), Flexible Port Mapping, IPv4/IPv6 management, Unified Fabric Port (UFP), Converged Enhanced Ethernet, Fibre Channel over Ethernet (FCoE) transit switch operations.
Performance	Non-blocking architecture with wire-speed forwarding of traffic: <ul style="list-style-type: none"> • Up to 1.28 Tbps aggregated throughput • 100% line rate performance with sub-microsecond switching latency • Up to 960 Million packets per second (Mpps) • Up to 9,216-byte jumbo frames

Component	Specification
Scalability	<ul style="list-style-type: none"> • MAC address forwarding database entries: 128,000 • VLANs: 256 per SPAR • Link aggregation groups: 8 • Ports in a link aggregation group: 16
Hot-swap parts	SFP/SFP+/QSFP+ transceivers, SFP+/QSFP+ DAC cables.
Management ports	2x GbE internal ports connected to the chassis management module; 1x 10/100/1000 Mb Ethernet EXTM external port (RJ-45); 1x RS-232 external port (Mini-USB).
Management interfaces	Industry standard command line interface (isCLI); SNMP v1 and v3. Optional Lenovo Switch Center. Optional Lenovo XClarity.
Security features	Secure Shell (SSH); Secure FTP (sFTP); user level security; LDAP, RADIUS, and TACACS+ authentication; access control lists (ACLs).
Warranty	One-year customer-replaceable unit limited warranty. When installed in a supported chassis, the module assumes the chassis' base warranty and any warranty service upgrade; warranty includes Networking OS software upgrades.
Mean Time Between Failures	236,805 hours with ambient operating temperature of 40° C.
Dimensions	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).

Models

The SI4093 module is initially licensed for 24x 10 GbE ports. More ports can be enabled with Upgrade 1 and Upgrade 2 license options (Upgrade 1 must be applied before Upgrade 2 can be applied). The part numbers and feature codes for ordering the module and the upgrades are listed in the following table.

Table 2. Part numbers and feature codes for ordering

Description	Part number	Feature code
Interconnect module		
Lenovo Flex System Fabric SI4093 System Interconnect Module	00FM518	ASUV
Features on Demand upgrades		
Flex System Fabric SI4093 System Interconnect Module (Upgrade 1)	95Y3318	A45U
Flex System Fabric SI4093 System Interconnect Module (Upgrade 2)	95Y3320	A45V

The base part number for the interconnect module includes the following items:

- One Lenovo Flex System Fabric SI4093 System Interconnect Module
- Documentation package

Note: QSFP+ and SFP/SFP+ transceivers and DAC cables are not included and should be ordered together with the interconnect module (see Transceivers and cables for details).

The interconnect module does not include a serial management cable; the optional Flex System Management Serial Access Cable (part number 90Y9338) is supported and includes two cables: a mini-USB-to-RJ45 serial cable and a mini-USB-to-DB9 serial cable. These cables can be used to connect to the interconnect module locally for configuration tasks and firmware updates.

The part numbers for the upgrades (95Y3318 and 95Y3320) include the following items:

- Features on Demand Activation Flyer
- Upgrade authorization letter

The base module and upgrades include the following default configurations:

- Part number 00FM518 is for the base module and includes 14 internal 10 GbE ports enabled (one to each compute node) and 10 external 10 GbE ports enabled.
- Part number 95Y3318 (Upgrade 1) can be applied on the base module when you use four-port adapters that are installed in each compute node. This upgrade enables 14 more internal ports for a total of 28 ports. The upgrade also enables two 40 GbE external ports. This upgrade requires the base module.
- Part number 95Y3320 (Upgrade 2) can be applied on top of the Upgrade 1 when you need more external bandwidth on the module or if you need more internal bandwidth to the compute nodes with the six-port capable adapters. The upgrade enables the remaining four external 10 GbE ports and 14 internal 10 GbE ports for a total of 42 internal ports (three to each compute node).

With flexible port mapping, clients have more flexibility in assigning ports that they licensed on the SI4093, which can help eliminate or postpone the need to purchase upgrades. While the base model and upgrades still activate specific ports, flexible port mapping provides clients with the capability of reassigning ports as needed by moving internal and external 10 GbE ports or trading off four 10 GbE ports for the use of an external 40 GbE port. This feature is valuable when you consider the flexibility with the base license and with Upgrade 1.

With flexible port mapping, clients have the following licenses for a specific number of ports:

- Part number 00FM518 is for the base module. It provides 24x 10 GbE ports licenses that can enable any combination of internal and external 10 GbE ports and external 40 GbE ports (with the use of four 10 GbE port licenses per one 40 GbE port).
- Part number 95Y3318 (Upgrade 1) upgrades the base module by activation of 14 internal 10 GbE ports and two external 40 GbE ports, which is equivalent to adding 22 10 GbE port licenses for a total of 46x 10 GbE port licenses. Any combination of internal and external 10 GbE ports and external 40 GbE ports (with the use of four 10 GbE port licenses per one 40 GbE port) can be enabled with this upgrade. This upgrade requires the base module.
- Part number 95Y3320 (Upgrade 2) requires that the base module and Upgrade 1 already be activated. It activates all of the ports on the SI4093, which is 42 internal 10 GbE ports, 14 external SFP+ ports, and 2 external QSFP+ ports.

Note: When Upgrade 1 and Upgrade 2 are activated, flexible port mapping is no longer used because all the ports on the SI4093 are enabled.

The supported port combinations on the SI4093 and required upgrades are listed in the following tables.

Table 3. Supported port combinations: Default port mapping

Supported port combinations (Default port mapping)	Quantity required		
	Base module, 00FM518	Upgrade 1, 95Y3318	Upgrade 2, 95Y3320
<ul style="list-style-type: none"> • 14x internal 10 GbE ports • 10x external 10 GbE ports 	1	0	0
<ul style="list-style-type: none"> • 28x internal 10 GbE ports • 10x external 10 GbE ports • 2x external 40 GbE ports 	1	1	0
<ul style="list-style-type: none"> • 42x internal 10 GbE ports† • 14x external 10 GbE ports • 2x external 40 GbE ports 	1	1	1

† This configuration uses six of the eight ports on the CN4058S adapter.

Table 4. Supported port combinations: Flexible port mapping

Supported port combinations (Flexible port mapping)	Quantity required		
	Base module, 00FM518	Upgrade 1, 95Y3318	Upgrade 2, 95Y3320*
<ul style="list-style-type: none"> • 24x 10 GbE ports (internal and external) or • 20x 10 GbE ports (internal and external) • 1x external 40 GbE ports or • 16x 10 GbE ports (internal and external) • 2x external 40 GbE ports 	1	0	0
<ul style="list-style-type: none"> • 46x 10 GbE ports (internal and external) or • 42x 10 GbE ports (internal and external) • 1x external 40 GbE ports or • 38x 10 GbE ports (internal and external) • 2x external 40 GbE ports 	1	1	0

* Upgrade 2 is not used with flexible port mapping because with Upgrade 2, all ports on the module become licensed and there is no need to reassign ports.

Transceivers and cables

With the flexibility of the interconnect module, customers can use the following connectivity technologies:

- For 1 GbE links, customers can use RJ-45 SFP transceivers with UTP cables up to 100 meters. Customers that need longer distances can use a 1000BASE-SX transceiver, which can drive distances up to 220 meters with 62.5 μ multi-mode fiber (OM1) and up to 550 meters with 50 μ multi-mode fiber (OM2), or the 1000BASE-LX transceivers that support distances up to 10 kilometers with single-mode fiber (1310 nm).
- For 10 GbE links (on external SFP+ ports), customers can use SFP+ direct-attached copper (DAC) cables for in-rack cabling for distances up to 7 meters or SFP+ active optical cables (AOCs) for distances up to 20 meters. These cables have SFP+ connectors on each end, and they do not need separate transceivers. For distances up to 30 meters, the 10GBASE-T SFP+ transceiver can be used with Category 6a or 7 RJ-45 UTP cables. For longer distances, the 10GBASE-SR transceiver supports distances up to 300 meters over OM3 multimode fiber or up to 400 meters over OM4 multimode fiber. The 10GBASE-LR transceivers can support distances up to 10 kilometers on single mode fiber.

To increase the number of available 10 GbE ports, customers can split out four 10 GbE ports for each 40 GbE port by using QSFP+ DAC or active optical breakout cables for distances up to 5 meters. For distances up to 100 meters, the 40GBASE-iSR4 QSFP+ transceivers can be used with OM3 optical MPO-to-LC breakout cables or up to 150 meters with OM4 optical MPO-to-LC breakout cables. For longer distances, the 40GBASE-eSR4 transceivers can be used with OM3 optical MPO-to-LC breakout cables for distances up to 300 meters or OM4 optical MPO-to-LC breakout cables for distances up to 400 meters.

- For 40 GbE to 40 GbE connectivity, customers can use the affordable QSFP+ to QSFP+ DAC cables for distances up to 7 meters or QSFP+ to QSFP+ active optical cables for distances up to 20 meters.

With multimode fiber LC cables, customers can use the 40GBASE QSFP+ bi-directional transceivers for distances up to 100 meters with OM3 MMF LC cables or up to 150 meters with OM4 MMF LC cables.

With multimode fiber MPO cables, customers can use the 40GBASE-SR4/iSR4 QSFP+ transceivers for distances up to 100 meters with OM3 MMF MPO cables or up to 150 meters with OM4 MMF MPO cables. For distances up to 300 meters, the 40GBASE-eSR4 QSFP+ transceiver can be used with OM3 MMF MPO cables or up to 400 meters with OM4 MMF MPO cables.

For distances up to 10 kilometers, the 40GBASE-LR4 QSFP+ transceiver can be used with single mode fiber LC cables.

The supported transceivers and cables are listed in the following table.

Table 5. 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
SFP transceivers - 1 GbE			
Lenovo 1000BASE-T (RJ-45) SFP Transceiver (no 10/100 Mbps support)	00FE333	A5DL	14
Lenovo 1000BASE-SX SFP Transceiver	81Y1622	3269	14
Lenovo 1000BASE-LX SFP Transceiver	90Y9424	A1PN	14
SFP+ transceivers - 10 GbE			
Lenovo Dual Rate 1/10Gb SX/SR SFP+ Transceiver	00MY034	ATTJ	14
Lenovo 10GBASE-SR SFP+ Transceiver	46C3447	5053	14
Lenovo 10GBASE-LR SFP+ Transceiver	90Y9412	A1PM	14
Lenovo 10GBASE-T SFP+ Transceiver	7G17A03130	AVV1	14
Optical cables for 1 GbE SX SFP, 10 GbE SR SFP+, and 40 GbE SR QSFP+ BiDi transceivers			
Lenovo 1m LC-LC OM3 MMF Cable	00MN502	ASR6	14
Lenovo 3m LC-LC OM3 MMF Cable	00MN505	ASR7	14
Lenovo 5m LC-LC OM3 MMF Cable	00MN508	ASR8	14
Lenovo 10m LC-LC OM3 MMF Cable	00MN511	ASR9	14
Lenovo 15m LC-LC OM3 MMF Cable	00MN514	ASRA	14
Lenovo 25m LC-LC OM3 MMF Cable	00MN517	ASRB	14
Lenovo 30m LC-LC OM3 MMF Cable	00MN520	ASRC	14
SFP+ active optical cables - 10 GbE			
Lenovo 1m SFP+ to SFP+ Active Optical Cable	00YL634	ATYX	14
Lenovo 3m SFP+ to SFP+ Active Optical Cable	00YL637	ATYY	14
Lenovo 5m SFP+ to SFP+ Active Optical Cable	00YL640	ATYZ	14
Lenovo 7m SFP+ to SFP+ Active Optical Cable	00YL643	ATZ0	14
Lenovo 15m SFP+ to SFP+ Active Optical Cable	00YL646	ATZ1	14
Lenovo 20m SFP+ to SFP+ Active Optical Cable	00YL649	ATZ2	14
SFP+ direct-attach cables - 10 GbE			
Lenovo 1m Passive SFP+ DAC Cable	90Y9427	A1PH	14
Lenovo 1.5m Passive SFP+ DAC Cable	00AY764	A51N	14
Lenovo 2m Passive SFP+ DAC Cable	00AY765	A51P	14
Lenovo 3m Passive SFP+ DAC Cable	90Y9430	A1PJ	14
Lenovo 5m Passive SFP+ DAC Cable	90Y9433	A1PK	14
Lenovo 7m Passive SFP+ DAC Cable	00D6151	A3RH	14
QSFP+ transceivers - 40 GbE			
Lenovo 40GBase QSFP+ Bi-Directional Transceiver	00YL631	ATYW	2
Lenovo 40GBASE-SR4 QSFP+ Transceiver	49Y7884	A1DR	2
Lenovo 40GBASE-iSR4 QSFP+ Transceiver	00D9865	ASTM	2

Description	Part number	Feature code	Maximum quantity supported
Lenovo 40GBASE-eSR4 QSFP+ Transceiver	00FE325	A5U9	2
Lenovo 40GBASE-LR4 QSFP+ Transceiver	00D6222	A3NY	2
Optical cables for 40 GbE QSFP+ SR4/iSR4/eSR4 transceivers			
Lenovo 10m QSFP+ MPO-MPO OM3 MMF Cable	00VX003	AT2U	2
Lenovo 30m QSFP+ MPO-MPO OM3 MMF Cable	00VX005	AT2V	2
Optical breakout cables for 40 GbE QSFP+ iSR4/eSR4 transceivers			
Lenovo 1m MPO-4xLC OM3 MMF Breakout Cable	00FM412	A5UA	2
Lenovo 3m MPO-4xLC OM3 MMF Breakout Cable	00FM413	A5UB	2
Lenovo 5m MPO-4xLC OM3 MMF Breakout Cable	00FM414	A5UC	2
QSFP+ active optical cables - 40 GbE			
Lenovo 1m QSFP+ to QSFP+ Active Optical Cable	7Z57A04256	AX42	2
Lenovo 3m QSFP+ to QSFP+ Active Optical Cable	00YL652	ATZ3	2
Lenovo 5m QSFP+ to QSFP+ Active Optical Cable	00YL655	ATZ4	2
Lenovo 7m QSFP+ to QSFP+ Active Optical Cable	00YL658	ATZ5	2
Lenovo 15m QSFP+ to QSFP+ Active Optical Cable	00YL661	ATZ6	2
Lenovo 20m QSFP+ to QSFP+ Active Optical Cable	00YL664	ATZ7	2
QSFP+ active optical breakout cables - 40 GbE to 4x10 GbE			
Lenovo 1M QSFP+ to 4xSFP+ Active Optical Cable	00YL667	ATZ8	2
Lenovo 3M QSFP+ to 4xSFP+ Active Optical Cable	00YL670	ATZ9	2
Lenovo 5M QSFP+ to 4xSFP+ Active Optical Cable	00YL673	ATZA	2
QSFP+ direct-attach cables - 40 GbE			
Lenovo 1m Passive QSFP+ DAC Cable	49Y7890	A1DP	2
Lenovo 3m Passive QSFP+ DAC Cable	49Y7891	A1DQ	2
Lenovo 5m Passive QSFP+ DAC Cable	00D5810	A2X8	2
Lenovo 7m Passive QSFP+ DAC Cable	00D5813	A2X9	2
QSFP+ breakout cables - 40 GbE to 4x10 GbE			
Lenovo 1m Passive QSFP+ to SFP+ Breakout DAC Cable	49Y7886	A1DL	2
Lenovo 3m Passive QSFP+ to SFP+ Breakout DAC Cable	49Y7887	A1DM	2
Lenovo 5m Passive QSFP+ to SFP+ Breakout DAC Cable	49Y7888	A1DN	2

The network cables that can be used with the switch are listed in the following table.

Table 6. SI4093 network cabling requirements

Transceiver	Standard	Cable	Connector
40 Gb Ethernet			
40Gb SR QSFP+ BiDi (00YL631)	40GBASE-SR BiDi	Up to 30 m with fiber optic cables supplied by Lenovo (see Table 5); up to 100 m with OM3 or up to 150 m with OM4 multimode fiber optic cable.	LC
40Gb SR4 QSFP+ (49Y7884)	40GBASE-SR4	10 m or 30 m MPO fiber optic cables supplied by Lenovo (see Table 5); up to 100 m with OM3 or up to 150 m with OM4 multimode fiber optic cable.	MPO
40Gb iSR4 QSFP+ (00D9865)	40GBASE-SR4	10 m or 30 m MPO fiber optic cables or MPO-4xLC breakout cables up to 5 m supplied by Lenovo (see Table 5); up to 100 m with OM3 or up to 150 m with OM4 multimode fiber optic cable.	MPO
40Gb eSR4 QSFP+ (00FE325)	40GBASE-SR4	10 m or 30 m MPO fiber optic cables or MPO-4xLC breakout cables up to 5 m supplied by Lenovo (see Table 5); up to 300 m with OM3 or up to 400 m with OM4 multimode fiber optic cable.	MPO
40Gb LR4 QSFP+ (00D6222)	40GBASE-LR4	1310 nm single-mode fiber optic cable up to 10 km.	LC
Active optical cable	40GBASE-SR4	QSFP+ to QSFP+ active optical cables up to 1 m; QSFP+ to 4x SFP+ active optical break-out cables up to 5 m for 4x 10 GbE SFP+ connections out of a 40 GbE port (see Table 5)	QSFP+
Direct attach copper cable	40GBASE-CR4	QSFP+ to QSFP+ DAC cables up to 7 m; QSFP+ to 4x SFP+ DAC break-out cables up to 5 m for 4x 10 GbE SFP+ connections out of a 40 GbE port (see Table 5).	QSFP+
10 Gb Ethernet			
10Gb SR SFP+ (46C3447) 1/10Gb SFP+ (00MY034)	10GBASE-SR	Up to 30 m with fiber optic cables supplied by Lenovo (see Table 5); up to 300 m with OM3 or up to 400 m with OM4 multimode fiber optic cable.	LC
10Gb LR SFP+ (90Y9412)	10GBASE-LR	1310 nm single-mode fiber optic cable up to 10 km.	LC
10Gb RJ-45 SFP+ (7G17A03130)	10GBASE-T	UTP Category 6a or 7 up to 30 meters.	RJ-45
Active optical cable	10GBASE-SR	SFP+ active optical cables up to 20 m (see Table 5)	SFP+
Direct attach copper cable	10GSFP+Cu	SFP+ DAC cables up to 7 m (see Table 5).	SFP+
1 Gb Ethernet			
1Gb RJ-45 SFP (00FE333)	1000BASE-T	UTP Category 5, 5E, or 6 up to 100 meters.	RJ-45
1Gb SX SFP (81Y1622) 1/10Gb SFP+ (00MY034)	1000BASE-SX	Up to 30 m with fiber optic cables supplied by Lenovo (see Table 5); 850 nm multimode fiber cable 50 μ (OM2) up to 550 m or 62.5 μ (OM1) up to 220 m.	LC
1Gb LX SFP (90Y9424)	1000BASE-LX	1310 nm single-mode fiber cable up to 10 km.	LC
Management ports			
1 GbE management port	1000BASE-T	UTP Category 5, 5E, or 6 up to 100 meters.	RJ-45
RS-232 management port	RS-232	DB-9-to-mini-USB or RJ-45-to-mini-USB console cable (comes with the optional Cable Kit, 90Y9338).	Mini-USB

Software features

Note: The features that are listed in this section are based on Networking OS version 8.4.

The Flex System Fabric SI4093 System Interconnect Module has the following software features:

- Modes of operations:
 - Transparent (or VLAN-agnostic) mode
In VLAN-agnostic mode (default configuration), the SI4093 transparently forwards VLAN tagged frames without filtering on the customer VLAN tag. This mode provides an end host view to the upstream network. The interconnect module provides traffic consolidation in the chassis to minimize TOR port usage, and it enables the compute node-to-compute node communication for optimum performance (for example, vMotion). It can be connected to the FCoE transit switch or FCoE gateway (FC Forwarder) device.
 - Local Domain (or VLAN-aware) mode
In VLAN-aware mode (optional configuration), the SI4093 provides more security for multi-tenant environments by extending client VLAN traffic isolation to the interconnect module and its external ports. VLAN-based access control lists (ACLs) can be configured on the SI4093. When FCoE is used, the SI4093 operates as an FCoE transit switch and it should be connected to the FCF device.
 - Flex System Interconnect Fabric mode
In Flex System Interconnect Fabric mode, the SI4093 module is running optional Interconnect Fabric software image and operates as a leaf switch in the leaf-spine fabric. Flex System Interconnect Fabric integrates the entire point of delivery (POD) into a seamless network fabric for compute node and storage under single IP management. It also attaches to the upstream data center network as a loop-free Layer 2 network fabric with a single Ethernet external connection or aggregation group to each Layer 2 upstream network.

Note: Flexible port mapping is supported in Flex System Interconnect Fabric mode with Networking OS version 8.3 or later.
- Scalability and performance:
 - Media access control (MAC) address learning with automatic updates
 - Static and LACP (IEEE 802.3ad) link aggregation
- Availability and redundancy:
 - Layer 2 Trunk Failover to support active/standby configurations of network adapter teaming on compute nodes.
 - Hot Links provide basic link redundancy and fast recovery for network topologies without a need for Spanning Tree protocol.
- VLAN support:
 - Up to 256 VLANs supported per interconnect module SPAR partition, with VLAN numbers 1 - 4095 (4095 is used for management module's connection only)
 - 802.1Q VLAN tagging support on all ports
 - Private VLANs
- Security:
 - VLAN-based access control lists (ACLs) (VLAN-aware mode)
 - Multiple user IDs and passwords
 - User access control
 - Radius, TACACS+, and LDAP authentication and authorization
 - NIST 800-131A Encryption
 - Selectable encryption protocol; SHA 256 enabled as default
- Quality of service (QoS): Support for IEEE 802.1p traffic classification and processing.

- Virtualization:
 - Unified fabric port (UFP):
 - Up to eight UFP virtual ports (vPorts) per 10 GbE physical port (adapter-specific)
 - Ethernet, iSCSI, or FCoE traffic on vPorts.
 - Up to 1,024 VLAN for the virtual ports.
 - Integration with L2 failover.
 - 802.1Qbg Edge Virtual Bridging (EVB) is an emerging IEEE standard for allowing networks to become virtual machine (VM)-aware:
 - Virtual Ethernet Bridging (VEB) and Virtual Ethernet Port Aggregator (VEPA) are mechanisms for switching between VMs on the same hypervisor.
 - Edge Control Protocol (ECP) is a transport protocol that operates between two peers over an IEEE 802 LAN providing reliable, in-order delivery of upper layer protocol data units.
 - Virtual Station Interface (VSI) Discovery and Configuration Protocol (VDP) allows centralized configuration of network policies that persist with the VM, independent of its location.
 - EVB Type-Length-Value (TLV) is used to discover and configure VEPA, ECP, and VDP.
 - VMready:
 - Up to 4,096 virtual entities (VEs)
 - Automatic VE discovery
 - Up to 4,096 local or distributed VM groups for VEs
 - NMotion® feature for automatic network configuration migration
 - Switch partitioning (SPAR):
 - SPAR forms separate virtual switching contexts by segmenting the data plane of the module. Data plane traffic is not shared between SPARs on the same module.
 - SPAR operates as a Layer 2 broadcast network. Hosts on the same VLAN that are attached to a SPAR can communicate with each other and with the upstream switch. Hosts on the same VLAN but attached to different SPARs communicate through the upstream switch.
 - SPAR is implemented as a dedicated VLAN with a set of internal compute node ports and a single external port or link aggregation (LAG). Multiple external ports or LAGs are not allowed in SPAR. A port can be a member of only one SPAR.
- Converged Enhanced Ethernet:
 - Priority-Based Flow Control (PFC) (IEEE 802.1Qbb) extends 802.3x standard flow control to allow the module to pause traffic that is 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 that is based on the 802.1p priority value in each packet's VLAN tag.
 - Data Center Bridging Capability Exchange Protocol (DCBX) (IEEE 802.1AB) allows neighboring network devices to exchange information about their capabilities.
- Fibre Channel over Ethernet (FCoE):
 - FC-BB5 FCoE specification compliant
 - FCoE transit switch operations
 - FCoE Initialization Protocol (FIP) support
- Manageability:
 - IPv4 and IPv6 host management
 - Simple Network Management Protocol (SNMP V1 and V3)
 - Industry standard command-line interface (IS-CLI) through Telnet, SSH, and serial port
 - Secure FTP (sFTP)
 - Service Location Protocol (SLP)
 - Firmware image update (TFTP and FTP/Secure FTP [sFTP])
 - Network Time Protocol (NTP) for clock synchronization
 - Lenovo Switch Center and XClarity support

- Monitoring:
 - LEDs for external port status and module status indication
 - Change tracking and remote logging with syslog feature
 - POST diagnostic tests

Ethernet standards

The SI4093 supports the following standards:

- IEEE 802.1AB Data Center Bridging Capability Exchange Protocol (DCBX)
- 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 802.3 10BASE-T Ethernet
- IEEE 802.3ab 1000BASE-T copper twisted pair Gigabit Ethernet
- IEEE 802.3ad Link Aggregation Control Protocol
- IEEE 802.3ae 10GBASE-SR short range fiber optics 10 Gb Ethernet
- IEEE 802.3ae 10GBASE-LR long range fiber optics 10 Gb Ethernet
- IEEE 802.3ap 10GBASE-KR backplane 10 Gb Ethernet
- 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
- IEEE 802.3z 1000BASE-SX short range fiber optics Gigabit Ethernet
- IEEE 802.3z 1000BASE-LX long range fiber optics Gigabit Ethernet
- SFF-8431 10GSFP+Cu SFP+ Direct Attach Cable

Warranty

The SI4093 carries a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a supported chassis, these I/O modules assume your system's base warranty and any warranty service upgrade.

Physical specifications

The SI4093 features the following approximate dimensions and weight :

- 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)

The SI4093 features the following approximate shipping dimensions and weight:

- 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 SI4093 conforms to the following regulations:

- United States FCC 47 CFR Part 15, Subpart B, ANSI C63.4 (2003), Class A
- IEC/EN 60950-1, Second Edition
- Canada ICES-003, issue 4, Class A
- Japan VCCI, Class A
- Australia/New Zealand AS/NZS CISPR 22:2006, Class A
- Taiwan BSMI CNS13438, Class A
- CE Mark (EN55022 Class A, EN55024, EN61000-3-2, EN61000-3-3)
- CISPR 22, Class A
- China GB 9254-1998
- Turkey Communiqué 2004/9; Communiqué 2004/22
- Saudi Arabia EMC.CVG, 28 October 2002

Chassis and adapters

The I/O modules are installed in I/O bays in the rear of the Flex System Chassis, as shown in the following figure. I/O modules 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.

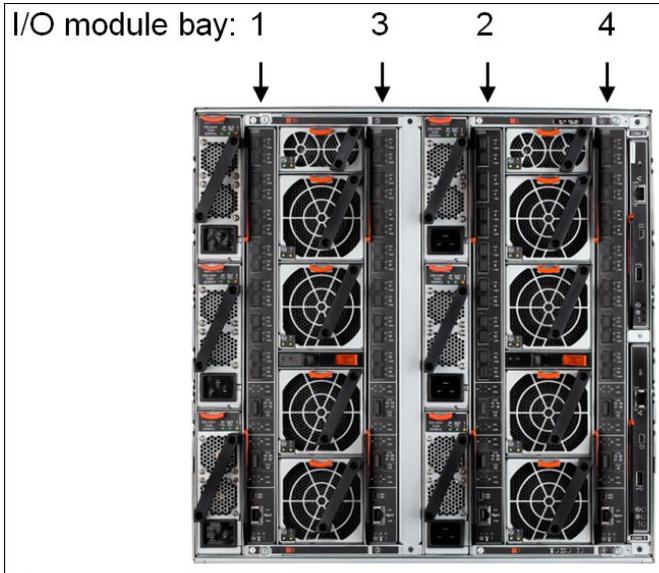


Figure 3. Location of the I/O bays in the Flex System Chassis

The SI4093 interconnect modules can be installed in bays 1, 2, 3, and 4 of the Enterprise Chassis. A supported adapter must be installed in the corresponding slot of the compute node. Each adapter can use up to four lanes to connect to the respective I/O module bay. The SI4093 can use up to three of the four lanes.

In 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, the periscope connector can be replaced with the adapter when needed. In such a case, integrated NIC is disabled.

With flexible port mapping, there is no need to buy more module upgrades for 4-port and 8-port adapters if the total number of port licenses on the SI4093 does not exceed the number of external (upstream network ports) and internal (compute node network ports) connections used.

The following table shows compatibility information for the SI4093 and Flex System chassis.

Table 7. Flex System chassis compatibility

Description	Part number	Enterprise Chassis with CMM	Enterprise Chassis with CMM2	Carrier-grade Chassis with CMM2
Flex System Fabric SI4093 System Interconnect Module	00FM518	No	Yes	No

The midplane connections between the adapters that are installed in the compute nodes to the I/O module bays in the chassis are listed in the following table. Half-wide compute nodes support up to two adapters, and full-wide compute nodes support up to four adapters.

Table 8. Adapter to I/O bay correspondence

I/O adapter slot in the compute node	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		
	Port 3	Yes			
	Port 4		Yes		
	Port 5	Yes			
	Port 6		Yes		
	Port 7*				
	Port 8*				
Slot 2	Port 1			Yes	
	Port 2				Yes
	Port 3			Yes	
	Port 4				Yes
	Port 5			Yes	
	Port 6				Yes
	Port 7*				
	Port 8*				
Slot 3 (full-wide compute nodes only)	Port 1	Yes			
	Port 2		Yes		
	Port 3	Yes			
	Port 4		Yes		
	Port 5	Yes			
	Port 6		Yes		
	Port 7*				
	Port 8*				
Slot 4 (full-wide compute nodes only)	Port 1			Yes	
	Port 2				Yes
	Port 3			Yes	
	Port 4				Yes
	Port 5			Yes	
	Port 6				Yes
	Port 7*				
	Port 8*				

* Ports 7 and 8 are routed to I/O bays 1 and 2 (Slot 1 and Slot 3) or 3 and 4 (Slot 2 and Slot 4), but these ports cannot be used with the SI4093 module.

The following table lists the adapters that are supported by the I/O module.

Table 9. Network adapters

Description	Part number	Feature code
50 Gb Ethernet		
ThinkSystem QLogic QL45212 Flex 50Gb 2-Port Ethernet Adapter	7XC7A05843	B2VT
ThinkSystem QLogic QL45262 Flex 50Gb 2-Port Ethernet Adapter with iSCSI/FCoE	7XC7A05845	B2VV
25 Gb Ethernet		
ThinkSystem QLogic QL45214 Flex 25Gb 4-Port Ethernet Adapter	7XC7A05844	B2VU
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 CN4052S 2-port 10Gb Virtual Fabric Adapter	00AG540	ATBT
Flex System CN4052S 2-port 10Gb Virtual Fabric Adapter Advanced	01CV780	AU7X
Flex System CN4054 10Gb Virtual Fabric Adapter (4-port)	90Y3554*	A1R1
Flex System CN4054R 10Gb Virtual Fabric Adapter (4-port)	00Y3306*	A4K2
Flex System CN4054S 4-port 10Gb Virtual Fabric Adapter	00AG590	ATBS
Flex System CN4054S 4-port 10Gb Virtual Fabric Adapter Advanced	01CV790	AU7Y
Flex System CN4058S 8-port 10Gb Virtual Fabric Adapter	94Y5160	A4R6
Flex System EN4172 2-port 10Gb Ethernet Adapter	00AG530	A5RN
1 Gb Ethernet		
Embedded 1 Gb Ethernet controller (2-port)**	None	None
Flex System EN2024 4-port 1Gb Ethernet Adapter	49Y7900	A10Y

* Withdrawn from marketing

† The Embedded 10Gb Virtual Fabric Adapter is built into selected compute nodes.

** The Embedded 1 Gb Ethernet controller is built into selected compute nodes.

Network connectivity

The most common SI4093 connectivity topology, which can be used with Lenovo and non-Lenovo upstream network devices, is shown in the following figure.

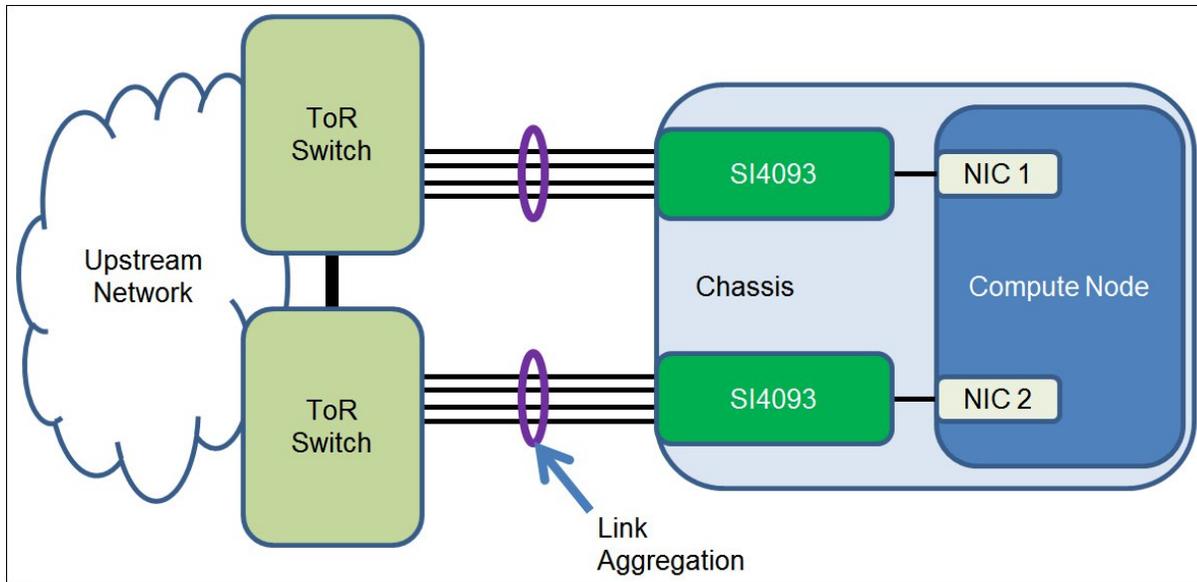


Figure 4. SI4093 connectivity topology - Link Aggregation

In this loop-free redundant topology, each SI4093 is physically connected to a separate Top-of-Rack (ToR) switch with static or LACP aggregated links.

When the SI4093 is used with the Lenovo RackSwitch switches, Virtual Link Aggregation Groups (vLAGs) can be used for load balancing and redundancy purposes. The virtual link aggregation topology with the Lenovo RackSwitch G8272 is shown in the following figure.

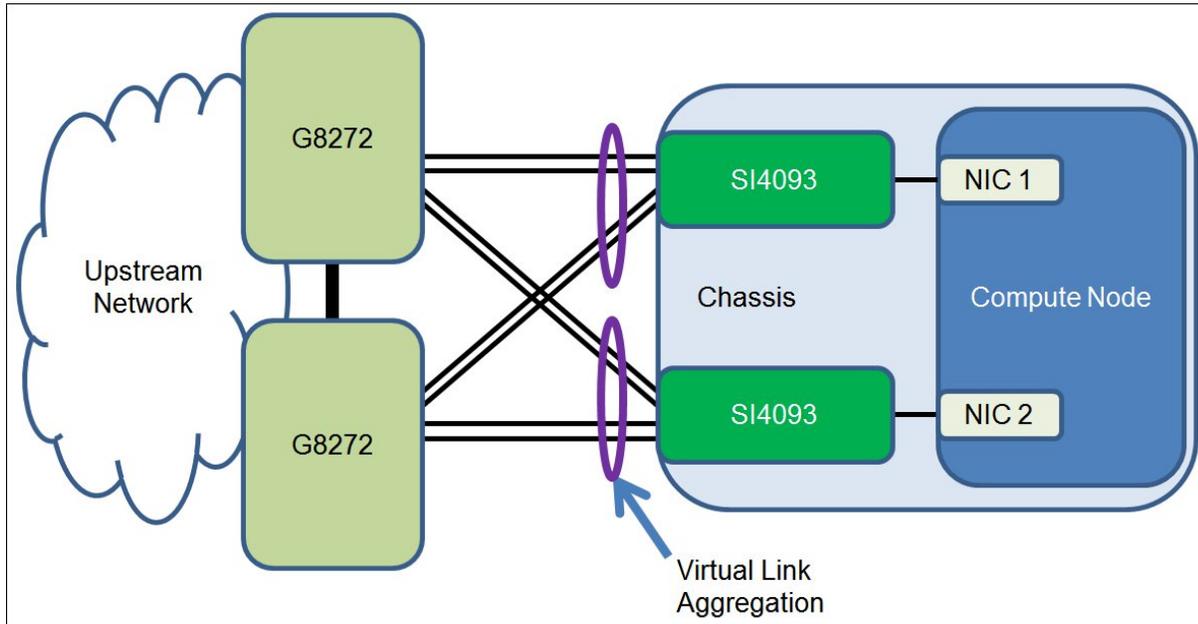


Figure 5. SI4093 connectivity topology: Virtual Link Aggregation

In this loop-free topology, aggregation is split between two physical switches (which appear as a single logical switch) and each SI4093 is connected both ToR switches through static or LACP aggregated links.

Dual isolated SAN fabrics: If you plan to use FCoE and follow a dual isolated SAN fabric design approach (which is also known as *SAN air gaps*), consider the SI4093 connectivity topology that is shown in Figure 4 (Link Aggregation).

The following table lists the 10 Gb and 40 Gb Ethernet network switches that are offered by Lenovo that can be used with the SI4093 interconnect module in Flex System network connectivity solutions.

Table 10. Network switches

Description	Part number
10 Gb Ethernet switches	
Lenovo RackSwitch G8124E (Rear to Front)	7159BR6
Lenovo RackSwitch G8264 (Rear to Front)	7159G64
Lenovo RackSwitch G8272 (Rear to Front)	7159CRW
Lenovo RackSwitch G8296 (Rear to Front)	7159GR6
10 Gb Converged switches	
Lenovo RackSwitch G8264CS (Rear to Front)*	7159DRX
40 Gb Ethernet switches	
Lenovo RackSwitch G8332 (Rear to Front)	7159BRX

* The SI4093 supports FCoE transit switch operations when connected to the RackSwitch G8264CS.

For more information, see the list of Product Guides in the Top-of-rack Switches category:
<http://lenovopress.com/servers/options/switches>

Related publications and links

For more information, see the following Lenovo Flex System Fabric SI4093 System Interconnect Module product publications, which are available from the Flex System Information Center:

http://flexsystem.lenovofiles.com/help/topic/com.lenovo.acc.si4093pt.doc/IO_Module_SI4093.html

- *Flex System Fabric SI4093 System Interconnect Module Installation Guide*
- *Flex System Fabric SI4093 System Interconnect Module Application Guide*
- *Flex System Fabric SI4093 System Interconnect Module Industry Standard CLI Command Reference*

For more information, see the following resources:

- *Flex System Enterprise Chassis Product Guide:*
<http://lenovopress.com/tips0865>
- *Flex System Products and Technology*, SG24-8255:
<http://lenovopress.com/sg248255>
- *Flex System Interoperability Guide:*
<http://lenovopress.com/fsig>
- *Product Guides for Flex System compute nodes and options:*
<http://lenovopress.com/flexsystem>

Related product families

Product families related to this document are the following:

- [10 Gb Embedded Connectivity](#)
- [Blade Networking Modules](#)

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This document, TIPS1294, was created or updated on March 6, 2024.

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