Emulex VFA5.2 Adapter Family for System x
Product Guide

The Emulex Virtual Fabric Adapter 5 Generation 2 (VFA5.2) Network Adapter Family for System x builds on the foundation of the previous generation of Emulex VFA5 adapters by delivering performance enhancements, including RoCE v2 support and management enhancements with improved support for Lenovo XClarity. These new features help reduce complexity, reduce cost, and improve performance with Lenovo servers.

The following figure shows the Emulex VFA5.2 ML2 Dual Port 10GbE SFP+ Adapter.
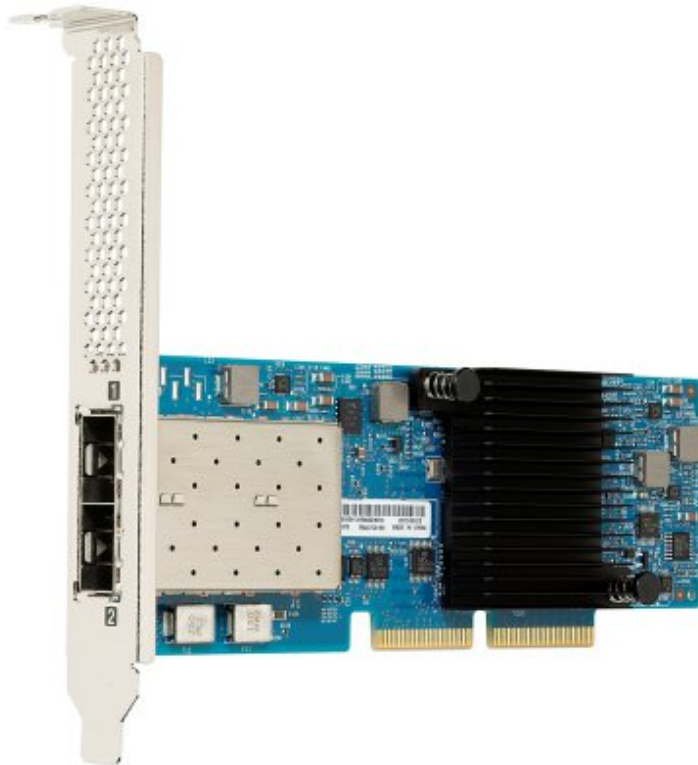

Figure 1. Emulex VFA5.2 ML2 Dual Port 10GbE SFP+ Adapter

Did you know?

The Emulex VFA5.2 adapters support three methods to virtualize I/O, out of the box: Virtual Fabric Mode (vNIC1), Switch Independent mode (vNIC2) and Unified Fabric Port (UFP) mode. With Virtual Fabric, up to eight virtual network ports (vNICs) can be created with a single two-port 10 GbE network adapter. Storage protocols such as iSCSI and FCoE are also supported by Features on Demand upgrades. Using a common hardware infrastructure for Ethernet and SAN and by virtualizing your network adapter, you can reduce your infrastructure capital expense.

Part number information

The part numbers to order these adapters are listed in the following table. The FCoE/iSCSI upgrade licenses are a Features on Demand field upgrade that enables full hardware offloaded converged networking capabilities of the adapters. Adapters 00AG580 and 01CV770 already includes the FCoE/iSCSI license.

Table 1. Ordering part number and feature code

Part number	Feature code	Description
Adapters		
00AG570	AT7S	Emulex VFA5.2 2x10 GbE SFP+ PCIe Adapter
00AG580	AT7T	Emulex VFA5.2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW (Includes the FCoE/iSCSI license pre-installed)
00AG560	AT7U	Emulex VFA5.2 ML2 Dual Port 10GbE SFP+ Adapter
01CV770	AU7Z	Emulex VFA5.2 ML2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW (Includes the FCoE/iSCSI license pre-installed)
Features on Demand license upgrades		
00D8544	A4NZ	Emulex VFA5 ML2 FCoE/iSCSI License for System x (FoD) Features on Demand license for FCoE/iSCSI for 00AG560
00JY824	A5UV	Emulex VFA5 FCoE/iSCSI SW for PCIe Adapter for System x (FoD) Features on Demand license for FCoE/iSCSI for 00AG570

The adapter, when shipped as a stand-alone option, includes the following items:

- One Emulex adapter
- An attached full-height (3U) bracket, and a low-profile (2U) bracket that can be substituted if needed
- Quick Install Guide
- Warranty information and Important Notices flyer
- Documentation CD

The FCoE/iSCSI license is delivered in the form of an authorization code that you enter on the Features on Demand website to generate an activation key.

Supported transceivers and direct-attach cables

The adapters in the Emulex VFA5.2 family each have two empty SFP+ cages that support SFP+ SR transceivers and twin-ax direct-attached copper cables, as listed in the following two tables.

Table 2. Supported transceivers

Part number	Feature Code	Description
49Y4216	0069	Brocade 10Gb SFP+ SR Optical Transceiver
49Y4218	0064	QLogic 10Gb SFP+ SR Optical Transceiver
46C3447	5053	10Gb SFP+ SR Optical Transceiver

Table 3. Supported direct-attach cables

Part number	Feature Code	Description
Passive direct-attach cables		
00D6288	A3RG	0.5m Passive DAC SFP+ Cable
90Y9427	A1PH	1 m Passive DAC-SFP+ Cable
00AY764	A51N	1.5 Passive DAC SFP+ Cable
00AY765	A51P	2.0 Passive DAC SFP+ Cable
90Y9430	A1PJ	3 m Passive DAC-SFP+ Cable
90Y9433	A1PK	5 m Passive DAC-SFP+ Cable
00D6151	A3RH	7 m Passive DAC SFP+ Cable
Active direct-attach cables		
00VX111	AT2R	Lenovo 1m Active DAC SFP+ Cables
00VX114	AT2S	Lenovo 3m Active DAC SFP+ Cables
00VX117	AT2T	Lenovo 5m Active DAC SFP+ Cables

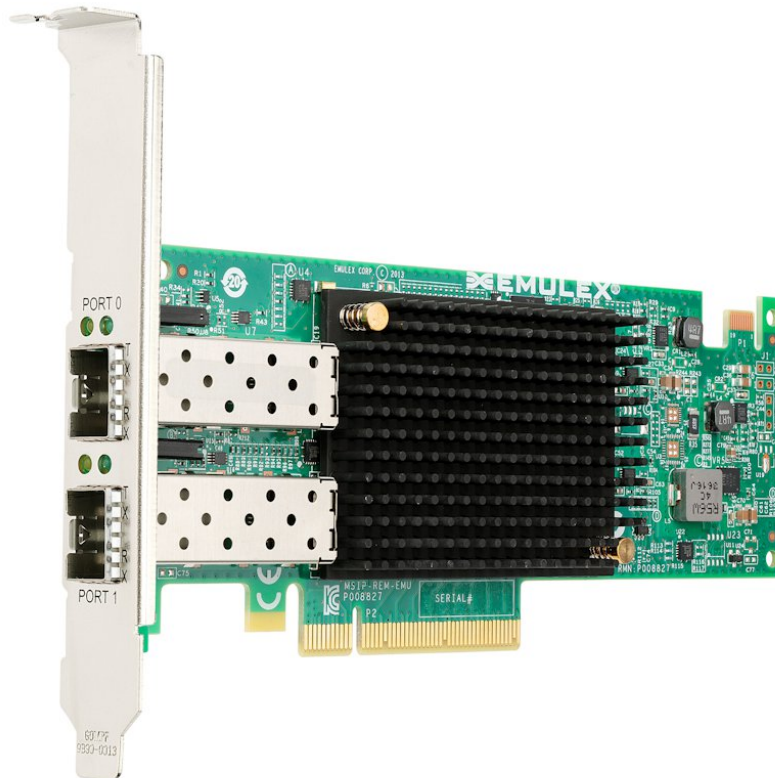The following figure shows the PCIe adapter.

Figure 2. Emulex VFA5.2 2x10 GbE SFP+ PCIe Adapter

Features

The VFA5.2 adapters offer virtualized networking, support a converged infrastructure, and improve performance with powerful offload engines. The adapter has the following features and benefits.

Reduce complexity

- Virtual NIC emulation
  The Emulex VFA5.2 supports three NIC virtualization modes right out of the box: Virtual Fabric mode (vNIC1), switch independent mode (vNIC2), and Unified Fabric Port (UFP). With NIC virtualization, each of the two physical ports on the adapter can be logically configured to emulate up to four virtual NIC (vNIC) functions with user-definable bandwidth settings. Additionally, each physical port can simultaneously support a storage protocol (FCoE or iSCSI).

- Common drivers and tools
  You can deploy faster and manage less when you use both Virtual Fabric Adapters (VFAs) and Host Bus Adapters (HBAs) that are developed by Emulex. VFAs and HBAs developed by Emulex use the same installation and configuration process, streamlining the effort to get your server configured and running, saving you valuable time. They also use the same Fibre Channel drivers, reducing time to qualify and manage storage connectivity. With Emulex's OneCommand Manager, you can manage VFAs and HBAs that are developed by Emulex through the data center from a single console.

- Improved support for Lenovo XClarity
  - Supports agent-free management, eliminating platform agents to reduce complexity
  - Supports automatic inventory management to simplify management
  - Supports real-time monitoring, fault detection and alert handling for a more secure managed environment
  - Supports automatic firmware downloads and installation for true bare metal provisioning

Reduce cost

- Multiprotocol support for 10 GbE
  The Emulex VFA5.2 adapter family offers two 10 Gb Ethernet ports and is cost- and performance-optimized for integrated and converged infrastructures. The VFA5.2 offers a "triple play" of converged data, storage, and low-latency RDMA networking on a common Ethernet fabric. The Emulex VFA provides customers with a flexible storage protocol option for running heterogeneous workloads on their increasingly converged infrastructures.

- Power savings
  When compared with previous generation Emulex VFA3 adapters, the Emulex VFA5.2 adapters can save up to 50 watts per server, reducing energy and cooling OPEX through improved storage offloads.

- Delay purchasing features until you need them with Features on Demand (FoD)
  VFA5.2 adapters 00AG570 and 00AG560 use Features on Demand (FoD) software activation technology. FoD enables the adapter to be initially deployed as a low-cost Ethernet NIC, and then later upgraded in the field to support FCoE or iSCSI hardware offload.

Improve performance

- VXLAN/NVGRE offload technology
  Emulex supports Microsoft's network virtualization using generic routing encapsulation (NVGRE) and VMware's virtual extensible LAN (VXLAN). These technologies create more logical LANs (for traffic isolation) that are needed by cloud architectures. Because these protocols increase the processing burden on the server's CPU, the VFA5.2 has an offload engine specifically designed for processing these tags. The resulting benefit is that cloud providers can leverage the benefits of VXLAN/NVGRE with no reduction in the server's performance.

- Full hardware storage offloads
The Emulex VFA5.2 adapters support a hardware offload engine (optionally enabled via Features on Demand upgrade, standard on 00AG580 and 01CV770). This accelerates storage protocol processing, which enables the server's processing resources to focus on application workloads, thus improving the server's performance.

- Advanced RDMA capabilities with RoCE v2
RDMA over Converged Ethernet v2 (RoCE v2) delivers application and storage acceleration through faster I/O operations with support for Windows Server SMB Direct and Linux NFS protocols.

The XE100-P2 controllers leverage RoCE v2, enabling server-to-server data movement directly between application memory without any CPU involvement. This provides high throughput and data acceleration on a standard Ethernet fabric, without the need for specialized infrastructure or management.

The XE100-P2 controllers support the new InfiniBand Trade Association (IBTA) RoCE v2 specification for Layer 3 routing.

RoCE also helps accelerate workloads in the following ways:

  - Capability to deliver a 4x boost in small packet network performance vs. previous generation adapters, which is critical for transaction-heavy workloads

  - Desktop-like experiences for VDI with up to 1.5 million FCoE or iSCSI I/O operations per second (IOPS)

  - Ability to scale Microsoft SQL Server, Exchange, and SharePoint using SMB Direct optimized with RoCE

  - More VDI desktops/server due to up to 18% higher CPU effectiveness (the percentage of server CPU utilization for every 1 Mbps I/O throughput)

  - Superior application performance for VMware hybrid cloud workloads, with up to 129% higher I/O throughput compared to adapters without offload

Specifications

Adapter specifications:

- Dual-channel 10 Gbps Ethernet controller

- Based on the Emulex XE102-P2 ASIC

- PCI Express 3.0 host interface

- Line-rate 10 GbE performance

- Upgradeable to support converged networking (FCoE and iSCSI) through Features on Demand

- 2 SFP+ empty cages to support either SFP+ SR or twin-ax copper connections
    - SFP+ SR link is with the SFP+ SR optical module with LC connectors.
    - SFP+ twin-ax copper link is with the SFP+ direct attached copper module/cable.

- Power dissipation: 14.4 W typical

- Form factor:
    - Mezzanine LOM (ML2) form factor (adapters 00AG560 and 01CV770)
    - PCIe low-profile form factor (adapters 00AG570 and 00AG580)

Virtualization features

- Virtual Fabric support:
    - Virtual Fabric mode (vNIC1)
    - Switch Independent mode (vNIC2)
    - Unified Fabric Port (UFP) support
- Four NIC partitions per adapter port
- Complies with PCI-SIG specification for SR-IOV
- VXLAN/NVGRE encapsulation and offload
- PCI-SIG Address Translation Service (ATS) v1.0
- Virtual Switch Port Mirroring for Diagnostic purposes
- Virtual Ethernet Bridge (VEB)
- 62 Virtual functions (VF)
- QoS for controlling and monitoring bandwidth that is assigned to and used by virtual entities
- Traffic shaping and QoS across each virtual function (VF) and physical function (PF)
- Message Signal Interrupts (MSI-X) support
- VMware NetQue / VMQ support
- Microsoft VMQ & Dynamic VMQ support in Hyper-V

Ethernet and NIC features

- NDIS 5.2, 6.0, and 6.2 compliant Ethernet functionality
- IPv4/IPv6 TCP, UDP, and Checksum Offload
- IPv4/IPv6 TCP, UDP Receive Side Scaling (RSS)
- IPv4/IPv6 Large Send Offload (LSO)
- Programmable MAC addresses
- 128 MAC/vLAN addresses per port
- Support for HASH-based broadcast frame filters per port
- vLAN insertion and extraction
- 9216 byte Jumbo frame support
- Receive Side Scaling (RSS)
- Filters: MAC and vLAN

Remote Direct Memory Access (RDMA):

- Direct data placement in application buffers without processor intervention
- Supports RDMA over converged Ethernet (RoCE) specifications
    - Supports RoCE v2 by replacing RoCE over IP with RoCE over UDP
    - 20% more RoCE Queue Pairs compared to VFA5
    - 16K RoCE Memory Regions (VFA5 offers 8K)
- Linux Open Fabrics Enterprise Distribution (OFED) Support
- Low latency queues for small packet sends and receives
- Local interprocess communication option by internal VEB switch
- TCP/IP Stack By-Pass

Data Center Bridging / Converged Enhanced Ethernet (DCB/CEE):

- Hardware Offloads of Ethernet TCP/IP

- 802.1Qbb Priority Flow Control (PFC)
- 802.1 Qaz Enhanced Transmission Selection (ETS)
- 802.1 Qaz Data Center Bridging Exchange (DCBX)

Fibre Channel over Ethernet (FCoE) offload (included with 00AG580 and 01CV770; optional via a Features on Demand upgrade for 00AG570 and 00AG560):

- Hardware offloads of Ethernet TCP/IP
- ANSI T11 FC-BB-5 Support
- Programmable Worldwide Name (WWN)
- Support for FIP and FCoE Ether Types
- Supports up to 255 NPIV Interfaces per port
- FCoE Initiator
- Common driver for Emulex Universal CNA and Fibre Channel HBAs
- 255 N_Port ID Virtualization (NPIV) interfaces per port
- Fabric Provided MAC Addressing (FPMA) support
- Up to 4096 concurrent port logins (RPIs) per port
- Up to 2048 active exchanges (XRIs) per port

iSCSI offload (included with 00AG580 and 01CV770; optional via a Features on Demand upgrade for 00AG570 and 00AG560):

- Full iSCSI Protocol Offload
- Header, Data Digest (CRC), and PDU
- Direct data placement of SCSI data
- 2048 Offloaded iSCSI connections
- iSCSI initiator and concurrent initiator /target modes
- Multipath I/O
- OS-neutral INT13 based iSCSIboot and iSCSI crash memory dump support
- RFC 4171 Internet Storage Name Service (iSNS)

Standards

The following IEEE standards are supported:

- 802.3-2008 10Gbase Ethernet port
- 802.1Q vLAN
- 802.3x Flow Control with pause Frames
- 802.1 Qbg Edge Virtual Bridging
- 802.1Qaz Enhanced transmission Selection (ETS) Data Center Bridging Capability (DCBX)
- 802.1Qbb Priority Flow Control
- 802.3ad link Aggregation/LACP
- 802.1AB Link Layer Discovery Protocol
- 802.3ae (SR Optics)
- 802.3p (Priority of Service)
- IPV4 (RFC 791)
- IPV6 (RFC 2460)

Server support

The Emulex VFA5.2 adapter family is supported in the System x servers that are listed in the following tables.

Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Table 4. Support for System x and dense servers with Xeon E5/E7 v4 and E3 v5 processors

Part number	Description	x3250 M6 (3943)	x3250 M6 (3633)	x3550 M5 (8869)	x3650 M5 (8871)	x3850 X6/x3950 X6 (6241, E7 v4)	nx360 M5 (5465, E5-2600 v4)	sd350 (5493)
00AG570	Emulex VFA5.2 2x10 GbE SFP+ PCIe Adapter	Y	Y	Y	Y	Y	Y	N
00AG580	Emulex VFA5.2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	N	N	Y	Y	Y	Y	N
00AG560	Emulex VFA5.2 ML2 Dual Port 10GbE SFP+ Adapter	N	N	Y	Y	Y	Y	N
01CV770	Emulex VFA5.2 ML2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	N	N	Y	Y	Y	Y	N

Support for servers with Intel Xeon v3 processors

Table 3. Support for servers with Intel Xeon v3 processors

Part number	Description	x3100 M5 (5457)	x3250 M5 (5458)	x3500 M5 (5464)	x3550 M5 (5463)	x3650 M5 (5462)	x3850 X6/x3950 X6 (6241, E7 v3)	nx360 M5 (5465)
00AG570	Emulex VFA5.2 2x10 GbE SFP+ PCIe Adapter	N	N	Y	Y	Y	Y	Y
00AG580	Emulex VFA5.2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	N	N	Y	Y	Y	Y	Y
00AG560	Emulex VFA5.2 ML2 Dual Port 10GbE SFP+ Adapter	N	N	N	Y	Y	Y	Y
01CV770	Emulex VFA5.2 ML2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	N	N	N	N	N	Y	Y

Support for servers with Intel Xeon v2 processors

Table 5. Support for servers with Intel Xeon v2 processors

Part number	Description	x3300 M4 (7382)	x3500 M4 (7383, E5-2600 v2)	x3550 M4 (7914, E5-2600 v2)	x3630 M4 (7158, E5-2400 v2)	x3650 M4 (7915, E5-2600 v2)	x3650 M4 BD (5466)	x3750 M4 (8753)	x3850 X6/x3950 X6 (6241, E7 v2)
00AG570	Emulex VFA5.2 2x10 GbE SFP+ PCIe Adapter	N	N	N	N	N	N	Y	Y
00AG580	Emulex VFA5.2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	N	N	N	N	N	N	Y	Y
00AG560	Emulex VFA5.2 ML2 Dual Port 10GbE SFP+ Adapter	N	N	N	N	N	N	Y	Y
01CV770	Emulex VFA5.2 ML2 2x10 GbE SFP+ Adapter and FCoE/iSCSI SW	N	N	N	N	N	N	N	Y

Modes of operation

The Emulex VFA5.2 adapter family supports three types of virtual NIC (vNIC) operating modes, and a physical NIC (pNIC) operating mode. This support is built into the adapter:

- **Virtual Fabric Mode** (also known as vNIC1 mode)
  Virtual Fabric Mode works only with RackSwitch™ G8124E, G8264CS, G8264, G8264T top-of-rack switches. In this mode, the Emulex adapter communicates with the switch to obtain vNIC parameters (using DCBX). A special tag is added within each data packet and is later removed by the NIC or switch for each vNIC group to maintain separation of the virtual data paths.

  In vNIC mode, each physical port is divided into four virtual ports for a maximum of eight virtual NICs per adapter. The default bandwidth for each vNIC is 2.5 Gbps. Bandwidth for each vNIC can be configured through the RackSwitch from 100 Mbps to 10 Gbps, up to a total of 10 Gb per physical port. The vNICs can also be configured to have zero bandwidth if you must allocate the available bandwidth to fewer than four vNICs per physical port. In Virtual Fabric Mode, you can change the bandwidth allocations through the switch user interfaces without requiring a reboot of the server.

  vNIC bandwidth allocation and metering are performed by both the switch and the VFA. In such a case, a bidirectional virtual channel of an assigned bandwidth is established between them for every defined vNIC.

- **Switch Independent Mode** (also known as vNIC2 mode)
  In Switch Independent Mode, the adapter works with any 10 Gb Ethernet switch. Switch Independent Mode offers the same capabilities as Virtual Fabric Mode in terms of the number of vNICs and the bandwidth each can be configured to have. Switch Independent Mode extends the existing customer VLANs to the virtual NIC interfaces. The IEEE 802.1Q VLAN tag is essential to the separation of the vNIC groups by the NIC adapter or driver and the switch. The VLAN tags are added to the packet by the applications or drivers at each endpoint rather than by the switch.

vNIC bandwidth allocation and metering are performed only by VFA itself. In such a case, a unidirectional virtual channel is established where the bandwidth management is performed only for the outgoing traffic on a VFA side (server-to-switch). The incoming traffic (switch-to-server) uses the all available physical port bandwidth, because there is no metering performed on either the VFA or a switch side.

In Switch Independent Mode mode, when storage protocols are enabled on the Emulex 10GbE Virtual Fabric Adapters, six vNICs (three per physical port) are Ethernet, and two vNICs (one per physical port) are either iSCSI or FCoE.

- **Unified Fabric Port (UFP)**
  Unified Fabric Port provides a feature rich solution compared to the original vNIC Virtual Fabric mode. Supported with RackSwitch™ G8272, G8264CS, and G8264 top-of-rack switches. Like Virtual Fabric mode vNIC, UFP allows carving up a single 10 Gb port into four virtual NICs (called vPorts in UFP). UFP also has a number of modes associated with it, including:
  Only one vPort (vPort 2) per physical port can be bound to FCoE. If FCoE is not desired, vPort 2 can be configured for one of the other modes.

  - Tunnel mode: Provides Q-in-Q mode, where the vPort is customer VLAN-independent (very similar to vNIC Virtual Fabric Dedicated Uplink Mode).
  - Trunk mode: Provides a traditional 802.1Q trunk mode (multi-VLAN trunk link) to the virtual NIC (vPort) interface. In other words, host-side tagging.
  - Access mode: Provides a traditional access mode (single untagged VLAN) to the virtual NIC (vPort) interface which is similar to a physical port in access mode.
  - FCoE mode: Provides FCoE functionality to the vPort.
  - Auto-VLAN mode: Auto VLAN creation for Qbg and VMready environments.
- **pNIC mode** (physical NIC mode)
  In pNIC mode, the adapter operates as a standard dual-port 10 Gbps Ethernet adapter, and it functions with any 10 GbE switch. In pNIC mode, with the Emulex FCoE/iSCSI License, the card operates in a traditional Converged Network Adapter (CNA) mode with two Ethernet ports and two storage ports (iSCSI or FCoE) available to the operating system.

The following table compares the three virtual fabric modes.

Table 6. Comparison of virtual fabric modes

Function	Virtual Fabric Mode (vNIC1)	Switch Independent Mode (vNIC2)	UFP Mode
Description	Intelligence in the Networking OS working with select Emulex adapters. VLAN based.	Intelligence in the adapter, independent of the upstream networking device.	Intelligence in the adapter, independent of the upstream networking device.
Supported switches	G8124E, G8264, G8264T, G8264CS	All 10 GbE switches	G8272, G8264CS, and G8264 (NOS 7.9 or later)
Number of vNICs per physical 10 Gb port	4 (3 if storage functions are used to provide a vHBA)	4 (3 if storage)	4 (3 if storage)
Minimum vNIC bandwidth	100 Mb	100 Mb	100 Mb
Server-to-switch bandwidth limit per vNIC	Yes	No	Yes, maximum burst allowed and minimum guarantee

Function	Virtual Fabric Mode (vNIC1)	Switch Independent Mode (vNIC2)	UFP Mode
Switch-to-server bandwidth limit per vNIC	Yes	No	Yes, maximum burst allowed and minimum guarantee
IEEE 802.1q VLAN tagging	Optional	Required (untagged traffic will be tagged with LPVID which is configured in UEFI on a per-vNIC basis)	Optional for Trunk or Tunnel mode; not supported for access mode.
Isolated NIC teaming failover per vNIC	Yes	No	Yes (NOS 7.9 or later)
Switch modes	Tunnel mode	Access or Trunk Mode (two vNIC which are part of the same physical port cannot carry the same VLAN)	Access, Trunk, Tunnel, and FCoE modes
Uplink connectivity	Dedicated	Share	Dedicated for Tunnel mode; Shared for other modes
iSCSI/FCoE support	Yes	Yes	Yes

Physical specifications

ML2 adapter (approximate):

- Height: 69 mm (2.7 in.)
- Length: 168 mm (6.6 in.)
- Width: 17 mm (0.7 in.)

PCIe adapters:

- Height: 167 mm (6.6 in)
- Width: 69 mm (2.7 in)
- Depth: 17 mm (0.7 in)

Shipping dimensions and weight (approximate):

- Height: 189 mm (7.51 in.)
- Width: 90 mm (3.54 in.)
- Depth: 38 mm (1.50 in.)
- Weight: 450 g (0.99 lb)

Operating environment

This adapter is supported in the following environment:

- Temperature:
    - Operating: 0 °C to 55 °C (32 °F to 131 °F)
    - Non-operating: -40 °C to 70 °C (-40 °F to 158 °F)
- Humidity: 5 - 95%, non-condensing

Warranty

One-year limited warranty. When installed in a supported server, these cards assume the system's base warranty and any warranty upgrade.

Operating system support

The Emulex VFA5.2 adapter family supports the following operating systems:

- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2016
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 7
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for x86
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 12
- SUSE Linux Enterprise Server 12 with XEN
- VMware vSphere 5.1 (ESXi)
- VMware vSphere 5.5 (ESXi)
- VMware vSphere 6.0 (ESXi)

Top-of-rack switches

The following 10 Gb Ethernet top-of-rack switches are supported.

Table 7. 10Gb Ethernet Top-of-rack switches

Part number	Description
Switches mounted at the rear of the rack (rear-to-front airflow)	
7159BR6	Lenovo RackSwitch G8124E (Rear to Front)
7159G64	Lenovo RackSwitch G8264 (Rear to Front)
7159DRX	Lenovo RackSwitch G8264CS (Rear to Front)
7159CRW	Lenovo RackSwitch G8272 (Rear to Front)
7159GR6	Lenovo RackSwitch G8296 (Rear to Front)
Switches mounted at the front of the rack (front-to-rear airflow)	
7159BF7	Lenovo RackSwitch G8124E (Front to Rear)
715964F	Lenovo RackSwitch G8264 (Front to Rear)
7159DFX	Lenovo RackSwitch G8264CS (Front to Rear)
7159CFV	Lenovo RackSwitch G8272 (Front to Rear)
7159GR5	Lenovo RackSwitch G8296 (Front to Rear)

For more information, see the Lenovo Press Product Guides in the 10Gb top-of-rack switch category: https://lenovopress.com/networking/tor/10gb

Related publications

For more information, see these resources:

- Lenovo product page for System x network adapters
  http://shop.lenovo.com/us/en/systems/servers/options/systemx/networking/
- Lenovo ServerProven compatibility information for network adapters:
  http://www.lenovo.com/us/en/serverproven/xseries/lan/matrix.shtml
- Emulex 10GbE Virtual Fabric Adapter drivers
  http://www.emulex.com/downloads/oem-qualified/lenovo/system-x-rack-software-kits/
- System x Configuration and Options Guide
  http://www.ibm.com/systems/xbc/cog/

Related product families

Product families related to this document are the following:

- Ethernet Adapters

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