# Emulex Networking and Converged Networking Adapters for ThinkServer
**Product Guide (withdrawn product)**

The Emulex OCe14000 family of 10 Gb Ethernet Networking and Converged Networking Adapters for ThinkServer builds on the foundation of previous generations of Emulex Ethernet adapters by delivering performance enhancements and new features that reduce complexity and cost and improve performance. With FCoE and iSCSI offloads standard on most adapters in the family, these adapters delivers a set of powerful features and capabilities that are designed for the virtualized enterprise environment, multi-tenant and single-tenant cloud environments, I/O intensive environments, and converged infrastructure environments. Figure 1 shows the 2-Port SFP Converged Network Adapter.



Figure 1. ThinkServer OCe14102-UX-L PCIe 10Gb 2-Port SFP+ Converged Network Adapter by Emulex (4XC0F28736)

## Did you know?

The Emulex OCe14000 family of adapters for ThinkServer are equivalent to the VFA5 family of adapters for System x with some differences. The OCe14000 adapters support Universal Multi-Channel virtualization, which is equivalent to switch independent mode (vNIC2) in System x. The VFA5 adapters support Virtual Fabric NIC (vNIC1), Unified Fabric Port (UFP), and vNIC2. The OCe14000 and VFA5 adapters share common drivers and can be managed by Emulex OneConnect management software.

## Part number information

The part numbers to order the adapter are listed in the following table. The table also specifies which adapters include transceivers (optics). For adapters where transceivers are not included, part numbers are listed in the Supported transceivers section.

Table 1. Ordering part numbers

| Lenovo part number | Description | Includes optics |
|---|---|---|
| PCIe adapters - 10 GbE | | |
| 4XC0F28722 | ThinkServer OCe14102-UM-L 10Gb 2-Port SFP+ Converged Network Adapter by Emulex | Yes (2) |
| 4XC0F28723 | ThinkServer OCe14102-UX-L 10Gb 2-Port SFP+ Converged Network Adapter by Emulex | No |
| 4XC0F28724 | ThinkServer OCe14102-NX-L 10Gb 2-Port SFP+ Ethernet Adapter by Emulex | No |
| 4XC0F28736 | ThinkServer OCe14102-UX-L PCIe 10Gb 2-Port SFP+ Converged Network Adapter by Emulex | No |
| PCIe adapter - 40 GbE | | |
| 4XC0F28738 | ThinkServer OCe14401-UX-L PCIe 40Gb 1-Port QSFP+ Converged Network Adapter by Emulex | No |
| AnyFabric adapters - 10 GbE | | |
| 4XC0F28743 | ThinkServer OCm14102-UX-L AnyFabric 10Gb 2-Port SFP+ Converged Network Adapter by Emulex | No |
| 4XC0F28744 | ThinkServer OCm14104-UX-L AnyFabric 10Gb 4-Port SFP+ Converged Network Adapter by Emulex | No |
| 4XC0G88830 | ThinkServer OCm14102-NX-L AnyFabric 10GbE 2-Port SFP+ Ethernet Adapter by Emulex | No |

The following figure shows the four-port AnyFabric Converged Network Adapter. AnyFabric adapters are installed in a dedicated mezzanine adapter slot in supported servers.



Figure 2. ThinkServer OCm14104-UX-L AnyFabric 10Gb 4-Port SFP+ Converged Network Adapter by Emulex (4XC0F28744)

## Supported transceivers

As stated in the Part number information section, some adapters do not include transceivers and should therefore be ordered separately. The following table lists the supported transceivers.

SFP+ Direct Attached Copper (DAC) cables (also known as Twin-Ax) are also supported.

Table 2. Supported transceivers

| Part number | Description |
|---|---|
| 4XC0F28716 | ThinkServer 10Gbps Fibre Module Upgrade by Emulex<br>(Supported with 4XC0F28723, 4XC0F28724, 4XC0F28736) |
| 4XC0F28737 | ThinkServer 10Gb Optical Module by Emulex<br>(Supported with 4XC0F28736, 4XC0F28743, 4XC0F28744, 4XC0G88830) |
| 4XC0F28739 | ThinkServer 40Gb Optical Module by Emulex<br>(Supported with 4XC0F28738) |

## Features

The Emulex OCe14000 family of adapters for ThinkServer 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 OCe14000 adapters all support Universal Multi-Channel virtualization, which is equivalent to switch independent mode (vNIC2) in System x. With NIC virtualization, each of the 10 GbE physical ports on the adapter can be logically configured to emulate up to four virtual NIC (vNIC) functions with user-definable bandwidth settings. With a four-port adapter, up to 16 vNIC functions are supported. With the 40 GbE adapter, up to 16 vNIC functions are supported on the 40 GbE port. Also, 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 implement Emulex adapters for ThinkServer and System x Ethernet, Converged Network Adapters (CNAs), and Virtual Fabric adapters (VNAs) and Fibre Channel Host Bus Adapters (HBAs). Ethernet, CNAs, VFAs, and HBAs that are developed by Emulex use the same installation and configuration process, which streamlines the effort to get your server running and saves you valuable time. They also use the same Fibre Channel drivers, which reduces time to qualify and manages storage connectivity. With Emulex's OneCommand Manager, you can manage Emulex adapters through the data center from a single console.

**Reduce cost**

- AnyFabric form factor adapters are a lower-cost offering and do not use a PCIe slot
  The AnyFabric adapters are a mezzanine-style adapter design that is supported in servers, such as the RD550 and RD650. AnyFabric adapters do not occupy a regular PCIe slot. Although they occupy minimal space in the server chassis that is similar to an onboard adapter, they allow flexibility that is not available with a built-in controller. AnyFabric adapters are often cheaper than their PCIe counterparts.

- Multi-protocol support for 10 GbE
  The Emulex OCe14000 adapters offer a "triple play" of converged data, storage, and low latency RDMA and RDMA over Converged Ethernet (RoCE) networking on a common Ethernet fabric. The Emulex CNAs provide customers with a flexible storage protocol option for running heterogeneous workloads on their increasingly converged infrastructures.

- Power savings
  When compared with previous generation Emulex adapters, the Emulex OCe14000 family you can save up to 50 watts per server, which reduces energy and cooling OPEX through improved storage offloads.

**Improve performance**

- VXLAN/NVGRE offload technology
  Emulex supports Microsoft's network virtualization by 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 OCe14000 adapters have an offload engine that is designed for processing these tags. The resulting benefit is that cloud providers can realize the benefits of VXLAN/NVGRE while not being penalized with a reduction in the server's performance.

- Full hardware storage offloads
  The Emulex OCe14000 adapters support a hardware offload engine as standard that accelerates storage protocol processing, which enables the server's processing resources to focus on applications. This benefit improves the server's performance.

- Advanced RDMA capabilities
  RoCE delivers application and storage acceleration through faster I/O operations with support for Windows Server SMB Direct and Linux NFS protocols. With RoCE, the adapters helps accelerate workloads in the following ways:

    - Capability to deliver a 4x boost in small packet network performance versus 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 by using SMB Direct that is optimized with RoCE
    - More VDI desktops and servers because of up to 18% higher CPU effectiveness (the percentage of server CPU usage for every 1 Mbps I/O throughput)
    - Superior application performance for VMware hybrid cloud workloads because of up to 129% higher I/O throughput compared to adapters without offload

## NIC virtualization

The Emulex OCe14000 adapter family supports NIC virtualization with the Universal Multi-Channel (UMC) feature. With UMC, each physical port is divided into four virtual ports; therefore, for a 2-port adapter, you can have up to eight virtual NICs per adapter. The default bandwidth for each vNIC is 2.5 Gbps. Bandwidth for each vNIC is configured in the adapter and IEEE 802.1Q VLAN tags are used to separate the vNIC functions. The VLAN tags are added to the packet by the applications or drivers at each endpoint.

vNIC bandwidth allocation and metering are performed by the adapter. The bandwidth of each vNIC can be between 100 Mbps and 10 Gbps with up to a total of 10 Gb per physical port (a total of 40 Gb per port for the 40 Gb adapter). The vNICs can also be configured to have 0 bandwidth if you must allocate the available bandwidth to fewer than four vNICs per physical port. A unidirectional virtual channel is established in which the bandwidth management is performed only for the outgoing traffic on the adapter side (server-to-switch). The incoming traffic (switch-to-server) uses the all available physical port bandwidth because no metering is performed on the adapter or switch side.

When storage protocols are enabled on the adapter, the following virtual port counts apply:

- 10 Gb adapters: Up to two vNICs (one per physical port) can be iSCSI or FCoE. The remaining six vNICs (three per physical port) can be Ethernet.

- 40 Gb adapter: Up to four vNICs can be iSCSI or FCoE. The remaining 12 vNICs can be Ethernet.

## Specifications

## Specifications

The Emulex OCe14000 adapters feature the following specifications:

- Based on the Emulex XE100 series ASICs
- PCI Express 3.0 x8 host interface
- Line-rate 10 GbE or 40 GbE performance
- Converged networking (FCoE and iSCSI) standard on most adapters (for more information, see the following table).
- 10 Gb Ethernet adapters: SFP+ cages to support SFP+ SR or twin-ax copper connections:
  - 2 or 4 SFP+ ports, depending on the adapter (for more information, see the following table)
  - Some adapters include SFP+ optics (for more information, see the following table)
  - 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 or cable
- 16Gb Ethernet adapter: QSFP+ cage to support SFP+ SR or twin-ax copper connections
- Form factor:
  - AnyFabric form factor (adapters 4XC0F28743 and 4XC0F28744)
  - PCIe low-profile form factor (all other adapters)

The adapters in the Emulex OCe14000 family are compared in the following table.

Table 3. Adapter comparison

| Part number | Description | External Ports | FCoE/ iSCSI | RoCE |
|---|---|---|---|---|
| PCIe adapters - 10 GbE | | | | |
| 4XC0F28722 | OCe14102-UM-L 10Gb 2-Port SFP+ CNA | 2x 10 Gb | Yes | Yes |
| 4XC0F28723 | OCe14102-UX-L 10Gb 2-Port SFP+ CNA | 2x 10 Gb | Yes | Yes |
| 4XC0F28724 | OCe14102-NX-L 10Gb 2-Port SFP+ Ethernet | 2x 10 Gb | No | Yes |
| 4XC0F28736 | OCe14102-UX-L PCIe 10Gb 2-Port SFP+ CNA | 2x 10 Gb | Yes | Yes |
| PCIe adapter - 40 GbE | | | | |
| 4XC0F28738 | OCe14401-UX-L PCIe 40Gb 1-Port QSFP+ CNA | 1x 40 Gb | Yes | Yes |
| AnyFabric adapters - 10 GbE | | | | |
| 4XC0F28743 | OCm14102-UX-L AnyFabric 10Gb 2-Port SFP+ CNA | 2x 10 Gb | Yes | Yes |
| 4XC0F28744 | OCm14104-UX-L AnyFabric 10Gb 4-Port SFP+ CNA | 4x 10 Gb | Yes | Yes |
| 4XC0G88830 | OCm14102-NX-L AnyFabric 10GbE 2-Port SFP+ Ethernet | 2x 10 Gb | No | Yes |

The adapters include the following Virtualization features:

- NIC virtualization with Universal Multi-Channel (Switch Independent mode/vNIC2) support
- NIC partitions per adapter port:
  - 10 Gb adapters: 4 vNIC partitions per port
  - 40 Gb adapter: 16 vNIC partitions per port
- Comply with PCI-SIG specification for SR-IOV - 63 Virtual Functions (VFs) per port
- 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

The adapters include the following 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 and 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

The adapters include the following Remote Direct Memory Access (RDMA) features:

- Direct data placement in application buffers without processor intervention
- Supports RDMA over converged Ethernet (RoCE) specifications
- Linux Opens 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

The adapters include the following Data Center Bridging/Converged Enhanced Ethernet (DCB/CEE) features:

- 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)

The adapters include the following Fibre Channel over Ethernet (FCoE) offload (for CNAs only) features:

- Hardware offloads of Ethernet TCP/IP
- ANSI T11 FC-BB-5 Support
- Programmable Worldwide Name (WWN)
- Support for FIP and FCoE Ether Types
- Support for 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

The adapters include the following iSCSI offload (for CNAs only) features::

- 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 or 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 OCe14000 adapter family is supported in the ThinkServer systems that are listed in the following tables.

Table 4. Supported ThinkServer Generation 5 systems

| Part number | Description | Xeon E5 v3 | | | | | Xeon E5 v4 | | | | | E3 v5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TD350 (E5-2600 v3) | RD350 (E5-2600 v3) | RD450 (E5-2600 v3) | RD550 (E5-2600 v3) | RD650 (E5-2600 v3) | TD350 (E5-2600 v4) | RD350 (E5-2600 v4) | RD450 (E5-2600 v4) | RD550 (E5-2600 v4) | RD650 (E5-2600 v4) | TS150 | TS450 | TS460 | RS160 |
| **Adapters** | | | | | | | | | | | | | | | |
| 4XC0F28722 | OCe14102-UM-L 10Gb 2-Port SFP+ CNA | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| 4XC0F28723 | OCe14102-UX-L 10Gb 2-Port SFP+ CNA | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| 4XC0F28724 | OCe14102-NX-L 10Gb 2-Port SFP+ Ethernet | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N |
| 4XC0F28736 | OCe14102-UX-L PCIe 10Gb 2-Port SFP+ CNA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N |
| 4XC0F28738 | OCe14401-UX-L PCIe 40Gb 1-Port QSFP+ CNA | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N |
| 4XC0F28743 | OCm14102-UX-L AnyFabric 10Gb 2-Port SFP+ CNA | N | N | N | Y | Y | N | N | N | Y | Y | N | N | N | N |
| 4XC0F28744 | OCm14104-UX-L AnyFabric 10Gb 4-Port SFP+ CNA | N | N | N | Y | Y | N | N | N | Y | Y | N | N | N | N |
| 4XC0G88830 | OCm14102-NX-L AnyFabric 10GbE 2-Port SFP+ Ethernet | N | N | N | Y | Y | N | N | N | Y | Y | N | N | N | N |
| **Optical modules** | | | | | | | | | | | | | | | |
| 4XC0F28716 | 10Gbps Fibre Module Upgrade by Emulex | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| 4XC0F28737 | 10Gb Optical Module by Emulex | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N |
| 4XC0F28739 | 40Gb Optical Module by Emulex | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | N | N | N |

Table 5. Supported ThinkServer Generation 4 systems

| Part number | Description | TS140 | TS440 | RS140 | TD340 | RD340 | RD440 | RD540 | RD640 |
|---|---|---|---|---|---|---|---|---|---|
| **Adapters** | | | | | | | | | |
| 4XC0F28722 | OCe14102-UM-L 10Gb 2-Port SFP+ CNA | N | N | N | Y | Y | Y | Y | Y |
| 4XC0F28723 | OCe14102-UX-L 10Gb 2-Port SFP+ CNA | N | N | N | Y | Y | Y | Y | Y |
| 4XC0F28724 | OCe14102-NX-L 10Gb 2-Port SFP+ Ethernet | N | N | N | Y | Y | Y | Y | Y |
| 4XC0F28736 | OCe14102-UX-L PCIe 10Gb 2-Port SFP+ CNA | N | N | N | N | N | N | N | N |
| 4XC0F28738 | OCe14401-UX-L PCIe 40Gb 1-Port QSFP+ CNA | N | N | N | N | N | N | N | N |
| 4XC0F28743 | OCm14102-UX-L AnyFabric 10Gb 2-Port SFP+ CNA | N | N | N | N | N | N | N | N |
| 4XC0F28744 | OCm14104-UX-L AnyFabric 10Gb 4-Port SFP+ CNA | N | N | N | N | N | N | N | N |
| 4XC0G88830 | OCm14102-NX-L AnyFabric 10GbE 2-Port SFP+ Ethernet | N | N | N | N | N | N | N | N |
| **Optical modules** | | | | | | | | | |
| 4XC0F28716 | 10Gbps Fibre Module Upgrade by Emulex | N | N | N | Y | Y | Y | Y | Y |
| 4XC0F28737 | 10Gb Optical Module by Emulex | N | N | N | N | N | N | N | N |
| 4XC0F28739 | 40Gb Optical Module by Emulex | N | N | N | N | N | N | N | N |

## Physical specifications

AnyFabric adapter (approximate):

- Width: 165 mm (6.5 in)
- Depth: 73 mm (2.875 in)
- Height: 16 mm (0.625 in)

PCIe adapters:

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

## Warranty

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

## Operating system support

The Emulex OCe14000 adapter family supports the following operating systems:

- Windows Server
- Red Hat Enterprise Linux
- Novell SUSE Linux Enterprise Server
- VMware ESX
- Citrix XenServer

## Related publications

For more information, see the following resources:

- Lenovo Quick Pick:
  http://www.lenovoquickpick.com

## Related product families

Product families related to this document are the following:

- 10 Gb Ethernet Connectivity
- Ethernet Adapters

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