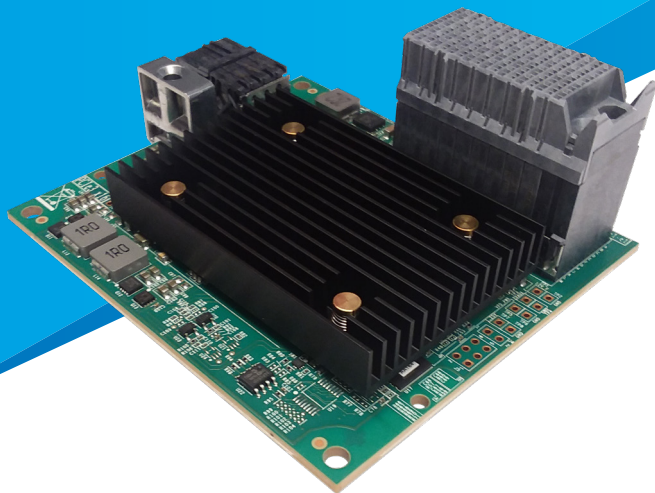


# Lenovo ThinkSystem QLogic QL45212/262/214

## Dual and Quad-Port 10/25/50GbE Adapters with Universal RDMA for Lenovo Flex System Blade Servers



- Industry's most powerful 10/25/50GbE adapters deliver the best price and performance ratio compared to 10GbE
- Universal RDMA delivers the ultimate choice and flexibility with concurrent support for RoCE, RoCEv2, and iWARP technologies
- Enables provisioning of either 10/25GbE or 10/25/50GbE ports for greater deployment flexibility through switch-independent NIC partitioning
- Increases VM density and accelerates multitenant networks with full offload for tunneling protocols
- Supports NVMe-oF, iSCSI, and FCoE storage operation<sup>1</sup>

<sup>1</sup> iSCSI and FCoE support only on QL45262 Adapter

### OVERVIEW

The Lenovo™ ThinkSystem™ QLogic® QL45214 Flex (10/25/50GbE) quad-port NIC, QL45212 (10/25/50GbE) dual-port NIC, and QL45262 (10/25/50GbE) dual-port CNA Network Adapters with RDMA leverage QLogic's eighth generation technology to deliver 25Gb and 50Gb per second (25/50Gbps) Ethernet performance. Optimized for use across enterprises, managed service providers (MSPs), and large public and scalable public cloud deployments, the QL45214/45262/45214 enable organizations to achieve new levels of performance in physical, virtual, and cloud environments.

The 25-gigabit Ethernet (25GbE) specification enables network bandwidth to be cost-effectively scaled in support of next-generation server and storage solutions residing in cloud and Web-scale data center environments. 25GbE results in a single-lane connection similar to existing 10GbE technology—but delivers up to two and a half times greater bandwidth. The 25G/50G Ethernet consortium specification describes how two of these lanes can be interleaved together to create 50GbE. Cavium is a leading innovator driving 25GbE and 50GbE technologies across enterprise and cloud market segments.

For more effective use of the 10/25/50GbE bandwidth, the QL45214/45262/45214 Ethernet Adapters offer Lenovo Switch Independent Partitioning, which enables segmentation of each 25/50GbE port into eight virtual ports, with flexible allocation of bandwidth

to each port. The segmentation allows IT organizations to improve resource utilization while lowering infrastructure and operational costs. Virtualization, cloud computing, High Performance Computing (HPC), convergence, and clustering initiatives are increasing workload demands. The QL45214/45262/45214 Ethernet Adapters are the solution of choice for workload-intensive computing environments, providing a reliable, high-performance 10/25/50GbE connectivity solution.

The Lenovo ThinkSystem QLogic QL45212/262/214 deliver advanced Ethernet solutions that are designed to meet requirements from leading enterprise and cloud providers. QLogic features that collectively deliver the most advanced 10/25/50GbE adapters include:

- The QLogic data plane development kit (DPDK) high-speed packet processing engine that accelerates the most demanding telco network function virtualization (NFV) workloads
- Cutting-edge server virtualization technologies—single-root I/O virtualization (SR-IOV) and Lenovo Switch Independent Partitioning
- Network virtualization—offloads for Virtual Extensible LAN (VXLAN), Generic Network Virtualization Encapsulation (GENEVE), Generic Routing Encapsulation (GRE), and Network Virtualization using Generic Routing Encapsulation (NVGRE)

- Universal RDMA technologies—RDMA over Converged Ethernet (RoCE), RoCEv2, iSCSI Extensions for RDMA (iSER), and Internet wide area RDMA protocol (iWARP)
- Cavium cloud-enabled management framework that orchestrates and manages hyperscale OpenStack® deployments
- Lenovo Switch Independent Partitioning that enables provisioning of 10/25/50GbE ports for greater deployment flexibility

#### REDUCE CAPITAL EXPENDITURE AND OPERATING EXPENSE

Lenovo ThinkSystem QLogic QL45212/262/214 Adapters' 25/50GbE technology delivers better price-per-gigabit versus 10GbE. The adapters are backward compatible with existing 10GbE installations while allowing an upgrade to 25/50GbE infrastructure. This technology enables cloud providers and large-scale data center operators to reduce operating expense while continuing to scale their network of server and storage nodes to meet increasing demands of the future. Cavium 25GbE technology is cost-efficient and power-efficient because it uses a single lane, compared to other alternatives such as quad-lane 40GbE. The QL45214/45262/45214 Ethernet Adapters are compatible with the Lenovo ThinkSystem NE2552E 25/50/100GbE Flex Switch, allowing seamless connectivity to 100GbE networks.

#### STREAMLINING NETWORKING WITH SWITCH INDEPENDENT PARTITIONING

Switch Independent Partitioning helps simplify the data center and the network and storage infrastructure in several ways. For example, when connecting servers, administrators may need to use many cables, sometimes adding switches to reduce cable proliferation. Switch Independent Partitioning provides an alternative: consolidating connections onto significantly reduced numbers of devices. Like switches, Switch Independent Partitioning reduces the number of cables without adding workloads on the network. However, Switch Independent Partitioning requires fewer devices compared to using switches and cables, thereby reducing network sprawl, maximizing network scalability, and simplifying administration.

#### ACCELERATE ANY NETWORK WITH UNIVERSAL RDMA OFFLOAD

The Lenovo ThinkSystem QLogic QL45212/262/214 support RoCE and iWARP acceleration to deliver low latency, low CPU utilization, and high performance on Windows Server® Message Block (SMB) Direct 3.0 and 3.02, Windows Server Storage Spaces Direct (S2D), and iSER. The QL45214/45262/45214 Adapters have the unique capability to deliver Universal RDMA that enables RoCE, RoCEv2, and iWARP. Cavium Universal RDMA and emerging low latency I/O bus mechanisms such as Network File System over RDMA (NFSoverRDMA) and Non-Volatile Memory Express (NVMe™) allow customers to accelerate access to data. Cavium's cutting-edge offloading technology increases cluster efficiency and scalability to many thousands of nodes.

#### HIGH-DENSITY SERVER VIRTUALIZATION

The latest hypervisors and multicore systems use several technologies to increase the scale of virtualization. The Lenovo ThinkSystem QLogic QL45212/262/214 Adapters support:

- VMware® NetQueue
- Windows® Hyper-V® virtual machine queue (VMQ)
- Linux® Multiqueue
- Windows, Linux, and VMware switch-independent NIC partitioning (NPAR)
- Windows Hyper-V, Linux Kernel-based Virtual Machine (KVM), and VMware ESXi SR-IOV

These features provide ultimate flexibility, quality of service (QoS), and optimized host and virtual machine (VM) performance while providing full 10/25/50GbE bandwidth per port. Public and private cloud virtualized server farms can now achieve two and a half times the VM density for the best price and VM ratio.

#### WIRE-SPEED NETWORK VIRTUALIZATION

Enterprise-class data centers can be scaled using overlay networks to carry VM traffic over a logical tunnel using NVGRE, VXLAN, GRE, and GENEVE. Although overlay networks can resolve virtual LAN (VLAN) limitations, native stateless offloading engines are bypassed, which places a higher load on the system's CPU.

The Lenovo ThinkSystem QLogic QL45212/262/214 efficiently handle this load with advanced NVGRE, VXLAN, GRE, and GENEVE stateless offload engines that access the overlay protocol headers. This access enables traditional stateless offloads of encapsulated traffic with native-level performance in the network. Additionally, the QL45214/45262/45214 support VMware NSX® and Open vSwitch (OVS).

#### HYPER-SCALE ORCHESTRATION WITH OPENSTACK

The Lenovo ThinkSystem QLogic QL45212/262/214 support the OpenStack open source infrastructure for constructing and supervising public, private, and hybrid cloud computing platforms. They provide for both networking and storage services (block, file, and object) for iSER. These platforms allow providers to rapidly and horizontally scale VMs over their entire, diverse, and widely spread network architecture to meet the real-time needs of their customers. Cavium's integrated, multiprotocol management utility, QConvergeConsole® (QCC), provides breakthrough features that allow customers to visualize the OpenStack-orchestrated data center using autodiscovery technology.

**ACCELERATE TELCO NETWORK FUNCTION VIRTUALIZATION (NFV) WORKLOADS**

In addition to OpenStack, the QL45214/45262/45214 support NFV, which allows decoupling of network functions and services from dedicated hardware (such as routers, firewalls, and load balancers) into hosted VMs. NFV enables network administrators to flexibly create network functions and services as they need them, reducing capital expenditure and operating expenses, and enhancing business and network services agility. Cavium 25/50GbE technology is integrated into the DPDK and can deliver up to 68 million packets per second to host the most demanding NFV workloads.

**TRUSTED, RELIABLE, AND INTEROPERABLE**

Cavium is an industry leader in 25/50GbE and was the first to demonstrate end-to-end interoperability for 25Gb, 50Gb, and 100Gb Ethernet solutions. The Lenovo ThinkSystem QLogic QL45212/262/214 adhere to standards that ensure interoperability with a wide range of network FCoE and iSCSI solutions. In addition, QLogic technology provides an easy upgrade path to 100GbE networks that utilize multiple 25/50GbE lanes.

**BETTER TOGETHER**

The QLogic 10/25/50Gb Ethernet adapters, along with the 25/50/100GbE ThinkSystem NE2552E Flex Switch, are solution tested by Lenovo to provide the best integration possible for Lenovo compute, storage, and networking in the data center. Flex System compute, adapter, and switch options, designed to work together, result in smooth installations and reliable operations.

## Host Bus Interface Specifications

### Bus Interface

- PCI Express® (PCIe®) Gen3 x16, Gen2 x16 (electrical)

### Host Interrupts

- MSI-X supports independent queues

### I/O Virtualization

- SR-IOV (up to 192 virtual functions)
- NIC partitioning (NPAR) (up to 16 physical functions)
- United fabric port partitioning (UFP) (up to 16 physical functions)

### Compliance

- PCI Express Base Specification, rev. 3.1
- PCI Express Card Electromechanical Specification, rev. 3.0
- PCI Bus Power Management Interface specification, rev. 1.2
- Advanced Configuration and Power Interface (ACPI), v2.0

## Ethernet Specifications

### Throughput

- 10Gbps line rate per-port in 10GbE mode
- 25Gbps line rate per-port in 25GbE mode
- 50Gbps line rate per-port in 50GbE mode (using two lanes)

### Ethernet Frame

- Standard MTU sizes and jumbo frames up to 9,600 bytes

### Stateless Offload

- IP, TCP, and user datagram protocol (UDP) checksum offloads
- TCP segmentation offload (TSO)
- Large send offload (LSO)
- Giant send offload (GSO)
- Large receive offload (LRO)
  - LRO (Linux)
  - Receive segment coalescing (RSC) (Windows)
- Receive side scaling (RSS)
- Transmit side scaling (TSS)
- Interrupt coalescing
- VMware NetQueue, Microsoft® Hyper-V dynamic VMQ (up to 208 dynamic queues), and Linux Multiqueue
- Universal RDMA

## Tunneling Offloads

- VXLAN
- NVGRE
- GRE
- GENEVE

## Compliance

- IEEE Specifications:
  - 802.3-2015 (1Gb, 10Gb, and 25Gb Ethernet Flow Control)
  - 802.3-2015 Clause 72 (10Gb backplane)
  - 802.3by-2016 (25G Ethernet)
  - 802.1ax (Link Aggregation)
  - 802.1Qbb (Priority-based Flow Control)
  - 802.1Qaz (DCBX and ETS)
  - 802.1q (VLAN)
- Other Specifications:
  - 25/50G Ethernet Consortium—25G and 50G Specification
  - IPv4 (RFC 791)
  - IPv6 (RFC 2460)
  - 1588-2002 PTPv1 (Precision Time Protocol)
  - 1588-2008 PTPv2

## RDMA Specifications

### Universal RDMA

- RoCE
- RoCEv2
- iWARP
- Storage over RDMA: iSER, SMB Direct, S2D, and NVMe over Fabrics
- NFSoRDMA

## FCoE Specifications

### Performance

- Up to 3.6 million FCoE IOPS

## iSCSI Specifications

### Performance

- Up to 2.9 million iSCSI IOPS
- Lossless iSCSI-type-length-value (TLV) over data center bridging (DCB)

## Tools and Utilities

### Management Tools and Device Utilities

- QLogic Control Suite integrated network adapter management utility (CLI) for Linux and Windows
- QConvergeConsole (QCC) integrated network management utility (GUI) for Linux and Windows
- QCC Plug-ins for vSphere (GUI) and ESXCLI plug-in for VMware
- QCC PowerKit (Windows PowerShell®) cmdlets for Linux and Windows
- Pre-boot unified extensible firmware interface (UEFI) Device Configuration pages in system BIOS
- Native OS management tools for networking
- SMI-S

### Boot Support

- Unified extensible firmware interface (UEFI)
- Pre-execution environment (PXE) 2.0
- FCoE boot from SAN (QL45262 only)
- iSCSI remote boot (QL45262 only)

### Operating Systems

- For the latest applicable operating system information, see <http://static.lenovo.com/us/en/serverproven/index.shtml>

## Physical Specifications

### Ports

- QL45212: dual-port, 10/25/50GbE Lenovo Flex System RDMA-NIC mezzanine
- QL45262: dual-port, 10/25/50GbE Lenovo Flex System RDMA-CNA mezzanine
- QL45214: quad-port, 10/25/50GbE Lenovo Flex System RDMA-NIC mezzanine

### Form Factor

- Custom mezzanine form factor for the Lenovo Flex System

## Environment and Equipment Specifications

### Temperature

- Operating: 0°C to 55°C (32°F to 131°F)
- Storage: -40°C to 65°C (-40°F to 149°F)

### Humidity (Relative, Non-condensing)

- Operational: 10% to 80%
- Non-operational: 93% maximum at 65°C

**Airflow**

- 185LFM @ 55°C

**Power**

- Typical: 14.9W

**New Zealand and Australia**

- AS/NZS: Class A

**Korea**

- KC-RRA Class A

**Agency Approvals—Safety**

**US and Canada**

- UL 60950-1
- CSA C22.2

**Europe**

- TUV EN60950-1
- TUV IEC 60950-1
- CB Certified

**Agency Approvals—EMI and EMC (Class A)**

**US and Canada**

- FCC Rules, CFR Title 47, Part 15, Subpart Class A
- Industry Canada, ICES-003: Class A

**Europe**

- EN55032
- EN55024
- EN61000-3-2
- EN61000-3-3

**Japan**

- VCCI: Class A

**Ordering Information**

**Lenovo Part Numbers**

**QL45212: 2×10G/25G/50GbE NIC with Universal RDMA**

- QL45212HMKR-LN-BK
- QL45212HMKR-LN-FR

**QL45262: 2×10G/25G/50GbE CNA with Universal RDMA, iSCSI, and FCoE**

- QL45262HMKR-LN-BK
- QL45262HMKR-LN-FR

**QL45214: 4×10G/25G, 2x50GbE NIC with Universal RDMA**

- QL45214HMKR-LN-BK
- QL45214HMKR-LN-FR



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