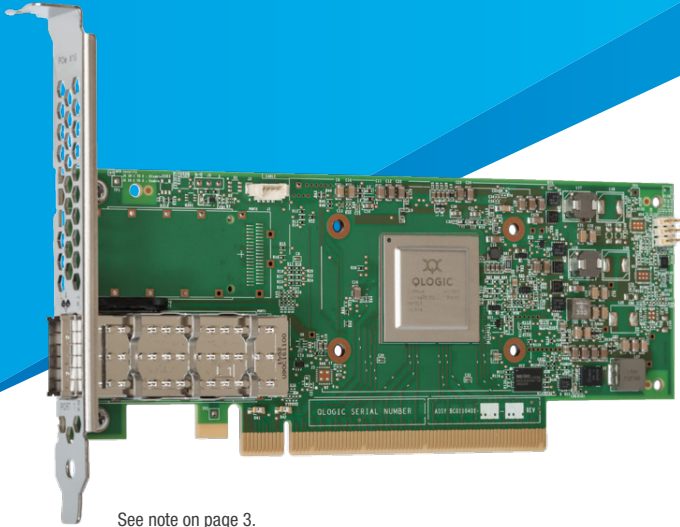# FastLinQ QL45611HLCU

100Gb Intelligent Ethernet Adapter

See note on page 3.

- Industry's most powerful 100GbE adapter delivers the best price and performance ratio versus 10GbE

- Increase VM density and accelerate multitenant networks with full offload for tunneling protocols

- Build the most powerful scale-out storage systems with Cavium's unique support of universal RDMA technologies (RoCE, RoCEv2, and iSER)

- Accelerate the most demanding telco NFV workloads with the Cavium DPDK high-speed packet processing engine

- Orchestrate and manage hyperscale OpenStack® deployments with the Cavium cloud-enabled management framework

OVERVIEW

Cavium FastLinQ® QL45611HLCU Intelligent Ethernet Adapters leverage fifth-generation technology to deliver true 100Gb per second (100Gbps) Ethernet performance. Integrated, advanced networking eliminates I/O bottlenecks and conserves CPU cycles. Optimized for use across enterprises, managed service providers (MSPs), and large public and scalable public cloud deployments, the QL45611HLCU enables organizations to achieve new levels of performance in physical, virtual, and cloud environments.

IEEE specifications 100GBASE-CR4 for direct attach copper (DAC) and 100GBASE-SR4 for multimode fiber (MMF) enable network bandwidth to be cost-effectively scaled. The specifications support next-generation server and storage solutions residing in cloud and Web-scale data center environments. Cavium is a leading innovator driving 100GbE technologies across both enterprise and cloud market segments.

The Cavium FastLinQ QL45611HLCU 100GbE adapter delivers advanced Ethernet solutions that are specifically designed to meet requirements from leading enterprise and cloud providers. Cavium features that collectively deliver the most advanced 100GbE adapter include:

- Cutting-edge server virtualization technologies—single-root I/O virtualization (SR-IOV) and NIC partitioning (NPAR)

- 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)

- Multiple RDMA technologies—RDMA over Converged Ethernet (RoCE), RoCEv2, and iSCSI Extensions for RDMA (iSER)

REDUCE CAPITAL EXPENDITURE AND OPERATING EXPENSE

QL45611HLCU 100GbE technology delivers better price-per-gigabit ratio versus 10GbE. 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.

ACCELERATE ANY NETWORK WITH UNIVERSAL RDMA OFFLOAD

QL45611HLCU 100GbE technology supports RoCE acceleration to deliver low latency, low CPU utilization, and high performance on Windows Server® Message Block (SMB) Direct 3.0 and 3.02, and iSER. QL45611HLCU 100GbE adapters have the unique capability to deliver universal RDMA that enables RoCE and RoCEv2. Cavium's multi-RDMA and emerging low-latency I/O bus mechanisms such as NVM 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. QL45611HLCU 100GbE technology supports:

- VMware® NetQueue

- Windows® Hyper-V® Virtual Machine Queue (VMQ)

- Linux® Multiqueue

- Windows, Linux, and VMware switch-independent 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 100Gbps bandwidth per port. Public and private cloud virtualized server farms can now achieve four 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 GRE, NVGRE, VXLAN, and GENEVE. Although overlay networks can resolve virtual Local Area Network (VLAN) limitations, native stateless offload engines are bypassed, which places a higher load on the system's CPU. QL45611HLCU 100GbE technology efficiently handles this load with advanced NVGRE, VXLAN, and GENEVE stateless offloading engines that access the overlay protocol headers. This access enables traditional stateless offloads of encapsulated traffic with native-level performance in the network. Additionally, QL45611HLCU 100GbE technology supports VMware NSX® and Open vSwitch (OVS).

HYPERSCALE ORCHESTRATION WITH OPENSTACK

QL45611HLCU 100GbE technology supports the OpenStack open source infrastructure for constructing and supervising public, private, and hybrid cloud computing platforms. It provides 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 auto-discovery technology.

ACCELERATE TELCO NETWORK FUNCTION VIRTUALIZATION (NFV) WORKLOADS

In addition to OpenStack, QL45611HLCU 100GbE technology supports NFV that 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. 100GbE technology is integrated into the Data Plane Development Kit (DPDK), and can deliver up to 60 million packets per second to host the most demanding NFV workloads.

TRUSTED, RELIABLE, AND INTEROPERABLE

QL45611HLCU 100GbE technology adheres to standards that ensure interoperability with a wide range of network solutions. Using advanced Cavium technologies based on mature software stacks, enterprise-class data centers can confidently deploy reliable, high-performance networks.

Host Bus Interface Specifications

Bus Interface
- PCI Express® (PCIe®) 3.0 x16, 2.0 x16 (electrical), 1.0 x16 (electrical); x16 (physical connector)

Host Interrupts
- MSI-X

I/O Virtualization
- SR-IOV (up to 120 virtual functions)
- NPAR (up to 8 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

Ethernet Specifications

Throughput
- 100Gbps line rate per port

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)
- 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 VMQ (up to 160 queues), and Linux Multiqueue
- RDMA

Network Virtualization
- GRE
- VXLAN
- NVGRE
- GENEVE

Compliance
- IEEE Specifications:
  - *100GBASE-CR4 (Direct Attach Copper)*
  - *100GBASE-SR (Multimode Fiber)*
  - *802.1AX- (Link Aggregation)*
  - *802.1p (Priority Encoding)*
  - *802.1q (VLAN)*
  - *802.1Qau (Congestion Notification)*
  - *802.1Qaz (DCBX/Enhanced Transmission Selection)*
  - *802.1Qbb (Priority-Based Flow Control)*
  - *1588-2002 PTPv1 (Precision Time Protocol)*
  - *1588-2008 PTPv2*
- Other specifications:
  - *IPv4 (RFQ 791)*
  - *IPv6 (RFC 2460)*

RDMA Specifications

Converged Ethernet
- RoCE
- RoCEv2
- iSER

Tools and Utilities

Management Tools and Device Utilities
- QLogic Control Suite integrated network adapter management utility (CLI) for Linux and Windows
- QConvergeConsole PowerKit cmdlets for Linux and Windows
- QConvergeConsole integrated network management utility (GUI) for Linux and Windows
- QConvergeConsole Plug-ins for vSphere® (GUI) and ESXCLI plug-in for VMware
- Native OS management tools for networking

Boot Support
- Unified extensible firmware interface (UEFI)
- Pre-execution environment (PXE)

APIs
- SNIA HBA API v2
- SMI-S

Operating Systems
- For the latest applicable operating system information, see http://driverdownloads.qlogic.com

Server Support

- Cisco UCS® C480 ML M5

Physical Specifications

Ports
- QL45611: Single 100Gbps Ethernet quad small form factor pluggable (QSFP28) cage
- Supports CAUI-4 compliant QSFP modules

Form Factor
- Low profile PCIe card (6.6in. × 2.54in.)
- Custom form factors also available

Environment and Equipment Specifications

Temperature
- Operating: 0°C to 55°C (32°F to 131°F)
- Storage: −20°C to 70°C (−4°F to 158°F)

Humidity
- Operating: 10% to 90%
- Storage: 5% to 95%

Maximum Cable Distances
- 5m DAC
- 70m OM3 multimode fiber
- 100m OM4 multimode fiber

Note:
All advertised features are enabled in the hardware. Actual feature availability is dependent on software driver releases. See the release notes.

Picture may not be representative of the final shipping product.

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
- EN55022
- EN55024
- EN61000-3-2
- EN61000-3-3

Japan
- VCCI: Class A

New Zealand and Australia
- AS/NZS: Class A

Korea
- KC-RRA Class A

Taiwan
- BSMI CNS 13438

Ordering Information

QL45611HLCU
- QSFP28 cage for DAC connectivity
- Can also be used with industry-standard 100G optical modules provided by customer (optical modules not included)

Cisco Product ID
- UCSC-PCIE-QS100GF
- UCSC-PCIE-QS100GF=(Spare)