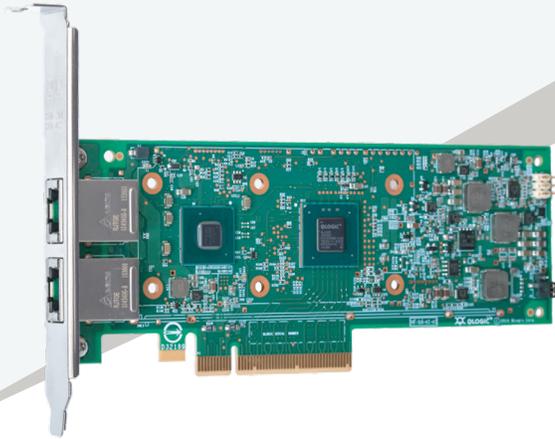# MARVELL®

Investment Protection with High-Performance 10GBASE-T

Marvell FastLinQ adapters with 10GBASE-T connections provide investment protection to easily transition from 1GbE to 10GbE performance while reducing cost instead of migrating to the higherpriced SFP+ optical connectivity.

KEY BENEFITS

- 10Gbps bandwidth, backward compatible with 1GbE (auto negotiation)
- Compatible with CAT6a/7 UTP cabling up to 100 meters and CAT6 cabling up to 40 meters
- Extensive virtualization support
- Universal remote direct memory access (RDMA)
- NVMe over fabrics with universal RDMA
- Switch-independent NIC Partitioning (NPAR), with up to eight partition assignments per 10GbE link
- VLAN support with VLAN tagging
- Full suite of stateless offloads

WHEN CUTTING COSTS RESTRICTS POTENTIAL PERFORMANCE

The high cost of 10GbE top-of-rack switches and optical cabling has slowed the migration from legacy 1GbE infrastructure to new higher performance 10GbE. Many enterprise customers using the latest generation servers from OEMs (like Dell®, HPE®, Lenovo®, and others) are still connecting to legacy 1Gb Ethernet (1GbE) networks. This makes it virtually impossible for these customers to reach the full potential of the compute capability of these servers since they simply don't have enough network bandwidth available.

The alternative is to utilize 6-10 1GbE connections, which increases complexity and can impact reliability due to the large number of connections. In most cases, settling for 1GbE connectivity was a trade-off made because many IT departments don't have the budget to upgrade both the compute and network infrastructure at the same time, and thus new server technology was deployed connected to legacy 1GbE networks.

OVERCOMING THE COST BARRIER

Marvell® FastLinQ® 41000 Series 10GBASE-T ethernet adapters overcome the cost barrier by offering higher performance with the low-cost CAT6A/7 cabling. FastLinQ 10GBASE-T ethernet adapters are fully backward compatible with 1GbE networks and utilize the same RJ-45 connectors as 1GbE adapters. This eliminates the need to use expensive SFP+ optics or DAC cables. Marvell 10GBASE-T adapters support cable length of up to 100 meters compared to DAC cables limited to 7 meters. In addition, CAT6A cable costs averages $1-2 per foot and comes in a variety of colors, which helps to easily identify specific network connections in a server rack.

Table 1 compares the typical cost of these cable types.

Table 1. Typical Cost by Connector Type

Connector Type	Used with	Typical Cost*
SFP+Transceiver	10Gb SFP+ I/O Adapter	$600-$900 each
10GbE Direct Attach Copper (DAC) Cable	10Gb SFP+ I/O Adapter	$60-$200 per meter 1/3/5/7 meter lengths
CAT6-A Copper Cable, RJ-45	1Gbase-T or 10GBASE-T Adapter	$1-$2/meter, up to 100 meters

*Source: Internet Price from CDW.COM for OEM-branded/supported products.

Figure 1. Low-cost CAT6A Cabling

REDUCED COST TO UPGRADE

For example, let's compare deploying 10 servers with a pair of 10GbE connections per server using optical, DAC, or 10GBASE-T connections. The cost comparison would break down to look like Table 2 below. As you can see, deploying 10GBASE-T can save 46% compared to the SFP+ optical transceiver implementation.

Table 2. Total Cost by Connector Type

Connector Type	Adapter Costs	5M Cable Costs	Trans-ceiver Cost	Total Cost
10GBE SFP+ with Optics	$600 x 10 = $6000	$50 x 20 = $1000	$600 x 10 = $6000	$13,000
10GbE SFP+ with DAC	$600 x 10 = $6000	$300 x 20 = $6000	N/A	$12,000
10GBASE-T	$700 x 10 = $7000	$5 x 20 = $100	N/A	$7,100

The Marvell FastLinQ 41000 Series 10GBASE-T adapters can auto negotiate with Ethernet switches and connect to either a 1GbE switch port or a 10GbE switch port. Given that the network infrastructure will eventually be upgraded, 10GBASE-T technology provides a way to "future proof" server configurations to connect to 1GbE networks today, and 10GbE networks tomorrow.

THE MARVELL DIFFERENCE

Marvell FastLinQ 41000 Series 10GBASE-T adapters support several advanced features that reduce CPU utilization and improve performance and server virtualization scalability. The Marvell 10GBASE-T adapters also have added intelligence including stateless and tunnel offloads, network partitioning (NPAR), and support for SR-IOV when operating in both 1GbE or 10GbE modes. These advanced features reduce CPU utilization and optimize server I/O connectivity in virtual server environments. The result is faster applications and more VM scalability for the servers they are installed in.

UNIVERSAL REMOTE DIRECT MEMORY ACCESS

All Marvell FastLinQ 41000 Series adapters support Universal RDMA. This includes support for RDMA over Converged Ethernet (RoCE), RoCEv2 (sometimes referred to as Routable RoCE), and iWARP (Internet wide area RDMA protocol). The Marvell adapters support any of these RDMA types concurrently. This enables customers to avoid a vendor lock-in with a specific type of RDMA.
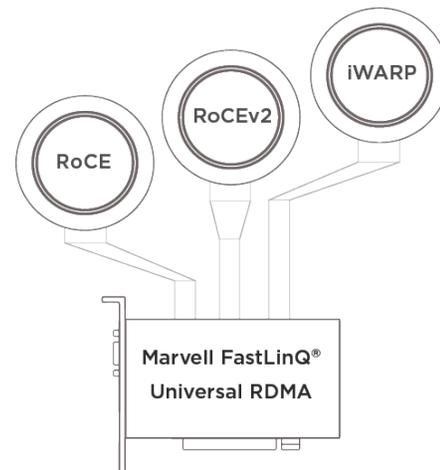

Figure 3. Marvell FastLinQ Universal RDMA

Figure 2. FastLinQ Adapters Support Multiple RDMA Protocols Concurrently

With RDMA, latency is reduced significantly. Table 3 shows the latency improvement compared to standard L2 NIC performance for each of the three different types of RDMA implementations.

Table 3. Latency Improvements1

RDMA Types	Latency Improvement vs. L2 NIC, no RDMA (Frame Size -64 Bytes)
RoCE v1/v2	53% lower
iWARP	10% lower

DESIGNED FOR NEXT-GEN SERVER VIRTUALIZATION - SDS AND SDN

The FastLinQ 41000 Series 10GBASE-T Ethernet Adapters support today's most compelling set of powerful networking virtualization features: SR-IOV, NPAR, tunneling offloads (VXLAN, GRE, GENEVE, and NVGRE), and industry-leading performance, thus enhancing the underlying server virtualization features. In addition FastLinQ ethernet adapters are fully supported for SDS platforms like VMware vSAN, Microsoft Storage Spaces Direct (S2D) and SDN platforms like VMware NSX and NSX-T, RedHat OpenStack Platform (RHOSP) and others.

- SR-IOV delivers higher performance and lower CPU use with increased virtual machine (VM) scalability.

- Marvell NPAR enables up to 16 physical, switch-agnostic, switch-independent NIC partitions per adapter. Dynamic and fine-grained bandwidth provisioning enables control of network traffic from VMs and hypervisor services.

- Availability of both RSS and TSS allows for more efficient load balancing across multiple CPU cores.

NVME OVER FABRICS

Marvell FastLinQ 41000 Series 10GBASE-T Ethernet Adapters deliver enterprise-class performance and reliability. FastLinQ enables seamless upgrades to next generation storage fabrics by delivering concurrent offloads for NVMe-oF (RoCE, iWARP and TCP) , iSER and iSCSI.

MANAGEMENT

All Marvell FastLinQ adapters are managed using any of the following management utilities from Marvell:

- Marvell® QLogic® Control Suite (QCS) CLI

- QConvergeConsole® (QCC) GUI

- QCC PowerShell Cmdlets

- QCC VMware vCenter Plug-in

MARVELL FASTLINQ 10GBASE-T ADAPTER FEATURES

- PCIe™ Gen 3 (8 GT/s) host bus interface

- 20Gbps full-duplex per port, backward compatible to 1GbE

- Compatible with CAT6a/7 UTP cabling up to 100 meters and CAT6 cabling up to 40 meters

- Extensive virtualization support

  - Single root I/O virtualization (SR-IOV), Microsoft® VMQ, and VMware® NetQueue™

  - Network Virtualization using Generic Routing Encapsulation (NVGRE) packet task offloads, Virtual Extensible LAN (VXLAN) packet task offloads, Generic Routing Encapsulation (GRE) offloads, and Message Signaled Interrupt (MSI-X)

- Universal remote direct memory access (RDMA)

  - RoCEv1, RoCEv2, iWARP

  - Concurrent RoCE and iWARP on single adapter

- NVMe over fabrics with RDMA and TCP

- Switch-independent NIC Partitioning (NPAR), with up to eight partition assignments per 10GbE link

  - Gives the appearance of multiple adapter ports to the operating system, and each can be customized to allocate bandwidth as needed

  - Flexible configuration of either 1 to 8 NIC, or 1 to 7 NIC + 1 (FCoE or iSCSI) HBA configurations per port

- VLAN support with VLAN tagging

- Full suite of stateless offloads

  - Large send/segment offload (LSO)

  - Large receive offload (LRO)

  - Giant send offload/generic segmentation offload (GSO)

  - Receive segment coalescing (RSC)

  - Interrupt coalescing

  - TCP segmentation offload (TSO)

  - Receive side scaling (RSS)

  - Transmit side scaling (TSS)

  - IPv4 and IPv6 TCP/UDP

  - Checksum offloads (CO)

- VxLAN, NVGRE, GENEVE stateless offloads

1. Statistics based on head-to-head performance benchmarks conducted in Marvell Labs.

2. https://www.marvell.com/ethernet-adapters-and-controllers/fastlinq-performance-nics/41000-ethernet-adapters/documents.jsp

SUMMARY

When the time comes to upgrade servers, using 10GBASE-T adapters will provide significantly better performance and capabilities, even if connected to a 1GbE network. When connected to 10GbE networks, the Marvell FastLinQ 41000 Series adapters provide the industry's most flexible, scalable high-performance 10GbE connectivity option available today.

ABOUT MARVELL: Marvell first revolutionized the digital storage industry by moving information at speeds never thought possible. Today, that same breakthrough innovation remains at the heart of the company's storage, processing, networking, security and connectivity solutions. With leading intellectual property and deep system-level knowledge, Marvell semiconductor solutions continue to transform the enterprise, cloud, automotive, industrial, and consumer markets. For more information, visit www.marvell.com.