Accelerating the move to 10 Gigabit Ethernet with 10GBASE-T

By Carl Hansen and Rich Hernandez

An expanding ecosystem of cost-effective 10GBASE-T technologies smooths the way for mainstream enterprise deployment of 10GbE networks that support the needs of a virtualized environment.

To establish an IT infrastructure that responds quickly to changing business requirements, IT managers are applying strategies such as virtualization and cloud computing together with server, application and network consolidation. As they make these enhancements to support additional processes and applications, they need to ensure that the network itself does not become a bottleneck.

For example, growing numbers of hosted applications and virtual machines can combine to dramatically increase the demand for network I/O. As a result, enterprises using Gigabit Ethernet (GbE) to scale their networks may find that their networks are becoming ever more complex and constricted. IT managers at medium-to-large enterprises need an easy way to simplify their networks, and upgrade network performance and agility to meet the requirements of an efficient, virtualized data center.

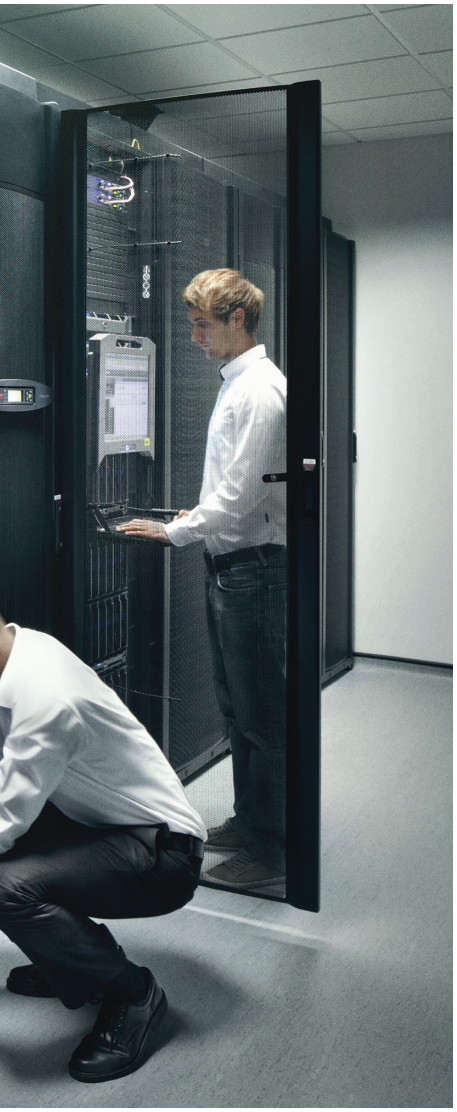
Now is the time to consider making the move to 10 Gigabit Ethernet (10GbE). The 10GbE ecosystem is ready to deliver and support cost-effective solutions across the network. In particular, the 10GBASE-T standard provides decision makers with an easy, incremental migration path to 10GbE networking.

Changes in the 10GbE ecosystem

Factors advancing the need for 10GbE continue to multiply and evolve, with the primary drivers being fast-growing server virtualization and the convergence of local area network (LAN) and storage area network (SAN) traffic. Organizations are consolidating applications onto high-performing virtualized servers, which increases the demand for high-bandwidth networking infrastructures. The move toward unified storage also heightens demand for bandwidth, with the convergence of multiple traffic types loading network ports.

Enormous amounts of bandwidth are required by media-rich applications such as video and imaging, as well as business applications that heavily use

"Now is the time to consider making the move to 10 Gigabit Ethernet (10GbE). The 10GbE ecosystem is ready to deliver and support cost-effective solutions across the network."



storage and big data. Moreover, the adoption of cloud computing may call for deploying large numbers of servers to the IT infrastructure, many of which support multi-core processors. The processing performed by these servers intensifies data communications over the network.

Although necessity has already pushed many large cloud computing providers and other internet giants to adopt 10GbE, some enterprises have held back until the cost and power demands of the technology improved and the range of connectivity choices expanded. These enterprises are finding that time has worked in their favor in several ways.

Their options for deploying 10GbE connectivity are no longer limited to fiber optic or small form-factor pluggable + (SFP+) direct-attach copper connections. Now, 10GBASE-T offers an alternative that is designed to be less expensive than fiber optic media and have a greater reach than the 23-foot (7-meter) limit of SFP+ direct-attach copper cabling, enabling economical end-of-row usage models.

In addition, 10GBASE-T is backward compatible with 1000BASE-T and supports link speed auto-negotiation, allowing IT professionals to deploy 10GbE incrementally. Organizations can add 10GBASE-T and connect it to an existing 1000BASE-T switch. In addition, 10GBASE-T supports the Energy-Efficient Ethernet standard to optimize the power consumption of the 10GBASE-T adapter — a feature not supported by 10GbE SFP+.

At the same time, the ecosystem has matured and is ready to support 10GbE across enterprise networks. Dell Networking switches provide 10GBASE-T connectivity to accelerate 10GbE deployments. Technology advancements in the latest generation of Intel® Ethernet 10GbE Converged Network Adapters (CNAs) and Network Daughter Cards (NDCs) for Dell PowerEdge servers help deliver significantly lower cost per port and power draw, compared with previous generations.

Intel Ethernet 10GbE CNAs and NDCs are also optimized to support virtualization and convergence. For example, Single Root I/O Virtualization (SR-IOV) capabilities take advantage of Flexible Port Partitioning technology, allowing administrators to create up to 126 virtual ports on one dual-port adapter. And support for Fibre Channel over Ethernet (FCoE) enables LAN/SAN convergence onto cost-effective Ethernet networks.

Network switches for a smooth transition

High-performance Dell Networking Ethernet switches help enterprise networks handle the escalating bandwidth demands of cloud, storage and big data usage models. For enterprises looking to consolidate server I/O at 10 Gbps, these switches provide cost-effective copper connectivity between servers and switches, maximizing investment protection and cable reuse.

Purpose-built for high-performing data center and cloud computing environments, the Dell Networking S4820T top-of-rack switch provides 10GBASE-T connectivity as well as 40 Gigabit Ethernet (40GbE) uplinks. This switch supports FCoE, which makes it well suited for enterprises consolidating LAN and SAN traffic over a common Data Center Bridging (DCB)–enabled 10GbE switching fabric. The Dell Networking S4820T is powered by the Dell Networking OS (formerly FTOS), which offers advanced monitoring and serviceability functions.

Dell Networking 8100 Series 10/40GbE switches are well suited for campus and medium-to-large business network aggregation. These high-density layer 3 switches can be used in converged Ethernet environments supporting virtualization, 10GbE traffic aggregation and Internet SCSI (iSCSI) storage environments with DCB. The switches come in configurations with 24 or 48 10GBASE-T auto-sensing GbE switching ports.

For advanced layer 3 distribution in office and campus networks, the Dell Networking N4000 Series provides energy-efficient 10GbE switching with 40GbE uplinks. The 24-port or 48-port 10GbE switches are ready for converged fabric requirements of SAN and LAN networks with loss-less operation for iSCSI environments with DCB. Hot-swappable expansion modules deliver quad-port 10GBASE-T connectivity.

Dell Networking N3000 Series GbE switches provide Power over Ethernet + (PoE+)–capable, non-blocking layer 3 switching. This switch has integrated 10GbE uplinks and supports dual-port 10GBASE-T modules.

10GbE connectivity for servers

Many enterprises have deployed blade servers in a move toward streamlined architecture for server and storage connectivity. The integration of I/O switch functionality within a blade enclosure enables IT to reduce the total amount of cabling required and boost reliability. Dell blade networking solutions extend the value of blade server investments for organizations moving to 10GbE.

Advantages of 10GbE networking

A combination of Dell and Intel technologies that support 10GBASE-T helps enterprises get the most out of a 10GbE deployment:

- **Performance:** Dell servers connecting with the latest Intel Ethernet 10GbE adapters are designed to provide the performance required for virtualization, cloud computing, big data and other demanding applications.
- **Agility:** Dell servers with Intel® Ethernet 10GbE connectivity help deliver the agility organizations need to align with business growth, meet customers' needs and expand with the business.
- **Simplicity:** A 10GbE fabric allows enterprises to unify networking, leading to cost-effective performance of next-generation storage networks.

The latest Dell PowerEdge servers provide a variety of other enhancements that deliver the horsepower and I/O performance needed for mission-critical applications. For example, the PowerEdge R920 high-performance rack server is powered by up to four processors from the Intel® Xeon® processor E7-4800 v2 product family, with up to 15 cores each. The processor supports more virtual machines and applications per server than previous-generation processors.

For 10GBASE-T connectivity, the PowerEdge R920 supports a variety of PowerEdge Select Network Adapters, including the Intel Ethernet X540 DP 10GBASE-T + I350 DP 1000BASE-T Network Daughter Card (NDC) and the Intel Ethernet X540 DP 10GBASE-T Converged Network Adapter (CNA).

Intel Ethernet CNAs and NDCs also support local and remote configuration, inventory and monitoring through the Lifecycle Controller integrated on Dell PowerEdge servers, helping simplify administrator tasks with a single, intuitive interface.

Powered by the Dell Networking OS, the Dell Networking MXL is a full-featured 1/10/40GbE layer 2 and layer 3 blade switch that is built for the Dell PowerEdge M1000e blade server chassis. The switch helps deliver exceptional bandwidth, scalability, performance and operational simplicity for data center and campus environments. To expand and aggregate bandwidth, the switch provides the flexibility to mix and match uplinks using Dell FlexIO modules, which include a 10GBASE-T media option.

The Dell Networking M I/O Aggregator is a flexible 1/10GbE aggregation switch similar to the Dell Networking MXL. The aggregator is designed to be installation-ready with all ports active, enabling instant plug-and-play deployment into converged networking environments. Its networking capabilities can be expanded through the addition of a FlexIO module that supports 10GBASE-T.

Both the Dell Networking MXL and the Dell Networking M I/O Aggregator support local switching of server-to-server, or east-west, traffic within the PowerEdge M1000e chassis. This support enhances network performance because traffic does not need to travel up to and back down from the data center core, as many other architectures require.

The Dell Networking M8024-k switch provides 10GbE connectivity for Dell PowerEdge M-Series blade servers equipped with the latest Intel® Ethernet-based 10GBASE-KR NDCs for running serial data over backplane systems. Through FlexIO modules, 10GBASE-T uplinks can be added or swapped as needed. The switch also supports GbE connections both to the blade server and to the LAN, giving the flexibility to meet changing data center demands.

For Dell PowerEdge rack servers, 10GbE connectivity is enabled by the Dell PowerEdge Select Network Adapter, an NDC that houses a LAN on Motherboard (LOM) subsystem. The Select Network Adapter family provides a set of flexible options to move from GbE to 10GbE without replacing servers. By offering GbE and 10GbE devices on the same network interface card (NIC), Select Network Adapters help maintain legacy GbE connectivity while delivering 10GbE availability for the latest functions and workloads. (For more information, see the sidebar, "Advantages of 10GbE networking.")

Available for select PowerEdge servers, both the full-height and low-profile configurations of the Intel® Ethernet X540 DP 10GBASE-T CNA provide 10GBASE-T connectivity with RJ-45 ports. The dual-port adapter offers cost-effective 10GbE connections to support bandwidth-intensive applications.

The CNA is designed to reduce I/O bottlenecks and enhance overall server performance through Virtual Machine Device Queues (VMDq) technology, a component of Intel® Virtualization Technology for Connectivity, which optimizes the processing of

virtualized data traffic to help reduce CPU utilization and improve bandwidth. With VMDq and Flexible Port Partitioning, administrators can spread data workloads across multiple processor cores and network I/O resources, independent of the network switch.

A flexible, scalable member of the Select Network Adapter family, the Intel Ethernet X540 DP 10GBASE-T + I350 DP 1000BASE-T NDC provides two ports of 10GBASE-T and two ports of 1000BASE-T. Its port configurations can be changed to easily meet evolving needs — for example, moving from two ports to four or from GbE to 10GbE. Auto-negotiation between GbE and 10GbE delivers the necessary backward compatibility. In a GbE environment, the NDC can act as a quad-port gigabit card, with all four ports providing GbE network performance. When the 10GbE ports are used, the GbE ports can act as dedicated management ports to heighten data center efficiencies.

Next-generation solutions to the bandwidth challenge

The 10GBASE-T standard enables cost-effective, streamlined 10GbE connectivity, which is critical for enterprises looking to reduce I/O bottlenecks created in their quest to enhance data center efficiency through virtualization and consolidation. Together with Dell PowerEdge servers and Dell Networking switches, the latest Intel Ethernet CNAs and NDCs that support 10GBASE-T technology are well suited for volume 10GbE deployments. These technologies accelerate and ease the transition to 10GbE, helping enterprises realize the full potential of their networks. PS

Authors

Carl Hansen is a senior product marketing engineer at Intel for the GbE and 10GbE Intel Ethernet server adapters for OEMs.

Rich Hernandez is a networking technologist at Dell working on server products, including GbE and 10GbE for rack, tower and modular servers.

Learn more

10GbE from Intel and Dell:
intelethernet-dell.com