



# Utilizing 10GBase-T for broad 10 Gigabit Ethernet deployment

By Robert Hartman and Carl Hansen

Virtualized data centers deploying Dell™ PowerEdge™ servers, Dell PowerConnect™ switches, and Intel® Ethernet server adapters can use 10GBase-T to broadly deploy 10 Gigabit Ethernet and help avoid I/O networking bottlenecks.



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Virtualization, increasingly powerful server platforms, and rising numbers of hosted applications and virtual machines have combined to dramatically increase the demand for additional I/O in the data center. Capitalizing on performance increases in the latest four-socket Dell server platforms, for example, enables organizations to host more virtual machines per server and more applications per virtual machine than ever before. As a result, the bottleneck in many data centers has now shifted to network I/O.

Organizations have addressed this challenge by adding Gigabit Ethernet (GbE) ports. But although this approach helps to increase I/O, it has also increased networking complexity. IT organizations can help reduce this complexity and provide the scalability to meet growing data demand by consolidating traffic from GbE ports onto fewer 10 Gigabit Ethernet (10GbE) ports, and leveraging technology advances that have helped dramatically improve the implementations of this consolidation.

Until now, either fiber optic or small form-factor pluggable + (SFP+) direct attach copper connections were available for deploying 10GbE connectivity. Both have limitations. The high cost of optical cabling and switches makes the optical connections appropriate for a limited number of usage models, while the 7 m (23 foot) reach of SFP+ direct attach copper cabling limits its use to short-distance connections.

IT managers need a different approach to enable broad 10GbE deployment—and 10GBase-T is well suited for the task. This article presents a best-practices deployment using the 10GBase-T standard in networks optimized with Dell servers and switches and Intel Ethernet server adapters using 10GbE technology.

## Driving the need for 10 Gigabit Ethernet

A number of recent advances in information and data center technologies are helping drive the need for a 10GbE fabric, including virtualization and server clustering, network convergence, and advanced storage architecture. The Internet is also a major factor, with new forms of Internet-based information delivery and an explosion of digital and social media content.

Organizations are consolidating applications onto high-performing virtualized servers, helping drive increased demand for high-bandwidth networking infrastructures. At the same time, sophisticated management tools, powerful applications, and the advent of cloud computing can require increasing the number of servers deployed in today's data centers. And as server processors move from dual to quad and octal cores, they are performing additional processing and producing increased data communications over the network.

Unified storage is also helping to increase the demand for high bandwidth. Organizations

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# “IT managers can use the Dell and Intel recipe to provide 10GbE performance for both top-of-rack switch and end-of-row usage models.”

moving to unified networking are simplifying network storage by merging multiple traffic types onto low-cost Internet SCSI (iSCSI) transport and Ethernet technology. This convergence significantly loads network ports because of the dynamic and random nature of the data, and IT planning for data over Ethernet places increased emphasis on bandwidth availability and utilization. Simply put, GbE cannot scale up to meet these demands—resulting in an environment that is ready for the benefits of 10GbE connectivity.

10GbE has emerged as a flexible, unified data center fabric for several reasons. It provides the bandwidth required for virtualization, today's powerful servers, and demanding applications. And 10GbE is expected to deliver the simplified network infrastructure needed to support cloud computing. 10GbE has also emerged as a cost-effective choice because it enables IT staff to consolidate multiple GbE ports onto fewer, more powerful 10GbE ports to help reduce cabling and costs for interconnection.

## Exploring usage models for the 10GBase-T standard

Today, IT managers can select from the following 10GbE interconnect and switch options based on specific intended uses:

- **SFP+ direct attach copper:** These connections are a good choice for deploying 10GbE within blade server enclosures or racks over short distances.
- **Optical cabling:** Fiber optic connections are well suited for areas of heavy traffic aggregation such as the network backbone.
- **10GBase-T:** Now, IT managers have 10GBase-T as a third option for either top-of-rack switch or end-of-row usage models.

This mix of interconnect and switch options provides the flexibility to choose the appropriate option for each situation. The 10GBase-T standard defines 10GbE over Category 6 (Cat 6) or Cat 6a copper wire with RJ-45 connectors. This continuation of the Ethernet standard helps ensure a smooth transition from GbE networks, and backward compatibility to GbE allows flexibility in upgrading the infrastructure. For example, an organization can upgrade its servers and its switch infrastructure at different times and know they will remain compatible during the transition.

Benefits offered by 10GBase-T include a mix of simplicity and low cost. Many networks today already have Cat 6 or Cat 6a cabling in place, so they are 10GBase-T ready. Any fiber already in place can be repurposed for 10GbE. And new Cat 6 or Cat 6a cabling can be added at a lower cost than either direct attach twinaxial copper or fiber multimode connections. Finally, training and knowledge transfer costs can be reduced, because IT staff are already familiar with Ethernet technology and RJ-45 connectors.

Along with cabling, today's 10GBase-T network adapters are also cost-effective. Intel dual 10GBase-T adapters are the third generation of Intel Ethernet server adapters with 10GbE technology, and third-generation technology advancements help deliver significantly lower cost per port and power draw compared with previous generations.

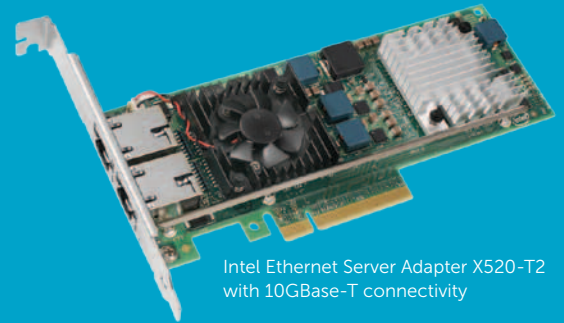
## Deploying 10GBase-T using Dell and Intel technologies

The Dell and Intel 10GBase-T deployment recipe brings together a combination of Dell server and switch technologies and Intel



# Blending a networking recipe for virtualized data centers

A mix of Intel and Dell technologies offers a recipe well suited for deployments using the 10GBase-T standard to deliver cost-effective 10 Gigabit Ethernet (10GbE) performance in virtualized data centers.



Intel Ethernet Server Adapter X520-T2 with 10GBase-T connectivity

## Intel Ethernet Server Adapter X520-T2

- Dual 10GBase-T connectivity is offered in a low-profile PCI Express (PCIe) 2.0 form factor.
- Included Intel Virtualization Technology for Connectivity (Intel VT-c) helps deliver high performance in virtualized server environments.
- Supported technologies under the Intel VT-c umbrella include Virtual Machine Device Queues (VMDq) technology and PCI-SIG Single Root I/O Virtualization (SR-IOV) standards.

- VMDq helps improve data processing by offloading functionality for sorting and queuing to the I/O controller from the hypervisor.
- Using the SR-IOV standard, the Intel Ethernet Server Adapter X520-T2 helps deliver direct assignment of a virtual function to a virtual machine, with mobility-enabling data isolation among virtual machines and migration of virtual machines.
- Internet SCSI (iSCSI) acceleration and iSCSI remote boot support storage over Ethernet by allowing storage and LAN traffic to share the existing Ethernet infrastructure using native iSCSI initiators in the OS.



## Intel Chip Chat

Intel Chip Chat is a series of podcast interviews ranging across a wide variety of technology topics. Episode 103 covers the advancements of 10GbE, including how integrating Media Access Control (MAC) and the physical layer (PHY) into a single processor helps reduce power and costs.

[intel.com/design/chipchat.htm](http://intel.com/design/chipchat.htm)

adapters (see the "Blending a networking recipe for virtualized data centers" sidebar). Ingredients include Dell PowerEdge rack and tower servers, Dell PowerConnect 8024 switches, and the Intel Ethernet Server Adapter X520-T2 with iSCSI support and Intel Virtualization Technology for Connectivity (Intel VT-c).

IT managers can use the Dell and Intel recipe to provide 10GbE performance for both top-of-rack switch and end-of-row usage models and data links from 1 m to 100 m:

- **Top-of-rack switch model:** This usage model is primarily used for aggregating all 10GbE connections—up to 24—in each individual rack. With dual 10GbE adapter ports, IT administrators can deploy a second PowerConnect 8024 switch per rack for redundancy.

- **End-of-row model:** Server network connections in the rack can connect all the way to the end of the row because of the 100 m reach of 10GBase-T. With the end-of-row model, organizations can use cost-effective patch panels in place of top-of-rack switches, helping reduce costs by avoiding an additional layer of switching.

Large enterprises can deploy 10GbE links across the backbone to the data center edge. The switch can be located at the edge or in a wiring closet and link to a PowerEdge T710 tower server using Intel Ethernet X520-T2 10GBase-T adapters.

## Addressing advanced high-bandwidth networking needs

Today's data centers demand flexible and scalable approaches to network I/O



Dell PowerEdge R910 rack server with the Intel Xeon processor architecture



Dell PowerConnect 8024, a 24-port 10GbE Layer 3 switch for mixed cabling environments

### Dell PowerEdge rack and tower servers

- Today's PowerEdge servers are based on powerful processors, such as the Intel Xeon® processor 5600 series and Intel Xeon processor 7500 series.
- These four-, six-, and eight-core processors support more virtual machines and applications per host than previous-generation processors.
- The innovative processor technologies in these PowerEdge servers offer enhanced efficiency and security options.

### Dell PowerConnect 8024 switch

- High-density 10GbE switching capability is available with 24 ports for high throughput and availability.
- Ready for converged Ethernet environments, the switch supports virtualization and iSCSI storage.
- Enterprise-class high-availability features include redundant hot-swappable power supplies and dual firmware image support for incremental image updates.

throughput to help meet the rigorous requirements of running mission-critical applications with increased performance and availability in virtualized and unified storage environments. The 10GBase-T standard enables cost-effective, streamlined 10GbE connectivity, and it can be well suited for volume 10GbE deployments in organizations continuing to enhance efficiency in their data centers through network consolidation, convergence, storage over Ethernet, and virtualization. Together with Dell PowerEdge servers and PowerConnect switches, the third generation of Intel adapters deploying 10GBase-T technology is designed to provide cost-effective, virtualization-optimized 10GbE network performance for top-of-rack switch and end-of-row model configurations. **PS**



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