Hewlett Packard Enterprise

Technical white paper

10GBASE-T: the 10GbE enabler

10GBASE-T ushers in era of affordable 10 Gb Ethernet

Contents

High costs associated with optical cabling and top-of-rack switches have delayed widespread adoption of 10 Gb Ethernet in many data centers. 10GBASE-T overcomes these cost barriers, opening the doors for cost-effective migration to 10GbE throughout the data center.

Executive summary

With the increase in server consolidation through virtualization in the data center, the resulting data demand has exceeded traditional 1 Gb/s throughput capabilities. Today these virtualized servers are typically configured with multiple 1 Gb/s ports in order to keep up with the I/O demands. The transition to a 10 Gb/s network overcomes these 1 Gb/s bandwidth limitations while dramatically simplifying cabling requirements, and also is the next natural progression in Ethernet speed. The recent availability of 10GBASE-T over common CAT 6a unshielded twisted pair (UTP) at attractive market prices enables rapid, large-scale adoption of 10GbE throughout the data center. This paper describes the details of 10GBASE-T and UTP media, its benefits, and why now is the right time to make the switch to 10GbE.

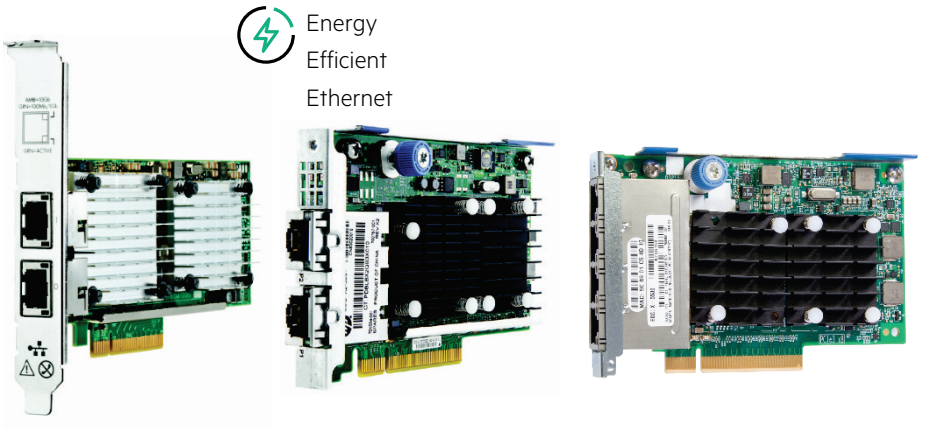

Figure 1. CN1100R 10Gbase-T, 530T,533FLR-T two-port 10GBASE-T adapters, and 536FLR-T Quad port adapter

Figure 2. CAT 6a UTP cabling with RJ45 connectors

10 Gb/s Ethernet

HPE Generation 9 multi-core, multi-socket servers with the E5-2600 processors allow users to increase the number of virtualized servers—and therefore, the number of applications—running on a single server, resulting in a significantly increased demand for I/O. The accelerated adoption of server virtualization consolidates the number of physical servers and increases the I/O demand well beyond the capabilities of a 1 Gb/s port.

The deployment of 10 Gb/s networks addresses these I/O bottleneck issues. In recent years, data center managers have been migrating portions of their data center to 10 Gb/s networks using a combination of direct attach copper (DAC) cables for short distances (up to 7 meters) and fiber optic cabling for longer distances (100s of meters, or more). Direct attach cables provide the connectivity from the 10GbE adapter to the top-of-rack switch, while fiber cabling connects to a switch at the end of the data center row.

While 10GbE deployments using SFP+ connections to accommodate either fiber optics or DAC connectivity improve the I/O capabilities for virtualized servers, the costs associated with a top-of-rack switch and expensive cabling limit the wide spread adoption. Industry analysts expect the adoption of 10GBASE-T to accelerate dramatically, becoming the predominant 10GbE connection for data center networks. Figure 3 already shows the widespread gain of 10GBASE-T projected over the next few years.

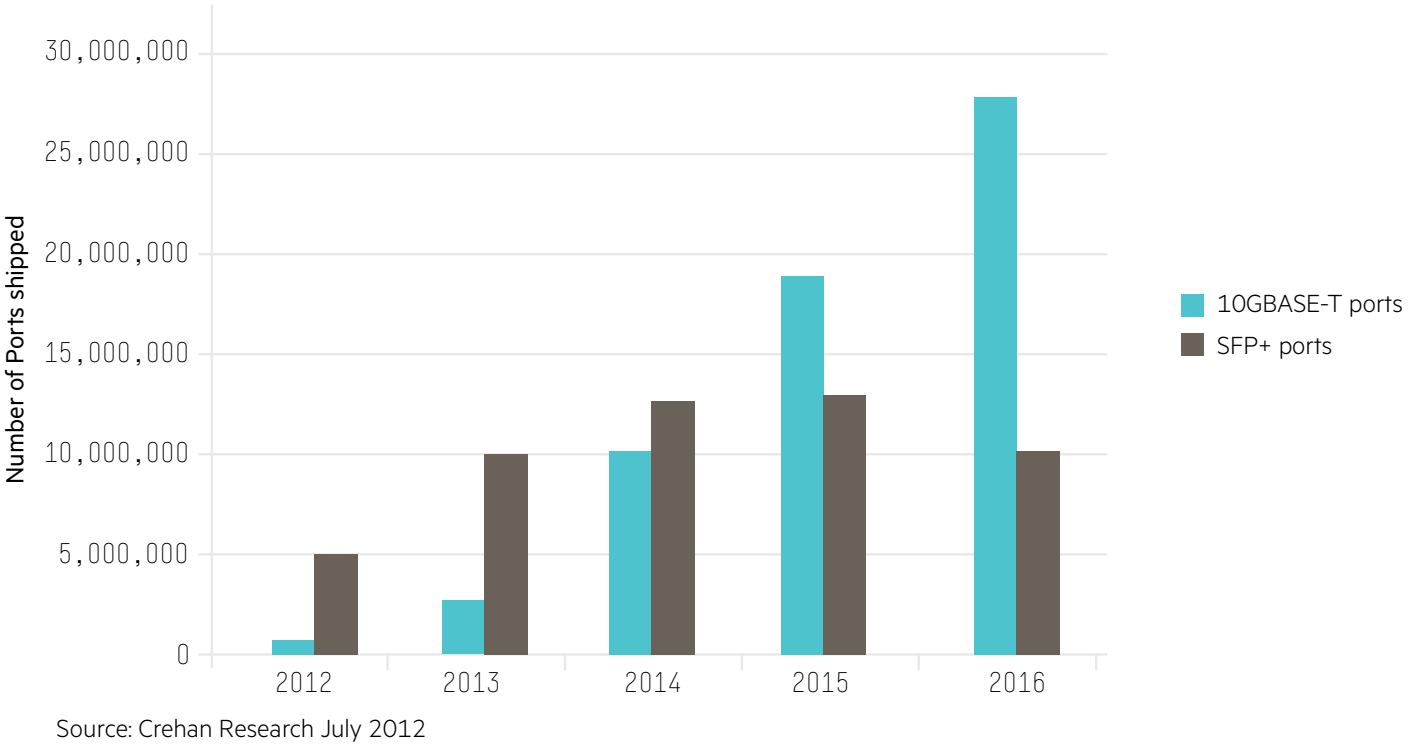

Figure 3. 10GBASE-T adoption continues to accelerate

10GBASE-T to the rescue

10GBASE-T over structured UTP cabling solves these problems and makes 10GbE available to a much broader market. 10GBASE-T with CAT 6a UTP cabling is the most flexible solution for most data center 10GbE networking applications. The raw cost of the cable itself is far less than either optical fiber or SFP+ DAC cables. Additional benefits include:

- Longer reach than SFP+ DAC
  - While direct attach copper (twinax) cables have been moderately successful over very limited distances, the more familiar UTP cabling—which has become so ubiquitous in today's data centers—affords an even lower cost solution with much longer reach; up to 100 meters. This makes CAT 6a UTP cabling the best universal solution for 10GbE requirements in today's data centers.
- Lower deployment cost than optical cabling
  - CAT 6a UTP cable is low cost and widely available. While optical fiber cable is a great solution for long distance (100s of meters, or more) 10GbE network backbone requirements, for connections less than 100 meters—typical for data center installations—CAT 6a cabling provides the optimum low cost, easy-to-use solution.
- Easier to install than optical cabling
  - CAT 6a cable is easy to install and maintain, allows for customized length, can be field installed, and is compatible with existing 1GbE switches and NICs.
  - Inexpensive wire cutting and crimping tools.
  - Familiar cables and RJ45 connectors.
  - Easy installation skill set.

- Ease of migration
  - CAT 6a UTP cabling is backward compatible with existing 1000BASE-T networks, allowing the cabling to be upgraded before upgrading the network switches and adapters. This allows for a smooth transition path for data centers that have an installed base of CAT 5e cabling that they need to upgrade.
- Advanced adapter virtualization
  - 10GBASE-T adapters incorporate new adapter virtualization technology called Network Partitioning, or nPar. This innovative technology allows a single dual-port 10GBASE-T adapter to be virtualized and present eight independent virtual adapters to the host O/S, with full fine-grain bandwidth control. This allows a single dual-port 10GbE adapter to replace eight 1GbE network connections, reducing cost and complexity.

By solving these key challenges with 10GbE deployment, 10GBASE-T has become the catalyst that finally makes 10GbE affordable and effective for use across the data center.

10GBASE-T adapters are now available

The Cavium based 10GBASE-T adapters are now available from Hewlett Packard Enterprise. Key benefits of the 10GBASE-T adapters include:

- Backward compatibility—can be deployed on 1GbE and 10GbE networks, providing easy migration to 10GbE
- Higher bandwidth and superior server virtualization than existing 1GbE
- Uses familiar CAT 6a cabling in the data center
- Cable distance support up to 100 meters
- Cable and port consolidation vs. multiple 1GbE connections
- Eliminates the need for top-of-rack switches

Below are the part numbers and key features for the HPE 10GBASE-T adapters:

- HPE Ethernet 10 Gb 2-port 530T Adapter: 656596-B21
- HPE FlexFabric 10 Gb 2-port 533FLR-T Adapter: 700759-B21
- HPE FlexFabric 10 Gb 4-port 536FLR-T Adapter: 764302-B21
- HPE Ethernet 10 Gb 2-port 521T Adapter: 867707-B21
- HPE StoreFabric CN1100R 10GBASE-T Converged Network Adapter: N3U52A
- Supported on HPE ProLiant Gen8 and Gen9 and HPE Apollo rack and tower servers
- Compatible with CAT 6a UTP cabling up to 100 meters
- Support for Energy Efficient Ethernet (EEE) to reduce power consumption up to 27 percent in network idle mode
- Inbox driver support for Windows®, Linux®, and VMware®
- Support for Network Partitioning (NPAR) to virtualize Physical Ports
- Support for RoCE and iWARP RDMA (521T)
- iSCSI and FCoE storage offloads (in FlexFabric adapter variants)
- Virtualization support including SR-IOV, Microsoft® VMQ and VMware NetQueue, and MSI-X
- Stateless offload support including LSO, TSO, RSS, TSS, and IPv4 and IPv6 offloads
- TCP/IP offload engine (TOE)
- Tunnel Offloads including NVRGE and VXLAN
- Powered by Cavium 57810S, and QL4101 controller

Conclusion

The 10GbE standards are mature, reliable, and well understood. 10GBASE-T breaks through important cost and cable installation barriers in 10GbE deployment as well as offering investment protection via backward compatibility with 1GbE networks. Deployment of 10GBASE-T will simplify the networking transition by providing easier path to migrate the HPE Generation 8 and 9 servers to 10GbE infrastructure in support of higher bandwidth needed for virtualized servers. The HPE 530T and 533FLR-T are the ideal solutions for data center managers considering the migration to 10GbE networks and they are available today.

Resources

HPE Flexible Network Adapters powered by Cavium

Learn more at

hpe.com/servers/ProLiantNICs

Cavium.com/info/hpe

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