

Overview of 10 Gigabit Ethernet technology - Part I

Originating for more than 25 years, Ethernet has met the growing demand for packet switching networks. Due to the low cost and reliability that have been challenging for years, the installation and maintenance are relatively simple, so Ethernet is increasingly used in network systems. To meet the speed requirements, Ethernet has adapted to handle many faster speeds as well as the capacity requirements associated with them.

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IEEE 802.3ae * 2002 (10 Gigabit Ethernet standard) [1] differs from previous Ethernet standards at some points as only implemented on fiber optic cables and only works in full-duplex mode (fullduplex mode) . With 10 Gigabit Ethernet, conflict detection protocols are unnecessary. Currently, Ethernet can handle up to 10 Gbit / s while still maintaining basic Ethernet properties such as packet format and existing capabilities and can easily switch to the new standard.

10 Gigabit Ethernet standard

The Ethernet 10 Gigabit standard extends the IEEE 802.3ae * standard protocols up to a transmission rate of 10 Gbit / s and extends the range of Ethernet applications such as WAN-compatible links. The 10 Gigabit Ethernet standard allows significant bandwidth increase while maintaining optimal compatibility with the installed platform of standard 802.3 interfaces, conserving previous investment in research, development and maintain existing principles of network operation and management.

Under the OSI (Open Systems Interconnection) model, Ethernet is basically in layer 1 and layer 2 protocols. The 10 Gigabit Ethernet retains the basic Ethernet architecture, including MAC protocol [2], Ethernet frame format and Minimum and maximum sizes of frames. True to Gigabit Ethernet, 1000BASE-X [1] and 1000BASE-T [1], following the standard Ethernet model, 10 Gigabit Ethernet continues the Ethernet revolution in terms of speed and distance, while retaining architecture. Ethernet has been used in other Ethernet specifications. Since 10 Gigabit Ethernet is a full-duplex (full-duplex) technology, it does not need the CSMA / CD [3] protocol used in previous Ethernet technologies (in some ways). , 10 Gigabit Ethernet is commensurate with the original Ethernet model).

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*Figure 1 Architectural components of 802.3ae **

At the physical layer (layer 1 of the OSI model), a physical layer Ethernet device (PHY) connects the transmission medium as fiber or copper cable to the MAC layer [2] via a coupling technology (see Figure 1). In addition, architecture Ethernet divides the physical layer into three subclasses: PMD (Physical Medium Dependent), PMA (Physical Medium Attachment) and PCS (Physical Coding Sublayer). PMDs provide physical connectivity and signaling for the transmission environment; For example, optical transceivers are PMDs. PCS includes encryption (eg 64B / 66B) and a serializer or multiplexor. The IEEE 802.3ae * standard defines two types of PHY: PHY LAN and PHY WAN. They provide the same functionality, except the WAN PHY has an extended feature set in PCS that allows connection to some other networks.

10 Gigabit Ethernet market

Current Ethernet technology is the most deployed technology for high-speed LAN environments. Businesses all over the world have invested in cables, equipment, processes and training courses specializing in Ethernet. In addition, the presence of Ethernet everywhere has kept its cost low and with every deployment of next-generation Ethernet technology, deployment costs tend to decrease. In today's networks, increasing global network traffic is driving service providers, administrators, and enterprise network designers to pay more attention to high-speed network technologies to address Demand for bandwidth is increasing. Currently 10 Gigabit Ethernet is 10 times faster than Gigabit Ethernet. With the addition of 10 Gigabit Ethernet to the family of Ethernet technologies, a LAN can now reach longer distances and can support more bandwidth-intensive applications. The 10 Gigabit Ethernet also satisfies several speed and efficiency criteria and is an obvious choice for the development, expansion and upgrading of existing Ethernet networks:

A customer's existing Ethernet infrastructure can work easily with 10 Gigabit Ethernet. New technology provides low cost including profitability and price support compared to current selection technologies.

The use of ready-to-use process, protocols, and management tools to deploy and 10 Gigabit Ethernet shows familiar management tools and a common skill foundation.

Flexibility in network design with server connections, switches and routers.

Many sources of standards-based products that work together have been challenged for a long time.

While Ethernet 10 Gigabit is penetrating the market and equipment vendors transfer 10 Gigabit Ethernet network devices, the next step for enterprise networks and service provider networks is bandwidth combination. Multi-gigabit with smart services, leading to multi-gigabit, smart, multi-gigabit networks with backbone and server links in the range of up to 10 Gbit / s. Convergence of voice networks and data running on Ethernet has become a realistic option. And while TCP / IP integrates advanced services and features, such as voice and video encapsulation, basic Ethernet can also carry these services without modification.

The 10 Gigabit Ethernet standard not only increases the speed of Ethernet to 10 Gbit / s, but also extends the interconnection capability and its operating range up to 40 km. Like Ethernet Gigabit, 10 Gigabit Ethernet (IEEE 802.3ae *) supports both fiber optic transmission media 'singlemode' [4] and 'multimode' [4]. However, for 10 Gigabit, the distance for 'single-mode' fiber optic cable is extended from 5 km in Gigabit Ethernet to 40 km in 10 Gigabit Ethernet. The advantage of achieving new distances allows their own LAN management companies to expand data centers up to 40 km from their campuses. That allows them to support more campuses within 40 km.

Applications for 10 Gigabit Ethernet

Suppliers and users alike believe that the cost of Ethernet is inexpensive, which means that widespread deployment is compatible with what already exists in existing LANs. Today a packet leaves a server on a Gigabit Ethernet port, transmitted within the country via a Dense-Wave Division Multiplexing DWDM network [5] and finds its way to a PC. Attached to a Gigabit copper cable port, all do not need to repack or convert the protocol. Ethernet is literally everywhere and 10 Gigabit Ethernet maintains a seamless transfer of functionality for any application that Ethernet applies to.

Ethernet 10 Gigabit is used for server area networks or storage area networks, traditionally the area of ?? dedicated dedicated networks with relatively small user platforms when Compare with Ethernet. These server area networks provide an excellent bandwidth for small range networks (usually less than 20 m). However, they are proprietary networks that are difficult to implement and maintain. Small capacity networks also result in higher costs for server adapters and switches. As with any proprietary solution, they cannot work with other technologies without the need for proper routers and switches.

In storage area networks, the lack of standards and some ability to work together makes it difficult to deploy the original Fiber Channel deployment. However, these technologies also face some of the same problems that occurred in server area networks that held monopolies due to lack of investment. In summary, Ethernet 10 Gigabit is used to replace proprietary technologies and as a next generation that links server and storage area networks together for several reasons:

- 10 Gigabit Ethernet for an essential bandwidth.
- Consolidate servers leading to cost savings.
- The planned growth of 10 Gigabit network features.

In addition, the expected deployment of the TOE (TCP / IP Offload Engine) [6] technology in 10 Gigabit Ethernet adapters can make it particularly effective on server systems with CPU utilization. desired as seen on current systems deploying Gigabit Ethernet. Due to the wide range of Ethernet agreements, TOE technology will become extremely cost effective when compared to lower capacity networks.

10 Gigabit Ethernet for local area networks (LAN)

Ethernet technology is always the most deployed technology for high-speed LAN environments. With the expansion of 10 Gigabit Ethernet in the family of Ethernet technologies, LANs can better support the increasing number of 'bandwidth-hungry' applications and reach longer distances. Similar to Gigabit Ethernet, the 10 Gigabit standard supports optical transmission environments in both 'single-mode' and 'multimode' modes [4].

With links of up to 40 km, 10 Gigabit Ethernet allows companies to manage their LAN environments themselves to be able to select locations for data centers and server farms - in range 40 km from their campuses. That allows them to support more campuses in this area (Figure 2). Within data centers, 'switch-to-switch' applications as well as 'switch-to-server' can be deployed using a 'multi-mode' interest rate optical environment to create bones. Ethernet 10 Gigabit live greatly supports the continuous increase of 'bandwidth-hungry' applications.

Picture 2 of Overview of 10 Gigabit Ethernet technology - Part I

Figure 2. Using 10 Gigabit Ethernet (10 GbE) in extended LAN environments.

With 10 Gigabit backbones, companies can easily support Gigabit Ethernet connectivity in workstations and desktops to reduce congestion on the network, allowing execution of bandwidth-intensive applications. 10 Gigabit Ethernet also improves network latency, because the link speed provides too much bandwidth to compensate for data explosion in enterprise applications. 10 Gigabit backbone bandwidth also facilitates the next generation of developing network applications. It supports remote health care, television, digital video conferencing . that will replace future remote control capabilities. And things like HDTV (high definition television), video-ondemand or Internet games.

10 Gigabit Ethernet allows businesses to reduce congestion on the network, increase the use of bandwidth-intensive applications, and make more strategic decisions about the location of networked devices primarily due to openness. wide their LAN network within 40 km.

See section II: **Overview of 10 Gigabit Ethernet technology - Part II**

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