Overview of 10 Gigabit Ethernet technology - Part II

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.

10 Gigabit Ethernet for urban area networks (MAN) and storage applications

Gigabit Ethernet has been deployed as a backbone technology for dark fiber urban networks [7]. With appropriate 10 Gigabit Ethernet interfaces such as 'singlemode' fiber optic and fiber transceivers, network and Internet service providers are capable of building links up to 40 km or more (Figure 3) surrounds urban areas with networks spread throughout the city.

10 Gigabit Ethernet currently allows high-speed, profitable infrastructure for both NAS (network attached storage) and SAN (storage area networks). Gigabit Ethernet storage servers, tape libraries and servers compute availability; 10 Gigabit Ethernet endpoint devices will soon be available in the market.

There are many applications for Gigabit Ethernet today such as back-up and database mining. Some of these applications will take advantage of 10 Gigabit Ethernet, Business continuance / disaster recovery, Remote back-up, Storage on demand and Streaming media.

10 Gigabit Ethernet in wide area networks WAN

10 Gigabit Ethernet allows ISPs (Internet service providers) and NSPs (network service providers) to create very high-speed links at very low cost from switches and routers within the company to Optical device 'assign' directly to SONET / SDH [8].

10 Gigabit Ethernet with PHY WAN also accepts geographically connected WAN structures with campus-based LANs or POP (points of presence) via SONET / SDH / TDM networks [8] present. 10 Gigabit Ethernet links between a service provider's switch and a Dense-Wave Division Multiplexing [5] or LTE (line termination equipment) [9] is in fact very close (300 meters).

Use fiber optic cable in 10 Gigabit Ethernet

PMD (Physical-Media-Dependent) devices

The IEEE 802.3ae * standard provides a physical layer (physical layer) that supports the link-specific distances of the transmission medium. To deal with distance targets, four PMD devices are selected.

1. A 1310 nm PMD serial supports 'single-mode' fiber optic cable with a maximum distance of 10 km
2. A 1550 nm PMD serial supports 'single-mode' fiber optic cable with a maximum distance of 40 km.
3. A 850 nm PMD serial supports 'multimode' fiber optic cable with a maximum distance of 300 m.
4. A 1310 nm PMD WWDM [13] supports a maximum distance of 10 km for 'single-mode' fiber optic cables as well as a maximum distance of 300 m for 'multimode' fiber optic cables.

Fiber optic cable

There are two types of fiber optic cables, 'multimode' and 'singlemode' fiber optic cables, currently used in data network connectivity and communications applications. Ethernet 10 Gigabit technology, as defined in the IEEE 802.3ae * standard, supports both types of fiber optic cables. However, the supported distances depend on the type of fiber optic cable and wavelength (nm) implemented in the application.

In 'single-mode' fiber optic applications, the IEEE 802.3ae standard supports 10 km with 1310 nm transmission mode and 40 km transmission with 1550 nm transmission mode. With 'multimode' fiber optic cables, these distances are not easily determined due to the variety of fiber optic cables and how each type is defined. The 'multimode' fiber optic cable is usually determined by the core [15] and the diameter of the cladding [14].

For example, fiber optic cable with 62.5 micron core and coating diameter of 125 micron belongs to fiber optic cable 62.5 / 125. Another factor that affects the distance in the 'multimode' fiber optic cable is the capacity carrying information (measured in MHz-kilometers) that determines the distance and speed measured in bits where a system can operate. (eg 1 Gbit / s or 10 Gbit / s). The distance a signal is transmitted decreases while the transmission rate increases.

When implementing 'multimode' fiber optic cables for 10 Gigabit Ethernet applications, an understanding of distance capabilities is an important component for 10 Gigabit Ethernet solutions.

The future of 10 Gigabit Ethernet

IEEE 802.3 * has recently established two research groups to investigate 10 Gigabit Ethernet studies for copper cables. The research group 10GBASE-CX4 is developing a standard for XAUI (X-Attachment Unit Interface, X only 10 Gbit / s) signals and transmission via a 4-pair twinax cable. The purpose of this team is to provide a standard for a low cost solution internally 'rack' (rack) and 'rack-to-rack'.

Hopefully within a year this standard can be completed. The 10GBASE-T team is also developing a standard for transmitting and receiving 10 Gigabit Ethernet via a Category 5 or better UTP copper cable (unshielded twisted pair) with a distance of 100 m. The time for this implementation may be longer than the implementation of 10GBASE-CX4 and is expected to be completed in late 2005 or early 2006.

Epilogue

Ethernet has overcome the challenge of time to become the globally accepted networking technology. With the introduction of network-dependent devices and the growth of large numbers of bandwidth-intensive applications, service providers pursuing higher-performance networking solutions can simplify and reduce the overall cost of network connectivity, thus allowing differentiation of profitable services, while maintaining a high level of reliability. IEEE 802.3ae * 10 Gigabit Ethernet standard has proven to be a solid solution to networking

challenges.

10 Gigabit Ethernet is an inevitable revolution of the standard that existed for a long time in IEEE 802.3 * in terms of speed and distance. In addition, to gradually increase the connection speed for enterprise networks, it expands the challenging value of Ethernet and benefits urban areas (MAN) and wide area networks (WANs). .

An optimized Ethernet infrastructure is being organized in urban areas and many urban areas are now a high-intensity network development focus that tends to share optical Ethernet services. 10 Gigabit Ethernet is in the process of most urban switches, routers and optical system providers to:

1. Generate profit, connect Gigabit level between customer access device and service provider's POP with inherent Ethernet format.
2. Simple access, low price, high speed to urban fiber optic network infrastructure.
3. Link university campuses based on urban area networks through 'dark fiber' infrastructure [7],
4. targeting distances from 10 to 40 km.
5. End-to-end fiber optic networks with public management systems.

Note

1. [1] 802.3ae - IEEE Standard for 10 Gigabit Ethernet, 802.3ab - IEEE Standard for Ethernet Gigabit UTP (1000BASE-T), 802.3z - IEEE Standard for Gigabit Ethernet (1000BASE-X).
2. [2] MAC (Media Access Control) - Transmission access control subclass provides a logical connection between its own MAC clients and the peer station. The main responsibility is to create, control and manage connection with peer stations. The 10 Gigabit MAC (MAC layer) layer uses the same Ethernet address and frame formats as other speeds and will operate in full-duplex mode. It supports a data rate of 10 Gbit / s that uses 'pacing' mechanisms to accommodate speed when connected to a WAN PHY.
3. [3] Carrier-sensing multiple-access CSMA / CD (collision detection): Multi-carrier carrier with collision detection. This is a mechanism for collision detection of Ethernet when transmitting packets.
4. [4] 'singlemode' & 'multimode': In fiber optic technology, 'single-mode' fiber optic cable is designed to transmit a single light ray or light mode as a carrier and is used for transmitting signal distance (light source here is a light created by laser lights). For close distance, 'multi-mode' fiber optic cable is used. The 'multi-mode' fiber optic cable is used to transmit multiple light rays or multiple light modes simultaneously, but each beam (or mode) with a slightly different reflection angle inside the core of the fiber (Light source is a lot of light generated by LED). The 'multi-mode' fiber optic cable has a larger core diameter than 'single-mode' fiber optic cable.
5. [5] DWDM (Dense-Wave Division Multiplexing): A technique of 'arranging' data together from different sources on a fiber optic cable with each signal being transmitted at the same time on the wavelength. separate light. When using DWDM, up to 80 (theoretically may be more) different wavelengths or data channels can be cornered into a lightstream stream transmitted on an optical fiber cable. Each channel carries a TDM (time division multiplexed) signal. DWDM is also called WDM (wave division multiplexing). DWDM promises to solve the "fiber exhaust" problem and is the technology in all fiber optic networks in the future.
6. [6] TOE (TCP / IP Offload Engine): A technology that is gaining popularity in high-speed Ethernet systems for the purpose of optimizing throughput. TOE components are integrated into one of the circuit segments such as NIC (network interface card) or HBA (host bus adapter).
7. [7] 'Dark fiber' - A fiber-optic cable infrastructure (including cables and repeater signal repeaters) currently exists but not yet used. Fiber optic cables transport information in the form of light pulses, where "dark" means 'no light pulses are sent'. For example, a number of utilities for power supply have installed fiber optic cables at the place where the power cable passes through for the purpose of leasing

infrastructure to telephone and cable companies or using it to Connect their offices together. To describe these settings unused, people use the word 'dark'. The "Dark fiber" service is a service provided by local exchange carriers (LEC) to maintain the transmission capacity by fiber optic cable between subscriber positions.

8. [8] SONET / SDH / TDM: Synchronous Optical Network / Synchronous Digital Hierarchy / Time Division Multiplexing. SONET is a standard of the American National Standards Institute to transmit data uniformly on a fiber-optic transmission medium. The equivalent of SONET internationally is SDH (synchronous digital hierarchy). Together, they ensure standards so that digital networks can be interconnected internationally and existing conventional transmission systems can take advantage of fiber optic cable environments. SONET provides standards for a large number of transfer rates up to 9,953 Gbit / s (actual transmission rate is about 20 Gbit / s). SONET defines a base rate of 51.84 Mbit / s and a base rate set is known as Ocx (Optical Carrier levels). "Of which OC-192 is a speed of SONET connected to a load rate. (payload rate) is equal to 9.584640 Gbit / s, mainly used in WAN environments.
9. [9] LTE (Line Termination Equipment)
10. [10] MMF (Multimode Fiber), SMF (Single-mode Fiber)
11. [11] WDM (Wavelength Division Multiplexing)
12. [12] WIS (WAN Interface Sublayer)
13. [13] WWDM (Wide-Wavelength Division Multiplexing): A technique used to efficiently transmit many wavelengths (for example, colors of light) from many laser sources passing through an optical fiber. Each laser source will be sized to send a single optical wavelength.
14. [14] Cladding: Material that surrounds the core of a fiber. 'cladding' has a lower refractive index (faster speed) refractive index used to hold light in the core. Cladding and core form a structure to conduct optical waves.
15. [15] Core: The central core of a fiber optic cable through which light is transmitted. It has a higher refractive index (slower speed) of refractive index of cladding around it.