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APPLICATIONS OF 10 GIGABIT ETHERNET

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Abstract

The 10n Gigabit Ethernet standard extends the IEEE 802.3ae standard protocols to a wire speed of 10 Gbps and expands the Ethernet application space to include WAN compatible links. The 10 Gigabit Ethernet standard provides a significant increase in bandwidth while maintaining maximum compatibility with the installed base of 802.3 standard interfaces, protects previous investment in research and development, and retains the existing principles of network operation and management.[4]

The application of 10 Gigabit Ethernet are in the areas of Local Area Networks, Fabric Interconnect Wide Area Networks Metropolitan and Storage Applications.

KEYWORDS- ***LAN, MAN, WAN, SAN, PHY,CSMA***

1. INTRODUCTION

The 10 Gigabit Ethernet is basically the faster speed version of Ethernet. It will support the data rate of 10 Gb/s. it offers similar benefits to those of those preceding Ethernet standard. However, it will not support half duplex operation mode. The potential applications and markets for 10 Gigabit Ethernet are enormous. There are broad groups of users who demand 10 Gigabit Ethernet, for example, enterprise users, universities, telecommunication carriers, and Internet service providers.

Each market typically has different requirements for link span and cost. Proving the initial skeptics wrong, 10 Gigabit Ethernet has found widespread acceptance.Companies are opting for 10 Gigabit Ethernet switches more as a norm than as an exception, in order to protect their investment, even if they don't need these immediately. The market has witnessed a growth of 30 per cent, also due to an exceptional surge in innovation, dictated by the needs of the market.

2. THE 10 GIGABIT ETHERNET STANDARDS

Under the International Standards Organization's Open Systems Interconnection(OSI) model, Ethernet is fundamentally a Layer 2 protocol. 10 Gigabit Ethernet uses the IEEE 802.3 Ethernet Media Access Control (MAC) protocol, the IEEE 802.3 Ethernet frame format, and the minimum and maximum IEEE 802.3 frame size. Just as 1000BASE-X and 1000BASE-T (Gigabit Ethernet) remained true to the Ethernet model, 10 Gigabit Ethernet continues the natural evolution of Ethernet in speed and distance. Since it is a full-duplex only and fiber-only technology, it does not need the carrier-sensing multiple-access with collision detection (CSMA/CD) protocol that denes slower, half-duplex Ethernet technologies.

In every other respect, 10 Gigabit Ethernet remains true to the original Ethernet model. An Ethernet Physical layer device (PHY), which corresponds to Layer 1 of the OSI model, connects the media (optical or copper) to the MAC layer, which corresponds to OSI Layer 2. Ethernet architecture further divides the PHY (Layer 1) into a Physical Media Dependent (PMD) and a Physical Coding Sublayer (PCS). Optical transceivers, for example, are PMDs. The PCS is made up of coding (e.g., 64/66b) and a serializer or multiplexing functions.

The 802.3aespecication de nes two PHY types: the LAN PHY and the WAN PHY (discussed below). The WAN PHY has an extended feature set added onto the functions of a LAN PHY. These PHYs are solely distinguished by the PCS. There will also be a number of PMD types. [1][4][6]

3. APPLICATIONS OF 10 GIGABIT ETHERNET

• 10 Gigabit Ethernet in Local Area Network

Ethernet technology is already the most deployed technology for high performance LAN environments. With the extension of 10 Gigabit Ethernet into the family of Ethernet technologies, the LAN now can reach farther and support up coming band-width hungry applications. Similar to Gigabit Ethernet technology, the 10 Gigabit proposed standard supports both single mode and multi-mode fiber mediums. How-ever in 10 Gigabit Ethernet, the distance for single-mode ber has expanded from the 5km

that Gigabit Ethernet supports to 40km in 10 Gigabit Ethernet. The advantage for the support of longer distances is that it gives companies who manage their own LAN environments the option of extending their data centers to more cost-e
ective locations up to 40km away from their campuses. This also allows them to support multiple campus locations within that 40km range. Within data centers, switch-to-switch applications, as well as switch to server applications, can also be deployed over a more cost effective multi-mode ber medium to create 10 Gigabit Ethernet backbones that support the continuous growth of bandwidth hungry applications.[1][4][5]

With 10 Gigabit backbones installed, companies will have the capability to begin providing Gigabit Ethernet service to workstations and, eventually, to the desktop in order to support applications such as streaming video, medical imaging, centralized applications, and high-end graphics.

10 Gigabit Ethernet will also provide lower network latency due to the speed of the link and over-provisioning bandwidth to compensate for the bursty nature of data in enterprise applications.[4][5]

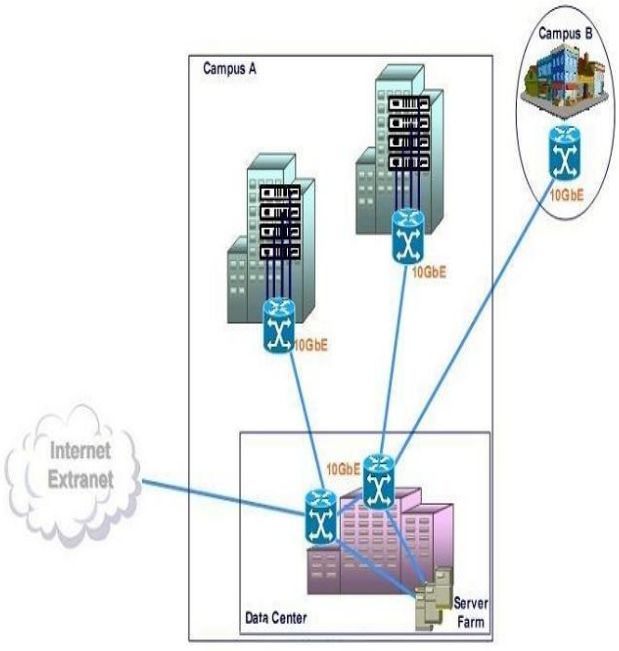

Figure1: 10 Gigabit Ethernet in LAN

- **10 Gigabit Ethernet in Metropolitan Area Network**

Vendors and users generally agree that Ethernet is inexpensive, well understood, widely deployed and backwards compatible from Gigabit switched down to 10Megabit shared. Today a packet can leave a server on a short-haul optic Gigabit Ethernet port, move cross-country via a DWDM (dense wave division multiplexing) network, and find its way down to a PC attached to a "thin coax" BNC (Bayonet Neill Con- celman) connector, all without any re-framing or protocol conversion. Ethernet is literally everywhere, and 10 Gigabit Ethernet maintains this seamless migration in functionality.

Figure2: 10 Gigabit Ethernet in MAN

Gigabit Ethernet is already being deployed as a backbone technology for dark fiber metropolitan networks. With appropriate 10 Gigabit Ethernet interfaces, optical transceivers and single mode fiber, service providers will be able to build links reaching 40km or more.[1][4][5]

10 Gigabit Ethernet in Wide Area Network

10 Gigabit Ethernet will enable Internet service providers (ISP) and network service providers (NSPs) to create very high-speed links at a very low cost, between co-located, carrier-class switches and routers and optical equipment that is directly attached to the SONET/SDH cloud.

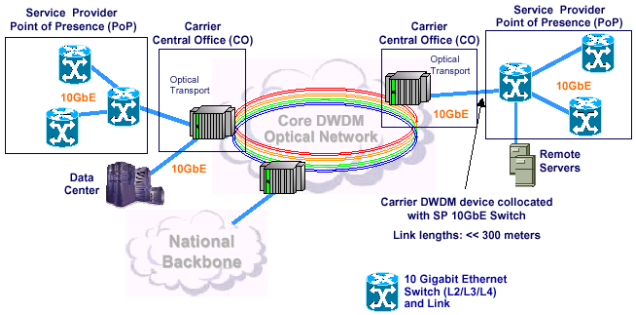

Figure1: 10 Gigabit Ethernet in WAN

10 Gigabit Ethernet with the WAN PHY will also allow the construction of WANs that connect geographically dispersed LANs between campuses or POPs (points of presence) over existing SONET/SDH/TDM networks. 10 Gigabit Ethernet links between a service provider's switch and a DWDM (dense wave division multiplexing) device or LTE (line termination equipment) might in fact be very short - less than 300 meters. [4][5]

- **10 Gigabit Ethernet in Storage Area Network**

Additionally, 10 Gigabit Ethernet will provide infrastructure for both network- attached storage (NAS) and storage area networks (SAN). Prior to the introduction of 10 Gigabit Ethernet, some industry observers maintained that Ethernet lacked su cient horsepower to get the job done. Ethernet, they said, just doesn't have what it takes to move "dump truck loads worth of data." 10 Gigabit Ethernet, can now o er equivalent or superior data carrying capacity at similar latencies to many other storage networking technologies including 1 or 2 Gigabit Fiber Channel, Ultra160 or 320 SCSI, ATM OC-3, OC-12 OC-192,and HIPPI (High Performance Parallel Interface). While Gigabit Ethernet storage servers, tape libraries and compute servers are already available, users should look for early availability of 10 Gigabit Ethernet end-point devices in the second half of 2001.

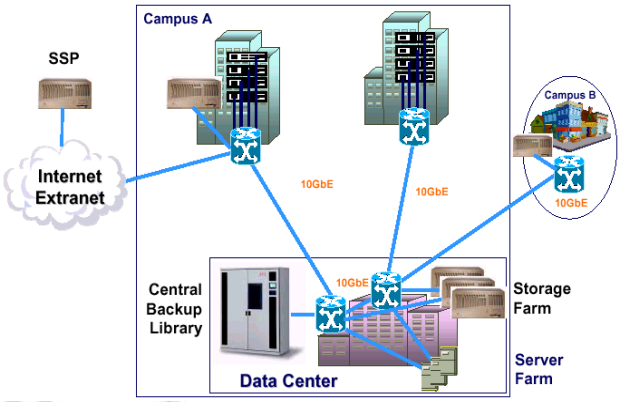

Figure1: 10 Gigabit Ethernet in SAN

There are numerous applications for Gigabit Ethernet in storage networks today, which will seamlessly extend to 10 Gigabit Ethernet as it becomes available. These include:

(i) Business continuance/disaster recovery
(ii) Remote backup
(iii) Storage on demand
(iv) Streaming media [5][9]

CONCLUSIONS

As the Internet transforms longstanding business models and global economies, Ethernet has withstood the test of time to become the most widely adopted networking technology in the world. Much of the world's data transfer begins and ends with an Ethernet connection. Ethernet is no longer designed only for the LAN. 10 Gigabit Ethernet is the natural evolution of the well-established IEEE 802.3 standard in speed and distance. It extends Ethernet's proven value set and economics to metropolitan and wide area networks by providing:
(i) Potentially lowest total cost of ownership (infrastructure/operational/human capital)
(ii) Straightforward migration to higher performance levels
(iii) Proven multi-vendor and installed base interoperability (Plug and Play)
(iv) Familiar network management feature set

An Ethernet-optimized infrastructure build out is taking place. The metro area is currently the focus of intense network development to deliver optical Ethernet services. 10 Gigabit Ethernet is on the roadmaps of most switch, router and metro optical system vendors to enable:

(i) Cost effective Gigabit-level connections between customer access gear and service provider POPs (points of presence) in native Ethernet format36

(ii) Simple, very high speed, low-cost access to the metro optical infrastructure
(iii) Metro-based campus interconnection over dark fiber targeting distances of 10/40km and greater end to end optical networks with common management systems

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