

10-Gigabit Ethernet – Why it will change optical data networking

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Ethernet is a 27-year old protocol to encapsulate IP packets in the Local Area Network (LAN) that has endured and successfully survived attack from Token Ring, FDDI, VG-AnyLAN, and ATM, only to come out as the winner every time. Today, Ethernet is recognizably the most simple, scalable, and resilient IP framing protocol and has evolved from Ethernet (10 Mb/s) to Fast Ethernet (100 Mb/s) and Gigabit Ethernet (1 Gb/s) in just 10 years. While Ethernet and Fast Ethernet were implemented mostly as shared-medium (broadcast) technology using a medium access protocol (CSMA/CD), the arrival of Ethernet Layer-2 switching turned Ethernet into just another full-duplex IP framing protocol, yet a very simple and cost effective one. By the time Gigabit Ethernet arrived in 1998, most implementations were full-duplex dedicated (rather than shared) links between switches. In addition, Gigabit Ethernet was the first Ethernet standard that was only available on fiber-optic cable initially (multimode as well as single-mode). What makes Ethernet so attractive is the large installed base, the backwards compatibility of the standard with previous lower-speed generations, and the low cost enabled by the large volumes Ethernet has enjoyed. This has resulted in port costs on switches and network interface cards that are significantly lower than for other competing standards.

Now, with the new 10-Gigabit Ethernet standard shaping up in the standards organizations (IEEE 802.3ae), a completely new space opens up for Ethernet – the metropolitan (MAN) and wide area network (WAN). While previous generations of Ethernet were pretty much confined to premises and campus network environments, 10Gigabit Ethernet will be designed from the start to be compatible with the requirements of the MAN and WAN.

Why is there so much excitement in the Ethernet community these days about its opportunities in the MAN and WAN? IP data is rapidly becoming the predominant traffic in the MAN and WAN, with TDM voice traffic accounting for less than half the traffic today. With 95% of all IP traffic originating and terminating in Ethernet nodes, the need to convert into Frame Relay, ATM cells, and SONET frames when going over the MAN and WAN becomes more and more questionable. Customers today are asking for access to the IP data network in the format that they are used to, and that is Ethernet, not T1's, T3's, Frame Relay, and ATM OC-3. Both emerging and increasingly also incumbent service providers have recognized that Gigabit and 10-Gigabit Ethernet networking offer very cost effective and simple approach to metro networking, and have begun to install new infrastructure to deliver Ethernet services to customers at revolutionary price points. But as these efforts are underway in the U.S. and abroad, carriers also have to address the missing "carrier-readiness" of Ethernet like operations, administration, management, and provisioning (OAMP) features that carriers need, and find novel solutions to manage and troubleshoot these networks.