10 Gigabit Ethernet over Copper: Short Reach Mode

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Version 1.0

February 2007

Executive Summary

A late addition to the recently released IEEE 802.3an standard for 10GBASE-T, Short Reach Mode is designed to run 10 gigabits per second (10 Gbps) with presumably less power than the full power version of 10GBASE-T. Short Reach Mode was added for cost-effective early implementations of 10 Gigabit Ethernet over copper in the data center.

This white paper addresses the technology behind Short Reach 10GBASE-T and helps guide you in properly implementing a 10GBASE-T infrastructure. Within this paper you will learn:

- What is 10GBASE-T Short Reach Mode and why was it added to the standard
- Why Short Reach Mode requires Augmented Category 6 (Cat 6A) or ISO Class F cabling
- What are the advantages and disadvantages of Short Reach Mode
- What applications are best suited for Short Reach Mode

10 Gigabit Ethernet over Copper: Short Reach Mode

Following nearly four years of intensive development, the IEEE standards association recently ratified the 10 Gigabit Ethernet (10GBASE-T) standard IEEE 802.3an, which specifies 10 Gbps data transmission over four-pair copper cabling. Short Reach Mode was a late addition to the standard, and many in the industry are unaware of its requirements, potential advantages, and applications. This white paper addresses the technology behind Short Reach 10GBASE-T and helps guide you in properly implementing a 10GBASE-T infrastructure.

What is Short Reach Mode?

The 10GBASE-T optional Short Reach Mode, also referred to as Low Power Mode, is designed to run 10 Gbps with less power than the full version of 10GBASE-T. Short Reach Mode is based on a cabling link of 30 meters Cat 6A or ISO Class F (shielded) cabling. The link consists of two connectors, 10 meters of patch cords, and 20 meters of horizontal cabling (see Figure 1).

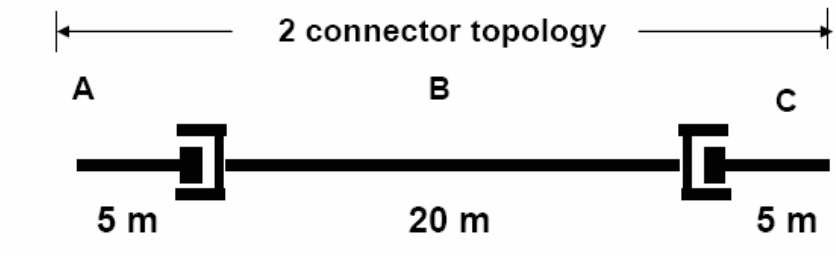

Figure 1: Short Reach Mode Test Configuration

Why was it added to the standard?

Some implementations of the full-power version of the 10GBASE-T standard may require as much as 10 to 15 watts of power to deliver 10 Gbps on a 100 meter channel using Cat 6A cabling or on a 55 meter channel using Category 6 cabling. However, the widely deployed X2 pluggable modules have a power limit of 4 watts. Power requirements greater than 4 watts would therefore sacrifice the ability to use existing X2 ports.

The IEEE 802.3an task force identified the need to satisfy a large portion of the market with a mode that would enable 10GBASE-T physical layer (PHY) devices to be deployed inside X2 modules. Instead of specifying a power limit, which changes as process technologies improve, a distance of 30 meters was selected to address the data center and server cluster applications. The result was the addition of a 30-meter test channel that became known as Short Reach Mode.

As 10GBASE-T PHY devices appear in the marketplace, it is expected that equipment vendors will soon be able to develop PHYs that can utilize less power to support 10 Gbps on all ports over greater distances. In the interim, Short Reach Mode enables customers who only require 30 meter cabling distances to implement lower power equipment. The lower power requirements and corresponding higher port densities achieve improved power load per port and price-performance per port.

Why does it require Augmented Category 6 or Class F cabling?

The IEEE 802.3an task force determined that high-performance cabling simplifies power reduction in the PHY devices for Short Reach Mode. Existing Category 6 cabling could potentially require more than 4 watts of power due to the characteristics of the cable and connectors. Because Cat 6A cabling and ISO Class F cabling offer much better attenuation and crosstalk performance than existing Category 6 cabling, the standard specified Short Reach Mode for these two types of cabling.

What are the advantages and disadvantages?

Data center and cluster computing applications will be some of the first applications to deploy 10 Gbps speeds and will require 30 meters or less cabling distances.

The advantages of Short Reach Mode include:

- Ability to use existing X2 ports on switches and adapters
- Reduced power and cooling requirements
- Better performing cabling to support reduced power and increased port density

The disadvantages of Short Reach Mode include:

- 30 meter distance limitation
- Not specified for Category 6 cabling
- 2-connector channel requires interconnect vs. cross-connect scenario

The result

It is expected that the 10 Gigabit Ethernet market will ramp up quickly with the introduction of 10GBASE-T PHY devices that offer the ability to transport 10 Gbps over four-pair copper cabling. The first generation of 10GBASE-T PHY devices may not support 10 Gbps to 100 meters due to power requirements. Until this technology matures to provide lower power per port, Short Reach Mode is the cost-effective alternative to deploying 10GBASE-T while addressing the demand of the data center and cluster applications.

It's important to remember that Short Reach Mode is only supported by Cat 6A and ISO Class F cabling – not existing Category 6. Because ISO Class F cabling is a pair-in-metal-foil shielded cable that is costly and time consuming to install, Cat 6A cabling is the best choice for supporting 10 gig over copper in today's data center and computer cluster applications.

For	See the following...
10GBASE-	www.ieee802.org\3\an
X2 module	www.x2msa.org

Authors

Brad Booth is a senior principal engineer at AMCC and drives alignment of AMCC strategic planning to industry initiatives and standards. Previously, Brad was the director of advanced products for Quake Technologies and the manager of Intel's Enterprise Interconnect Standards Team. Brad chaired the IEEE Std. 802.3an™-2006 (10GBASE-T) project, which developed a standard for 10 Gigabit Ethernet over twisted-pair balanced copper cabling. Prior to that, Brad was the editor-in-chief for IEEE Std. 802.3ae™-2002 for 10 Gigabit Ethernet on fiber optic cabling. Currently, Brad serves as the president for the Ethernet Alliance. Previously, he has held positions as director and as VP of technology for the 10 Gigabit Ethernet Alliance. In 2003, Brad received recognition as a senior member of the IEEE.

Blaine Kohl is the vice president of marketing, sales and business development for Tehuti Networks. Blaine also serves as the vice president of marketing for the Ethernet Alliance, an industry consortium dedicated to the promotion of Ethernet technologies. She last served as the vice president of marketing for Bandspeed. Prior to that she was the director of marketing for Intel's iSCSI, 10 Gigabit and 1 Gigabit Ethernet product lines where she was pivotal in the development of the technologies and products. Prior to Intel, Blaine was at Level One Communications, Jato Technologies and Motorola.

John Schmidt is the Product Manager for Structured Cabling at ADC. John has been with ADC for 10 Years in a variety of Design Engineering and Product Management roles. He is the author of several articles, white papers, and presentations related to the design of telecommunications and data networks. John has a Bachelor of Science Degree in Engineering from the University of Minnesota and has 10 patents for telecommunications and network equipment design

About Tehuti Networks

Tehuti Networks is a fabless semiconductor company that develops innovative solutions-on-a-chip (SoC) for accelerating TCP/IP processing in servers and network appliances. The solutions improve server processing performance and provide significant cost benefits to original equipment manufacturers and IT users. The company received seed funding from Alice Lab, Technion R&D Fund, ProSeed Venture Capital Fund, and Lachman Goldman Ventures. Tehuti Networks has offices in Austin, Texas and Herzliya, Israel. More information is available at www.tehutinetworks.net.