



Unleashing the 10 Gigabit Ethernet Market Proving 10GBASE-T Performance and Reliability Under Worst-Case Conditions

by
Bruce Tolley
Solarflare® Communications

With the advent of 10GBASE-T for 100 meter links of twisted pair copper cabling, 10 Gigabit Ethernet is moving into the market to provide simple, cost-effective, standards-based products for enterprise and data center networks. 10 Gb/s Ethernet on copper will more than halve the cost of 10 Gb/s links, by enabling higher port density and as well as transceivers that can follow a Moore's Law curve of cost reduction. 10GBASE-T will also support the plug and play simplicity of RJ-45 interconnects and twisted pair copper cabling.

A primary goal of the IEEE 802.3 Ethernet standards process is to enable robust, cost-effective technologies that can be used to build real economic solutions for today's data center and enterprise networks. 10GBASE-T was developed to support a standard reach of 100 meters on Category 6A cabling and 55 to 100 meters on Category 6 cabling. In fact, the IEEE 802.3an 10GBASE-T Standard mandates that all 10GBASE-T PHYs reach 100 meters in order to be compliant.

Solarflare's 10Xpress® 10GBASE-T PHY supports reaches over 100 meters on Category 6A cabling, 55 to 100 meters on Category 6 cabling, and 45 meters on legacy Category 5E cabling. In order to insure reliability and performance in 99.9% of applications, the standard specifies a worst case test with noise from alien cross talk impacting the ability of the copper cabling to carry a signal. The purpose of this test is to ensure that the 10GBASE-T links continue to perform as additional links are installed. The TIA cabling standard group has enhanced this test to develop an alien cross talk test (AFEXT and ANEXT) called 6 around one; six cables around one cable.

The application of this 6 around 1 test validates that 10GBASE-T PHYs in combination with the specified cabling systems will work under not just average or typical conditions but under all conditions and all topologies thereby maintaining the historical plug and play simplicity of Ethernet over twisted pair copper cabling. If IT managers use standards-compliant, 100-meter 10GBASE-T PHYs, they will not have to measure, test, qualify, and engineer the 10Gb/s links one by one. Furthermore, by using 100-meter, standards-compliant 10GBASE-T PHYs, IT managers will not have to worry about the lack of interoperability between fully compliant PHYs and non-compliant PHYs, namely those supporting only shorter reach.

The Requirement

All 10 Gb/s copper PHYs must reach 100 meters on Category 6A cabling using a worst case topology of 4 connectors in the presence of AFEXT and ANEXT

Milestones

- IEEE 802 standards board ratified the 802.3an standard for 10GBASE-T in June 2006.
- Solarflare® was the first company not only to demonstrate but also to sample to its customers a 10GBASE-T PHY, 10Xpress™, reaching 100 meters over an IEEE 802.3an standards-compliant Category 6A link in early September 2006.
- Solarflare conducts rigorous performance testing with third parties including all the leading cabling vendors. Third-party test configurations are described below.
- The tests were performed using Solarflare's newly-developed 10Xpress™10GBASE-T PHYs and cabling and test personnel from various cabling manufacturers. The validation trials were performed on 100-meter channels in a worst-case, 4-connector channel configuration. This configuration is specified in the TIA augmented Category 6 draft standard, titled Addendum 10 to TIA/EIA 568, which is currently under development in the TIA TR 42.7 subcommittee. A seven-cable (six-around-one) configuration was used. The 10 Gb/s Ethernet signals were generated using a traffic generator at the XAUI interface to the PHYs. The 10Gb/s Ethernet signal was looped back at the far end transceiver and the receiver frames compared to the sending frames. Live 10GBASE-T traffic was transmitted simultaneously on all six neighboring channels simulating a worst-case alien crosstalk environment.

Findings

The Solarflare 10GBASE-T PHY shows itself robust and reliable in this stressed environment delivering error-free transmission for the duration of the tests, demonstrating a bit error ratio better than the 10E-12 mandated by the Standard even in a worst-case crosstalk environment.

Cabling Systems

Solarflare successfully completed this performance and robustness testing on multiple occasions with personnel and cabling components from the following companies:

- **Belden**
Belden is a leader in the design, manufacture and marketing of signal transmission solutions for data networking and a wide range of specialty electronics marketing including entertainment, industrial, security and aerospace applications. Belden has manufacturing facilities in North America and Europe as well as distribution centers in the U.S., Canada, Singapore, Australia and The Netherlands. A majority of Belden's manufacturing, engineering and support functions are registered to the International Organization for Standardization.

“Belden IBDN™ System 10GX™ was validated during live, third party demonstration of 10GBASE-T technology at 100 meters using the worst-case channel configuration scenario specified by the TIA, the Belden 10GX 10-Gigabit Structured Cabling Solution performs error free.”

See: <http://www.belden.com/09News/100606pr.pdf>

- **Berk-Tek (a Nexans Company) and Ortronics**

NetClear is a Technology Alliance between Berk-Tek, a Nexans Company, and Ortronics/Legrand that provides advanced, end-to-end co-engineered solutions for enhanced Category 5e, Category 6, Augmented Category 6 – 10 Gigabit and optical fiber channels - all backed by a 25-year warranty.

“The NetClear GTX Augmented Category 6 UTP Cabling Solution successfully passed 10GBASE-T testing at Solarflare.”

See: http://www.solarflare.com/news/news_press_show.php?release=2007012

- **Commscope/SYSTIMAX**

SYSTIMAX Solutions from CommScope (NYSE: CTV) is a worldwide leader in structured cabling systems and provides integrated end-to-end connectivity solutions for video, voice, data and building management applications in both wired and wireless enterprise networks.

“SYSTIMAX® GigaSPEED® X10D Solution performed to standard specifications in full-day certification test demonstrations of 10GBASE-T technology on 100 meter links held at Solarflare’s labs.”

See: http://www.solarflare.com/news/news_press_show.php?release=20061128

- **Panduit**

Panduit is a leading, world-class developer and provider of innovative networking and electrical solutions. For more than 50 years, Panduit has engineered and manufactured end-to-end solutions that assist our customers in the deployment of the latest technologies. Our global expertise and strong industry relationships make Panduit a valuable and trusted partner dedicated to delivering technology-driven solutions and unmatched service. Through our commitment to innovation, quality and service, Panduit creates competitive advantages to earn customer preference.

“PANDUIT Verifies live 10GBASE-T Traffic Over 100 meters TX6™ 10Gig™ UTP Copper Cabling System Tests performed with Solarflare™ Communications’ 10GBASE-T product.”

See: <http://www.panduit.com/pressreleases/106347.asp>

- **Siemon**

Established in 1903, Siemon is an industry leader specializing in the manufacture and innovation of high quality, high-performance network cabling solutions. Headquartered in Connecticut, USA, with global offices and partners throughout the world, Siemon offers the most comprehensive suite of unshielded, shielded, twisted-pair copper and fiber structured cabling systems available. With over 400 active patents specific to structured cabling, Siemon Labs invests heavily in R&D and development of industry standards, underlining the company's long-term commitment to its customers and the industry.

“Siemon’s® 10G 6A™ UTP, 10G 6A F/UTP and Category 7/Class F TERA® copper cabling systems meet or exceed all 10GBASE-T performance parameters.”

See: http://www.solarflare.com/news/news_press_show.php?release=20070116

- **SMP Data Communications**

SMP Data Communications is internationally recognized for its role in establishing the world's data/communications standards, through its innovative-patented technologies. SMP, founded in 1990, manufactures and develops copper and fiber passive connectivity hardware components for use in commercial and residential applications. The company is a wholly owned subsidiary of Preformed Line Products (PLPC) of Cleveland, Ohio.

“SMP Participates in Industry’s First 10GBASE-T 100 Meter Bit Error Rate Validation Testing with Solarflare.”

See: <http://www.solarflare.com/news/>