



### 10GbE: Meeting the Traditional Cost and Performance Curves of Ethernet

#### Applications Requiring 10GbE

As networks are reaching the limits of 1 Gigabit Ethernet link aggregation (LAG), IT professionals are looking to 10 Gigabit Ethernet (10GbE) as the next generation technology to be deployed. Until now, many IT professionals have found that using up to four links via link aggregation was an acceptable way of increasing bandwidth beyond 1 Gigabit Ethernet (1GbE). However, more than four links becomes cumbersome from a management perspective and increases cost in terms of maintenance.

Much of this need has been driven by simple organic data growth, but is also further spurred by enterprise financial applications, database and data modeling simulations, weather forecasting, computer-aided design and manufacturing, and graphics intensive applications such as those often found in computer games and films. GbE found its way in to high-performance computing (HPC) cluster applications and as the costs and barriers to entry decline, 10GbE will grow in this market. Newer applications, such as RFID, are beginning to drive huge databases of information across networks, and cellular networks are moving to broadband to provide video and other high bandwidth services.

From an end user perspective there are many common consumer activities that drive the need for additional bandwidth. Digital photos from 7-10 megapixel cameras are now frequently housed using online storage or just simply emailed to family and friends. High resolution video downloads, automatic software upgrades, online video gaming, and live music and video feeds are some of the applications consumers have come to expect. These types of activities result in the need for higher performance servers that must be serviced by fatter network pipes.

#### PHY Options for 10GbE Deployment

In 2002, the first 10GbE standard was ratified. This standard, IEEE Std. 802.3ae™, was dedicated towards the deployment of 10GbE using fiber optics. In 2004, IEEE Std. 802.3ak™ was ratified, allowing for the operation of 10GbE over copper twinax cable. Known as 10GBASE-CX4, this

standard permitted the use of Infiniband™ cabling for distances up to 15 meters. However, 2006 saw the ratification of the highly desired 10GBASE-T standard, IEEE Std. 802.3an™, along with a new multimode fiber optics standard, IEEE Std. 802.3aq™, or 10GBASE-LRM. Unlike 10GBASE-CX4, 10GBASE-T could make use of unshielded twisted pair (UTP) copper cabling that meets or exceeds Category 6 specifications.

#### The 10GBASE-T Standard

Some of the attributes of 10GBASE-T include the following:

- Allows the introduction of copper PHYs that eventually are more power conscious and much less expensive than the optics solutions available within the respective time period.
- Operation of 10GbE over CAT-6 up to 55 meters, and over CAT-6A and CAT-7 up to 100 meters. The primary difference between CAT-6A and CAT-7 is CAT-6A is an unshielded cable, whereas, CAT-7 is shielded.
- A short reach mode, also known as low power mode, is available with CAT-6A and CAT-7. Based upon a cabling link of 30m, it is designed to allow 10 GbE to run with lower power and lower latency than the 100 meter reach version of 10GBASE-T.
- Supports easier installation and management capabilities associated with copper cabling, and alleviates the complexities associated with optical cabling.
- Supports auto-negotiation. This feature permits implementers to design PHY devices that operate over a broader range of speeds and media. While auto-negotiation provides the capability to be backwards compatible to lower speeds, the transformer requirements may limit the range of supported speeds in a 10GBASE-T system.

- Bit Error Ratio (BER) specified in IEEE Std. 802.3an is  $10^{-12}$ , but most products are expected to exceed this.

## Tehuti Networks 10GBASE-T NIC

Tehuti Networks TN7588 10GBASE-T network interface card (NIC) couples Tehuti Networks TN3016 host hardware offload controller with Teranetics TeraPHY™ TN1010 transceiver. Combined together, Tehuti Networks' TN7588 NIC offers the power and performance required by today's high-speed networks and is capable of:

- Near 10Gbps line rate
- Processor utilization of less than 50%
- A single port NIC solution for 20W
- A dual port NIC solution for 30W
- A BER that exceeds the IEEE Std. 802.3an of  $10^{-12}$
- Tehuti Networks' low power compliments the power challenge the PHY vendors are facing.



**Tehuti Networks TN7588-S 10GBASE-T NIC**

## The Importance of Tehuti Networks' Host Hardware Offload Controllers

The key to achieving 10Gb/s line rate, is meet the performance objective while achieving the lowest power, low CPU utilization, the fewest number of components, and lowest cost. Tehuti Networks' TN3016 host offload controller meets all of these requirements. TN3016 is offered as both a dual and a single port 10GbE host hardware offload controller for TCP applications requiring high bandwidth and a large connections count. Targeted for volume applications sensitive to performance, power, compatibility, real estate and price, TN3016 offers two modes of operation:

1. TCP/IP Offload Engine (TOE) mode via either Microsoft Chimney or Linux full TOE mode which offers near 10Gbps line rate.
2. Smart NIC (SNIC) mode provides approximately 5Gbps throughput and allows a seamless interface to the TCP/IP stack.

Both of these modes are offered with the same controller and at a price similar to basic MAC and or NIC solutions.

TN3016 integrates Tehuti Networks' OptiStrata™ Technology, 10GbE MAC functionality, a PCI Express™ x8 interface and XAUI into a single chip that provides up to near 10Gbps line rate of network performance per port.

***Tehuti Networks improves the flow of packets in enterprise applications to near 10Gbps line rate without increasing power or cost.***

## Tehuti Networks Solution

Tehuti Networks TN3016 makes the optimal compliment for 10GbE copper PHY solutions for the following reasons:

- Achieves near 10Gbps line rate
- Low power and small footprint
- Does not require external memory chips
- Cost

## About Tehuti Networks

Tehuti Networks is a leading provider of single-chip host hardware offload controllers that provide near 10 Gigabit Ethernet line rate performance combined with low CPU utilization and low-power for networking end point applications. These inexpensive, high performance solutions support all major operating systems as well as both hardware and software virtualization schemes. For more information, please visit [www.tehutinetworks.net](http://www.tehutinetworks.net).

## About Teranetics

Teranetics specializes in providing silicon solutions that enable significantly higher data rates over structured copper cabling than are currently available in today's Ethernet world. Founded by a team with unparalleled expertise and experience in developing high-performance mixed-signal semiconductor solutions and digital communications technologies, Teranetics has the financial backing of a strong consortium of venture investors with an outstanding track record in the semiconductor and data networking sectors. For more information, visit [www.teranetics.com](http://www.teranetics.com).

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