

## SWITCHES SWITCH FROM 1000BASE-T TO 10GBASE-T Now

OCTOBER-09

### INTRODUCTION

Power, cost, performance and interoperability are key concerns for data center managers. 10GBASE-T addresses all these facets without changing the investment of the existing infrastructure and its manageability. For Data Center IT managers, 10GBase-T offers the ideal solution.

The purposes of this paper evaluate the efficiencies attained by implementing 10GBase-T Ethernet solutions. The 10GBase-T technology itself inherently offers performance, interoperability, upgrade-ability, and density features strengths. Now, since ratification in 2006, the 10 Gigabit over Twisted Pair copper standard has reached the stage of additionally offering power, density, and cost efficiencies.

### EFFECTIVENESS OF 10 GIGABIT ETHERNET

#### DENSITY EFFICIENCIES

One Rack Unit (1 RU) can encompass a 48-port 1000BASE-T switch or a 48-port 10GBase-T. Utilizing the same standard structured cabling, as long as link segment requirements are met, a 10GBase-T system offers 10X more bandwidth in the same amount of space.



#### COST EFFICIENCIES

A conventional 48-port 1000Base-T switch will price at \$5000; this calculates to paying ~\$100 per Gigabit of Bandwidth. A 48-port 10GBase-T switch will price at \$26,500 which calculates to paying ~\$50 per Gigabit of bandwidth. An initial look the price tag on a 10G Ethernet system seems intimidating; however, the simple price per bandwidth computation shows that 10G Ethernet enables cutting costs in half.

48 Ports	1000Base-T	48G Bandwidth	\$5000	→ \$100/Gigabit
48 Ports	10GBase-T	480G Bandwidth	\$26,400	→ \$50/Gigabit
<b>SAME PORT COUNT = HALF THE COST PER BANDWIDTH WITH 10G</b>				

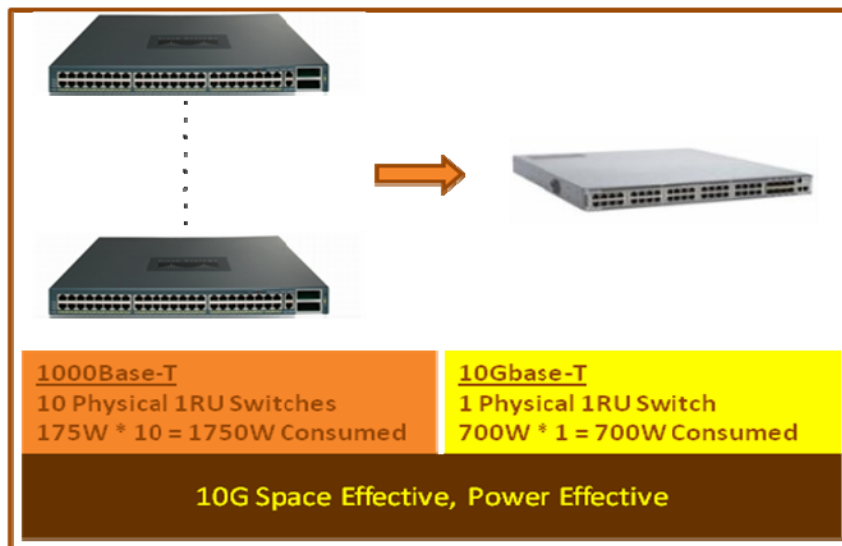
For IT managers, the ability to utilize the existing infrastructure medium, obtain significant density within the same space, *and* achieve significant cost savings makes 10GBase-T the technology of choice *now*.

**POWER EFFICIENCIES**

A conventional 48-port 1000Base-T switch will consume about 175W of power; this calculates to 3.6 Watts per Gigabit of Bandwidth. A 48-port 10GBase-T switch will utilize about 700W of power; this calculates to 1.5 Watts per Gigabit of bandwidth. Employing 10GBase-T, cuts power per gigabit of bandwidth by over half. In an environment where Energy Efficiency is a primary concern for Data Center, 10GBase-T offer significant savings.

48 Ports	1000Base-T	48G Bandwidth	176W	→ 3.6W/Gigabit
48 Ports	10GBase-T	480G Bandwidth	700W	→ 1.5W/Gigabit
<b>SAME PORT COUNT = 10G OFFERS OVER HALF THE POWER SAVINGS PER GIGABIT</b>				

Additionally, while considering the concerns of the Data Center: the cooling and power distribution are the primary contributors in power consumption within the data center. Equipment placement and the power consumption of that equipment affect this. It would take the placement 10 physical 48-port 1000Base-T systems to equate the bandwidth of a single 1RU 48-port 10GBase-T system; besides space utilization, this would consume 2.5X more power for 1000Base-T to achieve the same bandwidth.

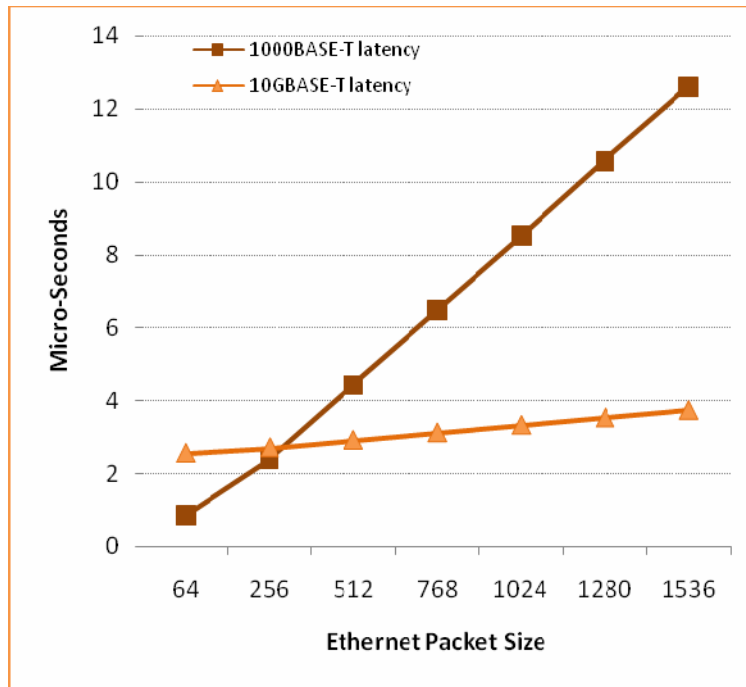


Now IT Managers are in the position to take advantage of the increased bandwidth of 10 Gigabit Ethernet over Twisted Pair Copper while simultaneously benefiting with increased density, cost and power efficiencies.

## THE PERFORMANCE OF 10GBASE-T

### **LATENCY**

The initial delay caused by 10GBase-T latency is significantly higher than that of 1000Base-T. This primary delay causes controversy among the acceptance of 10GBase-T. However, one simply needs to take into account basic throughput-ability and Ethernet packet size to realize that at any Ethernet packet size 512B or larger, 10GBase-T's overall throughput offers the advantage over 1000Base-T, even *with* its initial delay. When considering Jumbo Ethernet frames, there is virtually no impact of the initial 10GBase-T latency.



**Figure: The Non-Impact 10GBase-T's Initial Latency**

### **REACH**

Over 98% of Data Center copper reach requirements are less than 55m. IEEE 802.3an dictates 10GBase-T reach for up to 100m.

Specifically, the 10GBase-T standard allows for two modes of reach capability: 30 meters for short reach applications, and 55-100 meters for fuller reach applications. By segmenting the reach requirements, 10GBase-T embraces <30 meter within rack, top-of-rack, or rack-to-rack reach applications as well as end-of-row applications of 30-100 meters. In Short Reach Mode, IT Managers can further benefit in the power per gigabit efficiencies of 10 Gigabit Ethernet.

## 10GBASE-T OFFERS INTER-OPERABILITY

### **CONNECTORS & COPPER MEDIUM**

10GBase-T and 1000Base-T both utilize the ubiquitous RJ-45 connector, ensuring a plug-and-play advantage. The IT Manager sees no change in physical operations while upgrading to 10GBase-T technology.

The majority of data centers today utilize 1000Base-T for switch and server interconnect. 10GBase-T utilizes same standard, structured twisted-pair cable infrastructure, thus

- Ensuring ease of bandwidth upgradeability on existing mediums,
- Preserving investment of the existing cable plant infrastructure in terms of operations, manageability, and knowledge-base.

### *IEEE 802.3AN-2006 10GBASE-T SUPPORTED CABLING*

<b>Cable</b>	<b>Link Segment Distance</b>	<b>Cabling Reference</b>
Class E / Category 6	55 to 100 meters	ISO/IECTR-24750, TIA/EIA TSB-155
Class E / Category 6 unshielded	55 meters	ISO/IECTR-24750, TIA/EIA TSB-155
Class E / Category 6 shielded	100 meters	ISO/IECTR-24750, TIA/EIA TSB-155
Class F	100 meters	ISO/IECTR-24750
New Class E / Augmented Category 6	100 meters	ISO/IEC 11801 ed2.1, TIA/EIA-568-B.2-10

### **INDUSTRY STANDARD**

As an IEEE standard, 802.3an-2006 10GBase-T ensures a base interoperable technology among multiple vendors. No longer an infant technology, 10GBase-T now can offer IT Managers a security of interoperability among switch, router, and NIC/server vendors.

### SUMMARY

As a technology, 10GBase-T intrinsically offers increased bandwidth. As an IEEE standard, 10GBase-T offers base interoperability and upgradeability utilizing the *existing* infrastructure. As the market has matured, 10GBase-T now also offers IT Managers so much more: Cost efficiencies, Power efficiencies, and Density efficiencies. With this effectiveness, Data Centers are able to attack their primary concern: Energy Consumption, with the implementation of 10GBase-T. Leveraging all these advantages, 10GBase-T Switches are primed for installation by IT Managers.

### *10GBASE-T OFFERS INCREASED EFFECTIVENESS FOR IT MANAGERS*

<b>Factor</b>	<b>1G</b>	<b>10G</b>
Density	1 RU = 48G	1 RU = <b>480G</b>

Cost per Gigabit	\$100/Gigabit	<b>\$50/Gigabit</b>
Power per Gigabit	3.6W/Gigabit	<b>1.5W/Gigabit</b>
Latency	8.5 $\mu$ s; 1024B Packet	<b>3.3<math>\mu</math>s; 1024B Packet</b>
Short Reach Mode for lower power	N	<b>Y</b>
Copper Medium	Structured Twisted-Pair	Structured Twisted-Pair
Connector	RJ45	RJ45

### **ABOUT TERANETICS**

Teranetics is a leading provider of silicon solutions that enable significantly higher data rates over structured copper cabling than are currently available in today's Ethernet network environments. Led by a team with exceptional expertise and experience in the development and application of mixed-signal semiconductor solutions and digital communication technologies, Teranetics is the first company to ship a production-ready 10GBase-T semiconductor designed for next generation network applications. Teranetics is backed by a strong consortium of venture investors with in-depth experience and success in the semiconductor and data networking markets.

For More Information: [www.teranetics.com](http://www.teranetics.com)