

Why do we need 10G Ethernet?

Introduction

Over the last 20 years, computer networks have evolved from centralised mainframes to decentralised clusters, where computing processing power is spread throughout an organisation.

The powerful processing capabilities of these clusters, due largely to the scalability and flexibility of affordable servers have made clusters extremely popular for a number of different applications, particularly high-performance computing (HPC) environments. As servers have grown cheaper and more powerful, it has become common to cluster larger numbers of less powerful servers to build highly available, cost-effective networks that deliver the same high performance capabilities of HPC networks.

Ethernet has been the first choice of network technology for supporting the vast majority of network connectivity solutions. However, due to a lack of high-performance Ethernet products, most of these high-performance computing solutions could not continue to use Ethernet for their interconnect solutions. In order to maintain the high performance of clustered networks, servers were forced to use proprietary interconnects that added cost and complexity to the overall solution.

Today, with the availability of high-performance 10 Gigabit Ethernet technology, clustered networks can finally use this common and dependable network access method to interconnect their servers, while maintaining the high-performance capabilities they have grown to expect.

Emergence of 10 Gigabit Ethernet

Since being developed by the Xerox Corporation, Ethernet has proved surprisingly resilient, evolving into the default interconnect for networked servers around the globe. Starting as a relatively simple “blue book” 10 Mbps solution, Ethernet has seen off the challenges of Token Ring, and ATM protocols to the point where it easily has the majority share of the market. Successive generations of more powerful 100Mbps and 1Gbps versions were released, gaining favour due to compatibility with previous generations and lower costs, especially compared to other interconnect technologies. Users deploying the latest Ethernet products could leverage their expertise and their previous investments; making Ethernet a highly desirable networking solution. Keeping pace with developing cabling standards, has allowed Ethernet to run on low cost twisted pair cable, allowing for flexible and simple networks to be constructed with ease.

The emergence of 10gigabit-per-second Ethernet (10Gbps) carries on the tradition, bringing with it the same compatibility and easy migration expectations as its predecessors. Featuring 10 times the bandwidth of the previous 1Gbps Ethernet technology and with the cost dropping rapidly, 10Gbps has emerged as a viable technology that is ready to challenge the current proprietary solutions.

While some vendors, hoping to capitalize on this new opportunity, have announced the availability of 10Gbps network adapters and switches; vendors have been selling 10Gbps switch ports used primarily for inter-switch links and the cost has prevented the technology from achieving “prime time” status.

As the price of 10Gbps network interface cards and switch ports fall, 10Gbps is rapidly becoming an affordable solution. Switch port prices, have fallen

over 80 percent in the last two years, and network interface card prices have dropped by over 50 percent. Knowing the history and popularity of Ethernet, once the price of a 10Gbps switch port drops to around five times the price of 1Gbps switch port 10Gbps port shipments will grow in volume, causing the price to drop even further. This could happen sooner rather than later; currently, 10Gbps solutions for fibre and CX4 for copper have been released into the market, while 10Gbps solutions for unshielded twisted pair (UTP) — the most popular medium for Ethernet over copper cable — will be ready in 2006, driving cost down even further.

Processing: The 10 Gigabit Ethernet Bottleneck

History has shown that processing power has doubled every 18 months, and Ethernet speeds have kept far ahead of the processing speeds. A standard rule of thumb is that for every 1MHz of performance the CPU can process 1 Mbps of data; at this rate, to process 10Gbps of Ethernet traffic, a 10GHz processor is required, while a 20GHz processor is required to process full duplex traffic. Clearly, processing speeds are a serious obstacle preventing 10Gbps from realizing its true potential to servers and high bandwidth desktop PCs. With processor design still evolving every 18 months, processing power should catch up within 4 – 5 years well inside the expected life span of any cabling installed today.

Unfortunately the processor is not the only challenge; memory bandwidth and the host bus interface driving the traffic are also hindrances to achieving full 10Gbps throughput. New PCI bus systems are due for release in the next months and will go some way to solving this issue, leaving memory bandwidth as the most serious hurdle to be cleared. Developments are on the way into how the memory is used and reducing the amount of “trips” the data makes across the system bus to memory will improve the time or latency through the PC or server.

Conclusion

The flexibility and reduced cost of copper cabling gives the 10GBASET Ethernet a major advantage over other proprietary systems. The cabling cost has always been a significant factor in choosing the high speed protocols for the Data Centre, be this HPC or SAN environments and the advancement of twisted pair cabling to support 10Gbps Ethernet is a significant step forward.

Ethernet holds virtually 90% of the network market and the advances made with 10Gbps will only see the market share grow. The advances in copper cabling have shown that it is more than capable of supporting this bandwidth and is the ideal choice for any new cabling system. However with the need for near perfect termination of the connectors on a copper system, pre-terminated cabling would be the ideal choice for such installations.