TECHNOLOGY FUTURES INC.

Is Gigabit Ethernet the Answer Today? We Don't Think So!

A white paper by Technology Futures, Inc.

Technology Futures, Inc. 13740 Research Blvd., Bldg. C, Austin, Texas 78750-1859 U.S.A.
(800) TEK-FUTR [835-3887] • (512) 258-8898 • Fax: (512) 258-0087 • E-mail: info@tfi.com • www.tfi.com

Printed in the United States of America.

Published by Technology Futures, Inc.
13740 Research Boulevard, Building C
Austin, Texas 78750-1859
(800) 835-3887
(512) 258-8898
Fax: (512) 258-0087
www.tfi.com

Is Gigabit Ethernet the Answer Today? We Don't Think So!

David Smith
Technology Futures, Inc.

The trade press is touting gigabit Ethernet, a third-generation Ethernet LAN technology, as the solution to packet versus switched data network problems facing the information technology (IT) and communications industry. Positioned as a direct competitor to switched ATM technology in the high-speed LAN market, gigabit Ethernet—a broadcast solution—is expected to grow to almost a $1.5 billion market by 2001. A technology plan recently developed by Technology Futures, Inc. for a major university included an in-depth review of ATM and gigabit Ethernet as part of a critical examination of the various available transport options.

Our conclusion: If you need a short distance (less than 50 feet!) high-performance network, gigabit Ethernet may be the answer, but serious limitations to the existing technology make it unsuitable for most LAN/WAN applications. There are a number of issues concerning gigabit Ethernet, such as standards, interoperability, and product availability that must be addressed before it can be a market success. In the interim, there are a number of existing and emerging technologies that may well displace Ethernet technology. We'll address each of these issues briefly.

Standards

A standard for gigabit Ethernet—802.3z—is currently under development. It is hoped that this will resolve some of its technical problems, but it is still very much a work in

progress. Perhaps more important, though, is that many of the features of ATM—bandwidth aggregation, quality of service, virtual LAN emulation, and interoperability—are not currently written into the 802.3z standard. There are many more standards issues, but on a base issue in general, data services vendors and users fall into one of two camps:

- Those who love switched telecom-like transport.
- Those who love packet-based transport.

No matter which signaling scheme is selected by IEEE, the gigabit technology will be very complex, and it is important to remember that implementation complexity and network robustness do not always travel in pairs. A new and emerging Internet Engineering Task Force (IETF) standard for IP could be the key standard that merges the best of both IP and ATM. This protocol, called Multi-Protocol Label Switching (MPLS), will allow IP or ATM traffic to be efficiently routed over either or both IP and ATM networks, maintaining the better routing protocols of IP and quality of service capability of ATM.

Project Activities

In the conduct of this project, TFI and company personnel worked together to:

(1) It is not functionally capable of “plugging” into existing Ethernet architectures because it has a different packet size.

(2) It cannot use Category 5 patch cable as a distribution medium.

(3) It has a distance limitation of 25 meters, which means a wiring closet every 50 feet.

Category 5 patch cable, which is four-pair stranded PVC cable, is the industry standard for connecting networked workgroups and desktops. However, it is a two-pair specification and was never intended to supply signaling on more than two pairs. Ethernet LANs running at 10 Mb/s or 100 Mb/s (fast Ethernet) use only two pairs—one in each direction—and are therefore subject to the crosstalk from only one pair at each end. A gigabit Base-T device, on the other hand, transmits on all four pairs and in both directions simultaneously! As a result, it is subject to crosstalk from three pairs at either end.

In addition, the power consumption of a gigabit Base-T device is expected to be in the range of three to four watts. Put another way, it is a transmitter with the power of a CB

radio. Category 5 patch cable is not shielded, and there is great concern that running that much wattage over unshielded cable will create problems with other equipment. Technologies such as wireless LANs and analog cellular may not work at all around Category 5 cable running gigabit Ethernet because of the interference.

However, to meet the growing demand for greater bandwidth, all of the new increases in usable bandwidth of unshielded twisted pair cable will need to rely on using all four pairs as signal pairs. There are a number of emerging technologies that can solve this problem, including Category 5 enhanced cable, Category 6 cable (already existing in Europe), Category 7 cable, and fiber optics. This will surely change the way we design distribution networks. Gigabit speeds are three orders of magnitude faster than 10-Base-T and are part of what got the networks to where they are.

Pricing Issues

The high price of gigabit Ethernet technology is another issue for network sites. Initial adapter cards on the market cost nearly $2,000 each, and analysts are divided over how rapidly prices will fall. As we have seen with fast Ethernet, adapter costs are critical to the success of gigabit Ethernet. The cost extends beyond the adapters to include routing, building destination, and even connectors.

Competing Technologies

Business choices for high-speed data services today are pretty much limited to two market places: Ethernet and ATM. Both are mature technologies and are well entrenched in their network communities. Introduced in 1997, fast Ethernet or Ethernet running at 100 Mb/s is the basic data network staple. The cost has dropped to 10 Mb/s prices, and the technology is secure.

ATM (asynchronous transfer mode) is a cell-switched architecture promising variable bandwidth on demand from 51 Mb/s to more than 2.4 Gb/s, quality of service guarantees, virtual network support, and many other features. It is a mature technology that fully supports voice and video features. Driven by collaborative computing applications such as graphics, multimedia, and video, its advantages are its ability to multiplex voice, video, and data over the same infrastructure, and it facilitates a homogeneous WAN/LAN infrastructure. If standardized and implemented correctly, this standard promises to be the LAN/WAN choice for the foreseeable future.

Another way of looking at this is to examine the ATM demand at high-performance mainframe sites. As an early indicator, it is estimated that, by the end of 1998, ATM

probably will carry the majority of WAN traffic at leading edge, high-performance mainframe customer sites. We project that ATM will continue to dominate the telecom network backbone, despite competition from Ethernet technologies.

Although Ethernet and ATM are the dominant players in the high-speed data services field, there are some new technologies emerging that are likely to be strong contenders. These include HiPPI, Fibre Channel, and FDDI.

- HiPPI (high-performance parallel interface) is a copper-based channel standard that can be switched to form a high-performance network. This architecture is currently the only way to get true gigabits per second delivered to a machine.

- The Fiber Channel system (FCS) is a recent channel standard that, like HiPPI, can be switched to create a network. Prominent network speeds are 266 Mb/s (quarter speed) and 1 Gb/s. In addition to interconnecting machines and peripherals, FCS is being used to cluster high-performance workstations for distributed computing.

- FDDI (fiber distributed data interface) and its copper equivalent (CuDDI) are solutions for high-speed distribution. FDDI is a shared 100 Mb/s token passing network. FDDI has a version, FDDI-II, that supports isochronous data such as voice. FDDI Follow-On LAN is a standard for a gigabit version of FDDI. To date, little progress has been made on this standard, and it will continue to progress slowly unless all of the other network architectures fail.

If you're looking to increase your network performance, there are several ways you can hedge your bet. With the exception of fast Ethernet, ATM, and FDDI, the emerging network technologies mentioned above are still under development and may not survive. Therefore, you may want to wait until the network war settles down before making a choice.

If you believe that TFI could be of assistance to your organization in developing a fast follower strategy, please contact John Vanston, Larry Vanston, David Smith, or any other member of the TFI consulting staff.