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Network Digest

Mission-critical insights for managers of mission-critical systems

# The Gigabit Ethernet Opportunity

The no-hassle 1,000 Mbps backbone is here.

*By Gabriel Allan*

Today's network managers face a daunting paradox: Speeding their networks can actually slow them down.

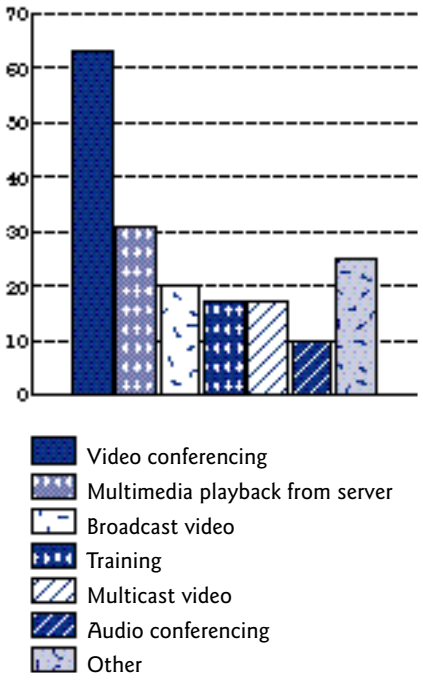
Upgrading desktop computers to 100 Mbps Fast Ethernet was supposed to boost data transmission rates by an order of magnitude, compared to standard 10 Mbps Ethernet, and eliminate the poor response times that plague most users. However, upgrading desktops to Fast Ethernet simply moves the bottleneck away from the desktop. When a half-dozen Fast Ethernet ports are attached a single 100 Mbps FDDI backbone, the result can be paralysis.

Yet the need for speed is intense. Organizations getting ready for the next century demand better performance, reliability, and cost effectiveness of their computing infrastructures. These demands are non-negotiable, because the network has become the backbone of the business. Roughly 75% of network mangers consider their networks to be critical to their organizations, according to the market research firm International Data Corp. of Framingham, Mass.

"Organizations depend on the network as an internal and external communications medium," says Lynn DeNoia, director of consulting services for Strategic Networks, a market analysis company in Rockland, Mass. For both critical and non-critical applications, the data network is achieving the same ubiquity of use as the telephone system. And users are demanding the same level of performance.

## Bandwidth Drivers

*Increased bandwidth is the primary tool that network managers will use to improve quality of service. A laundry list of applications drive bandwidth demand, according to a survey of IS managers (% of responses, multiple answers allowed):*




Source: Infonetics Research

The demand for better network performance stems from a number of sources. More people using more network-centric applications that usually involve significantly larger files have clogged existing data pipes.

A few years ago only a quarter or a half of an organization's staff were connected to a local area network. However, by next year, 92% will be linked, according to surveys by the Sentry Research Services firm of Westborough, Mass.

The influx of users are quick to embrace traditional network applications. "There is more of the same old kind of traffic," says DeNoia, of Strategic Networks. "There is more e-mail, more file sharing, and more groupware applications."

In addition, the new applications demanded by senior managers are bandwidth hogs. The graphics, audio, and video components of the typical corporate intranet can require the movement of files from 10-100 Mbytes. Even a word processing document today may be 100 times larger than its predecessor of three years ago, due to the inclusion of charts, fonts, and other

graphics elements.

Each industry has megafile applications: Medicine has imaging, manufacturing has CAD/CAM and 3-D modeling, finance and retailing have data warehousing. New horizontal applications can clog LANs, too: Infonetics Research Inc., a market research firm in San Jose, says videoconferencing is one of the primary reasons users are desperate for increased networking capability (see chart, "Bandwidth Drivers," first page).

These new server-based appli-cations also helped to reverse a network traffic tradition: instead of most traffic residing within a workgroup, most network transmissions are between servers. Dataquest, a market research firm in San Jose, Calif., says that the traditional 80/20 rule has become inverted. In the past, 80% of network traffic stayed in the workgroup and only 20% was server traffic. Today 80% of the network traffic makes it up to the server and only 20% stays local. "We've had a huge shift in patters of traffic," Virginia Brooks, director of network research for the Aberdeen Group consulting firm in Boston. "In the past, most of the communications was going on within a department. Today, the vast majority of network traffic travels across the backbone."

Architecture shifts, too, have increased the amount of server-to-server transactions. The drive toward network computers (NC), desktop devices with a minimum of computing power, will put an even greater strain on network capacities—these "thin clients" need to contact the server continuously, not only to download the initial application but also for applets that change fonts or create tables.

In this network-intense environment, backup is becoming a bigger headache than ever. Since the network has become mission critical for most companies, it must be backed up. There's greater traffic than ever, so there's more backup to be done. And large organizations are global in scope, so the segment of time during the week when they can take servers off-line is narrower than ever. These days IS managers are lucky if they have four hours to backup hundreds of gigabytes of data from local and remote sites.

## Several Solutions

Several approaches improve network throughput and reliability. Aberdeen's Brooks is high on the idea of "resource conservation: using technology to let you get more mileage out of your bandwidth." Caching techniques, switches and greater LAN segmentation each will all allow you to get more out of your network without actually changing your networking technology.

Adding bandwidth is the most obvious way of improving throughput. Over the past five years several higher speed technologies have become available that go beyond the limits of 10 Mbps Ethernet. Fast Ethernet provides throughput of 100 Mbps while using the same framing structure and address system as 10 Mbps Ethernet. Fast Ethernet also has all the maturity and stability of the original Ethernet at ten times the speed. The only drawback is that you really want something faster for the backbone.

The Fiber Distributed Data Interface (FDDI) is firmly entrenched as the backbone of choice. Almost 50% of all large corporations have installed it, according to Sage Research, of Natick, Mass. It's a reliable and fairly mature technology. It allows customers to extend to copper, lowering the cost of server connections.

Asynchronous Transfer Mode (ATM) protocol is the fastest of all the network technologies, making it an appropriate and popular choice for many backbones. There is no theoretical limit in link speed, with 622 Mbps available on LAN switches today. ATM products are expected to scale to 10 Gbps in the next three years for WAN access.

ATM has other advantages, beyond raw speed. It allows for fine grain mixing of different types of traffic, making it a

### Part Of The Family

*Gigabit Ethernet shares many technical characteristics with other forms of Ethernet.*

| CHARACTERISTIC | ETHERNET | FAST ETHERNET | GIGABIT ETHERNET |
|---|---|---|---|
| **Nominal speed** | 10 Mbps | 100 Mbps | 1,000 Mbps |
| **Uses CSMA/CD Access Method** | √ | √ | √ |
| **Supports Star topology** | √ | √ | √ |
| **Uses 802.3z Ethernet frame format** | √ | √ | √ |
| **Full and half duplex operation** | √ | √ | √ |
| **802.3x Flow control** | √ | √ | √ |
| **Copper cable distance*** | 100m | 100m | 25m-100m |
| **Multimode fiber optic cable distance** | 2km | 2km | 200m-550m |
| **Single mode fiber optic cable distance** | 60km | 60km | 2km-10km |

Sources: Gigabit Ethernet Alliance, *Network Digest* * Projected

good choice for networks where voice, video and data are mixed. Business Research Group, of Newton Mass, says that 42% of network managers plan to use ATM in their network backbones before the turn of the century.

However, for those networks built around Ethernet, ATM represents a change from frame-based to cell-based technology. Furthermore, ATM demands a new set of network management tools.

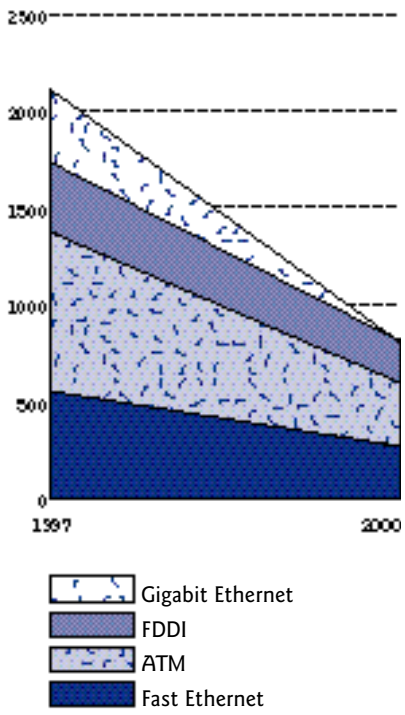
For those who are seeking both raw speed and ease of use, the best solution may well be the newest technology for networks, Gigabit Ethernet. At 1,000 Mbps, Gigabit Ethernet is an extension of the familiar 10 Mbps standard Ethernet and 100 Mbps Fast Ethernet. It adds another layer of scalability to the ubiquitous Ethernet networking scheme.

Therefore, Gigabit Ethernet allows companies to leverage the tremendous installed base of Ethernet equipment. More than 120 million interconnected PCs, workstations, and servers use Ethernet worldwide today, according to IDC.

Furthermore, Gigabit Ethernet makes use of the same frame format, frame size, protocols, and management data. Since network managers have already have the tools and training to manage Ethernet, there are only minimal incremental administrative costs associated with Gigabit Ethernet.

**Gigabit Ethernet To Narrow Price Gap**

*($ per port)*




Source: IDC

## Plummeting Prices

Today, the price per port of Gigabit Ethernet is relatively high. But hardware developers are familiar with Ethernet. That familiarity, combined with high user demand, should drive prices down quickly. By the year 2000, the price per port should fall to around $800—lower even than that of FDDI (See chart, "Gigabit Ethernet To Narrow Price Gap," this page). Market analysts predict that the cost per port should be about three times that of Fast Ethernet, for a 10-fold increase in performance.

However, the cost of owning a network is more than the cost of the equipment. The Gartner Group IT consulting firm in Stamford, Conn. estimates that only about 21% of the cost of operating a network is hardware and software—administrative and operating costs account for the remaining 79%.

The widespread deployment of Ethernet makes Gigabit Ethernet a logical migration choice for backbone use. Network administrators have extensive experience with Ethernet, and will need little new training to take care of Gigabit Ethernet gear. And a broad array of network management tools have been developed for Ethernet.

Prices will drop and IS comfort levels will rise as Gigabit Ethernet emerges as a standard next year. The IEEE 802.3 working group is scheduled to vote on the standard in the summer of 1997, and the complete standard should be voted on sometime early in 1998.

The initial Gigabit Ethernet has been defined only for fiber optic cable. Specifications for copper cable may lag as much as two years behind. This isn't a big issue for the backbone applications, though, since copper wiring has distance limits which would hamper a backbone anyway.

In 1996, a group of vendors formed the Gigabit Ethernet Alliance to promote the protocol and to provide technical resources and demonstration facilities for the IEEE working group. Today, more than 100 companies are supporting Gigabit Ethernet.

Vendors have ambitious plans for Gigabit Ethernet. They plan to offer Gigabit Ethernet equipment that supports switched, routed, and shared environments. A number of start-ups and established networking equipment vendors already have introduced equipment based on the draft standards.

## Implementation Strategies

Perhaps the most attractive aspect of Gigabit Ethernet is the smooth migration path. If an existing network backbone is pure Ethernet and/or Fast Ethernet, a network manager just needs to replace the 10/100 Mbps NIC cards and switches. Even if it isn't quite that simple for the majority of organizations that have multiple networking protocols at work, network administrators can typically keep existing wiring, operating systems, protocols, and network managing strategies when migrating to Gigabit Ethernet.

Indeed, larger players in the networking game have already announced products that place Gigabit Ethernet squarely in their family of networking technologies. Digital Equipment Corp., for example, says its GIGAswitch family will be expanded to include Gigabit Ethernet and Fast Ethernet backbone switches, and the company will provide for integration with its existing ATM and FDDI product lines.

The Gigabit Ethernet Alliance has identified five implementation scenarios areas where Gigabit Ethernet will have an impact: a switch to server connection upgrade, switch to switch upgrade, upgrading a switched Fast Ethernet backbone, upgrading a FDDI backbone, and as a high performance desktop connection. Backbone upgrades will be among the first of these applications to be adopted by the general networking community. (For more information about upgrade scenarios visit the following World Wide Web site: www.networks.digital.com/dr/feature/index.html).

Upgrading a switched Fast Ethernet backbone, while not trivial, is a fairly straightforward procedure. As described by the Alliance, a Fast Ethernet backbone switch that aggregates multiple 10/100 switches can be upgraded to a Gigabit Ethernet switch supporting 100/1000 switches. Those aggregate switches mean that a network doesn't have to change over to Gigabit Ethernet until ready to do so, and also that the network can operate at two speeds at once.

Once the backbone is upgraded, high performance server farms can be connected directly to the backbone. This will immediately increase throughput by a factor of ten, and also allow for greater segmentation, with more bandwidth per segment.

The advantage to upgrading an FDDI backbone to Gigabit Ethernet is that it's already operating on fiber optic cable. That means that upgrading a centralized FDDI backbone is just a matter of replacing an FDDI concentrator with a Gigabit Ethernet switch, though routers may have to be upgraded, or replaced with switches, too. Upgrading a distributed FDDI backbone means replacing each concentrator and router separately with a switch. In this context, you can do a partial migration upward if budgetary or other factors require it. Installed FDDI routers and concentrators will need to have an interface card installed until they are upgraded.

## Finding A Partner

Selecting the proper partner to help with the Gigabit Ethernet upgrade can be a challenge. Small startup companies have been first to market. What looks like a bargain price may not be a good deal, though. "The big players cover all the bases," says Strategic Network's DeNoia. "They have ATM switches, FDDI, and so on. There's a lot of attraction in that." She notes that most network managers want to reduce the number of vendors they support.

"The fewer vendors I have to deal with, the happier I will be," DeNoia adds. For network managers, their "job depends on how this network runs, and how reliable it is, and how fast they can fix things." In that context, price may not be the primary criterion.

Another factor is vendor stability. Given the sorry track record of high-tech startups, and the not-yet-standardized nature of Gigabit Ethernet, network managers must be sure that the supplier will be around tomorrow. ◘

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