(14)

# WHY DIGITAL IS COMMITTED TO ETHERNET FOR THE FIFTH GENERATION

A summary of remarks made by Gordon Bell, Vice President—Engineering, Digital Equipment Corporation, at the Xerox/Intel/Digital Seminar.

New York, February 10, 1982

# WHY DIGITAL IS COMMITTED TO ETHERNET FOR THE FIFTH GENERATION

## ABSTRACT

What the Digital Unibus did for minicomputers, Ethernet will do for the Fifth Generation.

Nearly all recent computers are organized around a single, high speed bus (Unibus-type structure) which provides communications among its processors, memory, disks, and interfaces to the external environment. This simple structure has been one factor in the rapid evolution and proliferation of computers. Unfortunately, a bus for interconnecting computer components within a cabinet, is not suitable for interconnecting a network of computers within a building.

Ethernet is a high speed, 10 megabits per second, standard bus providing the first two levels of the ISO Open Systems Architecture. It permits the dynamic connection of computers at a site to form a local-area network (LAN) in an open-ended fashion without the need of centralized equipment or planning and control. In the Fifth Generation, the network becomes the system and Ethernet is a key prerequisite of the generation.

Ethernet will be used initially, in an evolutionary fashion, to interconnect networks of today's computers to each other and to terminals and personal computers. Since Ethernet is a factor of 1000 higher speed standard than today's network links, and easily used to form networks, we expect a rapid transition to a tightly integrated network, where the network is the system. In this generation, separate function computers (eg. personal workstation, file server, print server, real time, timeshared) will be tightly integrated, interchanging many types of messages, such as, files, computed graphics, pictures, and voice. This kind of network will permit a radically different use of computers, and only then can we be certain that this is the Fifth Computer Generation.

Because Ethernet is so important to the Fifth Generation, Digital is committed to it as a standard. We use these networks and will be providing products in the near future.

**Ethernet Is The Unibus Of The Fifth Generation**

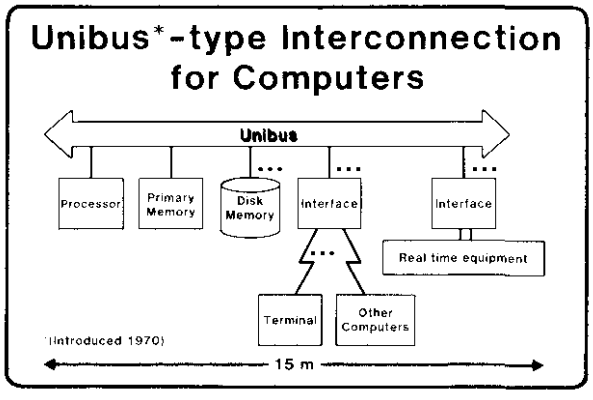
## "You have to look at Ethernet as a standard..."

Ethernet is one of the keys to the development of the Fifth Generation because it provides a standard for the interconnection of all sizes and types of computers in a passive, local-area network.

Up until now, interconnection has been a very difficult task simply because there has been no standard.

A standard is a blueprint that shows you how to build the components that will go into a system or onto a network.

## "... system components are connected by a single high-speed bus in an open-ended fashion."

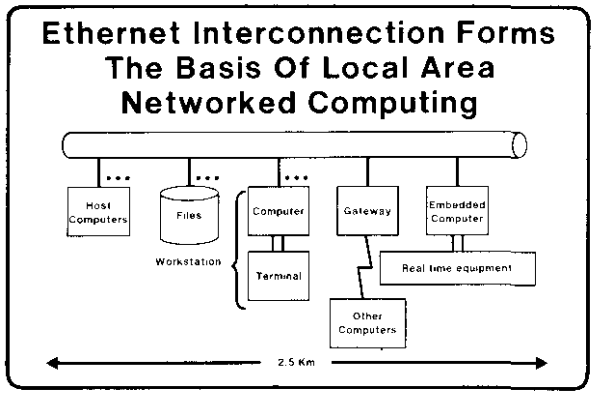



If you look at current computer architecture you will find standards. One such standard is the Digital Unibus that defines the architecture used in the largest selling series of minicomputers ever built—the PDP-11 series. The Unibus standard made it possible for our users and a number of different manufacturers to build memory boards, communications interfaces, and other components that can be plugged directly in a PDP-11 system in an open-ended fashion.

If you look at the Unibus-type architecture, or any competitive implementations of the Unibus idea such as Intel's Multibus or Motorola's Versabus, you will find that all system components—processors, system memory, data storage, and data communications interfaces—are connected by a single, high-speed data path or bus.

This bus enables the computer to move data within the system at very high speeds. Unfortunately there has been no standard bus to move data between systems at the similar speeds. Ethernet communications won't replace Unibus or any competitive busses but Ethernet will solve the local-area networking problem.

## "Think of Ethernet as an extended bus..."




Ethernet is an extended bus. Up until now busses have provided high-speed computer communications within a very limited area—a single cabinet or room. Ethernet provides an extended bus that will link information processing nodes throughout a building, campus, or industrial complex.

The system components don't change. You have the same components in an Ethernet as you have in a single system. The only difference is that you now have more components and they're dispersed over a wider area. Where a Unibus system has a single processor, an Ethernet can have many.

Where a Unibus system has local data storage, an Ethernet will support databases distributed throughout the network.

Where a Unibus system interfaces to other computers, an Ethernet interfaces to other networks through gateways.

## "The network becomes the system. . . ."

In other words, with Ethernet, the network becomes the system. And when this happens, we will have a whole new computer generation—The Fifth Generation.

We—that is Digital Equipment Corporation—want to be a leader in the development of this new generation just as we were the leader in interactive computing and the development of the minicomputer generation that made distributed data processing possible.

Let me take a minute to define what I mean by a computer generation.

A new generation of computers comes about when there is a convergence of Technology and Need that forms a new Structure that is then followed by general Use.

With Ethernet and VLSI—Very Large Scale Integrated Circuits—we have the technology. That technology is needed to build and network an ever-growing number of computers, terminals, intelligent workstations, and personal computers that are being bought to solve many of the productivity problems facing business today.

There is also a new structure, the local-area network. Just as minicomputers and distributed processing changed the way computers were used in the 70s, local-area networks and personal workstations will change the way computers are used in the 80s.

The final requirement for a new computer generation is customer acceptance. Will the new technology and the new structure come into general use? In this particular case, I am convinced it will. Just as I'm convinced that Ethernet is the technology that will make this happen.

Ethernet provides the simplicity, speed, and universality needed in local-area networking.

Unlike other local-area networks, Ethernet is open-ended. It allows the user to build a local-area network from the bottom up without making a large capital investment or developing an inflexible long-range plan.

As I mentioned earlier, Ethernet is a passive communications medium. An Ethernet is really nothing more than a coaxial cable and standard protocols that define the way data is transmitted. For example, the Ethernet protocol defines packet size. It defines the way packets are addressed. It's really very simple. And its been tested for 10 years and it works.

Ethernet can carry a great deal of information at very high speeds. But you don't have to take my word for it. I'd like to read you part of an advertisement written by another computer manufacturer who adopted the Ethernet standard.

**"Instead of taking . . . 44 seconds to transmit 10 pages of data, the transfer takes place in .042 second. In the 4.4 seconds it would take a conventional network to send one page of War and Peace . . . you could send the entire thousand page novel."**

It is not difficult to see the benefits. You can transmit entire files from a computer to a personal workstation almost instantaneously. You can transmit photographs, data sheets, engineering drawings, or even voice messages.

The key is universality. Any manufacturer who follows the Ethernet standard can build equipment to go onto the network.

But it is important that we realize that a network is more than just lines and nodes. Higher level protocols are needed to support the interconnection of dissimilar computers; to implement complex network functions such as file transfers and terminal-to-terminal communications; and to provide network management capabilities.

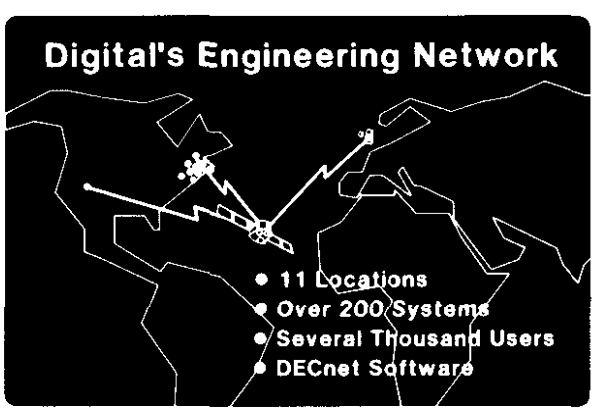
These protocols are complex. But they are a prerequisite for building a network such as the one that serves Central Engineering at Digital. One of the reasons we are committed to Ethernet is that it fits into the framework defined by Digital Network Architecture. We don't have to change the higher level protocols that are being used to support tens of thousands of DECnet nodes around the world. We can make Ethernet part of DECnet. We have a fit. And we have the range of capabilities required to implement complex computer networks.

Let's look at an example.

Digital's Engineering Network is made up of over 200 different systems serving about eight thousand terminal users. But interestingly enough, 80% of the traffic on this network is local traffic—only 20% of the traffic is between locations.

Local-area networking addresses the local problem. It provides high speed interconnection among computers within the same building or complex, and it simplifies the interconnection of terminals and processors to host computers.

## "Higher-level protocols are needed . . ."



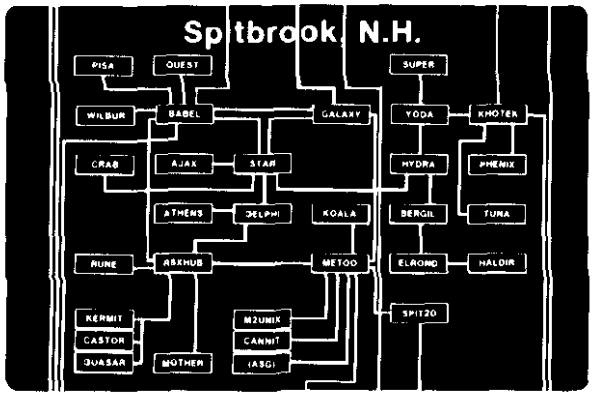
**"Ethernet can eliminate this complexity while providing the flexibility needed for future growth."**

Let's look at the computer-to-computer and terminal-to-computer interconnection problem in a little detail.

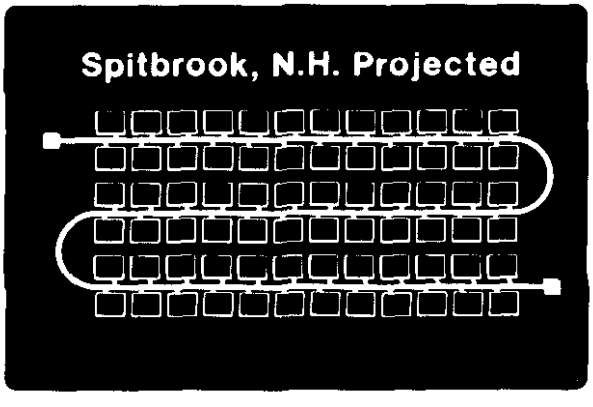
The problem is a wiring problem. It is one thing to connect A to B; quite another thing to connect A to B through Z. Before you know it you have a very complex maze of wires and switches. This is the wireroom in our Spitbrook, New Hampshire facility. As you can see, interconnecting a large number of devices is—at best—a very messy and, I might add, very expensive, business. You have fixed wires running all over the place. It's difficult to add systems or make changes.

Ethernet can eliminate this mess and provide needed flexibility. Ethernet will let us replace all this wiring with a single coaxial cable that will run throughout the building. When we want to add a terminal we'll just tap into the cable. It won't be necessary to run wires back to a central location. And we'll be able to add terminals to the network without interrupting network operations.

But we—like most other large organizations—are starting to provide individual users with intelligent workstations or personal computers rather than simple terminals. A simple terminal is usually a low speed device that can operate over telephone-type wiring. After all I can only read and write just so fast. I can type 50 words a minute. I can read about 200 words a minute. 9,600 bit per second transmission is more than fast enough for me as long as I only have a simple terminal. But when I have an intelligent terminal that can deal with information a lot faster than I can, I need to be able to communicate at computer speeds. Ethernet provides the speed needed to support intelligent user devices. The speed needed to transfer entire files or complex graphic images in a fraction of a second. I need Ethernet communications.




## "This is how our computers are connected today."




## "Ethernet eliminates message switching."

At the same time Ethernet solves the problem of interconnecting computer systems.

This is how the computers at Digital's Spitbrook, New Hampshire facility are connected today. As you can see messages have to be routed through the network. This creates computer overhead. Many systems spend much of their time switching and forwarding messages. And as more and more systems are added to the network this overhead just keeps growing and growing.

Fortunately, Ethernet can eliminate the overhead problem because it eliminates message switching and forwarding. This is how Spitbrook will look when we install an Ethernet.

As you see each system is connected directly to the Ethernet. There is no message switching. No routing. No forwarding. No computer overhead.

Instead of a maze of wires you have a high-speed, high-capacity extended bus that serves the entire complex. As you see Ethernet is changing the very definition of a system. With Ethernet, the network becomes the system.

We have a new technology. A pressing user need. And, a new structure. Three of the four prerequisites for a new computer generation. The fourth requirement is use. There are currently about 100 Ethernets in operation. There are going to be thousands. We've already talked to our customers. We know what they want and we know that many of them are going to install Ethernets. That's why I believe that we're looking at a new computer generation.

**"Within the next few months we will be introducing our first Ethernet products."**

We're going to build that generation. That's why we joined with Xerox and Intel to develop the Ethernet Specification. That specification conforms to both The Open Systems Architecture proposed by the International Standards Organization and Digital Network Architecture used in thousands of networks around the world. Right now we are implementing Ethernet as a part of Digital Network Architecture and within the next few months we will be announcing our Ethernet program and introducing our first Ethernet products.

I believe that Ethernet is one of the keys to the development of the Fifth Generation just as the Digital Unibus was one of the keys to the development of the minicomputer generation.