Ethernet Technologies

Background

The term *Ethernet* refers to the family of local-area network (LAN) products covered by the IEEE 802.3 standard that defines the CSMA/CD protocol as it is commonly known. The following data rates are currently defined for operation over optical fiber and for twisted-pair cables:

- 10 Mbps—10Base-T Ethernet
- 100 Mbps—Fast Ethernet
- 1000 Mbps—Gigabit Ethernet

Other technologies and protocols have been touted as likely replacements, but the market has spoken. Ethernet has survived as the major LAN technology (it is currently used for approximately 85 percent of the world's LAN-connected PCs and workstations), because its protocol has the following characteristics:

- Is easy to understand, implement, manage, and maintain.
- Allows low-cost network implementations.
- Provides extensive topological flexibility for network installation.
- Guarantees successful interconnection and operation of standards-compliant products, regardless of manufacturer.

Ethernet—A Brief History

The original Ethernet was developed as an experimental coaxial cable network in the 1970s by Xerox Corporation to operate with a data rate of 3 Mbps using a carrier sense multiple access collision detect (CSMA/CD) protocol for LANs with sporadic but occasionally heavy traffic requirements. Success with that project attracted early attention and led to the 1980 joint development of the 10-Mbps Ethernet Version 1.0 specification by the three-company consortium: Digital Equipment Corporation, Intel Corporation, and Xerox Corporation. The draft standard was approved by the 802.3 working group in 1983 and was subsequently published as an official standard in 1985. Since then, a number of supplements to the standard have been defined to take advantage of improvements in the technologies and to support additional network media and higher data rate capabilities, plus several new optional network access control features.

Ethernet Network Elements

Ethernet LANs consist of network nodes and interconnecting media. The network nodes fall into two major classes:

- **Data terminal equipment (DTE)**—Devices that are either the source or the destination of data frames. DTEs are typically devices such as PCs, workstations, file servers, or print servers that, as a group, are all often referred to as end stations.

- **Data communication equipment (DCE)**—Intermediate network devices that receive and forward frames across the networks. DCEs may be either standalone devices, such as networkswitches and routers, or communications interface units such as modems.

Ethernet Network Topologies and Structures

LANs take on many configurations, but regardless of their size or complexity, all LANs will be a combination of three basic interconnection structures. The simplest structure is the point-to-point interconnection, shown in Figure 7-1. Only two network units are involved, and the connection may be DTE-to-DTE, DTE-to-DCE, or DCE-to-DCE. The cable in point-to-point interconnections is known as a network link. The maximum allowable length of the link depends on the type of cable and the transmission method used.

Figure 7-1. Example of point-to-point interconnection.

The original Ethernet networks were implemented with a coaxial bus structure, as in Figure 7-2. Segment lengths were limited to 500 meters with up to 100 stations connected to a single segment. Individual segments could be interconnected with repeaters, as long as multiple paths did not exist between any two stations on the network and the number of DTEs did not exceed 1024. The total distance between the most-distant pair of stations was not allowed to exceed a maximum prescribed value.

Although new networks are no longer connected in a bus configuration, some older bus-connected networks still exist.

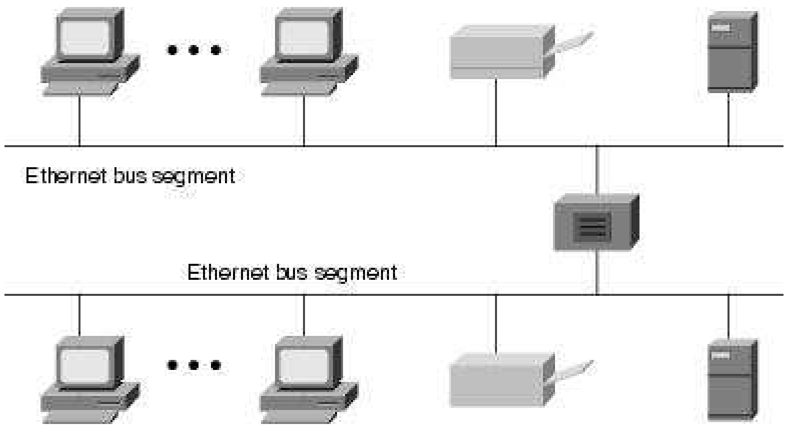

Figure 7-2. Example of coaxial bus topology.

Since the early 1990s, the network configuration of choice has been the star-connected topology, shown in Figure 7-3. The central network unit is either a multiport repeater, also known as a hub or a network switch. All connections in a star network are point-to-point links implemented with either twisted-pair or optical fiber cable.

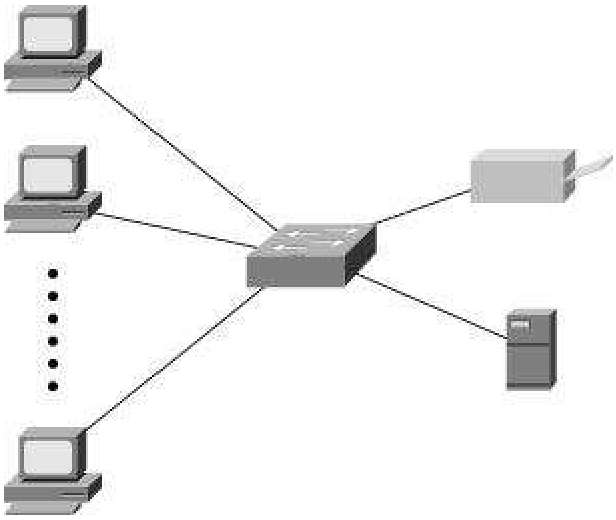

Figure 7-3. Example of star-connected topology.