# Introduction to LAN Protocols

This chapter introduces the various media-access methods, transmission methods, topologies, and devices used in a local area network (LAN). Topics addressed focus on the methods and devices used in Ethernet/IEEE 802.3, Token Ring/IEEE 802.5, and Fiber Distributed Data Interface (FDDI). Subsequent chapters in Part 2, "Lan Protocols" of this book address specific protocols in more detail. Figure 2-1 illustrates the basic layout of these three implementations.

Figure 2-1   **Three LAN implementations are used most commonly.**

FDDI

Ethernet/IEEE 802.3
100BaseT

Token Ring/IEEE 802.5
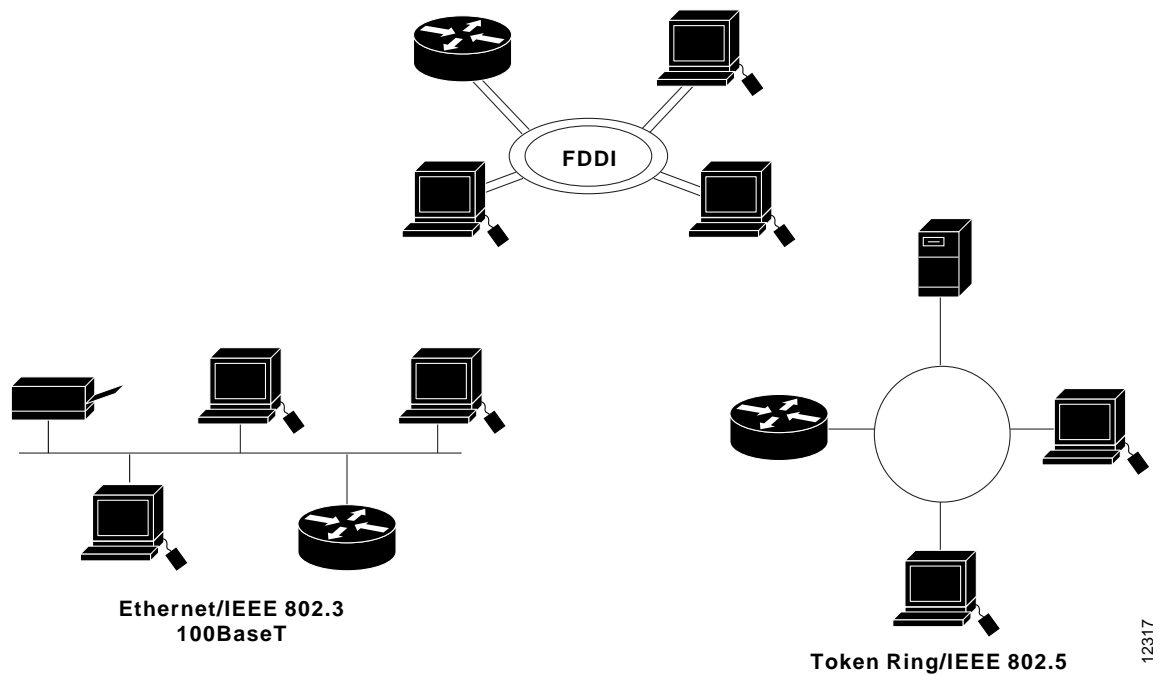
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What is a LAN?

A LAN

 is a high-speed, fault-tolerant data network that covers a relatively small geographic area. It typically connects workstations, personal computers, printers, and other devices. LANs offer computer users many advantages, including shared access to devices and applications, file exchange between connected users, and communication between users via electronic mail and other applications.

LAN Protocols and the OSI Reference Model

LAN protocols function at the lowest two layers of the OSI reference model, as discussed in Chapter 1, "Internetworking Basics," between the physical layer and the data link layer. Figure 2-2 illustrates how several popular LAN protocols map to the OSI reference model.

Figure 2-2   Popular LAN protocols mapped to the OSI reference model.
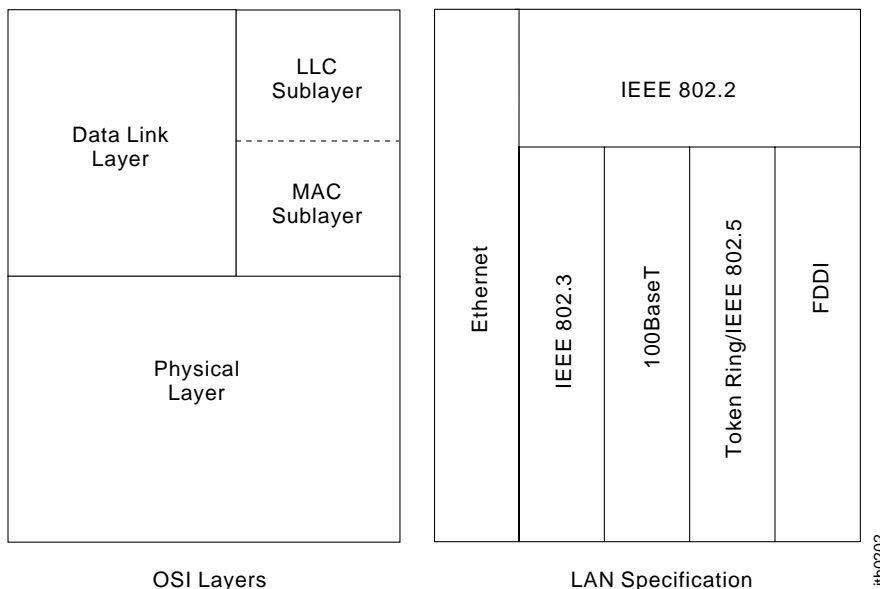
LAN Media-Access Methods

LAN protocols typically use one of two methods to access the physical network medium: *carrier sense multiple access collision detect* (CSMA/CD) and *token passing*.

In the CSMA/CD media-access scheme, network devices contend for use of the physical network medium. CSMA/CD is therefore sometimes called *contention access*. Examples of LANs that use the CSMA/CD media-access scheme are Ethernet/IEEE 802.3 networks, including 100BaseT.

In the token-passing media-access scheme, network devices access the physical medium based on possession of a token. Examples of LANs that use the token-passing media-access scheme are Token Ring/IEEE 802.5 and FDDI.

LAN Transmission Methods

LAN data transmissions fall into three classifications: *unicast*, *multicast*, and *broadcast*. In each type of transmission, a single packet is sent to one or more nodes.

In a unicast transmission, a single packet is sent from the source to a destination on a network. First, the source node addresses the packet by using the address of the destination node. The package is then sent onto the network, and finally, the network passes the packet to its destination.

A multicast transmission consists of a single data packet that is copied and sent to a specific subset of nodes on the network. First, the source node addresses the packet by using a multicast address. The packet is then sent into the network, which makes copies of the packet and sends a copy to each node that is part of the multicast address.

A broadcast transmission consists of a single data packet that is copied and sent to all nodes on the network. In these types of transmissions, the source node addresses the packet by using the broadcast address. The packet is then sent into the network, which makes copies of the packet and sends a copy to every node on the network.

LAN Topologies

LAN topologies define the manner in which network devices are organized. Four common LAN topologies exist: bus, ring, star, and tree. These topologies are logical architectures, but the actual devices need not be physically organized in these configurations. Logical bus and ring topologies, for example, are commonly organized physically as a star. A bus topology is a linear LAN architecture in which transmissions from network stations propagate the length of the medium and are received by all other stations. Of the three most widely used LAN implementations, Ethernet/IEEE 802.3 networks— , including 100BaseT—, implement a bus topology, which is illustrated in Figure 2-3.

Figure 2-3   Some networks implement a local bus topology.
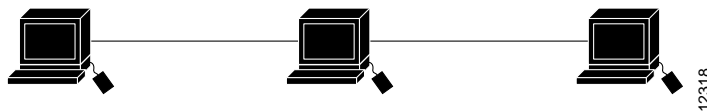
A ring topology is a LAN architecture that consists of a series of devices connected to one another by unidirectional transmission links to form a single closed loop. Both Token Ring/IEEE 802.5 and FDDI networks implement a ring topology. Figure 2-4 depicts a logical ring topology.

A star topology is a LAN architecture in which the endpoints on a network are connected to a common central hub, or switch, by dedicated links. Logical bus and ring topologies are often implemented physically in a star topology, which is illustrated in Figure 2-5.

A tree topology is a LAN architecture that is identical to the bus topology, except that branches with multiple nodes are possible in this case. Figure 2-5 illustrates a logical tree topology.

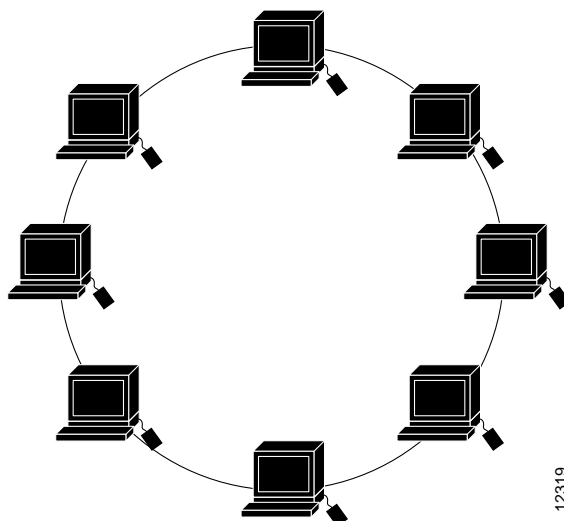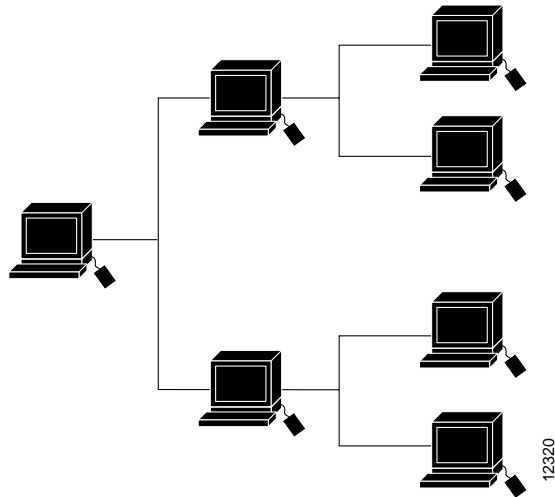**Figure 2-4   Some networks implement a logical ring topology.**

Figure 2-5 **A logical tree topology can contain multiple nodes.**

LAN Devices

Devices commonly used in LANs include *repeaters*, *hubs*, *LAN extenders*, *bridges*, *LAN switches*, and *routers*.


Note Repeaters, hubs, and LAN extenders are discussed briefly in this section. The function and operation of bridges, switches, and routers are discussed generally in Chapter 4, "Bridging and Switching Basics," and Chapter 5, "Routing Basics."

A *repeater* is a physical layer device used to interconnect the media segments of an extended network. A repeater essentially enables a series of cable segments to be treated as a single cable. Repeaters receive signals from one network segment and amplify, retime, and retransmit those signals to another network segment. These actions prevent signal deterioration caused by long cable lengths and large numbers of connected devices. Repeaters are incapable of performing complex filtering and other traffic processing. In addition, all electrical signals, including electrical disturbances and other errors, are repeated and amplified. The total number of repeaters and network segments that can be connected is limited due to timing and other issues. Figure 2-6 illustrates a repeater connecting two network segments.
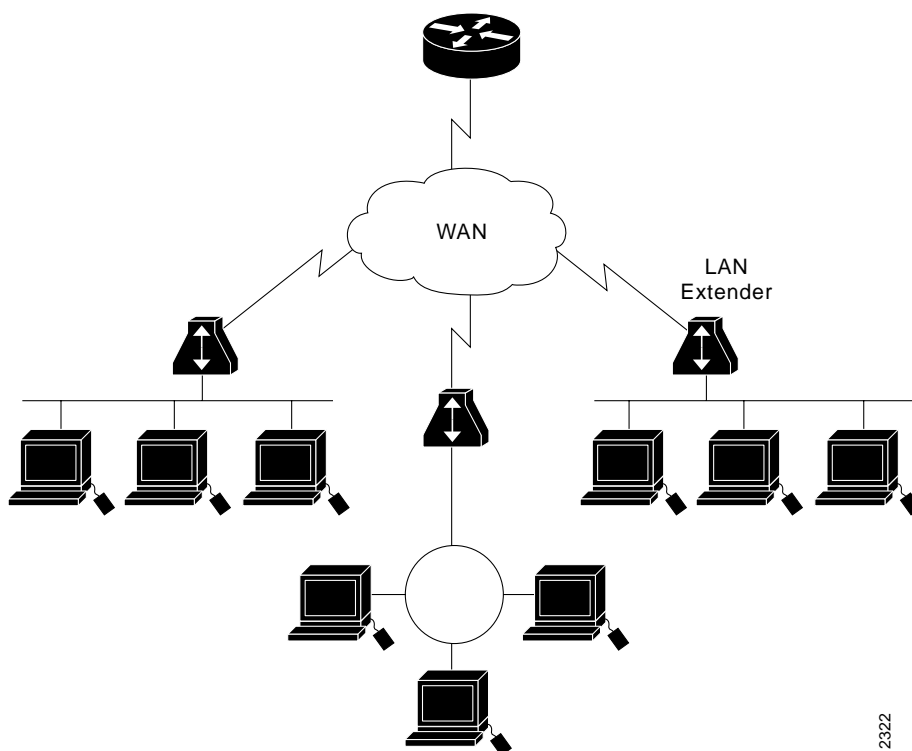
Figure 2-6 **A repeater connects two network segments.**

Repeater
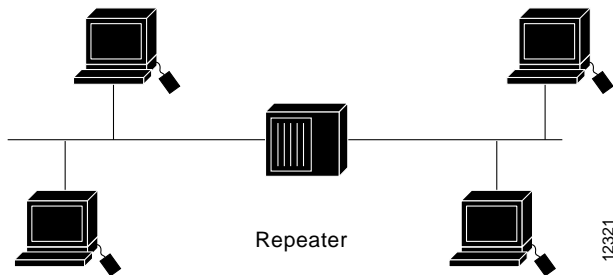
A *hub* is a physical-layer device that connects multiple user stations, each via a dedicated cable. Electrical interconnections are established inside the hub. Hubs are used to create a physical star network while maintaining the logical bus or ring configuration of the LAN. In some respects, a hub functions as a multiport repeater.

A LAN *extender* is a remote-access multilayer switch that connects to a host router. LAN extenders forward traffic from all the standard network-layer protocols (such as IP, IPX, and AppleTalk), and filter traffic based on the MAC address or network-layer protocol type. LAN extenders scale well because the host router filters out unwanted broadcasts and multicasts. LAN extenders, however, are not capable of segmenting traffic or creating security firewalls. Figure 2-7 illustrates multiple LAN extenders connected to the host router through a WAN.

Figure 2-7   Multiple LAN extenders can connect to the host router through a WAN.