Chapter 15

Connecting LANs, Backbone Networks, and Virtual LANs

15-1 CONNECTING DEVICES

In this section, we divide connecting devices into five different categories based on the layer in which they operate in a network.

Topics discussed in this section:

Passive Hubs

Active Hubs

Bridges

Two-Layer Switches

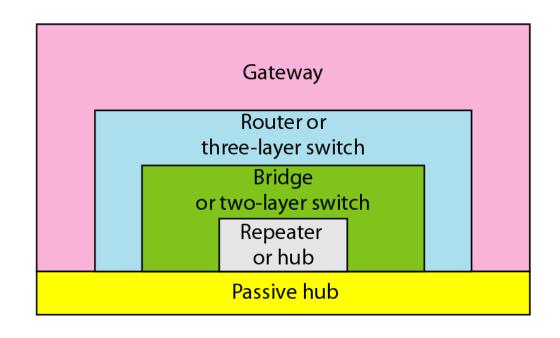
Routers

Three-Layer Switches

Gateways

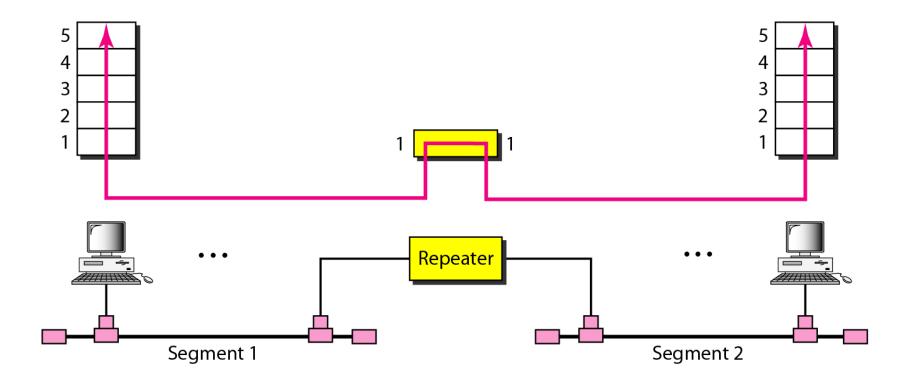
Figure 15.1 Five categories of connecting devices

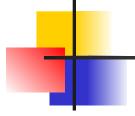
Application
Transport
Network
Data link
Physical



Application
Transport
Network
Data link
Physical

Figure 15.2 A repeater connecting two segments of a LAN





A repeater connects segments of a LAN.

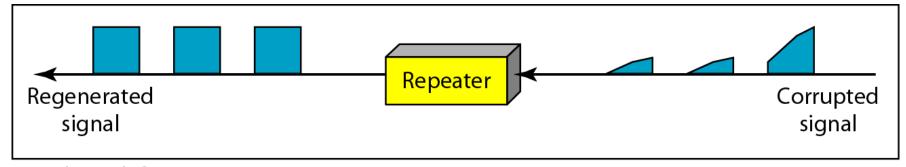


A repeater forwards every frame; it has no filtering capability.

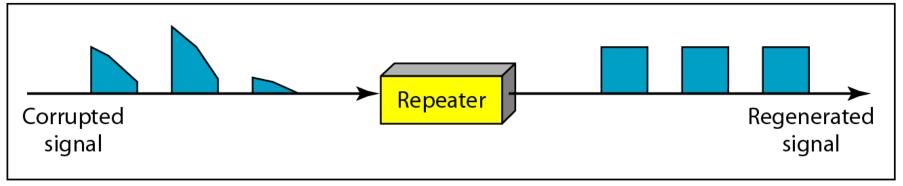


A repeater is a regenerator, not an amplifier.

Figure 15.3 Function of a repeater

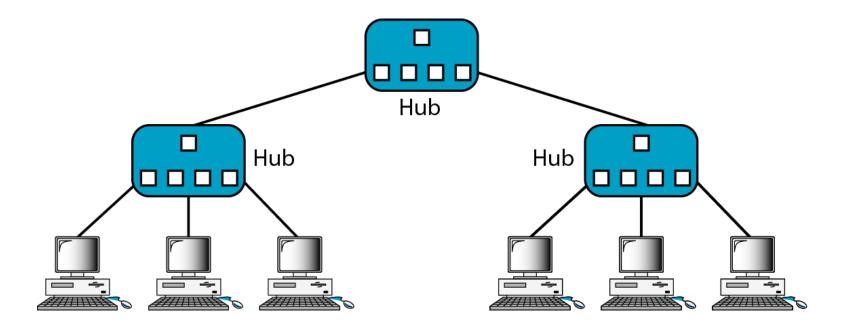


a. Right-to-left transmission.



b. Left-to-right transmission.

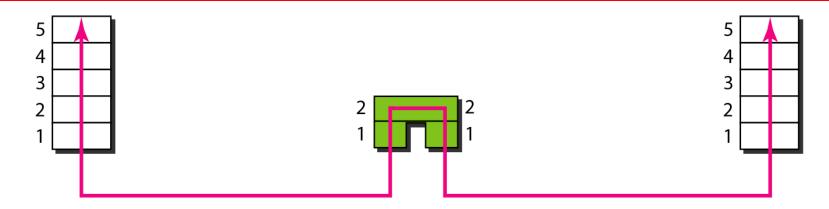
Figure 15.4 A hierarchy of hubs



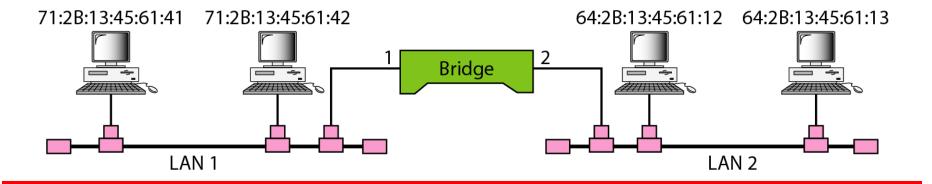


A bridge has a table used in filtering decisions.

Figure 15.5 A bridge connecting two LANs



	Address	Port	
I	71:2B:13:45:61:41	1	
l	71:2B:13:45:61:42	1	Bridge Table
l	64:2B:13:45:61:12	2	
l	64:2B:13:45:61:13	2	





A bridge does not change the physical (MAC) addresses in a frame.

Figure 15.6 A learning bridge and the process of learning

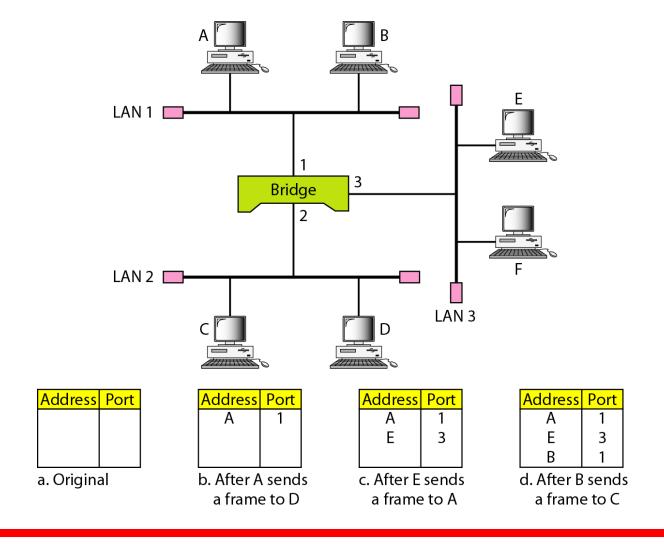
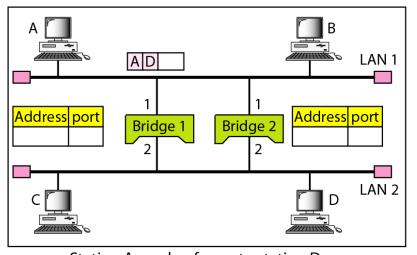
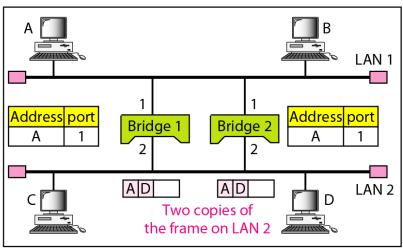


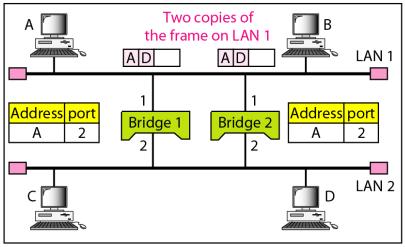
Figure 15.7 Loop problem in a learning bridge



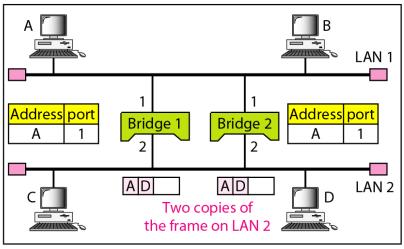
a. Station A sends a frame to station D



b. Both bridges forward the frame

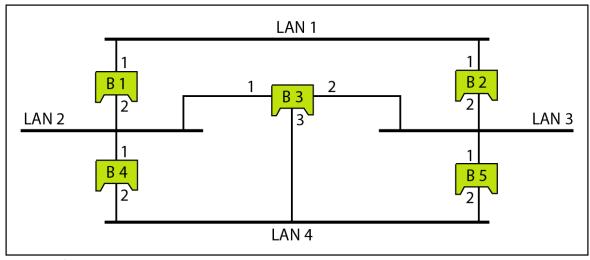


c. Both bridges forward the frame

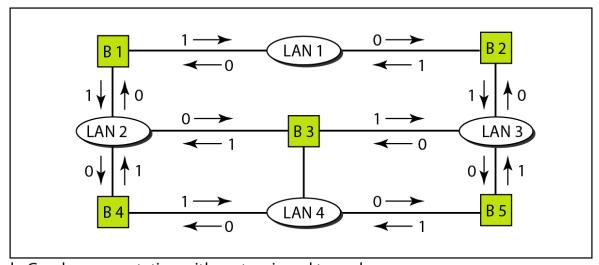


d. Both bridges forward the frame

Figure 15.8 A system of connected LANs and its graph representation

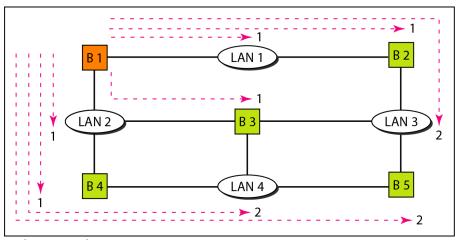


a. Actual system

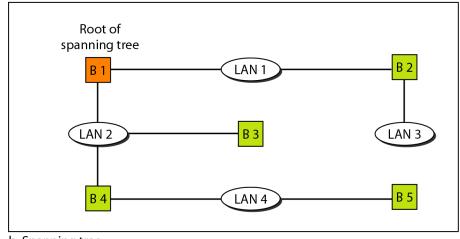


b. Graph representation with cost assigned to each arc

Figure 15.9 Finding the shortest paths and the spanning tree in a system of bridges

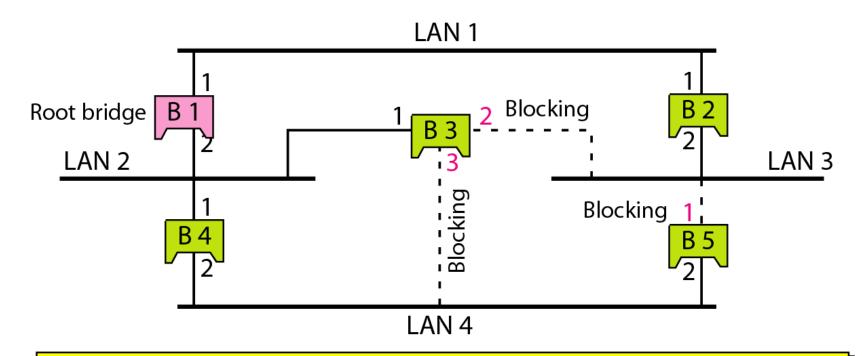


a. Shortest paths



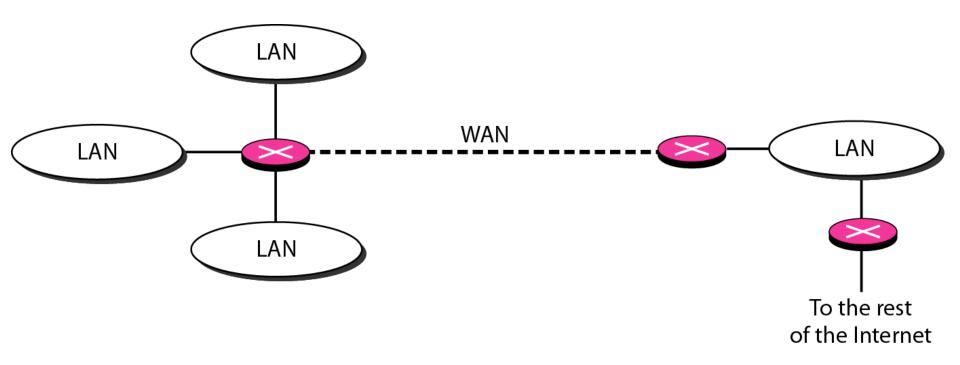
b. Spanning tree

Figure 15.10 Forwarding and blocking ports after using spanning tree algorithm



Ports 2 and 3 of bridge B3 are blocking ports (no frame is sent out of these ports). Port 1 of bridge B5 is also a blocking port (no frame is sent out of this port).

Figure 15.11 Routers connecting independent LANs and WANs



15-2 BACKBONE NETWORKS

A backbone network allows several LANs to be connected. In a backbone network, no station is directly connected to the backbone; the stations are part of a LAN, and the backbone connects the LANs.

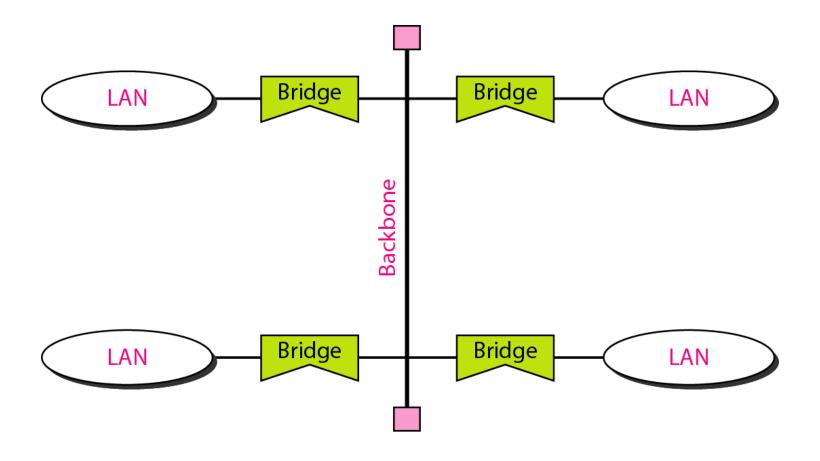
Topics discussed in this section:

Bus Backbone
Star Backbone
Connecting Remote LANs



In a bus backbone, the topology of the backbone is a bus.

Figure 15.12 Bus backbone





In a star backbone, the topology of the backbone is a star; the backbone is just one switch.

Figure 15.13 Star backbone

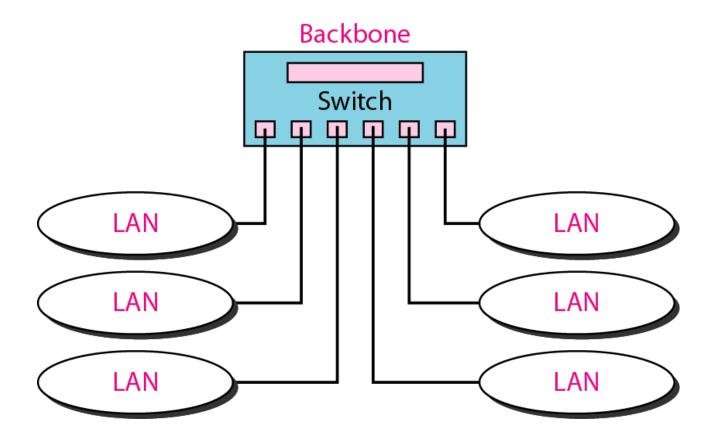
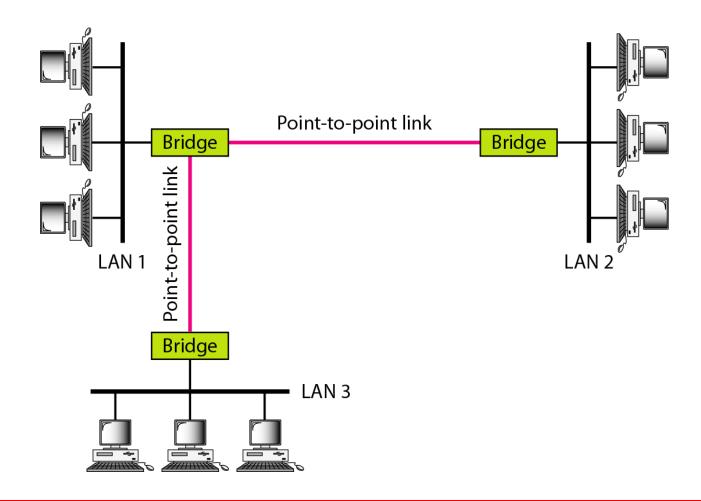


Figure 15.14 Connecting remote LANs with bridges





A point-to-point link acts as a LAN in a remote backbone connected by remote bridges.

15-3 VIRTUAL LANS

We can roughly define a virtual local area network (VLAN) as a local area network configured by software, not by physical wiring.

Topics discussed in this section:

Membership
Configuration
Communication between Switches
IEEE Standard
Advantages

15.26

Figure 15.15 A switch connecting three LANs

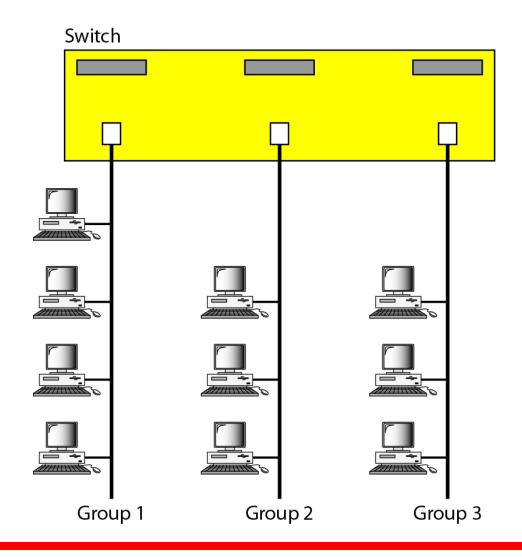


Figure 15.16 A switch using VLAN software

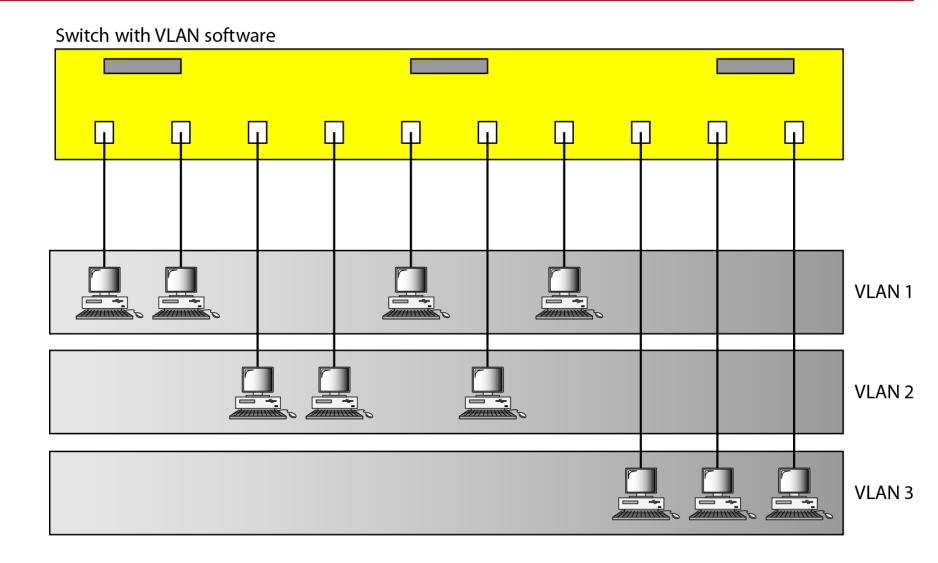
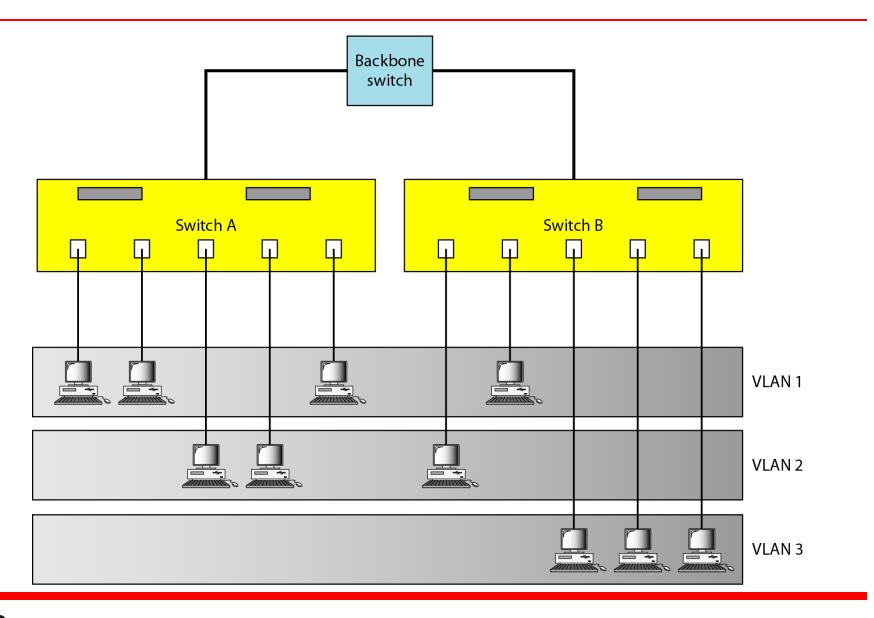


Figure 15.17 Two switches in a backbone using VLAN software





VLANs create broadcast domains.