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:
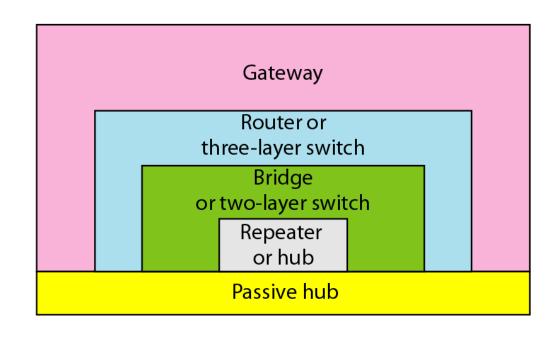
Passive Hubs
Active Hubs
Bridges
Two-Layer Switches
Routers
Three-Layer Switches
Gateways

15.2
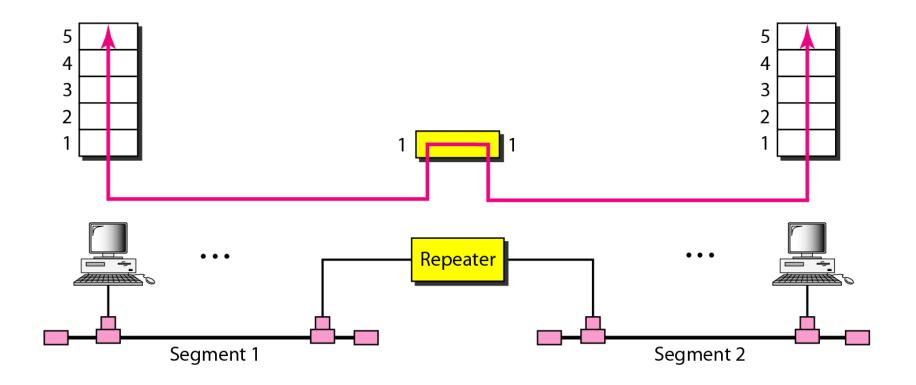
Figure 15.1 *Five categories of connecting devices*

Application
Transport
Network
Data link
Physical

Gateway
Router or three-layer switch
Bridge or two-layer switch
Repeater or hub
Passive hub

Application
Transport
Network
Data link
Physical

15.3

Figure 15.2 *A repeater connecting two segments of a LAN*

Note

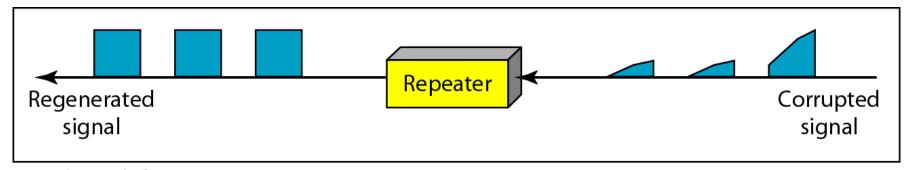A repeater connects segments of a LAN.

Note

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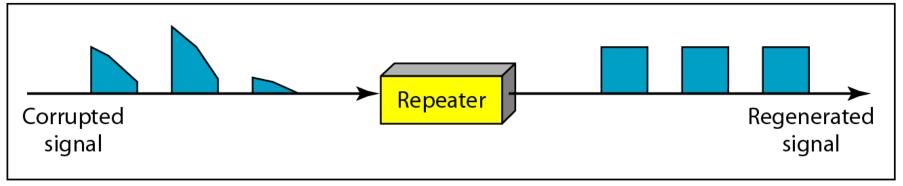it has no filtering capability.

Note

A repeater is a regenerator,
not an amplifier.
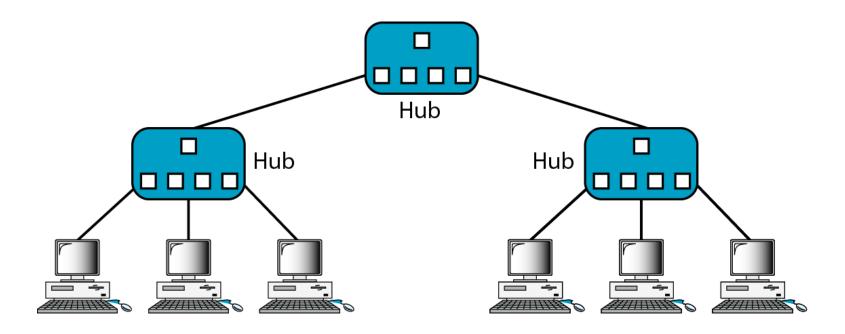
Figure 15.3 *Function of a repeater*

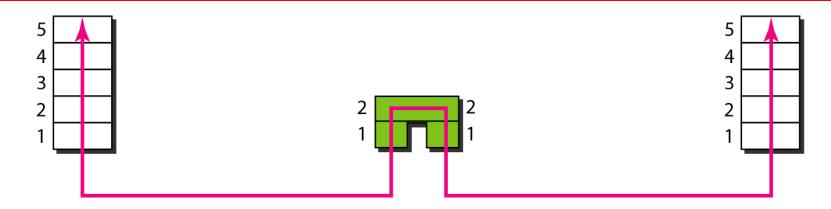a. Right-to-left transmission.

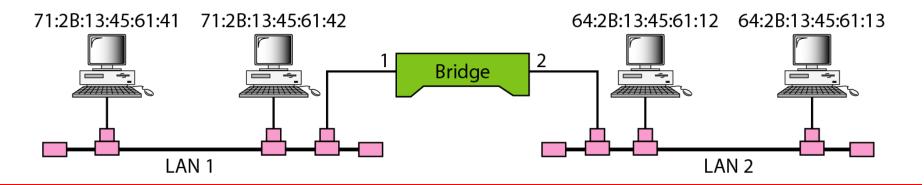b. Left-to-right transmission.

15.8

Figure 15.4 *A hierarchy of hubs*

Note

A bridge has a table used in filtering decisions.

Figure 15.5 *A bridge connecting two LANs*

Address	Port
71:2B:13:45:61:41	1
71:2B:13:45:61:42	1
64:2B:13:45:61:12	2
64:2B:13:45:61:13	2

Bridge Table

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

Figure 15.6 *A learning bridge and the process of learning*

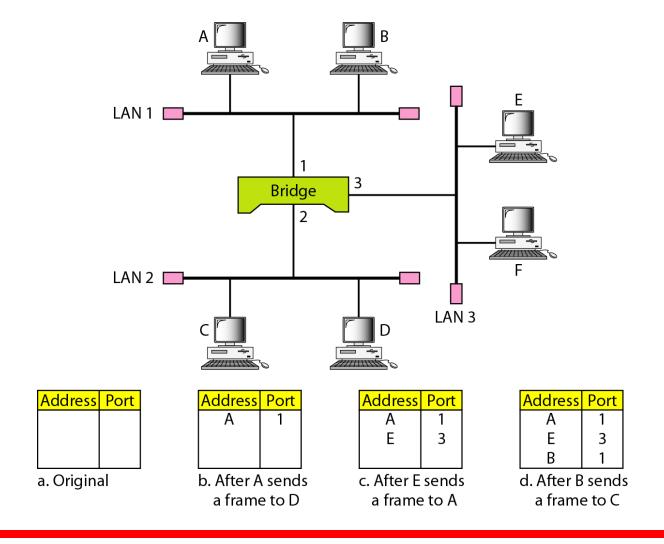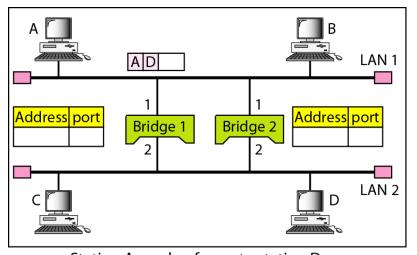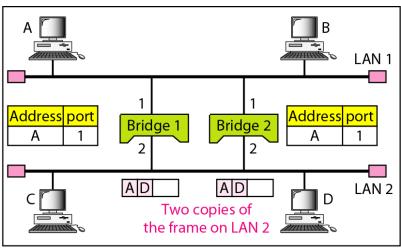| Address	Port

a. Original

Address	Port
A	1

b. After A sends
a frame to D

Address	Port
A	1
E	3

c. After E sends
a frame to A

Address	Port
A	1
E	3
B	1

d. After B sends
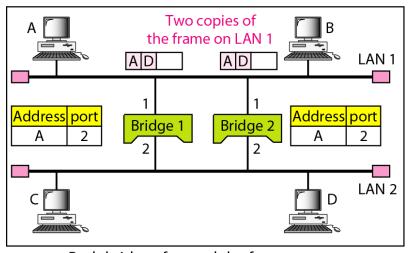a frame to C
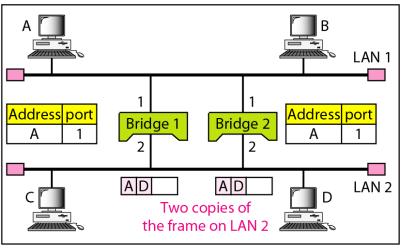
15.13

Figure 15.7 *Loop problem in a learning bridge*

a. Station A sends a frame to station D

b. Both bridges forward the frame

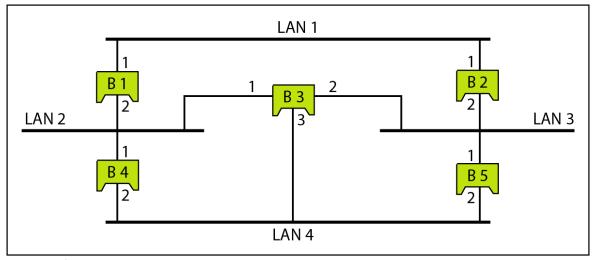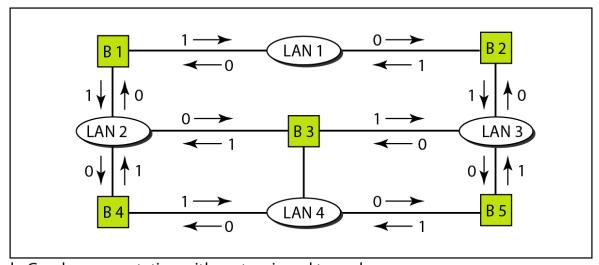c. Both bridges forward the frame

d. Both bridges forward the frame

15.14

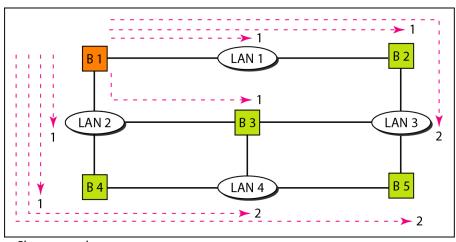# Figure 15.8 *A system of connected LANs and its graph representation*
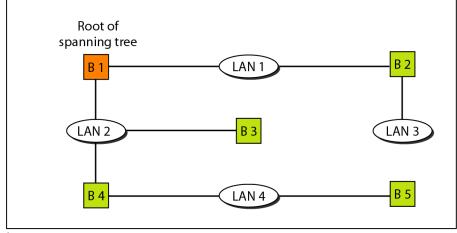

a. Actual system

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*
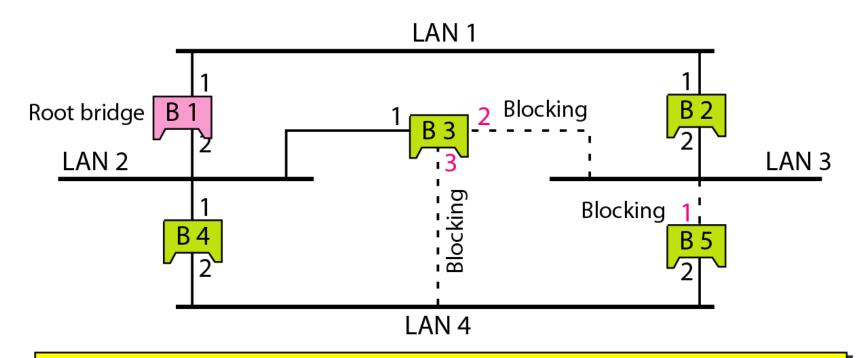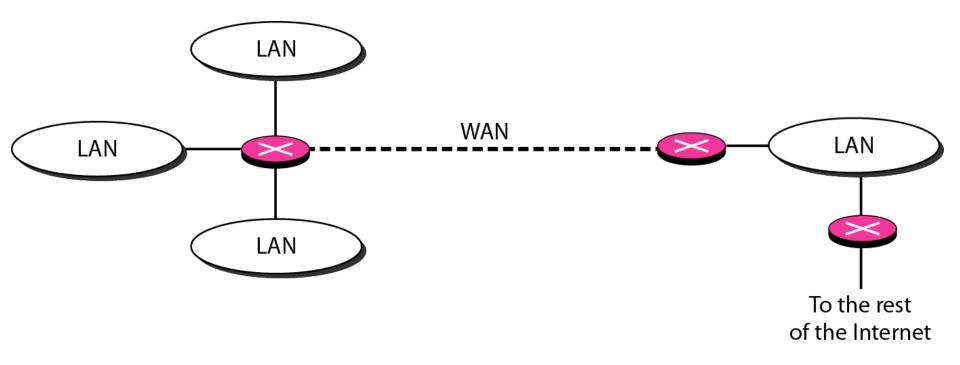

a. Shortest paths

b. Spanning tree

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).

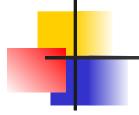# Figure 15.11 *Routers connecting independent LANs and WANs*

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.
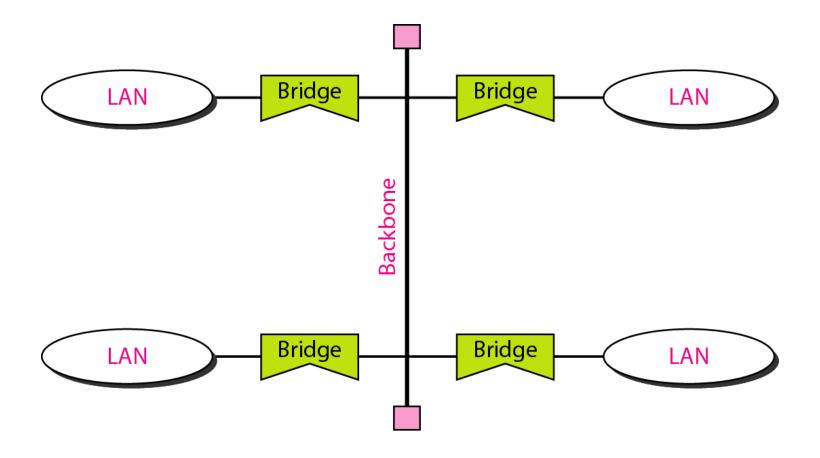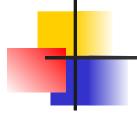
Topics discussed in this section:

Bus Backbone
Star Backbone
Connecting Remote LANs

15.19

Note

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.**
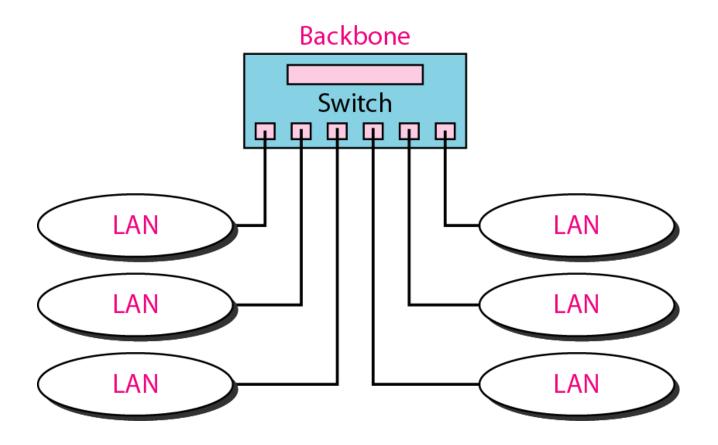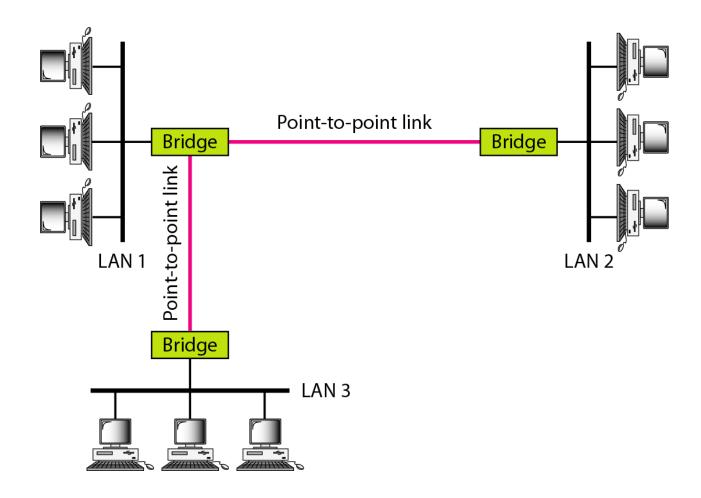
Figure 15.13 *Star backbone*

Figure 15.14 *Connecting remote LANs with bridges*

15.24

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*

15.27

Figure 15.16 *A switch using VLAN software*

Switch with VLAN software

VLAN 1

VLAN 2

VLAN 3

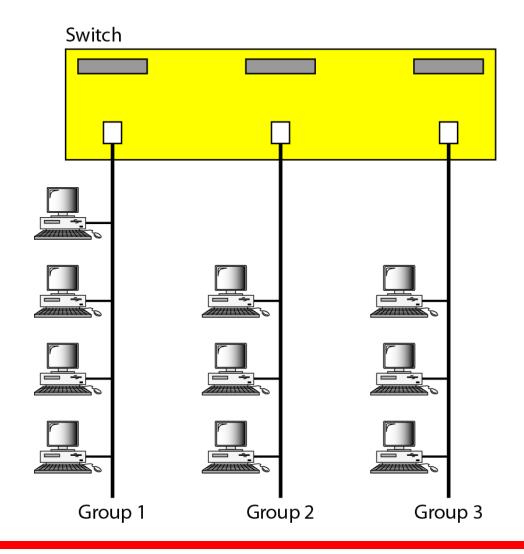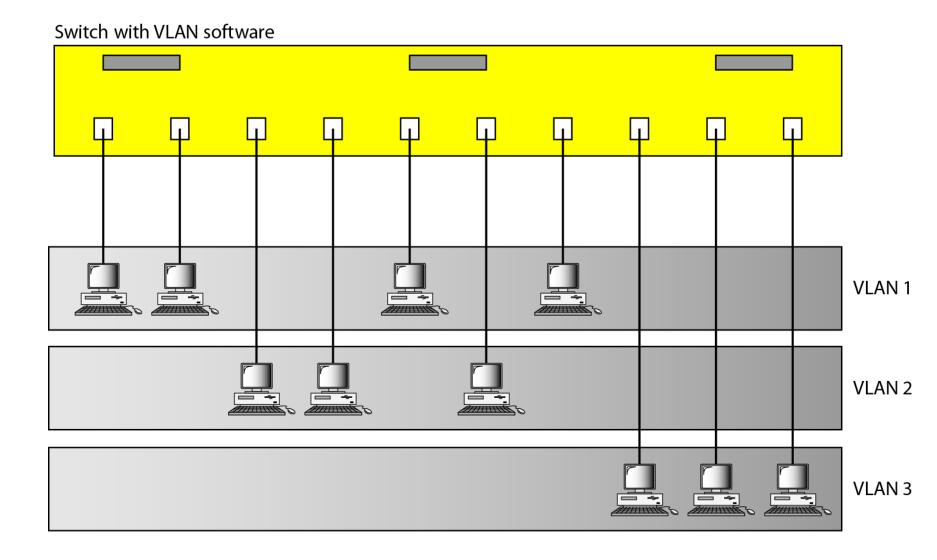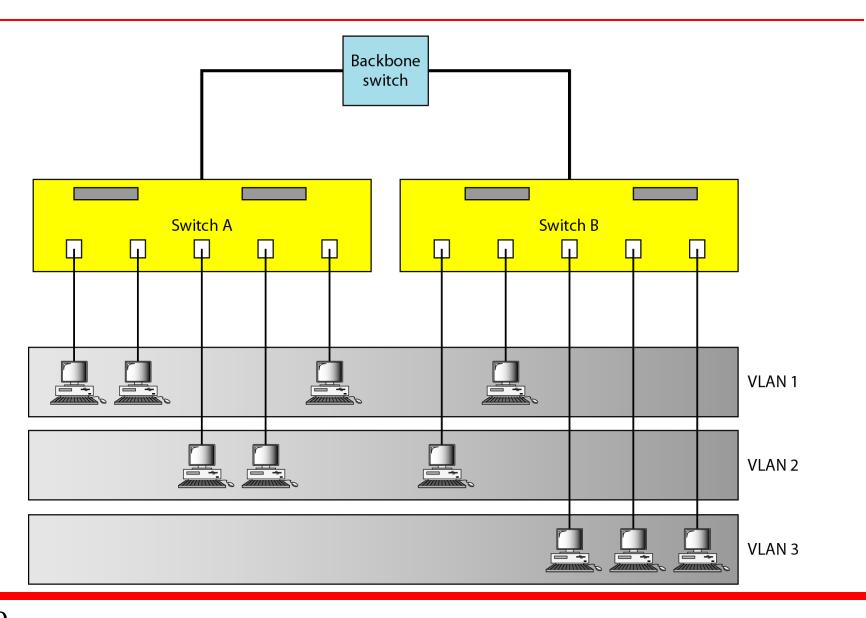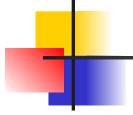# Figure 15.17 *Two switches in a backbone using VLAN software*

Note

VLANs create broadcast domains.

15.30