



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*

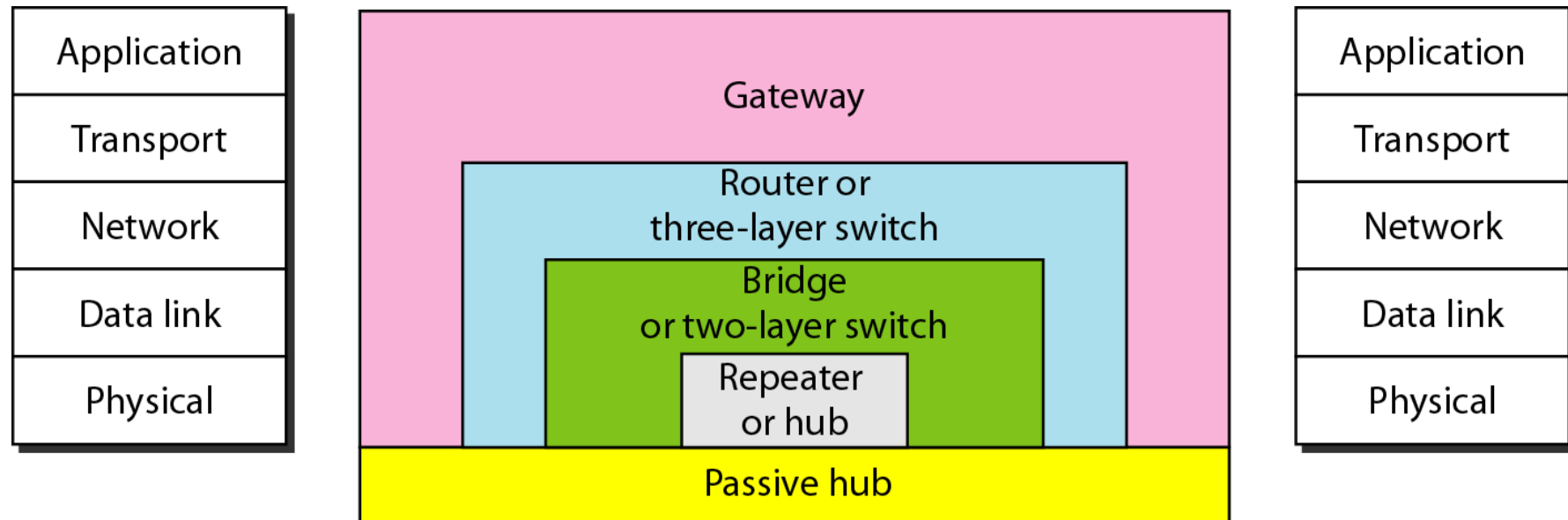
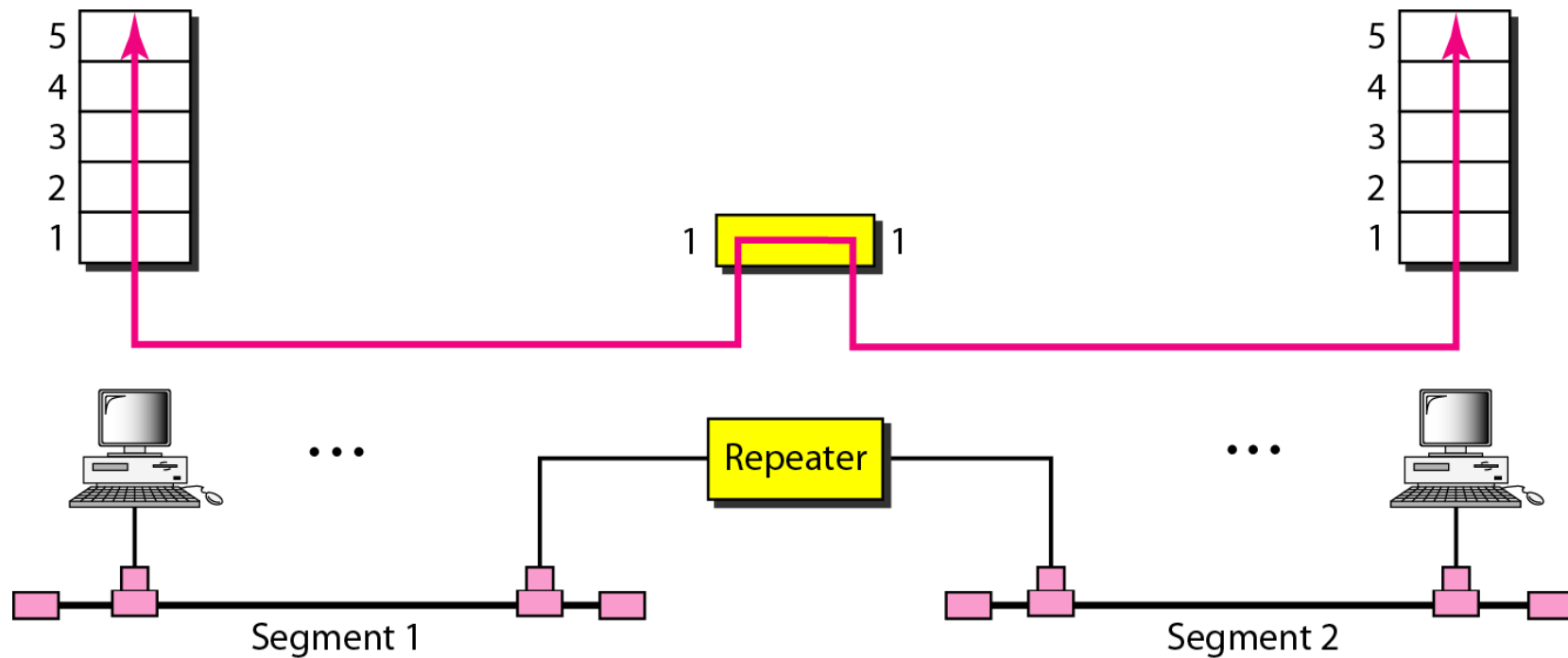
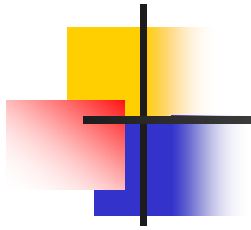


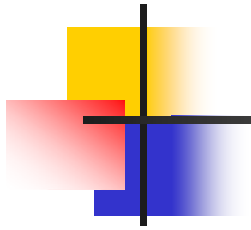
Figure 15.2 *A repeater connecting two segments of a LAN*





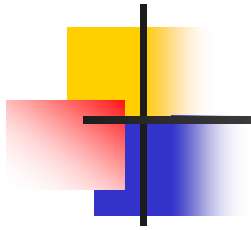
Note

A repeater connects segments of a LAN.



Note

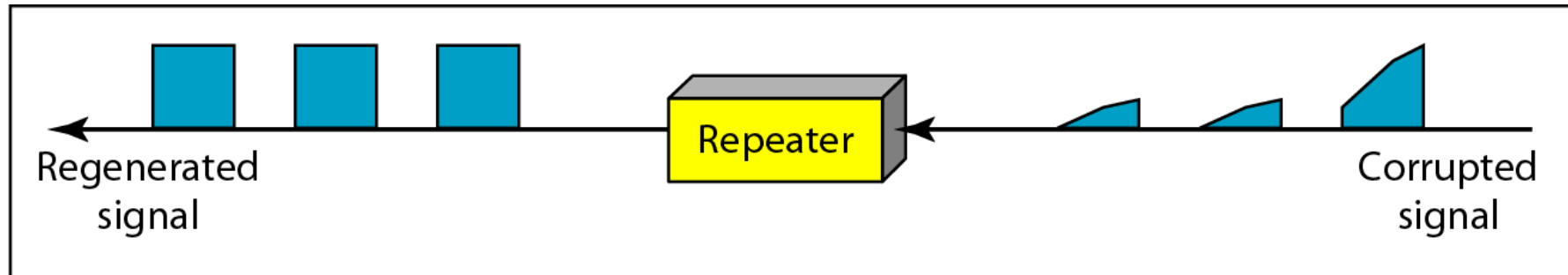
**A repeater forwards every frame;
it has no filtering capability.**



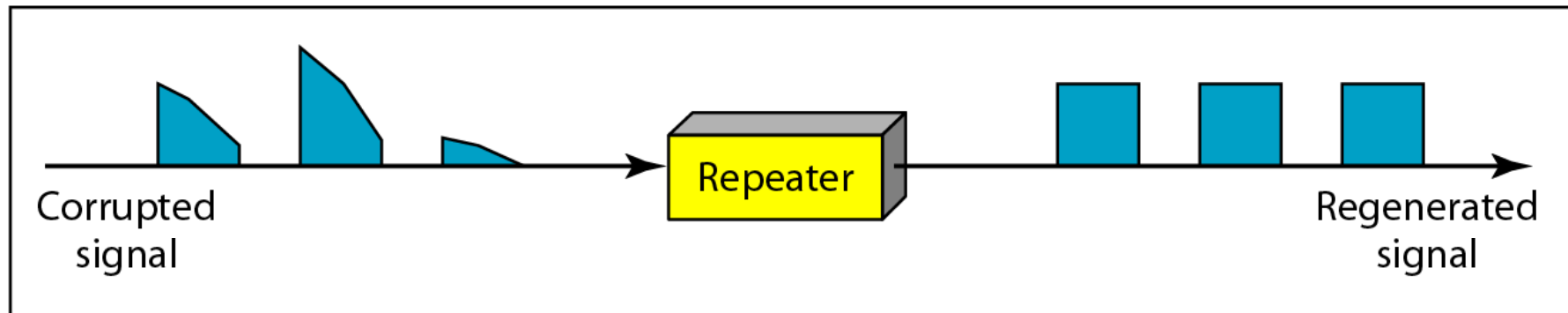
Note

**A repeater is a regenerator,
not an amplifier.**

Figure 15.3 *Function of a repeater*

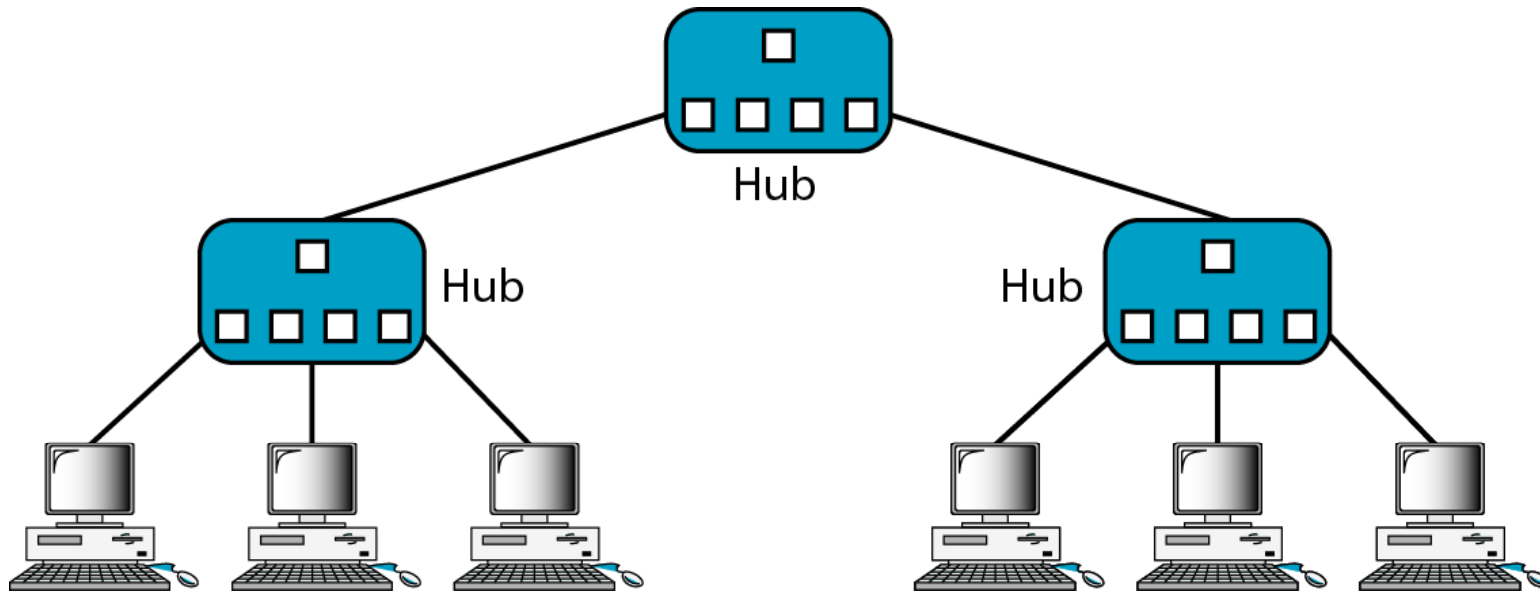


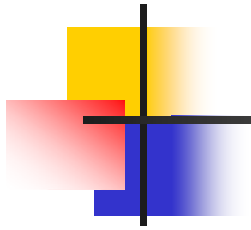
a. Right-to-left transmission.



b. Left-to-right transmission.

Figure 15.4 *A hierarchy of hubs*

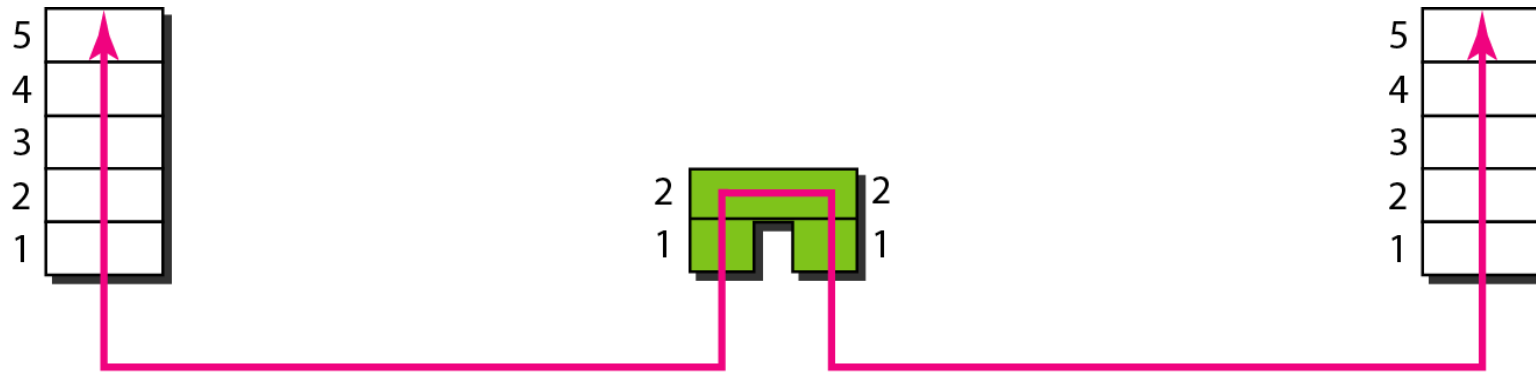




Note

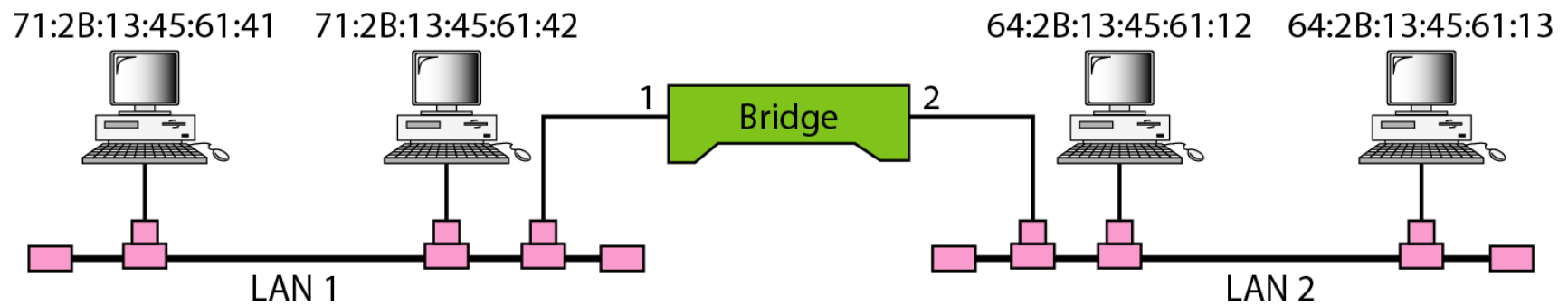
A bridge has a table used in filtering decisions.

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





Note

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

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

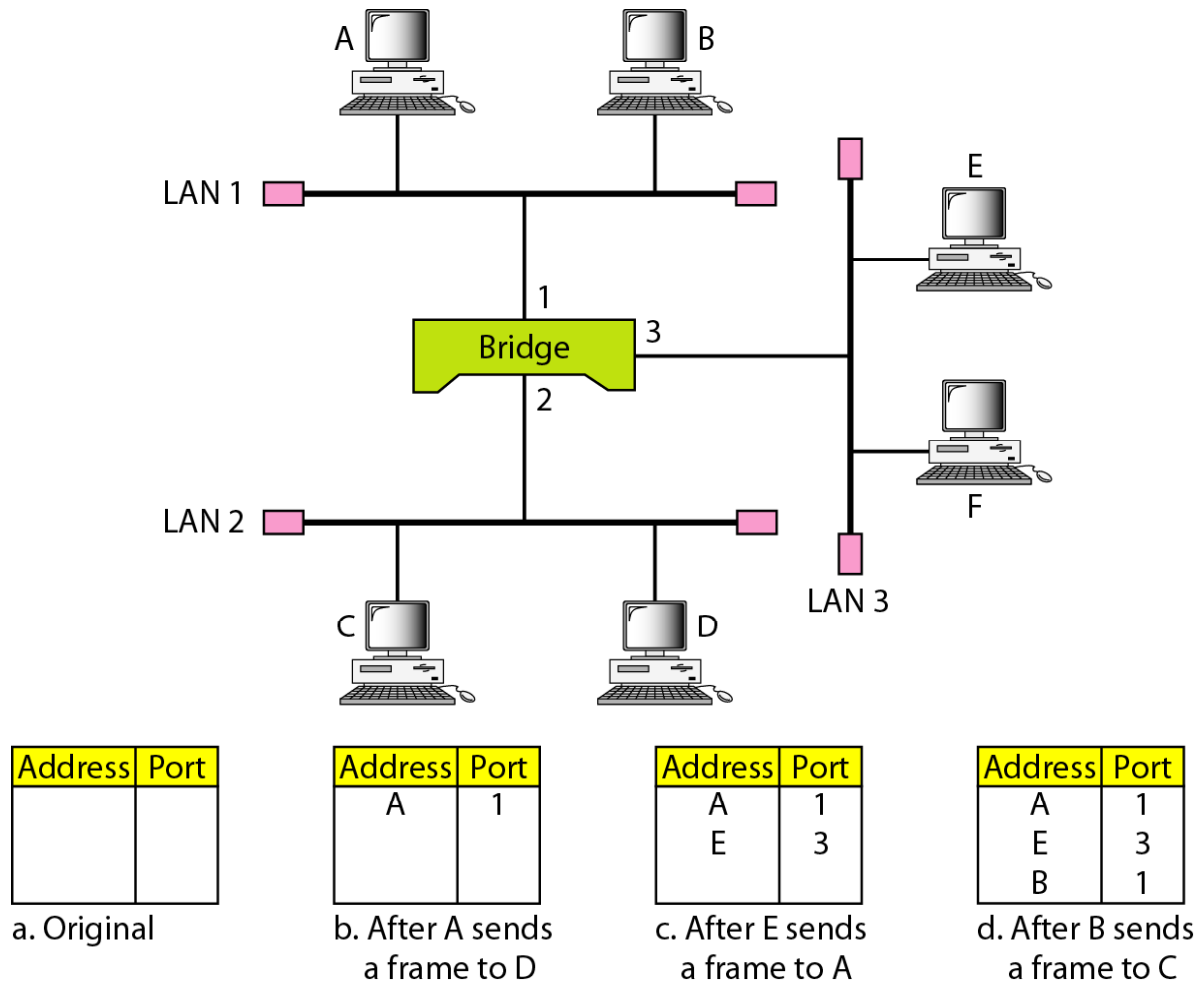
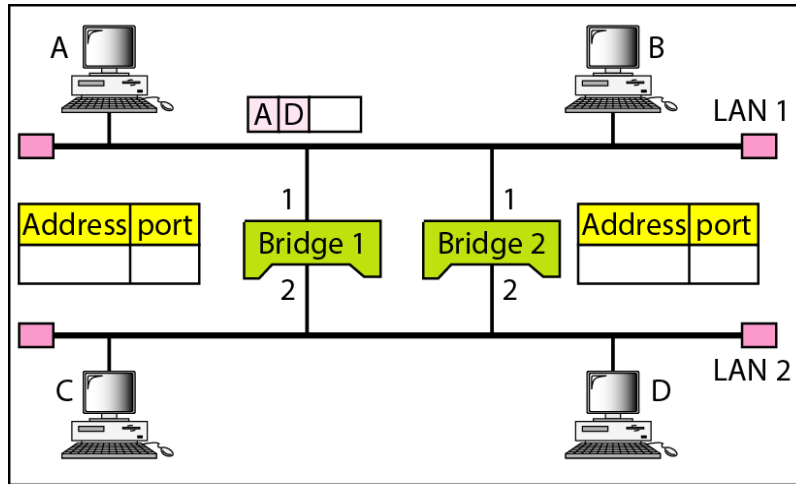
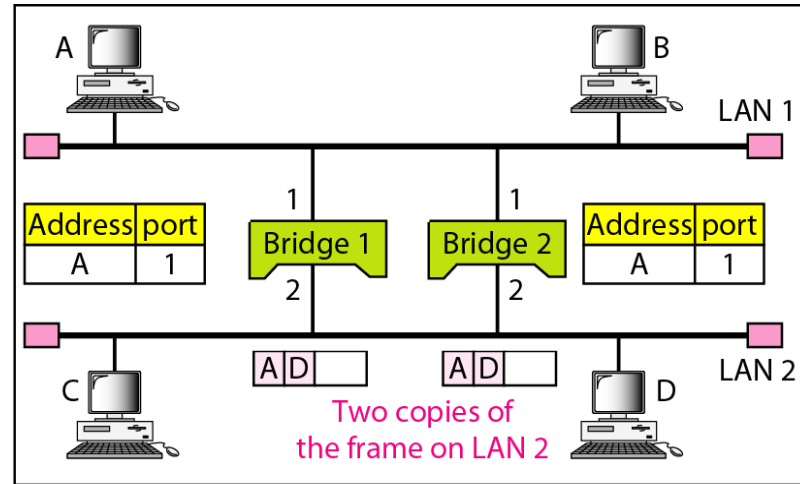


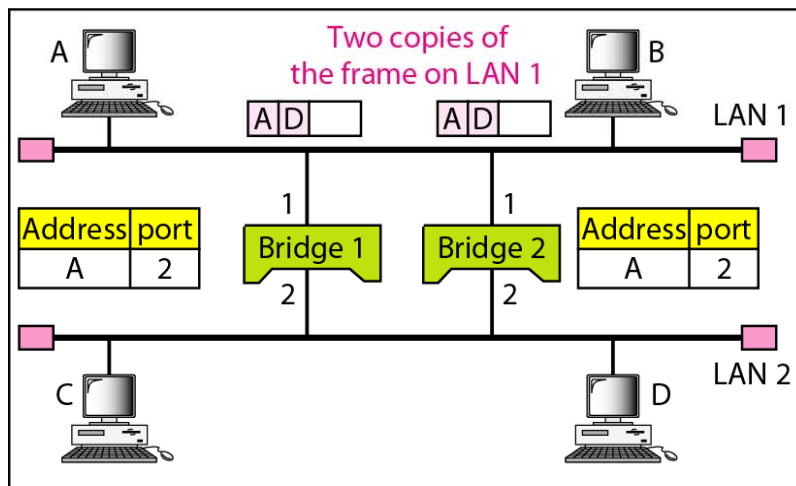
Figure 15.7 Loop problem in a learning bridge



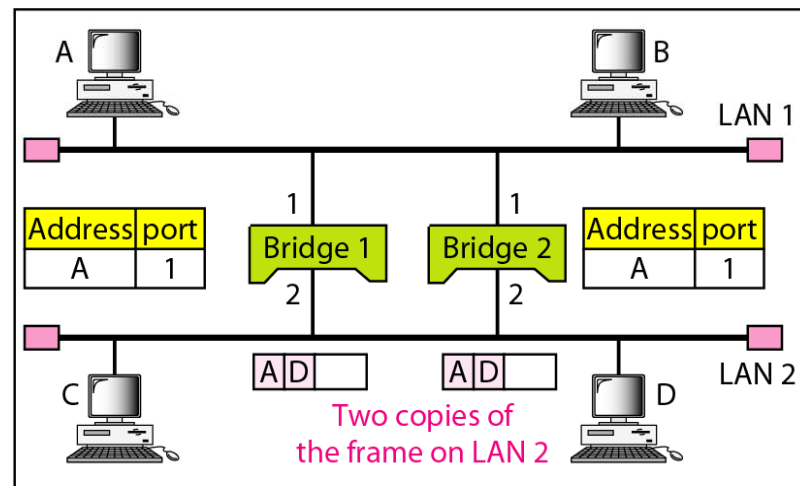
a. Station A sends a frame to station D



b. Both bridges forward the frame

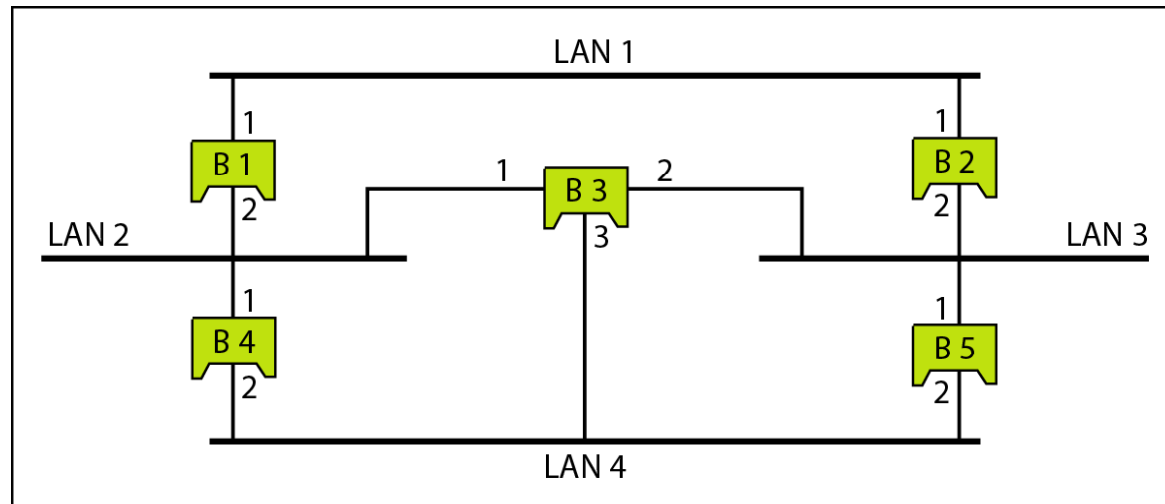


c. Both bridges forward the frame

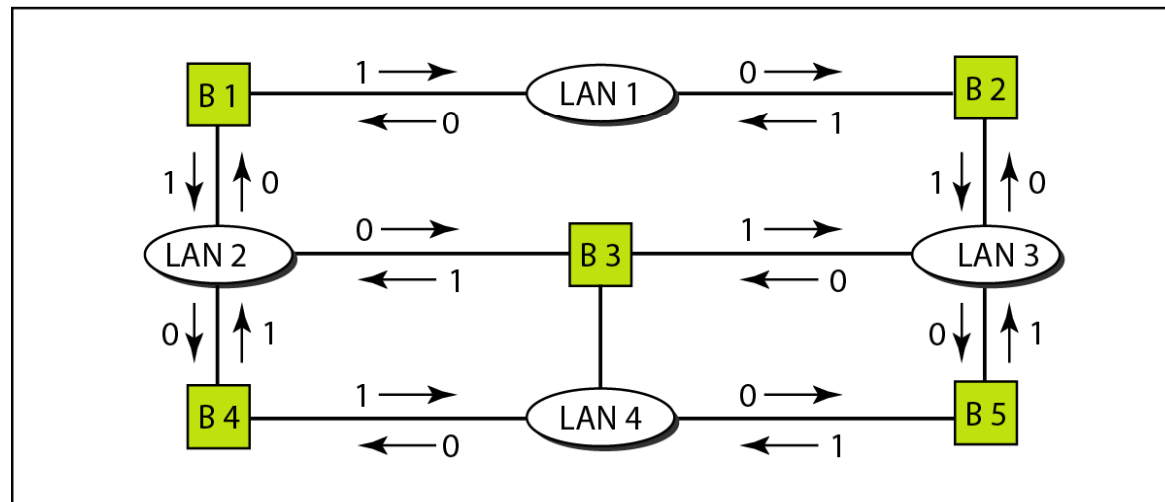


d. Both bridges forward the frame

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

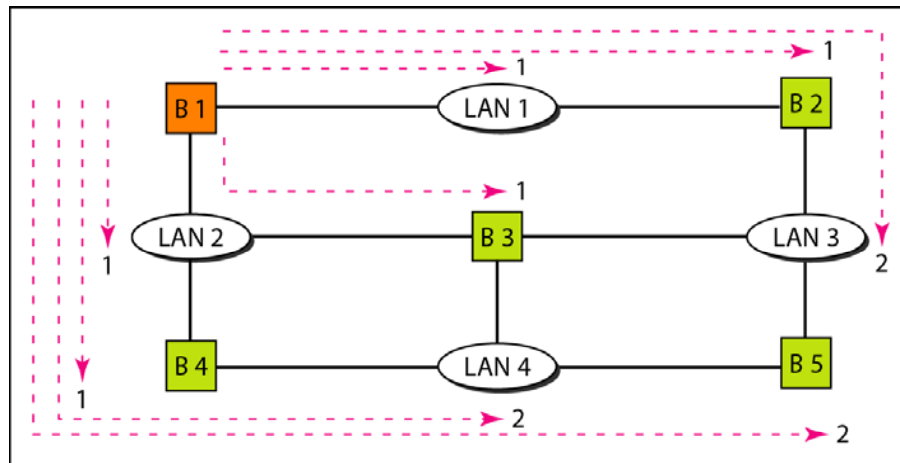


a. Actual system

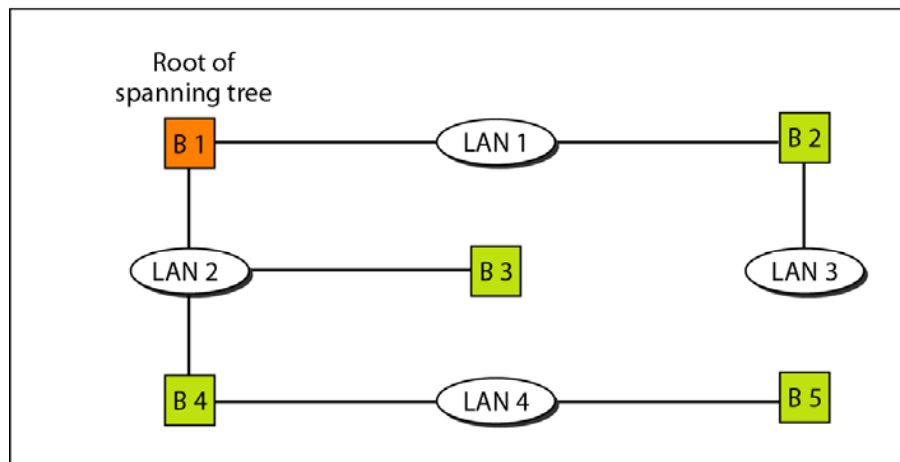


b. Graph representation with cost assigned to each arc

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

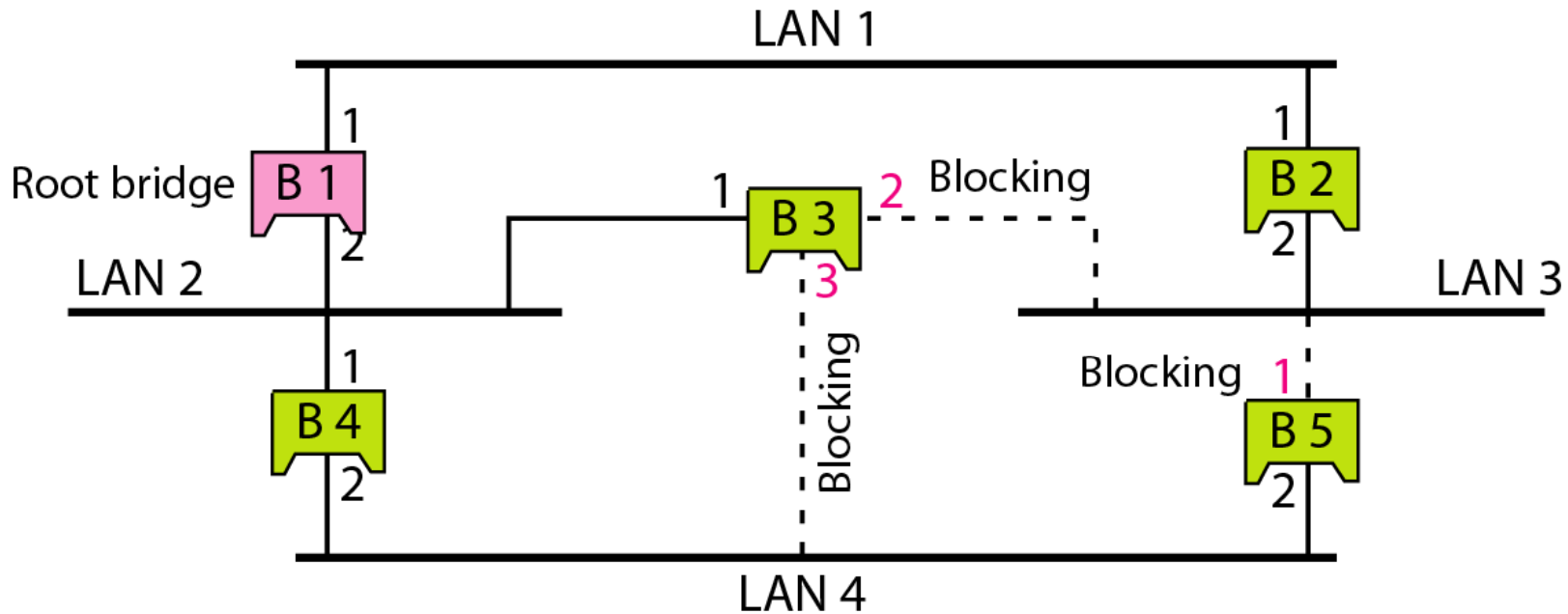


a. Shortest paths



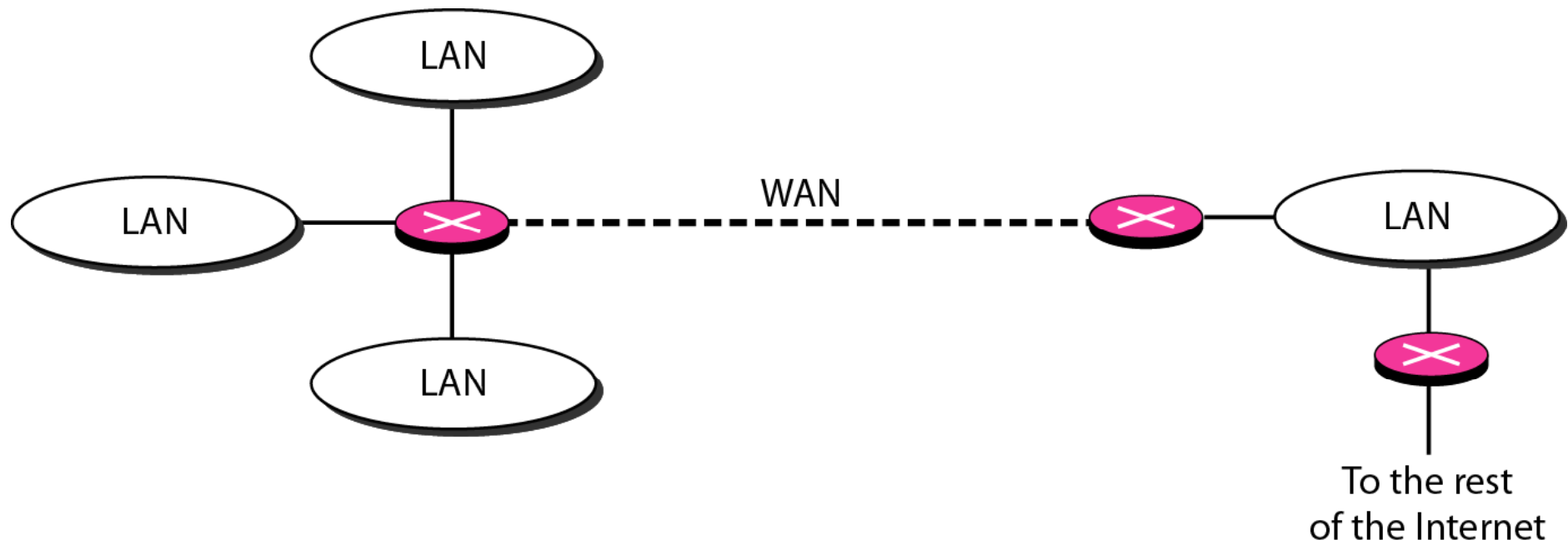
b. Spanning tree

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

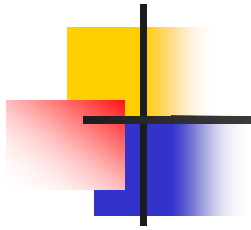
A backbone network allows several LANs to be connected. In a backbone network, no station is directly connected to the backbone; the stations are part of a LAN, and the backbone connects the LANs.

Topics discussed in this section:

Bus Backbone

Star Backbone

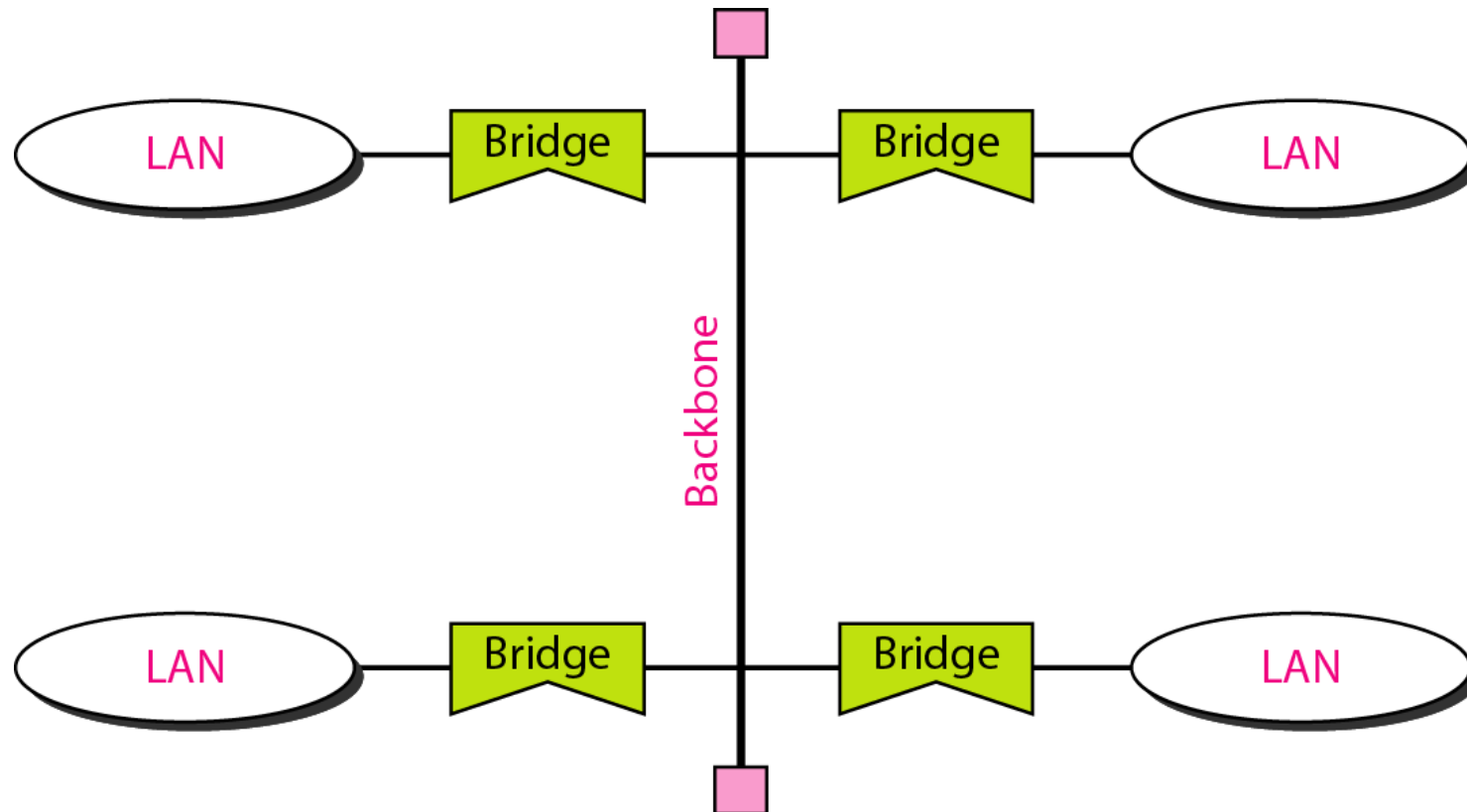
Connecting Remote LANs



Note

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

Figure 15.12 *Bus backbone*





Note

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

Figure 15.13 *Star backbone*

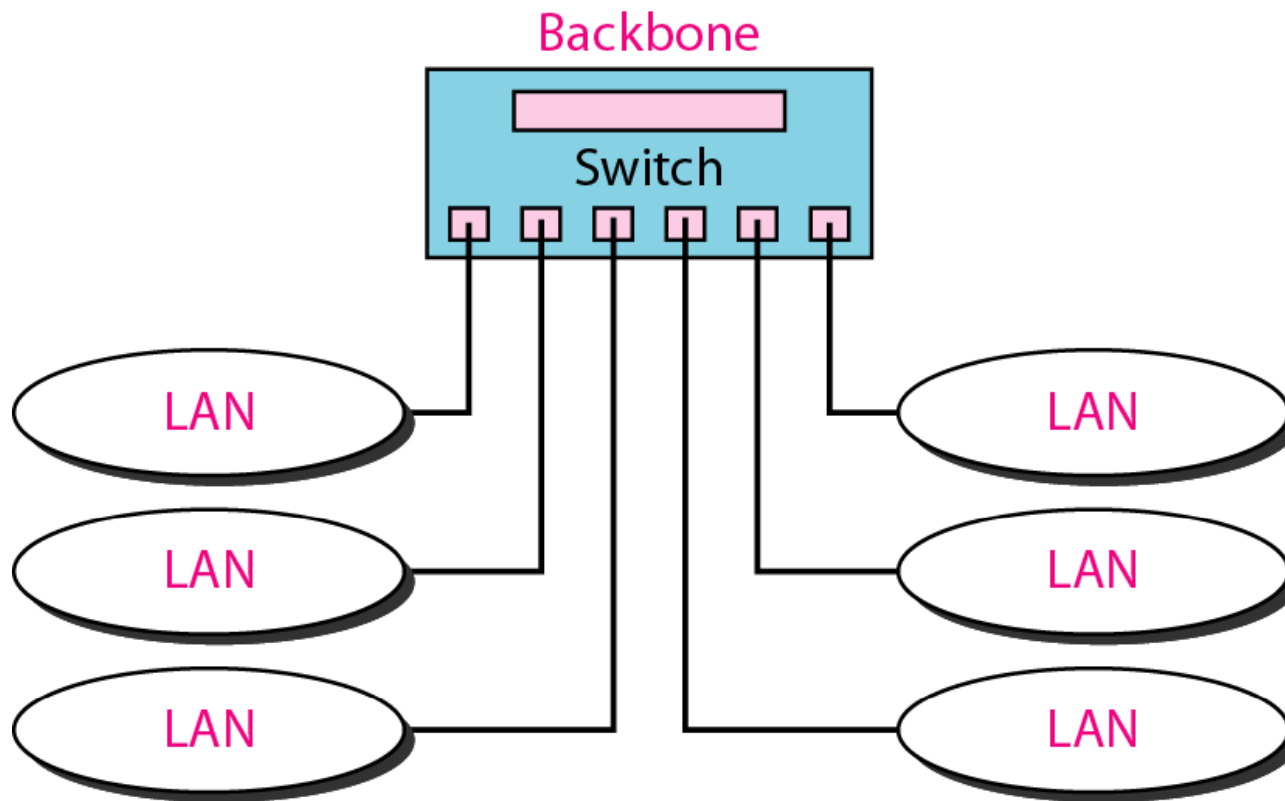
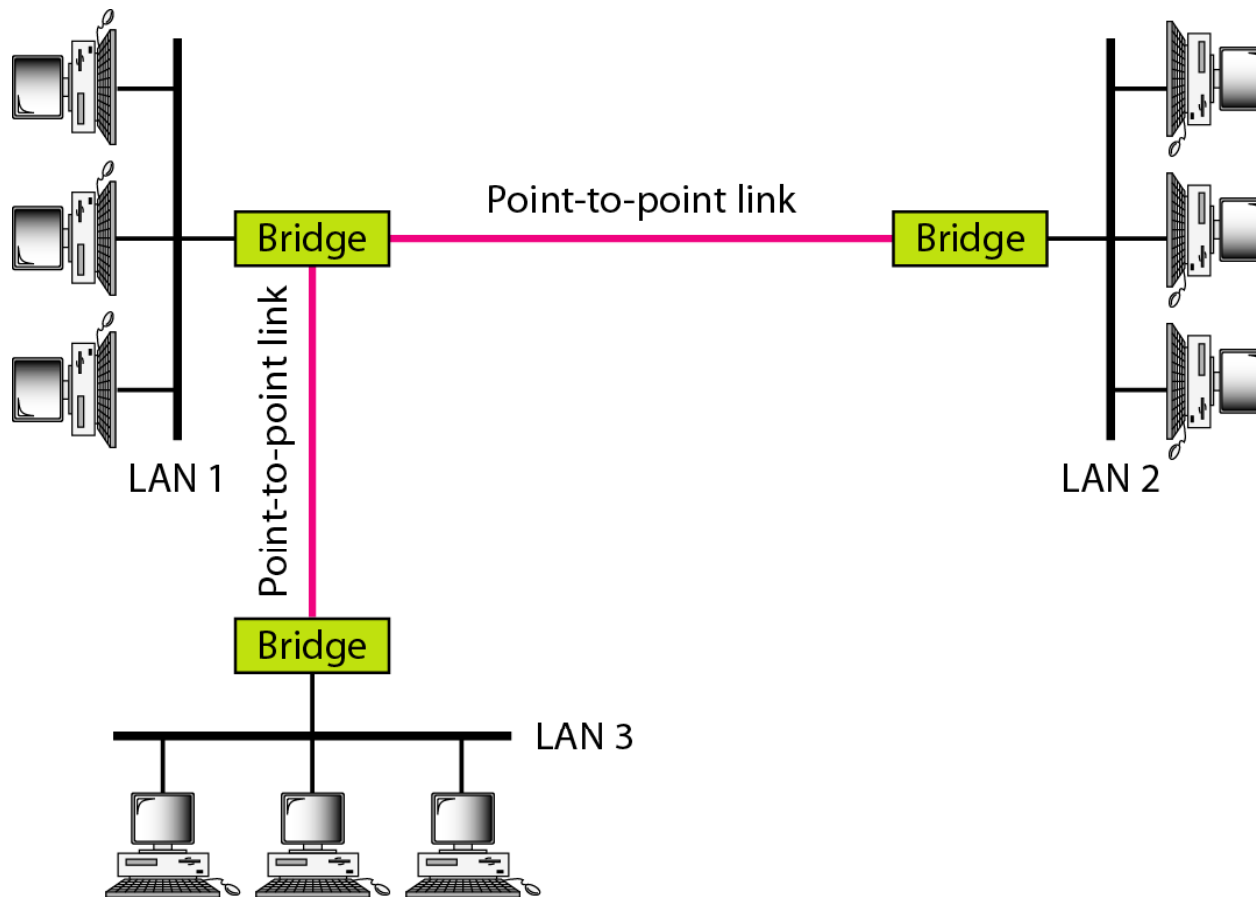


Figure 15.14 *Connecting remote LANs with bridges*





Note

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

Figure 15.15 *A switch connecting three LANs*

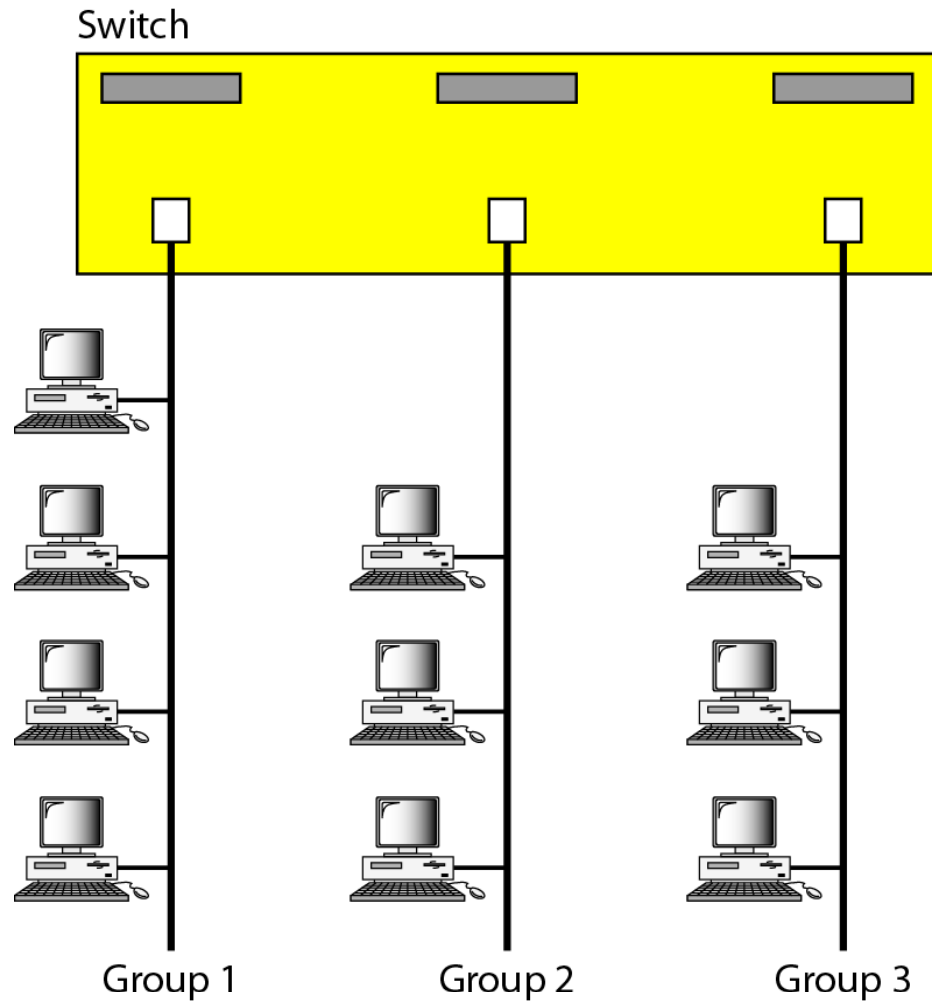


Figure 15.16 *A switch using VLAN software*

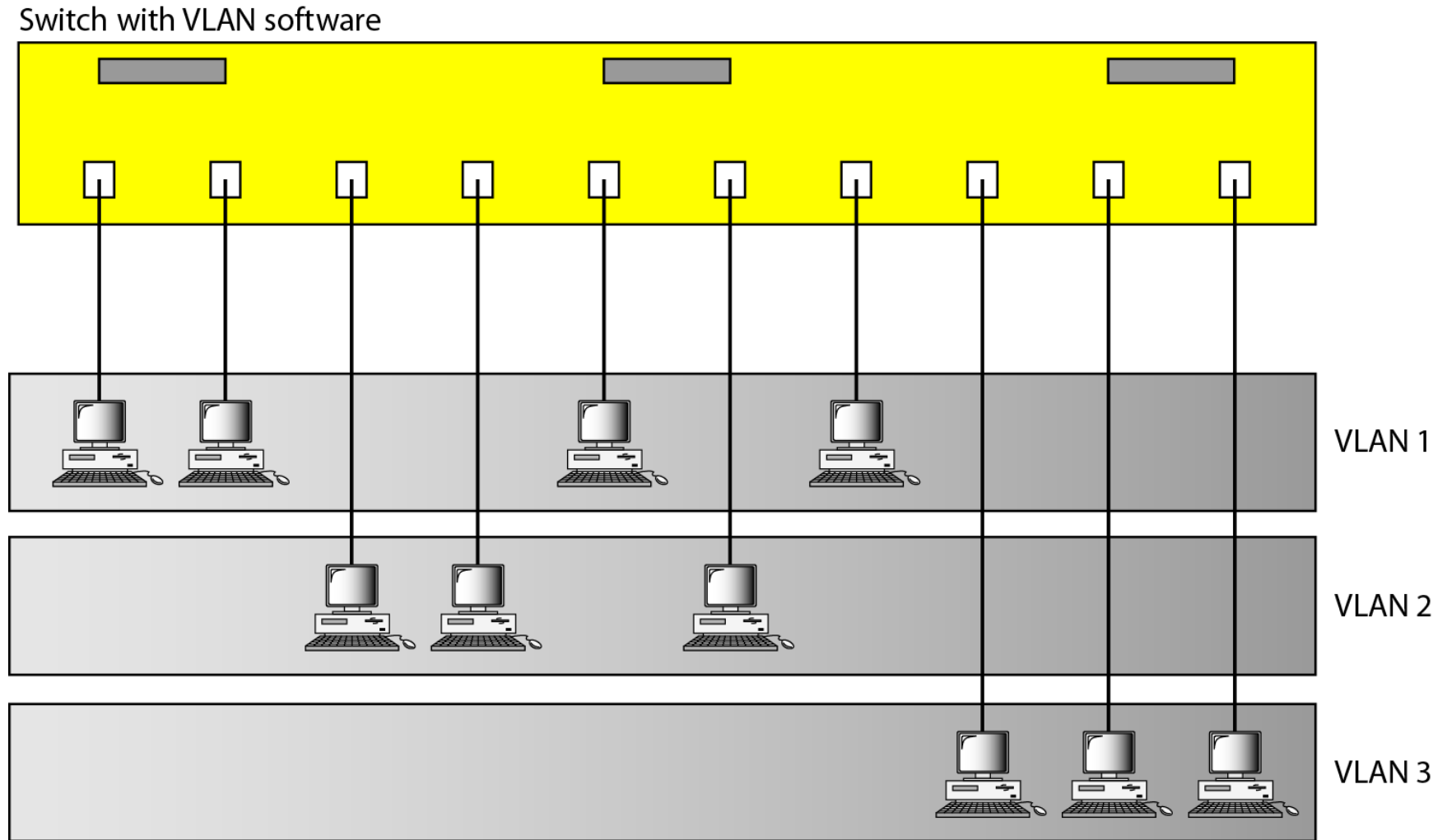
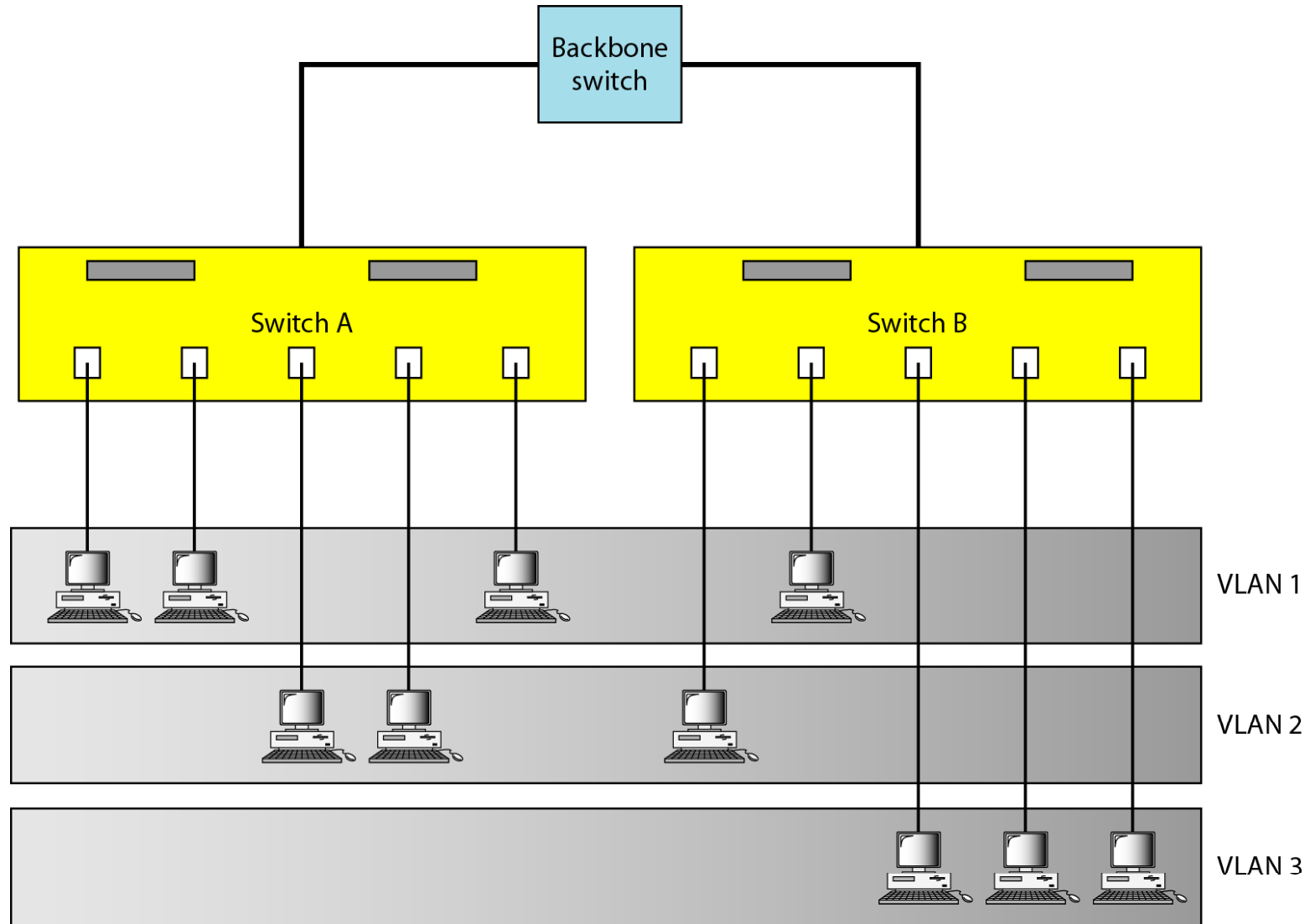
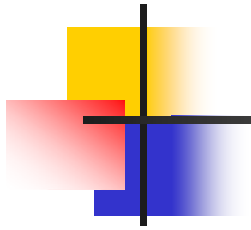


Figure 15.17 *Two switches in a backbone using VLAN software*





Note

VLANs create broadcast domains.