Unit - 3

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*

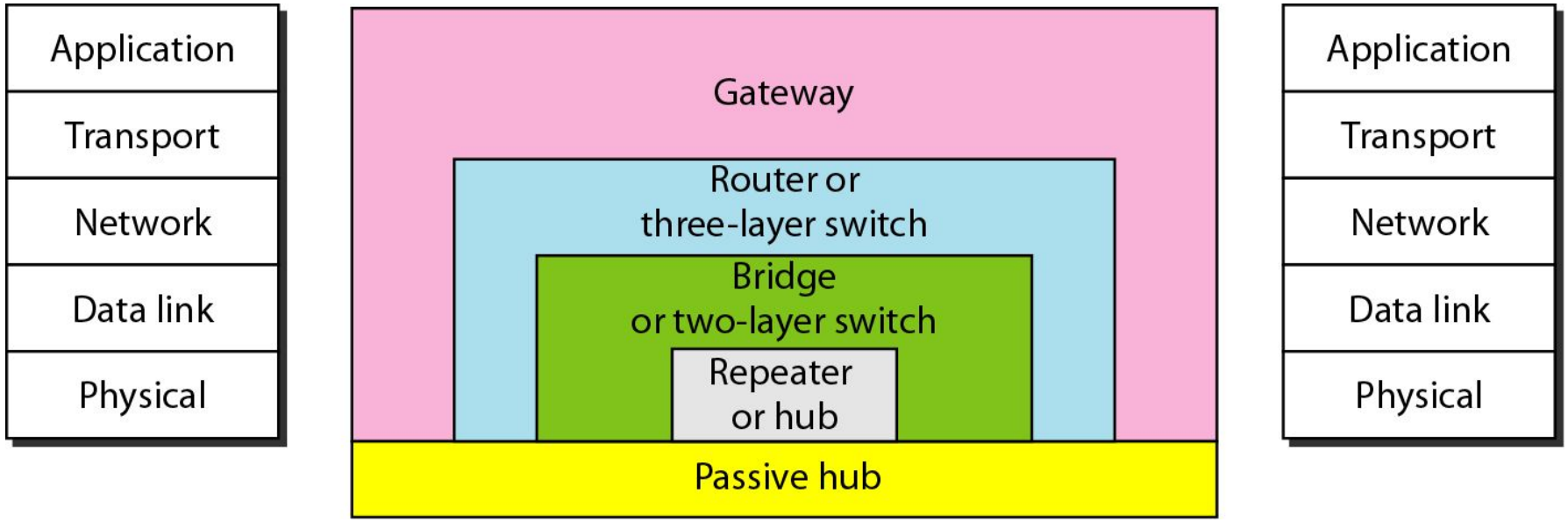
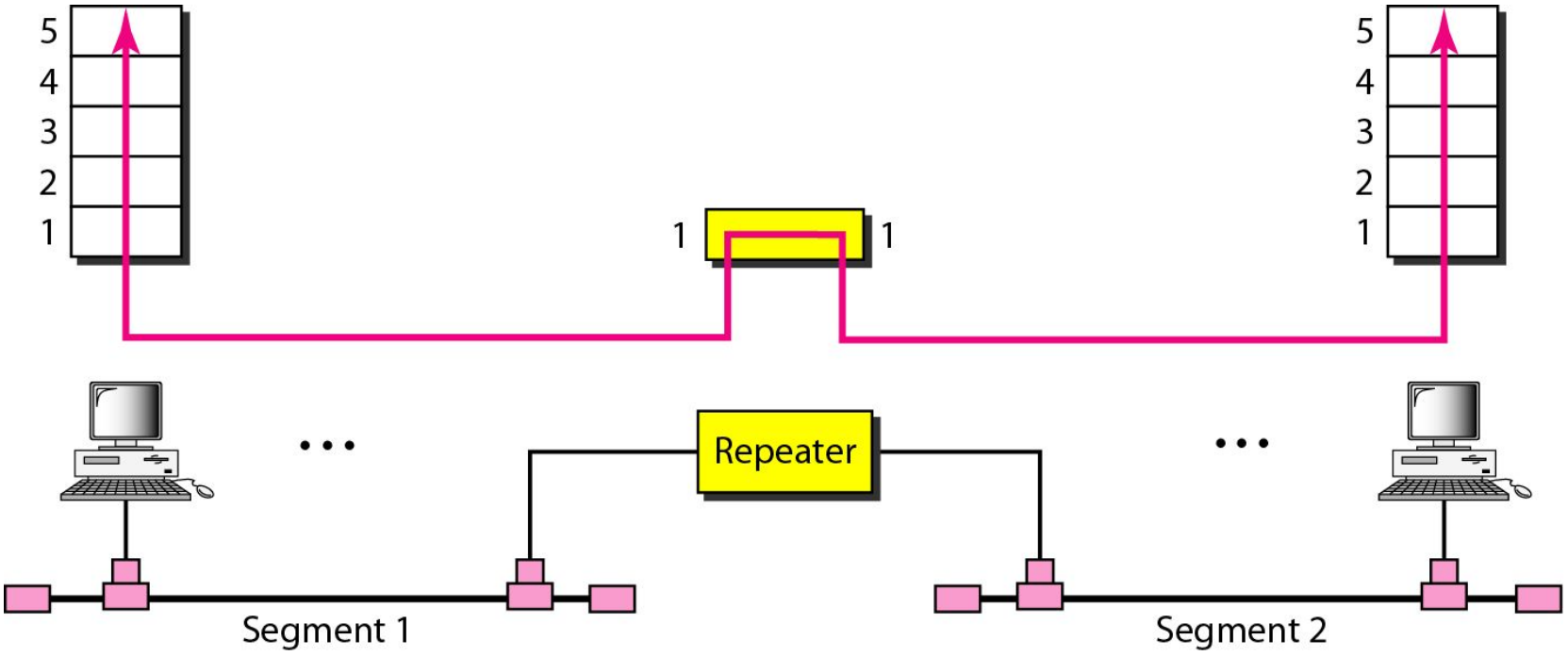


Figure 15.2 *A repeater connecting two segments of a LAN*



Note

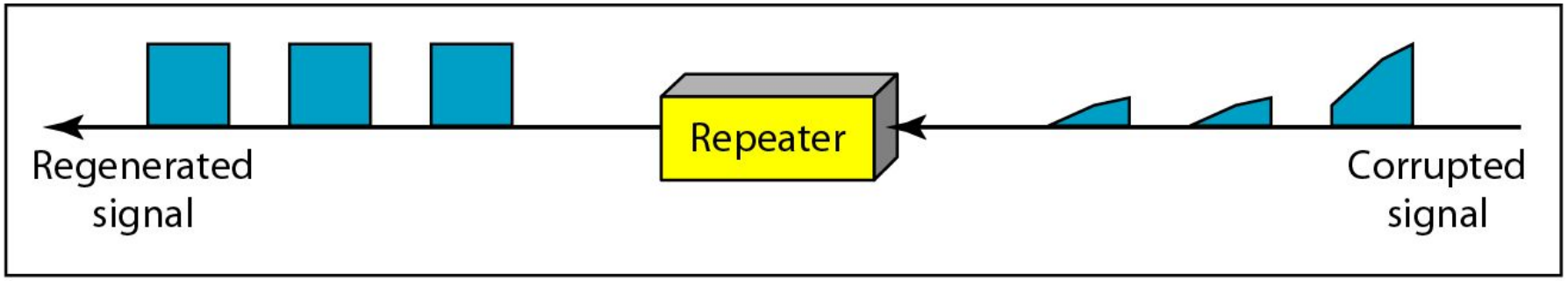
A repeater connects segments of a LAN.

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

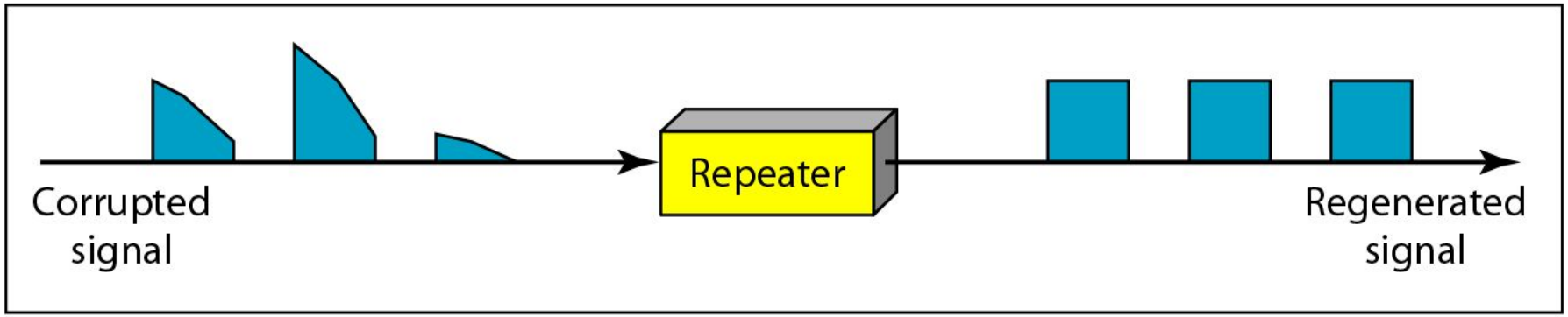
A repeater is a regenerator,
not an amplifier.

1. bit for bit copy
2. remove noise, but do not correct/detect error
3. Recover the signal strength

Figure 15.3 *Function of a repeater*



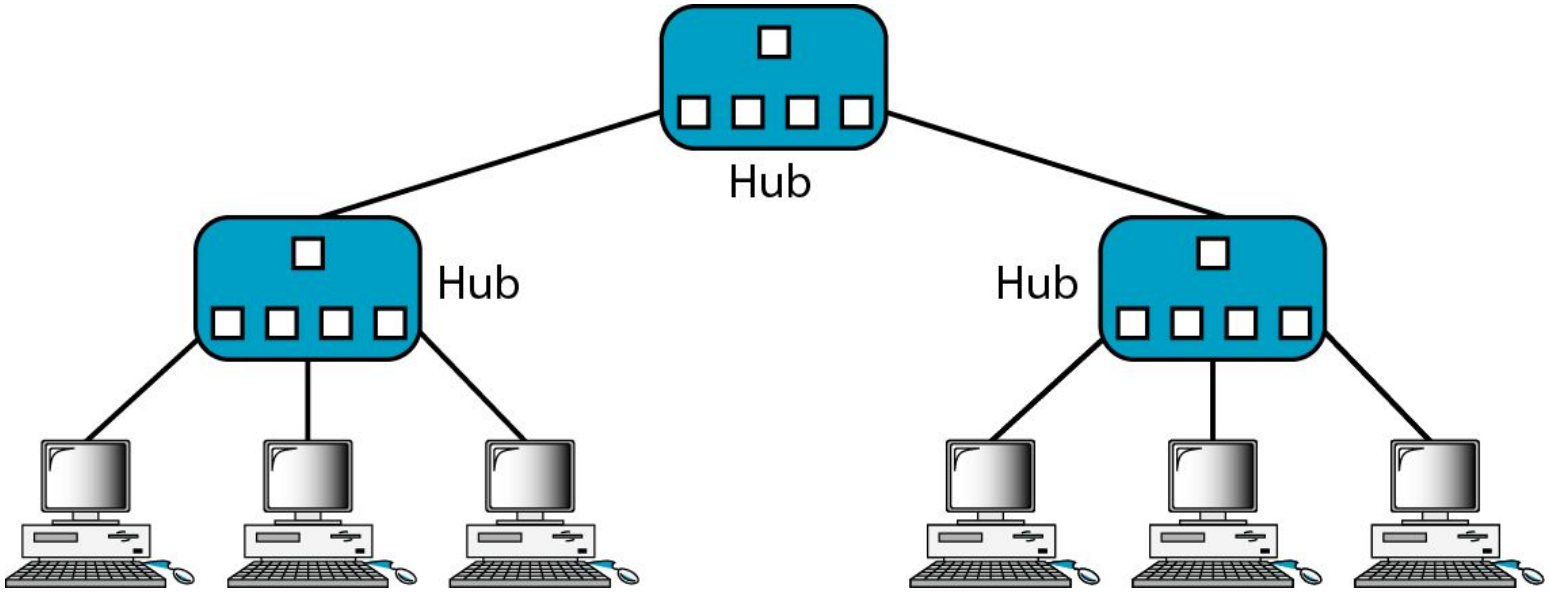
a. Right-to-left transmission.



b. Left-to-right transmission.

Figure 15.4 *A hierarchy of hubs*

A hub is actually a multiport repeater

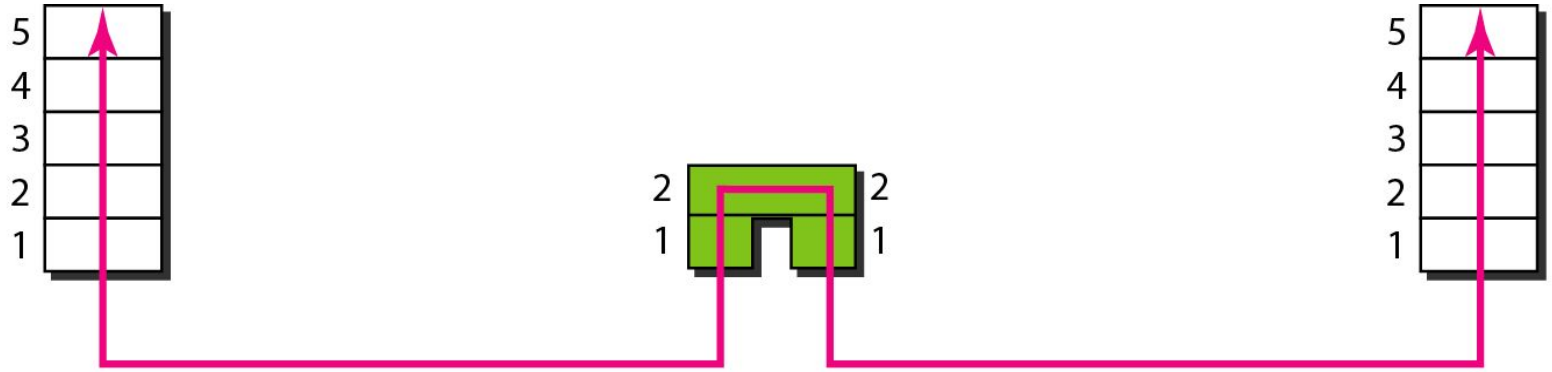


Note

A bridge checks MAC addresses. It has a table used in filtering decisions (Forward? Drop?). The table shows the map between MAC addresses and ports.

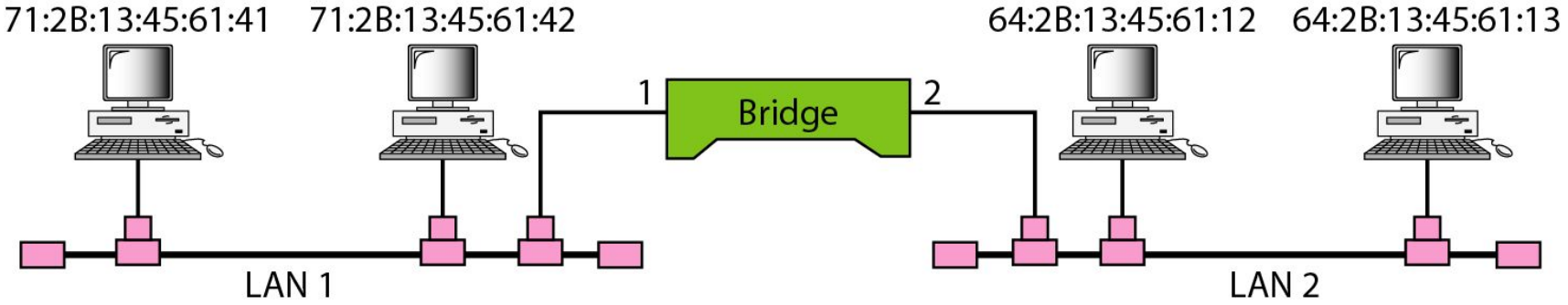
In Ethernet, Ethernet switch is a bridge device

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

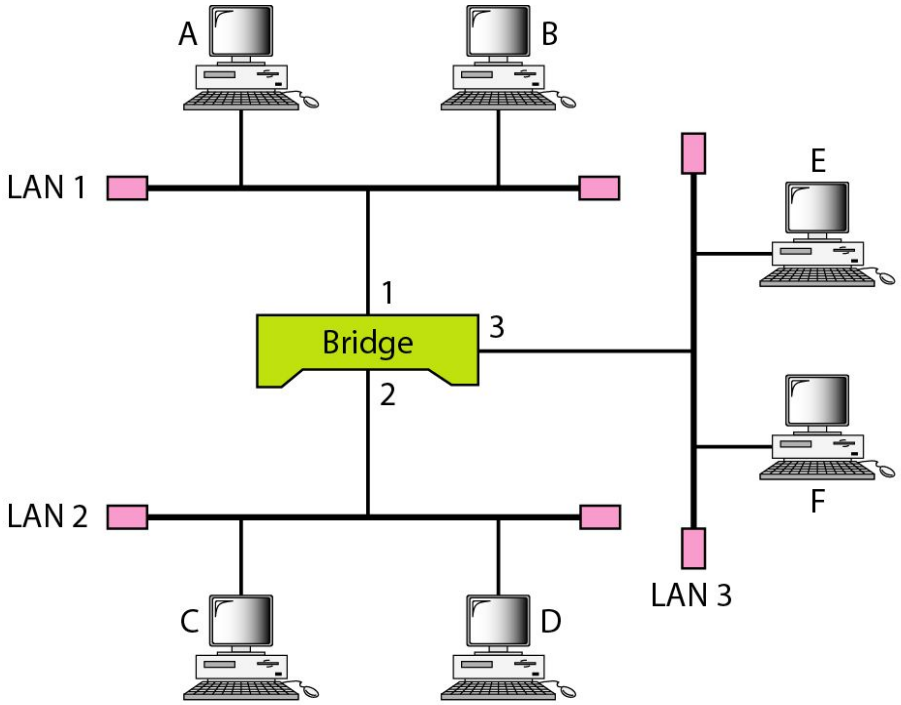
Bridge Table



Note

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

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



Address	Port

a. Original

Address	Port
A	1

b. After A sends a frame to D

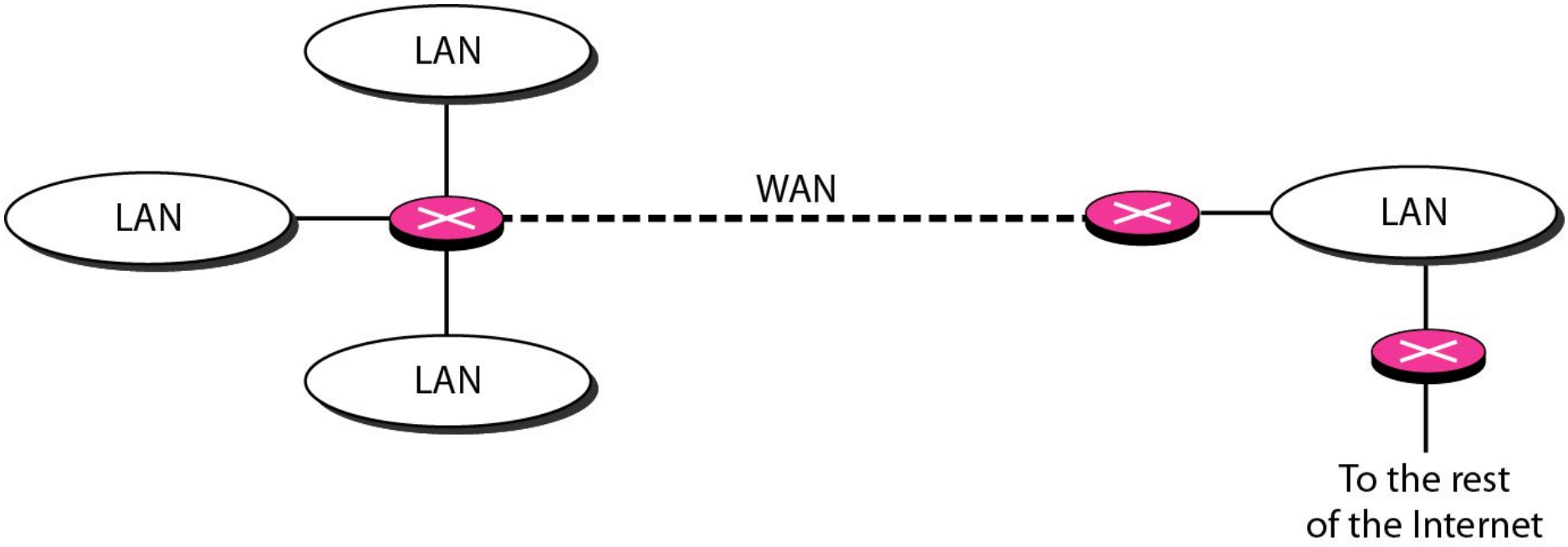
Address	Port
A	1
E	3

c. After E sends a frame to A

Address	Port
A	1
E	3
B	1

d. After B sends a frame to C

Figure 15.11 *Routers (layer-three switch) connecting independent LANs and WANs*



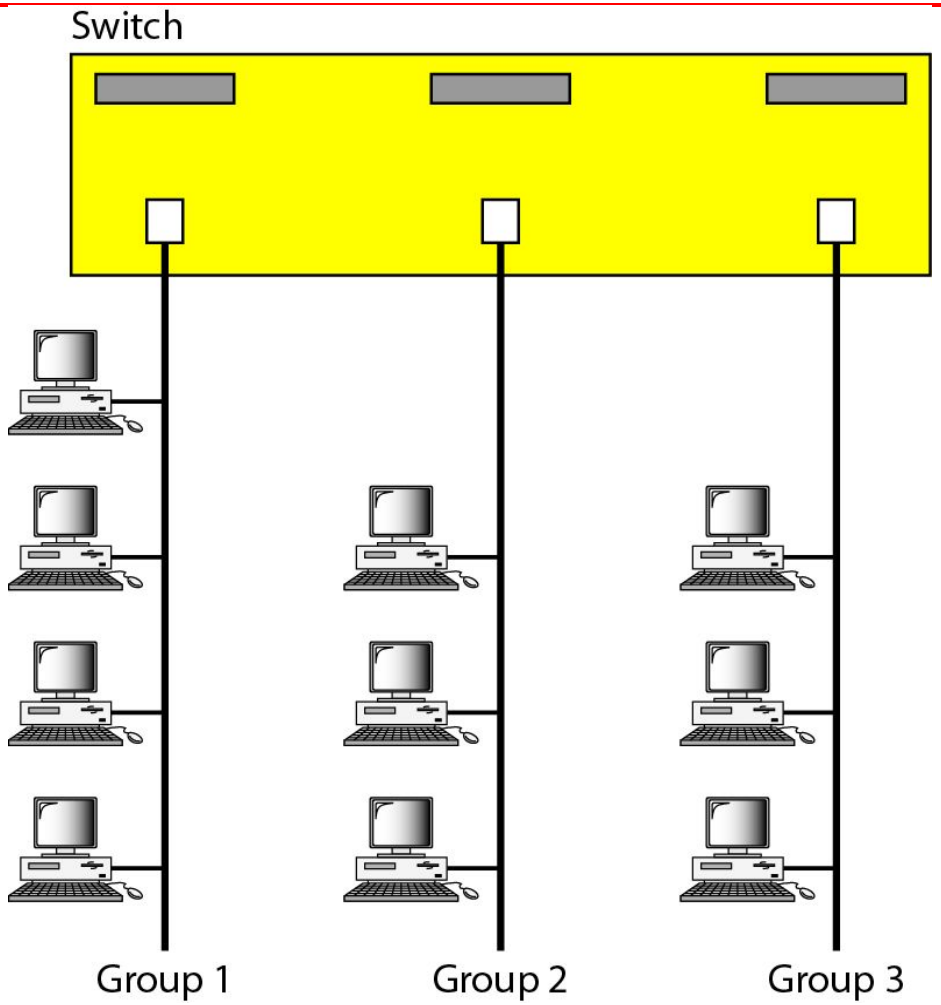
15-3 VIRTUAL LANs

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*



Physical wiring makes it hard to dynamically change group allocation

Figure 15.16 *A switch using VLAN software*

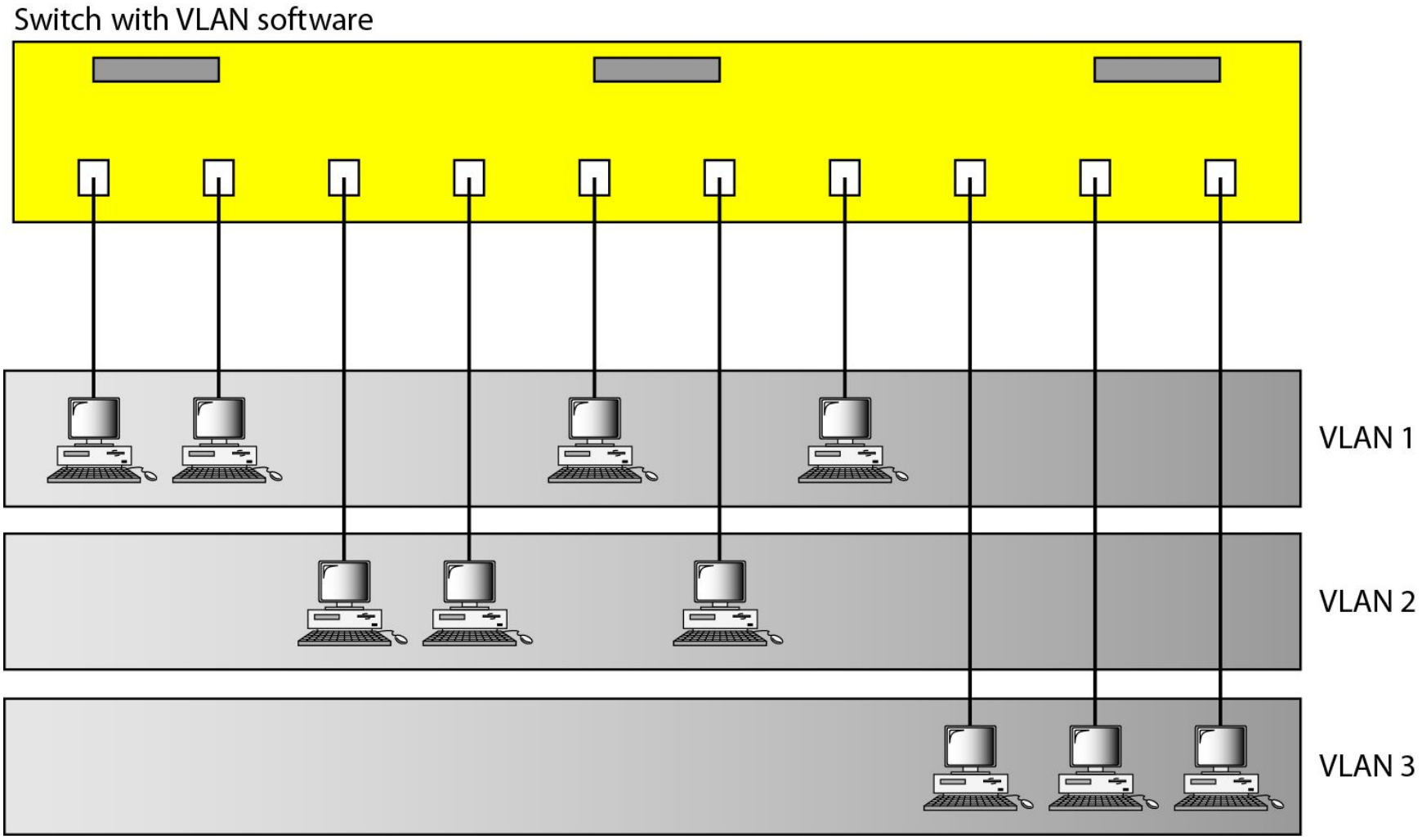
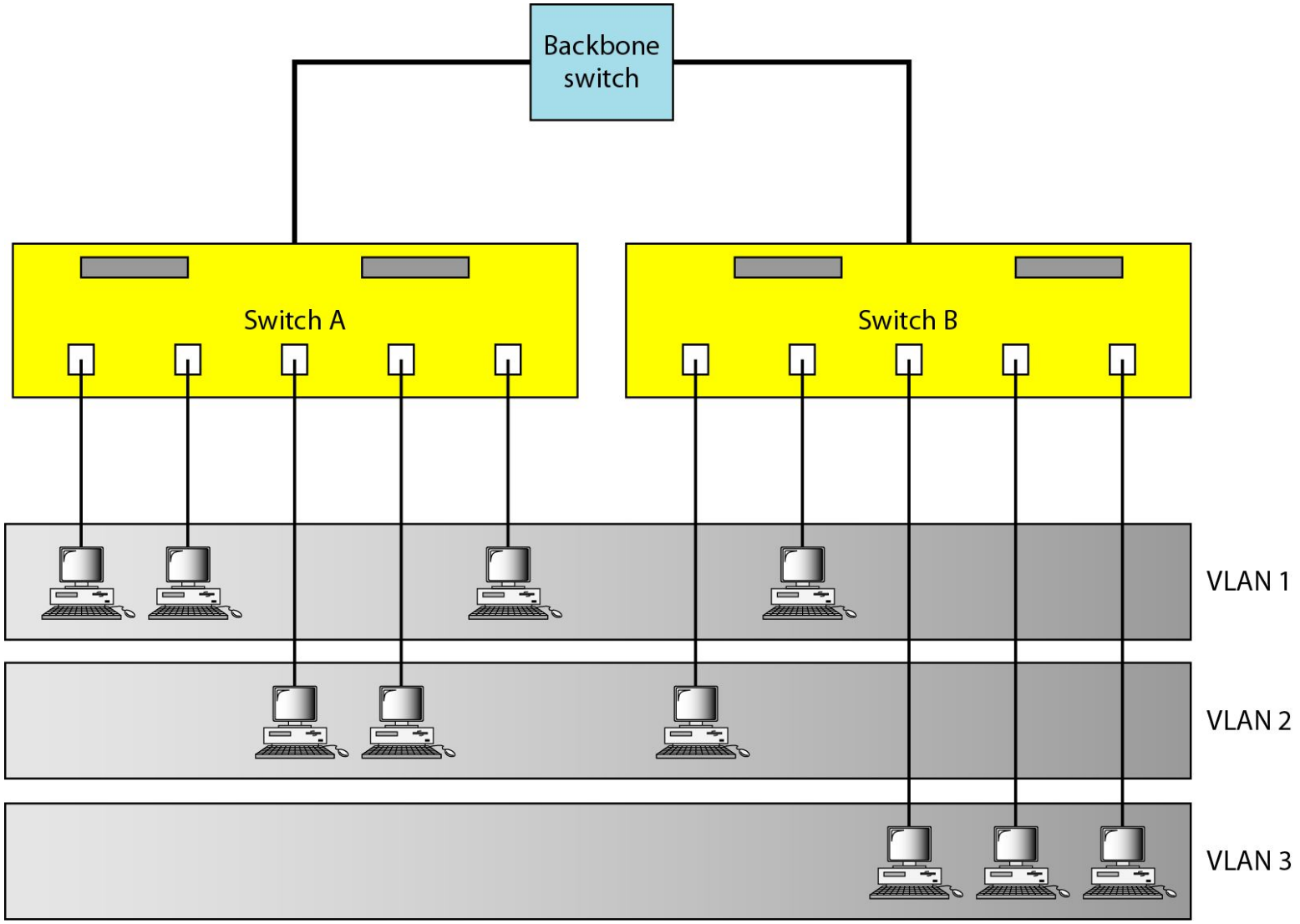


Figure 15.17 *Two switches in a backbone using VLAN software*



Good for a company with two separate buildings

Note

VLANs create broadcast domains.

VLAN: Membership Definition

- Switch port Numbers
- MAC Address
- IP Address
- Multicast IP Address
- Combination

VLAN Configuration

- Manually
- Automatic
- Semiautomatic

VLAN: Communication between switches

- Table maintenance
- Frame tagging
  - Extra header added to MAC frame to define the destination VLAN
- Time-Division Multiplexing (TDM)

VLAN: Advantages

- Cost and time reduction
- Creating Virtual Work Groups
- Security
  - Separation of broadcast messages