



## **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

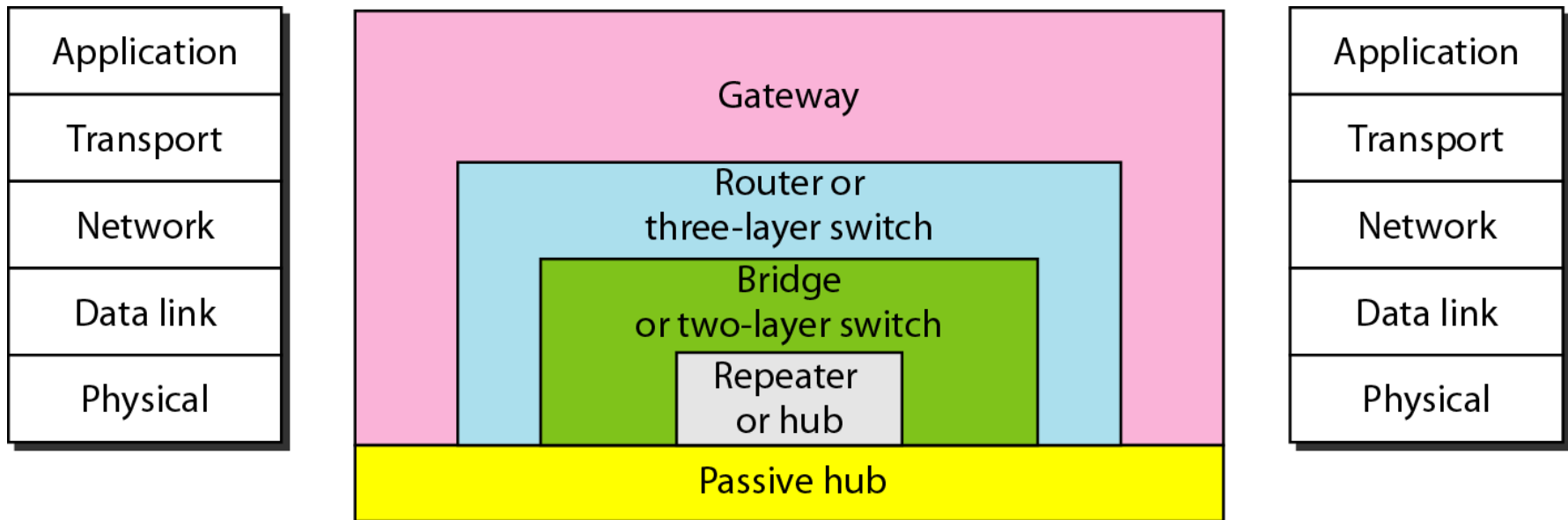
Three-Layer Switches

Gateways

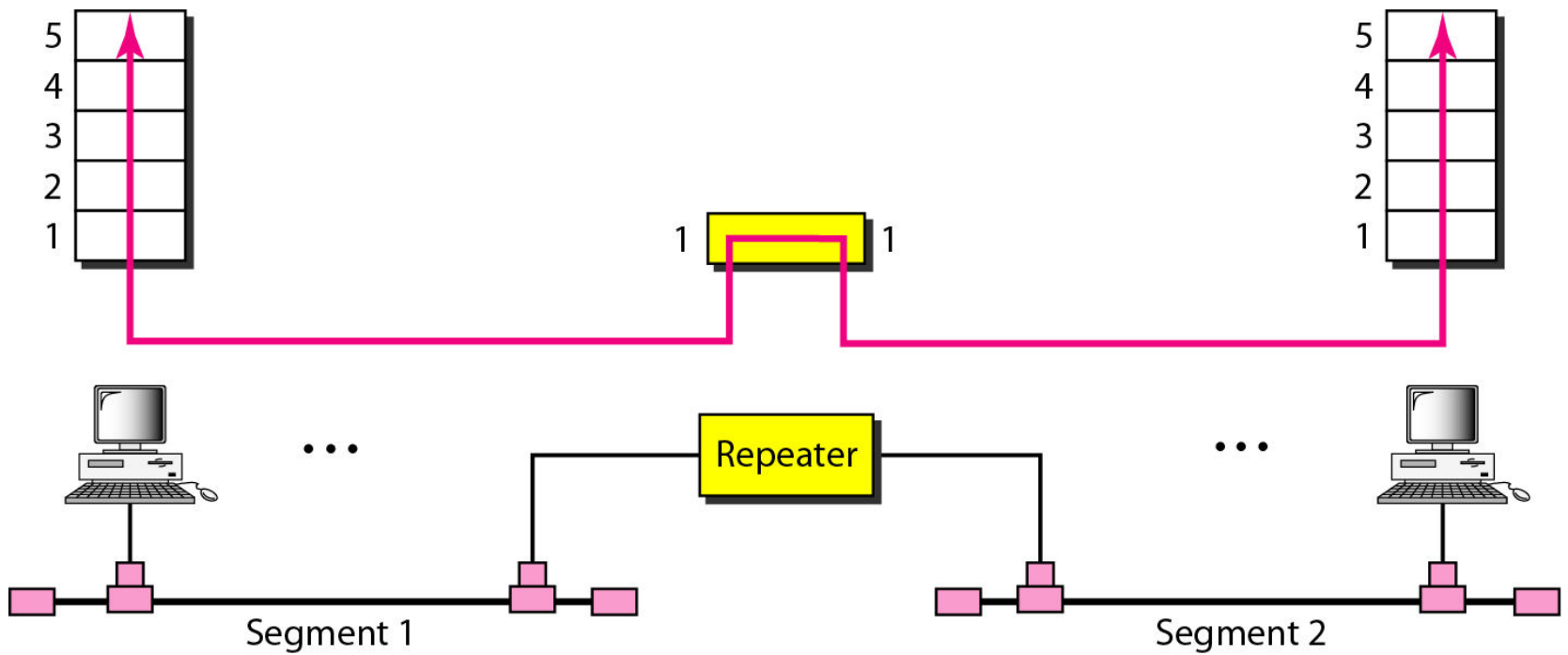
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**Figure 15.1** *Five categories of connecting devices*

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





*Note*

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**A repeater connects segments of a LAN.**

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*Note*

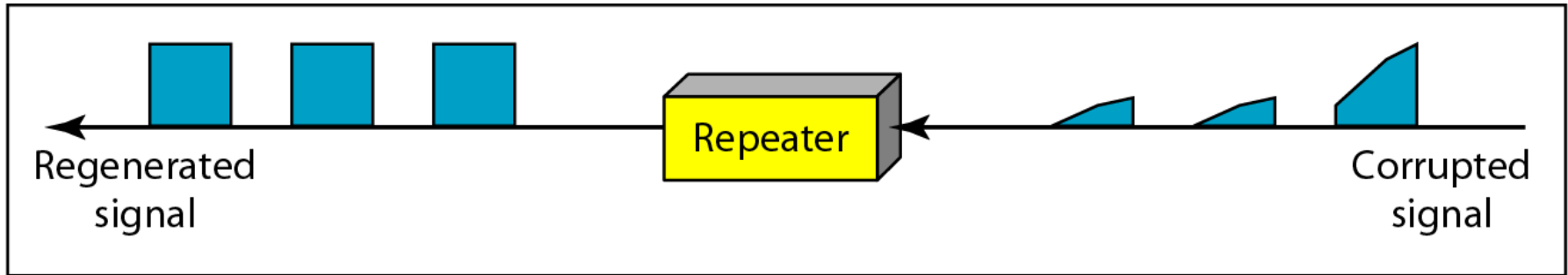
**A repeater forwards every frame;  
it has no filtering capability.**



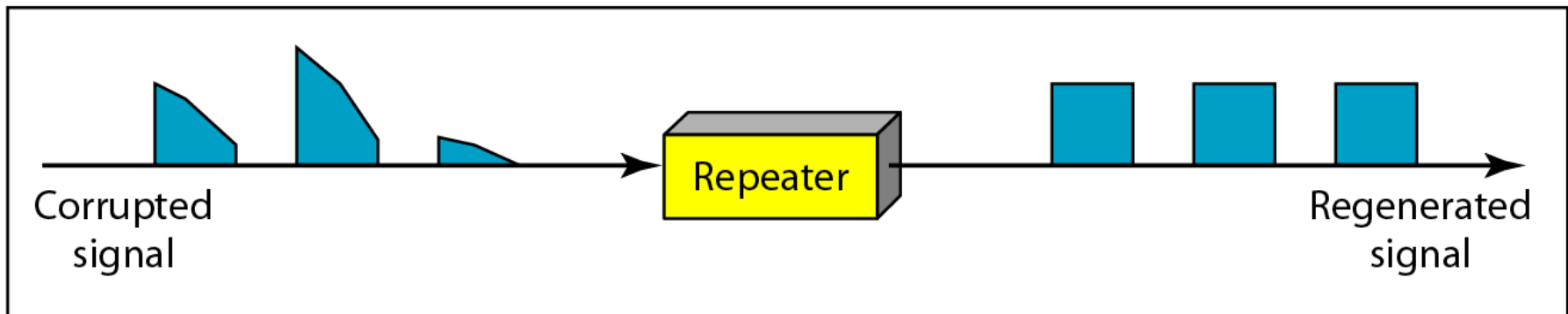
*Note*

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

**Figure 15.3** *Function of a repeater*



a. Right-to-left transmission.



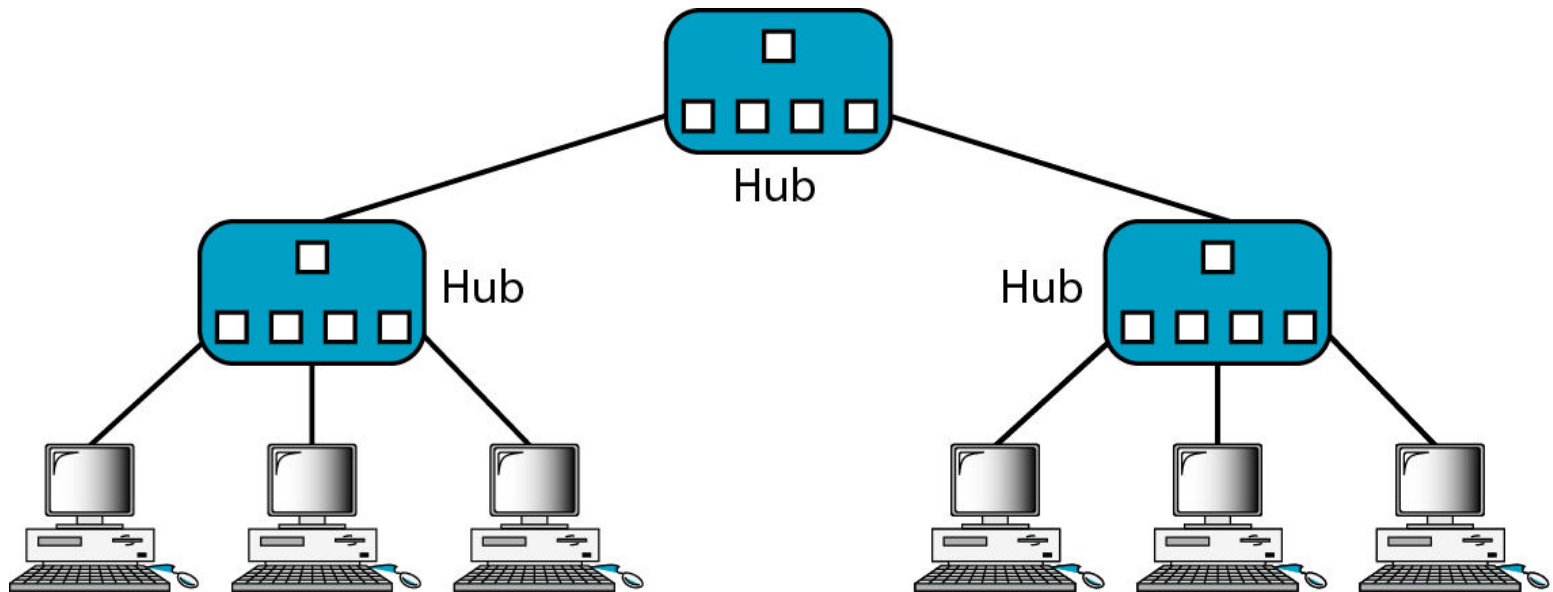
b. Left-to-right transmission.



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**Figure 15.4** *A hierarchy of hubs*

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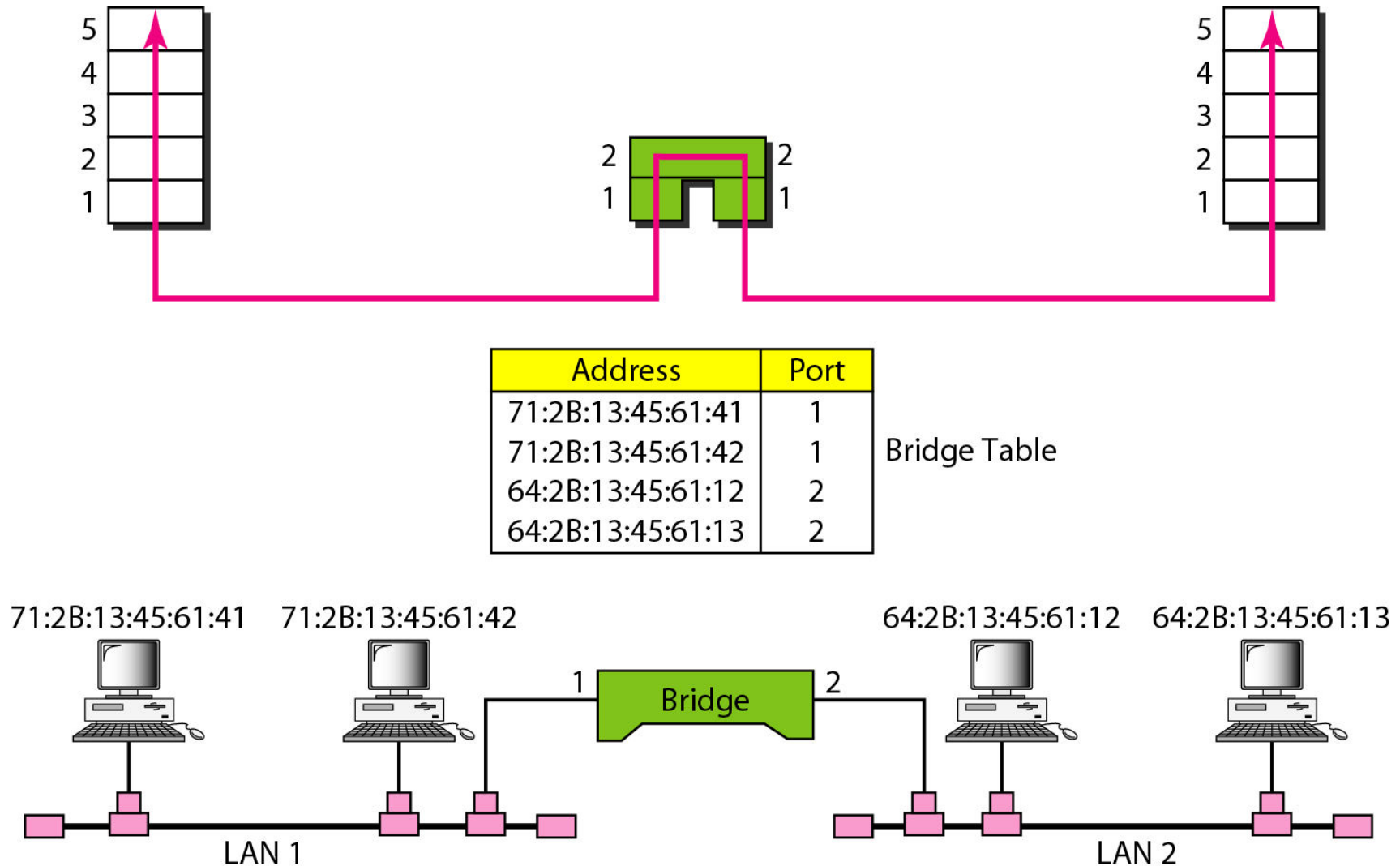




*Note*

**A bridge has a table used in  
filtering decisions.**

**Figure 15.5** *A bridge connecting two LANs*

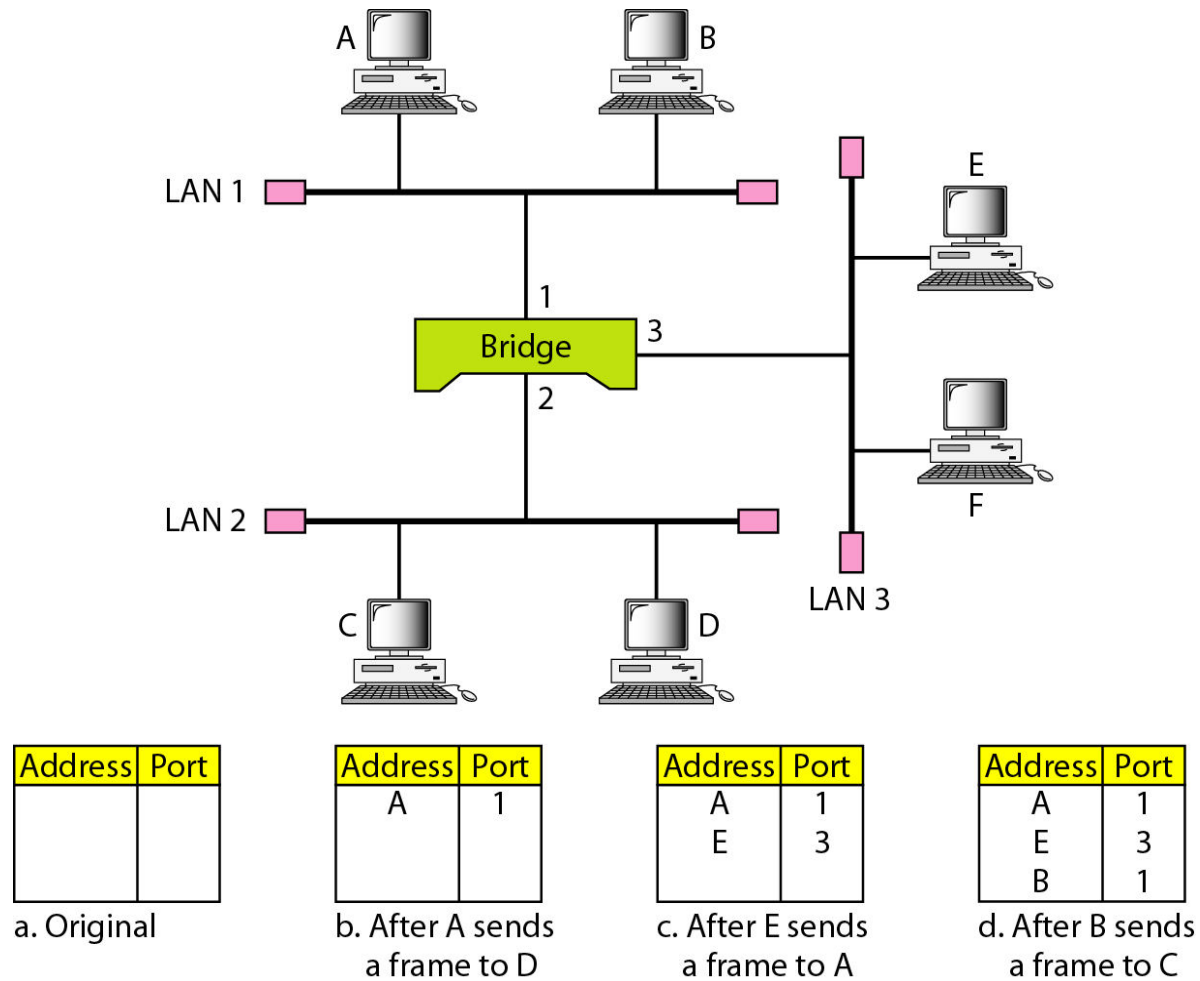




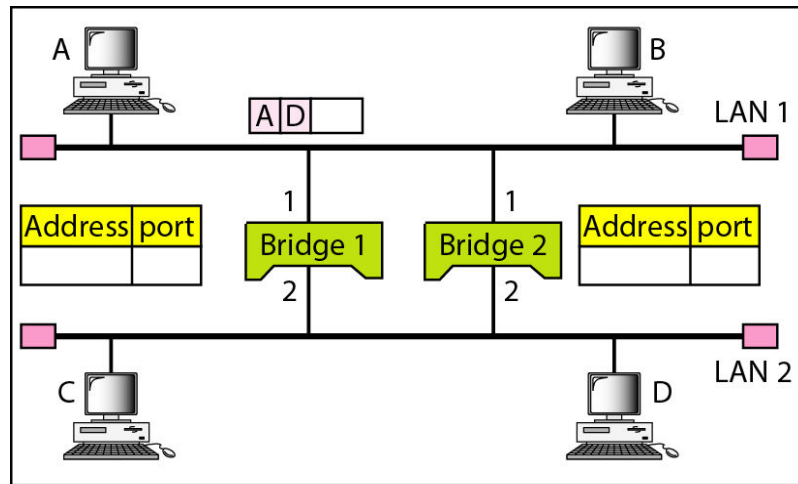
*Note*

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

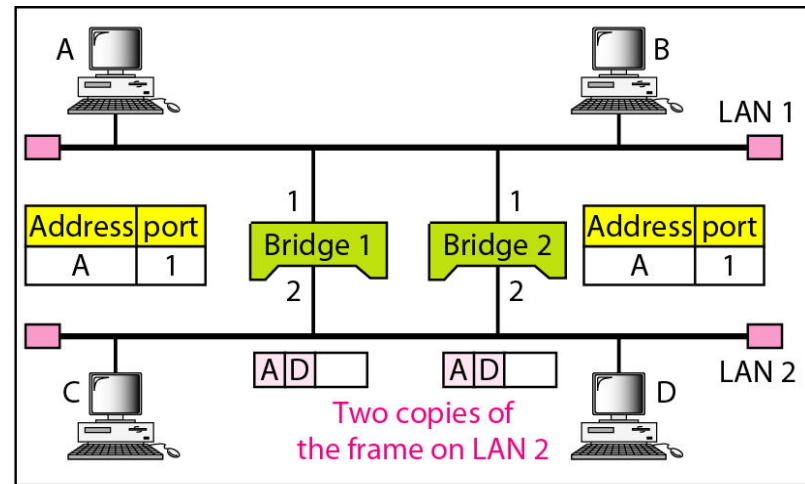
**Figure 15.6** *A learning bridge and the process of learning*



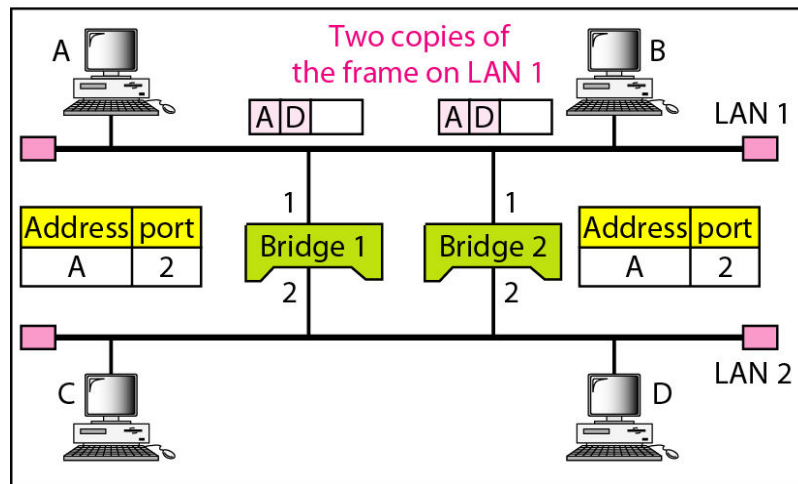
**Figure 15.7** *Loop problem in a learning bridge*



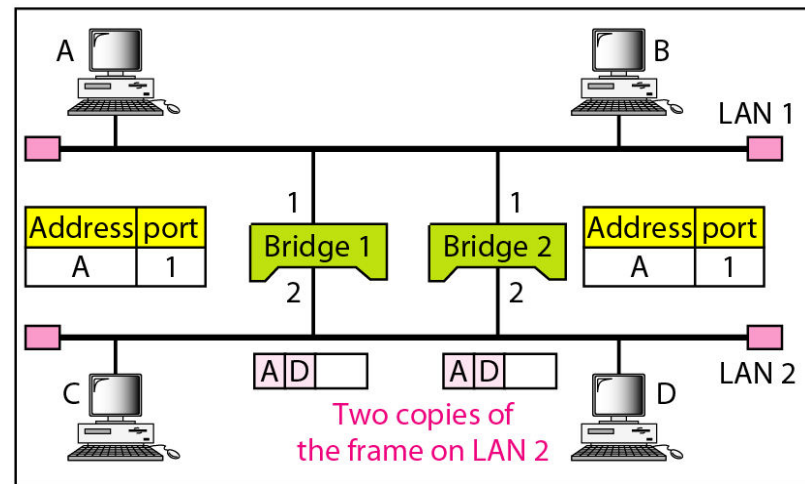
a. Station A sends a frame to station D



b. Both bridges forward the frame

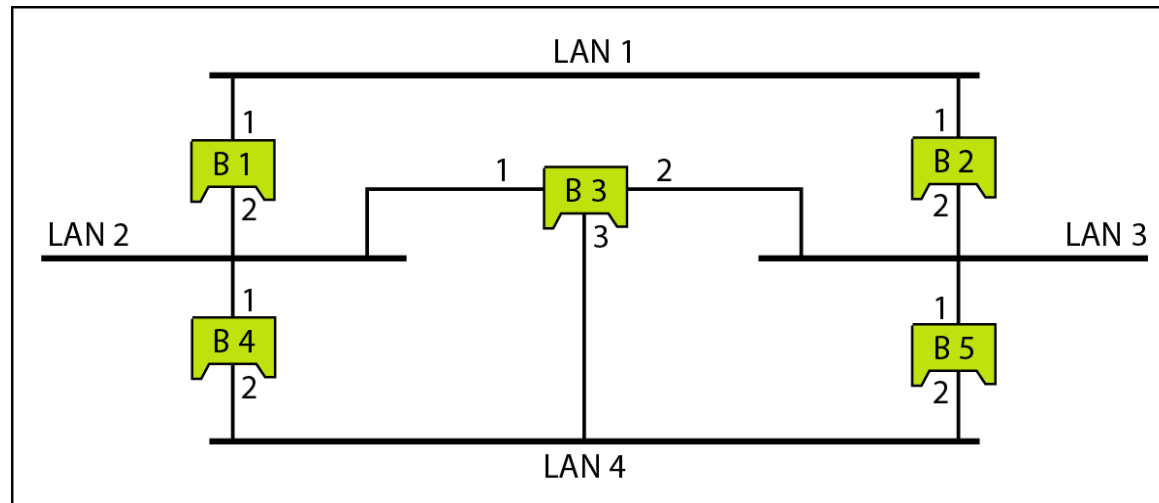


c. Both bridges forward the frame

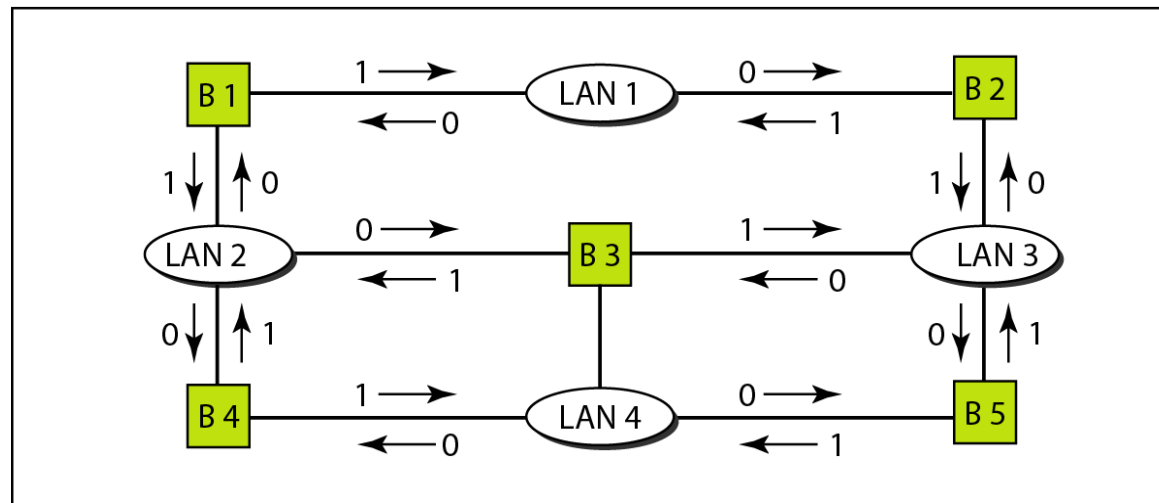


d. Both bridges forward the frame

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

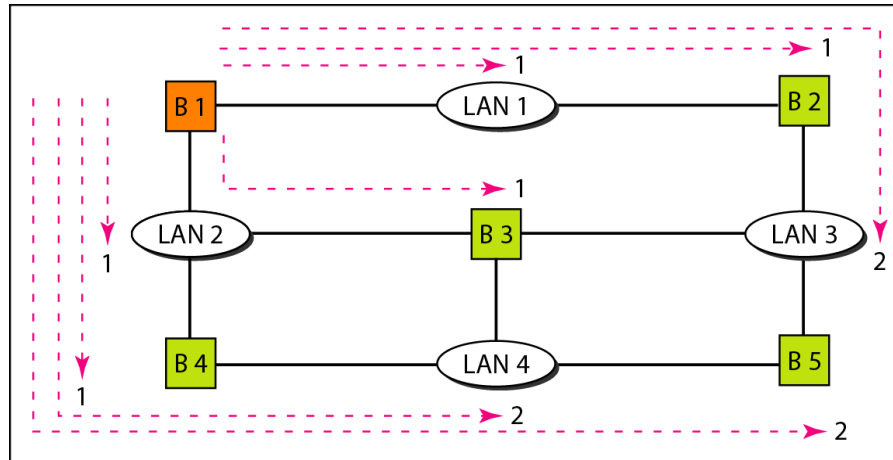


a. Actual system

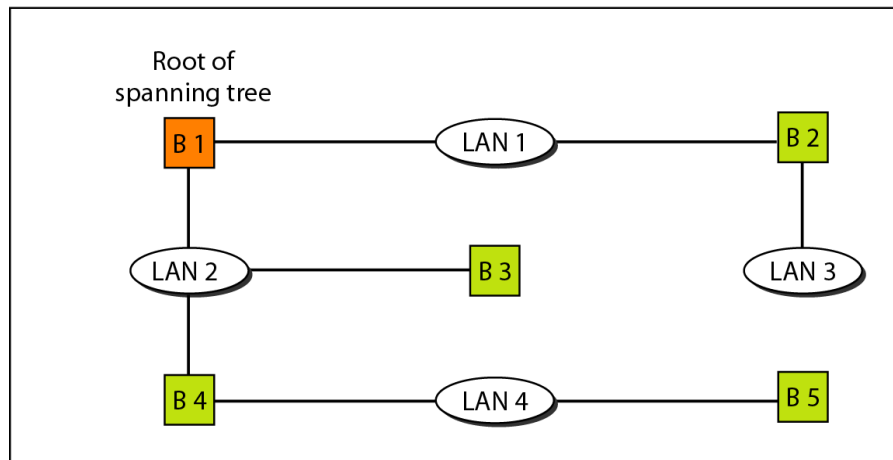


b. Graph representation with cost assigned to each arc

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



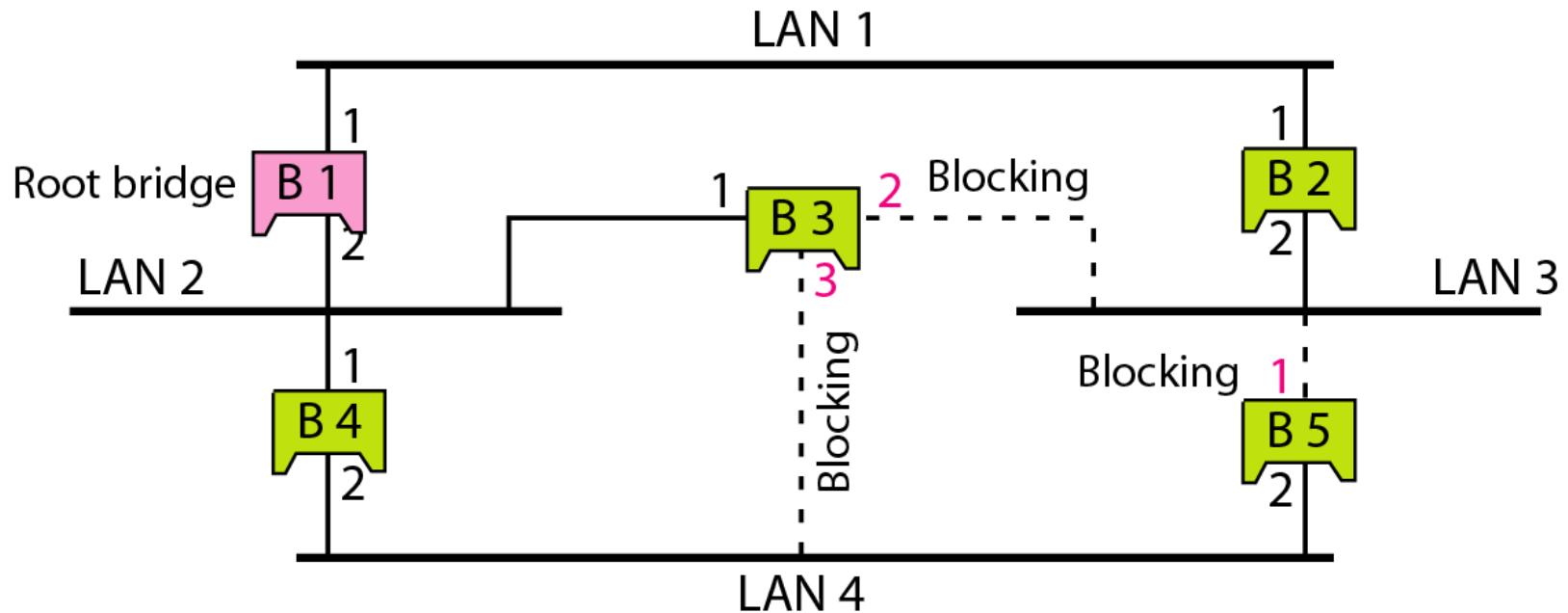
a. Shortest paths



b. Spanning tree

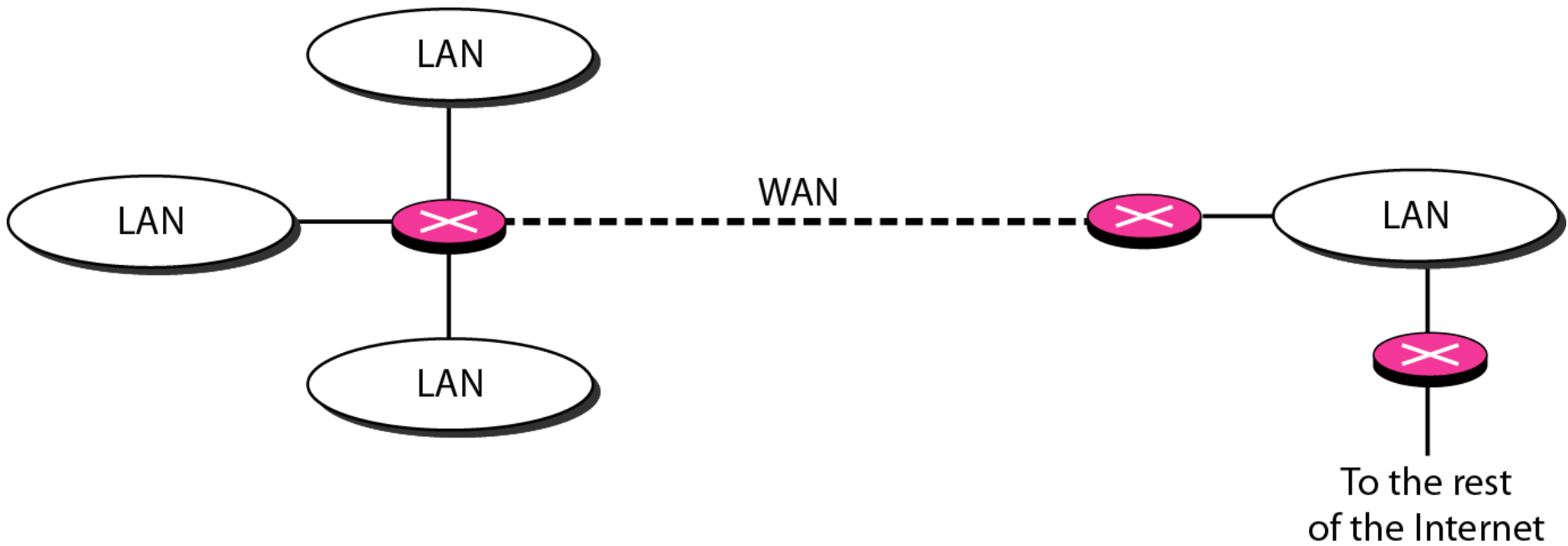


**Figure 15.10** *Forwarding and blocking ports after using spanning tree algorithm*



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



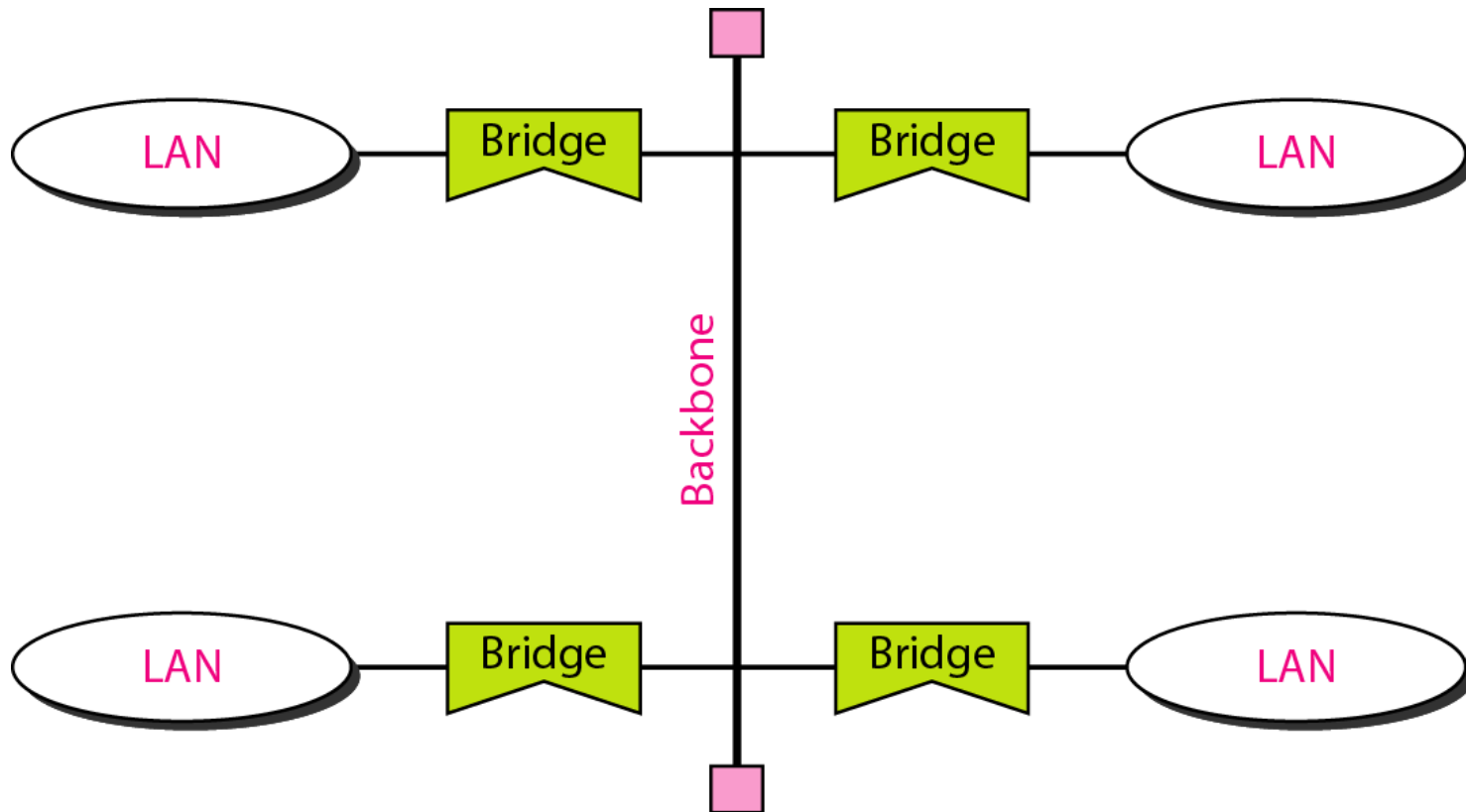
*Note*

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

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**Figure 15.12** *Bus backbone*

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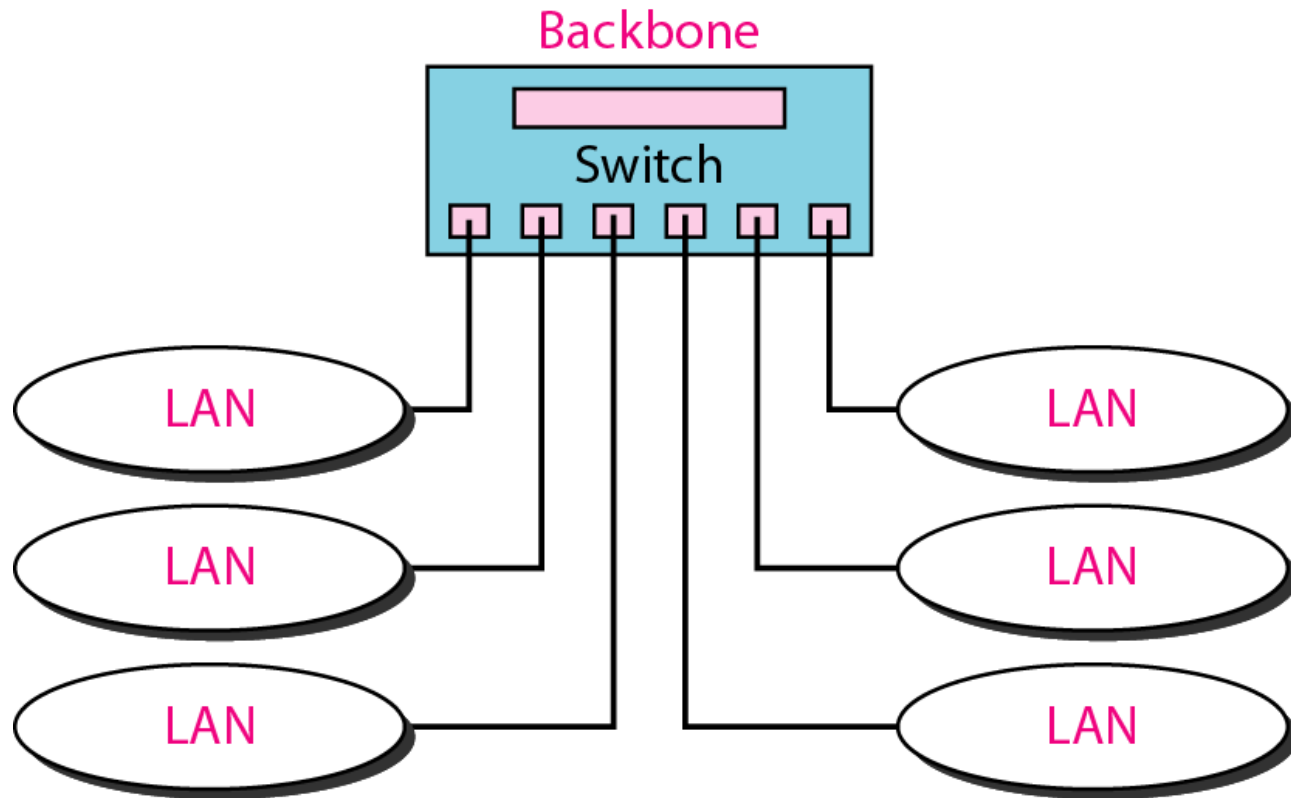
*Note*

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

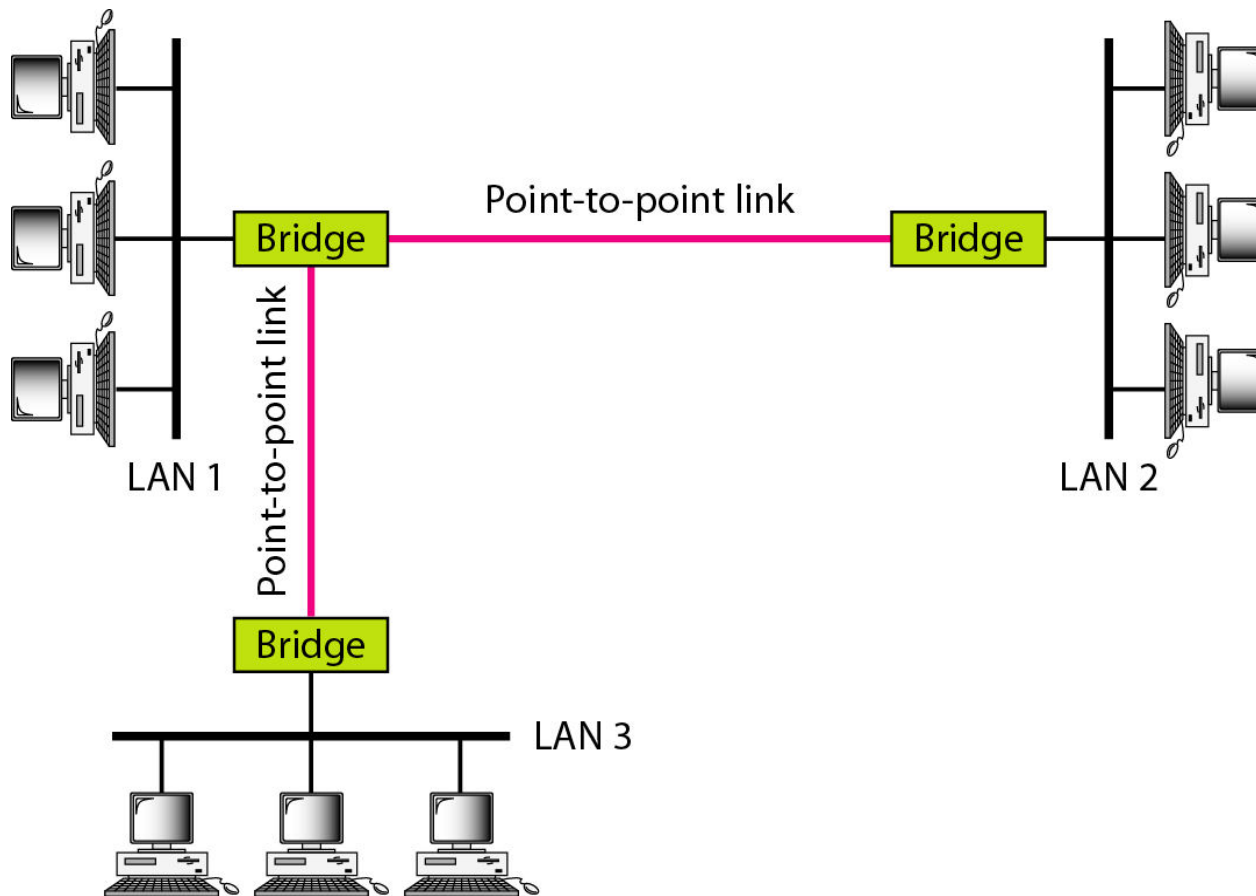
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**Figure 15.13** *Star backbone*

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**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**

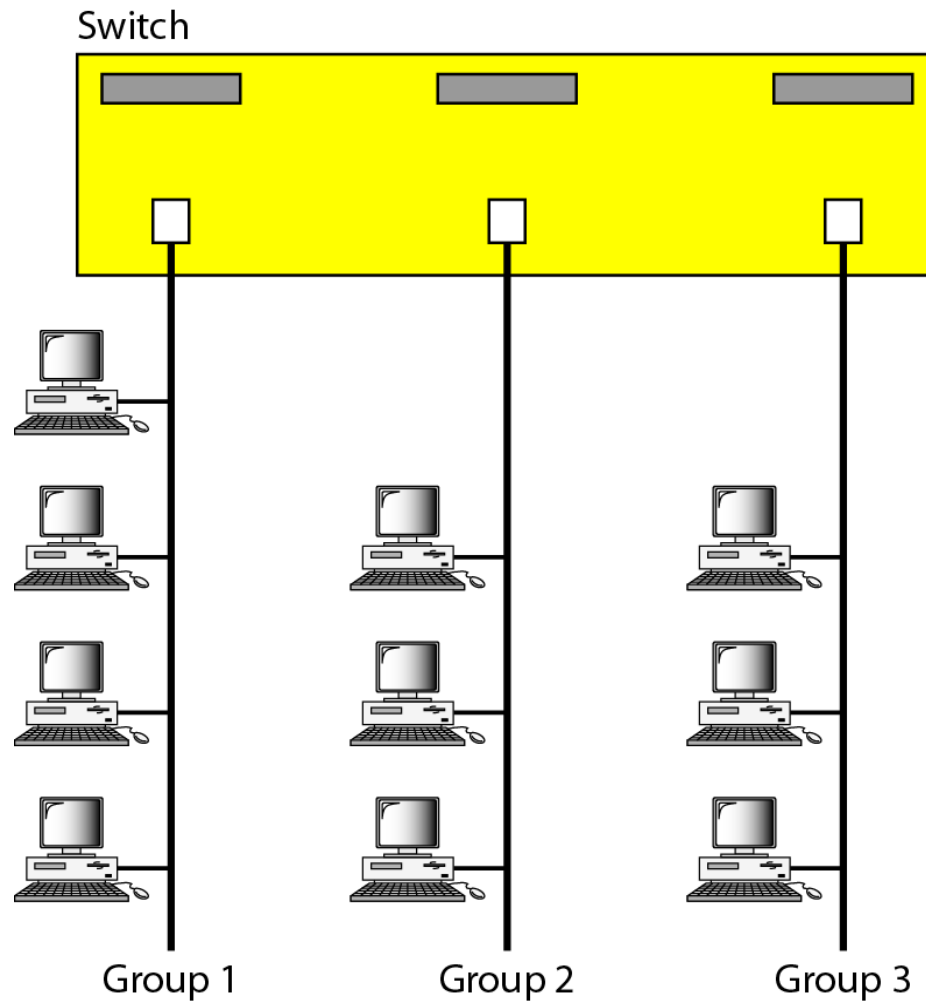
**Configuration**

**Communication between Switches**

**IEEE Standard**

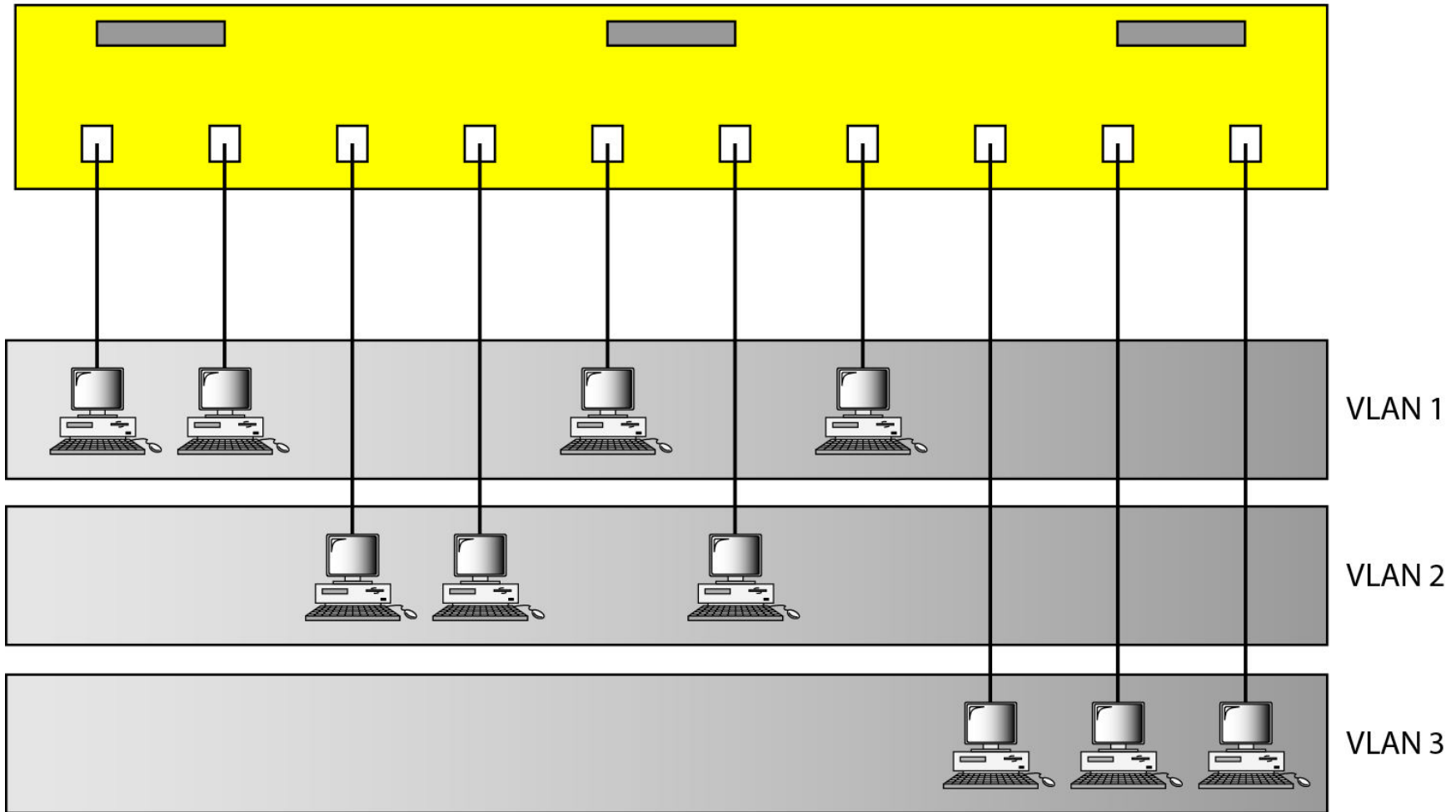
**Advantages**

**Figure 15.15** *A switch connecting three LANs*

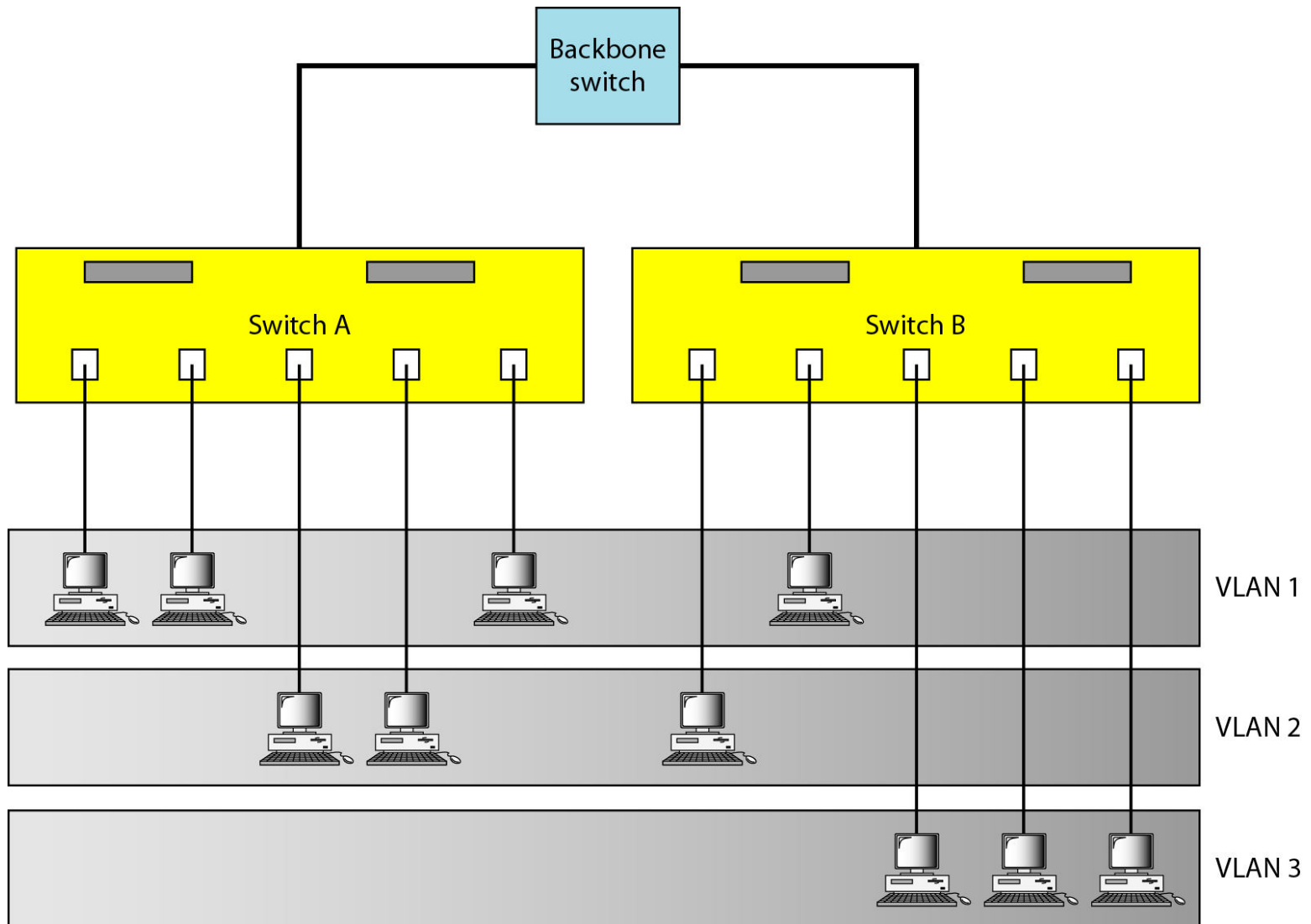


**Figure 15.16** *A switch using VLAN software*

Switch with VLAN software



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





*Note*

**VLANs create broadcast domains.**