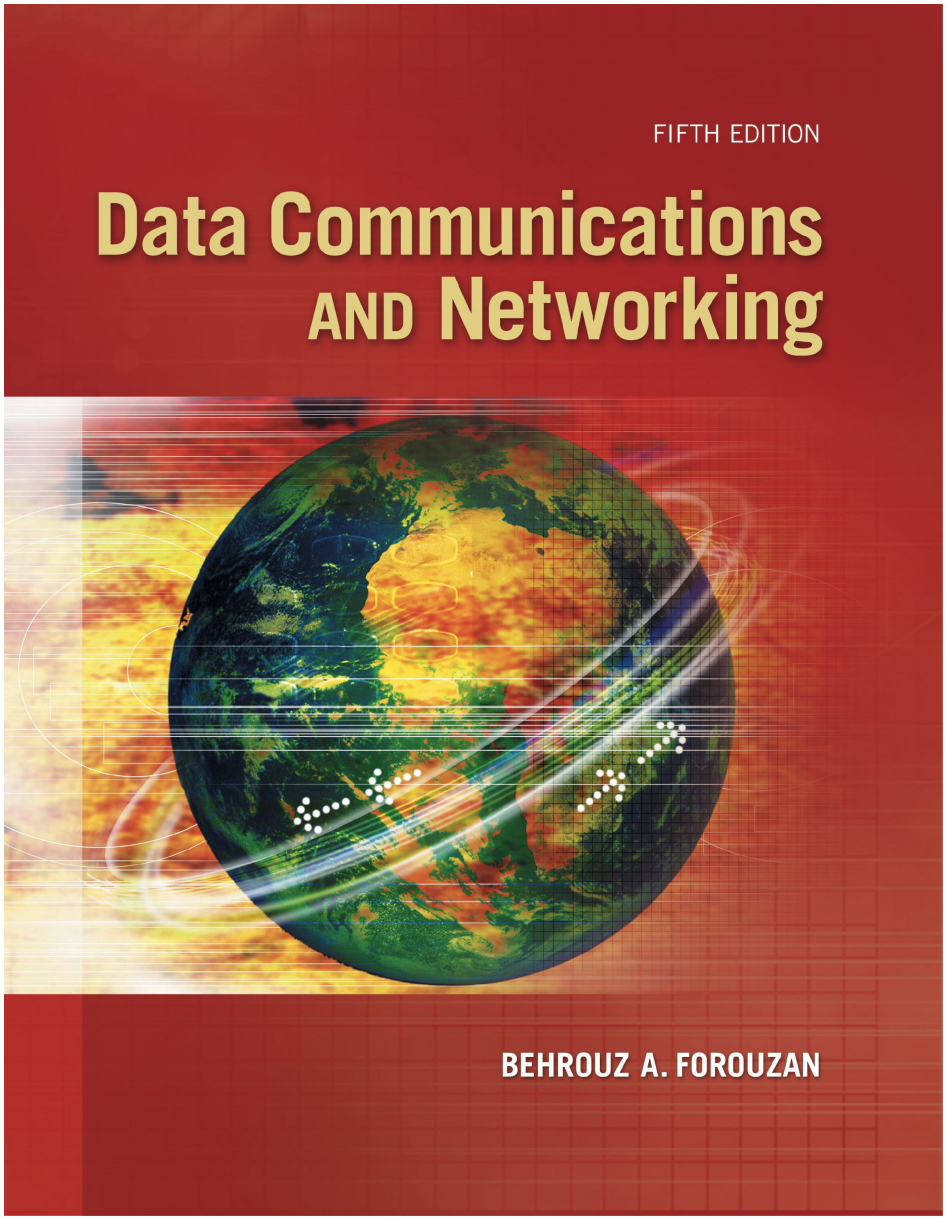
Chapter 17

Connecting Devices And Virtual LANs



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Chapter 17: Outline

17.1 CONNECTING DEVICES

17.2 VIRTUAL LANS

Chapter 17: Objective

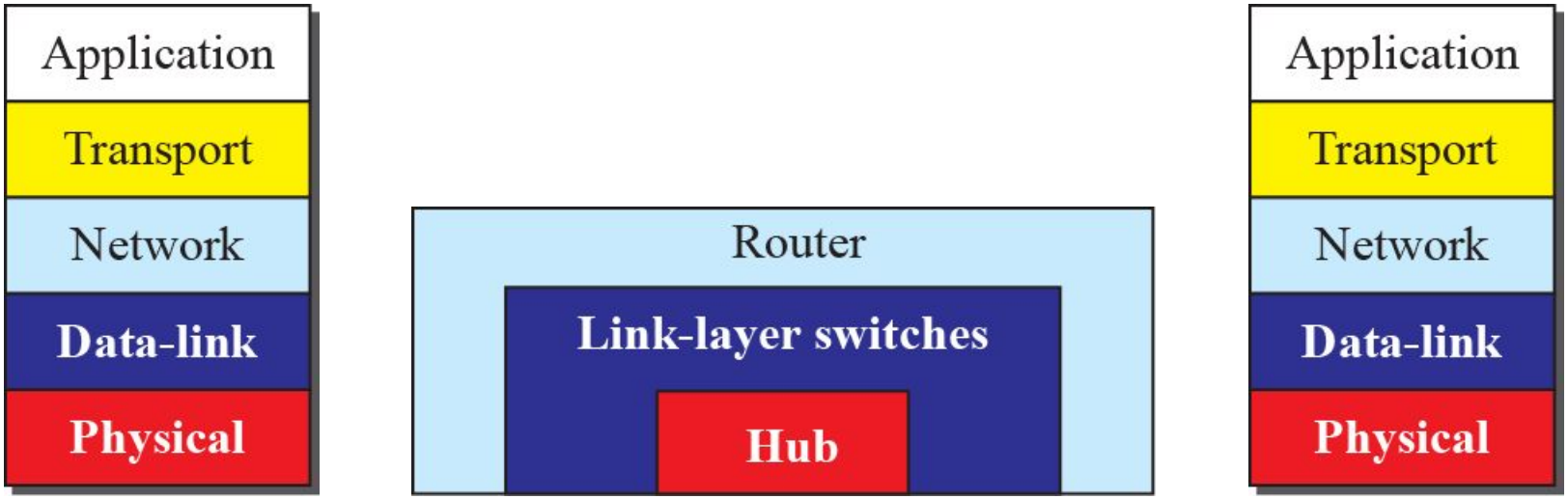
- *The first section discusses connecting devices. It first describes hubs and their features. The section then discusses link-layer switches (or simply switches, as they are called), and shows how they can create loops if they connect LANs with broadcast domains.*

- *The second section discusses virtual LANs or VLANs. The section first shows how membership in a VLAN can be defined. The section then discusses the VLAN configuration. It next shows how switches can communicate in a VLAN. Finally, the section mentions the advantages of a VLAN..*

17-1 CONNECTING DEVICES

Hosts and networks do not normally operate in isolation. We use connecting devices to connect hosts together to make a network or to connect networks together to make an internet. Connecting devices can operate in different layers of the Internet model. We discuss three kinds of connecting devices: hubs, link-layer switches, and routers.

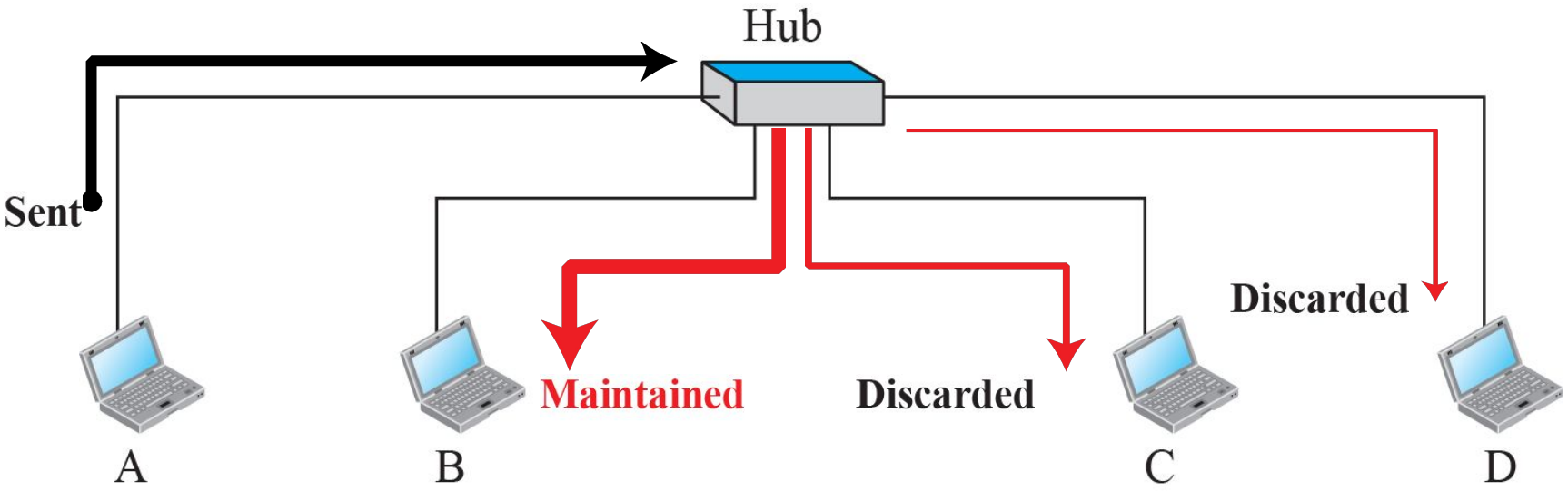
Figure 17.1: Three categories of connecting devices



17.17.1 Hubs

A hub is a device that operates only in the physical layer. Signals that carry information within a network can travel a fixed distance before attenuation endangers the integrity of the data. A repeater receives a signal and, before it becomes too weak or corrupted, regenerates and retimes the original bit pattern.

Figure 17.2: Hub



17.17.2 Link-Layer Switches

A link-layer switch (or switch) operates in both the physical and the data-link layers. As a physical-layer device, it regenerates the signal it receives. As a link-layer device, the link-layer switch can check the MAC addresses (source and destination) contained in the frame.

Figure 17.3: Link-Layer Switch

Switching table

Address	Port
71:2B:13:45:61:41	1
71:2B:13:45:61:42	2
64:2B:13:45:61:12	3
64:2B:13:45:61:13	4

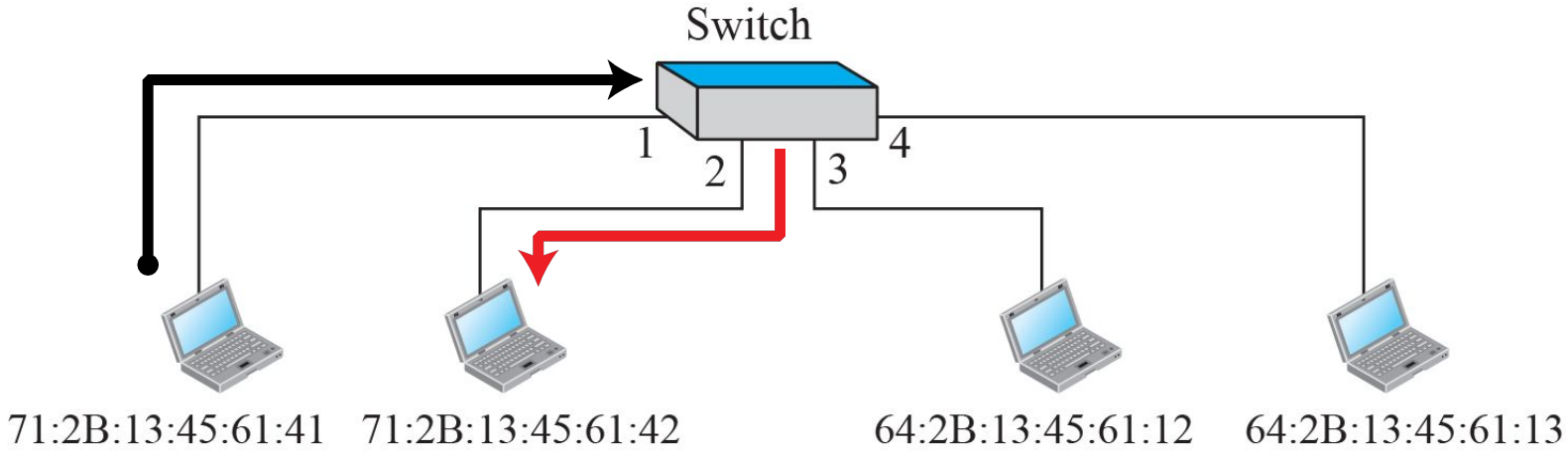


Figure 17.4: Learning switch

a. Original

Address	Port

b. After A sends a frame to D

Address	Port
71:2B:13:45:61:41	1

c. After D sends a frame to B

Address	Port
71:2B:13:45:61:41	1
64:2B:13:45:61:13	4

d. After B sends a frame to A

Address	Port
71:2B:13:45:61:41	1
64:2B:13:45:61:13	4
71:2B:13:45:61:42	2

e. After C sends a frame to D

Address	Port
71:2B:13:45:61:41	1
64:2B:13:45:61:13	4
71:2B:13:45:61:42	2
64:2B:13:45:61:12	3

Gradual building of Table

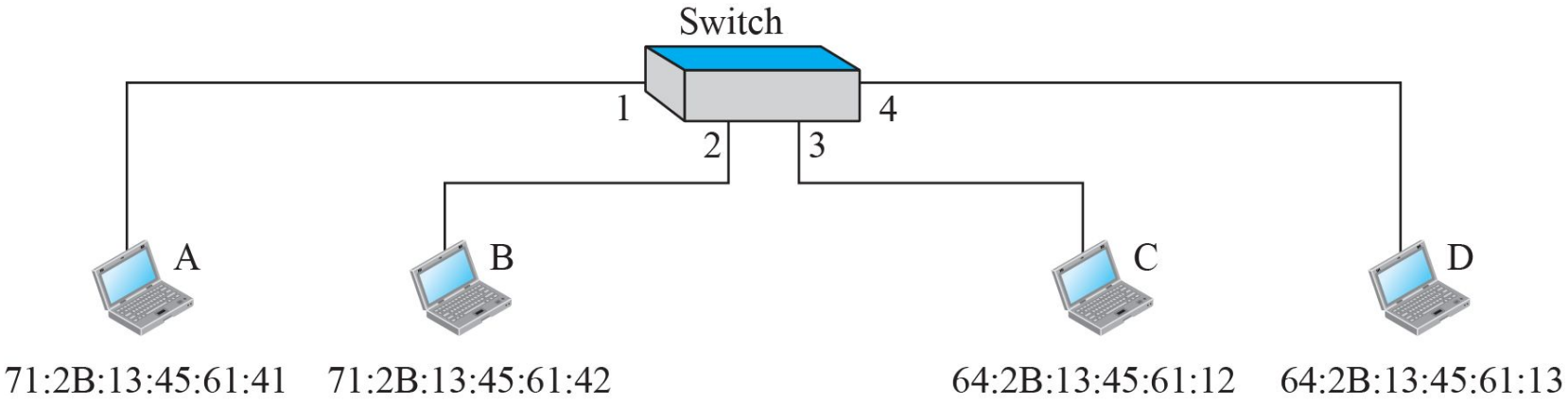


Figure 17.5: ***Loop problem in a learning switch (Part a)***

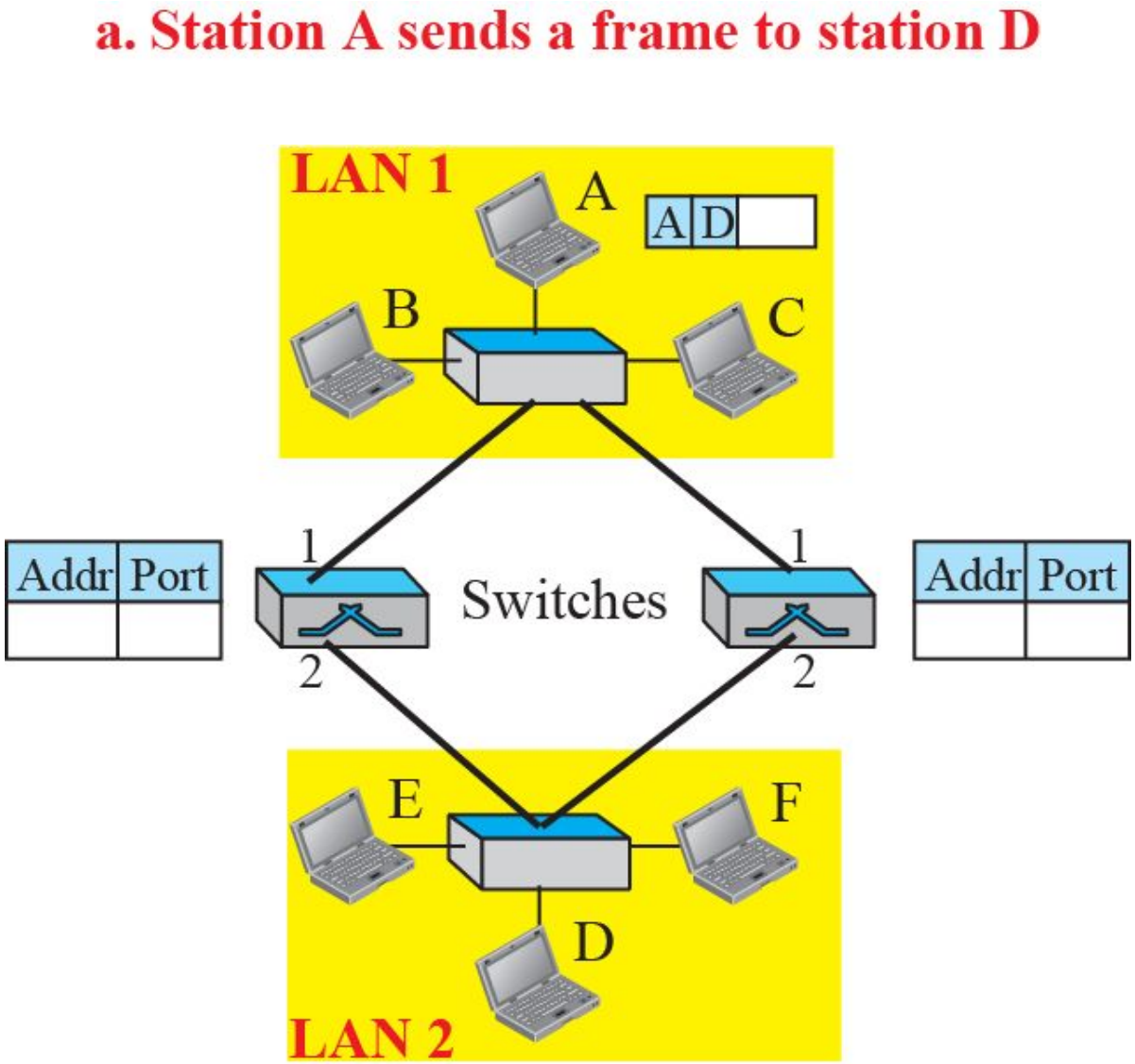


Figure 17.5: Loop problem in a learning switch (Part b)

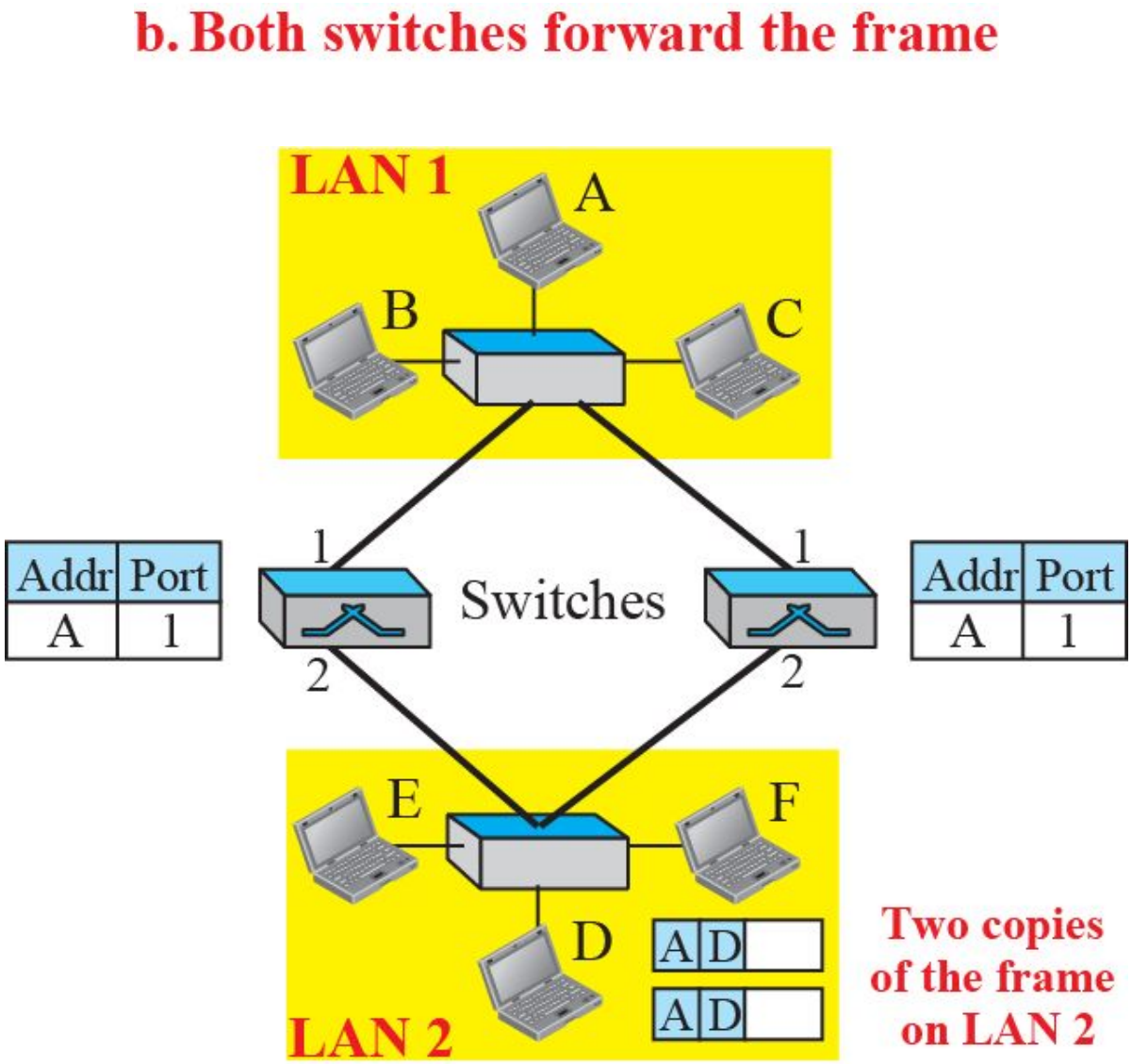


Figure 17.5: ***Loop problem in a learning switch (Part c)***

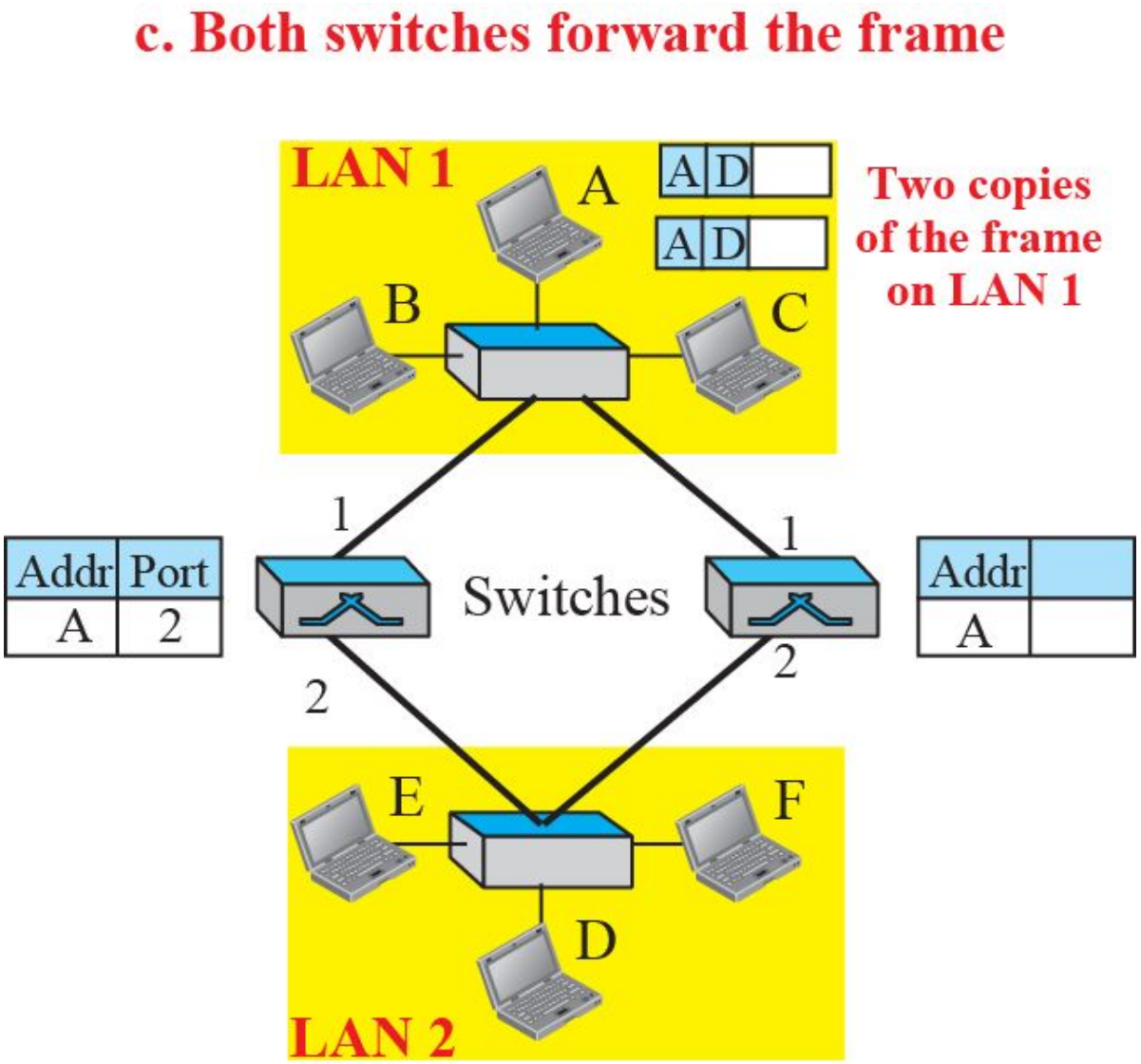


Figure 17.5: ***Loop problem in a learning switch (part d)***

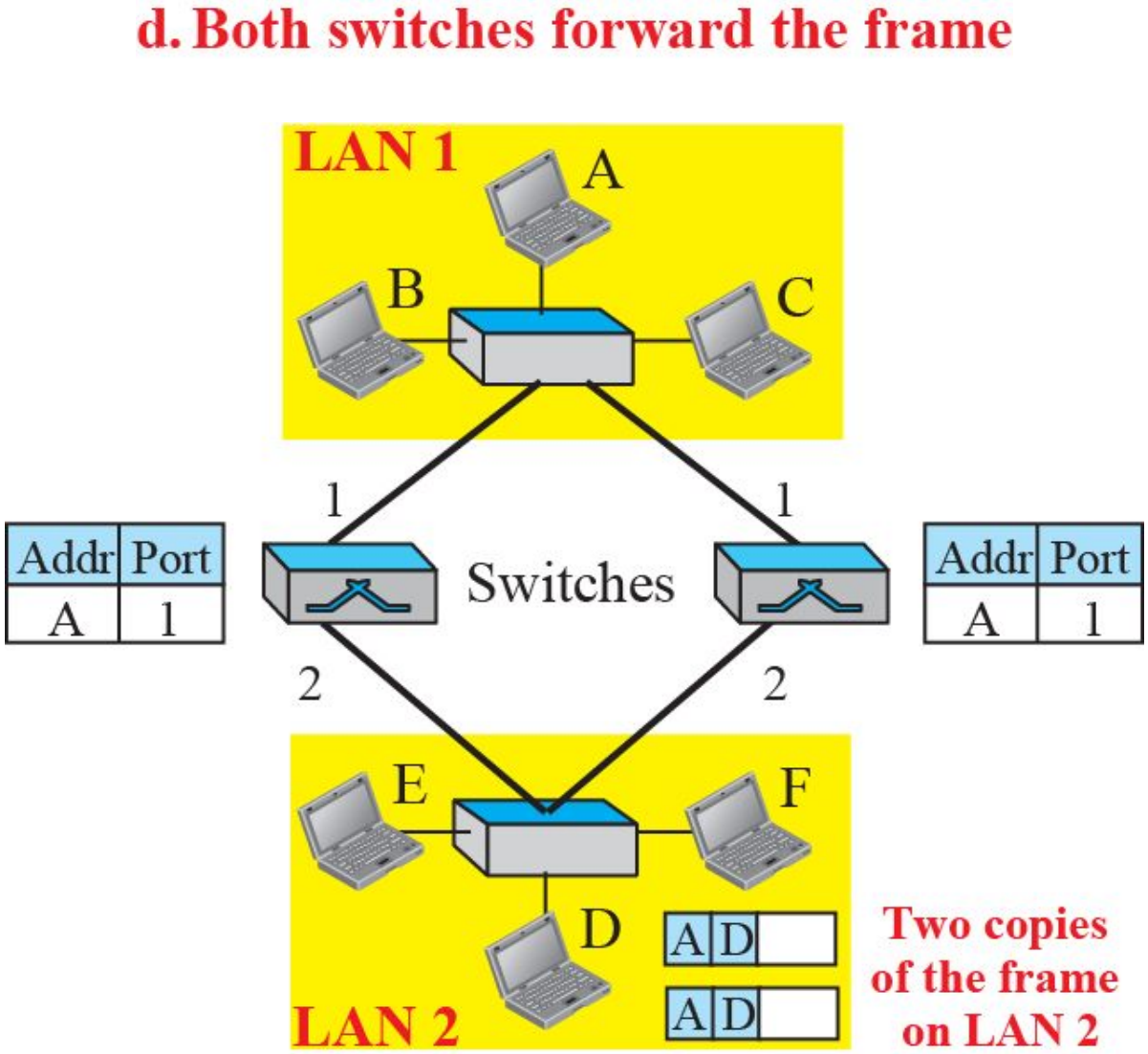
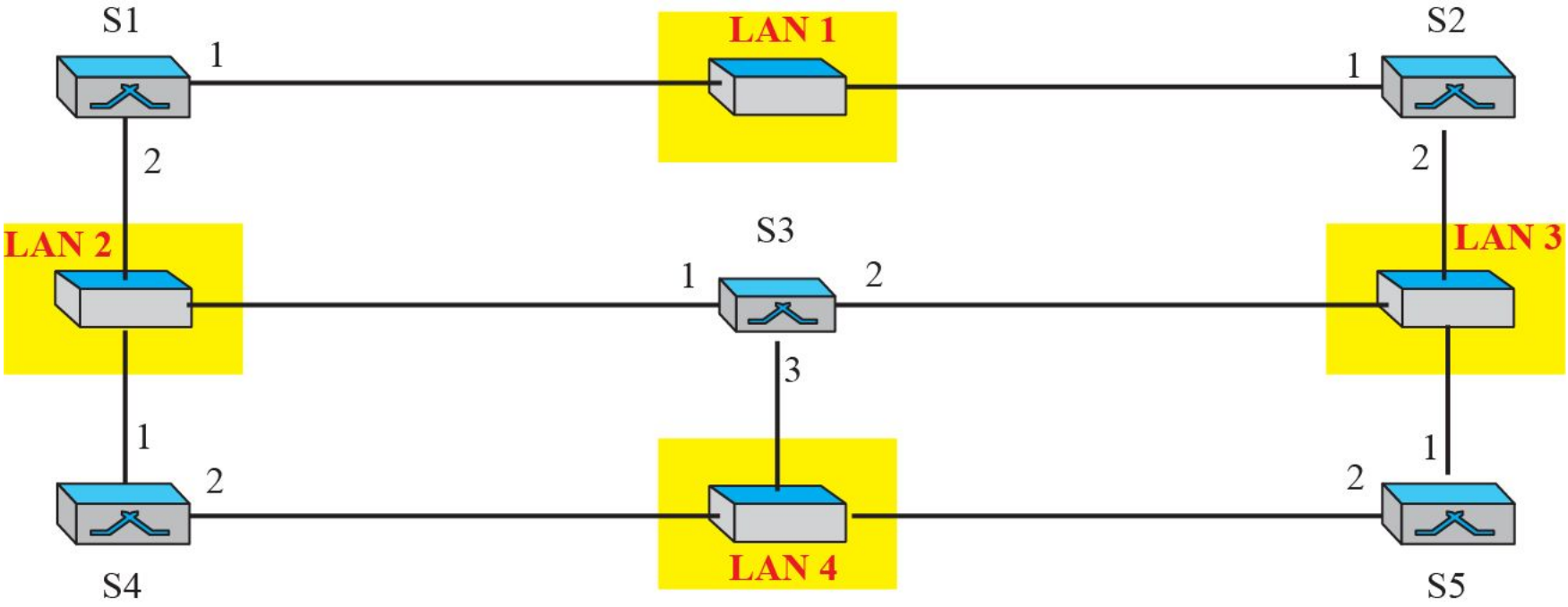
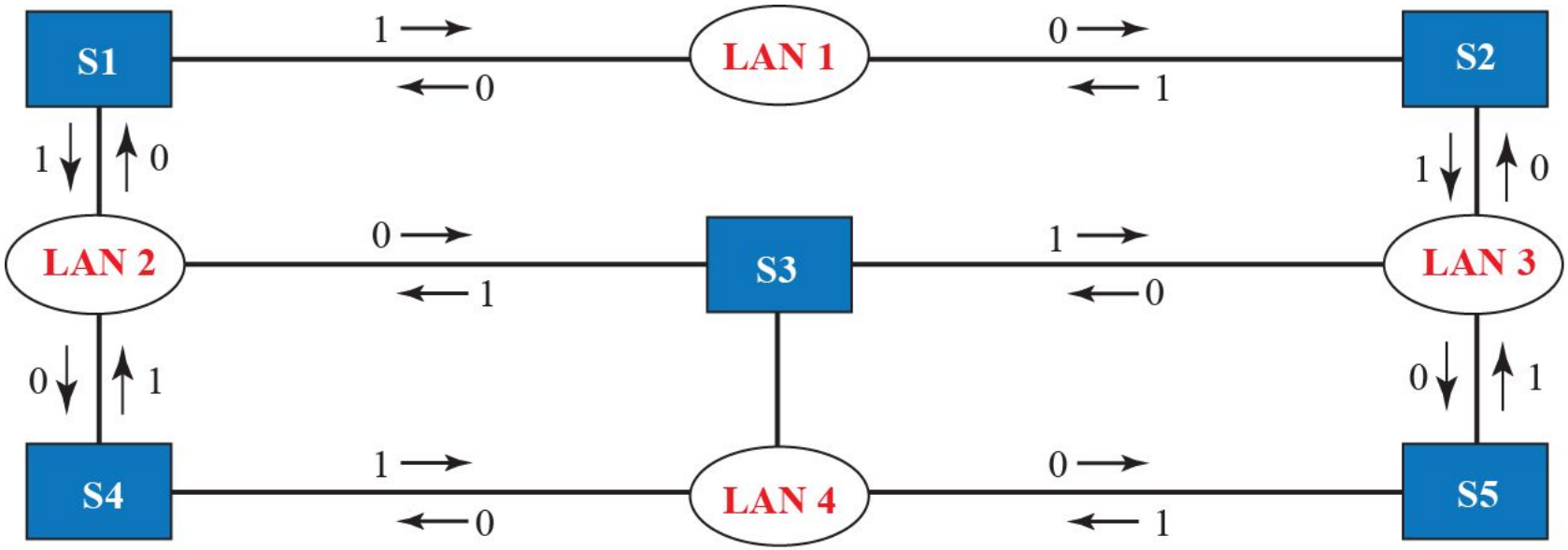


Figure 17.6: A system of connected LANs and its graph (Part a)



a. Actual system

Figure 17.6: A system of connected LANs and its graph (Part b)



b. Graph representation with cost assigned to each arc

Figure 17.7: ***Finding the shortest path and the spanning tree for a switch.***

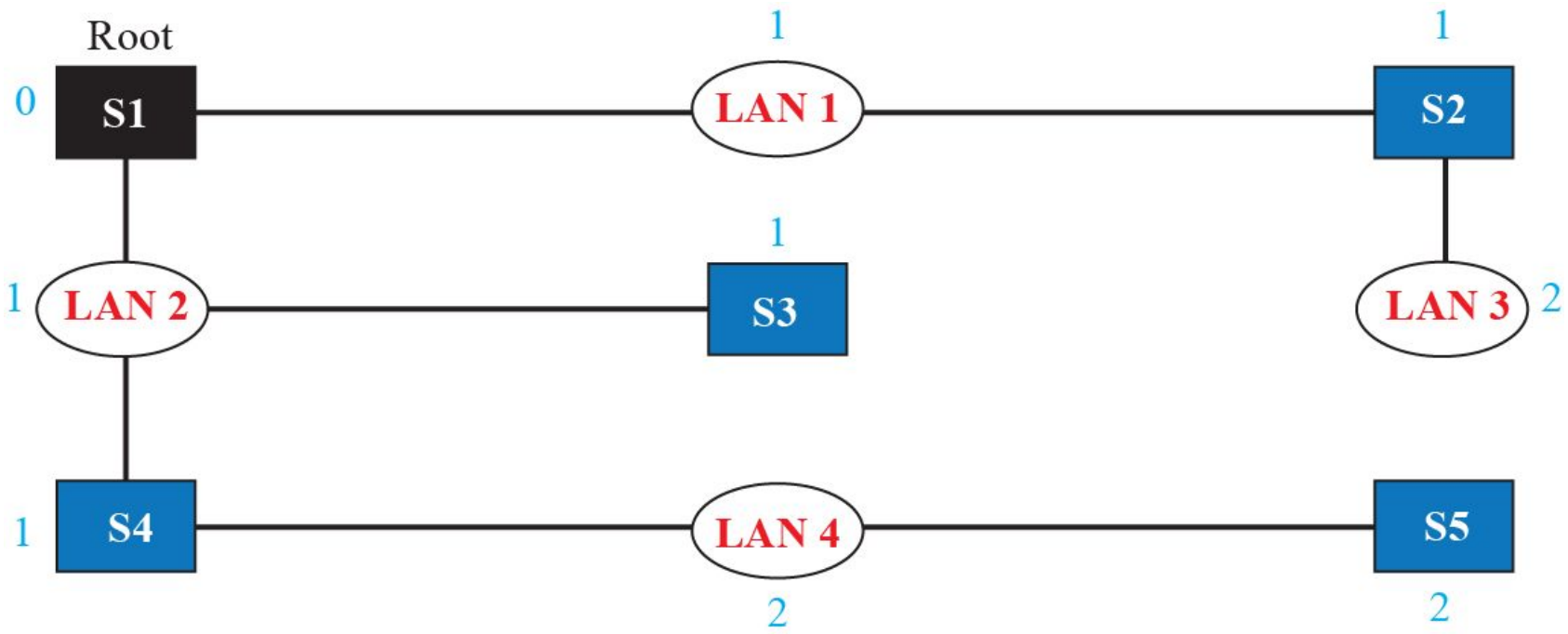
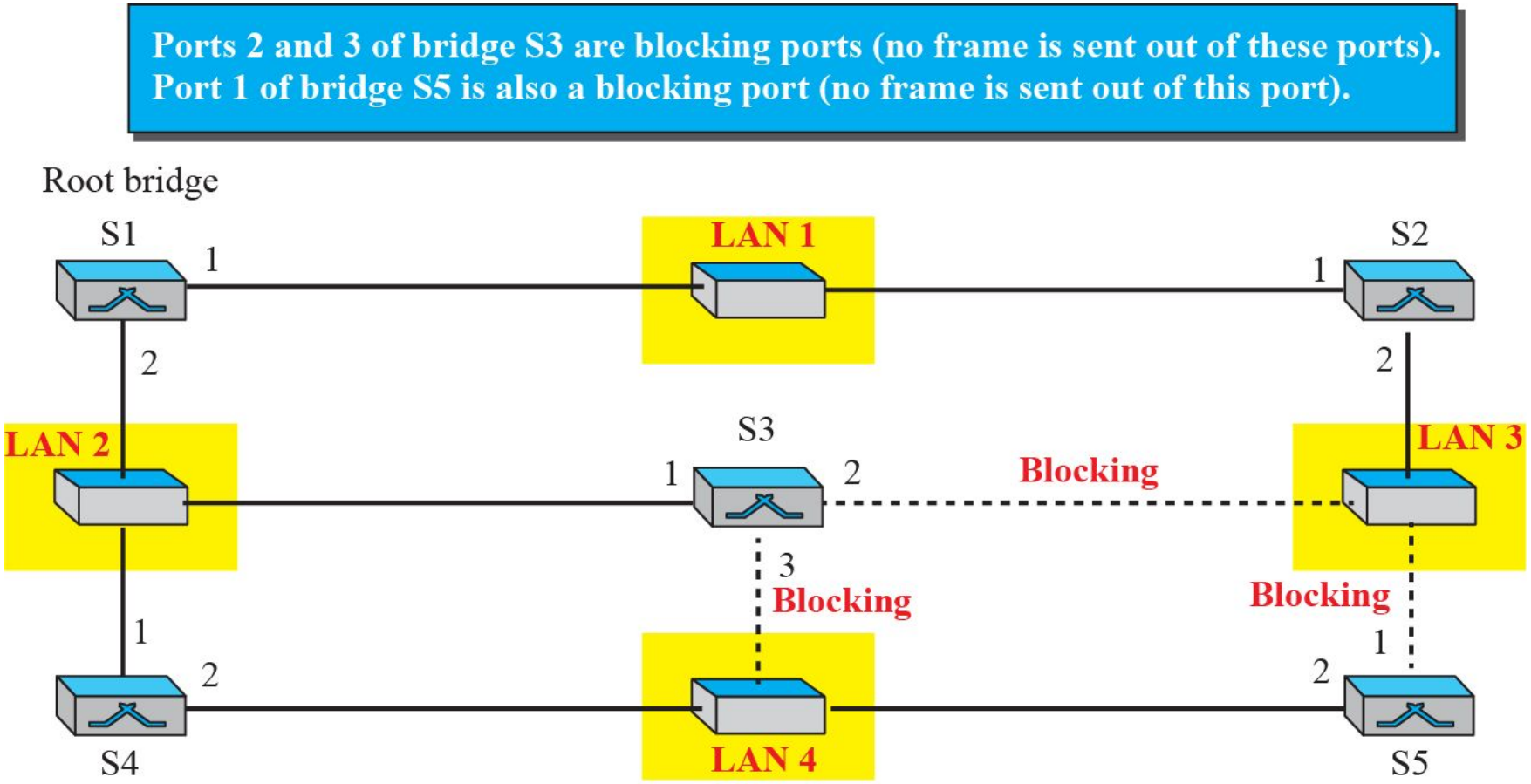


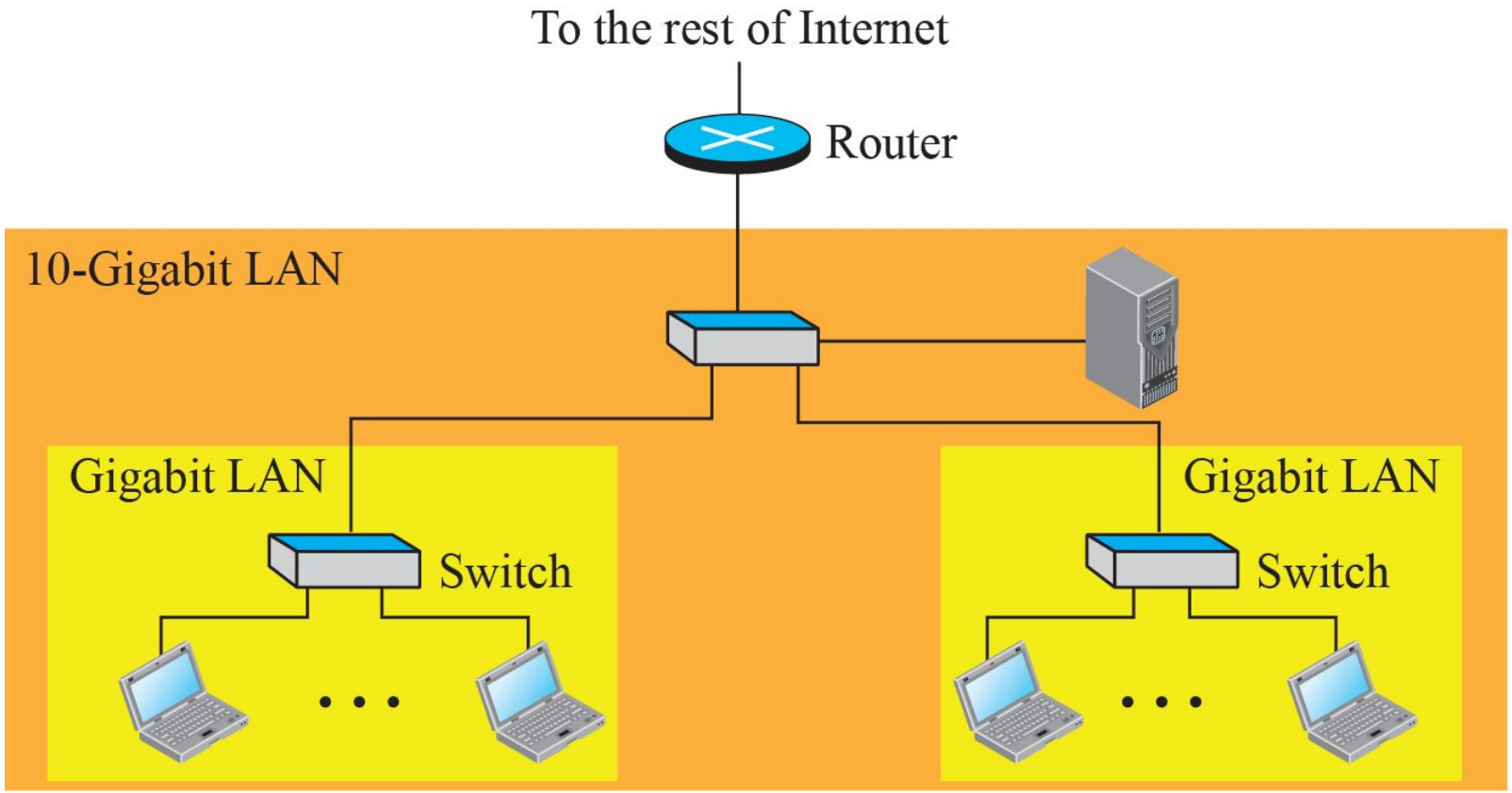
Figure 17.8: ***Forwarding and blocking ports after using spanning tree algorithm***



17.17.3 Routers

We will discuss routers in Part IV of the book when we discuss the network layer. In this section, we mention routers to compare them with a two-layer switch and a hub. A router is a three-layer device; it operates in the physical, data-link, and network layers.

Figure 17.9: ***Routing example***



17-2 VIRTUAL LANS

A station is considered part of a LAN if it physically belongs to that LAN. The criterion of membership is geographic. What happens if we need a virtual connection between two stations belonging to two different physical LANs? We can roughly define a virtual local area network (VLAN) as a local area network configured by software, not by physical wiring.

Figure 17.10: ***A switch connecting three LANs***

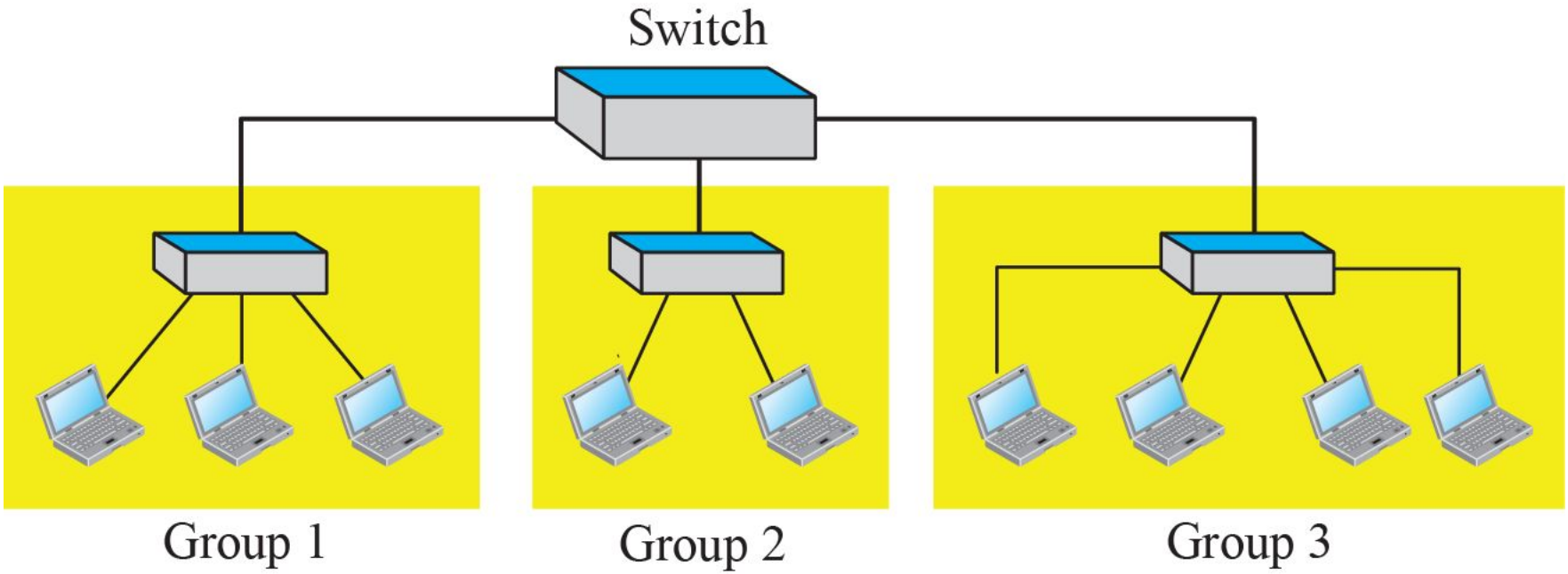


Figure 17.11: A switch using VLAN software

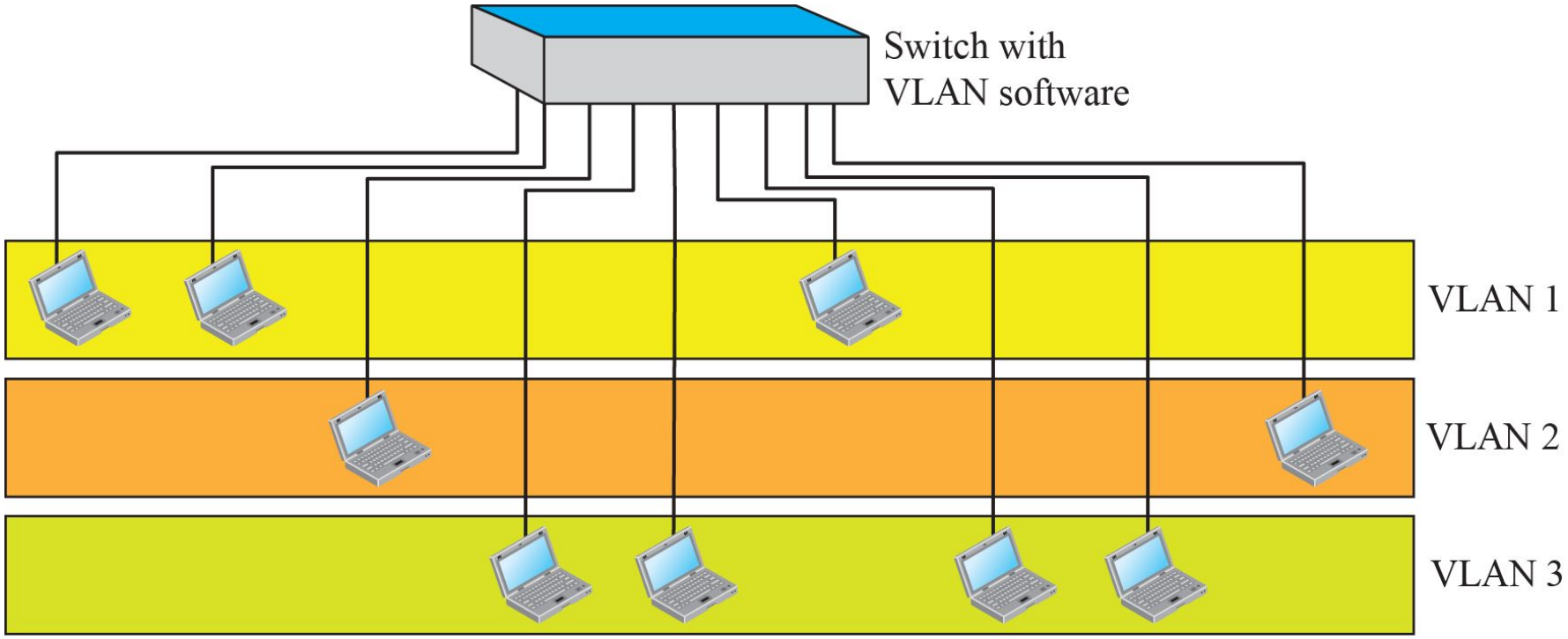
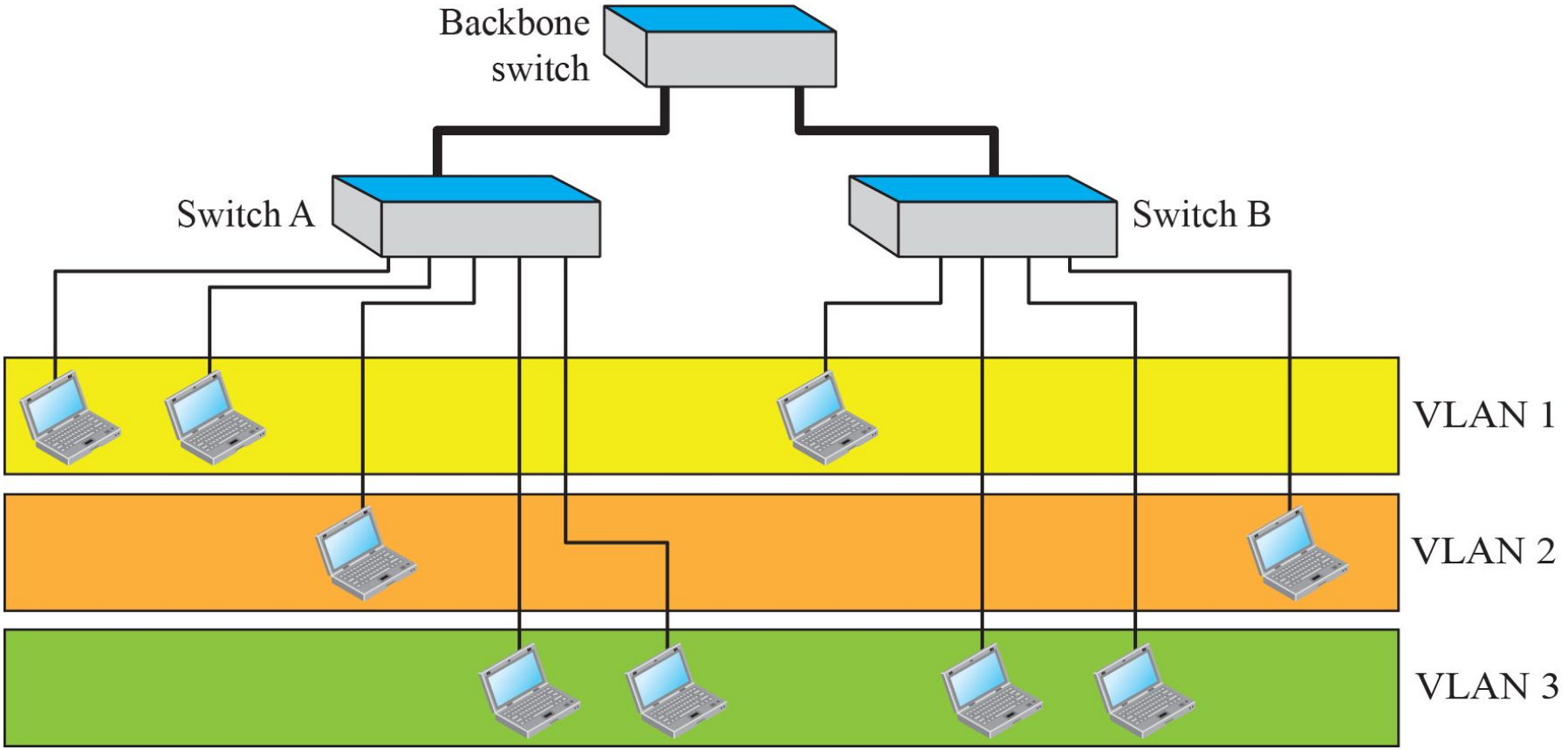


Figure 17.12: ***Two switches in a backbone using VLAN software***



17.2.1 Membership

What characteristic can be used to group stations in a VLAN? Vendors use different characteristics such as interface numbers, port numbers, MAC addresses, IP addresses, IP multicast addresses, or a combination of two or more of these.

17.2.2 Configuration

How are the stations grouped into different VLANs?

Stations are configured in one of three ways: manually, semi-automatically, and automatically.

17.2.3 Communication between Switches

In a multi-switched backbone, each switch must know not only which station belongs to which VLAN, but also the membership of stations connected to other switches. For example, in Figure 17.12, switch A must know the membership status of stations connected to switch B, and switch B must know the same about switch A. Three methods have been devised for this purpose: table maintenance, frame tagging, and time-division multiplexing.

17.2.4 Fourth Generation (4G)

The fourth generation of cellular telephony is expected to be a complete evolution in wireless communications. Some of the objectives defined by the 4G working group are discussed in this section.