Chapter 17

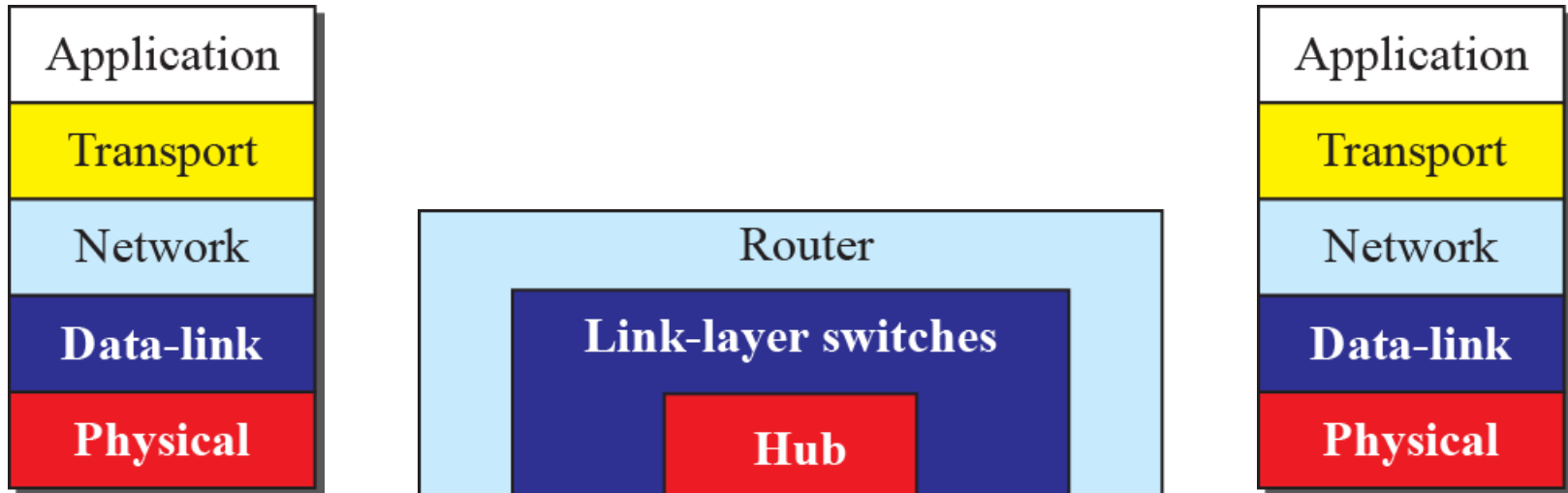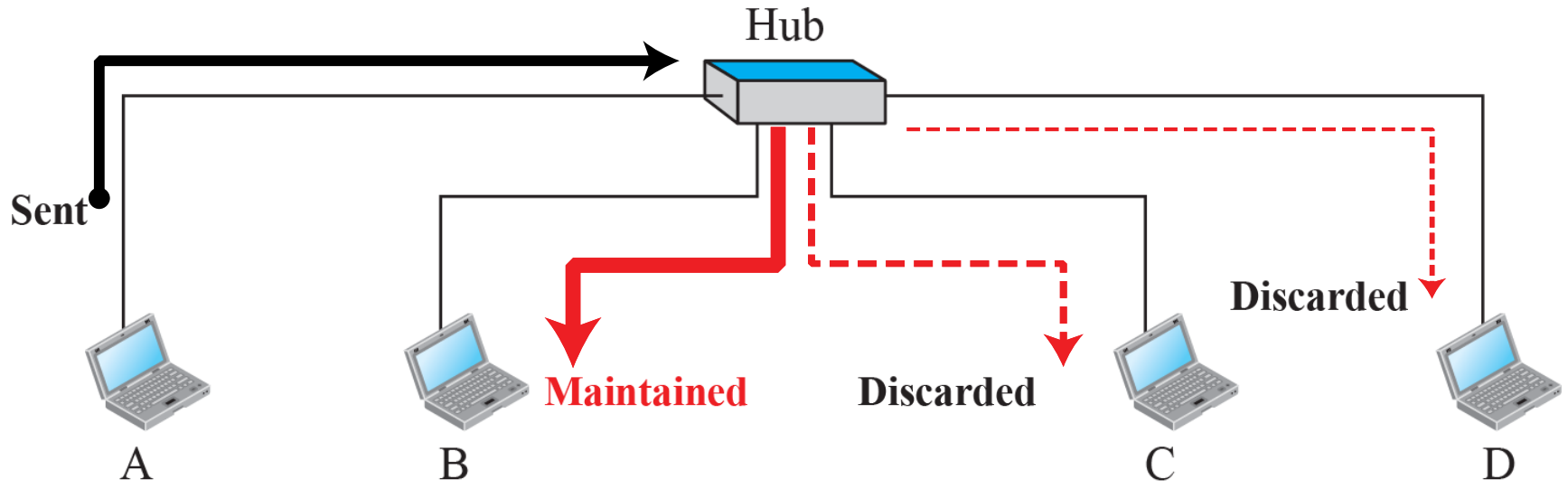## *Connecting Devices and Virtual LANs*

CONNECTING DEVICES

- *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, e.g., hubs, link-layer switches, and routers.*

Connecting devices

| Application |
| Transport |
| Network |
| **Data-link** |
| **Physical** |

Router
Link-layer switches
Hub

| Application |
| Transport |
| Network |
| **Data-link** |
| **Physical** |

Hub

Hub

Sent

Maintained

Discarded

Discarded

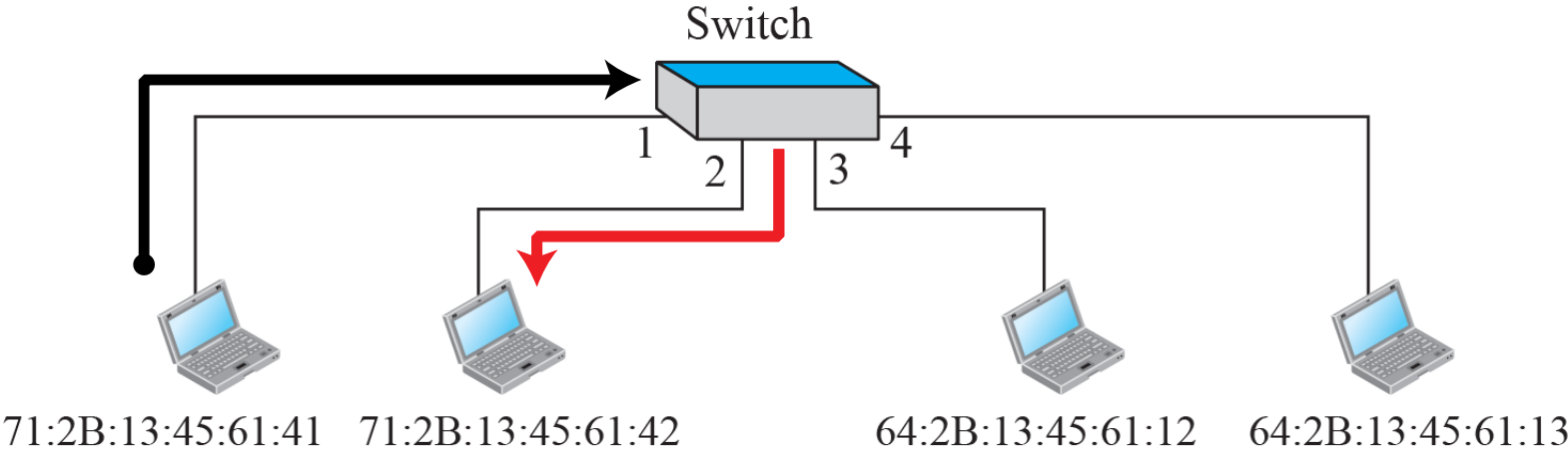A   B   C   D

17.4

Link-Layer Switches

the link-layer switch can check the MAC addresses (source and destination) contained in the frame.
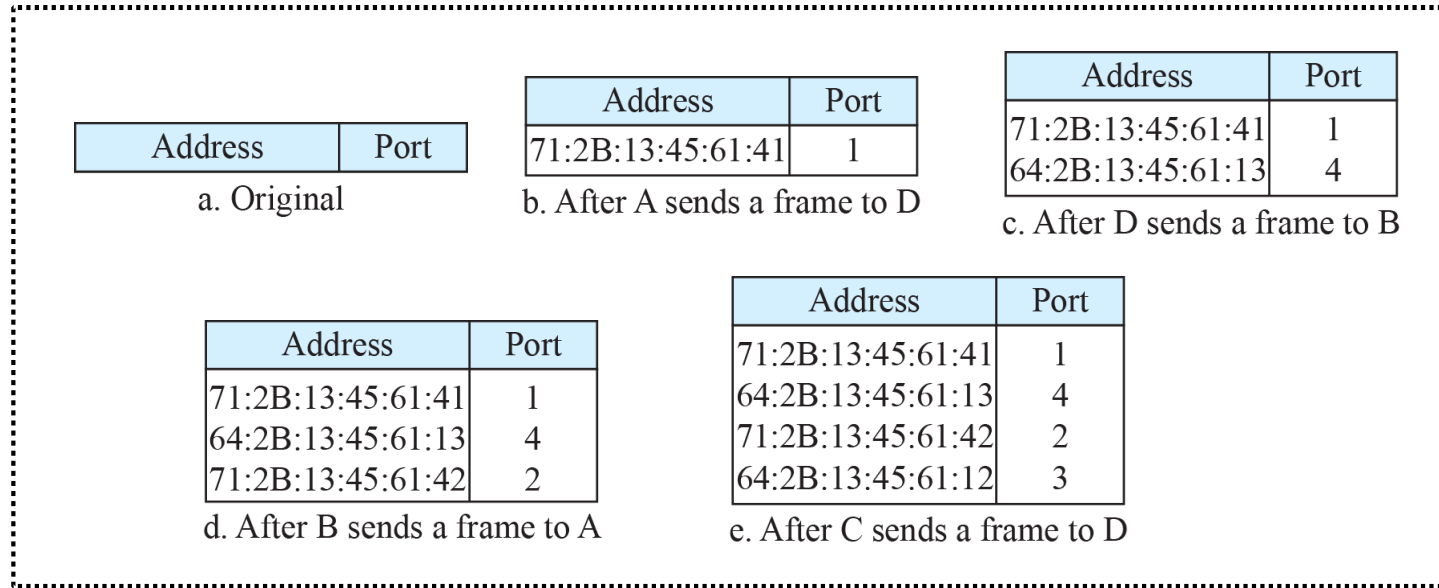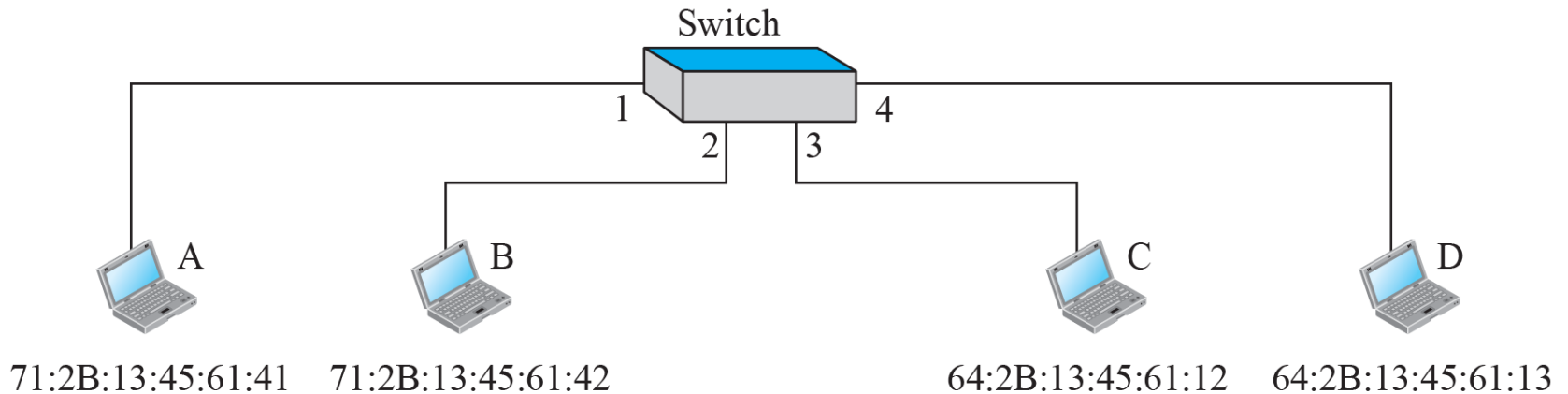
Link-Layer Switch

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

Switch

1   2   3   4

71:2B:13:45:61:41   71:2B:13:45:61:42   64:2B:13:45:61:12   64:2B:13:45:61:13

Learning switch

Address	Port

a. Original

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

b. After A sends a frame to D

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

c. After D sends a frame to B

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

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
64:2B:13:45:61:12	3

e. After C sends a frame to D

Gradual building of Table

Switch

1   2   3   4

A
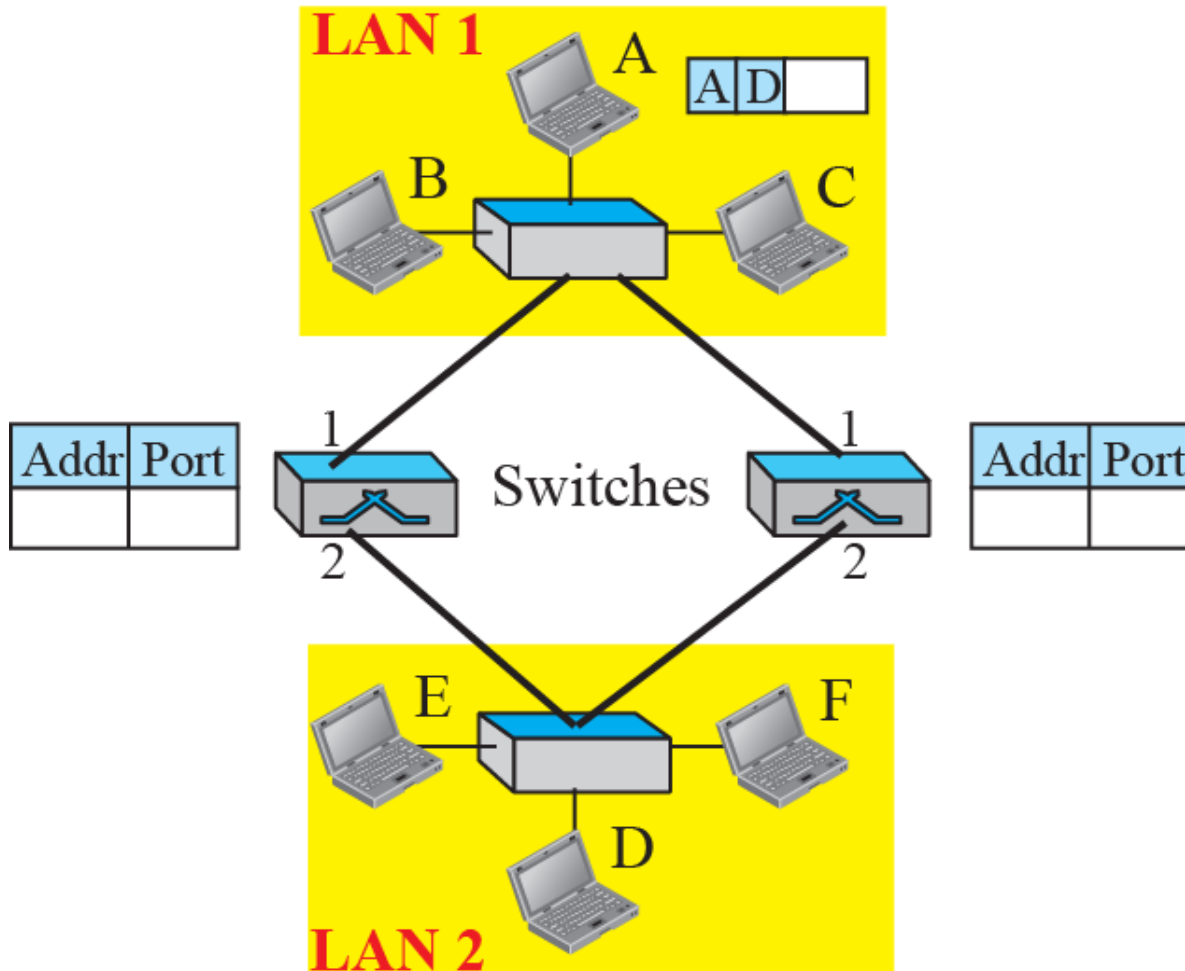71:2B:13:45:61:41

B
71:2B:13:45:61:42

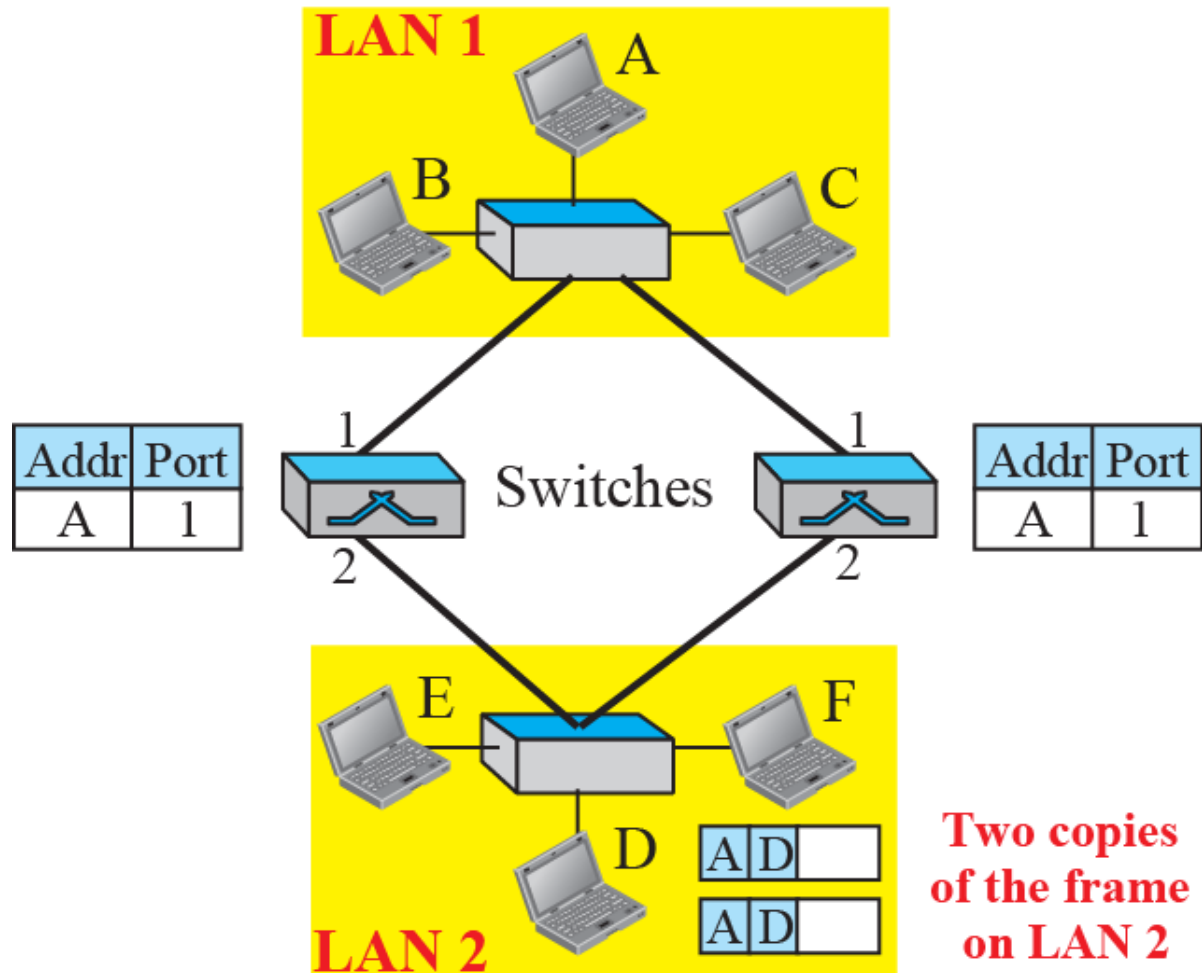C
64:2B:13:45:61:12

D
64:2B:13:45:61:13

Loop problem in a learning switch (Part a)

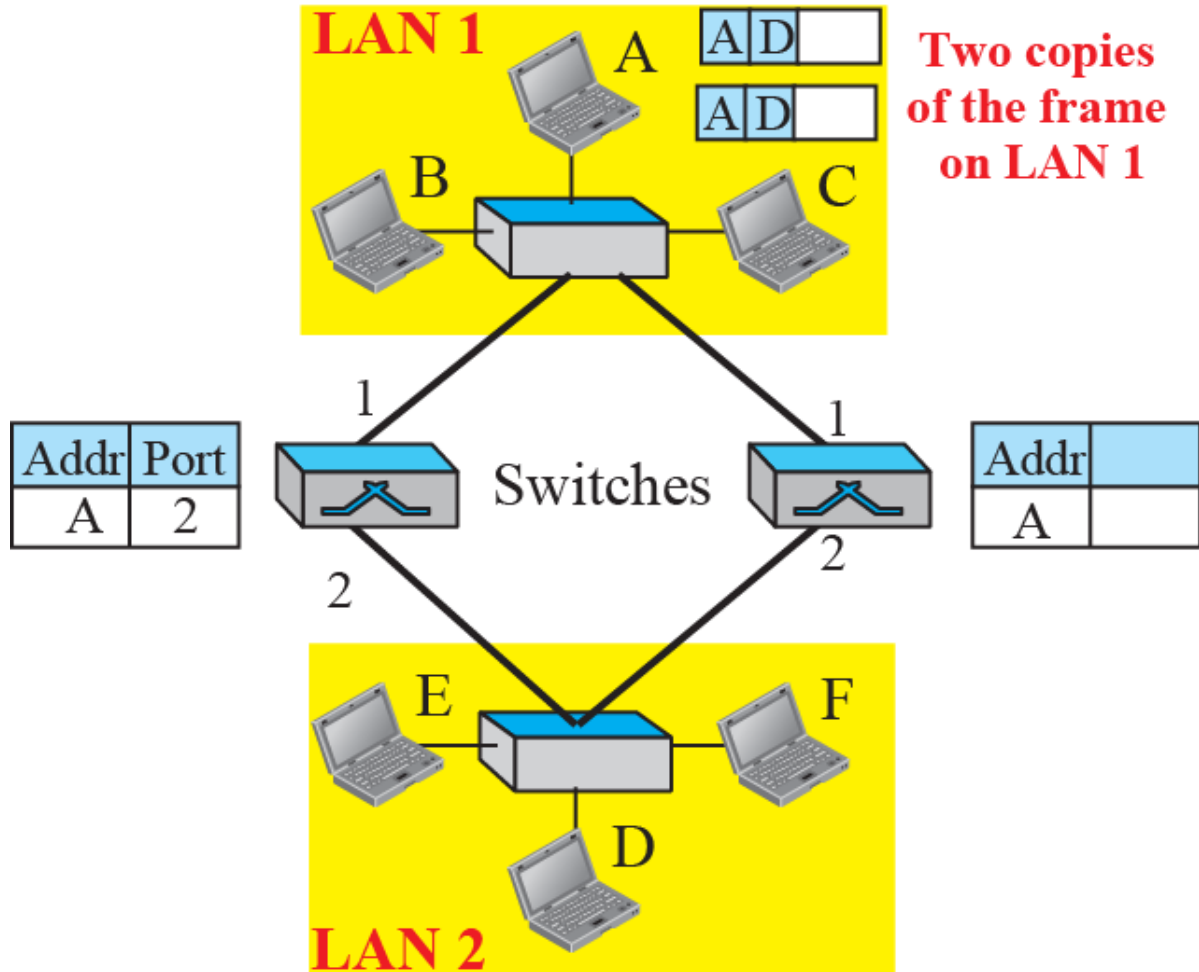## a. Station A sends a frame to station D

Loop problem in a learning switch (Part b)

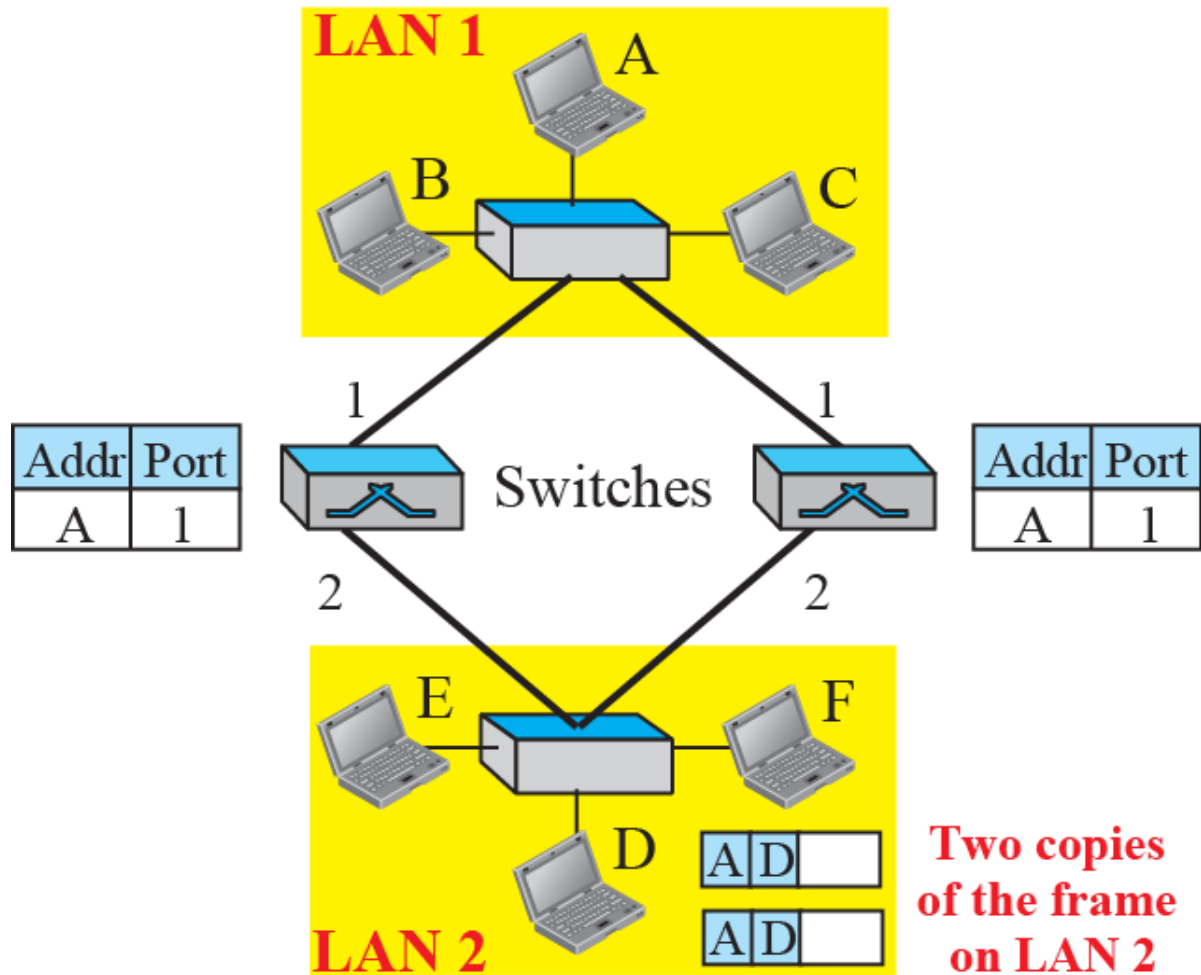b. Both switches forward the frame

Loop problem in a learning switch (Part c)

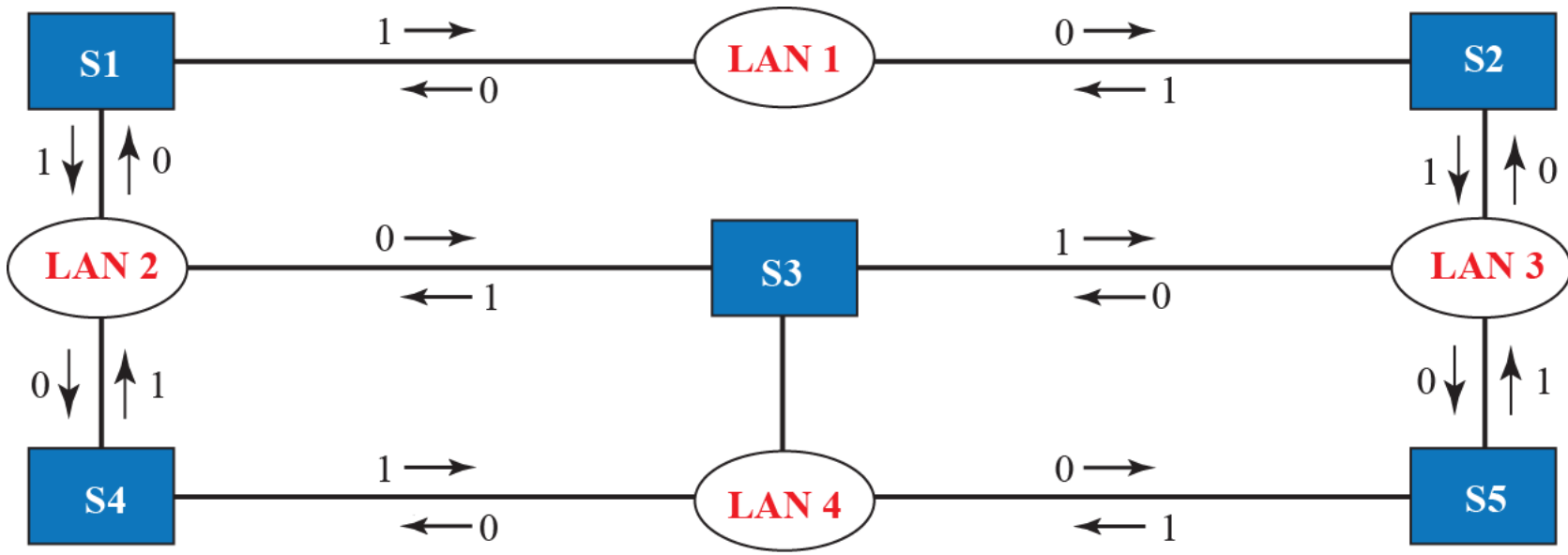c. Both switches forward the frame

Loop problem in a learning switch (part d)

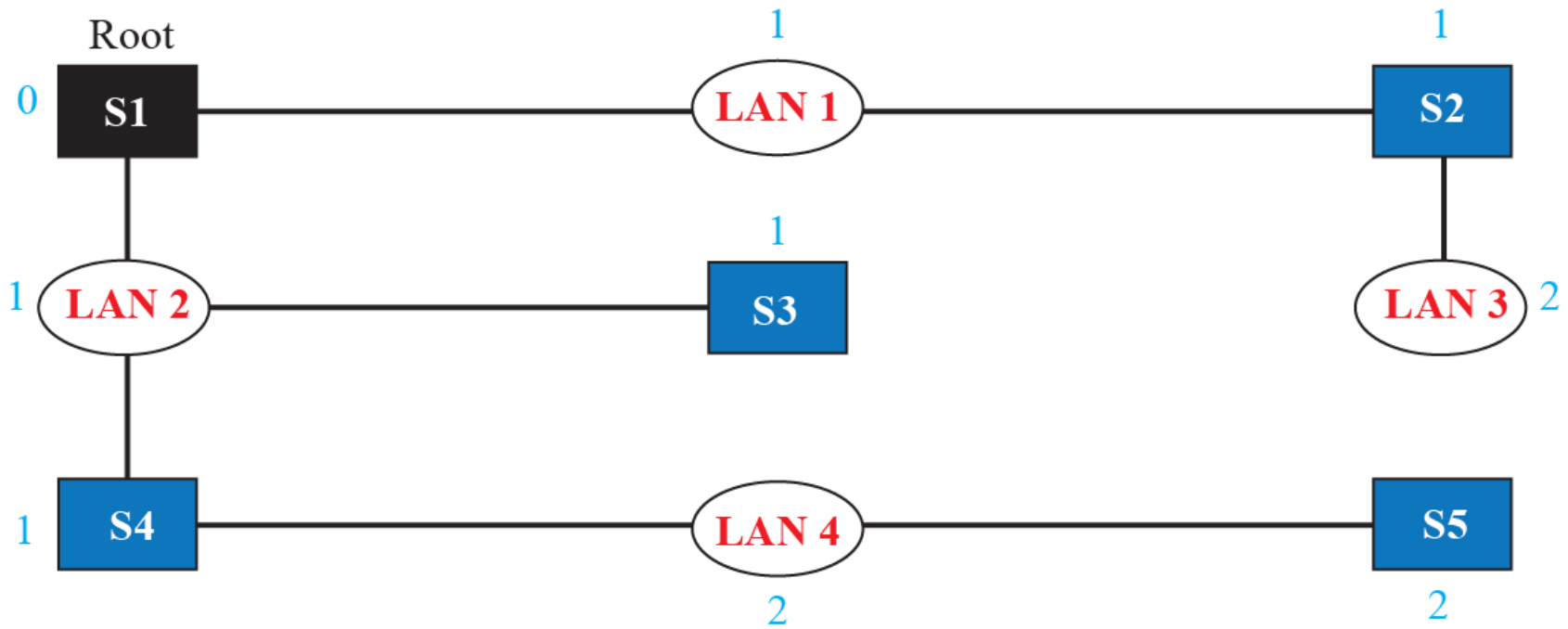d. Both switches forward the frame

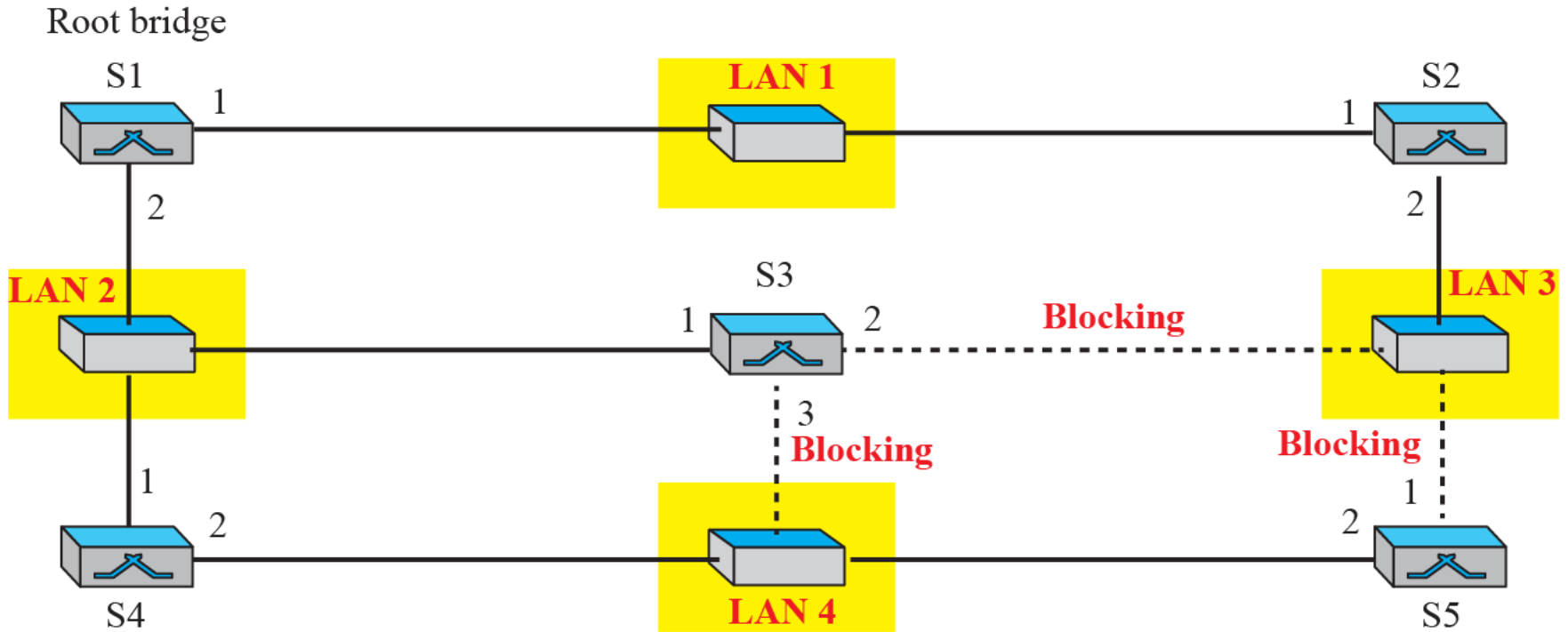# A system of connected LANs and its graph (Part b)

b. Graph representation with cost assigned to each arc

Finding the shortest path and the spanning tree for a switch.

# Forwarding and blocking ports after using spanning tree algorithm

Ports 2 and 3 of bridge S3 are blocking ports (no frame is sent out of these ports). Port 1 of bridge S5 is also a blocking port (no frame is sent out of this port).

Root bridge

S1
1
LAN 1
S2
1

2
2

LAN 2
S3
1   2   **Blocking**   LAN 3

3
**Blocking**   **Blocking**

1
1
2
2

S4
LAN 4
S5

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.*
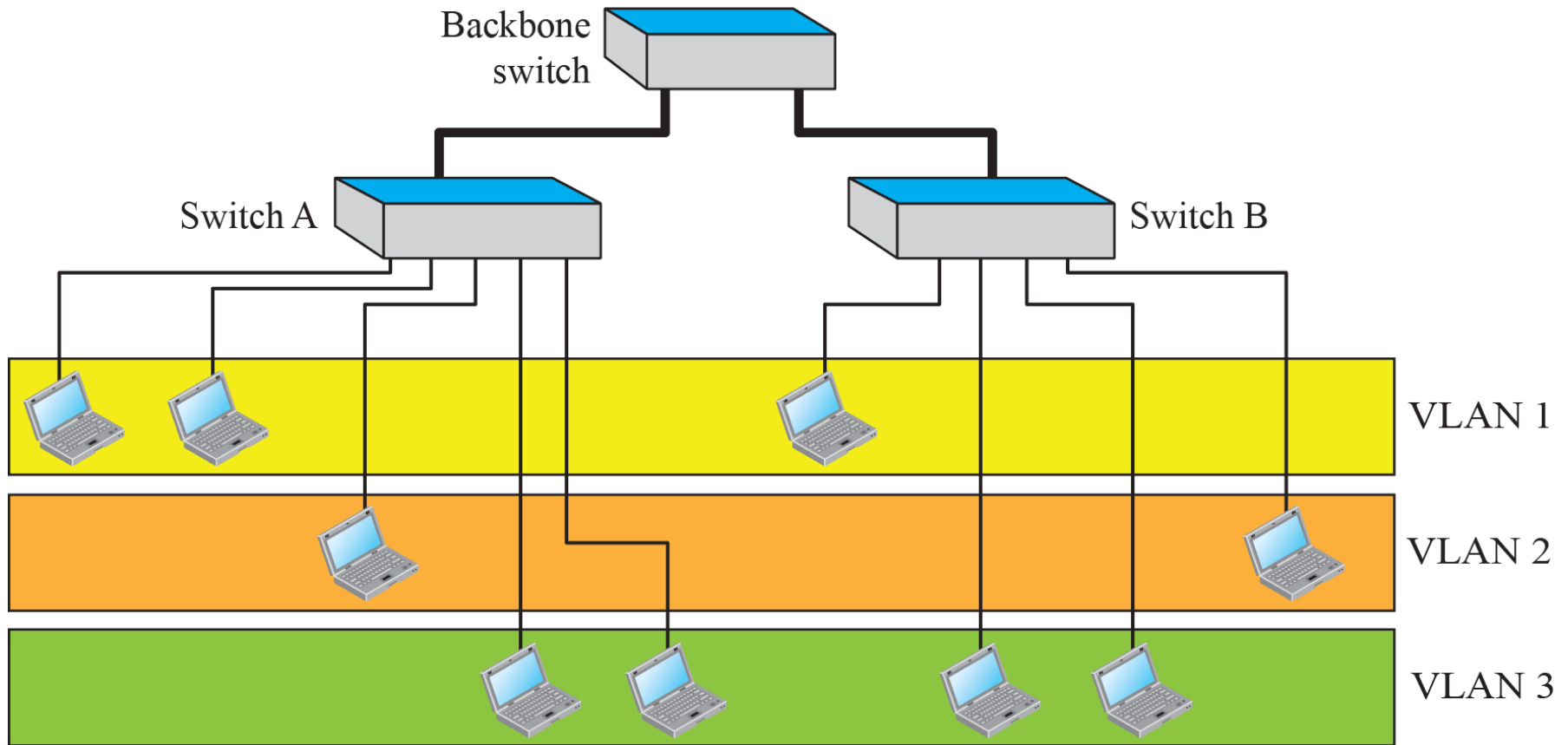
A switch connecting three LANs
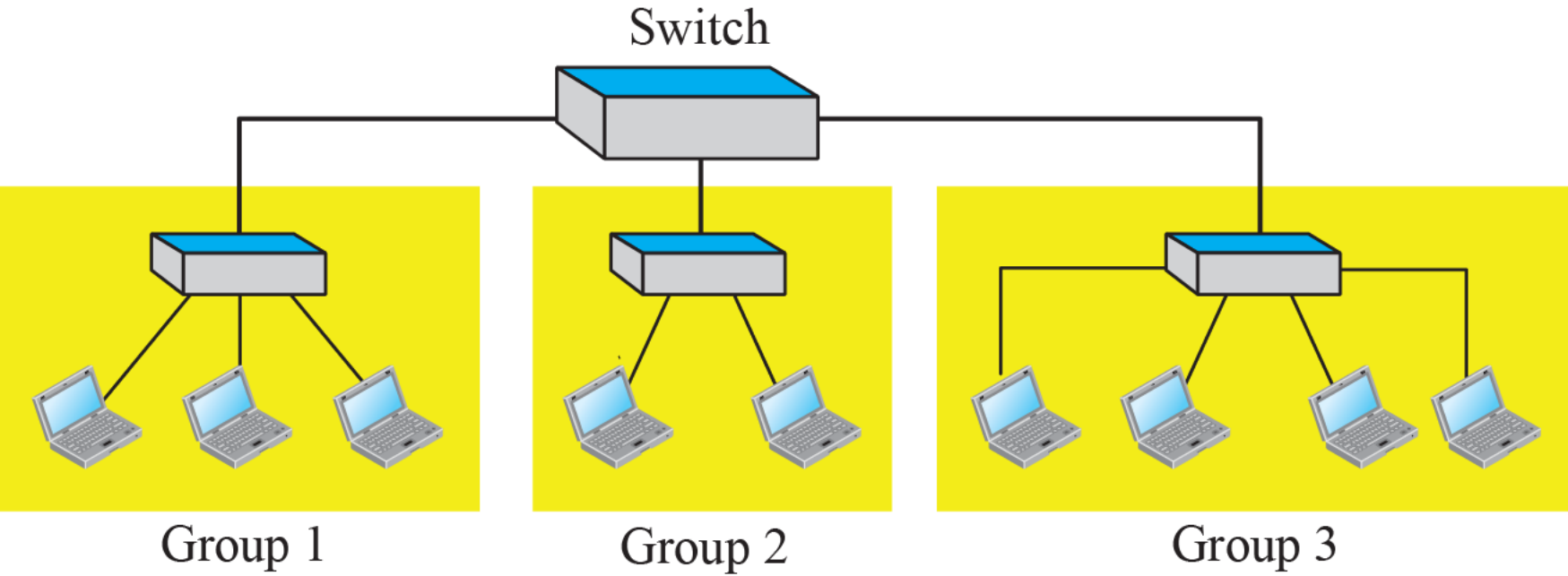
A switch using VLAN software

Switch with
VLAN software

VLAN 1

VLAN 2

VLAN 3
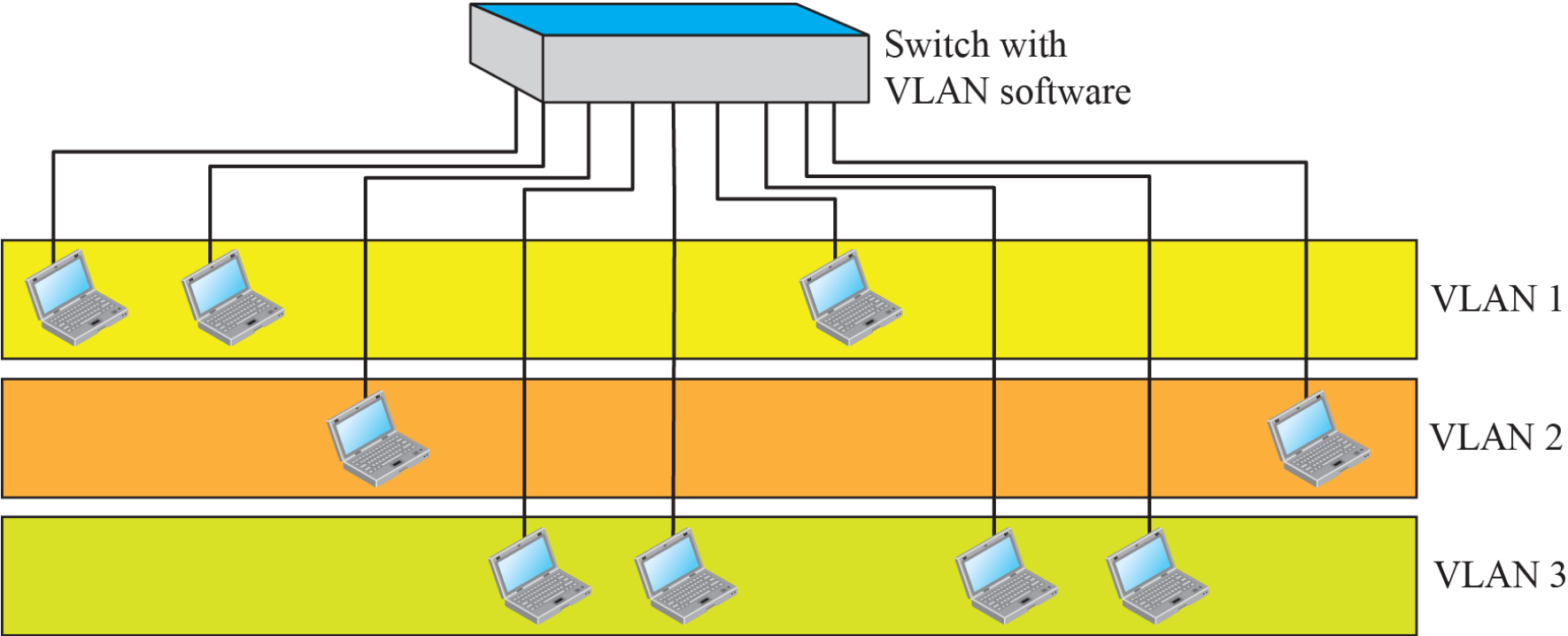
Two switches in a backbone using VLAN software

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.*