SNS COLLEGE OF ENGINEERING

Department of Information Technology

Course Name – 110IT401 Computer Networks

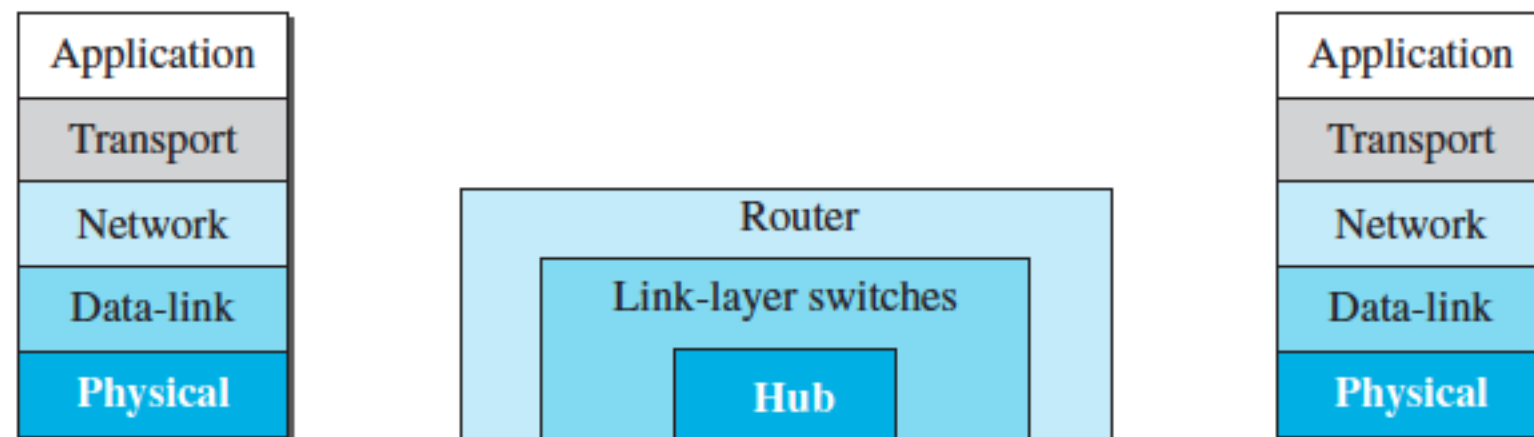## II Year / IV Semester

Unit 2 – Link Layer

## Topic 10- Routers, Hubs, Switches

Connecting Devices

- There are three kinds of connecting devices:
  - Hubs,
  - Link-layer switches, and
  - Routers.

Hubs today operate in the first layer of the Internet model.
Link-layer switches operate in the first two layers.
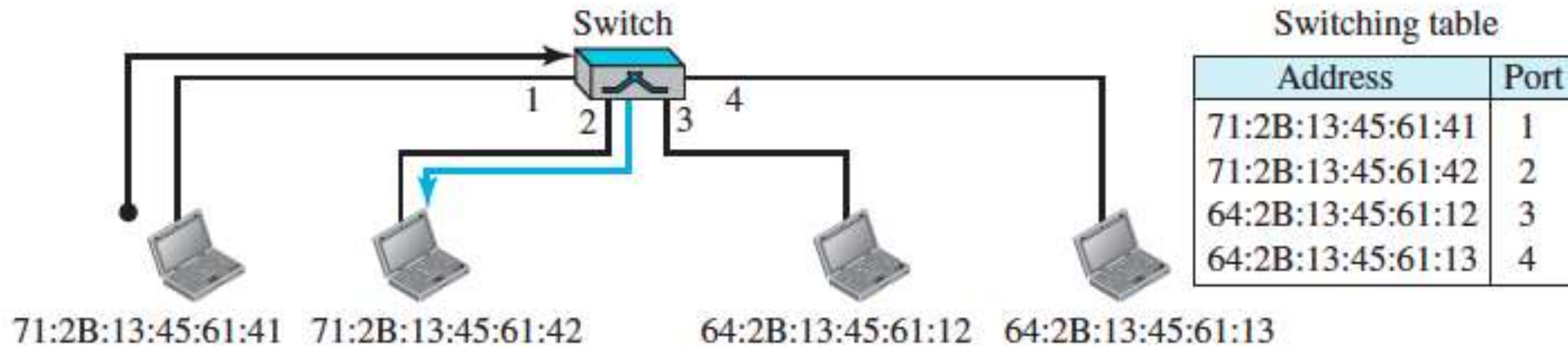Routers operate in the first three layers
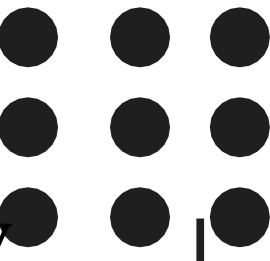
Connecting Devices - Hubs

- 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.
- The repeater then sends the refreshed signal.
- Ethernet LANs use star topology. In a star topology, a repeater is a multiport device, often called a hub, that can be used to serve as the connecting point and at the same time function as a repeater.
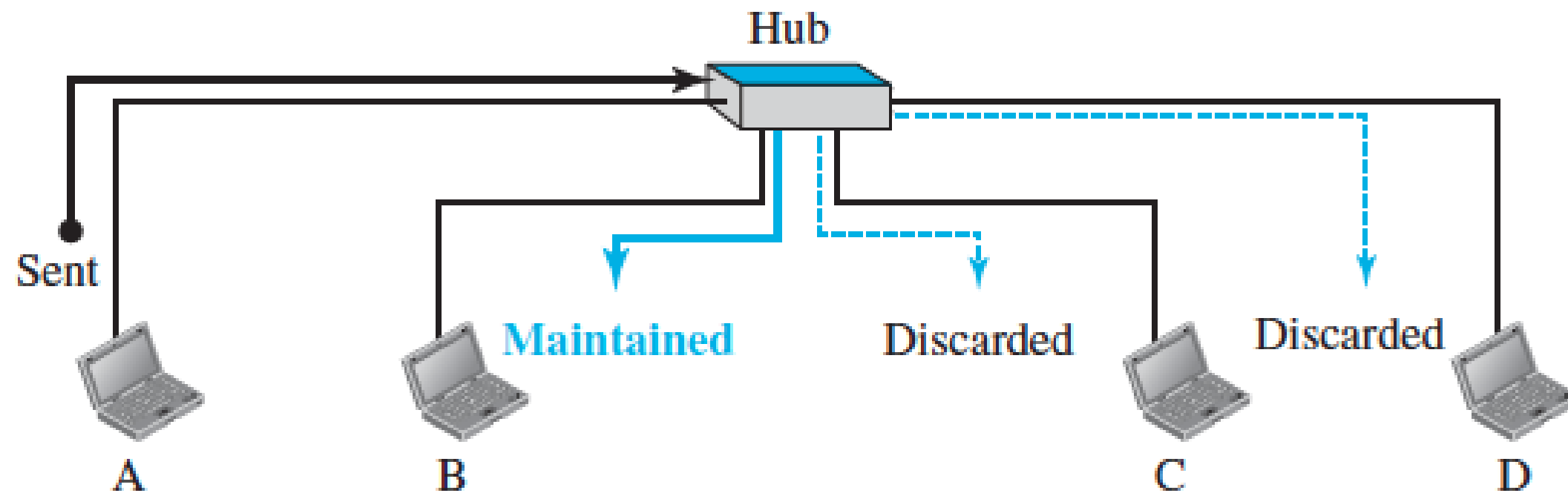
Connecting Devices - Switch

- 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.
- A link-layer switch has filtering capability. It can check the destination address of a frame and can decide from which outgoing port the frame should be sent.

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

Connecting Devices - Switch

Static Switches

The earliest switches had switching tables that were static. The system administrator would manually enter each table entry during switch setup.

Transparent Switches

- A transparent switch is a switch in which the stations are completely unaware of the switch's existence. Transparent switches uses dynamic tables.
- To make a table dynamic, we need a switch that gradually learns from the frames' movements. To do this, the switch inspects both the destination and the source addresses in each frame that passes through the switch.

Learning

- When station A sends a frame to station D, the switch does not have an entry for either D or A. The frame goes out from all three ports; the frame floods the network.
- However, by looking at the source address, the switch learns that station A must be connected to port 1. This means that frames destined for A, in the future, must be sent out through port 1. The switch adds this entry to its table. The table has its first entry now.

Connecting Devices - Switch

Gradual building of table

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

Switch

1   2   3   4

A   B   C   D

71:2B:13:45:61:41   71:2B:13:45:61:42   64:2B:13:45:61:12   64:2B:13:45:61:13
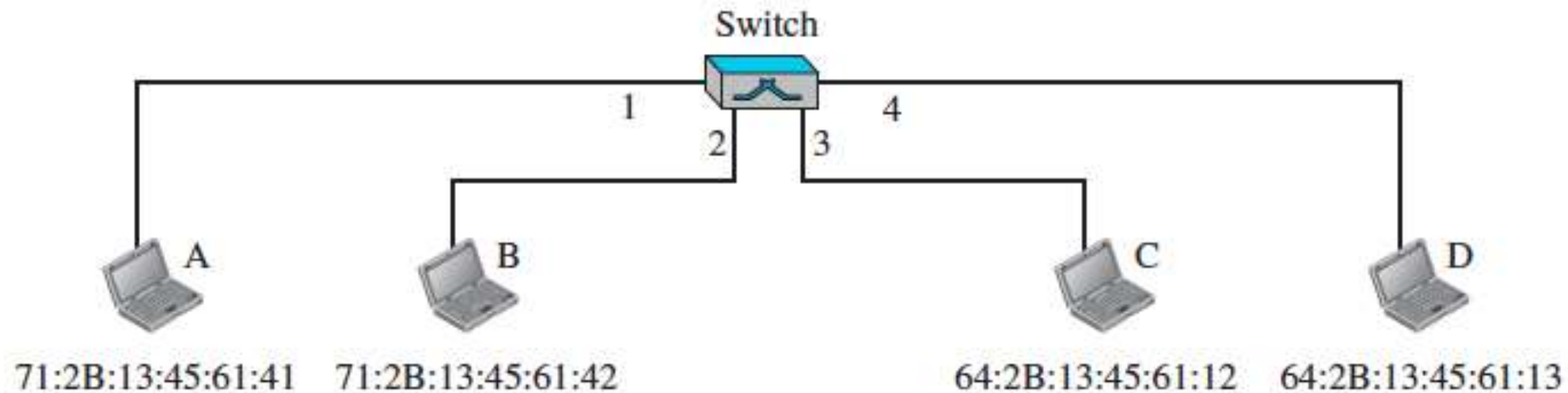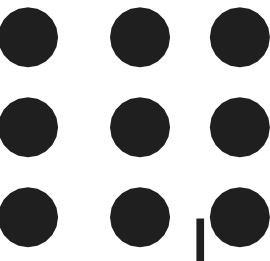
Connecting Devices - Switch

- When station D sends a frame to station B, the switch has no entry for B, so it floods the network again. However, it adds one more entry to the table related to station D.

- The learning process continues until the table has information about every port.

Disadvantage of Switches

Looping Problem

Transparent switches work fine as long as there are no redundant switches in the system. Systems administrators, however, like to have redundant switches (more than one switch between a pair of LANs) to make the system more reliable. If a switch fails, another switch takes over until the failed one is repaired or replaced. Redundancy can create loops in the system, which is very undesirable.
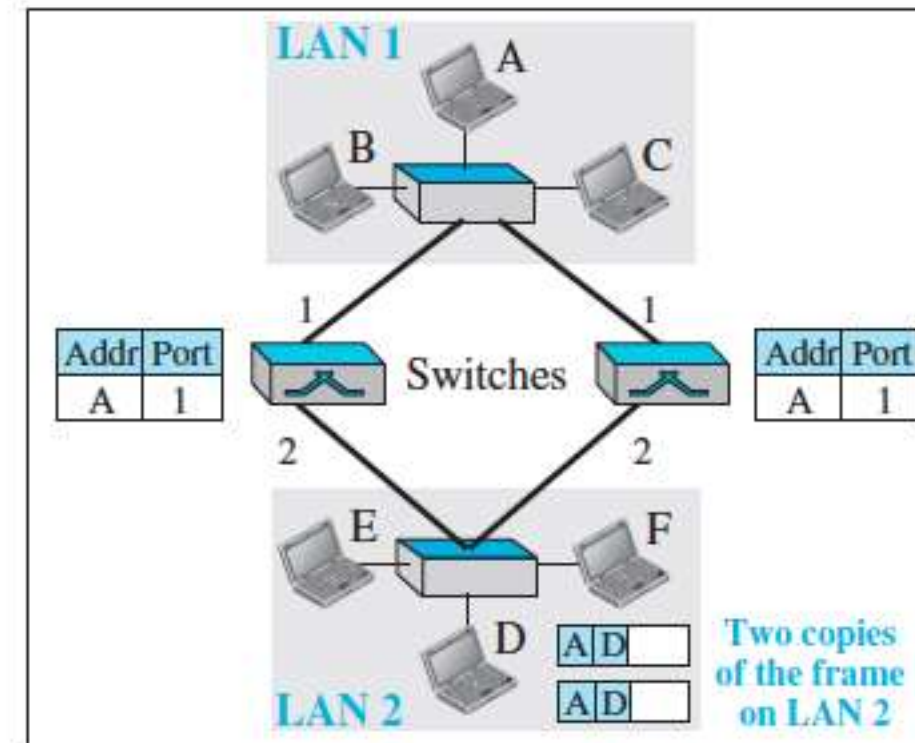
a. Station A sends a frame to station D
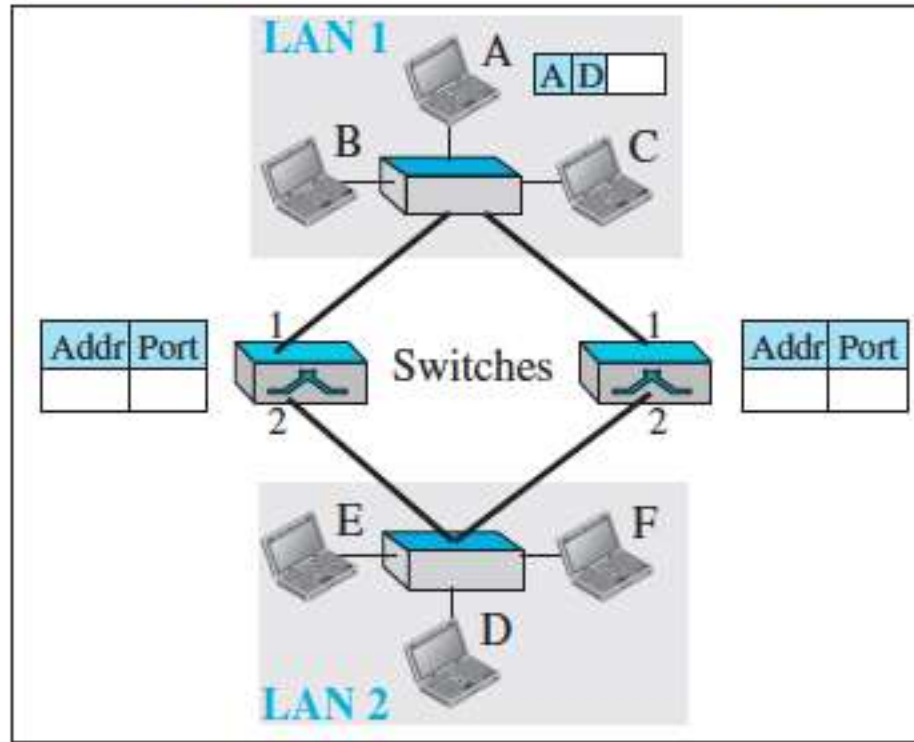
b. Both switches forward the frame
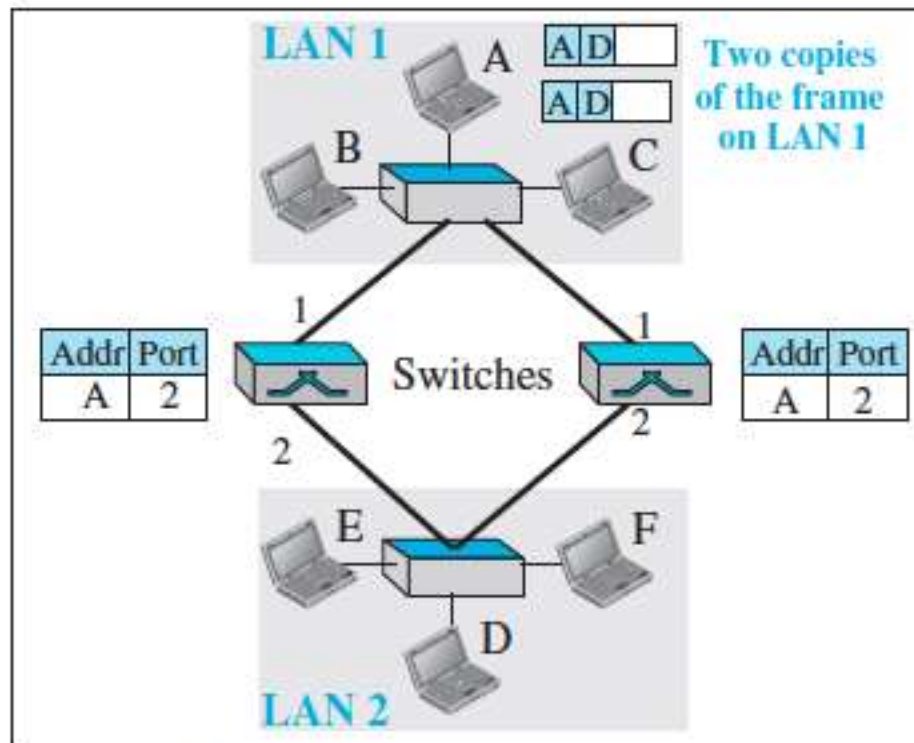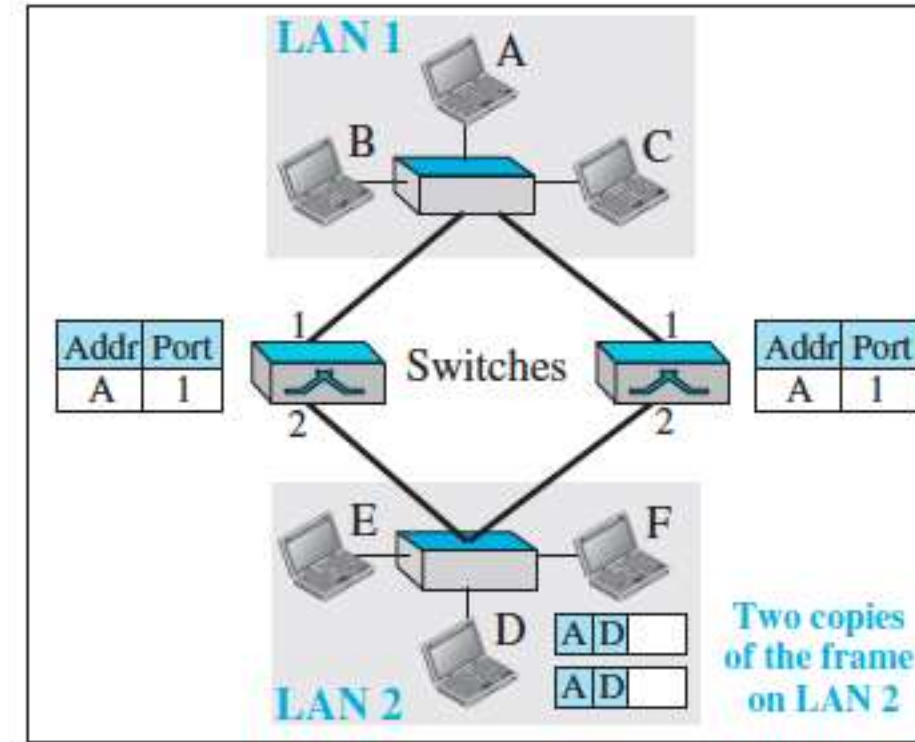
c. Both switches forward the frame

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Connecting Devices - Router

A router is a three-layer device; it operates in the physical, data-link, and network layers.

As a physical-layer device, it regenerates the signal it receives.

As a link-layer device, the router checks the physical addresses (source and destination) contained in the packet.

As a network-layer device, a router checks the network-layer addresses.

A router can connect networks. In other words, a router is an internetworking device; it connects independent networks to form an internetwork.

According to this definition, two networks connected by a router become an internetwork or an internet.

Connecting Devices - Router

There are three major differences between a router and a repeater or a switch.
1. A router has a physical and logical (IP) address for each of its interfaces.
2. A router acts only on those packets in which the link-layer destination address matches the address of the interface at which the packet arrives.
3. A router changes the link-layer address of the packet (both source and destination) when it forwards the packet.