



## Unit 1- Part 3

# Introduction to Data communications and Networking

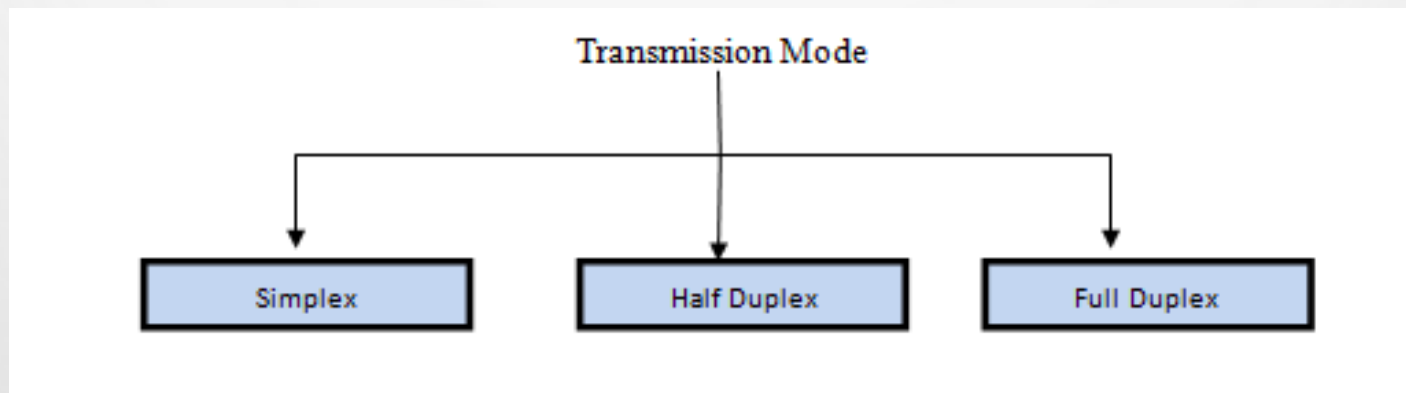
**Note:** This notes are for reference only. This is **not the only material** you need to refer for exam.

Prof. Rinkal shah

# Modes of Data Transmission

## Simplex, Half Duplex, Full Duplex

- Transmission mode refers to the mechanism of transferring of data between two devices connected over a network. It is also called Communication Mode. These modes direct the direction of flow of information. There are three types of transmission modes. They are:
  - **Simplex Mode**
  - **Half duplex Mode**
  - **Full duplex Mode**



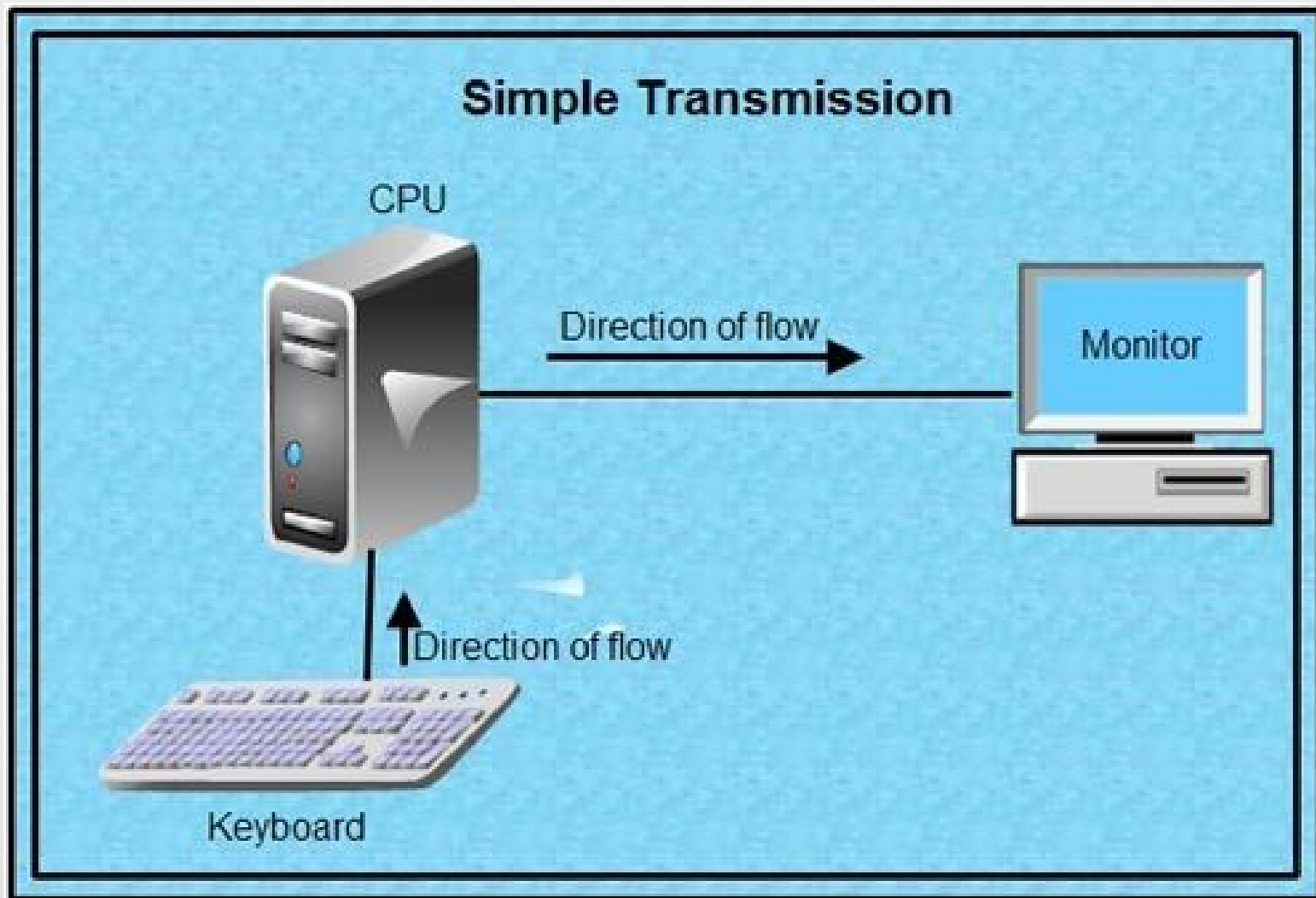
# Modes of Data Transmission

- **Simplex Mode:**

- The communication is unidirectional only.
- A simplex communication channel only sends information in one direction.
- We cannot send a message back to the sender. Unidirectional communication is done in Simplex Systems where we just need to send a command/signal, and do not expect any response back.
- Examples of simplex Mode are loudspeakers, television broadcasting, television and remote, keyboard and monitor etc.
- For example, a radio station usually sends signals to the audience but never receives signals from them.
- E.g. Keyboard to computer monitor data transmission.
- In Simplex, entire bandwidth can be used during the transmission.



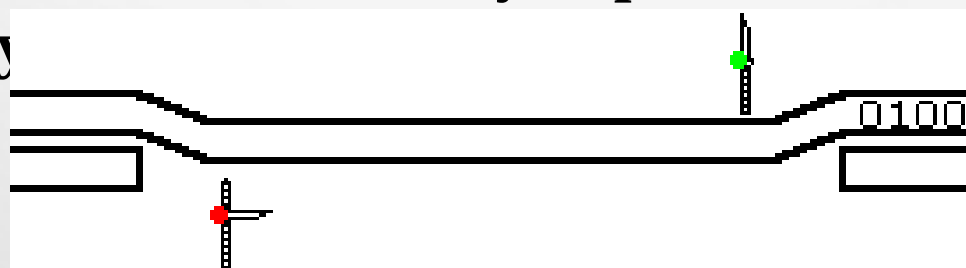
# Modes of Data Transmission



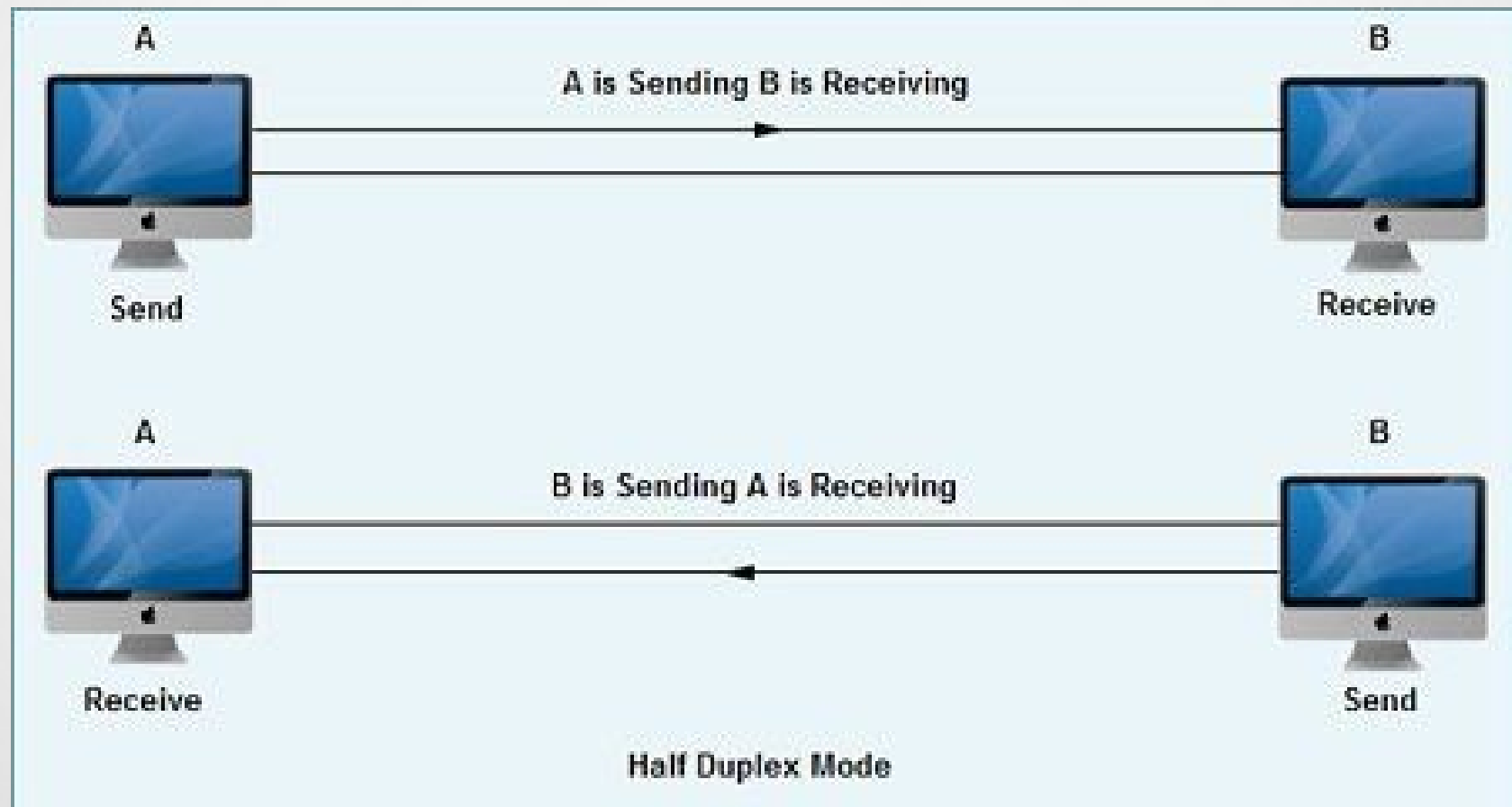
# Modes of Data Transmission

- **Half Duplex Mode:**

- Both devices can transmit; not at the same time.
- When one device is sending data, the other must only receive it, and vice versa.
- half-duplex transmission implies a bidirectional line (one that can carry data in both directions) but data can be sent in only one direction at a time.
- Half duplex communication is slower. However, it is more convenient than simplex.
- Walkie-talkie is a typical half duplex device. It has a “push-to-talk” button which can be used to turn on the transmitter but turn off the receiver. Therefore, once you push the button, you cannot hear the person you are talking to..



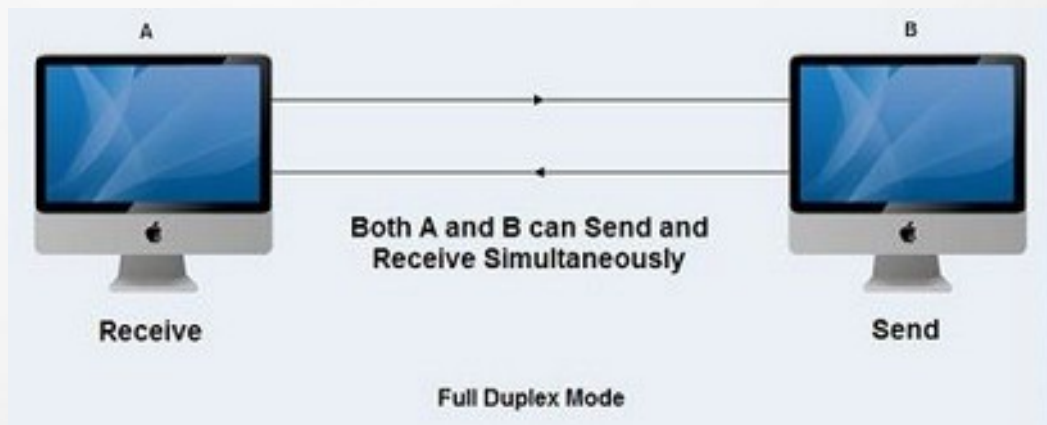
# Modes of Data Transmission



# Modes of Data Transmission

- **Full Duplex Mode:**

- In full duplex system we can send data in both the directions as it is bidirectional at the same time in other words, data can be sent in both directions simultaneously.
- Both the connected devices can transmit and receive at the same time
- Example of Full Duplex is a Telephone Network in which there is communication between two persons by a telephone line, using which both can talk and listen at the same time.



```
010010010100010101000011
110000101010001010010010
```

# Internetworking devices - Repeater

- Repeaters are also called **regenerator**.
- **Repeater regenerates a signal.**
- Even digital signals become weak when they travel long distances.
- In telecommunications, a repeater is an electronic device that receives a signal and retransmits it.
- Repeaters are used to extend transmissions so that the signal can cover longer distances or be received on the other side of an obstruction.
- Repeaters amplify the received/input signal to a higher frequency domain so that it is reusable, scalable and available.
- Signals travelling across a physical wire travel some distance before they become weak or corrupted as they get interfered with other signals/voice.
- **It operates at the physical layer.**



# Internetworking devices - Repeater

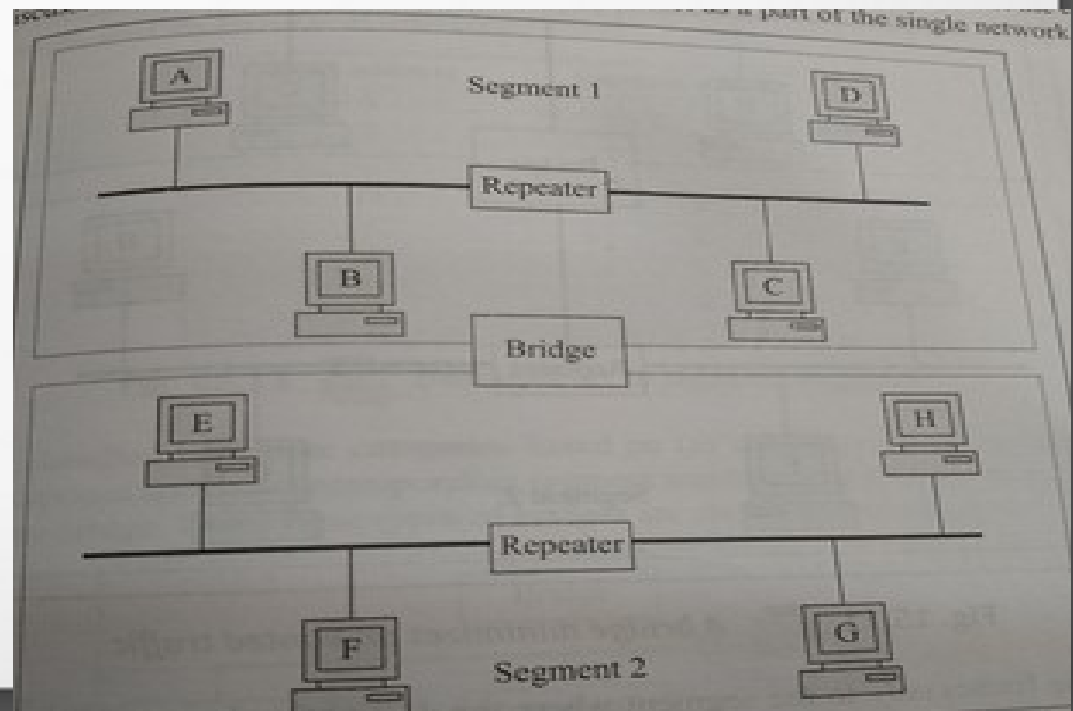
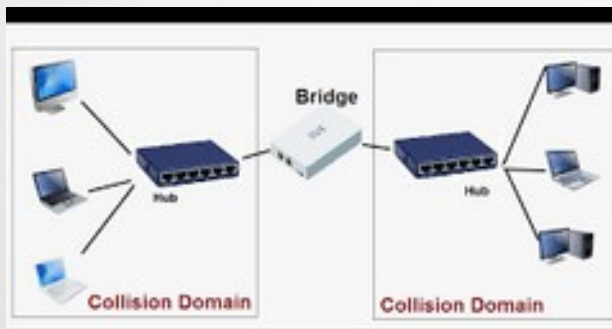


**WIFI-Repeater**



# Internetworking devices - Bridges

- A bridge is a computer that has its own processor, memory and two NIC cards to connect to two portions of a network.
- A bridge does not run application programs but it facilitates hosts-to-host communication within a network.
- It operates at the physical layer and data link layer of OSI layer.
- The main idea of bridge is to divide a big network into smaller subnetworks called **segments**.



# Internetworking devices - Routers

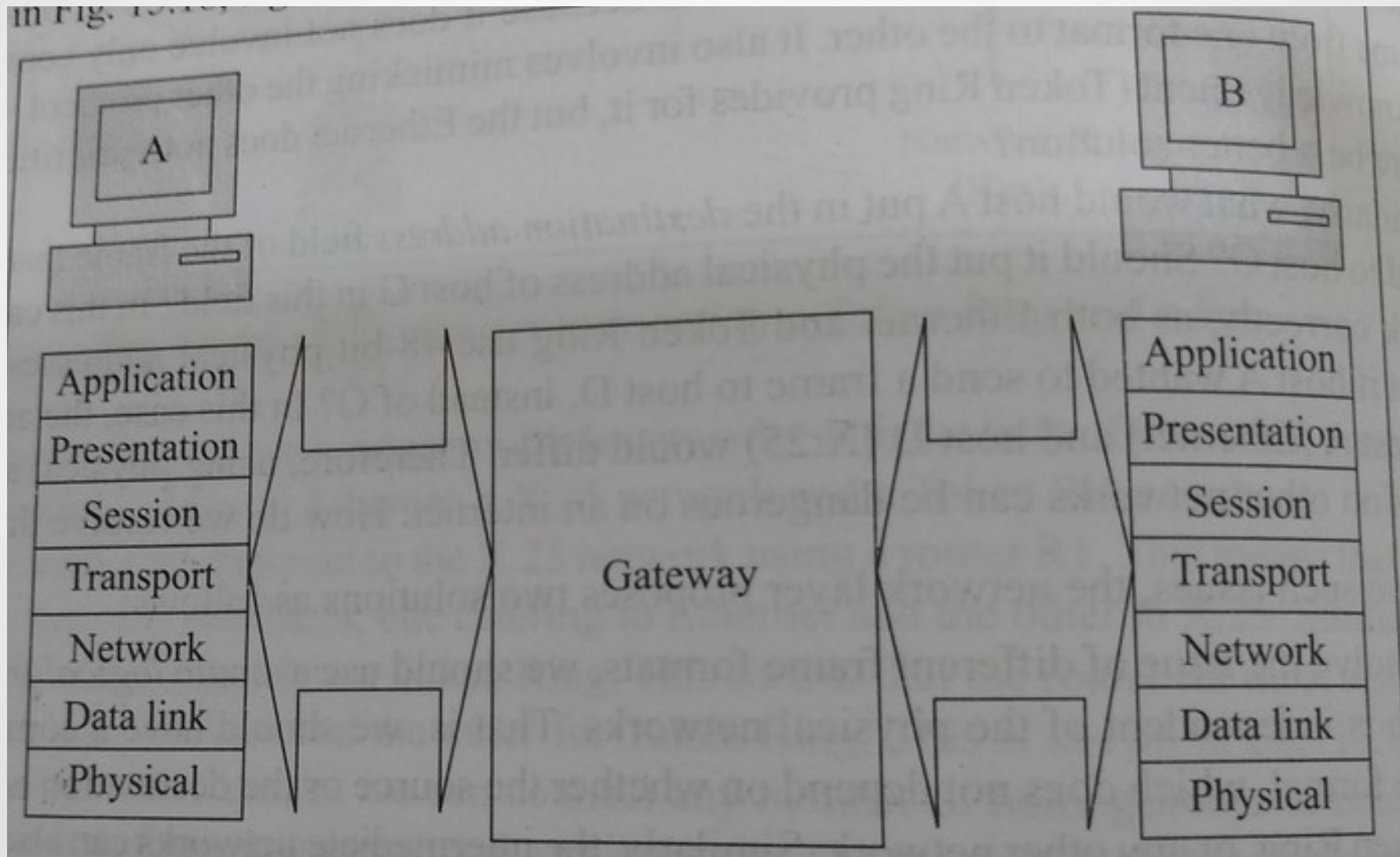
- **A Router operates at the physical, data link and network layer of the OSI model.**
- **A router is termed as intelligent device.**
- **It interconnects two or more network.**
- Network can differ in physical characteristics such as frame size, transmission rates, topologies, addressing, etc.
- A router is a device that forwards data packets along networks.
- A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network.
- Routers are located at gateways, the places where two or more networks connect.
- These nodes maintain routing tables and execute routing algorithms to take routing decisions.
- When an intermediate node is equipped with the capability to take decisions, it called router instead of switch.

# Internetworking devices - Gateway



- A gateway operates at **all the seven layers** of the OSI model.
- A router can forward packets across different network types. However they are not using the same protocol a router would not be able to forward packets from one network to another.
- **Example: if network is a Token Ring using TCP/IP and network B is Novell Netware network, a gateway can relay frames between the two.**
- Gateway is not only responsible for translating between different frame formats but also different protocols.
- A gateway is a very powerful computer as compared to a bridge or a router.
- It is used to connect **huge incompatible networks**.

# Internetworking devices - Gateway



# Internetworking devices - Switch

- A switch is a multiport device that improves network efficiency.
- The switch maintains limited routing information about nodes in the internal network, and it allows connections to systems like hubs or routers.
- Switches can read the hardware addresses of incoming packets to transmit them to the appropriate destination.
- A switch can work at either the Data Link layer or the Network layer of the OSI model.
- A multilayer switch is one that can operate at both layers, which means that it can operate as both a switch and a router.
- A multilayer switch is a high-performance device that supports the same routing protocols as routers.

# Internetworking devices - Switch

- The switch can perform error checking before forwarding data, that makes it very efficient as it does not forward packets that have errors and forward good packets selectively to correct port only.
- Switches can be subject to distributed denial of service (DDoS) attacks; flood guards are used to prevent malicious traffic from bringing the switch to a halt.
- Switch port security is important so be sure to secure switches: Disable all unused ports and use DHCP snooping, ARP inspection and MAC address filtering.



# Internetworking devices - Switch





Router	Gateway
It is a hardware device which is responsible for receiving, analyzing and forwarding the data packets to other networks.	It is a device that is used for the communication among the networks which have a different set of protocols.
It supports the dynamic routing.	It does not support dynamic routing.
The main function of a router is routing the traffic from one network to the other.	The main function of a gateway is to translate one protocol to the other.
A router operates on layer 3 and layer 4 of the OSI model.	A gateway operates upto layer 5 of the OSI model.
Working principle of a router is to install routing details for multiple networks and routing traffic based upon the destination address.	5. Working principle of a gateway is to differentiate what is inside the network and what is outside the network.
It is hosted on only the dedicated applications.	It is hosted on dedicated applications, physical servers or virtual applications.
The additional features provided by a router are Wireless networking, Static routing, NAT, DHCP server etc.	The additional features provided by a gateway are network access control, protocol conversion etc.