

UNIT 3 (PART -1)

Data Communication Components

☒ DATA COMMUNICATION COMPONENTS

Or

☒ NETWORKING AND INTERNETWORKING DEVICES

- ★ Two or more devices connected for the purpose of sharing data or resources can form a network.
- ★ In the first case, a device called a repeater or re-generator is inserted into the network to increase the coverable distance.
- ★ In the second, a device called a bridge is inserted for traffic management.
- ★ An internet is an interconnection of individual networks. To create an internet, routers and gateways.
- ★ Networking & Internetworking devices are divided into four categories: Routers, Bridges, Repeaters and Gateways.
- ★ There are five kinds of connecting devices: Repeaters, Hubs, Bridges and two or three layer switches.

☒ DATA COMMUNICATION COMPONENTS:-

1) MODEM

2) HUBS

3) REPEATERS.

4) ROUTERS

5) BRIDGES

6) SWITCHES

1) MODEM: (Modulator and Demodulator)

- ★ The telephone system is working on an analog signaling and our computer is working on a digital signal.
- ★ We want to transmit a digital data of the computer on telephone system then, it is necessary to convert the digital data into analog form.
- ★ A modem is communication device that convert your binary signal into analog signal and analog signal to binary signal for transmission over the telephone lines.
- ★ MODEM stands for Modulation and Demodulation.
- ★ A conversion from binary to analog signal is known as **Modulation**.
- ★ The reverse conversion i.e. from analog signal to binary signal is known as **Demodulation**.
- ★ When you connect your telephone to computer that time you must require a modem for internet.
- ★ You can use an internal as well as external modem to connect computer to telephone for internet.

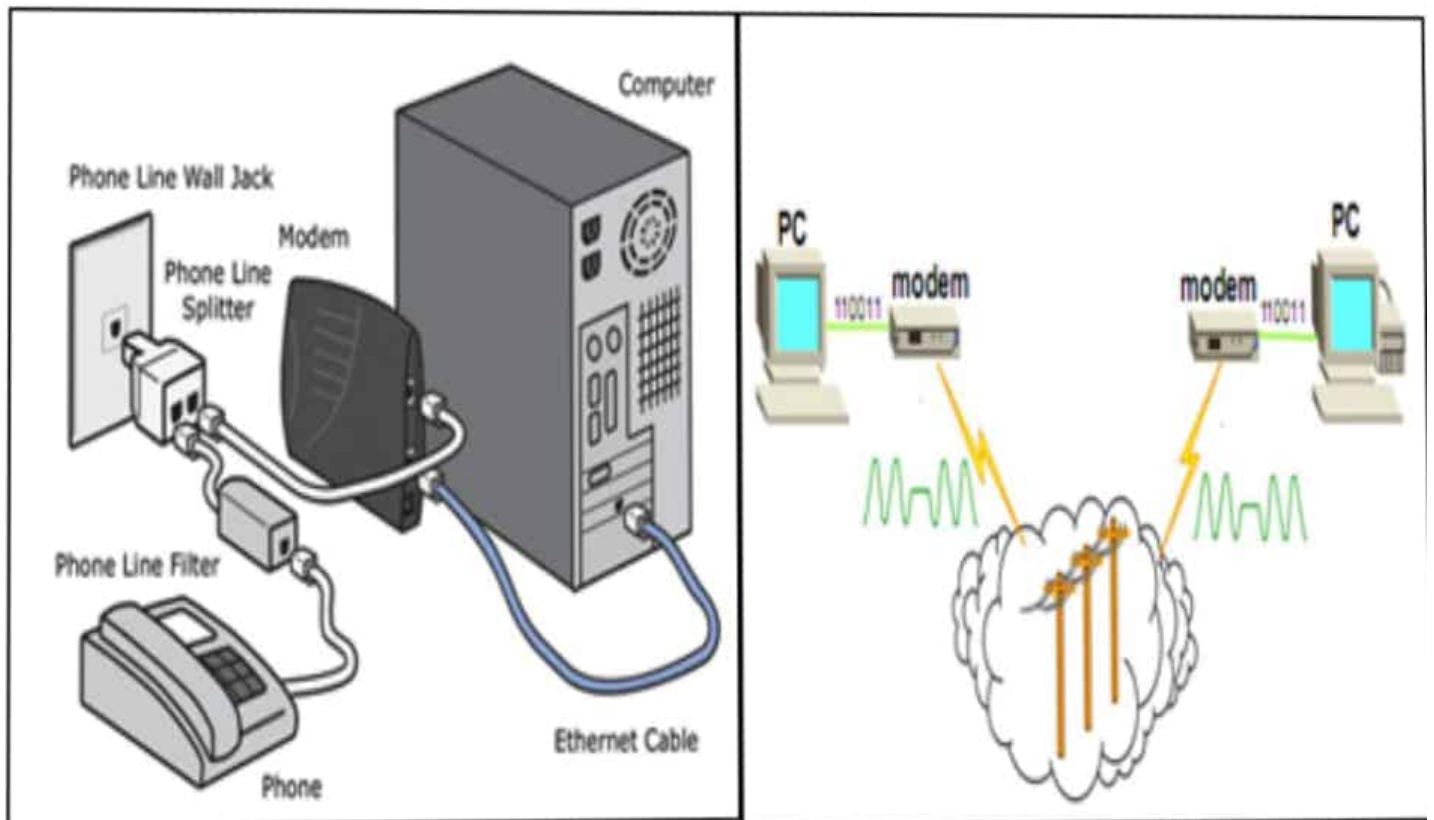


Fig. MODEM

- ★ A modem permits your computer to connect to and communicate with the rest of the world.
- ★ When you use a modem, you normally use a communication program or web browser to utilize the modem on a telephone line.
- ★ Data (bytes representing letters, pictures, etc.) flows from your computer to your modem and then out on the telephone line.
- Based on location, a modem for a PC may be either internal, external serial, or external USB.

1. Internal Modem:

- √The internal one is installed inside of your PC (you must remove screws, etc. to install it).
- √The internal modems are less expensive.
- √It is less likely to suffer data loss due to buffer overrun.
- √It is usually use less electricity.
- √An internal modem obviously doesn't use up any desk space.

2. External Modem:

- √ An external one just plugs in to a cable: USB cable (USB modem) or to the serial port (RS-232 serial modem).
- √ The external modems are very expensive.
- √ External serial modems are usually easier to install.
- √ It usually has less configuration problems.
- √ External modems have lights (LEDs) which may give you a clue as to what is happening and to help in troubleshooting.
- √ External modems are easy to move to another computer.
- √ If you need to turn the power off to reset your modem because you don't have to power down the entire PC.

- Other MODEL

2. HUB

- ★ A Hub is a Central device in a star topology that provides a common connection among the nodes.
- ★ Hub is a central point in a network.
- ★ A Hub is actually a multi port repeater.
- ★ Hubs can be used to connect multiple segments (nodes) of the same network and transfer data from one segment to another segment.
- ★ In a network a Hub acts as a central point for various devices such as computers, printers and routers.
- ★ Hubs can increase network traffic because they broadcast data to the device connected on all the ports.



★ If Node-A (segment-1) sends data to Node-D (segment-2), the data reaches port-1 of the hub then transmits the signal to all the port therefore to all computers in segment-2 picks up the signal which is then converted into data.

★ Above example you can see the signal was addressed to only one computer in particular segment it transmitted to all the segments so the resulting in increased network traffic. And made a collision and degrade network performance.

3. REPEATER

- ★ A repeater is a device that operates only in the physical layer.
- ★ The function of the repeater is to regenerate the weak signal back to its original signal.
- ★ A repeater installed on a link receives the signal before it becomes too weak or corrupted. So regenerates the original bit pattern and puts the re-freshed copy back on the link.
- ★ Repeater is one example of an active hub. Repeaters are devices that can receive signals, strengthen and sends the signal back to another place. So that the signal can reach more remote areas
- ★ In digital communication systems, a repeater is a device that receives a digital signal on an electromagnetic or optical transmission medium and regenerates the signal along the next leg of the medium. In electromagnetic media, repeaters overcome the attenuation caused by free-space electromagnetic-field divergence or cable loss. A series of repeaters make possible the extension of a signal over a distance.



Fig. Repeater

4. ROUTER

- ★ An internetworking device operating at the first three (Physical, Data link & Network layer) OSI model.
- ★ A router is attached to two or more networks and forwards packets from one network to another network.
- ★ Routers are devices that connect to more networks they consist of a combination of hardware (h/w) and software (s/w).
- ★ Routers have access to network layer address and contain software that enables them to determine which of several possible paths between those addresses the best for a particular transmission is.
- ★ The main function of routers, it should follow the shortest, fastest route.
- ★ The hardware includes the physical interfaces.
- ★ Two main places of software in routers are the operating system and the routing protocol.
- ★ Router use logical and physical addressing to connect two or more logically separate network.

- ★ Each of those sub-networks is given a logical address. This allows the networks to be separate but still access each other and exchange data when necessary.
- ★ The network address allows router to more accurately calculate the optimal path.
- ★ Routers relay packets among multiple interconnected networks.

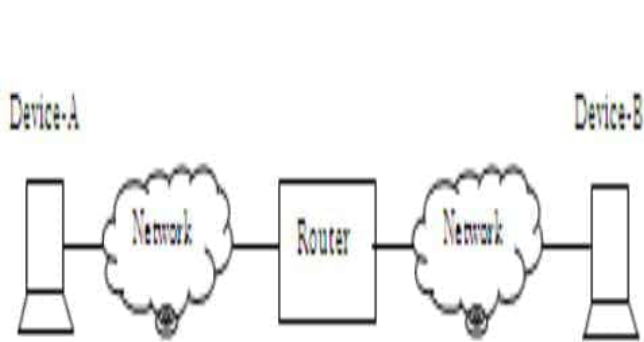
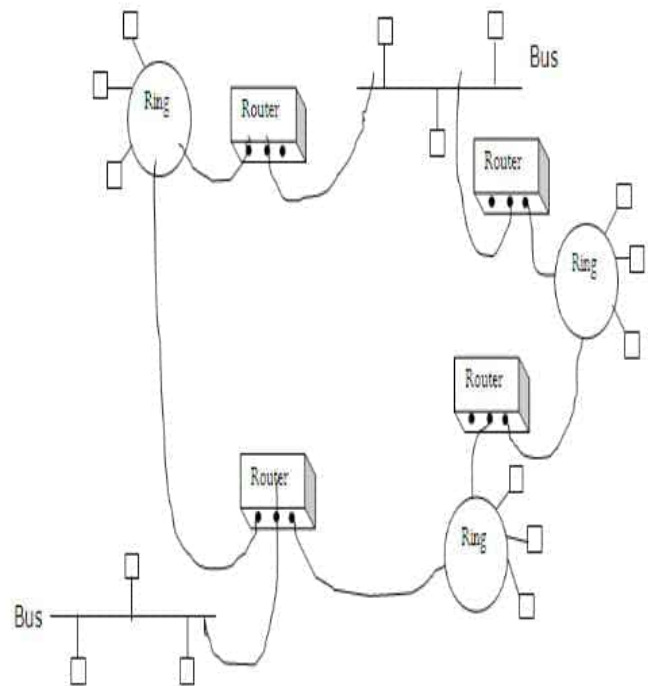


Fig :- Routers



- ★ Hop count describes the number of routers a message must pass through to reach its destination.
- ★ Delay count describes the amount of time required for a message to reach its destination.

Routing is classified as Non-adaptive or Adaptive routing:-

1. Non-adaptive Routing:-

- ★ In some routing protocols, once a pathway to a destination has been selected, the router sends all packets for that destination along that one route.
- ★ In short, the routing decisions are not made based on the condition or topology of the networks.

2. Adaptive Routing:-

- ★ Other routing protocols employ a technique called adaptive routing by which a router may select a new route for each packet in response to changes in condition & topology of the networks.

5. BRIDGES

- ★ Bridge is a data communication devices it s used for to communication between more the one networks.
- ★ Bridge is a network device operating at the first two layers (Physical and Data Link Layer) of the OSI model with filtering and forwarding capabilities.
- ★ As a Physical layer device, it regenerates the signal it receives.
- ★ As a Data Link Layer device, the Bridge can check the physical (MAC) addresses (Source and destination) contained the frame.
- ★ A Bridge operates at the Data Link layer giving it access to the physical address of all stations connected to it.
- ★ When a frame enters a bridge, the bridge not only regenerates the signal but checks the address of the destination and forwards the new copy only to the segment to which the address belongs.
- ★ As a bridge encounters a Packet, it reads the address contained in the frame and compares the address with a table of all the stations on both segments.
- ★ When it finds a match, it discovers to which segment the station belongs and relays the packet only to the segment.
- ★ A bridge does not change the physical (MAC) address in a frame.

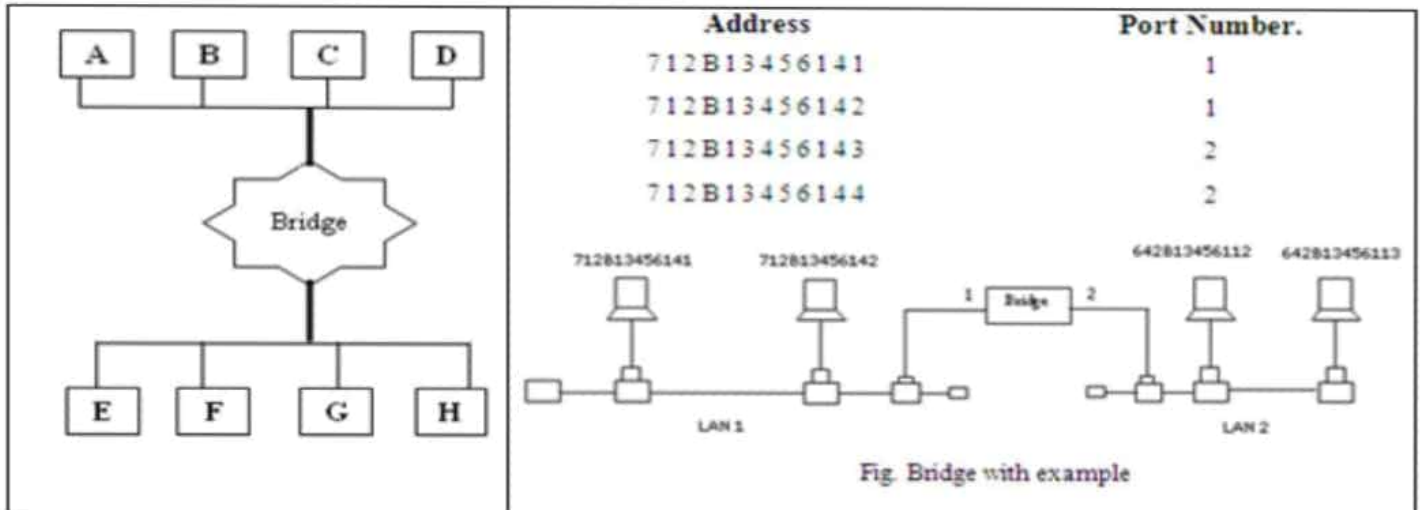


Fig. Bridge.

★ In Fig if a frame destined for station 712B1345642 arrives at port 1, the bridge consults its table to find the departing port.

★ According to its table, frames for 712B1345642 leave using port 1, therefore there is no need for forwarding the frame is dropped on the other hand, if a frame for 712B1345641 arrives at port 2, the departing port is port 1 and the frame is forwarded.

★ In the first case, LAN-2 remains free of traffic in the second case both LANs have traffic. In our example, we show a two-port bridge in reality a bridge usually has more

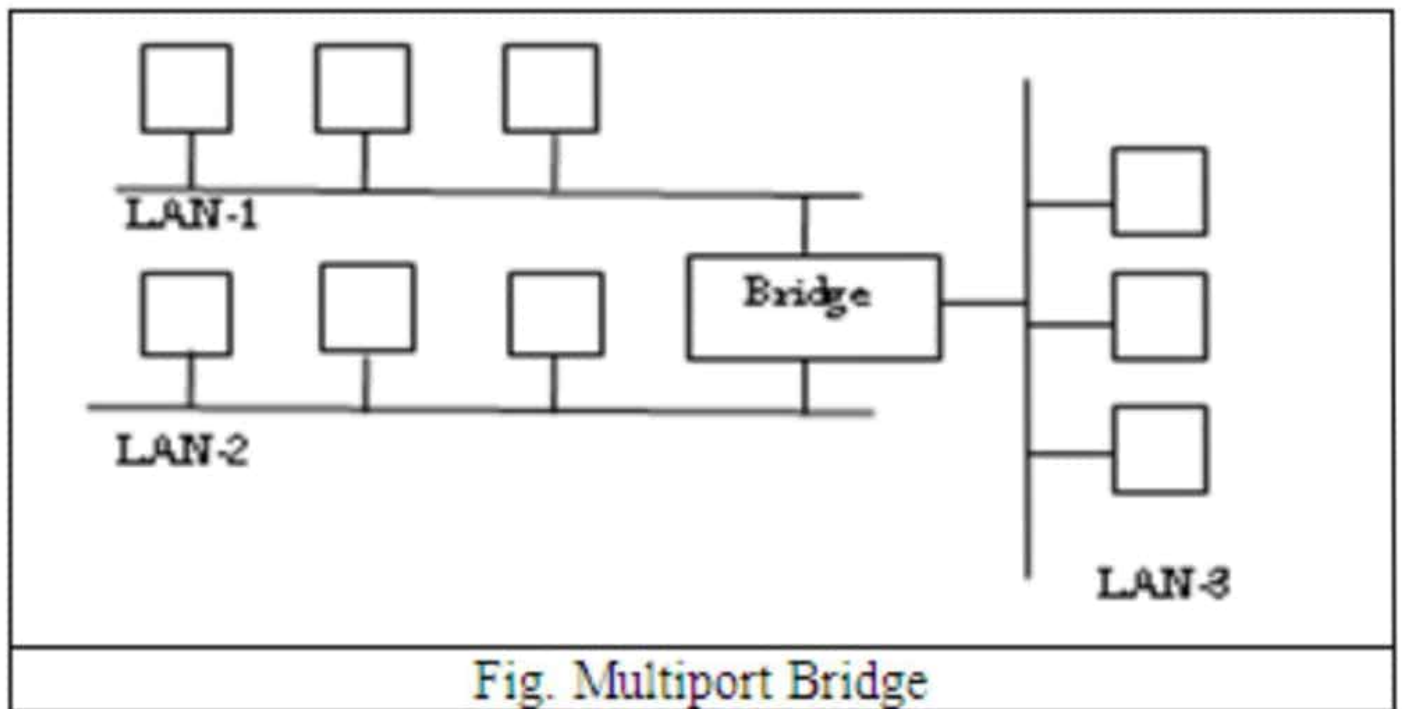
● TYPES OF BRIDGES:-

1 SIMPLE BRIDGE:-

- ★ Simple bridges are the most primitive and least expensive type of bridge.
- ★ Simple bridge links two segments and contains a table that lists the addresses of all the stations included in each of them.
- ★ It primitive is that these addresses must be entered manually.
- ★ Before a simple bridge can be used an operator must sit down and enter the addresses of every station.
- ★ Whenever a new station is added, the table must be modified.
- ★ If a station is removed, the newly invalid address must be deleted.
- ★ Installation and maintenance of simple bridges are time-consuming and potentially more trouble than the cost savings one worth.

2. MULTI PORT BRIDGE:-

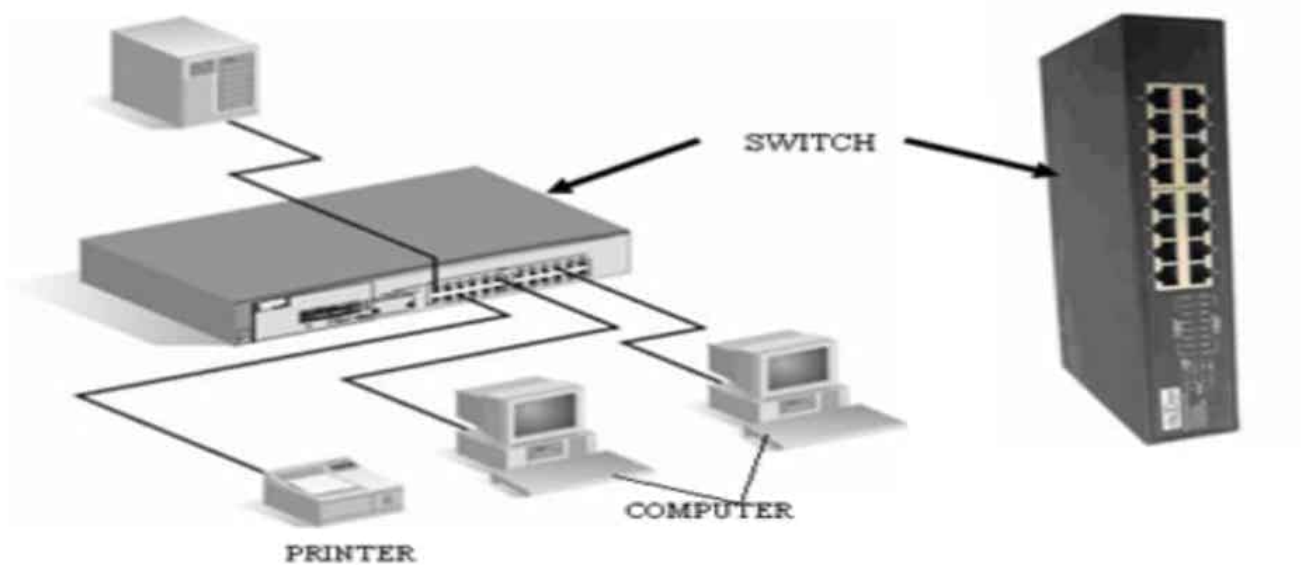
★ A Multiport bridge can be used to connect more than two LANs; the bridge has three tables, each one holding the physical address of stations reachable through the corresponding port.



6. SWITCHES

- ★ Switch acts as a central point for various devices such as computers, printers and routers.
- ★ Switch also connects computers in a network or different segments of the same network like Hub.

Fig. Switches



- ★ The two-layer switch performs at the physical and data link layer in OSI model.
- ★ A three layer switch is used at the network layer; it is a kind of router.
- ★ Switches treat data in the form of frames and the data frame contains the MAC address of Ethernet for the destination computer.
- ★ Switches can maintain a list of MAC address and the port number associated with each MAC address.
- ★ When the data frame is sent using a switch the data frame carries the address of the destination computer.
- ★ Switch can read this MAC addresses and data is forwarded only to that computer.
- ★ Switch reduce network traffic and therefore enhance network performance because switches are hardware and software devices capable of creating temporary connection between two or more devices linked to the switch but not to each other.
- ★ A two layer switch is a bridge, a bridge with many ports and a design that allows better performances.
- ★ A bridge with many ports may be able to allocate a unique port to each station, with each station on its own independent entity.

TYPES OF SWITCHES:-

There are many types of switch used.

1. SIMPLE SWITCH:-

★ A simple switch is a device with n inputs and m outputs that creates a temporary connection between input link and output link.



Fig. Simple Switch

2. A FOLDED SWITCH:-

★ An n by n folded switch can connect n lines in full-duplex mode.

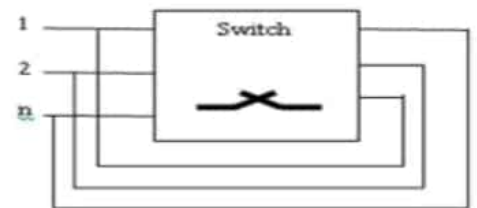


Fig. Folder Switch

3. CROSS BAR SWITCHES:-

★ A cross bar switch connects n inputs to m outputs in a grid using electronic micro switches (transistors) at each cross point.

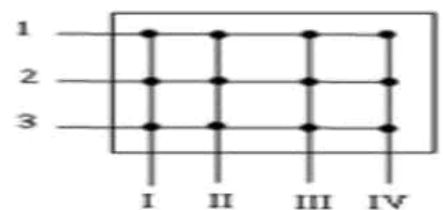


Fig. Cross Bar Switch

SWITCH TRANSMITTED METHODS: -

There are two methods used for data transmitted.

1. Store and forward switching

2. Cut through switching

1. Store and forward switching:-

★ A store and forward switching ensures that corrupt frames are dropped and only error-free data is forwarded.

★ Disadvantage:-

★ This switching is slower than cut through switching because each frame is checked for integrity and error-free data is forwarded only after the switch receive all the frames data.

2. Cut-through switching:-

★ In this method the switch reads the destination MAC address of data frame and immediately forwards the frame to the respective port.

★ Advantage:- The switch forwards the frame as soon as it receive the frame and so the data transfer rate is not affected.