

UNIT : 3 Transmission Media & Network Devices

* Network Devices :

↳ Definition :

Network devices are essential components in computer networks that facilitate communication between different hardware.

↳ They can be categorized into two main types :

- i> End-devices and
- ii> Intermediate devices.

↳ Types of Network Devices :

• End Devices :

These devices originate or terminate data flow in a network. Example include ; Computers, Printers and Servers.

• Intermediate Devices :

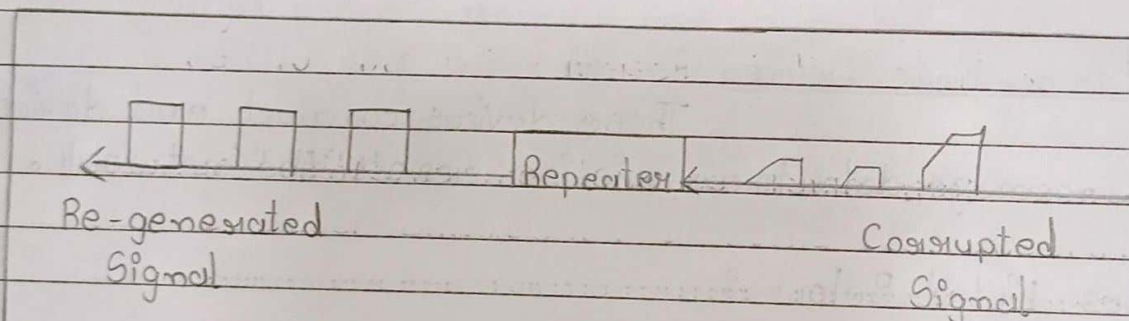
These devices connect end devices and manage data transmission across the network.

Types Listed Below :

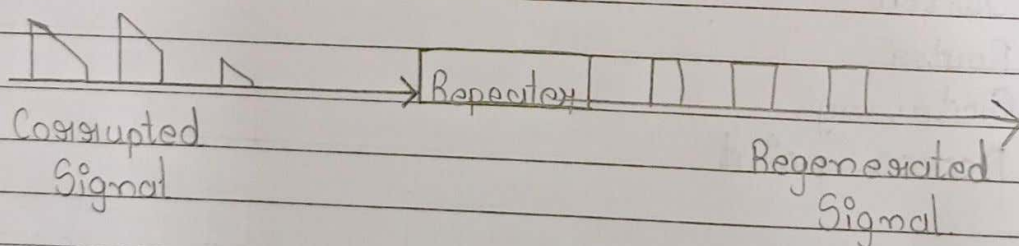
- i> Repeater
- ii> Bridge
- iii> Hub
- iv> Switch
- v> Router
- vi> Gateways
- vii> Access point

1) Repeaters :

- ↳ Repeater is an electronic device which operates only in physical layer.
- ↳ Repeaters, installed on a link receives the signals before it becomes too weak or corrupted, it regenerates the original bit pattern and puts the new refreshed copy of signal back on the link.
- ↳ Repeaters allows us to extend only the physical length of a network.
- ↳ It does not change the functionality of the network.
- ↳ Figure :



a. Right-to-left transmission



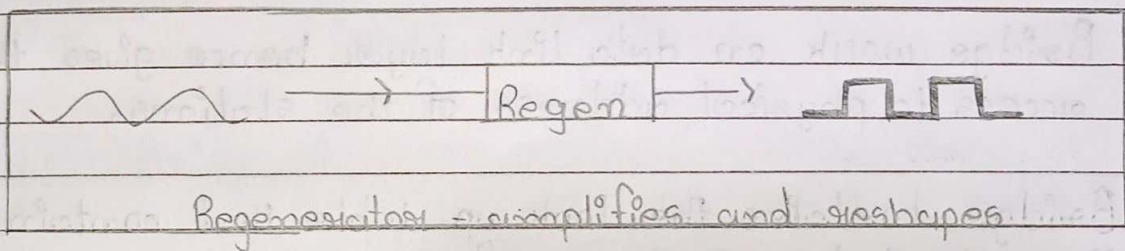
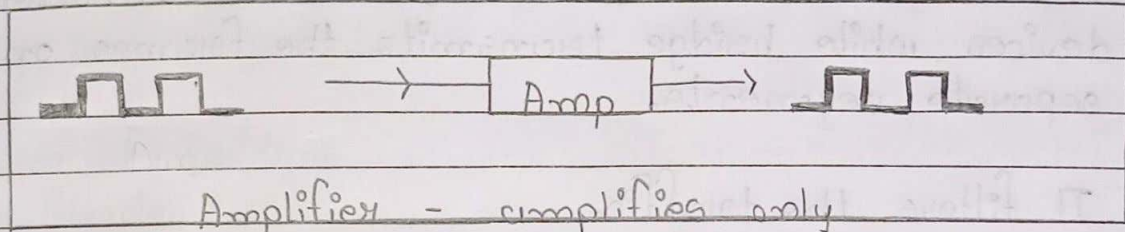
b. Left-to-right transmission

- ↳ Repeater is not an amplifier.

→ An amplifier can not differentiate the intended signal and noise signal, hence it amplifies equally everything [given as input] into it.

→ While repeater does not amplify the signal instead it regenerates it.

→ Repeaters placed so that a signal reaches it before the noise changes the meaning of any of its bits.



ii > Bridge :

↳ It operates on both physical and data link layer of OSI model.

↳ It connects two or more LANs.

↳ Bridge has a software which keeps the separate traffic for each segment.

↳ Repeater transmits frames to entire connected devices while bridge transmits the frames only to separate segments.

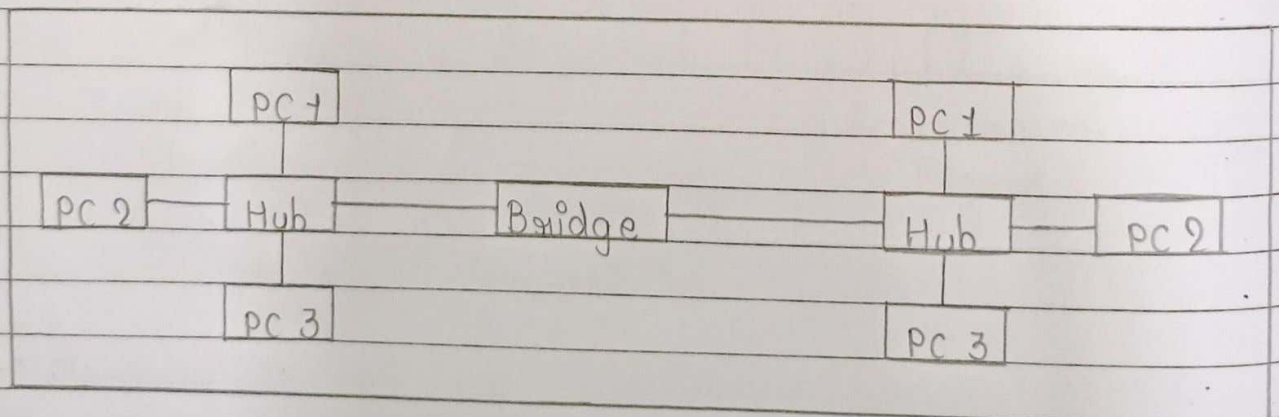
↳ It filters the traffic.

↳ Bridge work on data link layer hence gives the access to physical address of the stations.

↳ Bridge contains the look up table that contains the physical addresses of every stations connected to it.

↳ Bridge is also worked for collision resolution.

↳ Figure :



↳ In the working of a bridge → when a frame enters to the bridge, it regenerates the signal and it checks the address of the destination and forwards the new copy only to segment to which the address belongs.

↳ As a bridge found the frame, it reads the address contained in the frame and compares the address with a table of all the stations on both the segments.

↳ When bridge finds the correct match, it finds to which segment the station belongs and send the frame to only that segment.

↳ Types of Bridges :

1. Simple Bridge
2. Multipoint Bridge
3. Transparent Bridge

1. Simple Bridge :

↳ It is the most primitive and least expensive types of a bridge.

↳ It links two segments.

↳ It contains a table that lists the physical address of all the stations connected with it. Physical address must entered manually.

↳ In this bridge, updating of device is time consuming when new device is add / removed, the table must be modified at this time.

↳ So installation and maintenance for this bridge is time consuming and tedious.

2. Multipoint Bridge :

↳ It is used to connect more than two LANs.

↳ In this bridge, different tables are created each one holding the physical address of stations reachable through the corresponding port.

3. Transparent Bridge :

↳ It builds the table of physical address on its own as it performs its bridge function.

↳ Table is automatically built as frames are moved in the networks.

↳ Initially when bridge is installed, it is empty.

↳ As transmission is done the table is updated accordingly.

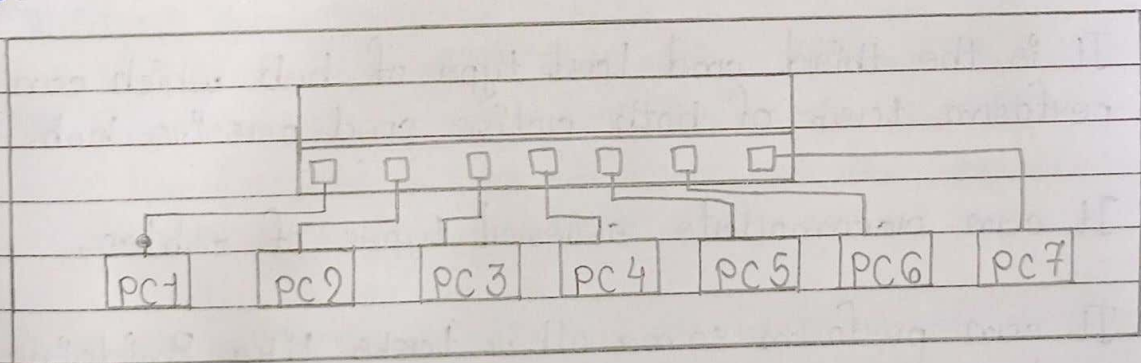
↳ The first packet transmitted by each station, the bridge makes entries inside the table with corresponding segment. So at last the table is completed with all details.

↳ The bridge has 'Self updating features'.

iii) > Hub :

- ↳ Hub is used to create connections between stations in physical star topology.
- ↳ Large number of computers can be connected in single or multiple LANs.
- ↳ Hub is a central network device that connects network nodes. So is also referred as concentrator.
- ↳ Hub enables central network management.
- ↳ It provides connections for several different media types like : coaxial, fiber optic, twisted pair.
- ↳ Hubs are available in 8 / 16 / 24 ports.
- ↳ It provides high speed communication.

↳ Figure :



↳ Types of Hub :

1. Passive Hub
2. Active Hub
3. Intelligent Hub

1. Passive Hub :

- ↳ It provides the physical connections between the attached devices.
- ↳ It do not amplify or regenerate the signals passes through hub.
- ↳ It do not require electricity to run.

2. Active Hub :

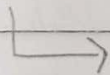
- ↳ It acts like repeaters, it regenerates and retransmits the signals.
- ↳ Because of multiple ports are available in it, it also called Multipoint Repeaters.
- ↳ It need electric power to run.

3. Intelligent Hub :

- ↳ It is the third and last type of hub which can perform task of both active and passive hub.
- ↳ It can accommodate several types of cables.
- ↳ It can perform some other tasks like Bridging and routing.
- ↳ It increases the speed and effectiveness of total network thus makes the performance of whole network fast and efficient.
- ↳ It is intelligent because capable of doing hub management and switching functionality.

iv > Switch :

- ↳ Switch provide the bridging functionality with greater efficiency.
- ↳ It acts as a multipoint bridge to connect different devices or segments in a LAN.
- ↳ It operates in data link layer of OSI model [also called layer 2 switch].
- ↳ Switch has buffer for each link connected with it.
- ↳ When it receives the frame, it stores the frame in the buffer of receiving link and checks address to find outgoing link.
- ↳ If outgoing link is free the switch sends the frame to that particular link.
- ↳ Two different characteristics of switch :
 - i > Store and forward switch → it stores the frame in input buffer until the whole frame is received.
 - ii > Cut through switch → It forwards the frame to the output buffer as soon as the destination address is received.
- ↳ Difference Between Layer 2 switch & Layer 3 switch.



Layer-2 Switch	Layer-3 Switch
↳ Forwards data based on MAC addresses.	↳ Routes data based on IP addresses & forwards data based on MAC addresses.
↳ Cannot route data between VLANs.	↳ Can route data - between VLANs.
↳ Requires little to know configuration.	↳ Requires a more complex configuration.
↳ Relatively in expensive.	↳ More expensive.
↳ Very fast.	↳ Slower.

> Router :

- ↳ A router is hardware device designed to receive, analyze and move incoming packets to another network.
- ↳ It operates in physical, data link and network layer of the OSI model. But most active in network layer.
- ↳ Routers are able to access network layer address [IP address] of the device.
- ↳ Simple function of router is to receive the packet from one connected network and pass them to a second connected network.
- ↳ Routers also perform the traffic directing functions on the Internet.
- ↳ A packet sent from a station on one network to a device on a neighboring network goes to the jointly device - router which forwards the packet to the destination network.
- ↳ Routers consult with routing table when packet is ready to be forwarded.
- ↳ Characteristics of Router :
 - Least-cost routing :
Router finds the shortest path for the packet which is fastest, cheapest, reliable and secure.

↳

- Non-adaptive routing :

In which, once a pathway to a destination has been selected, the router sends all packets for that destination along that one route.

- Adaptive routing :

In this, Router may select a new route for each packet. Router sends the packet depending on which route is most efficient at that moment.

- * Types of Router :

- i> Static Router :

- ↳ In it, routing table information are entered manually.
- ↳ In case of change in the connection, it cannot update automatically.
- ↳ It is more secure, It always uses the same route.

- ii> Dynamic Router :

- ↳ In it, routing table is created and updated automatically.
 - ↳ When there is a change in the connection, routing table is updated using any of the routing protocols.
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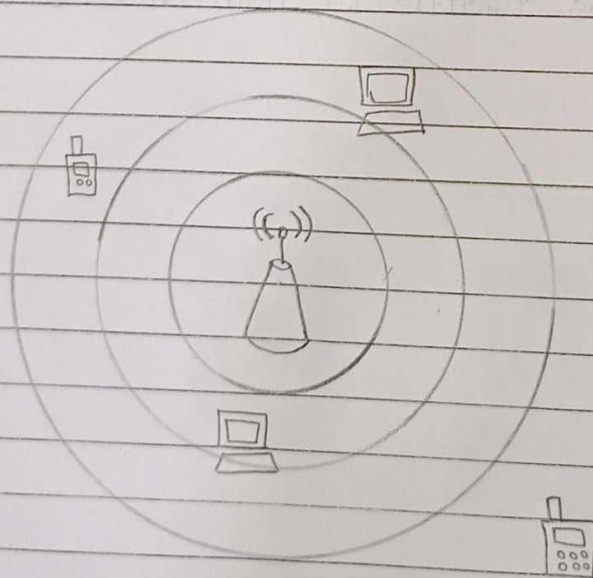
vi) Gateways :

- ↳ Gateways operates in all seven layer of OSI model.
 - ↳ A gateway is a hardware device that acts as a "gate" between two networks.
 - ↳ It is also called as protocol converter.
 - ↳ It is generally used to connect two different network systems.
 - ↳ Routers transfers packets only across networks using similar protocols while a gateway can accept a packet formatted for one protocol and converts it into a packet formatted for another protocol before forwarding it.
 - ↳ It may be a router, firewall, server, or other device that enables traffic to flow in and out of the network.
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vii) Access Point :

- ↳ An access point is a device that allows wireless devices to connect to a wired network using Wi-Fi.
- ↳ Most access points have built-in routers, while others must be connected to a router in order to provide network access.
- ↳ Access points can be found in many places, including houses, businesses, and public locations.
- ↳ Every access point has its own range. Any device placed within the range of access point can only use the services of that.

↳ Figure :



Due to not in the range,
this device can't access
the access point.

↳ Working :

- Wireless access point performs the technique called 'modulation' to transfer the data receives in or out.
 - It takes the modulated audio frequency voltages high and low transmitted from a nearby wireless network card, and turns them into 1s and 0s instead.
 - These 1s and 0s assembled into packets and forwarded to the destination.
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