

Government College of Engineering, Jalgaon

(An Autonomous Institute of Govt. of Maharashtra)

Department of Computer Engineering

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Experiment No. _____

Title: -Network connecting devices specifications and configurations

Aim: -Study of Network Connecting Devices. Such As Repeater, Switch/HUB, Router

THEORY:-

To understand what connecting devices are, it is important to know about Backbone Networks.

Backbone Network is a means of connecting 2 LAN"s. It provides a transmission channel for packets from being transmitted from one LAN to the other. The individual LAN"s are connected to the Backbone Network by using some types of devices such as Hubs, Repeaters, Switches, Bridges, Routers and Gateways.

Although these terms sound familiar, not many of us know the purpose of using these devices difference between these devices. Hence, it is very important to know the basic function of these devices in order to decide upon the device that is to be used for a particular purpose.

Hub

A hub works in the physical layer of the OSI model. It is basically a non-intelligent device, and has no decision making capability. What a Hub basically does is take the input data from one of the ports and broadcast the information to all the other ports connected to the network.

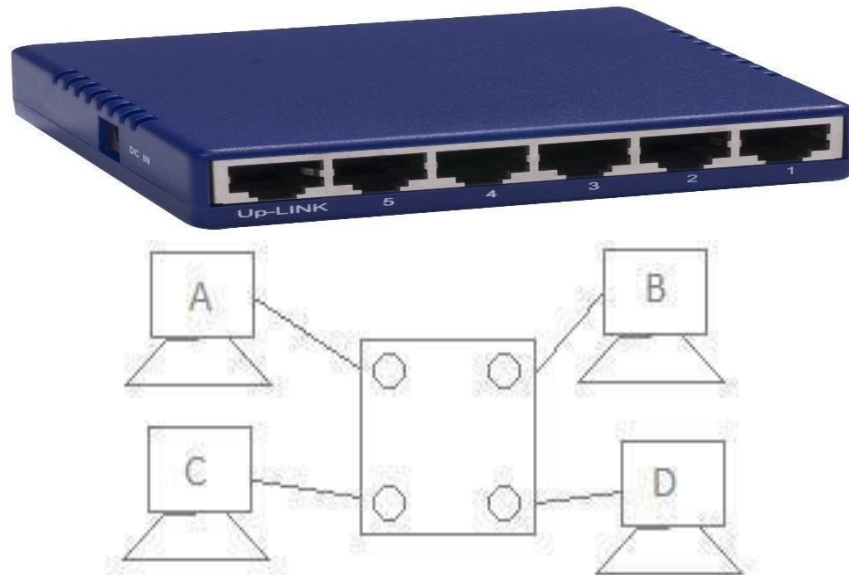


Fig 1 : 4 port Network

To demonstrate its working, consider a 4 port network as shown in Fig 1. There are 4 computers connected to the 4 ports. Suppose, if Computer A wants to send some data to Computer B using a Hub, then, Computer A broadcasts the data on the network, and Computer B, being connected to the network, has access to the data. But, in this case all the other ports connected to the network has access to the data that is being transmitted by Computer A. This happens because, the Hub works in the Physical Layer and hence it does not know about the MAC addresses of the ports connected to the network. So, there is a lack of security in the Hub.



Fig 2 :USB Hub

The picture shows a USB Hub, wherein the data is fed into the input port and is broadcasted to all the other 4 ports. The Network Hubs are outdated and are out of the market.

Repeater

A repeater is a device similar to the Hub, but has additional features. It also works in the Physical layer. The repeaters are used in places where amplification of input signal is necessary. But, the kind of amplification done by the repeater is different from the regular amplification by amplifiers. The regular amplifies everything fed into it. That means, if the input signal has noise induced into it, both the desired signal and noise signal are together amplified. But, in the case of a repeater, it regenerates the input signal, and amplifies only the desirable signal. Hence, the noise component of the signal is eliminated.



Fig 3: Repeater

The repeaters are necessary since, during the transmission of the signals over long distances, the signal has attenuation, delay distortions and noise, which lead in loss of data. Hence, in order to prevent this, the regenerative repeaters are used. Hence, the repeater regenerates the faded signal. In addition, it has all the features of a Hub. One common problem between the repeaters and the Hubs are that only one transmission can take place on the network at a particular time. If multiple devices transmit data simultaneously, there will be data collision.

Switch

A switch is an intelligent device that works in the data link layer. The term intelligent refers to the decision making capacity of the Switch. Since it works in the Data link layer, it has knowledge of the MAC addresses of the ports in the network.



Fig 4: Switch

Hence, in the Fig 1, if data has to be sent from Computer A to Computer B, then, the data is transferred to the Computer B only, and not to any other computers connected on the network. Hence, it establishes a link between the sender and the receiver based on the MAC addresses. This also means that when data is being sent from A to B, Computer C can establish a link with Computer D and communication can take place between them. So, simultaneous data transfer is possible in a switch. Also, Hub divides bandwidth, but a Switch does not.

It is also to be noted that a switch is a secure device, because it sends information only to the desired destinations, and also certain security features such as firewalls can be implemented in the Switches.

Bridge

A bridge is also a device which works in the Data Link Layer, but is more primitive when compared to a switch. Initial bridges were used to connect only 2 LAN's, but the most recent ones perform similar operation as the switches. It also works on the principle of transfer of information using the MAC addresses of the ports.



Fig 5 : Bridge

It can be noted is that the normal ADSL modem can be connected via bridging also. The only difference is that, when bridging is used, each time the device has to be connected to the internet, it has to dial to the internet and establish a connection. Also, a bridge alone cannot be used to connect to the internet, because, the bridge works in the Data Link Layer, and has no knowledge of the IP Addresses, which are used in the Internet.

Router

Any computer can be connected to the internet via MODEM, which performs the MODulation and the DEModulation operations. But, when there are more than one computer at home or in an organization, and you have a single internet connection, you need a Router. Router is a device which is used when multiple devices need to connect to the Internet using the same IP. Any Internet Service Provider (ISP) provides a single IP, and especially for personal use, the IP address is assigned dynamically. This is done because, suppose, an ISP has 1000 IP addresses, it does not mean that it has 1000 customers. An ISP assumes that not all devices will be connected to the internet at the same time. Hence, when a user wants to access the internet, any IP address from the pool of IP addresses from the ISP will be assigned to connect the user to the internet.



Fig 6: Router

Hence, the router does the job of connecting multiple devices in a LAN to the internet using the same IP address. Since the router works in the Network Layer, it does forwarding on the basis of IP addresses.

Routers are networking devices used to extend or segment networks by forwarding packets from one logical network to another. Routers are most often used in large internetworks that use the

TCP/IP protocol suite and for connecting TCP/IP hosts and local area networks (LANs) to the Internet using dedicated leased lines.

Routers work at the network layer (layer 3) of the Open Systems Interconnection (OSI) reference model for networking to move packets between networks using their logical addresses (which, in the case of TCP/IP, are the IP addresses of destination hosts on the network). Because routers operate at a higher OSI level than bridges do, they have better packet-routing and filtering capabilities and greater processing power, which results in routers costing more than bridges. The WiFi routers that are commonly used now are the IEEE 802.11 b/g standard router, which is explained below.

IEEE 802.11

IEEE 802.11 is a standard for WiFi. There are several different technologies/ generations that have been implemented. As mentioned, the recent modems are IEEE 802.11 b/g modems. The word b/g has the meaning as follows:

An IEEE 802.11 b standard uses 2.4GHz band and has a maximum transfer rate of 11 Mbps, while the IEEE 802.11 g standard uses 2.4 GHz band and has maximum transfer rate of 54 Mbps. Thus the b/g modem refers to a dual bandwidth modem, which is compatible with both the b and g standards. The standards are mainly differentiated based on the distance and speed of data transfer.

The more recent IEEE 802.11 N standard has the capability to provide speeds of over 100 Mbps. It basically uses multiple wireless signals and antennas, and has increased signal intensity in order to be able to provide network for greater distances. It employs MIMO technology, wherein spatial encoding is used. The spatial pre-coding is done at the transmitter and the post-coding is done at the receiver. Recently, Reliance Communications was in news for implementing MIMO technology to improve its 3G data transfer speeds.

Gateway:

The Gateway devices work in the Transport layer and above, where the different network technologies are implemented. A gateway is necessary when there are different technologies implemented by the different LAN's which are to be connected together.

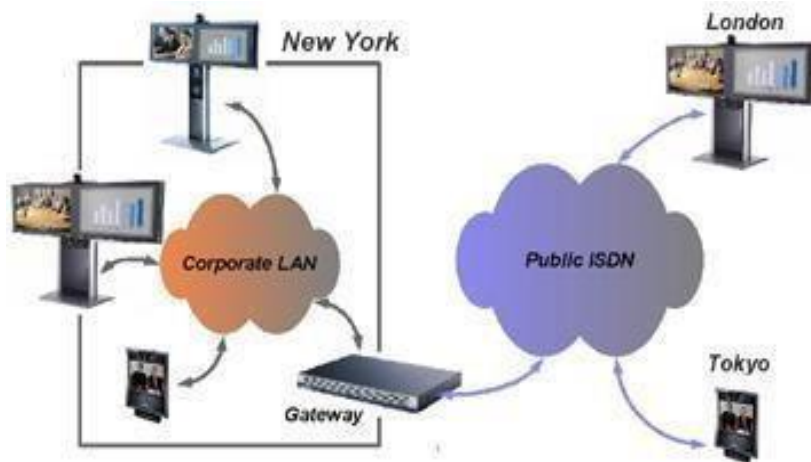


Fig 7 : Gateway function

The Fig shows the working of a gateway. Consider 2 networks, say in New York, and a network in London. If data has to be sent from one place to another, we need to ensure that the network technologies that are being used by both the networks are the same. If not, we need to use a Gateway.

In the more common example, we use a telephone network and internet networks, which works on different technologies. The telephone network follows the ISDN, and the Internet follows the IP. Here, 2 different technologies are being used. In this case, the router fails to work, since the router cannot understand the functionalities of both the networks. Hence, we require a Gateway, which acts as a translator in communicating between the 2 networks.

The different connecting devices or connectors used in these different layers in computer networks can be summarized by the following table:

| DEVICE | LAYER | CONNECTS | FEATURES |
|-----------------------|--------------------------------------|---|---|
| Passive Hub | Below physical layer | Wires from different branches | It is just a connector – does not do anything else |
| Repeater | Physical layer | Two segments of the same LAN | Regenerates signals for greater coverage; No filtering – only forwarding & regeneration |
| Active Hub | Physical layer | To extend the same LAN | It is a multiport repeater |
| Bridges | Both physical & data link layer | Connects two different LANs | Has filtering capacity – uses a bridge table to match address to port |
| 2-Layer Switch | Physical & data link layers | Connect many different LANs | Add functionally to bridges like advanced filtering and multiport capability |
| Router | Physical, data link & network layers | Connects multiple networks of the same protocol stack | Routes packets based on their logical address |
| 3-Layer Switch | Physical, data link & network layers | Multiple networks of same stack | Adds features to routers like faster look up tables & hence, faster forwarding |
| Gateway | All 5 Layers | Connects networks of different protocol stacks | Provides filtering and security |

POST-LAB TASK:-

This was the first network.

- A) CSNET
 - B) NSFNET
 - C) ANSNET
 - D) ARPANET
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Which organization has authority over interstate and international commerce in the communications field?

- A) ITU-T
 - B) IEEE
 - C) FCC
 - D) ISOC
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_____ are special-interest groups that quickly test, evaluate, and standardize new technologies.

- A) Forums
 - B) Regulatory agencies
 - C) Standards organizations
 - D) All of the above
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Which agency developed standards for physical connection interfaces and electronic signaling specifications?

- A) EIA
- B) ITU-T
- C) ANSI
- D) ISO

1. What is mean by network?

2. List the types of network?

3. What is the function of the router?

4. Why the network devices are use?

5. Write the limitation of the network using SWITCH?

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