Unit 7

DATA COMMUNICATION AND NETWORKING

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DATA COMMUNICATION AND NETWORKING

7.1 Introduction:

The rapid growth of the technology has enhanced the role of data communications in modern life. The knowledge of computer networks is now essential part of basic information technology concepts. Therefore this unit has been included at the bachelor level course. It covers fundamental view of the broad field of data communications and network

7.2 Objectives:

After completing this unit, students should be able to:

- Learn the conceptual model and basic elements of data communication system
- Differentiate between data transmission mode and data transmission forms.
- Understand different type of data transmission media
- Learn basic concepts of computer networks
- Have a knowledge of switching and routing techniques
- Understand concept of OSI layer model

7.3 Data Communication

Data communication is the flow of electronic data among two nodes (computers and other devices) through communication media.

In order to manage the communication, the nodes must be part of communication system and linked with each other via some media like cables or microwave. Furthermore the data communication software is used to transfer data from one node to another.

Figure-7.1: Data Communication

The communication system is governed by three fundamental principles that include deliver, accuracy, and timeliness.

1. Delivery: The system must carry data to the correct end or destination. Data must be received by the correct recipient (device/user).

2. Accuracy: The system must deliver the data with accuracy. The

altered or incomplete data is unusable, therefore it should be accurate as per sending format.

3. Timeliness: The system must deliver data in time. Late delivery of data may not be effective; therefore time delivery should be achieved.

7.4 Basic Elements of Communication System:

The following five basic elements are required for any communication system.

1. Message: Message is the information that is communicated over the communication system. It includes text, audio, video and images.

2. Sender: The node that is used for transferring data is called transmitter, source or sender. In recent digital communication system, the source is mostly a computer or a mobile device.

3. Medium: Medium is the pathway through which data is sent from one point to another. If the receiver and transmitter are within a building, a wire can connect them. If they are located at different locations, they may be connected through telephone lines, fiber optics or microwaves.

4. Receiver: The node that receives the data is called receiver. The receiver can be a computer, mobile device or a printer.

5. Protocols: A protocol is set of rules which govern the data

transmission between sender and receiver. Without protocol the information is useless for the receiver as a person understanding only Urdu cannot understand English messages. Therefore messages sent over through communication protocols can only be understood by the receiver.

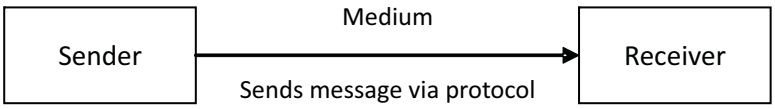

Figure-7.2: Elements of Communication System

7.5 Data Representations Forms:

Different kind of information can be sent over through a communication channel. It includes the following:

1. **Text and Numbers**

   Text and numbers are sequence of bits (0s or 1s). They are represented by a set of bit patterns called code. The code is sent over the communication channel from a sender to a receiver

2. **Images**

   Images are also characterized by special bit patterns. It is comprised of matrix of pixels (picture elements). The size of image is larger than that of text and numbers therefore data transmission speed is important for reliable and fast delivery of images.

3. Audio and Video

Audio refers to the recording or broadcasting of music or sound and video refers to the recording or broadcasting of a movie or picture. They both are also sent over the communication system.

7.6 Data Transmission Modes:

There are three modes of data communication simplex, half-duplex, or full-duplex.

7.6.1 Simplex Mode

In a simplex connection, the data flows only in one direction, from the source to the destination. This type of transmission is used when data do not need to flow in both directions. For example, the instructions flow from your key board to CPU and from CPU to printer. Another important example is the television and radio transmission.

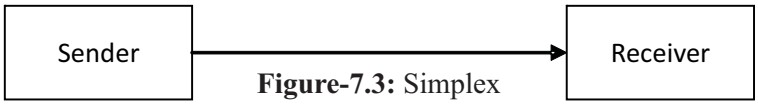

Figure-7.3: Simplex

7.6.2 Half-duplex

In half-duplex the data flows in both directions but one at the same time. It means that data can be either sent or received in turn-wise. If a device is receiving data then it cannot sent any data at the receiving time. Walkie-talkie is an example of half duplex where a user ends his transmissions with announcements of "over" to prevent overlap and facilitate other to talk. Surfing on Internet is also an example of half-duplex, as a client issues a

request for a web document and server sends the document before the client issues another request.

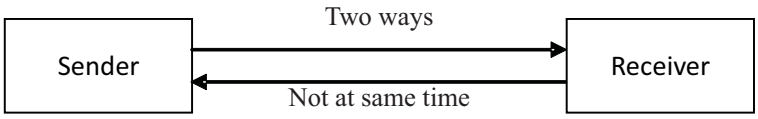

Figure-7.4: Half-duplex

7.6.3. Full-duplex

In full-duplex the data flows in both directions at the same time. Each node can thus transmit and receive the data simultaneously. Telephones are common examples of full-duplex devices. They allow both users to hear each other and talk at the same time.

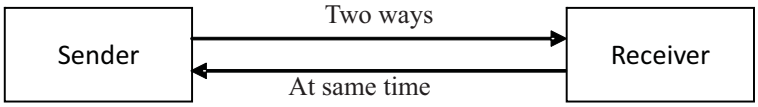

Figure-7.5: Full duplex

7.7 Data Transmission Speed:

Data Transmission speed is measured in bandwidth. It is a measure of the amount of data transferred through a network over a given amount of time. It is also called data transfer rate or baud and expressed in bits per second (bps).

A bit is the unit of information that is stored and processed by computers; it is either 0 or 1. A data transmission speed of 100 baud means 100 bit are transferred in one unit of time. All transmitted signals have a certain bandwidth, as do the receiving systems.

7.8 Data Transmission Forms:

There are two forms of data transmission i.e. Analog and Digital.

7.8.1 Analog Transmission

Analog is the transmission of data in a continuous wave form. Analog signals are represented by continuous signals which reflect the time varying quantities over a time interval. The human voice is an example of analog data. When someone talks, an analog wave is created in the air medium. The voice can be captured by a microphone and transformed to an analog signal. The outputs of many sensors, such as temperature and pressure sensors, are also examples of analog data. Analog signals are represented by continuous range of values as shown in the following figure.

Figure-7.6: Analog Transmission

7.8.2 Digital Transmission:

Digital is the transmission of data using distinct on and off electrical states. As you can switch on or off your light the data bit can have values 0 or 1. The combination of these bits actually forms the binary code. In this way the signals are converted into a binary code by grouping of binary numbers 0 (off) and 1 (on). The binary code forms the digital data. The data stored in computer memory is an example of digital data. It can be converted into

digital signal where it is transferred from one computer to other. At the receiving end it is again converted into analog signal. Digital signals are represented by discrete or discontinuous values as shown in the figure.

Figure-7.7: Digital Transmission

7.9 Data Transmission Media:

Data Transmission Media is the pathway used to carry a communication signal from one system to another. It is the means of communication from sender to receiver. There are two types of transmission media:

- Guided Media: Use a physical path for communication
- Un-guided-Media: Does not require any physical path for communication

7.9.1 Guided Media:

Guided Transmission media is based on a cabling mechanism that direct the signals of data transmission along a specific path. The data signals are dependent upon the physical characteristics of the medium; therefore it is also called bound media.

There are three basic types of Guided Media:

7.9.1.1 Twisted Pair

7.9.1.2 Coaxial Cable

7.9.1.3 Optical Fiber

7.9.1.1 Twisted Pair Wire:

Twisted Pair is a couple of copper wires, twisted together and enfolded with a plastic coating. Each pair consists of two wires used for the positive data signal and negative data signal.

Figure 7.8: Twisted Pair

One wire carries the signal while the other provides the ground reference. The difference between the two is used by the receiver. If a noise appears on one wire it also emerges on the other. However the twisting maintains the balance and reduces the distortion among the cable. It also decreases the tendency of the cable to give out radio frequency noise due to nearby cables and electronic components. There are two kinds of twisted pair wire:

- **Shielded Twisted Pair**
- **Unshielded Twisted Pair**

- **Shielded Twisted Pair:**

Shielded Twisted Pair cable is composed of two cables, twisted with each other and enclosed in a foil cover and woven copper shielding. STP cable uses shields to reduce outside interference. It is more secure cable since it keeps the signal from leaking out from it.

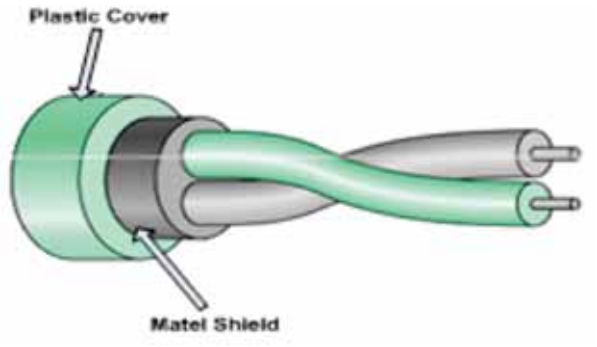

Figure-7.9: Shielded Twisted Pair

- **Unshielded Twisted Pair:**

Unshielded twisted-pair cable is not enclosed in any cover. UTP cable is usually very flexible and is easy to use. However it can get unnecessary interference and data from other cables and networks. The other disadvantage is that the UTP while traveling through it may leak to other nearby cables. UTP cables are used in local telephone communications and short distances up to 1 km.

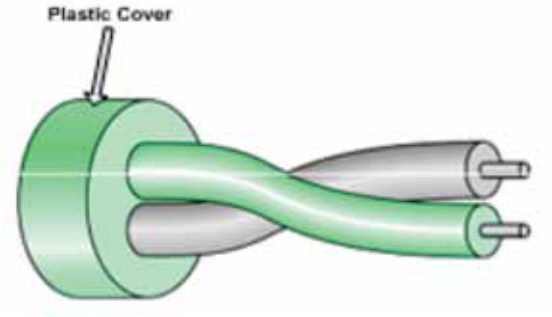

Figure-7.10: Un-shielded Twisted Pair

7.9.1.2 Coaxial Cable:

Coaxial cable like twisted pair is comprised of two conductors. However its construction is slightly different as compared to coaxial cable. It consists of

two cylinders; a hollow outer cylindrical conductor and an inner conductor. The outer cylinder surrounds a single inner wire conductor and includes physical channel that carries the signal. It is covered with a jacket or shield The inner conductor is a solid dielectric material surrounded by regularly spaced insulating rings..

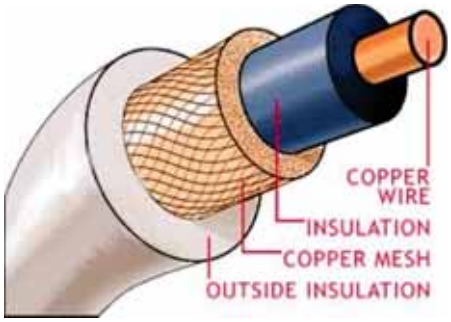

Figure-7.11: Coaxial Cable

A signal coaxial cable has a diameter which varies from 1 to 2.5 cm. Due to protected construction; coaxial cable is much less vulnerable to interference and crosstalk as compared to twisted pair. Coaxial cable can be used over longer distance and support more stations on a common line than twisted pair.

Coaxial cable is one of the most common types of flexible transmission medium. Due to its flexibility it is used in wide variety of data transmission applications. The most important of these includes:

- **Television Network**
- **Long-Distance Telephone Communication**
- **Local Area Networks**

Coaxial cable is also effectively used in the scenarios where distance is short and high data communication rate is required.

7.9.1.3 Optical Fibers:

An optical fiber is a slim, flexible and transparent medium for data transmission. The optical fiber transports the data with very high speed by converting electrical data signals into light signals and transmits it through a thin glass fiber. These signals are re-converted into electrical signals.

The shape of optical fiber is like a cylinder that consists of three sections: the core, cladding, and the jacket.

Core: Core is the inner most section which serves as light-carrying device. Cladding: Cladding is the middle layer, which serves to detain the light to the core. Jacket: Jacket is the outer layer which protects the core and cladding from damage. It also serves as a "shock absorber" against crushing and other environmental damages.

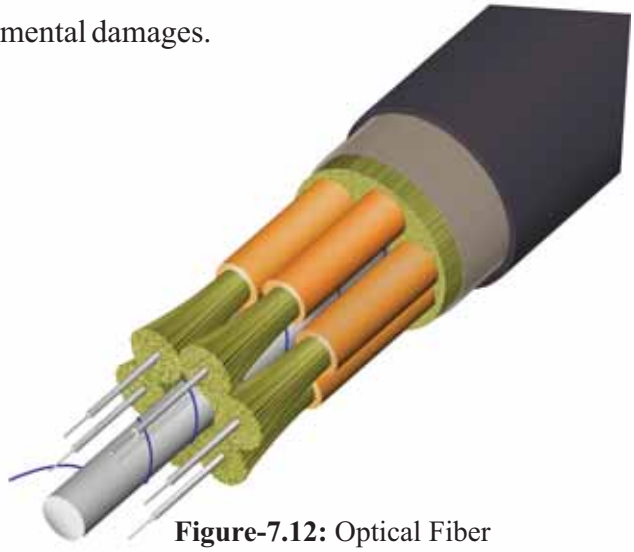

Figure-7.12: Optical Fiber

Some important features of optical fiber include the following:

1. Optical fiber provides protection against external electromagnetic fields.
2. Optical fiber has low attenuation than coaxial cable or twisted pair.
3. They are smaller in size and lighter in weight.
4. They have greater capacity of data transmission.

Uses of optical fibers include the following:

1. Optical fibers are used as light guides and imaging tools for microscopic study and factory automations.
2. Optical fibers are used as lasers for surgeries in medical field.
3. Optical fibers are used to construct networks of different topologies.
4. Optical fibers provide high speed data transmission with accuracy.
5. Broadcast/cable companies are using fiber optic cables for wiring purposes.

7.9.2 Unguided Media:

Unguided media doesn't use any physical path between the two devices communicating. It simply carries electromagnetic waves without using any physical medium. Signals are normally broadcasted through the atmosphere

and carry on to the receiving end. Important types of unguided media include microwave systems and communication satellite.

7.9.2.1 Microwave Systems:

Microwaves are of high frequency radio signals that transmit data through space. It is used to provide communication link when it is unrealistic or too costly to install physical media.

Following are the types of Microwaves.

- **Terrestrial Microwaves**
- **Satellite Microwaves**
- **Terrestrial Microwaves:**

Terrestrial Microwaves are used to broadcast wireless signals across a distance (few miles). The transmitter is a parabolic dish (shaped like a bowl) and is mounted as high as possible to get the best frequency and transmission. These waves cannot bend or pass through buildings and hills therefore unblocked line of sight must be available between the source and the receiver. Repeaters are also used at a distance of 25-30 km between transmitting and receiving stations. Both private networks and common carriers can use terrestrial microwaves.

Terrestrial microwaves are used for both radio (voice) and television transmission. It can also be used for closed-circuit television but short

point-to-point connections between buildings will be needed for the transmission to work.

- **Satellite Microwaves:**

Satellites are transponders (units that receive on one frequency and retransmit on another) that are set in orbits directly over the equator. Communication satellites are microwave relay stations placed in space.

Satellite dishes are used to send the signals to the satellite where it is again send back down to the receiver satellite. The uplink is the transmitter of data to the satellite and the downlink is the receiver of data. Uplinks and downlinks are also called Earth stations because they are located on the Earth.

The communication satellite is a technological revolution in modern data communication. They are used in different data communication applications like:

i. Television distribution
ii. Long-distance telephone communication
iii. Private commercial networks

Because of their broadcast nature, satellites are used to broadcast live cricket matches and other sports programs and therefore extensively

used throughout the world. Programs are transmitted to the satellite and then broadcasted down to a number of stations. The stations distribute the programs to different destinations.

Satellite communication also provide one-to-one link between telephone exchange networks. It provides an efficient and reliable way to connect international trunks.

Another important use of satellite communication is its use in business data applications for satellite. The total channel capacity of satellite is divided into sub-channels and individual business users are given access to it. They use special antennas and dishes to download the sub-channel transmissions.

7.10 Switching Techniques:

A network is a connection of interlinked nodes. If there are more than two nodes then one to one communication requires some complex arrangements. One solution is to connect each node with the other but if there are large number of nodes than this solution is not possible

A better solution is switching. A switch is a connecting device that links network segments or network devices. Switches are also capable of building provisional connections between two or more network nodes. Some of the nodes are connected with the end systems. There are two important methods of switching i.e circuit

switching and packet switching.

7.10.1 Circuit Switching:

In circuit switching a devoted channel (or circuit) is built during transmission of data. In this method a physical path is created for a single connection between two end-points in the network for the period of the connection.

After the circuit or channel has been established, the data transfer takes place. The transmission path is booked during the transfer of data and other systems/devices cannot use it until the data transfer is completed and the circuit is released. The most common example of a circuit-switched network is the public telephone network like PTCL which provides telephone services.

7.10.1.1 Advantages of Circuit Switching:

- The circuit switching communication is efficient.
- There are less chances of errors.
- It is also highly reliable.

7.10.1.2 Disadvantages:

- Circuit switching requires a lot of formalities, during formation of the circuit.

- The bandwidth may be wasted, especially; when a user is only listening, and not talking.
- The set up of the channel may take longer time.

7.10.2 Packet Switching:

Packet switching is another communication method which divides data into small size blocks called packets. The packets have different type of transmitting data regardless of content, type, or structure. Each packet contains a "header" which consists of routing information from source to destination.

The same data path is shared among the users in a network due to division of different data items into packets. The packets are also independent of each other and therefore dedicated communication link is not required. This type of communication between sender and receiver is also known as connectionless. The example of packet switching includes Internet where most of the applications transfer data via connectionless mode of communication.

7.10.2.1 Advantages of Packet Switching

- It makes efficient use of network resources.
- It can manage variable data rates.
- It can easily handle increase number of transactions.

7.10.2.2 Disadvantages of Packet Switching

- It is not good scheme for small data packages.
- The ordering of packets may alter during the transmission and re-ordering may take more time.

7.11 Routing Techniques:

Routing is the process of transferring information from one location to another across a network. It's also referred to as the procedure of selecting a path to send the packets over a network. Routing is one of the most important features of the Internet because it takes messages from one node to other. Each node receives information and passes it to other until it reaches to its destination.

A router is a device that carries route to the routing process. It receives the packet and forwards it to its next destination node. It is located at gateways, the network connection point which connects two networks with each other.

A router can also maintain a data structure of the available routes and their conditions. The information is used to manipulate distance and cost algorithms in order to determine the best route for a given packet. Two popularly used routing techniques include source and hop by hop routing.

7.11.1 Source Routing:

Source routing is a technique that is used to specify the route of a packet

through the network. In this routing technique, the source needs to pass information along a specified way. Therefore the path through the network is set by the source or a device. The device provides complete information about the desired path to the network source. It is also assumed that packet source is familiar with the design of the network and can indicate the optimal path for the packet. Source routing can be used to troubleshoot a network and increase the network performance.

7.11.2 Hop by Hop Routing:

In hop by hop routing, the source does not have all the information about the destination. In this method each node along the path passes the information packet only to the next node. The packet forwarding process keeps on working until the final destination is reached. Hop by hop routing decisions are based on channel availability and readiness of adjacent nodes.

7.12 Difference between Switching and Routing:

The switching method makes use of switches only. A switch acts as a connector only, it receives packets and sends them directly. It connects one point of a network to other turning it on and off as necessary. Switches work at layer 2 of the OSI model (we will study OSI model in next section). A switch examines the MAC address and determines where a packet should be sent within the data link header of the packet, where the MAC address is unique identifier for a node over a network. A switch

maintains information about MAC address and related ports in database and uses it to find next location.

The routing method makes use of routers. A router acts as a connector and a scheduler and manages traffic of the network. It determines the optimal path (shortest or fastest) in a network, and routes packets accordingly. A router makes use of Network ID within the Network layer header to determine next destination of the packet. The information about destination host is maintained in routing table. The router makes use of this routing to determine the route to the destination host.

7.13 Network Topologies:

Network topology is the connection arrangement of the various links and nodes of a computer network. It is the topological structure of a network that defines configuration of cables, computers, and other peripherals.

The major types of network topologies include Star, Ring, Bus and Hybrid topologies.

7.13.1 Star Topology:

Star Topology is the most general type of network arrangement that is used in offices and homes. In Star topology, all the components of network are connected to a connection device. This device is known as "hub".

The communications take place via Hub, which acts as a common connection

device. All the data initiated by nodes passes through the Hub. The Hub forwards it to the destination node. Hub also manages and controls the whole network.

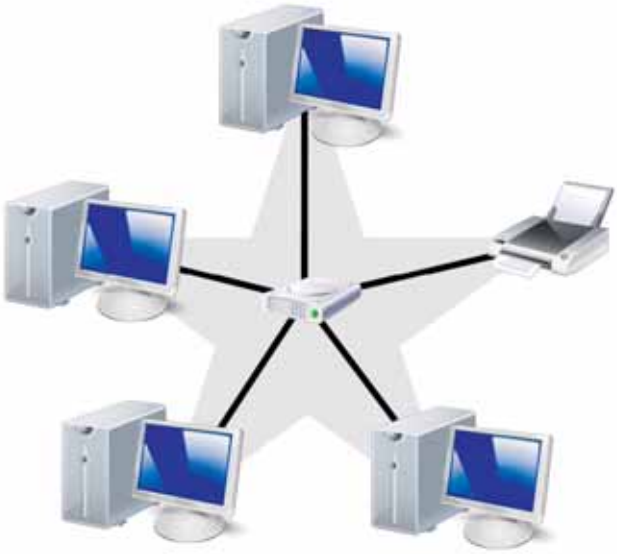

Figure-7.13: Star Topology

7.13.1.1 Advantages of a Star Topology:

1. The star topology is easy to install.
2. The wiring arrangement is also easy.
3. The transmission delays do not increase if a new node is added.
4. If any node fails, it does not affect the network
5. It is easy to detect faults.
6. Addition and removal of parts is easy in star topology.

7.13.1.2 Disadvantages of a Star Topology

1. Star topology requires large cable length.
2. If the hub goes down, the whole network will be blocked.

7.13.2 Ring Topology:

In a ring network; the nodes are attached with each other in a closed loop. Each node has exactly two neighbors. The computers and devices connect each other and complete the network. Each packet is initiated across the circle and passes through all nodes until it reaches its final destination. Any breaks in the connection loop might take down the entire network. Today, the ring topology is seldom used.

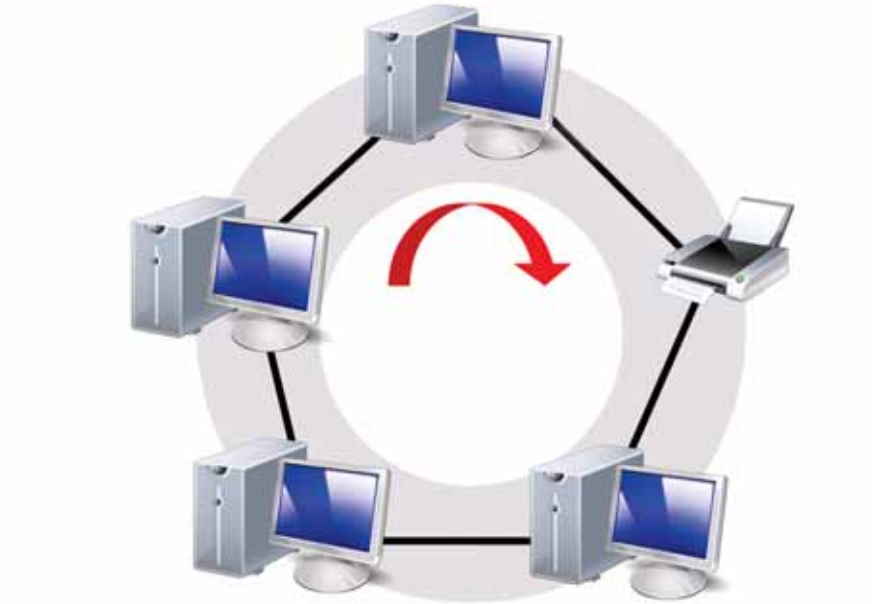

Figure-7.14: Ring Topology

7.13.2.1 Advantages of a Ring Topology:

1. There is no central node for controlling the network.
2. Ring topology is easy to install
3. The wiring arrangement is also easy.
4. It provides equal access to devices and not a single node use all the bandwidth

5. It is easy to detect faults.
6. Adding and removing node is also simple

7.13.2.2 Disadvantages of a Ring Topology

1. The transmission signals go in sequential order which create delays.
2. A single break in cable can disturb the flow of whole network

7.13.3 Bus Topology:

Bus Topology is one of the most simple network topology. In bus topology all the nodes are connected into a single cable. This central cable is the backbone of the network and therefore it is known as the Bus. Every node send and receive through this Bus.

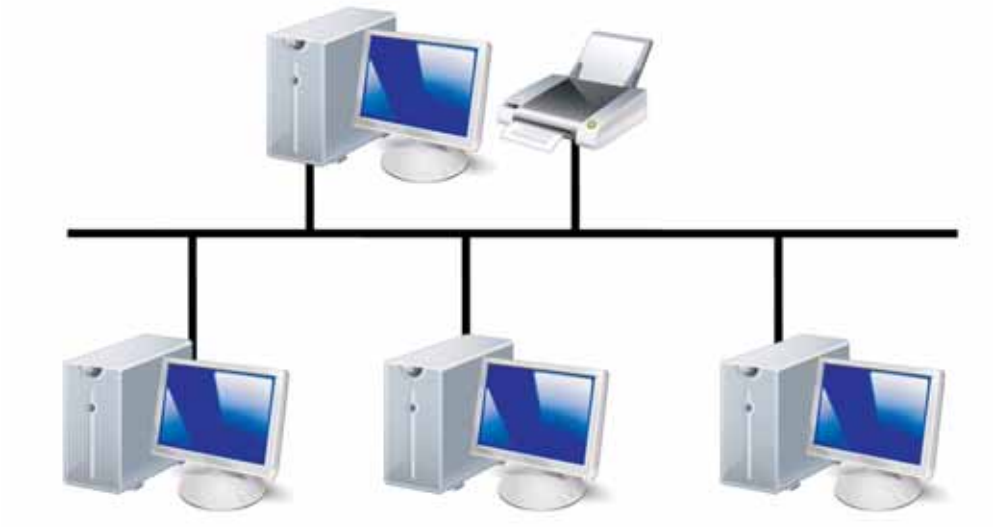

Figure-7.15: Bus Topology

7.13.3.1 Advantages of a Linear Bus Topology:

1. It is easy to add a new node in bus topology.
2. Bus topology requires smaller cable length as compared to star topology.
3. It is also cheaper as compared to star topology.
4. It is suitable for small networks.

7.13.3.2 Disadvantages of a Bus Topology:

1. If main cable breaks the whole communication system goes down.
2. All nodes should be capable to respond immediately against messages.
3. The main cable requires terminators at both ends.
4. If the number of devices is increased it drops down the efficiency of bus network.
5. It is not appropriate for networks with heavy amount of traffic.
6. The security of bus network is low because all the nodes receive the signals from the source.

7.13.4 Mesh Topology:

A mesh topology is made up of a network where each node is interconnected with each other. It provides a one-to-one connection between devices on the network. The arrangement of mesh technology is very expensive as dedicated connections are required between every node of the network and it

results in many redundant connections. The mesh topology is not frequently used to develop media based computer networks. Therefore it is mostly used in wireless networks.

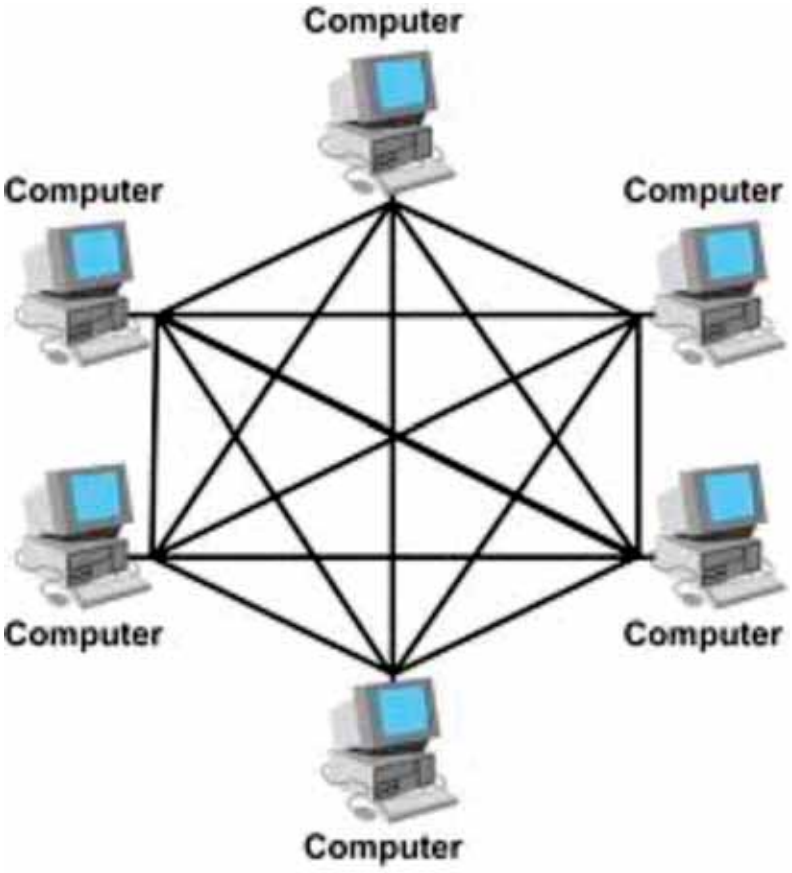

Figure-7.16: Mesh Topology

7.13.4.1 Advantages of Mesh Topology

1. Mesh topology allows to send data from different devices simultaneously.
2. If one of the nodes fails it does not affect the network.
3. Extension and alteration in mesh topology can be done without disturbing the other nodes.

7.13.4.2 Disadvantages of Mesh Topology

1. There are high chances of redundancy in many of the network connections.
2. Overall cost of mesh network is high as compared to other topologies.
3. Set-up and maintenance of this topology is also very difficult.

7.14 Types of Network:

A computer network connects two or more systems in order to exchange data and information with each other. Computer Networks are classified into three broad categories i.e. LAN, MAN and WAN.

7.14.1 Local Area Network (LAN):

A Local Area Network (LAN) is a connection network that connects group of systems and devices with each other within a limited geographical area, such as office or school. Most LANs connect personal computers and other devices including printers; with each other. Each node in a LAN has its own CPU and storage area. In addition, it has the access to the resources of other nodes anywhere on the LAN. It allows the users to share sophisticated devices, such as laser printers, data and other resources in LAN. They can also communicate with each other, by sending messages and e-mails. LANs are characterized by the following properties:

i. They transfer data with very high speed.

ii. They exist in a small geographical area.

iii. The LAN technology is less expensive.

7.14.2 Metropolitan Area Network (MAN):

A MAN (Metropolitan Area Network) is a larger network than LAN and usually covers several buildings and offices in the same city or area. It can connect several nearby LANs to one another (over an area of up to a few kilometers) at high speeds.

7.14.3 Wide Area Network (WAN):

A Wide Area Network (WAN) interconnects LANs and MANs. A WAN may be located within a province or country, or it may be interconnected around different parts of the world. WANs are characterized by the following properties:

i. They can span in an unrestricted geographical area.

ii. They interconnect multiple LANs and MANs.

iii. They are more complicated and complex than LANs and MANs.

iv. The WAN technology is expensive.

7.15 Communication Protocol:

A computer network connects two or more nodes together to share data, information and resources. Multiple networks are connected together to form a grand network. Besides the cables, there are many processes that execute behind the scene in order to run the network smoothly. However the smooth running of network is governed by some standards and specifications. These standards and specifications define set of rules for data communication and network.

A protocol is a set of rules and procedure that governs a process. A communication protocol describes the rules and regulations for data transfer between nodes over a network.

In a computer network, a communication protocol performs the following functions.

1. It defines the size of data blocks/packets.
2. It provides numbering scheme of data packets.
3. It provides error and flow control.
4. It also defines mechanism of connection establishment and termination.
5. It manages the data security.
6. It manages the data routing algorithms for delivery of data.
7. It also manages the communication log information.

The communication networks use layered protocols to manage the communication.

A layered protocol provides a conceptual framework to simplify the network design by dividing it into functional layers. These functional layers take the responsibility of data exchange in different forms and levels. Each protocol layer has a defined functionality. A layer provides a communication interface to the next higher protocol layer. It also conceal the details of the main physical network infrastructure.

The most important network protocol is OSI.

7.6 Concept of OSI Model:

The Open Systems Interconnection (OSI) is most commonly used protocol in network communication. The OSI model was first released in 1984 by the International Standards Organization (ISO). It describes the data transmission procedure in the form of seven layers. It explains how information is sent through a sender to a receiver and also describes different stages where information takes different forms through the underlying architecture of seven layers.

The OSI model consists of seven layers, each corresponding to a specific network function. The seven layers are Physical, Data Link, Network, Transport, Session, Presentation and Application.

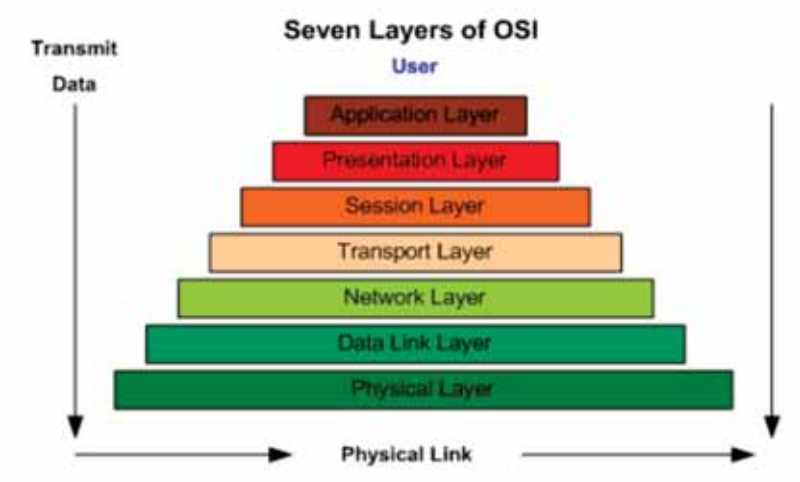

Figure-7.17: OSI Layers

7.16.1 Layer 1: Physical Layer

Physical layer is concerned with the bit stream that is transmitted over the physical medium. It deals with electrical, mechanical and timing specification of the interface and transmission medium. It also defines the functional and procedural specifications of the medium.

The physical layer is hardware-specific and describes procedures and functions for dealing hardware over the network. It also deals with physical characteristics of medium, data rate, synchronization and line configuration and physical topology of the network.

7.16.2 Layer 2: Data Link Layer

The Data Link layer is responsible for transmission of data over the network. It receives messages, from upper layers and assembles it into frames. Data Link layer converts these frames into bits for transmission over the network. It also receives the bit at the other end and reconverts it into the frames. The

Data Link layer has other functions as well, such as physical addressing, error, flow and access control for a single link between network nodes.

7.16.3 Layer 3: Network Layer

The network layer is responsible for delivery of messages from source to destination. It deals with routing of messages by translating logical addresses into physical addresses. It determines the path of the data on the basis of network environment, urgency of service, and other factors. It also manages traffic flow and associated problems on the network, such as switching, routing and congestion of data.

The network layer handles the routing and packet filtration using the logical addressing mechanism.

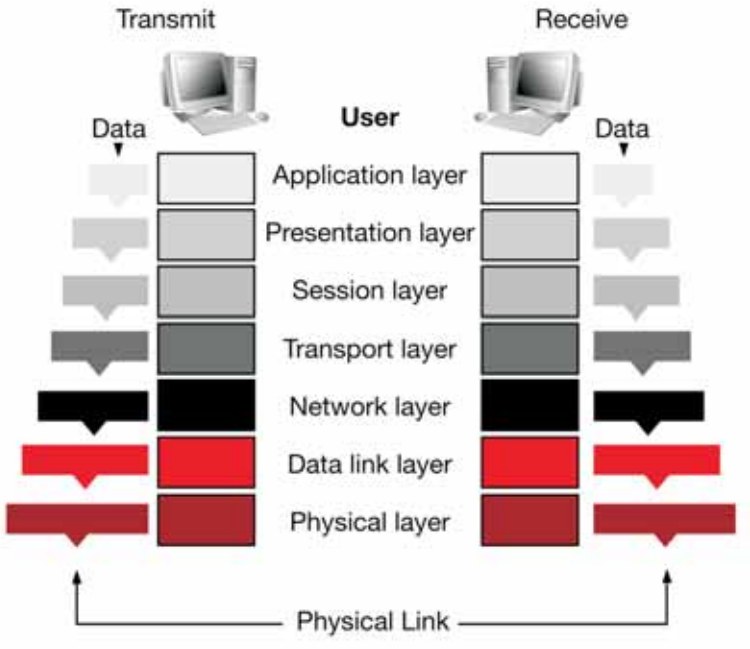

Figure-7.18: OSI Reference Model

7.16.4 Layer 4: Transport Layer

The Transport Layer receives messages from session layer and divides it in the form of packets. It submits the packets to network layer for transmission over the network. At the receiving node, it re-sequences the message by reassembling the packet segments. The transport layer ensures end to end delivery of packets and sequenced and ensures error delivery without losses or duplications.

The Transport Layer facilitate the upper but hiding the complexities of network operation from them. It also manages connection, flow and error control. It uses acknowledgment to manage source to destination flow control.

7.16.5 Layer 5: Session Layer

The Session Layer manages dialogues between two computers. It looks after identification of names and security parameters that are required by applications to communicate with each other. The session layer insert checkpoints in the data flow to synchronize the data stream. The checkpoints break the data into smaller groups for error detection.

The Session Layer also incorporates protocols to resume dialogues that have been interrupted.

7.16.6 Layer 6: Presentation Layer

The Presentation Layer looks after syntax (grammatical rules) and semantics of information needed for communication between two nodes. It defines the data and display format required to exchange information among network computers. The Presentation layer also handles the data formatting details, such as data encryption and data compression.

7.16.7 Layer 7: Application Layer

The Application Layer of the OSI reference model enables the user to access the network. It is concerned with providing user interfaces and services on the network, like file services, print and email services, and database services.

7.16.8 Network Interface Card:

Network Interface Card is a hardware device that physically makes the connection between the computer and the network cable. It is a printed circuit board that is installed on the expansion slot of the computer. It also provides a port to connect the network cable. The important functions of NIC are to:

1. Send the data to another host
2. Receive the incoming data and translate it into machine language
3. Prepare data from the computer for the network cable.

4. Control the flow of data.

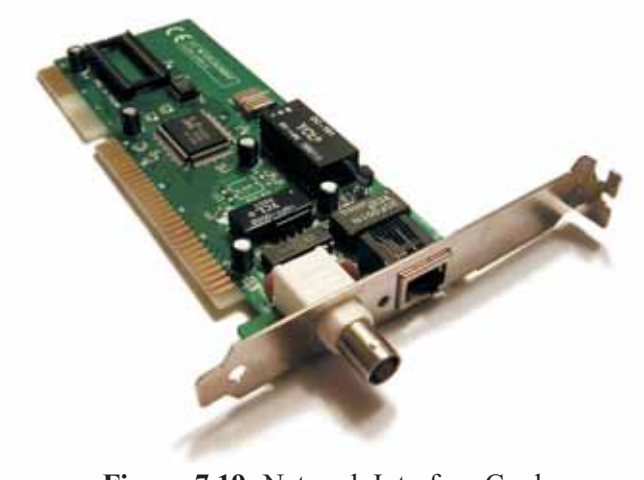

Figure-7.19: Network Interface Card

7.17 Self Assessment Questions:

Q.No.1. Identify basic elements of a communication system.

Q.No.2. Differentiate between Simplex, Half Duplex and Full Duplex.

Q.No.3. How speed of data transmission is measured?

Q.No.4. What are important types of communication media? Differentiate between analog and digital transmission.

Q.No.5. Differentiate between LAN and WAN. Also describe their features.

Q.No.6. Explain different types of network topologies with their characteristics.

Q.No.7. Explain the difference between Switching and Routing.

Q.No.8. Describe the basic concepts of OSI reference model.

7.18 Self Assessment Activities:

Visit IT department of any office or a company. Study the network architecture. Prepare a brief report.

Surf the Internet and explore mobile device communication standards.