

Chapter = 04

Data Communication and Computer Networks

Q1. List the properties of a good communication system. Explain any one.

Properties of a Good Communication System



The effectiveness of a data communications system depends on the fundamental characteristics which include delivery, accuracy and timeliness.

Characteristic

1. Delivery

Making sure that the data is delivered is the first fundamental characteristic of any communication network. The system must be able to deliver data in correct order to the correct destination.

3. Accuracy

The system must deliver the data accurately. Data that has been altered during transmission and left uncorrected is not useful.

4. Timeliness

The data must be delivered in a timely manner. Late delivered data is useless.

Q2. Explain components of communication using single example.

Components of a Communication System

A Communication system has following five components

1. Message

It is the information or data to be communicated. Common forms of information include text, numbers, pictures, audio and video.

2. Sender

It is the device that generates and sends a message. It can be a computer, telephone handset, etc.

3. Receiver

Any particular digital electronic device which has capability to receive data in form of message. The location of receiving computer is generally different from the sending computer. Like sender, it can also be a computer, telephone handset, etc.

4. Medium

It is the channel or path through which the message is carried from sender to the receiver. Some examples include twisted-pair cable, coaxial cable, radio waves, etc.

5. Protocol

Protocols are the rules and procedures on which computers exchange data on network. Sender and receiver follow same protocols to communicate with each other. In other words, a protocol is an agreement between two parties or vendors, using communication devices.

Q3. Write the function of following network devices.

Amplifiers, Routers, Switch, Hub

Amplifiers

Amplifiers are used to overcome attenuation and make signal stronger again.

Router

A Router is a device that connects two or more networks. Routers are a combination of hardware and software. The main function of a router is to

determine the optimal data path and transfer the information through that path, also known as network traffic controller.

Switch

A switch or network switch is a networking device that connects computers and other devices like printers, scanners and cameras on a network. Data cables from all computers and other devices of network are plugged into the switch to enable communication between them.



Hub

Hub is commonly used to connect segments of a LAN (Local Area Network). A hub contains multiple ports. When a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets. Hub acts as a common connection point for devices in a network.

Q4. List the causes of signal impairments. Explain them.

Causes of impairment

There are three causes of impairment i.e.

attenuation

distortion

noise

1. Attenuation

Attenuation means loss of energy. A signal loses its energy due to the resistance of medium while it is transmitted. Its strength decreases with

increase in distance. Amplifiers are used to overcome attenuation and make signal stronger again. It is measured in decibels.

2. Distortion

Distortion means change in the shape of the signal. A composite signal has several frequencies. When it travels through a medium different component of signal may reach at different time at destination because each component has different speed in that medium. This is called distortion. They have different phases at sender and receiver ends.

3. Noise

Unwanted signal that mixes up with the original signal during the transmission of data is called noise. It can be induced noise, crosstalk noise, thermal noise and impulse noise which may damage the signal.

Q5. What is the difference between radio wave and microwave?

Microwave	Radio Waves
Microwave transmission is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other.	Radio waves are also called electromagnetic waves. These are easy to generate and can penetrate through buildings.
Microwaves are electromagnetic waves with frequencies between	Radio waves are electromagnetic waves within the frequencies 30KHz - 300GHz, and Microwaves

300MHz (0.3GHz) and 300GHz in the electromagnetic spectrum.	are at the higher frequency end radio waves are at the lower frequency end.
These are mostly used for mobile phone communications tower and television broadcast	FM, AM radios, television and cordless phones use radio waves

Q6. Why OSI model is broken up in layers?

OSI model



The Open Systems Interconnection model is a conceptual model developed by ISO. It characterizes and standardizes the communication functions of a telecommunication and computing network. Its goal is the interoperability of different communication systems with standard communication protocols. This model divides a communication system into seven abstraction layers

Q7. Explain the purpose of Standard Organization.

Purpose of Standard Organization

Standard Organization develops, coordinates, revises, amends and reissues technical standards. These standards are intended to address the requirements of a group of concerned devices. There are several organizations working on standardization of computing equipment to enable the interoperability among different devices manufactured by different companies in different regions. IEEE, IETF, ITU and ANSI are the examples of standard organizations.

Q8. List merit and one demerit of each topology.

Bus Topology

Advantages of Bus Topology

1. It is easy to set up, handle, and implement.
2. It is best-suited for small networks.
3. It costs very less.

Disadvantages of Bus Topology

1. The cable length is limited. This limits the number of network nodes that can be connected.
2. This network topology can perform well only for a limited number of nodes. When the number of devices connected to the bus increases, the efficiency decreases.
3. It is suitable for networks with low traffic. High traffic increases load on the bus, and the network efficiency drops.
4. It is heavily dependent on the central bus. A fault in the bus leads to network failure.
5. It is not easy to isolate faults in the network nodes.
6. Each device on the network “sees” all the data being transmitted, thus posing a security risk.

Ring Topology

Advantages of Ring Topology



1. The data being transmitted between two nodes passes through all the intermediate nodes. A central server is not required for the management of this topology.
2. The traffic is unidirectional and the data transmission is high-speed.
3. In comparison to a bus, a ring is better at handling load.
4. The adding or removing of network nodes is easy, as the process requires changing only two connections.
5. The configuration makes it easy to identify faults in network nodes.
6. In this topology, each node has the opportunity to transmit data. Thus, it is a very organized network topology.
7. It is less costly than a star topology.

Disadvantages of Ring Topology

1. The failure of a single node in the network can cause the entire network to fail.
2. The movement or changes made to network nodes affect the entire network's performance.
3. Data sent from one node to another has to pass through all the intermediate nodes. This makes the transmission slower in comparison to that

in a star topology. The transmission speed drops with an increase in the number of nodes.

4. There is heavy dependency on the wire connecting the network node

Star Topology

Advantages of Star Topology

1. Due to its centralized nature, the topology offers simplicity of operation.
2. It also achieves isolation of each device in the network.
3. Adding or removing network nodes is easy, and can be done without affecting the entire network.
4. Due to the centralized nature, it is easy to detect faults in the network devices.
5. As the analysis of traffic is easy, the topology poses lesser security risk.
6. Data packets do not have to pass through many nodes, like in the case of a ring network. Thus, with the use of a high-capacity central hub, traffic load can be handled at fairly decent speeds.

Disadvantages of Star Topology

1. Network operation depends on the functioning of the central hub. Hence, central hub failure leads to failure of the entire network.
2. Also, the number of nodes that can be added, depends on the capacity of the central hub.

3. The setup cost is quite high.

Q9. Discuss brief of LAN, WAN and MAN.



1. Local Area Network (LAN)

LAN is a group of computer and peripheral devices which are connected in a limited area such as school, laboratory, home and office building. Useful resources like internet access, storage space and printers can be shared through LAN. It can be built with inexpensive hardware such as hubs, switches, network adapters and network cables. Data and software are also shared through LAN.

2. Metropolitan Area Network (MAN)

In MAN, computer network can spread across an entire city, college campus, or a small region. It can cover the area of several miles and may include multiple small networks or LANs. MANs offer very fast communication but they are expensive to establish. Therefore, only large business organization or universities set up MAN. It also requires security measures to prevent unauthorized access.

3. Wide Area Network (WAN)

A Wide Area Network is used for long distance transmission of data. WAN helps to cover a larger geographical area and connect cities, provinces or even countries. Using WAN technology, computers may be linked together in different countries using satellites, microwaves or telecommunication links. Therefore, large business, research and educational organizations situated at longer distances use WAN. A WAN

may include multiple MANs and LANS. WANs are set up with expensive devices and need some dedicated connections.

Q10. Discuss the Basic Terminologies of Data Communication

Data

Collection of raw facts and figures is called data. The word data is derived from Latin language and it is plural of Datum. The text, numbers, symbols, images, voice and video which are processed by computers and digital devices are called data. Data can be considered as unprocessed information.

Data Communication

Data Communication is the process of transferring data electrically from one place to another. It is the process of exchange of data and information between two parties such as human and electronic or computing device.

Data Transmission

The data transmission means emission of data in any direction via wireless or wired medium. Transmission may occur between source and destination.

Analog Signals

Analog signals are a continuously varying signals or waves that change with time period and used to represent data. An analog signal can be used to measure changes in some physical quantities such as light, sound, pressure or temperature.

Digital Signals

A digital signal is an electrical signal that is converted into a pattern of bits to represent a sequence of discrete values, at any given time. It can only be one of the finite numbers represented as 0 or 1.

Q11. Difference between Analog and Digital Signals



Analog Signals	Digital Signals
An analog signal is a continuous wave that changes by time period.	A digital signal is a discrete wave that carries information in binary form.
Analog signal has no fixed range	Digital signal has a finite number i.e. 0 and 1.
An analog signal can easily be disturbed by other signals or waves.	A digital signal is less prone to other signals disturbance
The human voice is example of an analog signal.	Signals used by computer are the digital signal
An analog signal is represented by a sine wave.	A digital signal is represented by square waves.
Analog signals are long term waves need to be boosting.	Digital signals are short term signals remain within digital devices /electronic.

Choose the right answer:

1. Wired Media is also called:

- a) targeted media
- b) directed media
- c) guided media
- d) unguided media



2. Communication system is made up of

- a) three components
- b) four components
- c) five components
- d) six components

3. Both Physical and Logical addresses are:

- a) different
- b) unique
- c) permanent
- d) temporary

4. If you are an electrical or electronic engineer, you should join:

- a) IEEE
- b) IETF
- c) ITU
- d) ANSI

5. The topology in which all computers are connected to a central device called hub is:

- a) Bus
- b) Star
- c) Ring
- d) Tree

6. Change in the shape of signal between sender and receiver is called:

- a) attenuation
- b) interruption
- c) noise
- d) distortion

7. Router determines data path to transfer data packets which is the:

