CHAPTER

12

DATA COMMUNICATION AND NETWORKING

The term 'communication' means sending or receiving information. When we communicate, we share information or data.

A communication system can be defined as the collection of hardware and software that facilitates inter-system exchange of information between different devices.

Data Communication

It is the exchange of data between two devices using some form of transmission media.

It includes the transfer of data or information and the method of preservation of data during the transfer process. Data is transferred from one place to another in the form of signals.

There are three types of signal

1. **Digital Signal** In this signal, data is transmitted in electronic form, i.e. binary digits (0 or 1).
2. **Analog Signal** In this signal, data is transmitted in the form of radiowaves like in telephone line.
3. **Hybrid Signal** These signals have properties of both analog signal and digital signal.

Components of Data Communication

Whenever we talk about communication between two computing devices using a network, five most important aspects come to our mind. These are sender, receiver, communication medium, the message to be communicated and certain rules called protocols to be followed during communication. The communication media is also called transmission media.

Five components of data communication are

(i) **Sender** It is a computer or any such device which is capable of sending data over a network. It can be a computer, mobile phone, smartwatch, walkie-talkie, video-recording device, etc.

(ii) **Receiver** It is a computer or any such device which is capable or receiving data from the network. It can be any computer, printer, laptop, mobile phone, television, etc. The sender and receiver are known as nodes in a network.

(iii) **Message** It is the data or information that needs to be exchanged between the sender and the receiver. Messages can be in the form of text, number, image, audio, video, multimedia, etc.

(iv) **Communication Media** It is the path through which the message travels between source and destination. It is also called medium or link which is either wired or wireless.

(v) **Protocol** It is a set of rules that need to be followed by the communicating parties in order to have successful and reliable data communication.

Characteristics of Data Communication

1. **Delivery** The data must be delivered from the source device to the correct destination in the right order.
2. **Accuracy** The data must be delivered error-free. If there exists any inaccuracy during transmission, the data should be re-transmitted.
3. **Timeliness** The data must be delivered during the specified time period. The late delivered data becomes useless.

Communication Channel

The communication channel refers to the direction of signal flow between two linked devices.

There are mainly three types of communication channels which are as follows

1. **Simplex Channel** In this channel, the flow of data is always in one direction with no capability to support response in other direction.

   This communication is uni-directional. Only one of the communicating devices transmits information and the other can only receive it.

   E.g. Radio, Television, Keyboard, etc.
2. **Half Duplex Channel** In this channel, the data can flow in both directions, but not at the same time. When one device transmits information, the other can only receive at that point of time. E.g. Walkie –Talkie.
3. **Full Duplex Channel** In this channel, the flow of data is in both directions at a time i.e., both stations can transmit and receive information simultaneously.

   E.g. Wireless handset (mobile phone).

Communication Media

Communication media of a network refers to the transmission media or the connecting media used in the network. It can be broadly defined as anything that can carry information from a source to the destination.

It refers to the physical media through which communication signals can be transmitted from one point to another.

Transmission media can be divided into two broad categories

Guided Media or Wired Technologies

The data signal in guided media is bound by the cabling system that guides the data signal along a specific path.

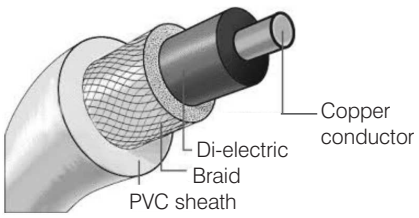
It consists of a cable composed of metals like copper, tin or silver.

Basically, they are divided into three categories

1. **Ethernet Cable or Twisted Pair Cable** In this cable, wires are twisted together which are surrounded by an insulating material and an outer layer called jacket. One of the wires is used to carry signals to the receiver and the other is used only as a ground reference.

   E.g. Local area networks use twisted pair cable.
2. **Co-axial Cable** It carries the signal of higher frequency data through the network. It has a single inner conductor that transmits electric signals and the outer conductor acts as a ground and is wrapped in a sheet of teflon or PVC. Co-axial cable is commonly used in transporting multi-channel television signals in cities.

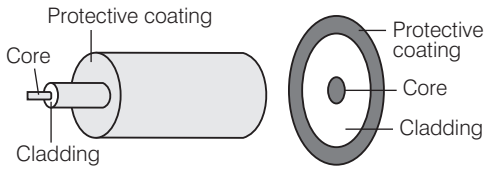
   E.g. Cable TV network.



Co-axial Cable

3. **Fibre Optic Cable** It is made up of glass or plastic and transmits signals in the form of light from a source at one end to another.

   Optical fibres allow transmission over longer distance at higher bandwidth which is not affected by electromagnetic field. The speed of optical fibre is hundred times faster than co-axial cables.



Fibre Optic Cable

Note *Tamil Nadu, the Indian state decided to implement Bharat Net Service which will connect all the village panchayats through optical fibre.*

Unguided Media or Wireless Technologies

It is the transfer of information over a distance without the use of enhanced electrical conductors or wires. When the computers in a network are interconnected and data is transmitted through waves, then they are said to be connected through unguided media.

Some commonly used unguided media of transmission are as follows

1. **Radiowave Transmission** When two terminals communicate by using radio frequencies than such type of communication is known as radiowave transmission. This transmission is also known as Radio Frequency (RF) transmission. The frequencies range from 3Hz to 1GHz. These are omni-directional. Radio waves, particularly those waves that propagate in the sky mode, can travel long distances.
2. **Microwave Transmission** Microwaves are electromagnetic waves having frequencies range from 0.3 to 300 GHz. Microwaves are uni-directional. It have higher frequency than that of radiowaves. It is used in cellular network and television broadcasting.
3. **Infrared Wave Transmission** Infrared waves are the high frequency waves used for short-range communication. The frequencies range from 300 GHz to 400 THz. These waves can not pass through the solid-objects. They are mainly used in TV remote and wireless speakers, etc.
4. **Satellite Communication** The communication across longer distances can be provided by combining radio frequency transmission with satellites. It works over long distances and allows fast communication. It is used for communication to ships, vehicles, planes and handheld terminals.

Note ***Bluetooth*** *It is a short range wireless communication technology that allows devices such as mobile phones, computers and peripherals to transmit data or voice wirelessly over a short distance.*

Computer Network

It is a collection of two or more computers, which are connected together to share information and resources.

Computer network is a combination of hardware and software that allows communication between computers over a network.

Note *ARPANET stands for Advanced Research Projects Agency Network. It was the first network developed by Vint Cerf in 1969.*

Benefits of Computer Network

Some of the benefits of computer network are discussed below

1. **File Sharing** Networking of computer helps the users to share data/files.
2. **Hardware Sharing** Users can share devices such as printers, scanners, CD-ROM drives, hard drives, etc., in a computer network.
3. **Application Sharing** Applications can be shared over the network and this allows implementation of client/server applications.
4. **User Communication** This allows users to communicate using E-mail, news groups, video-conferencing, etc. within the network.

Types of Computer Network

Computer network is broadly classified into various types which are as follows

Local Area Network (LAN)

LAN is a small and single-site network. It connects network devices over a relatively short distance.

It is a system in which computers are inter-connected in the geographical area such as home, office, building, school, etc. which are within a range of 1 km. Its speed is upto 1000 Mbps. On most LANs, cables are used to connect the computers.

LANs are typically owned, controlled and managed by a single person or organisation. They also use certain specific connectivity technologies, primarily Ethernet and Token Ring. LAN provides a sharing of peripherals in an efficient or effective way.

Wide Area Network (WAN)

WAN is a geographically dispersed collection of LANs. A WAN like the Internet spans most of the world. A network device called a router connects LANs to a WAN. Its speed is upto 150 Mbps.

Like the Internet, most WANs are not owned by any one organisation, but rather exist under collective or distributed ownership and management. WANs use technology like ATM, Frame Relay and X.25 for connectivity.

Metropolitan Area Network (MAN)

It is a data network designed for a town or city. It connects an area larger than a LAN, but smaller than a WAN. Its speed is upto 100 Mbps.

Its main purpose is to share hardware and software resources by various users. Cable TV network is an example of metropolitan area network. The computers in a MAN are connected using co-axial cables or fibre optic cables.

Personal Area Network (PAN)

PAN refers to a small network of communication. These are used in a few limited range, which is in reachability of individual person. Its speed is upto 3 Mbps. Few examples of PAN are Bluetooth, Wireless USB, Z-wave and Zig Bee.

- **Server** is a system that responds to requests across a computer network to provide a network service. It can be run on a dedicated computer. It is one of the most powerful and typical computer.
- **File Server** is a type of computer used on network that provides access to files. It allows users to share programs and data over LAN network.

Computer Network Devices

These devices are required to amplify the signal to restore the original strength of signal and to provide an interface to connect multiple computers in a network.

There are many types of computer network devices used in networking. Some of them are described below

1. **Repeater** It has two ports and can connect two segments of a LAN. It amplifies the signals when they are transported over a long distance so that the signal can be as strong as the original signal. A repeater boosts the signal back to its original level.
2. **Hub** It is like a repeater with multiple ports used to connect the network channels. It acts as a centralised connection to several computers with the central node or server. When a hub receives a packet of data at one of its ports from a network channel, it transmits the packet to all of its ports to all other network channel.
3. **Gateway** It is an inter-connecting device, which joins two different network protocols together. They are also known as protocol converters. It accepts packet formatted for one protocol and converts the formatted packet into another protocol.

   The gateway is a node in a network which serves as a proxy server and a firewall system and prevents the unauthorised access.
4. **Switch** It is a small hardware device that joins multiple computers together within one LAN. It helps to reduce overall network traffic.

   Switch forwards a data packet to a specific route by establishing a temporary connection between the source and the destination. There is a vast difference between a switch and a hub. A hub forwards each incoming packet (data) to all the hub ports, while a switch forwards each incoming packet to the specified recipient.
5. **Router** It is a hardware device which is designed to take incoming packets, analyse packets, moving and converting packets to the another network interface, dropping the packets, directing packets to the appropriate locations, etc.
6. **Bridge** It serves a similar function as switches. A bridge filters data traffic at a network boundary. Bridges reduce the amount of traffic on a LAN by dividing it into two segments.

Traditional bridges support one network boundary, whereas switches usually offer four or more hardware ports. Switches are sometimes called multiport bridges.

7. **Modem** It is a device that converts digital signal to analog signal (modulator) at the sender's end and converts back analog signal to digital signal (demodulator) at the receiver's end, in order to make communication possible via telephone lines. Modem is always placed between a telephone line and a computer.

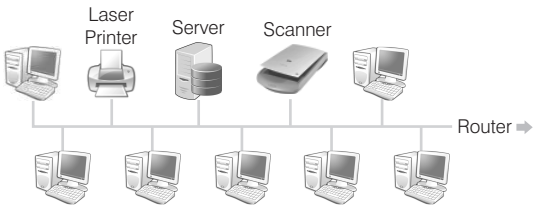
Network Topology

The term 'topology' refers to the way a network is laid out, either physically or logically. Topology can be referred as the geometric arrangement of a computer system. Each computer system in a topology is known as node.

The most commonly used topologies are described below

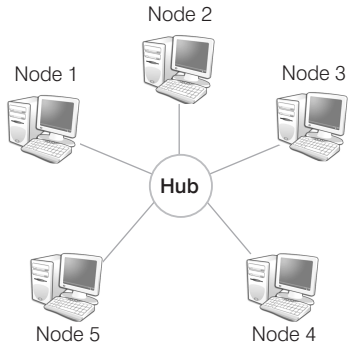
1. **Bus Topology** It is such that there is a single line to which all nodes are connected. It is usually used when a network installation is small, simple or temporary.

   In bus topology, all the network components are connected with a same (single) line.



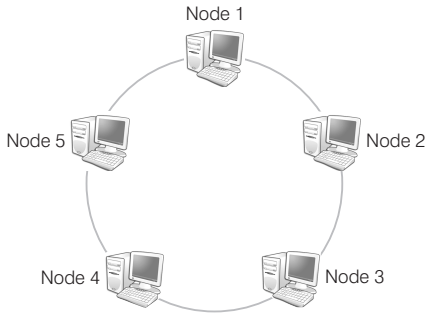
Bus Topology

2. **Star Topology** In this network topology, the peripheral nodes are connected to a central node, which re-broadcasts all transmissions received from any peripheral node to all peripheral nodes across the network. A star network can be expanded by placing another star hub.



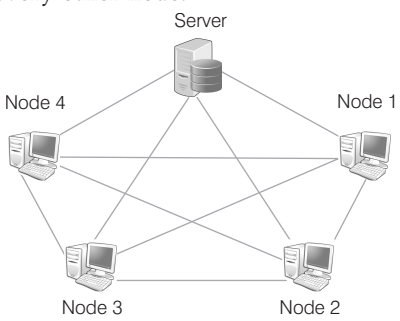
Star Topology

3. **Ring or Circular Topology** This topology is used in high-performance networks where large bandwidth is necessary. The protocols used to implement ring topology are Token Ring and Fiber Distributed Data Interface (FDDI). In ring topology, data is transmitted in the form of token over a network.



Ring or Circular Topology

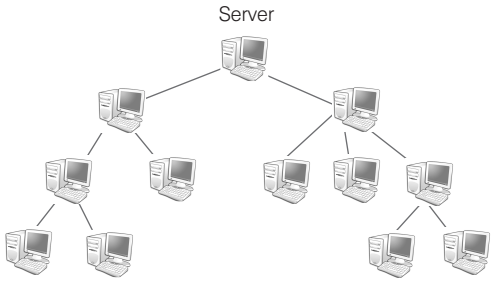
4. **Mesh Topology** It is also known as completely inter-connected topology. In mesh topology, every node has a dedicated point-to-point link to every other node.



Mesh Topology

5. **Tree Topology** This is a network topology in which nodes are arranged as a tree. The function of the central node in this topology may be distributed.

   Its basic structure is like an inverted tree, where the root acts as a server. It allows more devices to be attached to a single hub.



Tree topology

Models of Computer Networking

There are mainly two models of computer networking which are as follows

1. Peer-to-Peer Network

It is also known as P2P network. It relies on computing power at the edges of a connection rather than in the network itself.

P2P network is used for sharing content like audio, video, data or anything in the digital format.

In P2P connection, a couple of computers are connected via a Universal Serial Bus (USB) to transfer files. In peer-to-peer networking, each or every computer can work as server or client.

2. Client-Server Network

The model of interaction between two application programs in which a program at one end (client) requests a service from a program at the other end (server).

It is a network architecture which separates the client from the server. It is scalable architecture, where one computer works as server and others as client. Here, client acts as the active device and server behaves passively.

OSI Model

Open System Inter-connection (OSI) is a standard reference model for communication between two end users in a network. In 1983, the International Standards Organisation (ISO) published a document called Basic Reference Model for Open System Inter-connection, which visualises network protocols as a Seven Layered Model.

OSI is a layered framework for the design of network system that allows communication between all types of computer systems. It mainly consists of seven layers across a network.

Seven Layers of OSI Model and their Functions

Name of the Layer	Functions
Application Layer [User-Interface]	Re-transferring files of information, login, password checking, packet filtering, etc.
Presentation Layer [Data formatting]	It works as a translating layer, i.e. encryption or decryption.
Session Layer [Establish and maintain connection]	To manage and synchronise conversation between two systems. It controls logging ON and OFF, user identification, billing and session management.
Transport Layer [Transmission Control Protocol (TCP) accurate data]	It decides whether transmission should be parallel or single path, multi-plexing, splitting or segmenting the data, to break data into smaller units for efficient handling, packet filtering.
Network Layer [Internet Protocol (IP) routers]	Routing of the signals, divide the outgoing message into packets, to act as network controller for routing data.
Data Link Layer [Media Access Control (MAC) switches]	Synchronisation, error detection and correction. To assemble outgoing messages into frames.
Physical Layer [Signals-cables or operated by repeater]	Make and break connections, define voltages and data rates, convert data bits into electrical signal. Decide whether transmission is simplex, half duplex or full duplex.

In OSI model, physical layer is the lowest layer which is implemented on both hardware and software and application layer is the highest layer.

Computer Network Addressing

Network addresses are always logical, i.e. these are software based addresses which can be changed by appropriate configurations.

A network address always points to host/node/server or it can represent a whole network.

Network address is always configured on network interface card and is generally mapped by system with the MAC address of the machine for layer-2 communication.

There are different kinds of network addresses as

- IP
- IPX
- AppleTalk

Terms Related to Computer Network

1. **Multi-plexing** It is a technique used for transmitting signals simultaneously over a common medium. It involves single path and multiple channels for data communication.
2. **Code Division Multiple Access** (CDMA) It is a channel access method used by various radio communication technologies.

   CDMA employs spread spectrum technology and a special coding scheme, where each transmitter is assigned a code to allow multiple users to be multi-plexed over the same physical channel.
3. **Packet Switching** It refers to the method of digital networking communication that combined all transmitted data regardless of content, type or structure into suitable sized blocks known as packets.
4. **Public Switched Telephone Network** (PSTN) It is designed for telephone, which requires modem for data communication. It is used for FAX machine also.
5. **Integrated Services Digital Network** (ISDN) It is used for voice, video and data services. It uses digital transmission and combines both circuit and packet switching.
6. **Ethernet** It is a widely used technology employing a bus technology. An ethernet LAN consists of a single co-axial cable called Ether. It operates at 10 Mbps and provides a 48-bits address. Fast ethernet operates at 100 Mbps.
7. **Token** It is a small message used to pass between one station to another.

Tit-Bits

- **Bandwidth** determines the data transfer rate which is measured in Cycle Per Second (CPS) or Hertz (Hz).
- **Throughput** is the amount of data that is actually transmitted between two computers. It is specified in bits per second (bps). Giga bits per second (Gbps) is the fastest speed unit per data transmission.
- **GPS** (Global Positioning System) is a global navigation satellite system that provides location, velocity and time synchronisation. GPS is everywhere. You can find GPS system in your car, your smartphone and your watch.

QUESTION BANK

1. ..... is the transmission of data between two or more computers over communication links.
(1) Communication (2) Networking
(3) Data communication (4) Data networking

2. Communication channel having.....type(s).
(1) 1 (2) 2 (3) 3 (4) 4

3. In simplex channel, flow of data is
(1) always in one direction
(2) always in both direction
(3) in both direction, but one at a time
(4) All of the above

4. Communication between a computer and a keyboard involves ..... transmission. **[IBPS Clerk Mains 2017]**
(1) Automatic (2) Half duplex
(3) Full-duplex (4) Simplex
(5) None of these

5. Mobile phone is an example of which type of communication channel?
(1) Simplex (2) Half duplex
(3) Full duplex (4) None of these

6. Which of the following is not a property of twisted pair cabling?
(1) Twisted pair cabling is a relatively low speed transmission
(2) The wires can be shielded
(3) The wires can be unshielded
(4) Twisted pair cable carries signals as light waves

7. In twisted pair, wires are twisted together, which are surrounded by an insulating material and an outer layer called
(1) frame (2) cover
(3) disk (4) block
(5) jacket

8. Which of the following is the greatest advantage of co-axial cabling?
(1) High security (2) Physical dimensions
(3) Long distances (4) Easily tapped

9. Which of the following cables can transmit data at high speed? **[IBPS Clerk 2014]**
(1) Flat cable (2) Co-axial cable
(3) Optic fibre cable (4) Twisted pair cable
(5) UTP cable

10. Which Indian state decided to implement Bharat Net Service which will connect all the village panchayats through optical fibre? **[RRB NTPC 2016]**
A. Maharashtra B. Punjab
C. Tamil Nadu D. Uttar Pradesh
1. D 2. B 3. A 4. C

11. Networking using fibre optic cable is done as **[RBI Grade B 2012]**
(1) it has high bandwidth
(2) it is thin and light
(3) it is not affected by electro magnetic interference/power surges, etc
(4) All of the above
(5) None of the above

12. Which of the following is not a property of fibre optic cabling? **[IBPS Clerk Mains 2017]**
(1) Transmits at faster speed than copper cabling
(2) Easier to capture a signal from the copper cabling
(3) Very resistant to interference
(4) Carries signals as light waves
(5) Less attenuation

13. A device that connects to a network without the use of cables is said to be **[IBPS Clerk 2012, RBI Grade B 2012]**
(1) distributed (2) cabled
(3) centralised (4) open source
(5) wireless

14. Which of the following is the fastest communication channel?
(1) Radiowave
(2) Microwave
(3) Optical fibre
(4) All are operating at nearly the same propagation speed

15. Bandwidth refers to **[RBI Grade B 2013]**
(1) the cost of the cable required to implement a WAN
(2) the cost of the cable required to implement a LAN
(3) the amount of information a peer-to-peer network can store
(4) the amount of information a communication medium can transfer in a given amount of time
(5) None of the above

16. Which of the following represents the fastest data transmission speed? **[SBI Clerk 2012]**
(1) Bandwidth (2) bps
(3) gbps (4) kbps
(5) mbps

17. A(n) ..... is composed of several computers connected together to share resources and data. **[RBI Grade B 2014]**
(1) Internet (2) Network
(3) Backbone (4) Hyperlink
(5) Protocol

18. What do we call for the arrangement when two or more computers physically connected by cables to share information or hardware? **[SBI Clerk 2015]**
(1) URL (2) Network
(3) Server (4) Internet
(5) Modem

19. A combination of hardware and software that allows communication and electronic transfer of information between computers is a **[SBI Clerk 2012]**
(1) network (2) backup system
(3) server (4) peripheral
(5) modem

20. Which of the following terms is associated with networks? **[SBI Clerk 2014]**
(1) MS-Excel
(2) Mouse
(3) Word
(4) Connectivity
(5) Plotter

21. What type of resource is most likely to be a shared common resource in a computer network? **[Allahabad Bank Clerk 2010]**
(1) Printers
(2) Speakers
(3) Floppy disk drives
(4) Keyboards
(5) None of the above

22. The first network that has planted the seeds of Internet was
(1) ARPANET (2) NSFnet
(3) V-net (4) I-net

23. Pathways that support communication among the various electronic components on the system board are called **[SBI PO 2014]**
(1) network lines (2) processors
(3) logic paths (4) bus lines
(5) gateway

24. What do we call a network whose elements may be separated by some distance? It usually involves two or more network and dedicated high speed telephone lines. **[SBI Clerk 2015]**
(1) LAN (2) WAN
(3) URL (4) Server
(5) World Wide Web

25. LAN can use ..... architecture.
(1) peer-to-peer
(2) client and server
(3) Both (1) and (2)
(4) Neither (1) nor (2)

26. Ethernet, token ring and token bus are types of **[SBI Associates 2012, RBI Grade B 2014]**
(1) WAN
(2) LAN
(3) communication channels
(4) physical media
(5) None of the above

27. The advantage of LAN is **[SBI Clerk 2012]**
(1) sharing peripherals
(2) backing up your data
(3) saving all your data
(4) accessing the web
(5) automatic printing of data

28. Computer connected to a LAN can …….. . **[IBPS Clerk 2013]**
(1) run faster
(2) share information and/or share peripheral equipment
(3) go online
(4) E-mail
(5) None of the above

29. ..... allows LAN users to share computer programs and data.
(1) Communication server
(2) Print server
(3) File server
(4) All of the above

30. What is the use of bridge in network?
(1) To connect LANs
(2) To separate LANs
(3) To control network speed
(4) All of the above

31. Which of the following items is not used in Local Area Network (LAN)? **[SSC CGL 2012]**
(1) Interface card (2) Cable
(3) Computer (4) Modem

32. Which type of network would use phone lines? **[IBPS Clerk 2015]**
(1) WAN (2) LAN
(3) WWAN (4) Wireless
(5) None of these

33. Which of the following refers to a small, single-site network?
(1) PAN (2) DSL
(3) RAM (4) USB
(5) CPU

34. These servers store and manage files for network users.
(1) Authentication (2) Main
(3) Web (4) File

35. …….. is the most important/powerful computer in a typical network. **[SBI PO 2013]**
(1) Desktop (2) Network client
(3) Network server (4) Network station
(5) Network switch

36. A protocol is a set of rules governing a time sequence of events that must take place
(1) between peers (2) between an interface
(3) between modems (4) across an interface

37. A …….. is an agreement between the communication parties on how communication is to proceed. **[SSC CGL 2016]**
(1) Path (2) SLA
(3) Bond (4) Protocol

38. A device operating at the physical layer is called a
(1) bridge (2) router
(3) repeater (4) All of these

39. Which of the following devices that joins multiple computers together within one LAN?
(1) Repeater (2) Hub
(3) Gateway (4) Switch
(5) Router

40. Which of the following is used for modulation and demodulation?
(1) Modem (2) Protocols
(3) Gateway (4) Multi-plexer
(5) None of these

41. What is the name of the derive that links your computer with other computers and information services through telephone lines? **[SBI Clerk 2015]**
(1) Modem (2) LAN
(3) URL (4) WAN
(5) Server

42. What is the function of a modem? **[RBI Grade B 2012]**
(1) Encryption and decryption
(2) Converts data to voice and vice- versa
(3) Converts analog signals to digital signals and vice-versa
(4) Serves as a hardware anti-virus
(5) None of the above

43. The hardware device or software program that sends messages between network is known as a **[IBPS Clerk 2014]**
(1) bridge (2) backbone
(3) router (4) gateway
(5) Other than those given as options

44. Which of the following is not a network device?
(1) Router (2) Switch
(3) Bus (4) Bridge

45. Geometric arrangement of devices on the network is called
(1) topology (2) protocol
(3) media (4) LAN

46. Which of the following topologies is not of broadcast type?
(1) Star (2) Bus
(3) Ring (4) All of these

47. Network components are connected to the same cable in the ..... topology.
(1) star (2) ring
(3) bus (4) mesh
(5) tree

48. Hub is associated with ..... network. **[SBI Clerk 2011]**
(1) bus (2) ring
(3) star (4) mesh
(5) All of these

49. In a ring topology, the computer in possession of the ..... can transmit data.
(1) packet (2) data
(3) access method (4) token

50. In which topology, every node is connected to two other nodes? **[IBPS RRB PO Mains 2018]**
(1) Bus topology (2) Ring topology
(3) Star topology (4) Mesh topology
(5) None of these

51. Which is the name of the network topology in which there are bi-directional links between each possible node? **[SSC CGL 2012]**
(1) Ring (2) Star
(3) Tree (4) Mesh

52. An alternate name for the completely inter-connected network topology is **[SSC CGL 2012]**
(1) mesh (2) star
(3) tree (4) ring

53. Which is the highest reliability topology? **[IBPS RRB PO Mains 2018]**
(1) Mesh topology (2) Tree topology
(3) Bus topology (4) Star topology
(5) None of these

54. P2P is a ..... application architecture. **[IBPS Clerk 2012]**
(1) client/server (2) distributed
(3) centralised (4) 1-tier
(5) None of these

55. A packet filtering firewall operates at which of the following OSI layers?
(1) At the application layer
(2) At the transport layer
(3) At the network layer
(4) At the gateway layer

56. Encryption and decryption are the functions of
(1) transport layer (2) session layer
(3) presentation layer (4) All of these

57. Name the fourth layer of OSI model. **[SBI PO 2014]**
(1) Application layer (2) Data link layer
(3) Transport layer (4) Session layer
(5) None of these

58. In OSI network architecture, the routing is performed by **[IBPS Clerk 2012]**
(1) Network layer (2) Data link layer
(3) Transport layer (4) Session layer
(5) None of these

59. In the following list of devices which device is used in network layer? **[SSC CGL 2016]**
(1) Repeaters
(2) Router
(3) Application Gateway
(4) Switch

60. Switches work on which OSI layer?
(1) Data link layer
(2) Physical layer
(3) Transport layer
(4) Network layer
(5) Application layer

61. In IT networking, which of the following device is used in physical layer? **[SSC CGL 2016]**

(1) Repeater
(2) Router
(3) Transport Gateway
(4) Bridge

62. Multi-plexing involves ..... path(s) and ..... channel(s). **[SBI Clerk 2011]**

(1) one, one
(2) one, multiple
(3) multiple, one
(4) multiple, multiple
(5) None of the above

63. A processor that collects the transmissions from several communication media and send them over a single line that operates at a higher capacity is called **[RBI Grade B 2013]**

(1) multi-plexer (2) bridge
(3) hub (4) router
(5) None of these

64. To send data/message to and from computers, the network software puts the message information in a

(1) NIC (2) packet
(3) trailer (4) header
(5) None of these

65. How many bits are there in the ethernet address? **[SBI Clerk 2011]**

(1) 64 bits (2) 48 bits
(3) 32 bits (4) 16 bits
(5) None of these

66. Ethernet uses

(1) bus topology
(2) ring topology
(3) mesh topology
(4) All of the above

67. In networks, a small message used to pass between one station to another is known as **[SSC CGL 2016]**

(1) Token (2) Byte
(3) Word (4) Ring

68. ISDN is a tele-communication technology, where **[UPSSSC 2016]**

(a) Voice, video and data all are transmitted simultaneously
(b) Only sound is transmitted
(c) Only video is transmitted
(d) Only data is transmitted

69. What is the frequency range of data transmission under computer system? **[UPSSSC Village Panchayat Officer]**

(a) Band (b) Bandwidth
(c) Byte (d) Bit

ANSWERS

1. *(3)*	2. *(3)*	3. *(1)*	4. *(4)*	5. *(3)*	6. *(4)*	7. *(5)*	8. *(2)*	9. *(3)*	10. *(4)*
11. *(4)*	12. *(3)*	13. *(5)*	14. *(2)*	15. *(4)*	16. *(3)*	17. *(2)*	18. *(2)*	19. *(1)*	20. *(4)*
21. *(1)*	22. *(1)*	23. *(2)*	24. *(1)*	25. *(3)*	26. *(2)*	27. *(1)*	28. *(2)*	29. *(3)*	30. *(1)*
31. *(4)*	32. *(1)*	33. *(1)*	34. *(4)*	35. *(3)*	36. *(4)*	37. *(4)*	38. *(3)*	39. *(4)*	40. *(1)*
41. *(1)*	42. *(3)*	43. *(5)*	44. *(3)*	45. *(1)*	46. *(2)*	47. *(3)*	48. *(3)*	49. *(4)*	50. *(2)*
51. *(4)*	52. *(1)*	53. *(1)*	54. *(1)*	55. *(1)*	56. *(3)*	57. *(3)*	58. *(1)*	59. *(2)*	60. *(1)*
61. *(1)*	62. *(2)*	63. *(1)*	64. *(2)*	65. *(2)*	66. *(1)*	67. *(1)*	68. *(1)*	69. *(2)*	