Computer Networks

Topics to be covered

1. Evolution of networking
2. Data communications terminologies
3. Transmission Media
4. Network Devices
5. Network Topologies
6. Network Types
7. Network Protocols

What is Network?

It is a collection of Inter-connected computers and other devices that are able to communicate with each other i.e. it is a collection of hardware and software components that are connected together for effective information interchange wherein, one system/device is the sender and the other is the receiver.

Advantages of Computer Network:

a. Resource sharing
b. Remote access
c. Cost saving
d. Collaborative user interaction
e. Time saving
f. Enhanced storage

Drawbacks

a. Poor handling can cause chaos
b. If the files are stored centrally, it may sometimes become impossible to carry out any task
c. File security becomes high priority task in case of shared network
d. One may need specified staff to ensure data security

Evolution of Networking

Network Communication dates back to the earliest times since the evolution of human race on earth. All the living organisms communicate with each other on one way or the other. The early man used to communicate using the symbolic language, then with the development of modern languages and intelligence, the communication media came into picture. And, with the advent of computer systems, the data communication became important so as to take necessary decisions and pass the messages quickly.

In year 1967, the very first network came into existence, namely-ARPANET.

ARPANET

(Advanced Research Project Agency Network) that was designed to survive any nuclear threat. It was the first system to implement the TCP/IP protocol suite and was based on Client-Server architecture.

NSFNet

National Science Foundation Network, was started in 1980 with a view to enhance Academic and Scientific Research. It connected its server with the ARPANET in year 1986.

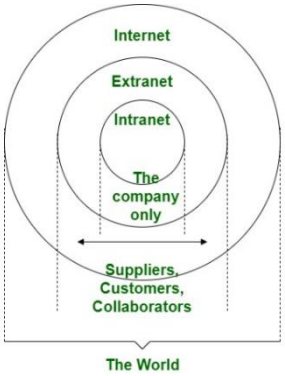
In the year 1990, the NSFNet, ARPANET and other smaller networks clubbed together to form the INTERNET (Interconnected Networks) and hence the foundation of modern INTERNET was laid down.

Internet:

It is the global network of interconnected devices that may/may not follow same set of rules, and connect together for sharing information and establishing communication. It is made up of two parts:

a. **IntraNet**:
   The word Intra means inside or within. Therefore, Intranet means the network within an organization. It is created using the protocols of LANs and PANs. Example: Wipro uses internal network for business development

b. **Extranet:**
   It is the network that lies outside the limits of the IntraNet. Dell and Intel use network for business related operation.



c. **Interspace:**
   It is the client-server software program that allows multiple users to communicate with each other using real-time audio, video and text in a dynamic 3D environment.

Data Communication

Data:

It is raw facts and figures that are yet to get a defined meaning. Examples: 11, A123x@r67Y, etc.

Information:

The processed form of data that had a defined meaning is known as the information. Examples: Roll No. 11, Password: A123x@r67Y, etc.

Data Channel:

It is a medium to carry information or data from one point to another.

Baud:

It is the measurement of the data transfer rate in a communication channel.

Bits per Second:

It is the rate by which the data transfer is measured. It is used to measure the speed of information through high-speed phone lines or modems. It is denoted ad **Bps, kbps, Mbps, Gbps,** etc.

Bandwidth:

It is the difference between the highest and lowest frequencies in a channel. The high bandwidth channels are known as **Broadband** Channels, and the low bandwidth channels are called as the **Narrowband** Channels.

Data Transfer Rate:

It is the amount of data transferred per second by a communication channel or a computing storage device. When applied to the data transmission rate, the abbreviations like K, M, G, T are added to the data rate that denote Kilo, Mega, Giga, and Tera respectively. They work in the power of 1024. Example 1 GB = 1024 MB, 1 TB = 1024 GB.

Switching Techniques:

These are used for transmitting data across the networks. The various switching techniques are:

a. Circuit Switching:

Here, the connection between the sender and receiver is established first, and then the data is transmitted from the source computer to destination computer. Before transferring the data, a call setup is required for establishing connection between sender and receiver. It is best for connections that require consistent bit rate for communication.

b. Message Switching:

In this technique, the message is sent to the switching office first that stores the data in the buffer, and then the switching office finds the free link to the receiver, and then sends the data to the receiver. There is no limit to the size of the message block to be transmitted over the network.

c. Packet Switching:

It is the most efficient data communication technique used to send and receive data over the internet. Instead of using the dedicated circuit for data communication, the data is independently routed through the network and reassembled at the destination computer system. Data is divided into fixed size packets before transmission. Each packet contains a fraction of data along with addressing information.

Comparison of circuit Switching, Packet switching & Message Switching

Parameter	Message switching	Circuit switching	Packet switching
Application	Telegraph network for transmission of telegrams	Telephone network for bi-directional, real time transfer of voice signals	Internet for datagram and reliable stream service between computers
End terminal	Telegraph, teletype	Telephone, modem	Computer
Information type	Morse, Baudot, ASCII	Analog voice or PCM digital voice	Binary information
Transmission system	Digital data over different transmission media	Analog and digital data over different transmission media	Digital data over different transmission media

Transmission Medias

A transmission media refers to the medium by which the data is transferred from one device to another. A transmission media can be:

a. Wired Transmission Media
b. Wireless Transmission Media

Wired Transmission Medias

In computer networks, wired transmission media refers to the physical mediums through which data is transmitted from one device to another. These media provide a pathway for electrical signals to travel, facilitating communication between network devices. Some common types of wired transmission media used in computer networks include:

A. Twisted Pair Cable:

Unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP) cables are widely used for Ethernet networking. UTP is commonly used in home and office networks due to its cost-effectiveness and ease of installation. STP provides better noise immunity and is suitable for environments with higher electromagnetic interference.

B. Coaxial Cable:

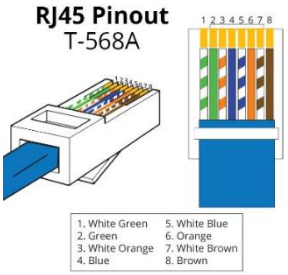
Coaxial cables consist of a copper conductor surrounded by a dielectric insulating material and a metallic shield. They are commonly used in Cable Television (CATV) networks and some older Ethernet installations.

C. Fiber Optic Cable:

Fiber optic cables use strands of glass or plastic to transmit data as pulses of light. They offer high data transfer rates, long-distance capabilities, and immunity to electromagnetic interference. Fiber optics are commonly used in high-speed data networks, telecommunications, and internet backbone connections.

D. Ethernet Cable:

Ethernet cables, such as Cat5e, Cat6, and Cat7, are a subset of twisted pair cables specifically designed for Ethernet networking. They are used to connect devices in local area networks (LANs) and provide reliable data transmission.



E. Power Line Communication (PLC):

PLC enables data transmission over existing electrical power lines. It is sometimes used to provide networking in situations where laying dedicated network cables is impractical.

F. Structured Cabling Systems:

Structured cabling refers to a standardized cabling infrastructure used to support various communication technologies within a building or campus. It typically involves a combination of twisted pair and fiber optic cables organized in a structured manner.

The choice of wired transmission media depends on factors such as data transfer speed requirements, distance, environmental conditions, and cost considerations. Each type of cable has its advantages and limitations, and network designers choose the most appropriate medium based on the specific needs of the network.

Wireless Transmission Medias

In computer networks, wireless transmission media refers to the means of transmitting data between devices without the use of physical cables. Wireless communication relies on electromagnetic waves to carry information. Some common types of wireless transmission media used in computer networks include:

A. Wi-Fi (Wireless Fidelity):

Wi-Fi is a widely used wireless technology for local area networking (LAN) and internet access. It operates in the unlicensed radio frequency bands, such as 2.4 GHz and 5 GHz, allowing multiple devices to connect to a wireless access point (router).

B. Bluetooth:

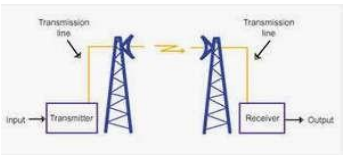
Bluetooth is a short-range wireless technology commonly used for connecting devices like smartphones, laptops, and peripherals (e.g., wireless keyboards, mice, and headphones). It

operates in the 2.4 GHz frequency band and supports relatively low data transfer rates compared to Wi-Fi.

C. Infrared (IR):

Infrared communication uses infrared light to transmit data between devices. It is commonly found in remote controls for TVs, audio systems, and other consumer electronics.

D. Microwaves:

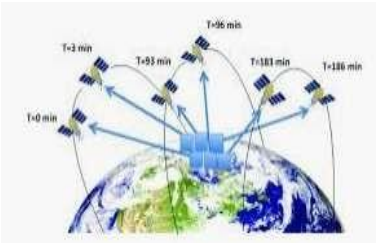


These are high frequency waves that can be used to transmit data over long distances, in a straight line, but these can not penetrate through solid objects. It consists of a transmitter, receiver, and air.

E. Radio Frequency Identification (RFID):

RFID uses radio waves to identify and track objects equipped with RFID tags. It is used in various applications, including supply chain management, access control, and asset tracking.

F. Satellite Communication:



Satellite communication involves transmitting data to and from Earth through communication satellites. It is used for long-distance communication in remote areas or where traditional wired communication is not feasible.

G. Near Field Communication (NFC):

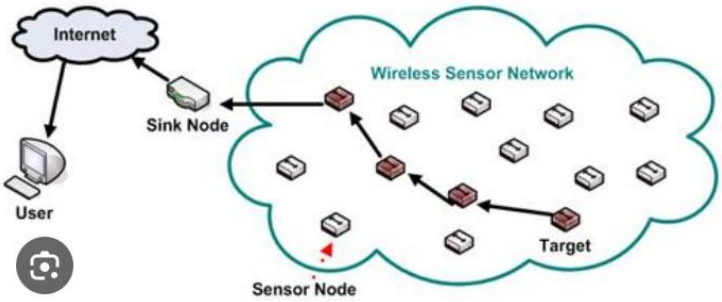
NFC enables short-range communication between devices (typically within a few centimeters). It is commonly used for contactless payment systems and data exchange between smartphones.

H. Cellular Networks:

Cellular networks provide wireless communication over a large geographic area using cell towers. They are the foundation for mobile phone networks and mobile internet access.

I. Wireless Sensor Networks (WSNs):

WSNs consist of interconnected sensors that wirelessly communicate with each other to gather and transmit data from the environment. They are used in various applications, such as environmental monitoring and industrial automation.



Wireless transmission media offer the advantage of mobility and flexibility, allowing devices to connect without the constraint of physical cables. However, they may be susceptible to interference, have limited range, and typically offer lower data transfer rates compared to wired media. The choice of wireless media depends on factors such as the required coverage area, data transfer speed, power consumption, and potential interference in the operating environment.

Sink Node:

It is a node with no outward connections to other nodes. In other words, it sends information to other nodes, but cannot receive the information by itself.

Network Devices:

For smooth functioning of computer network, other than computers and wirings, many devices play an important role. These devices are known as the Network Devices.

A. Modem:

Modulator-Demodulator allows us to reach the global network with ease. It is used to send and receive the data over the telephone lines or cable connections. Since, the ordinary telephone lines cannot carry the digital information, a modem changes the data from analog to digital format and vice versa.

Modems are of two types:

1. Internal modems: The modems that are fixed in the computer systems are Internal Modems.
2. External Modems: The modems that are connected externally are called External Modems.

B. Registered Jack-45 (RJ-45):

Registered Jack-45 of Rj-45 is an 8-wire connector that is commonly used on computers in a local area network. It looks similar to a standard phone connector (RJ-11), but is wider than the RJ-11 connector, as it uses 8 wires instead of 4. These are used to connect computers in Ethernet LAN.

C. NIC:

Network Interface Card (NIC) is a device used to connect the network with the Internet. It is sometimes called ad the TAP (Terminal Access Point). Since different manufacturers give different names to this device, hence, it is sometimes referred to as NIU (Network Interface Unit).

The NIC has a unique physical address to each card, and it is known as MAC (Media Access Control) Address.

D. MAC Address:

It is a b-byte address assigned to each NIC card and is separated by a colon. Example:

10 : E8 : 05 : **67 : 2A : GS**

Manufacturer ID Card No.

E. Ethernet Card:

It is a LAN architecture developed by *Xerox Corp* along with the DEC and Intel. It uses a bus or star topology for data transfer and can attain a speed of up to 10 Gbps. It can connect devices in both wired and wireless LAN or WAN.

F. Router:

It is responsible for forwarding data from one network to another. The main purpose of router is sorting and distribution of the data packets to their destination based on the IP address. The router uses the Logical address scheme.

G. Hub:

It is a device that connects several devices to a network and transmits the information to all the connected devices via broadcast mode.

The hubs are of two types:

- Active hubs: these electrically amplify the signal as it moves from one connected device to another.
- Passive hubs: these allow the signals to pass from one device to another without any change.

H. Switch:

It is a device that is used to divide network into smaller networks called *subnets* or LAN segments. This helps to avoid network traffic as it divides the traffic into smaller parts. It is responsible for filtering of data packets and then transmission over the network.

I. Repeaters:

A repeater is a network device that amplifies, restores and re-broadcasts signals for long-distance transmission.

J. Bridge:

It is a device that links two networks. It is smart system that knows which system lies on which side and in which network. These can handle the networks that follow different protocols.

K. Gateway:

It connects two dissimilar networks and establishes an intelligent connection between local and external networks with completely different architecture. It is also known as protocol translator.

L. Wi-Fi Card:

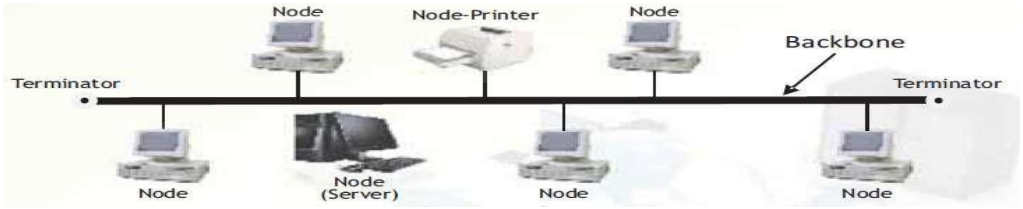
It is the LAN adapter whether external or internal with a built-in antenna and wireless radio. Its main benefit is that it allows a computer to setup the system as workstation without considering the availability of hard-line access.

Network Topologies

The term topology means the way of connecting different systems to form a network. Some of the commonly used topologies are as follows:

A. Bus Topology:

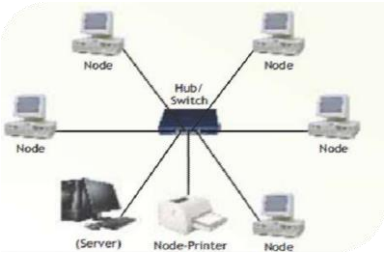
1. In a bus topology, all devices are connected to a single communication line called the bus or backbone.



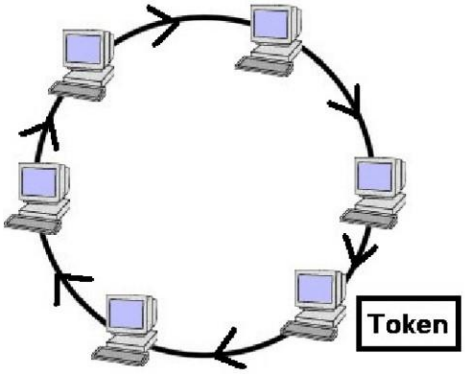
2. Data is transmitted from one end of the bus to the other, and all devices receive the data simultaneously.
3. It is relatively easy to implement and works well for small networks. However, a single break in the bus can disrupt the entire network.

B. Star Topology:

1. In a star topology, all devices are connected to a central hub or switch.
2. Each device has a dedicated point-to-point connection to the central hub.
3. If one device or cable fails, only that specific connection is affected, and the rest of the network remains operational.
4. It is straightforward to add or remove devices, making it scalable.

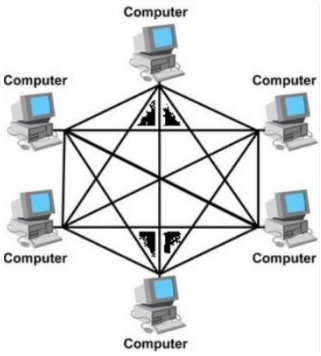


C. Ring Topology:



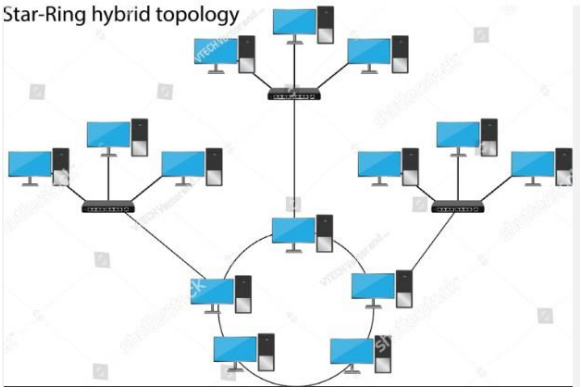
1. In a ring topology, devices are connected in a closed loop, forming a ring.
2. Each device is connected to exactly two other devices, creating a continuous circular pathway for data transmission.
3. Data travels in one direction around the ring until it reaches the intended recipient.
4. Failure of any single device or connection can disrupt the entire network.

D. Mesh Topology:



1. In a mesh topology, every device is connected to every other device in the network. It provides multiple redundant paths for data transmission, ensuring high reliability and fault tolerance.
2. Mesh topologies are commonly used in critical applications where network uptime is crucial. However, the extensive cabling and complex connections can be expensive and challenging to manage.

E. Hybrid Topology:

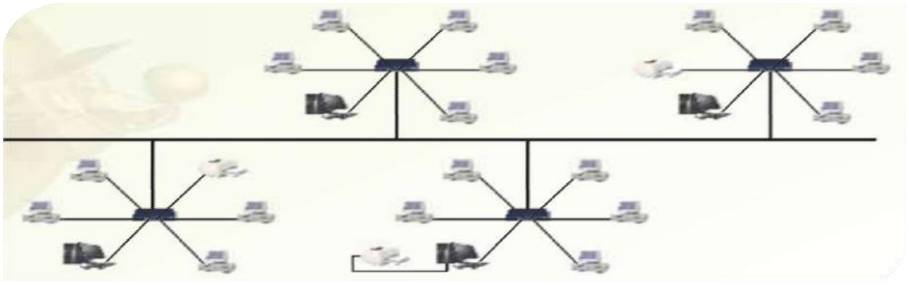


1. A hybrid topology is a combination of two or more basic topologies (e.g., star-bus or star-ring).
2. It leverages the advantages of different topologies and can be designed to suit specific networking needs.
3. Hybrid topologies are commonly used in large networks or in scenarios with diverse connectivity requirements.

F. Tree Topology:

Tree topology is a network design where devices are organized in a hierarchical structure, resembling a tree with a root node at the top and branches of nodes extending downward.

1. The root node acts as the central hub, and devices are connected to it directly or through intermediary devices like switches or hubs.



2. This creates a multi-level structure, with each level representing a different generation of devices.

Tree topology is commonly used in wide area networks (WANs) to interconnect different local area networks (LANs) or subnets in a hierarchical manner. It is also found in some enterprise networks and telecommunications networks.

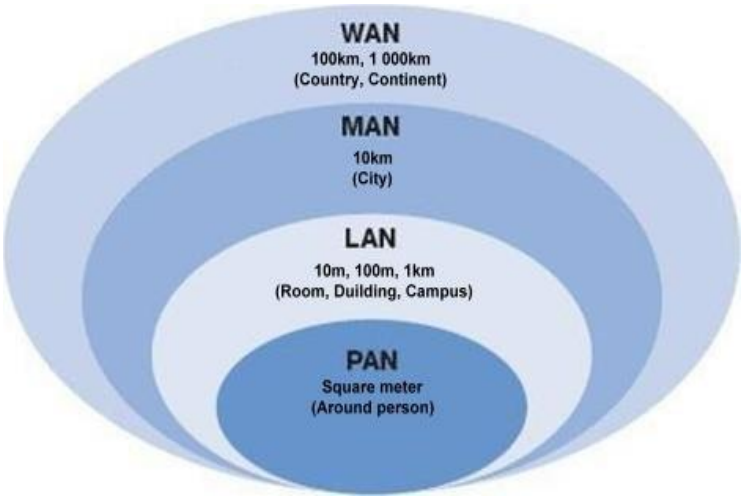
Advantages of Tree Topology:

1. Scalability: The network can be easily expanded by adding more devices or branches.
2. Centralized Management: The root node allows for centralized control and easy network management.
3. Fault Isolation: Issues in one branch do not affect the rest of the network, simplifying troubleshooting.
4. Point-to-Point Connections: Devices have dedicated connections, reduced data collisions and improving performance.

Disadvantages of Tree Topology:

1. Dependency on Root Node: The network's functionality relies on the root node, and its failure can disrupt the entire network.
2. Cost: Implementing tree topology can be expensive, especially for larger networks.
3. Complex Cabling: As the network grows, the cabling can become more complex and difficult to manage.

Types of Networks:



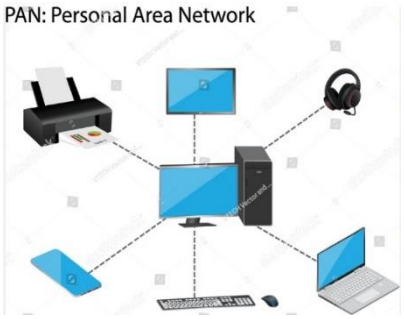
The computer networks are divided into the following parts based on the network span and number of systems connected.

1. PAN - Personal Area Network
2. LAN - Local Area Network
3. MAN - Metropolitan Area Network
4. WAN - Wide Area Network

PAN – Personal Area Network:

A personal area network (PAN) is designed for interconnection between devices typically located within the range of 10 meters approx. These are used to connect personal use devices like smartphones, laptops, tablets, wearable devices and other peripherals.
Bluetooth and Wi-Fi are the commonly used technologies for establishment of PANs.
PANs find applications in various scenarios, such as:

a. Wireless Headsets: For establishing connections between computers/smart phones with headsets/head phones.
b. Personal health Devices: For pairing fitness related trackers/ smart phones for monitoring health and workout timings.
c. Home automation: For connecting home use and safety devices to a central controller such as smart phone.
d. File Transfer: For ensuring smooth and fast transfer of files between laptops, tablets etc.
e. Security: To enhance and implement security protocols like encryption to ensure data privacy and prevent unauthorized access to the connected devices.



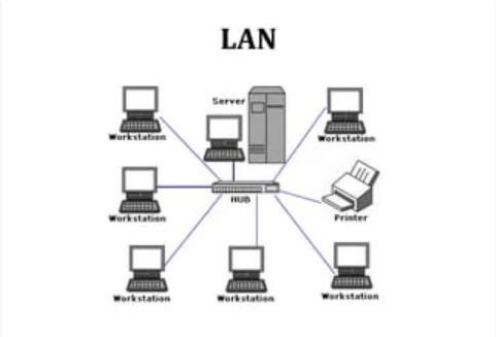
f. Ad-Hoc Networking: These are often used as Ad-Hoc networks for use as and when required. These networks are established and disbanded as per the requirement. Also, the devices can quickly connect to the network and disconnect whenever they are in or out of range.

LAN – Local Area Network

A local area network (LAN) is designed for implementation between devices that are located within a limited geographical area generally within the range of approximately 1 – 10 KM. this network can be setup using wired or wireless transmission medias, and can be controlled by an individual or an organization. It is also known as Intranet as it is a network within an organization.

a. These can use various topologies such as star, bus, ring, or mesh. The most commonly used topology for LANs is the Star topology, where all the devices are connected to a central switch or hub.

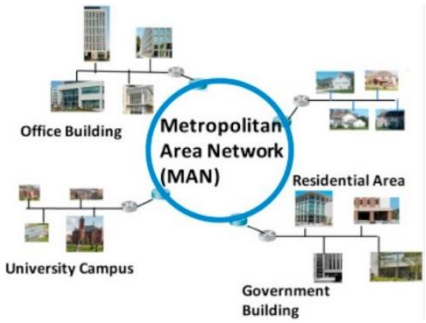
b. LANs offer high data transfer rates as the network has a limited span enabling fast communication and resource sharing.
c. The network administrator can easily manage and monitor devices in a LAN.
d. The LANs are commonly used in offices, homes, and educational institutions.
e. LANs implement security measure such as Firewalls, access controls, and encryption to protect data and unauthorized access to the network at a much cheaper cost.



MAN – Metropolitan Area Network:

It is a network infrastructure that covers a larger geographical area than a Local Area Network (LAN) but smaller than the Wide area Network (WAN). These use various connectivity technologies including fiber-optic cables, microwave links and wireless technologies to interconnect devices and networks within the area of a city and ranges between 5 – 100 KMs.

a. MANs often use high speed technologies like fiber-optic cables, microwave links to provide fast and reliable data transmission between network nodes.
b. These are often used by government agencies and large educational institutions to interconnect LANs and share resources like files, databases, and applications.



c. They often use different Internet Service Providers (ISPs) for effective data communication thereby strengthening the backbone of the Internet.
d. These can be either privately owned, cooperative, or government owned to provide services to the public.
e. These networks have grown rapidly in the past few years as the spans of cities have increased rapidly.
f. The network security plays a crucial role in the MANs and increases the cost incurred due to wide area coverage.

They play a significant role in interconnecting local networks within a city, enabling efficient data exchange and facilitating communication among various entities in the metropolitan region.

WAN – Wide Area Network:

It is a type of computer network that covers a vast geographical area spanning among cities, countries, or even continents.

a. These use various technologies like leased lines, fiber optic cables, and satellite links.
b. Since it is the expanded form of MAN, it is considered as the backbone.

c. These allow the efficient transfer of data, voice, and videos between different nodes thereby enabling communication and resource sharing between devices at far away distances.

d. These are designed with redundancy and backup links to ensure high fault tolerance thereby minimizing disruptions and maintaining connectivity even if some network segment fails.
e. Data Security becomes the key issue as it becomes essential to protect data from unauthorized access and cyber threats. Thus encryption, firewalls and virtual private Networks (VPNs) play an important role in ensuring data security.
f. These may have varying speeds and bandwidth depending upon the technology used and the distance between network nodes.

Note:

Virtual Private Network: It is used to access the public network as a private network. It ensures enhances security, and safety of data.

Difference between LAN, MAN, and WAN

Network → / Parameter ↓	PAN	LAN	MAN	WAN
Area Covered	Small Area (Upto 10m radius)	A few meters to a few kilometers (Upto 10Km radius)	A city and its vicinity (Upto 100Km radius)	Entire country, continent, or globe (No upper limit)
Error Rates	Lowest	Lowest	Moderate	Highest
Transmission Speed	High Speed	High Speed	Moderate Speed	Low speed
Networking Cost	Negligible	Inexpensive	moderately expensive equipment	Expensive

Network Protocols:

These are the set of rules that are required to run the internet keeping in mind the security of data for sake of users.

1. TCP (Transmission Control Protocol):
   a. Connection-oriented protocol for reliable data transmission.
   b. Provides error checking, retransmission of lost packets, and in-order delivery.
   c. Slower than UDP due to the additional overhead for reliability.

2. UDP (User Datagram Protocol):

a. Connectionless protocol for fast, unreliable data transmission.
b. No error checking or retransmission, suitable for real-time applications.
c. Lower overhead compared to TCP.

3. IP (Internet Protocol):
   a. Responsible for addressing and routing packets across networks.
   b. IP version 4 (IPv4) uses 32-bit addresses (e.g., 192.168.1.1).
   c. IP version 6 (IPv6) uses 128-bit addresses (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334).

4. HTTP (Hypertext Transfer Protocol):
   a. Used for web page communication between a client (browser) and a web server.
   b. Supports request methods like GET, POST, PUT, DELETE, etc.

5. HTTPS (Hypertext Transfer Protocol Secure):
   a. Secure version of HTTP that uses encryption (TLS/SSL) to protect data during transmission.
   b. Uses port 443.

6. FTP (File Transfer Protocol):
   a. Used for transferring files between a client and a server.
   b. Can operate in active or passive mode.

7. SMTP (Simple Mail Transfer Protocol):
   a. Used for sending email messages between servers.
   b. Port 25 is used for unencrypted communication, and port 587 is used for encrypted communication (SMTPS).

8. POP3 (Post Office Protocol version 3):
   a. Used for retrieving email from a remote server to a local email client.
   b. POP3 downloads emails to the client and removes them from the server.

9. IMAP (Internet Message Access Protocol):
   a. Used for accessing email messages on a remote server from multiple clients.
   b. IMAP keeps emails on the server and synchronizes changes across clients.

10. DNS (Domain Name System):
    a. Translates human-readable domain names (e.g., www.example.com) into IP addresses.
    b. Distributed hierarchical system for domain resolution.

11. DHCP (Dynamic Host Configuration Protocol):
1. Automatically assigns IP addresses and network configuration to devices on network.
2. Simplifies network administration by managing IP allocation.

12. ICMP (Internet Control Message Protocol):
    2.1. Used for error reporting and diagnostics in IP networks.
    2.2. Commonly associated with tools like ping to test network connectivity.

13. SLIP (Serial Line Internet Protocol):
    a. This is used for delivering/ relaying packets over the dial-up line.
    b. It defines the encapsulation mechanism for the packets.

14. PPP (Point to Point Protocol):
a. It is the internet standard for transmission of IP packets over the serial lines.
b. It is currently the best solution for dial-up connections.

These are just some of the many network protocols that facilitate communication and data transfer across the internet and local networks. Each one serves specific purposes and plays a crucial role in modern networking.

Web Services:

1. World Wide Web (WWW):

It is a global system of interconnected documents and resources that are accessible over the internet. It operates on the basis of hypertext links which allows the users to navigate between different documents and multimedia content.

2. Hypertext:

The web is built on the concept of hypertext where documents are linked to each other through hyperlinks. These allow the users to navigate from one place to another.

3. URL:

Each web page and the resource on the web can be accessed using the unique address called as the URL (Uniform Resource Locator).

4. Web Browser:

To access and view web pages on the internet (WWW), we need to have an application named as Web Browser. There are many web browsers available on the internet like Google Chrome, Microsoft Edge, and Mozilla Firefox etc.

5. Web Servers:

These are the computers that host websites and web applications. These respond to requests from web browsers, and provide the requested web pages and resources back to the users.

6. Weblinks:

These are the links available within the web pages that allow the users to access the pages that contain the topic related content.

7. HTML:

Hyper Text Markup Language (HTML) was developed with a view to structure and organize the static web pages. These are the symbols and codes that allow the used to develop web pages that can run over the internet. These define the layout, format, and linking of text, multimedia, and other elements within a web page. It uses tags for presentation of content.

8. XML:

Extensible Markup Language (XML) is designed to carry and store data in a structured and platform-independent format. These use the user-defined custom tags to represent specific data fields and structures. These are self-descriptive and make it easier for different applications to understand and interpret data.

9. Websites:

These are the collections of various web pages and data that are accessible for all, and are available on the internet. Many types of restrictions such as screenshot protections, copying of data can be implemented on the websites for data protection.

10. Web Hosting:

This refers to the service of providing storage space, server resources, and internet connectivity to make websites and web applications accessible to users over the internet. It allows individuals, businesses, and organizations to publish their websites on the World Wide Web, making them available to visitors and users worldwide.

a. Web hosting companies maintain powerful servers designed to store website files, databases, and other contents required for website operations.
b. These typically handle the maintenance tasks of the registered websites.
c. These ensure proper backup and recovery of the lost data (if any) while accessing it, and cope up with potential threats that can destroy data.

11. Domain Name Service (DNS):

It is a vital internet infrastructure that converts domain names into IP addresses, thereby enabling the users to navigate the web using easily recognizable and memorable names instead of numerical IP addresses.

12. Internet Protocol (IP) Address:

It is a unique serial number assigned to devices on a network, facilitating communication and data exchange between them over the internet, and other IP based networks. These are of two types:

a. IPv4:
   These are the addresses that consist of 32-bit addressing scheme. Example: 192.168.0.24
b. IPv6:
   This uses 128 bit addressing scheme represented by eight groups of hexadecimal digits separated by colons. Example: 2001:0db8:85a3:0f00:00a0:8a2e:0370:7334.

The potential growth of internet-connected devices led to exhaustion of available IPv4 addresses. To cope up with this problem, the IPv6 addressing scheme was introduces that provides a significantly large pool of IP addresses to accommodate the expansion of internet.

Multiple choice questions:

1) Which network topology is characterized by a central node that connects all devices on the network?
   a) Bus
   b) Star
   c) Ring
   d) Mesh

2) In a bus topology, what happens if there is a break in the main communication line?
   a) The entire network becomes inoperative
   b) Only the affected segment becomes inoperative
   c) Data packets are automatically rerouted through an alternative path
   d) The network speed decreases but remains functional

3) Which network topology provides fault tolerance and redundancy due to multiple interconnections between devices?
   a) Bus
   b) Star
   c) Ring
   d) Mesh

4) In a ring topology, what prevents data packets from endlessly circulating the loop?
   a) Bridges
   b) Routers
   c) Token passing
   d) Firewalls

5) Which network topology allows expansion of the network by simply adding more devices to the central hub?
   a) Bus
   b) Star
   c) Ring
   d) Mesh

6) What is the main disadvantage of a mesh topology?
   a) High installation cost
   b) Difficult to set up
   c) Limited scalability
   d) Susceptible to data collisions

7) Which network topology is commonly used in Ethernet networks and provides centralized management?
   a) Bus

b) Star
c) Ring
d) Mesh

8) In a star topology, what happens if the central hub fails?
   a) The entire network becomes inoperative
   b) Only the affected segment becomes inoperative
   c) Data packets are automatically rerouted through an alternative path
   d) The network speed decreases but remains functional

9) Which network topology is best suited for small networks and has a simple and cost-effective design?
   a) Bus
   b) Star
   c) Ring
   d) Mesh

10) What network topology is typically used in token ring networks to regulate data transmission?
   a) Bus
   b) Star
   c) Ring
   d) Mesh

11) Which transmission medium uses electrical signals to transmit data over short distances inside a computer or between devices in a local network?
   a) Coaxial cable
   b) Fiber-optic cable
   c) Twisted-pair cable
   d) Infrared transmission

12) Which transmission medium offers the highest data transmission speeds and is immune to electromagnetic interference?
   a) Coaxial cable
   b) Fiber-optic cable
   c) Twisted-pair cable
   d) Wireless transmission

13) In fiber-optic cables, data is transmitted through:
   a) Electric signals
   b) Infrared waves
   c) Radio waves
   d) Light pulses

14) Twisted-pair cables are commonly categorized into two types: unshielded twisted pair (UTP) and:
    a) Fiber-optic twisted pair (FOTP)
    b) Shielded twisted pair (STP)
    c) Coaxial twisted pair (CTP)
    d) Broadband twisted pair (BTP)

15) Which transmission medium is most susceptible to signal attenuation (weakening) over long distances?
    a) Coaxial cable
    b) Fiber-optic cable
    c) Twisted-pair cable
    d) Microwave transmission

16) The transmission medium that uses radio waves to carry signals is known as:
    a) Wi-Fi
    b) Bluetooth
    c) Fiber-optic cable
    d) Twisted-pair cable

17) Which transmission medium is commonly used for cable television (CATV) and internet services?
    a) Coaxial cable
    b) Fiber-optic cable
    c) Twisted-pair cable
    d) Satellite transmission

18) What type of transmission medium is suitable for underwater communications and long-distance networking?
    a) Coaxial cable
    b) Fiber-optic cable
    c) Twisted-pair cable
    d) Infrared transmission

19) Which transmission medium uses the least secure method of data transmission and is easily intercepted by unauthorized users?
    a) Coaxial cable
    b) Fiber-optic cable
    c) Twisted-pair cable
    d) Wireless transmission

20) Which transmission medium allows communication between devices using infrared light waves?
    a) Coaxial cable

b) Fiber-optic cable
c) Twisted-pair cable
d) Infrared transmission

21) Which of the following networks covers a large geographic area and is often used to connect multiple local area networks (LANs) together?
a) LAN (Local Area Network)
b) WAN (Wide Area Network)
c) MAN (Metropolitan Area Network)
d) PAN (Personal Area Network)

22) Which type of network is designed to connect devices within a limited physical area, such as a home or office?
a) WAN (Wide Area Network)
b) LAN (Local Area Network)
c) SAN (Storage Area Network)
d) WLAN (Wireless Local Area Network)

23) The network that uses radio waves to connect devices without the need for physical cables is called:
a) WLAN (Wireless Local Area Network)
b) WAN (Wide Area Network)
c) MAN (Metropolitan Area Network)
d) SAN (Storage Area Network)

24) A network that is completely contained within a single device, such as connecting a smartphone to a smartwatch, is known as:
a) LAN (Local Area Network)
b) PAN (Personal Area Network)
c) WAN (Wide Area Network)
d) WLAN (Wireless Local Area Network)

25) A network that spans across multiple buildings within a campus or a city is called:
a) LAN (Local Area Network)
b) WAN (Wide Area Network)
c) PAN (Personal Area Network)
d) MAN (Metropolitan Area Network)

26) What type of network is the internet?
a) LAN (Local Area Network)
b) WAN (Wide Area Network)
c) SAN (Storage Area Network)
d) MAN (Metropolitan Area Network)

27) Which type of network is the most suitable for securely sharing information between two geographically distant offices of the same organization?
    a) LAN (Local Area Network)
    b) WAN (Wide Area Network)
    c) SAN (Storage Area Network)
    d) WLAN (Wireless Local Area Network)

28) What type of network is commonly used to connect devices like printers, scanners, and computer peripherals?
    a) LAN (Local Area Network)
    b) PAN (Personal Area Network)
    c) WLAN (Wireless Local Area Network)
    d) MAN (Metropolitan Area Network)

Short Answer Questions

1. What is a network topology?
2. What is the star network topology?
3. Explain Bus topology?
4. What is point-to-point network?
5. What is the most commonly used network topology in modern Ethernet LANs?
6. What advantage does the mesh topology offer in terms of reliability?
7. Which topology is commonly used in wireless networks?
8. What advantage does the bi-directional ring offer over the uni-directional ring?
9. What advantage does the tree topology have over bus topology?
10. Explain the hybrid topology in brief.
11. What are transmission medias?
12. Name the different types of transmission medias.
13. What are the advantages and drawbacks of twisted pair cables?
14. What are the main drawbacks of coaxial cables?
15. What advantage does fiber optic cables have over coaxial cables?
16. Name some examples of devices that use infrared signals?
17. In terms of data security, which type of transmission medias offer more security- guided or unguided. Why?
18. Which transmission media is commonly used to transmit data over short distances?
19. Which transmission media is commonly used to transmit data over long distances?
20. What are the main factors that influence the choice of transmission medias in a network?
21. What is a Local Area Network (LAN)?
22. What is a Personal Area Network (PAN)?
23. What is a Metropolitan Area Network (MAN)?
24. What is a Wide Area Network (WAN)?
25. What is Virtual Private Network (VPN)?
26. What is domain name service?
27. What do you understand by Web Hosting?

28. Differentiate between website, web link, and web server.
29. Differentiate between hypertext, and hyperlink.
30. What are the different internet protocols?
31. Differentiate between SMTP, POP, and FTP.
32. Define WWW.
33. Define XML.
34. Define HTML.

Long Answer Questions

1. Differentiate between the Circuit switching, and Packet Switching techniques with examples.
2. Explain the Wired Transmission medias with the help of suitable examples and diagrams.
   OR
   Explain the guided transmission medias with the help of suitable examples.
3. Explain the unguided transmission medias with the help of suitable examples.
   OR
   Explain the various wireless transmission medias with the help of suitable diagrams.
4. What do you understand by network topologies. Explain in brief, the various topologies available for establishing a successful network.
5. What are the ways by which a network can be setup in a building. Give reasons to support your answer.
6. Differentiate between LAN, MAN, and WAN giving suitable examples.
7. Based on the geographical span, what are the various topologies used for establishing communications? Explain giving suitable examples and diagrams.
8. Explain the concept of bus topology. How is it different from bi-directional ring topology.
9. Discuss the tree topology in detail. What are its applications and potential limitations.
10. Discuss the advantages and drawbacks of guided transmission medias.
11. What are the advantages and drawbacks of unguided transmission medias.

Case Study based questions

A. Web server is a special computer system running on HTTP through web pages. The web page is a medium to carry data from one computer system to another. The working of the webserver starts from the client or user. The client sends their request through the web browser to the webserver. Web server takes this request, processes it and then sends back processed data to the client. The server gathers all of our web page information and sends it to the user, which we see on our computer system in the form of a web page. When the client sends a request for processing to the web server, a domain name and IP address are important to the webserver. The domain name and IP address are used to identify the user on a large network.

1. Web servers are:
   a) IP addresses
   b) Computer systems

c) Webpages of a site
d) A medium to carry data from one computer to another

2. What does the web server need to send back information to the user?
a) Home address
b) Domain name
c) IP address
d) Both b and c

3. What is the full form of HTTP?
a) Hypertext Transfer Protocol
b) Hypertext Transfer Procedure
c) Hyperlink Transfer Protocol
d) Hyperlink Transfer Procedure

4. The _____ translates internet domain and host names to IP address
a) Domain name system
b) Routing information protocol
c) Google
d) Network time protocol

5. Computer that requests the resources or data from other computer is called as ____ computer
a) Server
b) Client
c) None of the above
d) a and b

6. DNS stands for:
a) Domain Name Security
b) Domain Number System
c) Document Name System
d) Domain Name System

7. What is the format of IP address?
a) 34 bit
b) 32 bit
c) 16 bit
d) 64 bit

B. In mid 80's another federal agency, the NSF created a new high capacity network called NSFnet, which was more capable than ARPANET. The only drawback of NSFnet was that it allowed only academic research on its network and not any kind of private business on it. Now, several private organizations and people started working to build their own networks, named private networks, which were later (in 1990's) connected with ARPANET and NSFnet to form the Internet. The Internet really became popular in 1990's after the development of World Wide Web.

1. What does NSFnet stand for?
    a) National Senior Foundation Network
    b) National Science Framework Network
    c) National Science Foundation Network
    d) National Science Formation Network

2. What does ARPANET stand for?
    a) Advanced Research Premium Agency NETwork
    b) Advanced Research Projects Agency NETwork
    c) Advanced Review Projects Agency NETwork
    d) Advanced Research Protection Agency NETwork

3. What is internet?
    a) A single network
    b) A vast collection of different networks
    c) Interconnection of local area networks
    d) Interconnection of wide area networks

4. To join the internet, the computer has to be connected to a _____
    a) Internet architecture board
    b) Internet society
    c) Internet service provider
    d) Different computer

5. Internet access by transmitting digital data over the wires of a local telephone network is provided by:
    a) Leased line
    b) Digital subscriber line
    c) Digital signal line
    d) Digital leased line

6. A piece of icon or image on a web page associated with another webpage is called _____
    a) URL
    b) Hyperlink
    c) Plugin
    d) Extension

C. TCP/IP, or the Transmission Control Protocol/Internet Protocol, is a suite of communication protocols used to interconnect network devices on the internet. TCP/IP can also be used as a communications protocol in a private computer network (an intranet or an extranet). TCP defines how applications can create channels of communication across a network. It also manages how a message is assembled into smaller packets before they are then transmitted over the internet and reassembled in the right order at the destination address. IP defines how to address and route each packet to make sure it reaches the right destination. Each gateway computer on the network checks this IP address to determine where to forward the message. TCP/IP

uses the client-server model of communication in which a user or machine (a client) is provided a service (like sending a web page) by another computer (a server) in the network. Collectively, the TCP/IP suite of protocols is classified as stateless, which means each client request is considered new because it is unrelated to previous requests. Being stateless frees up network paths so they can be used continuously.

1. Which of the following protocols is used in the internet?
    a) HTTP
    b) DHCP
    c) DNS
    d) All of the above

2. Which one of the following is not an application layer protocol used in internet?
    a) Remote procedure call
    b) Internet relay chat
    c) Resource reservation protocol
    d) Local procedure call

3. Which protocol assigns IP address to the client connected to the internet?
    a) DHCP
    b) IP
    c) RPC
    d) RSVP

4. Several protocols for upper layers in Bluetooth use:
    a) UDP
    b) HSP
    c) ITC
    d) L2CAP

5. Internet protocols are a set of rules to govern:
    a) communication between computers on a network
    b) standard
    c) metropolitan communication
    d) bandwidth

6. Checksum is used on internet by several protocols although not at the _____
    a) sesson layer
    b) transport layer
    c) network layer
    d) data link layer

7. Network layer at source is responsible for creating a packet from data coming from another _____
    a) station
    b) link
    c) node
    d) protocol

D. A blog is a publication of personal views, thoughts, and experience on web links. It is a kind of personal diary note about an individual. The contents published on a blog are organized in a reverse manner, it means recent posts appear first and the older posts are further downwards. Blogger – a person who posts a blog in the form of text, audio, video, weblinks, etc is known as a blogger. Bloggers have followers who follow them to get instant messages post by the blogger. In most cases, celebrities, business tycoons, famous politicians, social workers, speakers, etc are the successful blogger because people follow them to know about their success stories and ideas.

1. Using websites for building network with friends and relatives is called as_____
    a. social networking
    b. blogging
    c. netbanking
    d. e-commerce

2. Websites used to buy and sell something are categorized under_____
    a. social networking sites
    b. e-commerce websites
    c. search engines
    d. entertainment sites

3. Google is an example of _____
    a. social network
    b. entertainment
    c. search engine
    d. none of these

4. Which of the following is an example of micro-blogging?
    a. orkut
    b. facebook
    c. google +
    d. twitter

5. Which of the following is not used as blogging platform?
    a. TypePad
    b. Blogger
    c. WordPress
    d. Pinterest

6. _____ was one of the first uses of the Internet and is still the most popular use, accounting for most of the traffic on the Internet.
    a. blogs
    b. chat rooms
    c. E-mail
    d. discussion boards

E. An email is a service of sending or receiving emails or messages in the form of text, audio, video, etc over the internet. Various service providers are providing email services to users. The most popular service providers in India are Gmail, Yahoo, Hotmail, Rediff, etc. An email address for an email account is a unique ID. This email ID is used to send and receive mails over the Internet. Each email address has two primary components: username and domain name. The username comes first, followed by the @) symbol and then the domain name.

1. Unsolicited e-mail advertising is known as _____
    a. newsgroup
    b. junk ads
    c. spam
    d. none of the above

2. Which of the following is the correct format of email address?
    a. name@website@info
    b. name@website.info
    c. www.nameofwebsite.com
    d. name.website.com

3. MIME stands for
    a. multipurpose internet mail extensions
    b. multipurpose internet mail email
    c. multipurpose internet mail end
    d. multipurpose internet mail extra

4. Mail access starts with client when user needs to download e-mail from the_____
    a. mail box
    b. mail server
    c. IP server
    d. Internet

5. When sender and receiver of an email are on same system, we need only two_____
    a. IP
    b. domain
    c. servers
    d. user agents

6. NVT stands for
    a. network virtual transmission
    b. network virtual test
    c. network virtual terminal
    d. network virtual tell

F. In 1989, Tim Berners Lee, a researcher, proposed the idea of World Wide Web). Tim Berners Lee and his team are credited with inventing Hyper Text Transfer Protocol (HTTP), HTML and the technology for a web server and a web browser. Using

hyperlinks embedded in hypertext the web developers were able to connect web pages. They could design attractive webpages containing text, sound and graphics. This change witnessed a massive expansion of the Internet in the 1990s.

1. What is a web browser?
    a. A program that can display a webpage
    b. A program used to view HTML documents
    c. It enables a user to access the resources of internet
    d. All of the above

2. Dynamic web page _____
    a. is same every time whenever it displays
    b. generates on demand by a program or a request from browser
    c. both is same every time whenever it displays and generates on demand by a program or a request from browser
    d. is different always in a predefined order

3. URL stands for _____
    a. unique reference label
    b. uniform reference label
    c. uniform resource locator
    d. unique resource locator

4. AJAX stands for
    a. asynchronous javascript and xml
    b. advanced JSP and xml
    c. asynchronous JSP and xml
    d. advanced javascript and xml

5. What is DOM?
    a. convention for representing and interacting with objects in html documents
    b. application programming interface
    c. hierarchy of objects in ASP.NET
    d. scripting language

6. An alternative to JavaScript on windows platform is _____
    a. a) VBScript
    b. b) ASP.NET
    c. c) JSP
    d. d) PHP

7. A web cookie is a small piece of data that is _____
    a. a) sent from a website and stored in user's web browser while a user is browsing a website
    b. b) sent from user and stored in the server while a user is browsing a website
    c. c) sent from root server to all servers
    d. d) sent from the root server to other root servers

G. E-business, commonly known as electronic or online business is a business where an online transaction takes place. In this transaction process, the buyer and the seller do not engage personally, but the sale happens through the internet. In 1996, Intel's marketing and internet team coined the term "E-business. E-Commerce stands for electronic commerce and is a process through which an individual can buy, sell, deal, order and pay for the products and services over the internet. In this kind of transaction, the seller does not have to face the buyer to communicate. Few examples of e-commerce are online shopping, online ticket booking, online banking, social networking, etc.

1. Which of the following describes e-commerce?
    a. doing business
    b. sale of goods
    c. doing business electronically
    d. all of the above

2. Which of the following is not a major type of e-commerce?
    a. C2B
    b. B2C
    c. B2B
    d. C2C

3. Which of the following is not considered to be one of the three phrases of e-commerce?
    a. innovation
    b. consolidation
    c. preservation
    d. reinvention

4. Which segment do eBay and Amazon belong to?
    a. B2B
    b. B2C
    c. C2B
    d. C2C

5. The primary source of financing during the early years of e-commerce was _____
    a. bank loans
    b. large retail films
    c. venture capital funds
    d. initial public offerings

6. The best products to sell in B2C e-commerce are:
    a. small products
    b. digital products
    c. specialty products
    d. fresh products

7. Which of the following is not a key element of a business model?

a. value proposition
b. competitive advantage
c. market strategy
d. universal standards

H. Due to the rapid rise of the internet and digitization, Governments all over the world are initiating steps to involve IT in all governmental processes. This is the concept of e-government. This is to ensure that the Govt. administration becomes a swifter and more transparent process. It also helps saves huge costs. E-Group is a feature provided by many social network services which helps you create, post, comment to and read from their "own interest" and "niche-specific forums", often over a virtual network. "Groups" create a smaller network within a larger network and the users of the social network services can create, join, leave and report groups accordingly. "Groups" are maintained by "owners, moderators, or managers", who can edit posts to "discussion threads" and "regulate member behavior" within the group.

1. E-Government:
    a. can be defined as the "application of e-commerce technologies to government and public services ."
    b. is the same as internet governance
    c. can be defined as "increasing the participation in internet use by socially excluded groups"
    d. none of the above

2. Privacy law is intended to protect the personal information about:
    a. Individuals in society
    b. computer networks
    c. Employees
    d. Students

3. What does TAN stand for?
    a. Tax Deduction Account Number
    b. Tax Deduction and Collection Account Number
    c. Taxable Account Number
    d. Tax Account Number

4. An e-group is a collection of users _____
    a. who conduct seminars
    b. who get together on weekends
    c. who have regular video conferences
    d. having the ability to access and contribute to forum topics

5. Whenever a new comment is posted, users of the e-group receive _____ notification that there is a new contribution to the discussion.
    a. SMS
    b. E-mail
    c. WhatsApp
    d. Call

6. Which of the following has E-groups?
    a. Instagram
    b. Twitter
    c. Yahoo!
    d. WhatsApp

I. Coursera has partnered with museums, universities, and other institutions to offer students free classes on an astounding variety of topics. Students can browse the list of available topics or simply answer the question "What would you like to learn about?", then when they answer that question, they are led to a list of available courses on that topic. Students who are nervous about getting in over their heads can relax.

1. What do MOOCs stand for?
    a. Mobile Online Open Courses
    b. Massive Online Open Courses
    c. Mobile Open Online Courses
    d. Massive Open Online Courses

2. "A combination of both face-to-face, traditional classroom methods with e-learning to create a hybrid approach to teaching". What is this type of e-learning?
    a. Blended learning
    b. Distance learning
    c. Synchronous learning
    d. Asynchronous learning

3. What type involves allowing participants to complete training in their own time via web-based training i.e. email, blackboard, intranets, and where there is no help from instructors and participants can use internet as a support tool?
    a. Blended learning
    b. Asynchronous learning
    c. Distance learning
    d. Synchronous learning

4. Which of the following training scenarios would e-learning be most suitable and efficient for?
    a. Induction to the company for new employees
    b. Microsoft excel training
    c. Team-building exercise
    d. Building your assertiveness skills at work

5. What best describes a virtual classroom?
    a. Learners using technology in a classroom environment lead by a tutor
    b. Training course done by youtube tutorials
    c. An online learning environment accessed through the internet (i.e. webinars)
    d. An online learning course

6. Which of the following is not an e-learning website?

a. edX
b. MasterClass
c. Flipkart
d. SimplyCoding

J. Search Engines allow us to filter the tons of information available on the internet and get the most accurate results. And while most people don't pay too much attention to search engines, they immensely contribute to the accuracy of results and the experience you enjoy while scouring through the internet. Besides being the most popular search engine covering over 90% of the worldwide market, Google boasts outstanding features that make it the best search engine in the market. It boasts cutting-edge algorithms, easy-to-use interface, and personalized user experience. The platform is renowned for continually updating its search engine results and features to give users the best experience.

1. Search engines are:
    a. Software systems that are designed to search for information on the world wide web
    b. Used to search documents
    c. Used to search videos
    d. All of the above

2. We get a list of sites after typing a word in search bar called:
    a. Single word
    b. Key phrase
    c. Site
    d. All of the above

3. The search results are shown in a line of results. This is called:
    a. Search engine pages
    b. Categories
    c. Search engine result pages
    d. Tag list

4. Search engines are able to search _____ type of information.
    a. Videos
    b. Images
    c. Documents
    d. All of the above

5. Web search engines store information about web pages with the help of:
    a. Web router
    b. Web crawler
    c. Web indexer
    d. Web organizer

6. Web crawler is also called as:
    a. Web spider

b. Web manager
c. Ink directory
d. Search optimizer

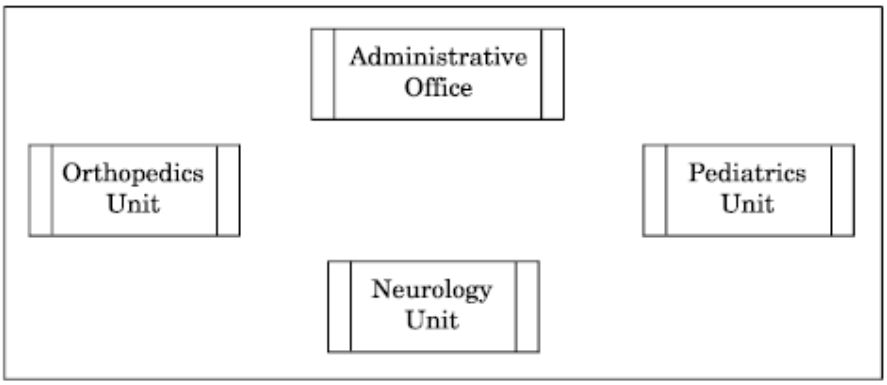
7. SEO is the process of _____ of a website or a web page in a search engine's search results.
   a. Generating cached files
   b. Affecting the visibility
   c. Getting meta tags
   d. All of these

K. Ayurveda Training Educational Institute is setting up its centre in Hyderabad with four specialised departments for Orthopedics, Neurology and Pediatrics along with an administrative office in separate buildings. The physical distances between these department buildings and the number of computers to be installed in these departments and administrative office are given as follows. You, as a network expert, have to answer the queries as raised by them in (i) to (iv). Shortest distances between various locations in meters:

Administrative Office to Orthopedics Unit	55
Neurology Unit to Administrative Office	30
Orthopedics Unit to Neurology Unit	70
Pediatrics Unit to Neurology Unit	50
Pediatrics Unit to Administrative Office	40
Pediatrics Unit to Orthopedics Unit	110

Number of Computers installed at various locations are as follows :

Pediatrics Unit	40
Administrative Office	140
Neurology	50
Orthopedics Unit	80



I. Suggest the most suitable location to install the main server of this institution to get efficient connectivity.
II. Suggest the best cable layout for effective network connectivity of the building having server with all the other buildings.

III. Suggest the devices to be installed in each of these buildings for connecting computers installed within the building out of the following:

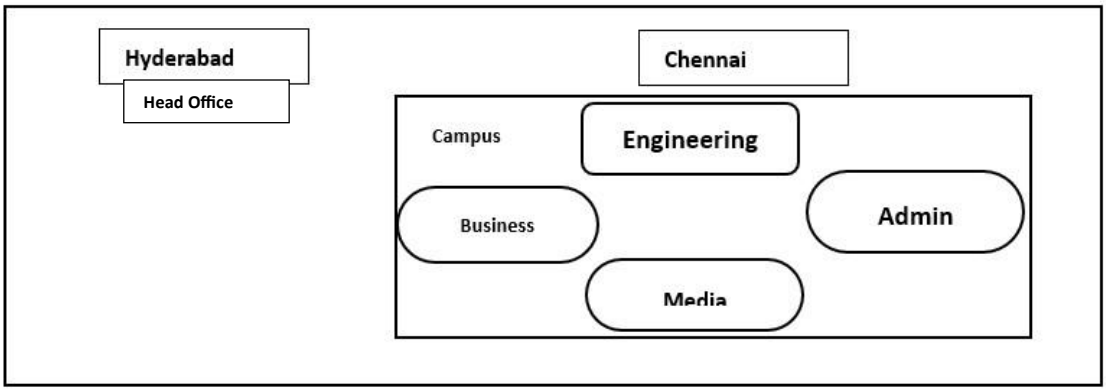
• Gateway • Modem • Switch

IV. Suggest the topology of the network and network cable for efficiently connecting each computer installed in each of the buildings out of the following:

Topologies: Bus Topology, Star Topology

Network Cable: Single Pair Telephone Cable, Coaxial Cable, Ethernet Cable

L. M/S Adco Informatics Services is an educational service organization. It is planning to setup its India campus in Chennai with its head office at Hyderabad. The Chennai campus has 4 buildings- ADMIN, MEDIA, ENGINEERING, and BUSINESS.



Block to block distances (in Meters)

From	To	Distance
Admin	Engineering	45 m
Admin	Business	80 m
Engineering	Business	25 m
Admin	Media	60 m
Engineering	Media	60 m
Business	Media	75 m
Hyderabad Head Office	Chennai Campus	692 Km

Number of Computers in each of the blocks/Centre is as follows:

Admin	140
Engineering	70
Business	35
Media	20
Hyderabad	30

i. Suggest and draw the cable layout to efficiently connect various blocks of buildings within the Chennai campus for connecting the devices.

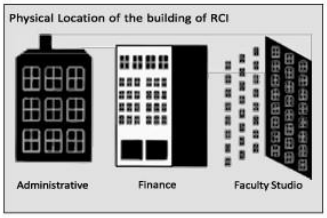
ii. Which network device will be used to connect computers in each block to form a local area network?

iii. Which block, in Chennai Campus should be made the server? Justify.

iv. Which fast and effective wireless transmission medium should preferably be used to connect the head office at Hyderabad with the campus in Chennai?

v. Is there a requirement of a repeater in the given cable layout? Why/Why not?

M. Rohit Communications International (RCI) is an online corporate training provider company for IT related courses. The company is setting up their new campus in Bengaluru. You as a network expert have to study the physical locations of various blocks and the number of computers to be installed. In the planning phase, provide the best possible answers for the queries (i) to (v) raised by them.



Block to block distances (in Mtrs.)

From	To	Distance
Administrative Building	Finance Building	60
Administrative Building	Faculty Studio Building	120
Finance Building	Faculty Studio Building	70

Expected computers to be installed in each block

Buildings	Computers
Administrative Building	20
Finance Building	40
Faculty Studio Building	120

i. Suggest the most appropriate block, where RCI should plan to install the server.
ii. Suggest the most appropriate block to block cable layout to connect all three blocks for efficient communication.
iii. Which type of a network out of the following is formed by connecting the computers of these three blocks? (LAN, MAN, WAN, PAN)
iv. Which wireless channel out of the following should be opted by RCI to connect to students from all over the world? (Infrared, Microwave, Satellite)
v. What is the satellite connection?

N. Ayurveda Training Educational Institute is setting up its centre in Hyderabad with four specialised departments for Orthopedics, Neurology and Pediatrics along with an administrative office in separate buildings. The physical distances between these department buildings and the number of computers to be installed in these departments and administrative office are given as follows. You, as a network expert, have to answer the queries as raised by them.

Shortest distances between various locations in metres :

Administrative Office to Orthopedics Unit	76
Neurology unit to Administrative Office	25
Orthopedics Unit to Neurology Unit	50
Pediatrics Unit to Neurology Unit	40
Pediatrics Unit to Administrative Office	65

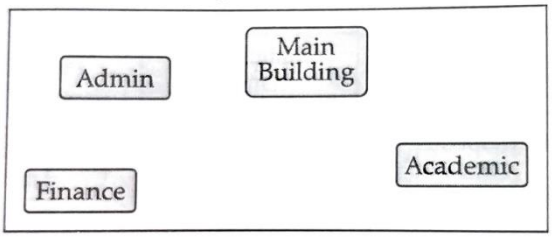
Pediatrics Unit to Orthopedics Unit	150

Number of Computers installed at various locations are as follows:

Pediatrics Unit	45
Administrative Office	190
Neurology	60
Orthopedics Unit	85

i. Suggest the most suitable location to install the main server of this institution to get efficient connectivity.
ii. Suggest the best cable layout for effective network connectivity of the building having server with all the other buildings.
iii. Suggest the devices to be installed in each of these buildings for connecting computers installed within the building out of the following:
(1) Gateway (2) Modem (3) Switch
iv. Suggest the topology of the network and network cable for efficiently connecting each computer installed in each of the buildings out of the following:
Topologies: Bus Topology, Star Topology
Network Cable: Single Pair Telephone Cable, Coaxial Cable, Ethernet Cable.

O. Sanskar University of Uttarakhand is setting up a secured network for its campus at Nainital for operating day to day office and web-based activities. They are planning to have network connectivity between four buildings. Answer the questions after going through the building positions in the campus and other details given below:
The distance between various buildings of university are given as follows:



Building 1	**Building 2**	**Distance (in mtrs.)**
Main	Admin	50
Main	Finance	100
Main	Academics	70
Admin	Finance	50
Finance	Academics	70
Admin	Academics	40

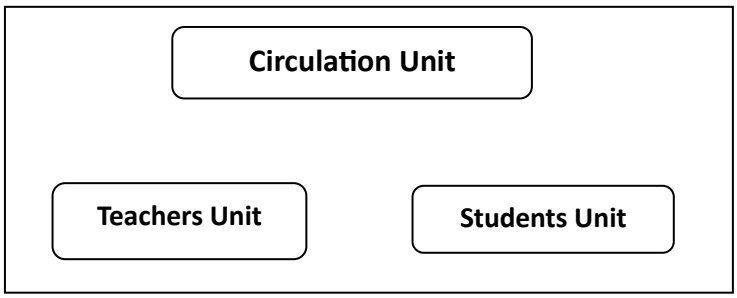
Number of Computers:

Building	**No. of Computers**
Main	200
Admin	100
Finance	75
Academics	70

As an expert, you are required to give the best possible solutions for the given queries of the university administration:

a. Suggest the cable layout for the connection between the various buildings.
b. Suggest the most suitable building to house the server of the network of the university.
c. Suggest the placement of the following devices with justification:
   Switch/Hub
   Repeater
d. Suggest the technology out of the following for setting-up very fast internet connectivity among buildings of the university
   Optical Fibre
   Coaxial Cable
   Ethernet Cable

P. A school library is connecting computers in its units in a LAN. The library has 3 units as shown in the diagram below:



The three units are providing the following services:

1. Teachers Unit: For the access of the Library Books by teachers
2. Students Unit: For access of the Library Books by students
3. Circulation Unit: For issue and return of the books for teachers and students

Centre to Centre distances between the 3 units are as follows:

- Circulation Unit to Teachers Unit – 30 metres
- Circulation Unit to Students Unit – 25 metres
- Teachers Unit to Students Unit – 15 metres

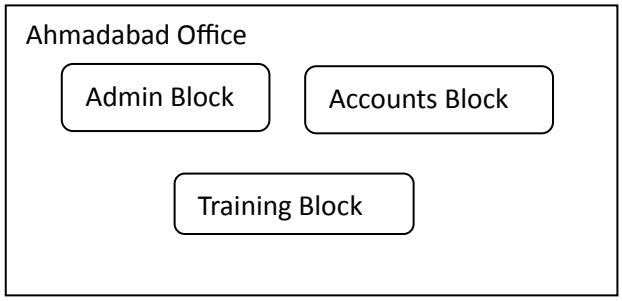
Number of computers in each of the units is as follows:

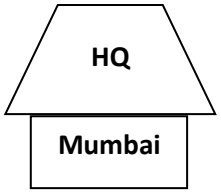
- Circulation Unit 20
- Teachers Unit 15
- Students Unit 15

a. Suggest the most suitable place to install the server of this library with a suitable reason.
b. Suggest an ideal layout for connecting these units for a wired connectivity.
c. Which device will you suggest to be installed and where should it be placed to provide Internet connectivity to all the units.
d. Suggest the type of the most efficient and economical wired medium for connecting all the computers in the network.
e. The university is planning to connect the library with the school Principal's computer which is in his office at a distance of 50 metres. Which type of network out of LAN, MAN or WAN will be used for the network? Justify your answer.

Q. M/S Sunny Shinde and sons Training Inc. Ltd. Is a Mumbai based organization which is expanding its office in Ahmedabad? At Ahmedabad compound, they are planning to have

3 different blocks for Admin, Training, and Accounts related activities. Each block has a number of computers, which are required to be connected in a network for communication, data and resource sharing. As a network consultant, you have to suggest the best network related solutions for them for issues/problems raised by them as per the distances between various blocks/locations and other given parameters.



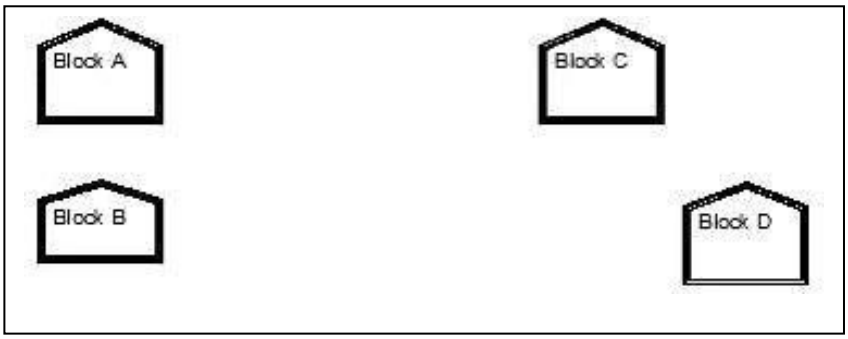


Shortest distances between various blocks/locations:

Admin Block to Accounts Block	300 metres
Admin Block to Accounts Block	200 metres
Admin Block to Accounts Block	350 metres
Mumbai Head Office to Ahmedabad Office	525 KM

a. Suggest the most appropriate block/location to house the server in Ahmedabad office to get the best and effective connectivity. Justify your answer.
b. Suggest the best wired medium and draw the cable layout to efficiently connect various blocks within the Ahmedabad office compound.
c. Suggest a device/software and its placement that would provide data security for the entire network of the Ahmedabad office.
d. Suggest a device and the protocol that shall be needed to provide wireless internet access to all smart phones/laptop users in the Ahmedabad office.

R. Knowledge Supplement Organization has set up its new centre at Mangalore for its office and web -based activities. It has 4 blocks of buildings as shown in the diagram below:



Center to center distances between various blocks:

Block A to Block B	50 m
Block B to Block C	150 m
Block C to Block D	25 m
Block A to Block D	170 m
Block B to Block D	125 m
Block A to Block C	90 m

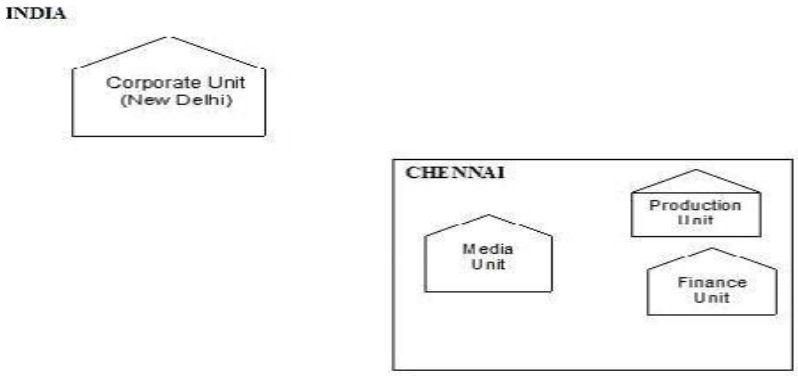
Number of Computers

Black A	25
Block B	50
Block C	125
Block D	10

- Suggest a cable layout of connections between the blocks.
- Suggest the most suitable place (i.e. block) to house the server of organization with a suitable reason.
- Suggest the placement of the following devices with justification
    - Repeater
    - Hub/Switch
- The organization is planning to link its front office situated in the city in a hilly region where cable connection is not feasible, suggest an economic way to connect it with reasonably high speed?

S. Richard Middleton Fashion is planning to expand their network in India, starting with two cities in India to provide infrastructure for distribution of their product. The company has planned to set up their main office units in Chennai at three locations and have named their offices as “Production Unit”, “Finance Unit” and “Media Unit”. The company has its corporate unit in New Delhi.

A rough layout of the same is as follows:



Approximate distances between these Units is as follows:

From	To	Distance
Production Unit	Finance Unit	75 Mtr
Production Unit	Media Unit	15 KM
Production Unit	Corporate Unit	2112 KM
Finance Unit	Media Unit	15 KM

In continuation of the above, the company experts have planned to install the following number of computers in each of their office units:

Production Unit	150
Finance Unit	35
Media Unit	10
Corporate Unit	30

i) Suggest the kind of network required out of (LAN, MAN, WAN) for connecting each of

the following office units:

• Production Unit and Media Unit
• Production Unit and Finance Unit

ii) Which one of the following devices will you suggest for connecting all the computers within each of their office units?

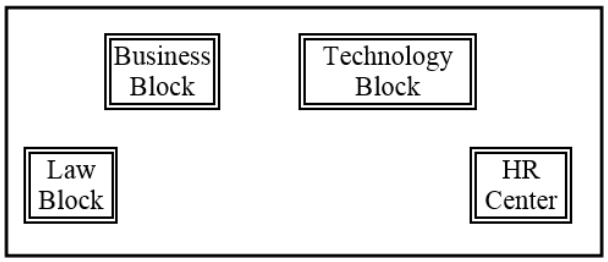
• Switch/Hub
• Modem
• Telephone

iii) Which of the following communication media, will you suggest to be procured by the company for connecting their local offices in Chennai for very effective (High Speed communication?

• Ethernet cable
• Optical fiber
• Telephone cable

iv) Suggest an effective method/technology for connecting the company's office unit located in Delhi.

T. MyPace University is setting up its academic blocks at Naya Raipur and is planning to set up a network. The University has 3 academics blocks and one Human Resource Centre as shown in the diagram below:



Centre to Centre distances between various blocks/centre is as follows:

Law Block to Business Block	40 m
Law Block to Technology Block	80 m
Law Block to HR Block	105 m
Business Block to Technology Block	30 m
Business Block to HR Centre	35 m
Technology Block to HR Centre	15 m

Number of computers in each of the block/Centre is as follows:

Law Block: 15

Technology Block: 40

HR Centre: 115

Business Block: 25

a.) Suggest the most suitable place (i.e., Block/Centre) to install the server of this university with a suitable reason.

b.) Suggest an ideal layout for connecting these blocks/centres for a wired connectivity.

c.) Which device will you suggest to be place/installed in each of these blocks/centres to

efficiently connect all the computers within these blocks/centres?

d.) Suggest the placement of a Repeater in the network with justification.

e.) The university is planning to connect its admission office in Delhi, which is more than 1250 Km from university. Which type of network out of LAN, MAN or WAN will be formed? Justify your answer.