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- 1.(a) Define data communication and computer network  
why to learn data communication and computer network
- (b) Write down the application of communication and computer network.
- (c) Describe 4 types of computer network factors.
- 2.(a) Describe various types of computer network.
- (b) Define internet.
- (c) Write down the purposes of internet.
- 3.(a) What do you mean by ethernet?
- (b) What is network topology? Describe two types of mesh topology.
- (c) Describe various types of topology.
- 4.(a) Discuss about OSI model.
- (b) Shortly describe the computer network security.
- (c) Define secret key encryption.

5.(a) Write about geographical span.

(b) Define Wide Area Network (WAN).

(c) What is fast ethernet?

6.(a) Define application layer.

(b) What do you mean by client-server model?

(c) Write down the processes of client-server model.

7.(a) Define application layer protocol.

(b) Briefly explain HTTP.

(c) Write down the categories of application layer protocols.

8.(a) Define network service.

(b) Describe different types of network services.

(c) Write down about application services.

1.(a) Define data communication and computer network.

Why to learn data communication and computer network?

Ans: Data communication refers to the transmission of digital data between two or more computers and a computer network or data network is a telecommunications network that allows computers to exchange data.

We learn computer network and data communication for many reasons:

1. Network Basic Understanding: A system of interconnected computers and computerized peripherals such as printer is called computer network. This interconnection among computer facilitates information sharing among them.

2. Network Engineering: Networking engineering is a complicated task, which involves software, firmware, hardware and electric pulses. To ease network engineering, the whole networking concept is divided into multiple task layers.

Each layer is involved in some particular task.

3. Internet: A network of networks is called an internetwork or simply the internet. It is the largest

network in existence on this planet. The internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol.

1.(b) Write down the application of communication in computer network.

Ans: Computer system and peripherals are connected to form a network. They provide numerous advantages:

1. Resources sharing such as printers and storage devices.
2. Information sharing by using web or internet.
3. Interaction with other user using dynamic web page.
4. IP phones.
5. Video conferences.
6. Parallel computing.
7. Instant messaging.

1.(c) Describe 4 types of computer network factors.

Ans: Computer networks are classified based on various factors. They includes:

- Geographical span.
- Inter-connectivity
- Administration
- Architecture

Geographical span: Geographically a network can be seen in one of the following categories:

- It may be spanned across your table, among bluetooth enabled devices.
- It may be spanned across a whole city.
- It may be one network covering whole world.

Inter-connectivity: Components of a network can be connected to each other in some fashion.

- Every single device can be connected to every other device on network, making the network mesh.
- Each device is connected to its left and right peers only.
- All devices connected together with a single device.

Administration: From an administrator's point of view, a network can be private network which belongs a single autonomous system and can't be accessed outside its physical or logical domain.

Network Architecture: Computer networks can be discriminated into various types of such as client-server, hybrid depending upon its architecture.

- There can be one or more systems acting as servers. Other being client, requests the server to serve request.
- There can be hybrid network which involves architecture

Ans: Computer networks have various types. These are:

Personal Area Network: A personal Area Network (PAN) is smallest network which is very personal to a user. This may include Bluetooth enabled device or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard, and mouse etc.

Local Area Network: A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network (LAN). Usually, LAN covers an organization's offices, schools, colleges or universities. LAN can be wired, wireless or both.

Metropolitan Area Network: The Metropolitan Area Network (MAN) generally expands throughout a city such as cable TV network. It can be in the form of Ethernet, Token Ring, ATM or Fiber Distributed Data Interface (FDDI). MAN works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or internet.

Wide Area Network: As the name suggests, the Wide Area Network (WAN) covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These networks provide connectivity to MANs and LANs.

## 2. (b) Define internet.

Ans: A network of networks is called an internetwork or simply the internet. It is the largest network in existence on this planet. The internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol. Present day, internet is widely implemented using IPv4. Because of shortage of address space it is gradually migrating from IPv4 to IPv6.

Internet enables its users to share and access enormous amount of information worldwide. It uses WWW, FTP, email services, audio and video streaming etc. At huge level, internet works on Client-Server model.

Internet uses very high-speed backbone of fiber optics.

To inter-connect various continents, fibers are laid under sea known to us as submarine communication table. Internet is widely deployed on world wide Web servers. Using HTML linked pages and is accessible by client software known as Web browsers.

2-(c) Write down the purposes of internet.

Ans: Internet is serving many purpose. Some of them are

- Web sites
- E-mail
- Instant messaging
- Blogging
- Social media
- Marketing
- Networking
- Resource sharing
- Audio and video streaming etc.

3.(a) What do you mean by Ethernet?

Ans: Ethernet is a widely deployed LAN technology. This technology was invented by Bob Metcalfe and D.R. Boggs in the year 1970.

Ethernet Shares media. Network which uses shared media has high probability of data collision. Ethernet uses Carrier Sense Multi Access/Collision Detection (CSMA/CD) technology to detect collisions. On the occurrence of collision in Ethernet, all its hosts roll back, wait for some random amount of time, and then re-transmit the data.

Ethernet connector is network interface card equipped with 48-bits MAC address. This helps other Ethernet devices to identify and communicate with remote device in Ethernet.

Traditional Ethernet uses 10 BASE-T specification. Ethernet follows star topology with segment length up to 100 meters. All devices are connected to a hub/switch in a star fashion.

3.(b) What is network topology? Describe two types of mesh topology.

Ans: A network topology is the arrangement with which computer systems or network devices are connected to each other.

In the mesh topology, a host is connected to one or multiple hosts. Mesh topology comes into two types:

- full Mesh: All hosts have a point-to-point connection to every other host in the network.
- Partially Mesh: Not all hosts have point-to-point connection to every other host. Hosts connect to each other in some arbitrarily fashion.

3.(c) Describe various types of topology.

Ans: Network topology have various types. These are:

Bus Topology: In case of Bus Topology, all devices share single communication line or cable. Bus Topology may have problem while multiple hosts sending data at the same time. It is one of the simple forms of networking where a failure of a device does not affect the others devices.

Star Topology: All hosts in Star Topology are connected to a central device, known as hub device, using a point-to-point connection. That is, there exists a point-to-point connection between hosts and hub.

Ring Topology: In Ring Topology, each host machine connects to exactly two other machines, creating a circular network structure. To connect one more host in the existing structure, the administrator may need only one more extra cable.

Tree Topology: Also known as Hierarchical Topology. This topology divides the network into multiple layers of network. Mainly in LANs, a network is bifurcated into 3 types of network. The lowermost is access layer. The middle layer is known as distribution layer. The highest layer is known as core layer.

Hybrid Topology: A network structure whose design contains more than one topology is said to be hybrid topology. Hybrid topology inherits merits and demerits of all the incorporating topologies. Internet is the best example of largest hybrid topology.

4.(a) Discuss about OSI model.

Ans: Open System Interconnect is an open standard for all communication system. This model has seven layers:

- Application layer: This layer is responsible for providing interface to the application user. This layer encompasses protocols which directly interact with the user.
- Presentation layer: This layer defines how data in the native format of remote host should be presented in the native format of host.
- Session layer: This layer maintains sessions between remote hosts.
- Transport layer: This layer is responsible for end-to-end delivery between hosts.
- Network layer: This layer is responsible for address assignment and uniquely addressing hosts in a network.
- Data link layer: This layer is responsible for reading and writing data from and onto the line. Line errors are detected at this layer.
- Physical layer: This layer defines the hardware, cabling

wiring, power output, pulse rate etc.

4.(b) Shortly describe the computer network security.

Ans: During initial days of internet, its use was limited to military and universities for research and development purpose. Later when all networks merged together and formed internet, the data used to travel through public transit network. Common people may send the data that can be highly sensitive such as their bank credentials, username and passwords, personal documents or confidential documents.

Security threats can be divided into the following categories:

• Interruption: Interruption is a security threat in which availability of resources is attacked.

• Privacy-Breach: In this threat, the privacy of a user is compromised.

• Integrity: This type of threat includes any alteration or modification in the original context of communication.

The attacker intercepts and receives the data sent by the sender and the attacker then either modifies or

generates false data and sends to the receiver.

**Authenticity:** This threat occurs when an attacker or a security violator, poses as a genuine person and accesses the resources or communicates with other genuine users.

#### 4.(c) Define secret key encryption.

Ans: Secret key is a cryptographic algorithm. Both Sender and receiver have one secret key. This secret key is used to encrypt the data at sender's end. After the data is encrypted, it is sent on the public domain to the receiver. Because the receiver knows and has the secret key, the encrypted data packets can easily be decrypted.

Example of secret key encryption is Data Encryption.

Standard (DES). In secret key encryption, it is required to have a separate key for each host on the network making it difficult to manage.

5.(a) Write about geographical span.

Ans: Geographically a network can be seen in one of the following categories:

- It may be spanned across your table, among Bluetooth enabled device. Ranging not more than few meters.
- It may be spanned across a whole building, including intermediate devices. to connect all floors.
- It may be spanned across a whole city.
- It may be spanned across multiple cities or provinces.
- It may be one network covering whole world.

5.(b) Define Wide Area Network (WAN).

Ans: Generally, networks are distinguished based on their geographical span. A network can be as small as distance between your mobile phone and its bluetooth headphone; and as large as the internet itself, covering the whole geographical world.

As the name suggests, the Wide Area Network (WAN) covers

a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are wide area network. These networks provide connectivity to MANs and LANs. Since they are equipped with very high speed backbone, WANs use very expensive network equipment.

Wide Area Network may use advanced technologies such as Asynchronous Transfer Mode(ATM), Frame Relay, and Synchronous Optical Network(SONET).

WAN may be managed by multiple administration.

In simplest form, a wide area network is a collection of local area networks or other networks that communicate with one another. A WAN is essentially a network of networks, with the internet the world's largest WAN.

5.(c) What is fast ethernet?

Ans: To encompass need of fast emerging software and hardware technologies, Ethernet extends itself as fast-Ethernet. It can run on UTP, Optical fiber, and wirelessly too. It can provide speed up to 100 MBPS. This standard is named as 100BASE-T in IEEE 802.3 using cat-5 twisted pair cable. It uses CSMA/CD technique for wired media sharing among the Ethernet hosts and CSMA/CA technique for wireless Ethernet LAN.

Fast Ethernet on fibre is defined under 100BASE-FX standard which provides speed up to 100 MBPS on fiber. Ethernet over fiber can be extended up to 100 meters in half-duplex mode and can reach maximum of 2000 meters in full-duplex over multimode fibers.

6.(a) Define application layer.

Ans: Application layer is the top most layer in OSI and TCP/IP layered model. This layer exists in both layered models because of its significance, or interacting with user and user applications. This layer is for applications which are involved in communication system.

When an application layer protocol wants to communicate with its peer application layer protocol on remote host, it hands over the data or information to the transport layer. The transport layer does the rest with the help of all the layers below it.

[Application layer]

[Presentation layer]

[Session layer]

[Transport layer]

[Network layer]

[Data link layer]

[Physical layer]

6.(b) What do you mean by Client-Server model?

Ans: Two remote application processes can communicate mainly in two different fashions:

- Peer to peers
- Client-Server

In client-server model any process can act as Server or Client. It is not the type of machine, size of the machine, or its computing power which makes it server, it is the ability of serving request that makes a machine a server.

A system can act as server and client simultaneously.

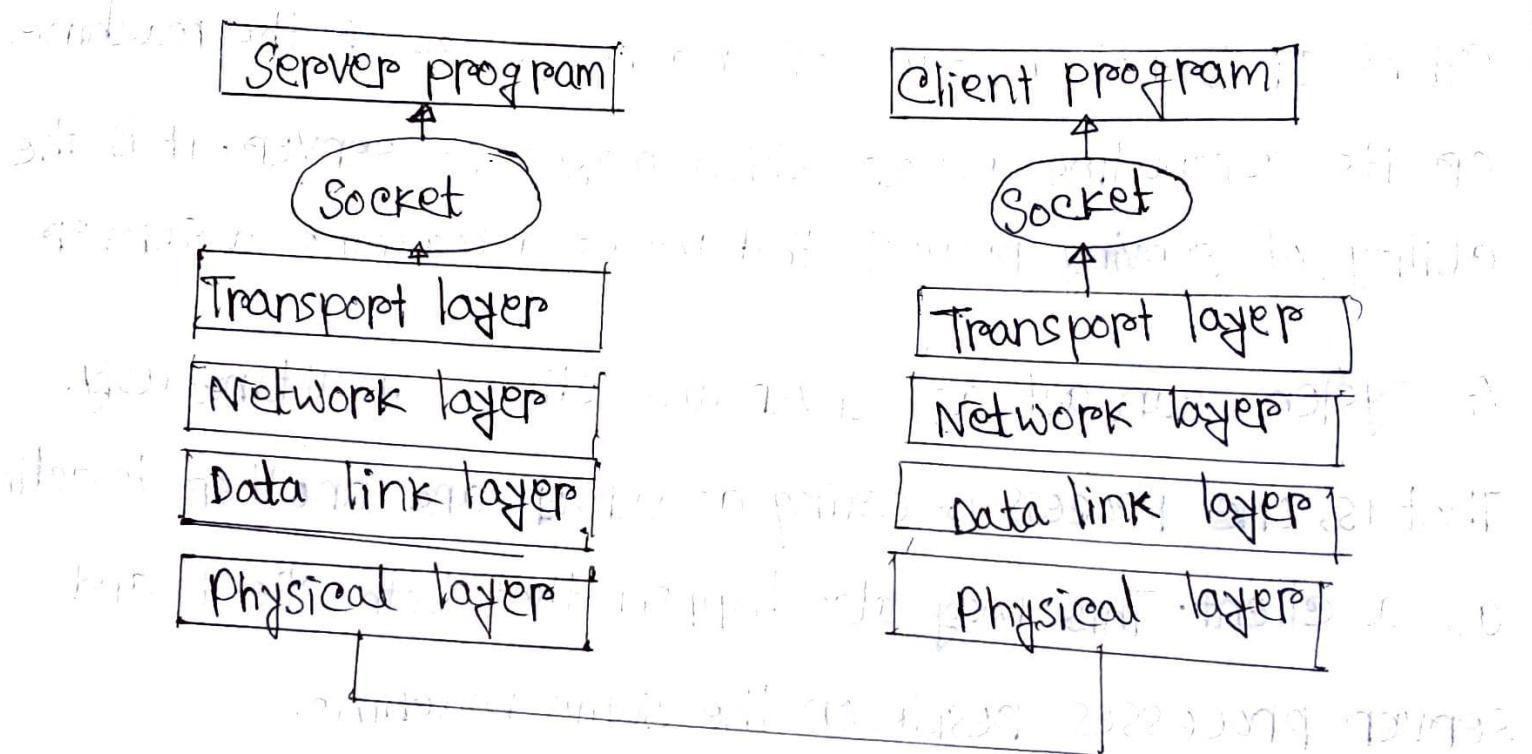
That is, one process is acting as server and another is acting as a client. This may also happen that both client and server processes reside on the same machine.

6.(c) Write down the processes of Client-Server mode

Ans: Two processes in client-server model can interact in various ways:

- Sockets
- Remote procedure calls (RPC)

Sockets: In this paradigm, the process acting as server opens a socket using a well-known port and waits until some client requests comes. The second process acting as a Client also opens a socket but, instead of waiting for an incoming request, the client processes request first.



Remote procedure call: This is a mechanism where one process interacts with another by means of procedure calls. One process calls the procedure lying on remote host. The process on remote host is said to be server. Both processes are allocated stubs.

7.(a) Define application layer protocol.

Ans: There are several protocols which work for users in application layer. These are:

Simple Mail Transfer Protocol: The Simple Mail Transfer Protocol (SMTP) is used to transfer electronic mail from one user to another. This task is done by means of email client software (User Agents) the user is using. User Agents help the user to type and format the email and store it until internet is available.

File Transfer Protocol: The File Transfer Protocol (FTP) is the most widely used protocol for file transfer over the network. FTP uses TCP/IP for communication and it works on TCP port 21.

Post Office Protocol (POP): The Post Office Protocol version 3 (POP 3) is a simple mail retrieval protocol used by User Agents (client email software) to retrieve mail from mail server. When a client needs to retrieve mails from

Servers, it opens a connection with the server on TCP port 110. User can then access his mails and download them to the local computer. POP3 works in two modes.

**Hyper Text Transfer Protocol (HTTP):** The Hyper Text Transfer Protocol (HTTP) is the foundation of World Wide Web.

7.(b) Briefly explain HTTP.

Ans: The Hyper Text Transfer Protocol (HTTP) is the foundation of World Wide Web. Hypertext is well organized documentation system which uses hyperlinks to link the pages in the text documents. HTTP works on client server model. When a user wants to access any HTTP page on the internet, the client machine at user end initiates a TCP connection to server on port 80.

When the server accepts the client request, the client is authorized to access web pages.

To access the web pages, a client normally uses web

browsers, who are responsible for initiating, maintaining, and closing TCP connections. HTTP is a stateless protocol, which means the server maintains no information about earlier requests by clients.

HTTP versions:

- HTTP 1.0 uses non-persistent HTTP. At most one object can be sent over a single TCP connection.
- HTTP 1.1 uses persistent HTTP.

7.(c) Write down the categories of application layer protocols

Ans: Application layer protocols can be broadly divided into two categories:

- Protocols which are used by users. For example: email.
- Protocols which help and support protocols used by users. For example: DNS.

8.(a) Define network service.

Ans: In computer networking, a network service is an application running at the network application layer and above, that provides data storage, manipulation, presentation, communication or other capability which is often implemented using a client-server or peer-to-peer architecture based on application layer network.

8.(b) Describe different types of network services.

Ans: Some basic services computer network can offer are:

Directory Services: This services are mapping between name and its value, which can be variable value or fixed. This software system helps to store the information, organize it and provides various means of accessing it.

File Services: File services include sharing and transferring files over the network.

• File Sharing: One of the reason which gave birth to networking was file sharing. File sharing enables its users to share their data with other users.

• file Transfer: This is an activity to copy or move file from one computer to another computer or to multiple computers which help of underlying network.

### Communication Services:

• Email: Electronic mail is a communication method and something a computer user cannot work without.

• Social networking: Recent technologies have made technical life social. The computer savvy peoples, can find other known peoples or friends, can connect with them, and can share thoughts, pictures and videos.

• Internet Chat: Internet chat provides instant text transfer services between two hosts. Two or more people can communicate with each other using text based internet relay chat services.

8.(c) Write down about application services

Ans: These are nothing but providing network based services to the user such as Web services, database managing and resource sharing.

• Resource Sharing: To use resources efficiently and economically, network provides a mean to share them. This may include servers, Printers and Storage Media etc.

• Databases: This application service is one of the most important services. It stores data and information, processes it and enables the users to retrieve it efficiently by using queries. Database help organizations to make decisions based on statistics.

• Web services: World Wide Web has become the synonym for internet. It is used to connect to the internet, and access files and information services provided by the internet servers.