Fundamentals of Networks

Assignment 1

Q1: State the classification of networks.

Ans:

There are fourth major of classification of networks :

1. **LAN:**
   LAN or Local Area Network connects network devices in such a way that personal computer and workstations can share data, tools and programs. The group of computers and devices are connected together by a switch, or stack of switches, using a private addressing scheme as defined by the TCP/IP protocol. Private addresses are unique in relation to other computers on the local network.
2. **MAN:**
   MAN or Metropolitan area Network covers a larger area than that of a LAN and smaller area as compared to WAN. It connects two or more computers that are apart but resides in the same or different cities.
3. **WAN:**
   WAN or Wide Area Network is a computer network that extends over a large geographical area, although it might be confined within the bounds of a state or country.
4. **PAN:**
   PAN It is used in a home, small office or one building and contains few devices and is controlled by one person

Q2: What are the functionalities of each layers of the OSI network model?

Ans:

1 - Physical layer:

The main functionality of the physical layer is to transmit the individual bits from one node to another node.

Line Configuration: It defines the way how two or more devices can be connected physically.

Data Transmission: It defines the transmission mode whether it is simplex, half-duplex or full-duplex mode between the two devices on the network.

2- Data-Link Layer

The data link layer translates the physical's raw bit stream into packets known as Frames. The Data link layer adds the header and trailer to the frame. The header which is added to the frame contains the hardware destination and source address.

3- Network Layer

Internetworking: An internetworking is the main responsibility of the network layer. It provides a logical connection between different devices.

Addressing: A Network layer adds the source and destination address to the header of the frame. Addressing is used to identify the device on the internet.

Routing: Routing is the major component of the network layer, and it determines the best optimal path out of the multiple paths from source to the destination.

Packetizing: A Network Layer receives the packets from the upper layer and converts them into packets. This process is known as Packetizing. It is achieved by internet protocol (IP).

4- Transport Layer

Transmission Control Protocol

1. It is a standard protocol that allows the systems to communicate over the internet.

2. It establishes and maintains a connection between hosts.

3. When data is sent over the TCP connection, then the TCP protocol divides the data into smaller units known as segments. Each segment travels over the internet using multiple routes, and they arrive in different orders at the destination. The transmission control protocol reorders the packets in the correct order at the receiving end.

User Datagram Protocol

1. User Datagram Protocol is a transport layer protocol.

2. It is an unreliable transport protocol as in this case receiver does not send any acknowledgment when the packet is received, the sender does not wait for any acknowledgment. Therefore, this makes a protocol unreliable.

5- Session Layer

1. Dialog control: Session layer acts as a dialog controller that creates a dialog between two processes or we can say that it allows the communication between two processes which can be either half-duplex or full-duplex.

2. Synchronization: Session layer adds some checkpoints when transmitting the data in a sequence. If some error occurs in the middle of the transmission of data, then the transmission will take place again from the checkpoint. This process is known as Synchronization and recovery.

6 - Presentation Layer

1. Translation: The processes in two systems exchange the information in the form of character strings, numbers and so on. Different computers use different encoding methods, the presentation layer handles the interoperability between the different encoding methods. It converts the data from sender-dependent format into a common format and changes the common format into receiver-dependent format at the receiving end.

2. Encryption: Encryption is needed to maintain privacy. Encryption is a process of converting the sender-transmitted information into another form and sends the resulting message over the network.

3. Compression: Data compression is a process of compressing the data, i.e., it reduces the number of bits to be transmitted. Data compression is very important in multimedia such as text, audio, video.

7 - Application Layer

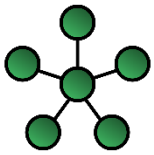
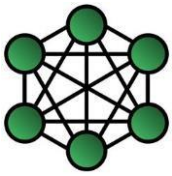
1- File transfer, access, and management (FTAM): An application layer allows a user to access the files in a remote computer, to retrieve the files from a computer and to manage the files in a remote computer.

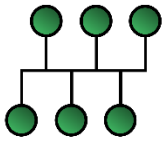
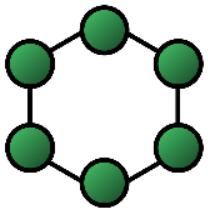
2- Mail services**:** An application layer provides the facility for email forwarding and storage.

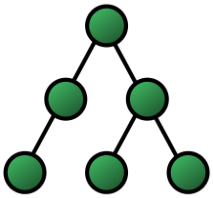
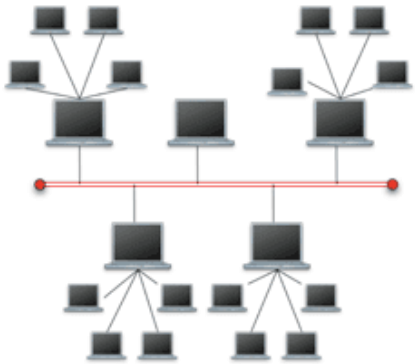
3- Directory services: An application provides the distributed database sources and is used to provide that global information about various objects.

Q3: Explain and compare between the different networks topologies?

Ans:

Topologies	Advantages	Disadvantages
Star 	1. It is very reliable – if one cable or device fails then all the others will still work 2. It is high-performing as no data collisions can occur 3. Easier to put in 4. Robust in nature	1. Requires more cable than a linear bus Extra 2. hardware is required (hubs or switches) which adds to cost More expensive than 3. linear bus topology due to the value of the
		connecting devices
Mesh 	1. Failure during a single device won't break the network. 2. There is no traffic problem as there is a dedicated point to point links for every computer. Fault identification is 3. straightforward. This topology provides 4. multiple paths to succeed in the destination and tons of redundancy. It provides high privacy 5. and security.	1. It's costly as compared to the opposite network topologies i.e. star, bus, point to point topology. 2. Installation is extremely difficult in the mesh. 3. Power requirement is higher as all the nodes will need to remain active all the time and share the load. Complex 4. process. The cost to 5. implement mesh is above other selections.

Bus 	1. It is the easiest network topology for connecting peripherals or computers in a linear fashion. 2. It works very efficient well when there is a small network. 3. Length of cable required is less than a star topology. 4. It is easy to connect or remove devices in this network without affecting any other device.	1. Bus topology is not great for large networks. 2. Identification of problem becomes difficult if whole network goes down. 3. Troubleshooting of individual device issues is very hard. 4. Need of terminators are required at both ends of main cable. 5. Additional devices slow network down.
Ring 	1. It is cheap to install and expand. 2. 3. Minimum collision. Speed to transfer the data is very high in this 4. type of topology. Due to the presence of token passing the performance of ring topology becomes better than bus topology under heavy 5. traffic. Easy to manage.	1. 2. It is Expensive. Addition and removal of any node during a network is difficult and may cause issue in 3. network activity. Difficult to troubleshoot 4. the ring. In order for all the computer to communicate with each other, all computer must 5. be turned on. Total dependence in on one cable. 6. They were not Scalable.

Tree 	1. The other nodes in a network are not affected, if one of their nodes get damaged or not working. 2. Tree topology provides easy maintenance and easy fault identification can be done. 3. A callable topology. Leaf nodes can hold more nodes. 4. Supported by several hardware and software vendors. 5. Point-to-point wiring for individual segments.	1. Requires large number of cables compared to star and ring topology. As the 2. data needs to travel from the central cable this creates dense network traffic. 3. The Backbone appears as the failure point of the entire segment of the network. Treatment 4. of the topology is pretty complex. The establishment cost 5. increases as well. If the bulk of nodes are 6. added in this network, then the maintenance will become complicated.
Mixture 	1. It is very reliable. 2. It is easily scalable as Hybrid networks are built in a fashion which enables for easy integration of new hardware components. 3. Error detecting and trouble shooting is easy. 4. Handles large volume of traffic. 5. It is used for create large network.	1. There is change hardware in order to connect topology with another topology. 2. Usually hybrid architectures are usually larger in scales so they requires a lot of cables in installation process. 3. Hubs which are used to connect two distinct networks, are very costly. And hubs are different from usual hubs as they need to be intelligent enough to work with different architectures. 4. Installation is a difficult process.

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