Network Servers and Infrastructure

Assignment 1

Q1: State the classification of networks.

Ans 1)

- LAN (Local Area Network)
- MAN (Metropolitan Area Network)
- WAN (Wide Area Network)

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

Ans 2)

7	application layer	The application layer enables the user -- human or software -- to interact with the application or network whenever the user elects to read messages, transfer files or perform other network-related tasks
6	presentation layer	The presentation layer translates or formats data for the application layer based on the semantics or syntax the application accepts. This layer also handles the encryption and decryption that the application layer requires.
5	Session layer	The session layer sets up, coordinates and terminates conversations between applications. Its services include authentication and reconnection after an interruption. This layer determines how long a system will wait for another application to respond.
4	Transport layer	The transport layer is responsible for transferring data across a network and provides error-checking mechanisms and data flow controls. It determines how much data to send, where it gets sent and at what rate.
3	Network layer	The primary function of the network layer is to move data into and through other networks. Network layer protocols accomplish this by packaging data with correct network address information
2	data-link layer	The data-link, or protocol layer, in a program handles moving data into and out of a physical link in a network. This layer handles problems that occur as a result of bit transmission errors
1	physical layer	transports data using electrical, mechanical or procedural interfaces. This layer is responsible for sending computer bits from one device to another along the network.

Q3: Explain and compare between the different networks topologies?

Q3)

1- Point to Point (P2P)

Point-to-point topology is the easiest of all the network topologies. In this method, the network consists of a direct link between two computers.
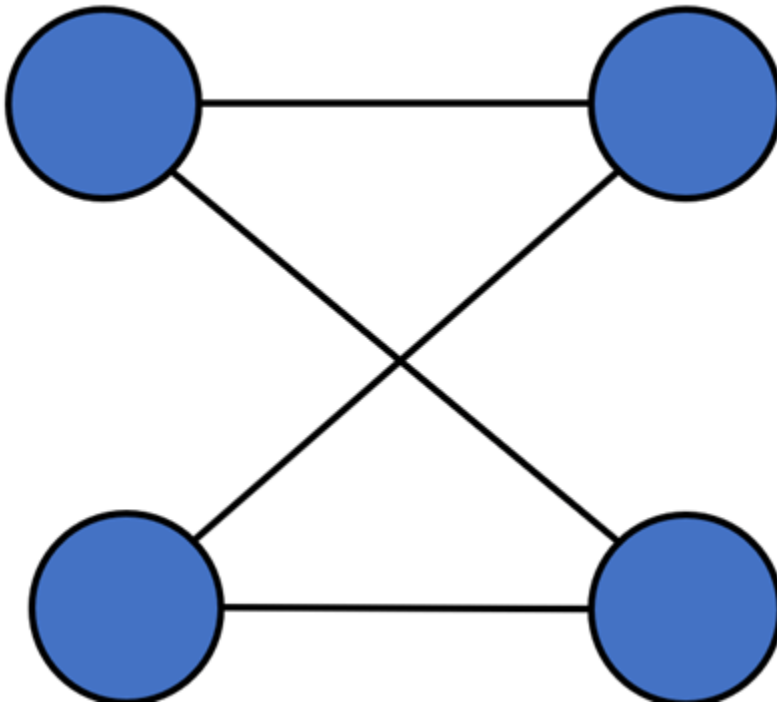
Advantages:

This is faster and highly reliable than other types of connections since there is a direct connection.

No need for a network operating system

Does not need an expensive server as individual workstations are used to access the files

No need for any dedicated network technicians because each user sets their permissions
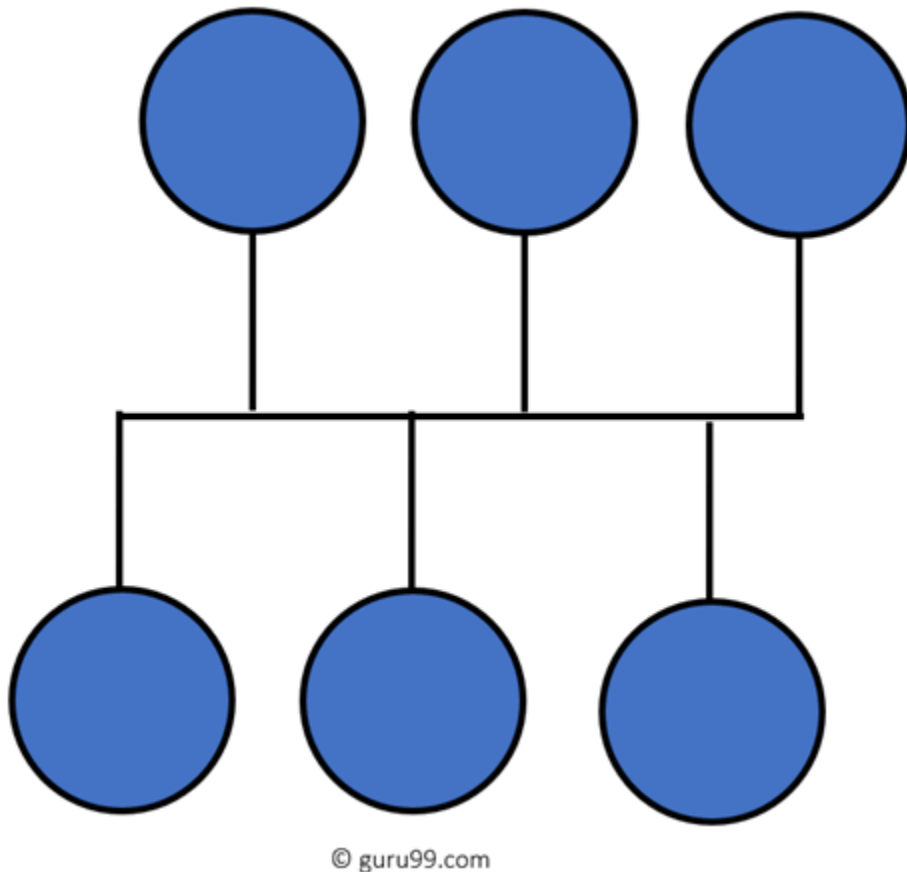
Disadvantages:

The biggest drawback is that it only be used for small areas where computers are in close proximity.

You can't back up files and folders centrally

There is no security besides the permissions. Users often do not require to log onto their workstations.

2- Bus Topology

Bus topology uses a single cable which connects all the included nodes. The main cable acts as a spine for the entire network. One of the computers in the network acts as the computer server. When it has two endpoints, it is known as a linear bus topology.

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Advantages:

Here are pros/benefits of using a bus topology:

- Cost of the cable is very less as compared to other topology, so it is widely used to build small networks.
- Famous for LAN network because they are inexpensive and easy to install.
- It is widely used when a network installation is small, simple, or temporary.
- It is one of the passive topologies. So computers on the bus only listen for data being sent, that are not responsible for moving the data from one computer to others.

Here are the cons/drawbacks of bus topology:

- In case if the common cable fails, then the entire system will crash down.
- When network traffic is heavy, it develops collisions in the network.
- Whenever network traffic is heavy, or nodes are too many, the performance time of the network significantly decreases.
- Cables are always of a limited length.

3- Ring Topology

In a ring network, every device has exactly two neighboring devices for communication purpose. It is called a ring topology as its formation is like a ring. In this topology, every computer is connected to another computer. Here, the last node is combined with a first one.

This topology uses token to pass the information from one computer to another. In this topology, all the messages travel through a ring in the same direction.

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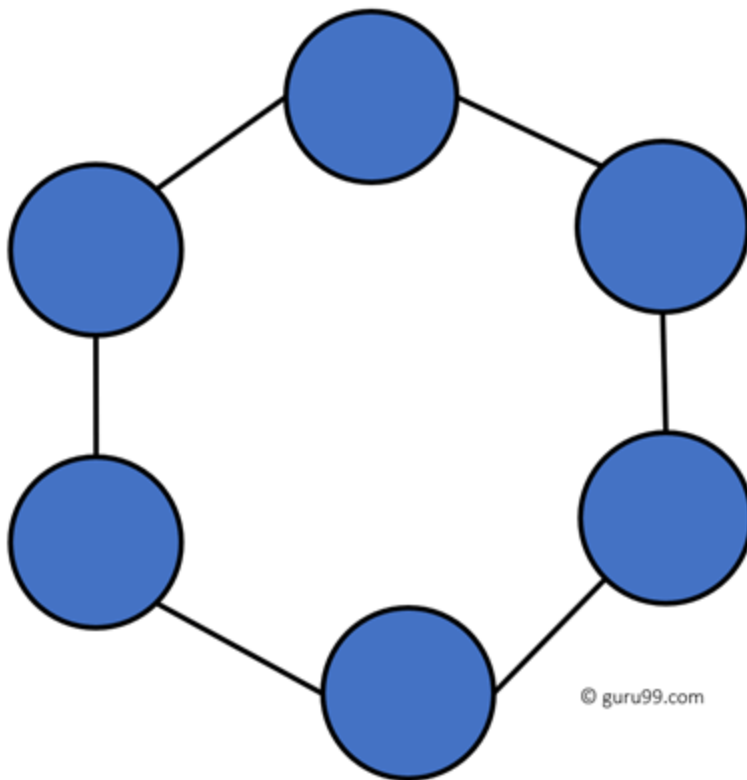
Here are pros/benefits of ring topology:

- Easy to install and reconfigure.
- Adding or deleting a device in-ring topology needs you to move only two connections.
- The troubleshooting process is difficult in a ring topology.
- Failure of one computer can disturb the whole network.
- Offers equal access to all the computers of the networks
- Faster error checking and acknowledgment.

Disadvantages:

Here are drawbacks/cons of ring topology:

- Unidirectional traffic.
- Break in a single ring can risk the breaking of the entire network
- Modern days high-speed LANs made this topology less popular.
- In the ring, topology signals are circulating at all times, which develops unwanted power consumption.
- It is very difficult to troubleshoot the ring network.
- Adding or removing the computers can disturb the network activity.

4- Star Topology

In the star topology, all the computers connect with the help of a hub. This cable is called a central node, and all other nodes are connected using this central node. It is most popular on LAN networks as they are inexpensive and easy to install.

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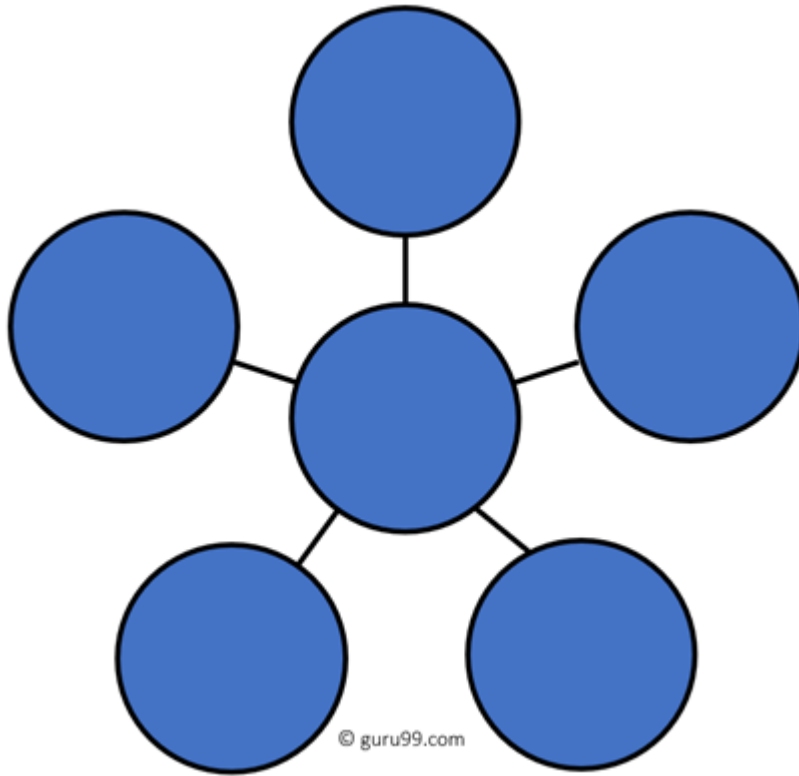
Advantages:

Here are pros/benefits of start topology:

- Easy to troubleshoot, set up, and modify.
- Only those nodes are affected, that has failed. Other nodes still work.
- Fast performance with few nodes and very low network traffic.
- In Star topology, addition, deletion, and moving of the devices are easy.

Disadvantages:

Here are cons/drawbacks of using Star:

- If the hub or concentrator fails, attached nodes are disabled.
- Cost of installation of star topology is costly.
- Heavy network traffic can sometimes slow the bus considerably.
- Performance depends on the hub's capacity
- A damaged cable or lack of proper termination may bring the network down.

5- Mesh Topology

The mesh topology has a unique network design in which each computer on the network connects to every other. It is develops a P2P (point-to-point) connection between all the devices of the network. It offers a high level of redundancy, so even if one network cable fails, still data has an alternative path to reach its destination.

Types of Mesh Topology:

- **Partial Mesh Topology:** In this type of topology, most of the devices are connected almost similarly as full topology. The only difference is that few devices are connected with just two or three devices.

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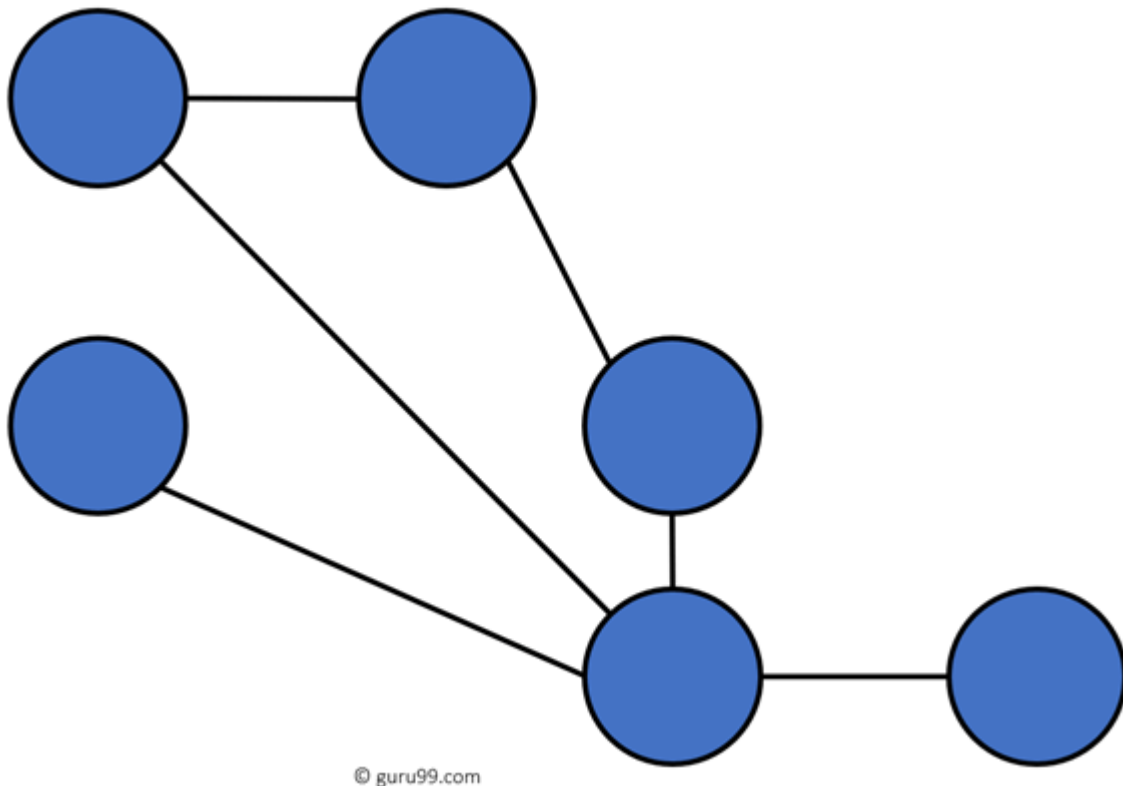
- **Full Mesh Topology:** In this topology, every nodes or device are directly connected with each other.

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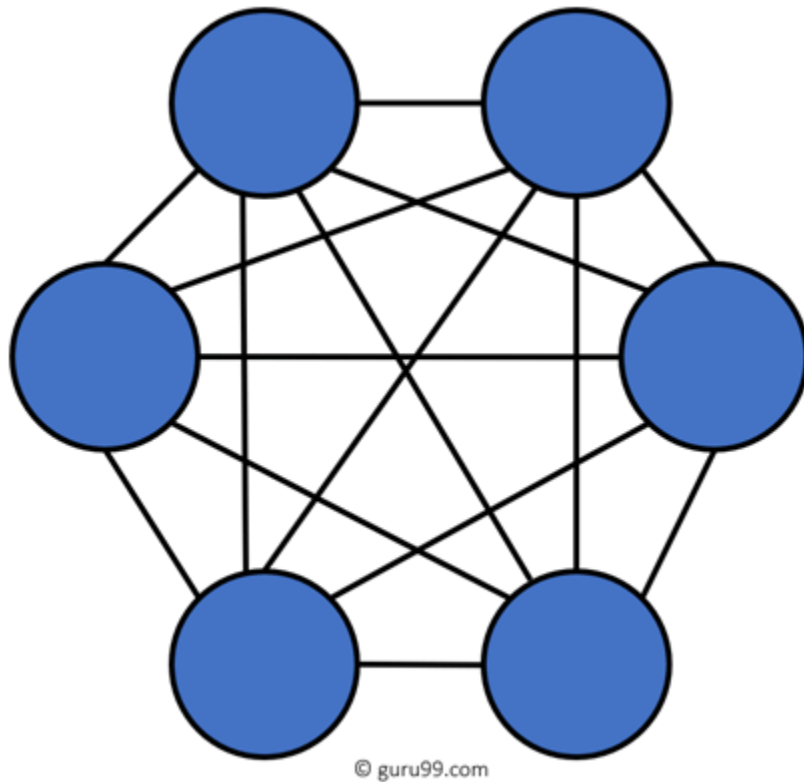
Advantages:

Here, are pros/benefits of Mesh topology

- The network can be expanded without disrupting current users.
- Need extra capable compared with other LAN topologies.
- No traffic problem as nodes has dedicated links.
- Dedicated links help you to eliminate the traffic problem.
- A mesh topology is robust.
- It has multiple links, so if any single route is blocked, then other routes should be used for data communication.
- P2P links make the fault identification isolation process easy.
- It helps you to avoid the chances of network failure by connecting all the systems to a central node.
- Every system has its privacy and security.
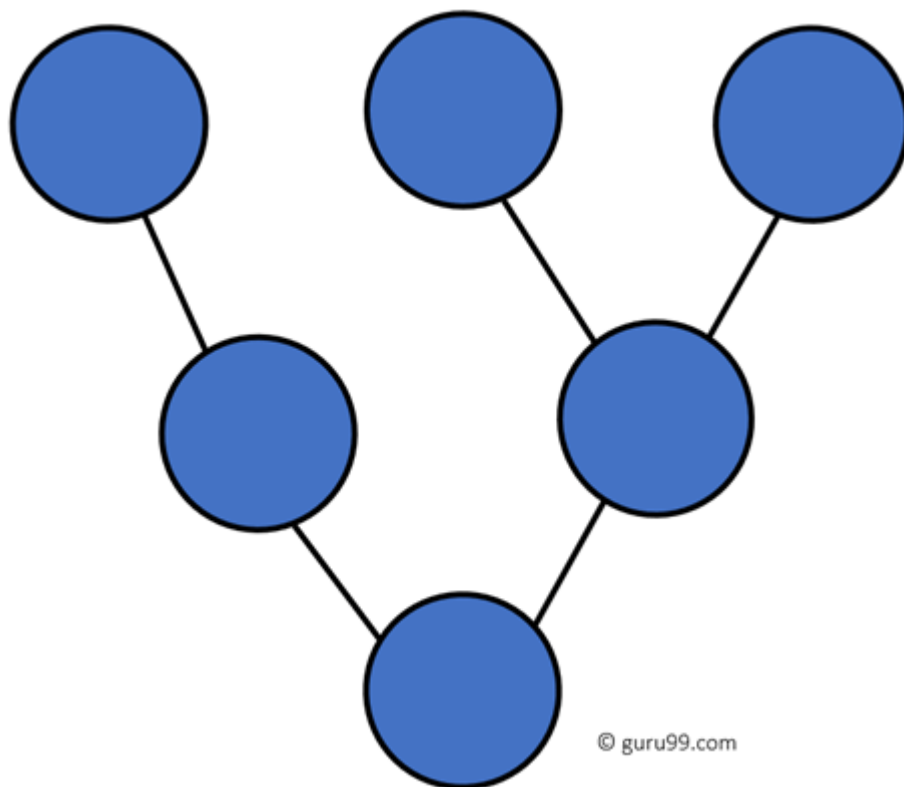
Disadvantages:

- Installation is complex because every node is connected to every node.
- It is expensive due to the use of more cables. No proper utilization of systems.
- Complicated implementation.
- It requires more space for dedicated links.
- Because of the amount of cabling and the number of input-outputs, it is expensive to implement.

- It requires a large space to run the cables.

6- Tree Topology

Tree topologies have a root node, and all other nodes are connected which form a hierarchy. So it is also known as hierarchical topology. This topology integrates various star topologies together in a single bus, so it is known as a Star Bus topology. Tree topology is a very common network which is similar to a bus and star topology.

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Advantages:

Here are pros/benefits of tree topology:

- Failure of one node never affects the rest of the network.
- Node expansion is fast and easy.
- Detection of error is an easy process
- It is easy to manage and maintain

Disadvantages:

Here are cons/drawback of tree topology:

- It is heavily cabled topology
- If more nodes are added, then its maintenance is difficult
- If the hub or concentrator fails, attached nodes are also disabled.

7- Hybrid Topology

Hybrid topology combines two or more topologies. You can see in the above architecture in such a manner that the resulting network does not exhibit one of the standard topologies.

For example, as you can see in the above image that in an office in one department, Star and P2P topology is used. A hybrid topology is always produced when two different basic network topologies are connected.

Advantages:

Here, are advantages/pros using Hybrid topology:

- Offers the easiest method for error detecting and troubleshooting
- Highly effective and flexible networking topology
- It is scalable so you can increase your network size

Disadvantages:

- The design of hybrid topology is complex
- It is one of the costliest processes