Name: Akinola Oluseyi Ezekiel

Matric Number: RUN/CMP/24/17874

Course Title: Internet Technology

Course Code: CSC 828

Assignment #2:

Discuss on the different types of network topologies and state their various advantages and disadvantages. Also, compare them on key performance metrics.

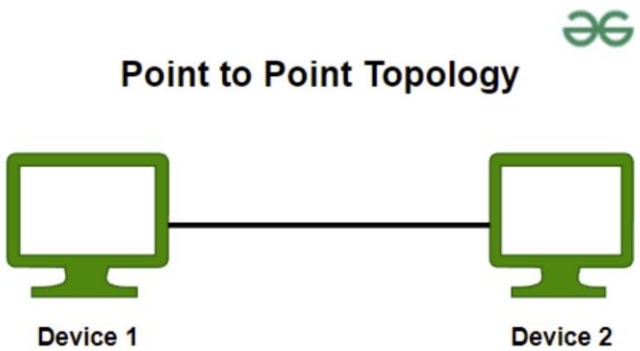
Response:

Background

Network topology is important because it defines how devices are connected and how they communicate in the network. The topology is very important because it helps to enhance network performance, reliability, expansion and security. There are about seven different types of network topologies. They are discussed below:

1. **Point-to-point Topology**

   The point-to-point topology is the simple form of network topology. It works on the sender-receiver functionality. It main advantages is that it provides high bandwidth. Figure 1 shows a sample set-up of a point-to-point network topology.



Point to Point Topology

Figure 1 Sample Point-to-point topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

2. Bus Topology

Bus Topology is a bi-directional type of network type which every computer and network device is connected to a single cable. It is a multi-point connection and a non-robust topology because if the backbone fails the topology crashes. Figure 2 shows a sample set-up of a Bus network topology.

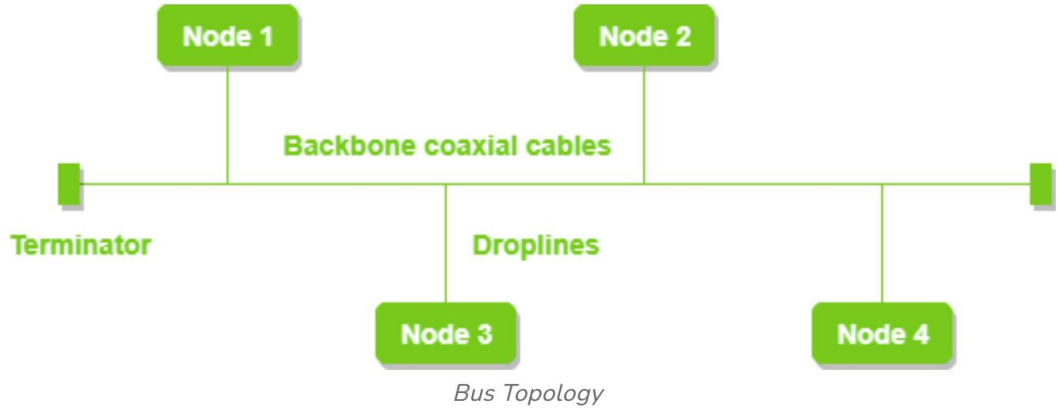


Figure 2 Sample BUS topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

Advantage of BUS topology

(i) It is easy to set up, handle, and implement.
(ii) It is best suited for small networks.
(iii) It costs very little.

Disadvantages of BUS topology

(i) The cable length is limited. This limits the number of network nodes that can be connected.

(ii) This network topology can perform well only for a limited number of nodes. When the number of devices connected to the bus increases, the efficiency decreases.

(iii)It is suitable for networks with low traffic. High traffic increases the load on the bus, and the network efficiency drops.

(iv) It is heavily dependent on the central bus. A fault in the BUS model leads to network failure.

(v) It is not easy to isolate faults in the network nodes.

(vi) Each device on the network "sees" all the data being transmitted, thus posing a security risk.

3. Ring Topology

This type of network topology forms a ring connecting devices with exactly two neighboring devices. Ring topology uses a number of repeaters with a large number of nodes. It enables data flow in one direction but can be made bi-directional (also known as dual ring topology). It also used ring passing protocol to transmit data. Figure 3 shows a sample set-up of a Ring network topology.

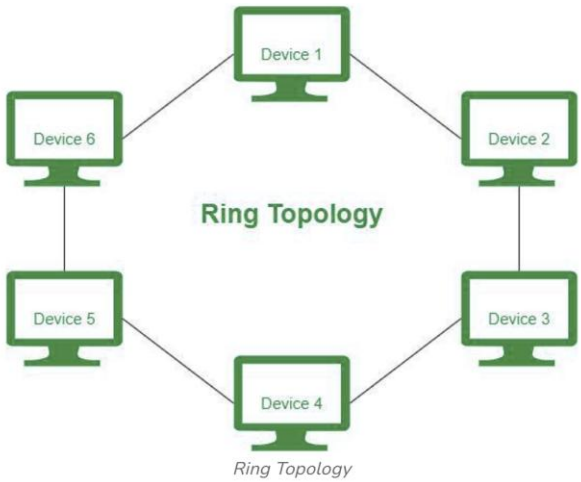


Figure 3 Sample Ring topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

Advantages of Ring topology

(i) The data being transmitted between two nodes passes through all the intermediate nodes. A central server is not required for the management of this

topology.

(ii) The traffic is unidirectional and the data transmission is high-speed.

(iii) In comparison to a bus, a ring is better at handling load.

(iv) The adding or removing of network nodes is easy, as the process requires changing only two connections.

(v) The configuration makes it easy to identify faults in network nodes.

(vi) In this topology, each node has the opportunity to transmit data. Thus, it is a very organized network topology.

(vii) It is less costly than a star topology.

Disadvantages of Ring topology

(i) The failure of a single node in the network can cause the entire network to fail.

(ii) The movement or changes made to network nodes affect the entire network's performance.

(iii) Data sent from one node to another has to pass through all the intermediate nodes. This makes the transmission slower in comparison to that in a star model. The transmission speed drops with an increase in the number of nodes.

(iv) There is heavy dependency on the wire connecting the network nodes in the ring.

4. Mesh topology

Mesh network topology connects every device to another device via a particular channel. Every device is connected to another via dedicated channels. These channels are known as links. An example of protocols used are AHCP (Ad Hoc Configuration Protocols), etc. Figure 4 shows a sample set-up of a Mesh network topology.

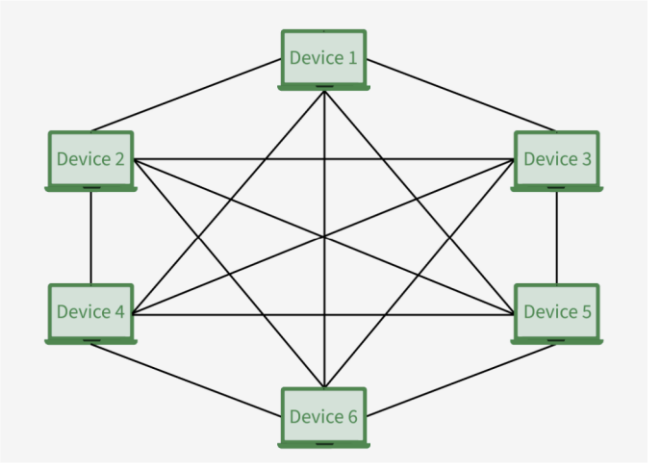


Figure 4 Sample Mesh topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

Advantages of Mesh topology

(i) The arrangement of the network nodes is such that it is possible to transmit data from one node to many other nodes at the same time.

(ii) The failure of a single node does not cause the entire network to fail as there are alternate paths for data transmission.

(iii) It can handle heavy traffic, as there are dedicated paths between any two network nodes.

(iv) Point-to-point contact between every pair of nodes makes it easy to identify faults.

Disadvantages of mesh topology

(i) The arrangement wherein every network node is connected to every other node of the network, many connections serve no major purpose. This leads to the redundancy of many network connections.

(ii) A lot of cabling is required. Thus, the costs incurred in setup and maintenance are high.

(iii) Owing to its complexity, the administration of a mesh network is difficult.

5. Star Topology

The Star network topology connects all the devices a to a single hub through a cable.

Thus, making the hub the central node and all other nodes are connected to the central node. The hub can be passive in nature i.e., not an intelligent hub such as broadcasting devices, at the same time the hub can be intelligent known as an active hub. They are connected by Coaxial cables or RJ-45 cables. Collision Detection (CD) LAN protocol is an example of ethernet used. Figure 5 shows a sample set-up of a Star network topology.

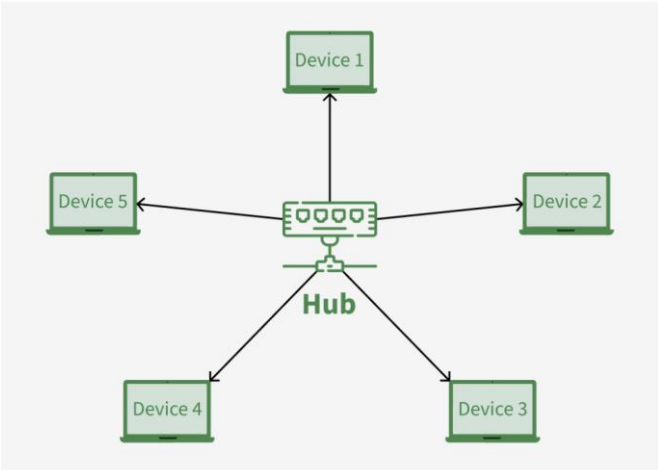


Figure 5 Sample Star topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

Advantages of Star topology

(i) Due to its centralized nature, the topology offers simplicity of operation.

(ii) It also achieves isolation of each device in the network.

(iii) Adding or removing network nodes is easy, and can be done without affecting the entire network.

(iv) Due to its centralized nature, it is easy to detect faults in the network devices.

(v) As the analysis of traffic is easy, the topology poses a lesser security risk.

(vi) Data packets do not have to pass through many nodes, like in the case of a ring network. Thus, with the use of a high-capacity central hub, traffic load can be handled at fairly decent speeds.

Disadvantages of Star topology

(i) Network operation depends on the functioning of the central hub. Hence, the middle hub failure leads to the failure of the entire network.

(ii) Also, the number of nodes that can be added, depends on the capacity of the central hub.

(iii) The setup cost is quite high.

6. **Tree Topology**

The Tree topology is the variation of the Star topology. This topology has a hierarchical flow of data. Tree Topology uses protocols like DHCP and SAC (Standard Automatic Configuration). Also, the tree topology uses various secondary hubs which are connected to the central hub that contains the repeater. Data flow in Tree network topology is from top to bottom i.e. from the central hub to the secondary and then to the devices or from bottom to top. Figure 6 shows a sample set-up of a tree network topology.

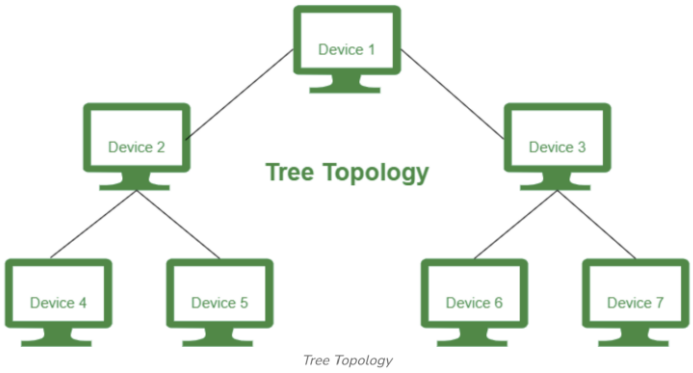


Figure 6 Sample Tree topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

Advantages of Tree topology

(i) It allows more devices to be attached to a single central hub thus it

decreases the distance that is traveled by the signal to come to the devices.

(ii) It allows the network to get isolated and also prioritize from different computers.

(iii) We can add new devices to the existing network.

(iv) Error detection and error correction are very easy in a tree topology.

Disadvantages of Tree topology

(i) If the central hub gets fails the entire system fails.

(ii) The cost is high because of the cabling.

(iii) If new devices are added, it becomes difficult to reconfigure.

7. Hybrid Topology

The Hybrid topology can be described as a combination of all the various types of topologies. They are used when the nodes are free to take any form. This means that hybrid topology can be an individual such as Ring or Star or Mesh topology or can be a combination of various types of topologies discussed above. Each individual topology uses the protocol that has been discussed earlier. Figure 7 shows a sample set-up of a hybrid network topology.

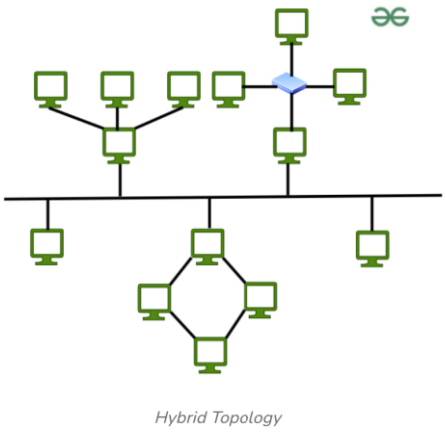


Figure 1 Sample hybrid topology (image source: https://www.geeksforgeeks.org/types-of-network-topology/)

Advantages of Hybrid topology

(i) This topology is very flexible.
(ii) The size of the network can be easily expanded by adding new devices.

Disadvantages of Hybrid topology

(i) It is challenging to design the architecture of the Hybrid Network.
(ii) Hubs used in this topology are very expensive.
(iii) The infrastructure cost is very high as a hybrid network requires a lot of cabling and network devices

Response:

Comparison of different topology Performance Matrices

Topology	Routing	Complexity	Expansion	Reliability	Cost	Security
Star	All information passes through the central network	Very simple (used for LANs)	Easy to add new computer by just plugging to the hub.	No so reliable because if the connection goes down, it also shutdown	It require costly connection cables.	Prone to denial of service attack
Ring	Information moves only in one direction	Used for LANs	Connecting new computer to the networks requires a complete breaking of the connecting cable thereby shutting down the whole network.	It allows the continuous transfer of information even when one of the cables is broken.	Very expensive to maintain since it uses more cable than others topologies.	The security is not o good as the information must travel through all the computer before reaching the final one.
Bus	One computer	The simplest	The network	A malfuncti	A cheaper	No so secure

	sends information over the network	used	needs to be shut down whenever a computer is to be added. Thereby making it unsuitable for some network configuration	on one computer leads to complete shut down of the whole network	network due to it use of copper cable	due to broadcast
Mesh	The connection is with many paths but with fault tolerance	Mostly used for WANs	Very difficult to expand	Very reliable as it does not have any single point of failure	Very expensive because of high cable cost.	Secured.
Tree	Information propagates from any station move through the medium and gets received by all other stations	Used for WANs	This is the simplest to install and extend.	The network can be partitioned easily.	Costly due to the use of many cable	The security is very low due to the fact that it is physically star but logically Bus.

References

https://iptcommunications.weebly.com/the-advantages-and-disadvantages-of-network-topologies.html

https://instrumentationtools.com/advantages-and-disadvantages-of-network-

topologies/

https://www.geeksforgeeks.org/types-of-network-topology/

www.edrawsoft.com/Network-Topologies.php

www.studytonight.com/computer-networks-topology-types

https://www.scribd.com/document/302259510/Comparison-Between-Network-Topologies?v=0.704