

Review

## A Study on Different Network Topologies

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### Abstract:

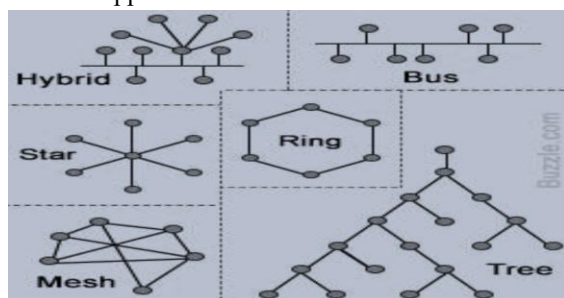
Constructing Network topology using computing program helps in understanding various applications in network design. Network topology refers to the physical and logical arrangement of a computer network. It defines the structure of the network of how all the components are interconnected to each other. It is geometrical arrangement of computer resources, remote devices and communication facilities is known as Network structure or Network topology. A computer network is comprised of nodes and links. A node represents an endpoint device such as a computer, terminal device, workstation or any interconnecting equipment facility. The terms "circuit" and "Channel" are frequently used as synonyms for the link. There are different types of the topologies like bus, ring, tree, mesh, tree and hybrid etc. Each topology has its own advantages and Limitations depending on the application.

**Keywords:** Network Topology, Nodes, Links, Communication, Mesh, Star.

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## 1. INTRODUCTION

The mathematical subject of Topology investigates objects whose characteristics are constant through distortion. Objects can be topologically equivalent while appearing physically different. As an example, any two objects are said to be topologically equivalent if one can be transformed into other without cutting or breaking. For example, objects formed using a simple rubber band are equivalent as long as the band is not cut. There are two main types of network topology physical and logical. physical actual layout of the computer cables and other network devices Logical – the way in which the network appears to the devices that use it.



## 2. TYPES OF TOPOLOGIES

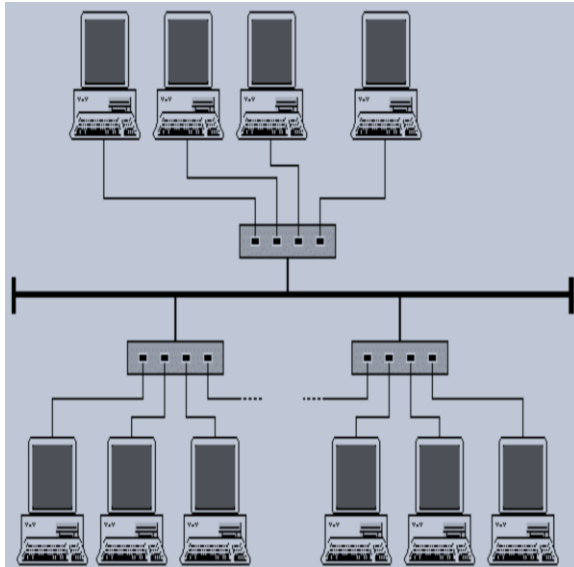
There are various types of Network topologies being used these days. These are mentioned below.

### 2.1 BUS TOPOLOGY

Alternatively referred to as a **line topology**, a **bus topology** is a network setup where each computer and network device are connected to a single cable or backbone. Bus networks are useful in small networks (like that setup in a small offices) and have the advantage of using less cable. Does not use any specialized network to equipment

Their main disadvantage is that if any segment of the network fails, all transmissions do as well. Difficult to troubleshoot. Below is a visual example of a simple computer setup on a network using the bus topology. By this type of topology, if one node goes faulty all nodes may be affected as all nodes share the same cable for the sending and receiving of information. The cabling cost of bus systems is the least of all the different topologies. Each end of the cable is terminated using a special terminator.

Coaxial cablings (10Base-2, 10Base5) were popular options years ago



**BUS TOPOLOGY**

**ADVANTAGES**

- It is a very small networks as well as easy to use and understand.
- Easy to connect a computer to a linear bus.
- Requires less cable length than a star topology.
- It works well for small networks.

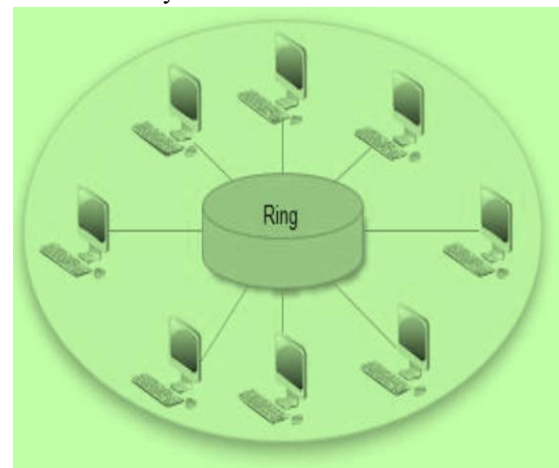
**DISADVANTAGES**

- Entire network shuts down if there is a break in the main cable.
- Terminators are required at both ends of the backbone cable.
- Difficult to identify the problem if the entire network shuts down.
- Not meant to be used as a stand-alone solution in a large building.
- It is slow when more devices are added into the network.
- If a main cable is damaged then network will fail or be split into two networks.

**2.2 RING TOPOLOGY**

A **ring network** is a network topology in which each node connects to exactly two other nodes, forming a single continuous pathway for signals through each node - a ring. Typically FDDI, SONET or Token Ring technology are used to implement a ring network

Ring networks are most commonly wired in a star configuration. A node failure or cable break might isolate every node attached to the ring. In response, some ring networks add a "counterrotating ring" (C-Ring) to form a redundant topology: in the event of a break, data are wrapped back onto the complementary ring before reaching the end of the cable, maintaining a path to every node along the resulting C-Ring. Such "dual ring" networks include Spatial Reuse Protocol, Fiber Distributed Data Interface (FDDI), and Resilient Packet Ring. 802.5 networks - also known as IBM token ring networks - avoid the weakness of a ring topology altogether: they actually use a *star* topology at the *physical* layer and a media access unit (MAU) to *imitate* a ring at the *datalink* layer.



**RING TOPOLOGY**

**ADVANTAGES**

- Very orderly network where every device has access to the token and the opportunity to transmit.
- Performs better than a bus topology under heavy network load.
- Does not require a central node to manage the connectivity between the computers.
- Due to the point-to-point line configuration of devices with a device on either side (each device is connected to its immediate neighbour), it is quite easy to install and reconfigure since adding or removing a device requires moving just two connections.
- It is Point to point line configuration makes it easy to identify.

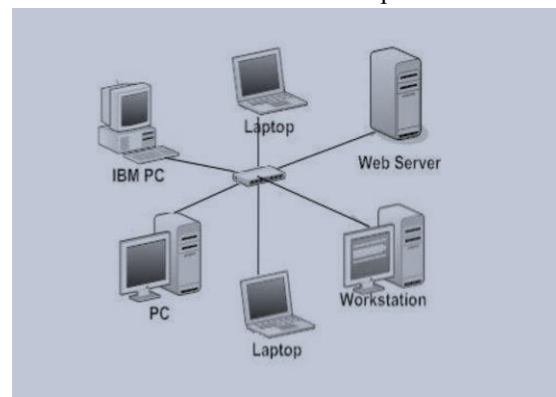
**DISADVANTAGES**

- One malfunctioning workstation can create problems for the entire network.
- This can be solved by using a dual ring or a switch that closes off the break. Moving, adding and changing the devices can affect the network. Communication delay is directly proportional to number of nodes in the network
- Bandwidth is shared on all links between devices. More difficult to configure than a Star: node adjunction = Ring shutdown and reconfiguration

**2.3 STAR TOPOLOGY**

Star topology uses a central hub through which all components are connected. In a Star topology, the central hub is the host computer, and at the end of each connection is a terminal. This consists of a central node, to which all other nodes are connected; this central node provides a common connection point for all nodes through a hub. In star topology, every node (computer workstation or any other peripheral) is connected to a central node called a hub or switch. The switch is the server and the peripherals are the clients. Thus, the hub and leaf nodes, and the transmission lines between them, form a graph with the topology of a star. If the central node is passive, the originating node must be able to tolerate the reception of an echo of its own transmission, delayed by the two-way transmission time (i.e., to and from the central node) plus any delay generated in the central node. An active star network has an active central node that usually has the means to prevent echo-related problems. The star topology reduces the damage caused by line failure by connecting all of the systems to a central node. When applied to a bus-based network, this central hub rebroadcasts all transmissions received from any peripheral node to all peripheral nodes on the network, sometimes including the originating node. All peripheral nodes may thus communicate with all others by transmitting to, and receiving from, the central node only. The failure of a transmission line linking any peripheral node to the central node will result in the isolation of that peripheral node from all others, but the rest of the systems will be unaffected.

It is also designed with each node (file servers, workstations, and peripherals) connected directly to a central network hub, switch, or concentrator. Data on a star network passes through the hub, switch, or concentrator before continuing to its destination. The hub, switch, or concentrator manages and controls all functions of the network. It also acts as a repeater for the data flow. This configuration is common with twisted pair cable. However, it can also be used with coaxial cable or optical fiber cable.

**STAR TOPOLOGY****ADVANTAGES**

- It is more reliable (if one connection fails, it does not affect others).
- The centre of a star network is a good place to diagnose network faults and if one computer fails whole network is not disturbed.
- Hub detects the fault and isolates the faulty computer. It is easy to replace, install or remove hosts or other devices, the problem can be easily detected-It is easier to modify or add a new computer without disturbing the rest of the network by simply running a new line from the computer to the central location and plugging it to the hub.
- Use of multiple cable types in a same network with a hub.
- It has good performance.

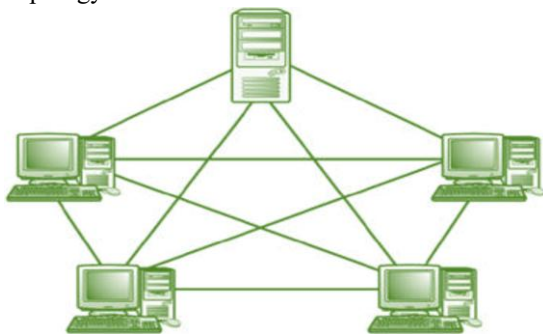
**DISADVANTAGES**

- It is expensive to install as it requires more cable, it costs more to cable a star network because all network cables must be pulled to one central point, requiring more cable length than other networking topologies.

- Central node dependency, if central hub fails, the whole network fails to operate.
- Many star networks require a device at the central point to rebroadcast or switch the network traffic.

## 2.4 MESH TOPOLOGY

Mesh Network Topologies capitalize on path redundancy. This Topology is preferred when traffic volume between nodes is large. A proportion of nodes in this type of network have multiple paths to another destination node. With the exception of the Bi-directional Ring (and this was only when a failure was detected) each of the topologies discussed so far had only one path from message source to message destination. Thus the probability of single point network failure is greatly minimized with Mesh Network Topology. A major advantage of the Mesh Network Topology is that source nodes determine the best route from sender to destination based upon such factors connectivity, speed, and pending node tasks. A disadvantage of Mesh Network Topologies is the large cost incurred in setting up the network. A further disadvantage of this type of network is the requirement for each node to have routing algorithm for path computation. A full mesh is described as each node being directly connected to every other node in the network. This type of topology is usually restricted to networks with a small number of nodes. A partial mesh is described as having some nodes in the network being indirectly connected to others in the network. The internet employs Mesh Network Topology.



**MESH TOPOLOGY**

### ADVANTAGES

- Yield the greatest amount of redundancy in the event that one of the nodes fails where network traffic can be redirected to another node.

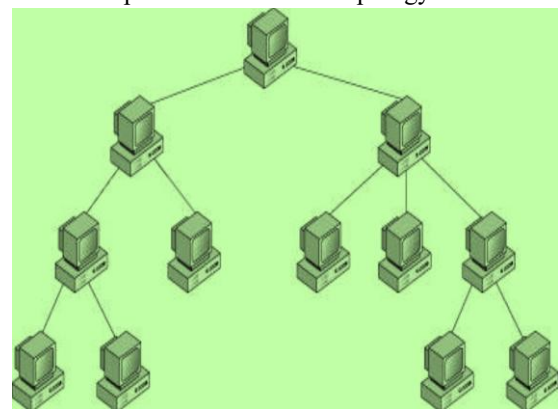
- Point-to-point link makes fault isolation easy. Privacy between computers is maintained as messages travel along dedicated path.
- Network problems are easier to diagnose.

### DISADVANTAGES

- The amount of cabling required is high.
- A large number of I/O (input/output) ports are required.

## 2.5 TREE TOPOLOGY

Tree Network Topology is constructed from either making a set of Star Network Topologies subordinate to a central node, or by linking a set of Star Network Topologies together directly via a bus, thereby distributing the functionality of the central node among several Star Network Topology top level nodes. The top-level nodes from each Star Network are the elements linked via a bus in the second arrangement. In simple Tree Network Topology, no Star Network Topology subordinate nodes are connected to the bus. Messages in a Tree Network Topology can be either broadcast from the central node to all interconnected Star Networks, or targeted to select Star Networks. One major advantage of the Tree Network Topology is the ease at which the network can be expanded. Expansion can be as simple as linking in an additional Star Network Topology onto the bus. Also, like the Star Network Topology there is localization of cabling failures with this configuration. However, if a Star Network top level node in the fails, or cabling to it fails an entire section of the network is lost to communication as opposed to just one subordinate node as in pure Star Network Topology.



**TREE TOPOLOGY**

### ADVANTAGES

- Installation and configuration of network are easy.
- The addition of the secondary hub allows more devices to be attached to the central hub.
- Less expensive when compared to mesh topology.
- Faults in the network can be detected traces.

### DISADVANTAGES

- Failure in the central hub brings the entire network to a halt.
- More cabling is required when compared to the bus topology because each node is connected to the central hub

### 3. CONCLUSION

Computer Network Topology brings inherent advantages and disadvantages to any system under study. Description of some of these advantages and disadvantages for several standard physical topologies has been provided in this paper. This will help us to know that which structure or topology is best for which organization or business. So finally, we can say that all topologies have some extra and different feature are available from other topology and that features are making it special from other topology

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