

# Network Topologies

Vishal Yadav, Atul Kaushik, Rajat Verma  
Dronacharya College of Engineering, India

**Abstract-** A network can be defined as a group of computers and other devices connected in some ways so as to be able to exchange data, and to do so we require a specific pattern. This is where the topologies come in use, The geometrical arrangement of computer resources, remote devices and communication facilities is known as Network structure or Network topology. A computer network comprises of nodes and links, a node is the end point of any branch in a computer, a terminal device, workstation or interconnecting equipment facility and a link is a communication path between two nodes.

**Index Terms-** network, topology, bus, star, mesh, etc.

## I. INTRODUCTION

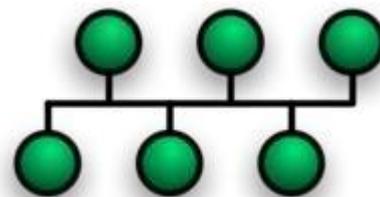
*Topology* defines the structure of the network. There are two parts to the topology definition: the physical topology which is the actual layout of the wire (media) and the logical topology which defines how the media is accessed by the hosts. It refers also to how computers are being connected with each other. Network topologies may be physical or logical. Physical topology refers to the physical design of a network including the devices, location and cable installation. Logical topology refers to how data is actually transferred in a network as opposed to its physical design. In general physical topology relates to a core network whereas logical topology relates to basic network. Topology can be understood as the shape or structure of a network. This shape does not necessarily correspond to the actual physical design of the devices on the computer network. The computers on a home network can be arranged in a circle but it does not necessarily mean that it represents a ring topology. Any particular network topology is determined only by the graphical mapping of the configuration of physical and/or logical connections between nodes. The study of network topology uses graph theory. Distances between nodes, physical interconnections, transmission rates, and/or signal types may differ in two networks and yet their topologies may be identical.

Some of the most common network topologies are:



## II. BUS TOPOLOGY

**BUS TOPOLOGY** uses a single backbone segment (length of cable) that all the hosts connect to directly. The idea is that is just like riding a bus. It has only one driver and many passengers who are riding. Bus networks (not to be confused with the system bus of a computer) use a common backbone to connect all devices. A single cable, the backbone functions as a shared communication medium that devices attach or tap into with an interface connector. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message. Ethernet bus topologies are relatively easy to install and don't require much cabling compared to the alternatives.



### Advantages:-

- Reliable in very small networks as well as easy to use and understand.
- Requires least amount of cable to connect the

computers (nodes) together and therefore is less expensive than other cabling arrangements.

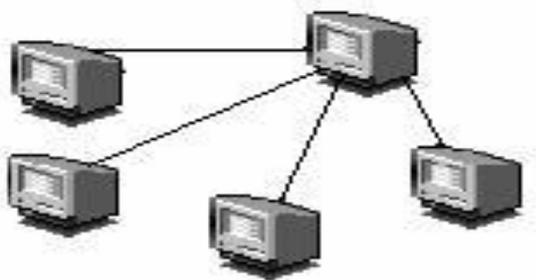
- A repeater can also be used to extend a bus configuration. It's easy to extend, Two cables can be easily joined with a connector, making a longer cable for more computers to join the network.

**Disadvantages:-**

- Heavy network traffic can slow a bus considerably because any computer can transmit at any time. But networks do not Coordinate when information is sent. Computer interrupting each other can use a lot of bandwidth.
- Each connection between two cables weakens the electrical signal.
- The bus configuration can be difficult to find and can cause the whole networks to stop functioning.

**III. STAR TOPOLOGY**

STAR TOPOLOGY connects all cables to a central point of concentration. This point is usually a hub or switch. It has a focal point where all the resources are there. Many home networks use the star topology. A star network features a central connection point called a "hub node" that may be a network hub, switch or router. Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet. Compared to the bus topology, a star network generally requires more cable, but a failure in any star network cable will only take down one computer's network access and not the entire LAN.



**Advantages:-**

- It is more reliable (if one connection fails, it does not affect others)
- The center 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.

- Use of multiple cable types in a same network with a hub.

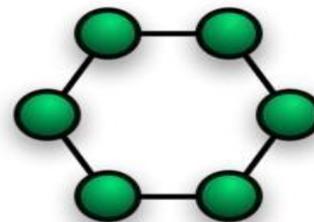
**Disadvantages:-**

- 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.

**IV. RING TOPOLOGY**

RING TOPOLOGY connects one host to the next and the last host to the first. This creates a physical ring of cable. In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counterclockwise"). A failure in any cable or device breaks the loop and can take down the entire network. To implement a ring network, one uses Token Ring technology. Ring topologies are found in some office buildings or school campuses.

**Advantages:-**



- Ring networks offer high performance for a small number of workstations or for larger networks where each station has a similar workload.
- Ring networks can span longer distances than other types of networks.
- Ring networks are easily extendable.

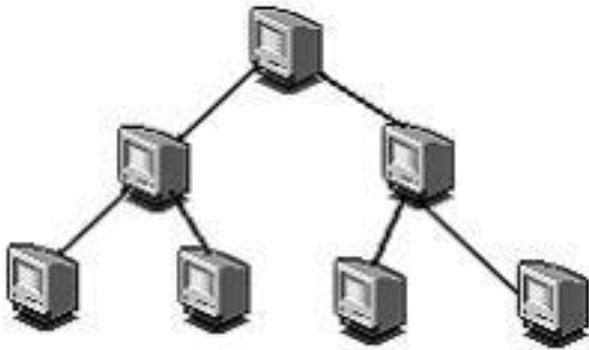
**Disadvantages:-**

- Relatively expensive and difficult to install .
- Failure of one computer on the network can affect the whole network.

- It is difficult to find fault in a ring network.

#### V. TREE TOPOLOGY

**TREE TOPOLOGY** Tree topologies integrate multiple star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus, and each hub functions as the root of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus (limited in the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub connection points) alone.



#### Advantages:-

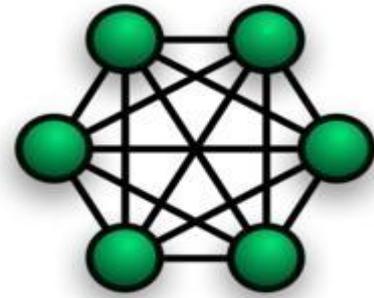
- Installation and configuration of network are easy.
- The addition of the secondary hub allows more devices to be attached to the central hub.
- Less expensive when compared to mesh topology.

#### 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.

#### VI. MESH TOPOLOGY

**MESH TOPOLOGY** is used when there can be absolutely no break in communications. So as you can see in the graphic, each host has its connections to all other hosts. This also reflects the design of the internet which has multiple paths to any one location. Mesh topologies involve the concept of routes. Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination. A mesh network in which every device connects to every other is called a full mesh. As shown in the illustration below, partial mesh networks also exist in which some devices connect only indirectly to others.



#### 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.

#### Disadvantages:-

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

#### VII. CONCLUSION

In this paper, performance of different kinds of topologies is considered and studied. Description of some inherent advantages and disadvantages of computer network topologies to any system under study also has been described in this paper. This paper has provided some knowledge of analysis approaches for dealing with network topology related problems. The techniques covered in this discussion can be adapted to related computer network applications.

#### REFERENCES

- [1] Network Topology [On-Line] Available at. <http://en.wikipedia.org>
- [2] Cem Ersoy, Shivendra PanWar "Topological Design of Interconnected LAN-MAN Networks", IEEE INFOCO, pp. 2260-2269, 1992.
- [3] Introduction to data communication and networking, Behrouz Forouzan, TMH.
- [4] [http://www.sis.pitt.edu/~icucart/networking\\_basics/networking\\_topology.html](http://www.sis.pitt.edu/~icucart/networking_basics/networking_topology.html)
- [5] C. M. Harris, Fundamentals of Queueing Theory, Wiley Series in Probability and Statistics, John Wiley & Sons, Hoboken, NJ, USA, 4th edition, 2008.