



## A Comparative and Analysis Study of Data Flow in Different Computer Network Topologies

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**Abstract**— *Topology plays a great role in computer network for connecting computers. Topology is designed for both small and large networks. Topology takes different types to construct those networks based on their needs. In this paper, I will discuss how the topology types work, analyse and compare those different types of topology through graph representation. And make comparison table and determine which one is the best for dataflow of all the topologies.*

**Keywords**— *topology, computer network, graph representation, dataflow, connecting computers.*

### I. INTRODUCTION

Basically, topology is usually schematic description of the arrangement of a network, including its nodes and connecting lines. The word **“topology”** comes from the *Greek* words **topos** meaning **place** and **logos** meaning **study**. It is a description of any locality in terms of its layout. There are two ways of defining network topology: the physical topology and the logical (or signal) topology. Physical Topology means the physical design of a network including the devices, location and cable installation. Logical Topology refers to the fact that how data actually transfers in a network as opposed to its design.

### II. ANALYSIS OF DIFFERENT NETWORK TOPOLOGY

Some of the important Topologies is mainly categorized into four types.

- A. Mesh Topology
- B. Ring Topology
- C. Star Topology
- D. Bus Topology

#### A. Mesh Topology

In this topology, each node is connected to every other node in the Network. Implementing the mesh topology is expensive and difficult. In this type of network, each node may send message to destination through multiple paths.

While the data is travelling on the Mesh Network, it is automatically configured to reach the destination by taking the shortest route which means the least number of hops.

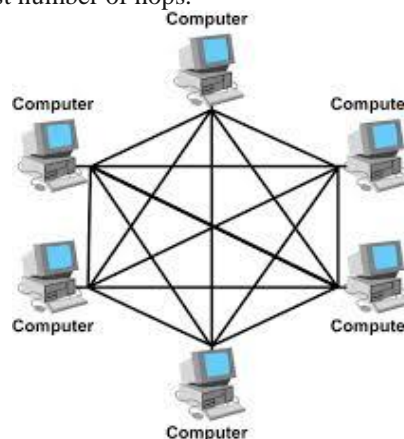


Fig 1 Mesh Topology

#### Advantage of Mesh Topology:

- No traffic problem as there are dedicated links.
- It has multiple links, so if one route is blocked then other routes can be used for data communication.
- Points to point links make fault identification easy.

**Disadvantage of Mesh Topology:**

- There is mesh of wiring which can be difficult to manage.
- Installation is complex as each node is connected to every node.
- Cabling cost is high.

**B. Ring Topology**

In this topology, the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is a direct point-to-point link between two neighboring nodes (the Next and the Previous). These links are unidirectional which ensures that transmission by a node traverses the whole ring and comes back to the node.

Information travels around the ring from one node to the next. Each packet of data sent to the ring is prefixed by the address of the station to which it is being sent. When a packet of data arrives, the node checks to see if the packet address is the same as its own, if it is, it grabs the data in the packet. If the packet does not belong to it, it sends the packet to the next node in the ring.

Faulty nodes can be isolated from the ring. When the workstation is powered on, it connects itself to the ring. When power is off, it disconnects itself from the ring and allows the information to bypass the node.

The most common implementation of this topology is token ring. A break in the ring causes the entire network to fail. Individual nodes can be isolated from the ring

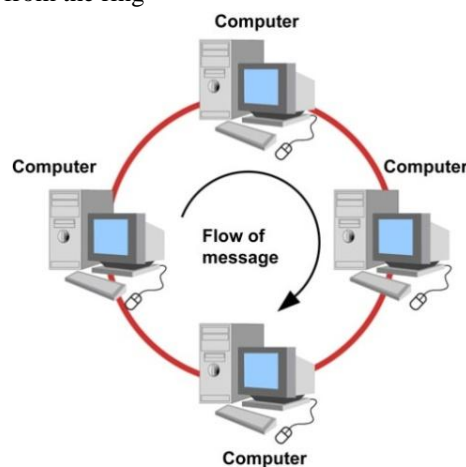


Fig 2 Ring Topology (Unidirectional)

**Advantage of Ring Topology:**

- Very orderly network where every device has access to the token and the opportunity to transmit.
- Ring networks are easily extendable .
- Ring networks can span longer distances than other types of networks.
- Handles high volume of traffic

**Disadvantages of Ring Topology:**

- The failure of a single node of the network can cause the entire network to fail.
- The movement or changes made to network nodes affects the performance of the entire network.

**C. Star Topology**

In a star network, each node (file server, workstations, and peripherals) is connected to a central device called a hub. The hub, switch, or concentrator manages and controls all functions of the network.

A star network uses a significant amount of cable as each terminal is wired back to the central hub, even if two terminals are side by side but several hundred meters away from the host.

The central hub makes all routing decisions, and all other workstations can be simple. The star topology reduces the chance of network failure by connecting all of the systems to a central node.

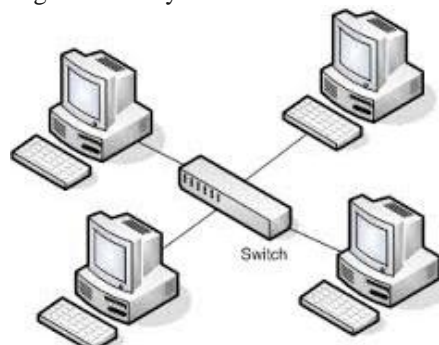


Fig 3 Star Topology based on switch

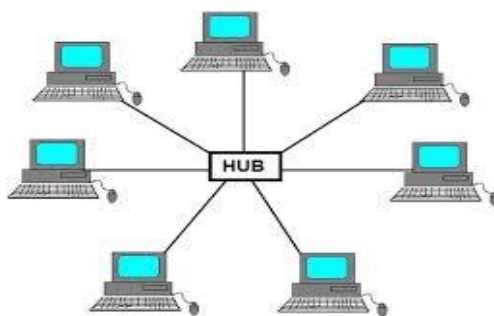


Fig 4 Star Topology based on hub

**Advantages of Star Topology:**

- Easy to manage.
- Easy to replace, install or remove hosts or other devices, the problem can be easily detected-
- Easy 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.
- Easier to expand than a bus or ring topology.
- Easy to install and wire.
- Use of multiple cable types in a same network with a hub
- Easy to detect faults and to remove parts.

**Disadvantages of Star Topology:**

- Requires more cable length than a linear topology.
- If the hub or concentrator fails, nodes attached are disabled.
- More expensive because of the cost of the concentrators.

**D. Bus Topology**

All the nodes (file server, workstations, and peripherals) on a bus topology are connected by one single cable. A bus topology consists of a main run of cable with a terminator at each end. All nodes (file server, workstations, and peripherals) are connected to the linear cable.

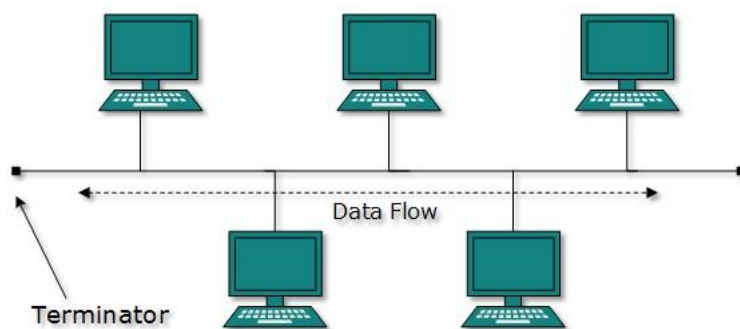


Fig 5 Bus Topology

**Advantages of Bus Topology:**

- It is Cheap, easy to handle and implement.
- Require less cable.
- It is best suited for small networks.

**Disadvantages of Bus Topology:**

- The cable length is limited. This limits the number of stations that can be connected.
- This network topology can perform well only for a limited number of nodes.

**III. CHART ANALYSIS**

A chart is a graphical representation of data, in which "the data is represented by symbols, such as bars in a bar chart, lines in a line chart, or slices in a chart. A chart can represent tabular numeric data, functions or some kinds of qualitative structure and provides different information. Line Chart analysis will do here.

A line chart is a two-dimensional scatterplot of ordered observations where the observations are connected following their order.

Charts are often used to ease understanding of large quantities of data and the relationships between parts of the data. Charts can usually be read more quickly than the raw data that they are produced from.

They are used in a wide variety of fields, and can be created by hand (often on graph paper) or by computer using a charting application

The relationship between nodes and physical link of different topologies shown in Table I.

Table I. Relationship between nodes and physical link of different topology

Topology Node	Mesh	Ring	Star	Bus
	Physical Link			
1	0	0	0	0
2	1	1	1	3
3	3	3	2	4
4	6	4	3	5
5	10	5	4	6
6	15	6	5	7
7	21	7	6	8

In the above analyses, I have shown the chart representation for number of physical links of different topology over nodes (X-axis: Nodes, Y-axis: Number of physical Link). For listening the chart Fig. 6, number of physical Link is more high level in the mesh topology compared to other topology (No disturbance of data flow, No traffic).

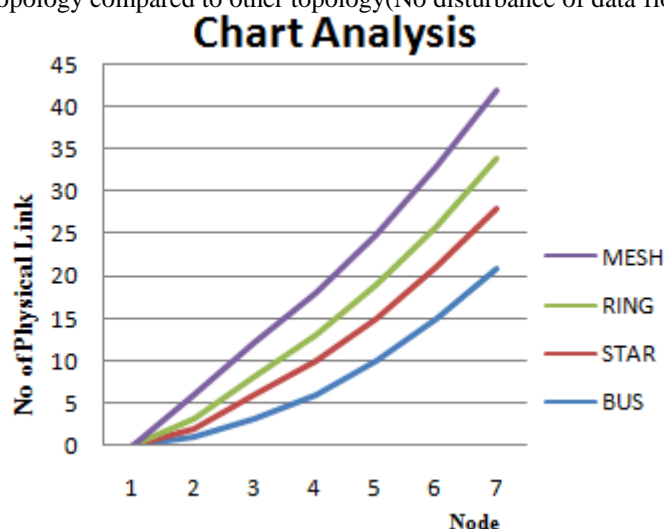


Fig 6 Number of physical links of different topology over node(s)

#### IV. COMPARISON OF TOPOLOGY

Comparison of topology gives various knowledge/ideas to determine the performance of the network, efficiency of dataflow, cost and cable requirement of specified topology as shown in Table II

Table II. Comparison of different topologies and its criteria

Topology Criteria	Bus	Ring	Star	Mesh
Network performance	Small	Small/Large	Small	Small
Cable Length Requirement	Less	Neither less nor more	More	More
Traffic	Less	High	Medium	No
Dataflow Efficiency	More	Neither less nor more	More	More
Failure	Easy to solve	Difficult to solve	Easy to solve except hub/switch fails	Easy to solve
Cost	Low	High	High	High

#### V. BEST TOPOLOGY FOR NETWORK CONNECTIVITY

Mesh Topology is well suited for avoiding traffic, efficient dataflow and dedicated Line. Example of this topology : Connection between the regional telephone offices.

Ring Topology is well suited for large and long distance networkS. Example of this topology :WAN connectivity

Star Topology is well suited for reliability, expand the network easily(that is easy to install and manage the new node). Example of this topology is connection between telephone exchange and local phones.

Bus Topology is well suited for small, less expensive and efficient network. Example of this topology is LAN connectivity in college/schools.

## VI. CONCLUSION

Basically, Data flow is the essential criteria of the network for avoiding traffic during data travel in the channel/link In this paper I have studied the different types of the topologies like Bus Topology, Ring Topology, Star Topology, Mesh Topology .

According to my conclusion, I have analyzed and compared the above four topologies that will help to know that mesh topology is best for data flow because of no disturbance in the dedicated links ,reliability(if any link fails, other link take care of those data),no traffic,good performance and efficiency .

I have concluded to choose the mesh topology to overcome the problems of dataflow.

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