Network Topologies

Topics of Discussion

- Network
- Type of Connections
  - Point-to-point
  - Multipoint
- Network Topologies
  - Physical Topology
  - Logical Topology
  - Mesh
  - Star
  - Bus
  - Ring
  - Hybrid
  - Tree

NETWORK

- A network is a set of **devices** (often referred to as nodes) connected by communication links.
- A **node** can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.
- A **link** can be a cable, air, optical fiber, or any medium which can transport a signal carrying information.

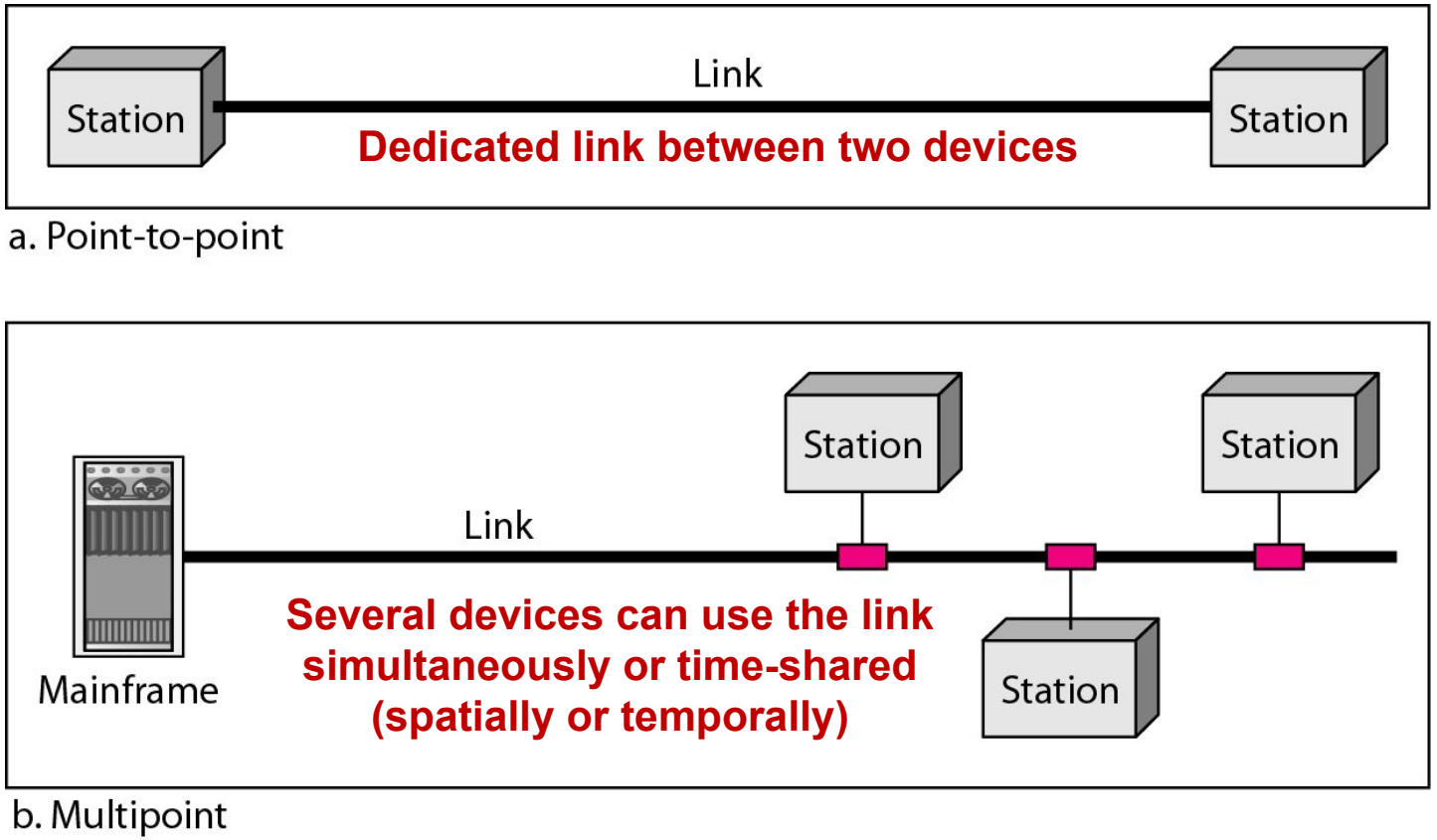
Type of connections

1. Point to Point *- single transmitter and receiver*

- *Dedicated link:* The term *dedicated* means that the link carries traffic only between the two devices it connects.
- *Entire capacity of the link is reserved for transmission*

2. Multipoint *- multiple recipients of single transmission*

Figure 1 *Types of connections: point-to-point and multipoint*



Topology

Two or more devices connect to a link; two or more links form a topology.

The topology of a network is the geometric representation of the relationship of all the links and linking devices/nodes to one another.

- ***Physical Topology***
- ***Logical Topology***

Physical Topology:

- *Refers to the way in which a network is laid out physically*
- *How devices are actually interconnected with wires and cables.*

Logical Topology:

- *A logical topology is how devices appear connected to the user.*

Figure 2 *Categories of topology*

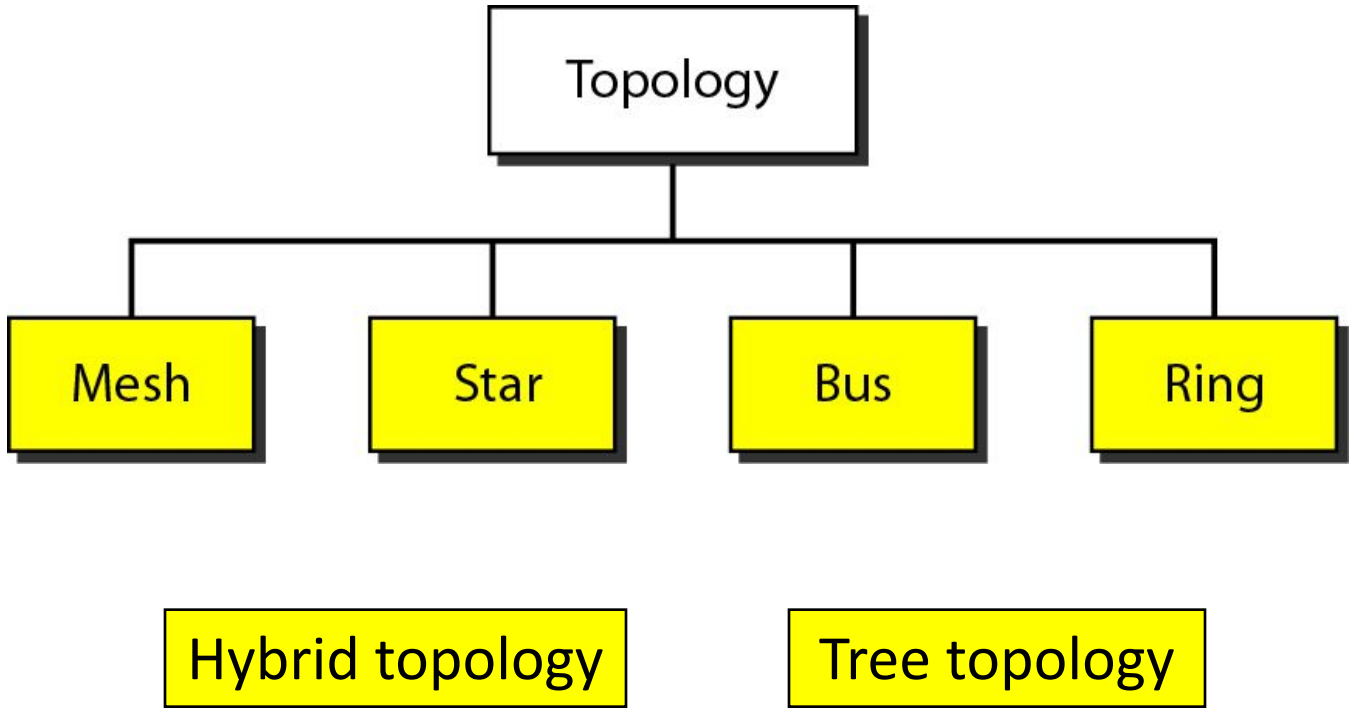


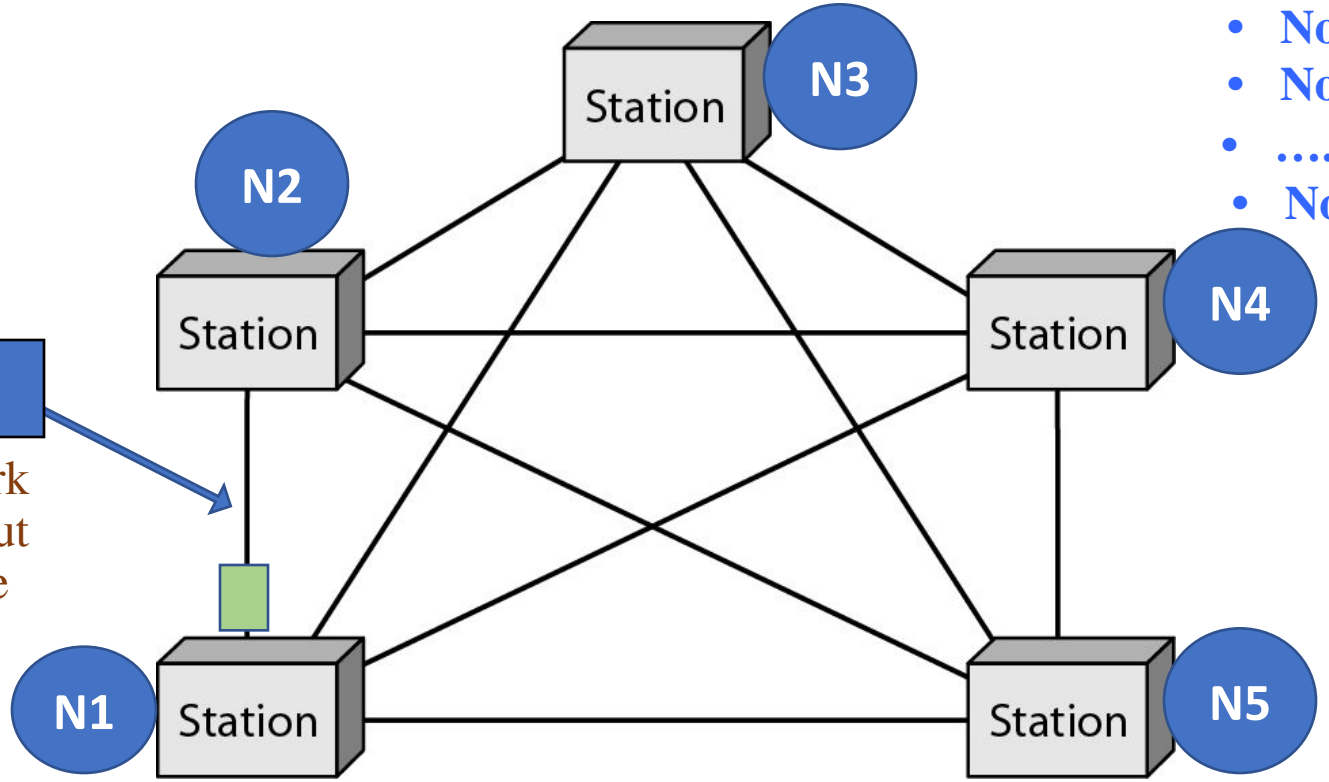
Figure 3 *A fully connected mesh topology (five devices)*

1. Mesh Topology: In a mesh topology, every device has a dedicated point-to-point link to every other device.

- **No. of physical links N(N-1)**
- **In duplex mode: No. of links N(N-1)/2**

- Every device on the network must have $n - 1$ input/output ports to be connected to the other n- 1 stations.


Data Packet



- **Node1 is connected to N-1 nodes**
- **Node2 is connected to N-1 nodes**
- **….**
- **Node N is connected to N-1 nodes**

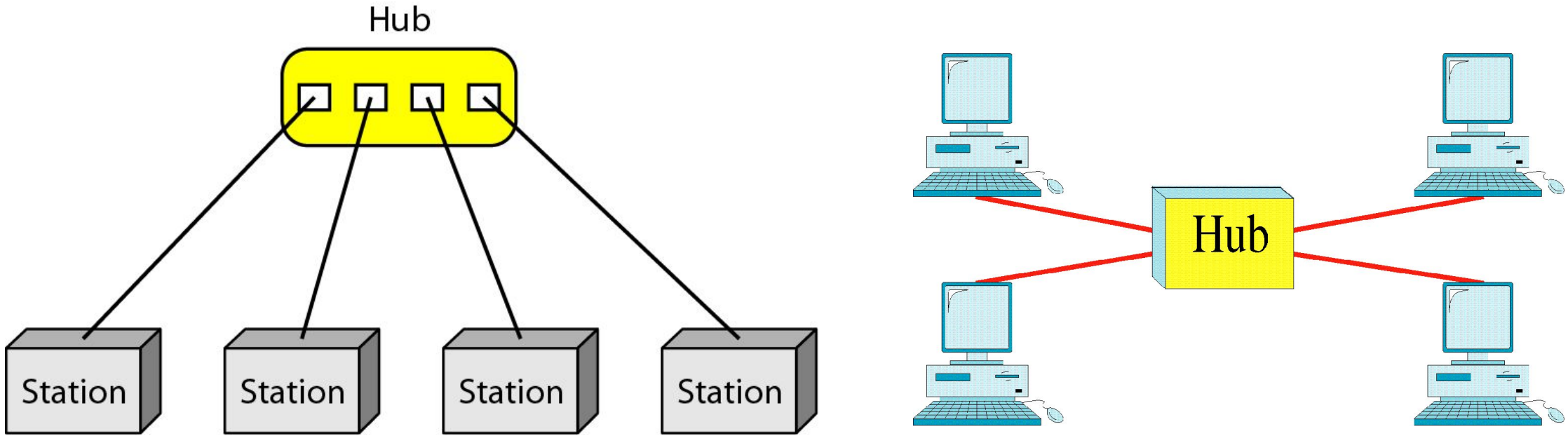
Mesh Topology: Pros & Cons

Advantages	**Eliminating the traffic problems**
	Robust
	Privacy and security
Disadvantages	**Installation and reconnection are difficult**
	Wiring can be greater than available space
	Expensive hardware

Practical example: Telephone regional offices

Figure 4 *A star topology connecting four stations*

2. Star Topology: In a star topology, each device has a dedicated point-to-point link only to a central controller (hub)



Star Topology: Pros & Cons

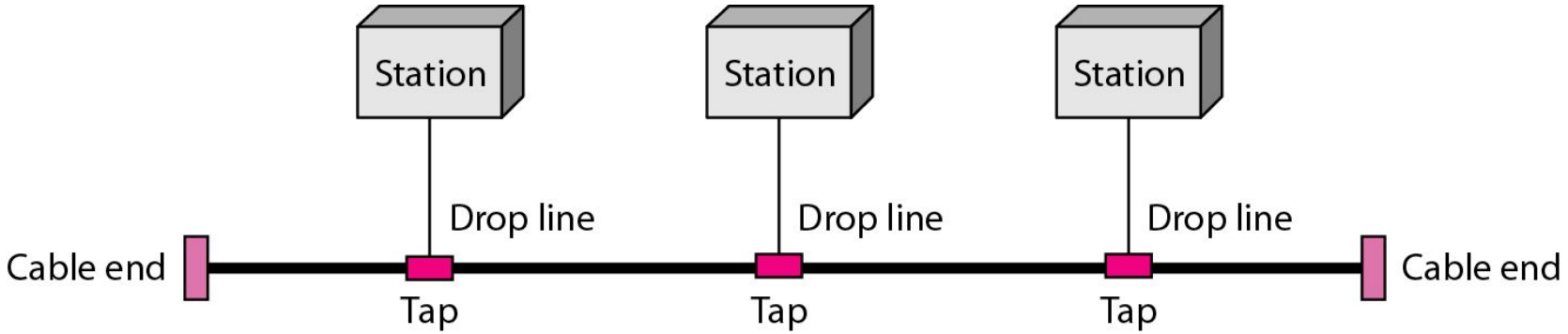
Advantages	**Less expensive than mesh topology**
	Each device needs only one link and one I/O port
	Easy to install and reconfigure
	Less cabling
	Robustness
Disadvantage	**Dependency of the whole topology on one single point, the hub**

The star topology is used in local-area networks (LANs)

Figure 5 *A bus topology connecting three stations*

3. Bus Topology: Nodes are connected to the bus cable by drop lines and taps.

- **A drop line is a connection running between the device and the main cable.**



- **A bus topology is multipoint.**
- **Mesh and star are examples of point-to-point connections.**

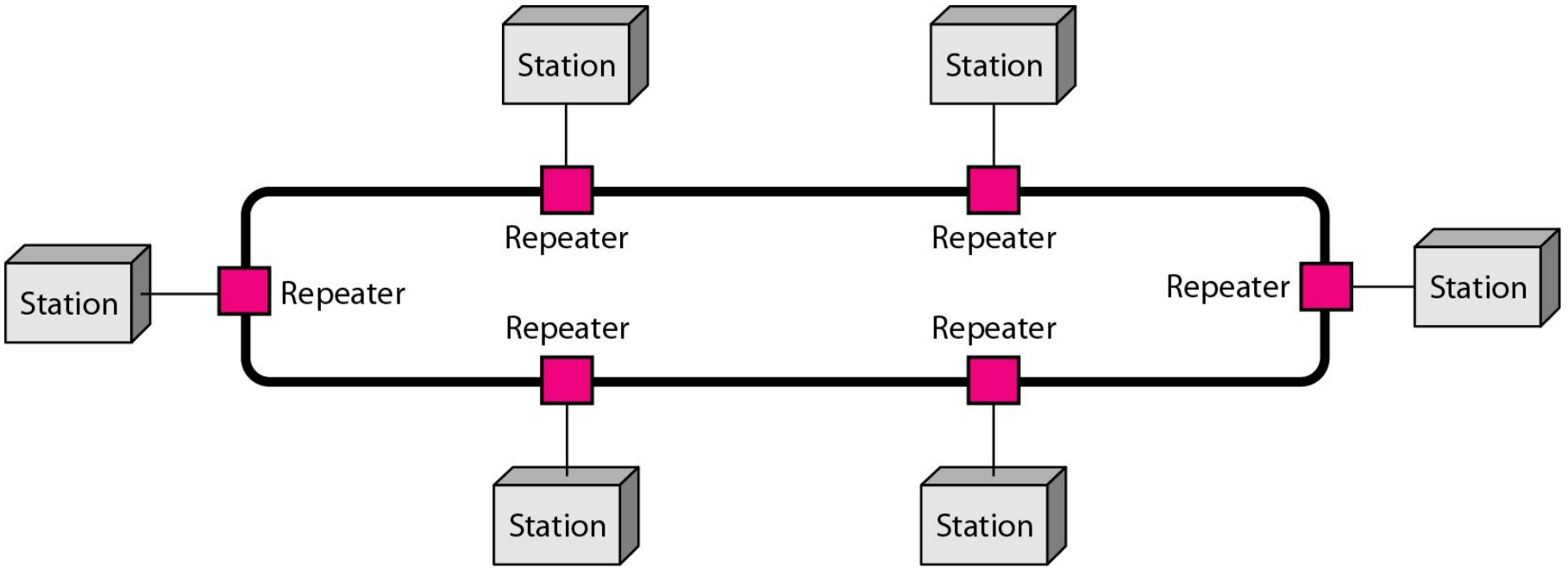
Bus Topology: Pros & Cons

Advantages	**Ease of installation**
	Less cabling than mesh or star topologies
Disadvantages	**Difficult reconnection and fault isolation**
	Signal reflection at the taps can cause degradation in quality.
	A fault or break in the bus cable stops all transmission

Ethernet LANs can use a bus topology.

Figure 6 *A ring topology connecting six stations*

4. Ring Topology: In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it.



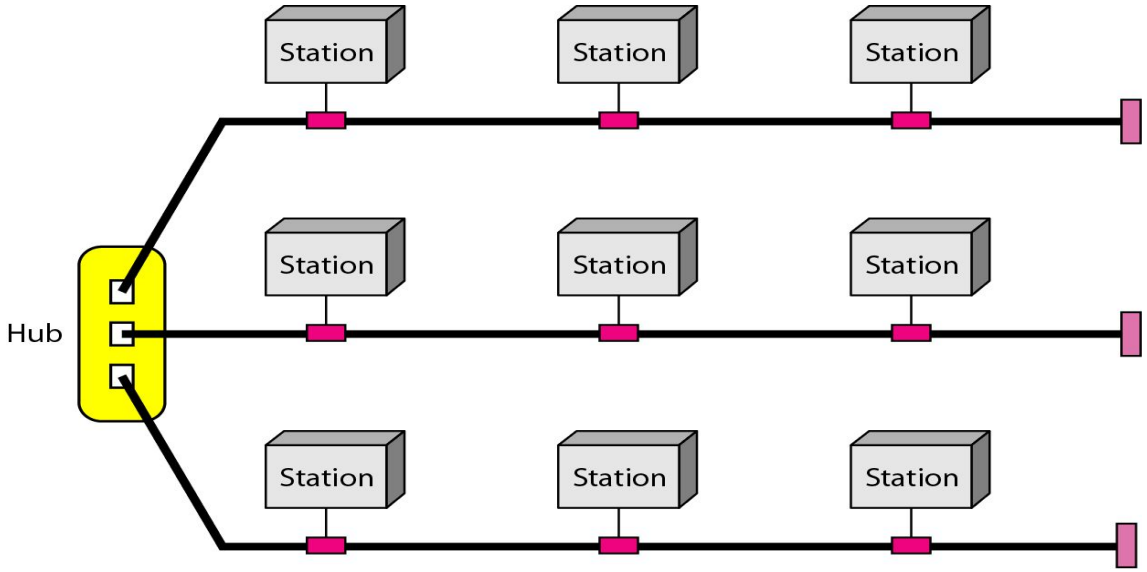
Ring Topology: Pros & Cons

Advantages	**Easy to install and reconfigure**
	Fault isolation is simplified
Disadvantages	**Unidirectional traffic**
	In a simple ring, a break in the ring (such as a disabled station) can disable the entire network. **Troubleshooting is difficult**

- **Ring topology was prevalent when IBM introduced its local-area network Token Ring in the middle 1980s.**
- **Token Ring had a "Star Ring" topology.**
- **Token ring networks were physically similar to a star topology in appearance, but logically wired as a Ring Topology.**

Figure 7 *A hybrid topology: a star backbone with three bus networks*

5. Hybrid Topology: This topology is a collection of two or more topologies.



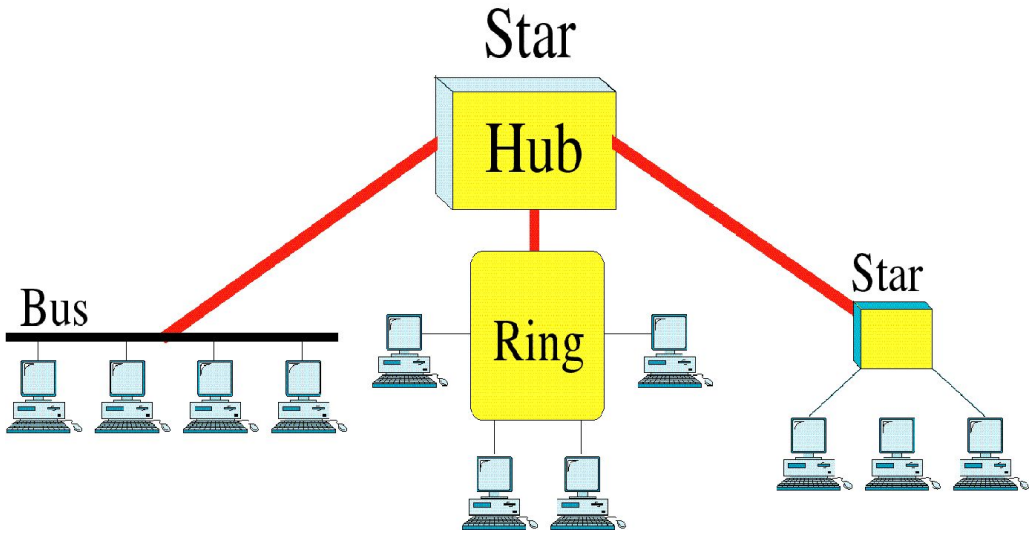
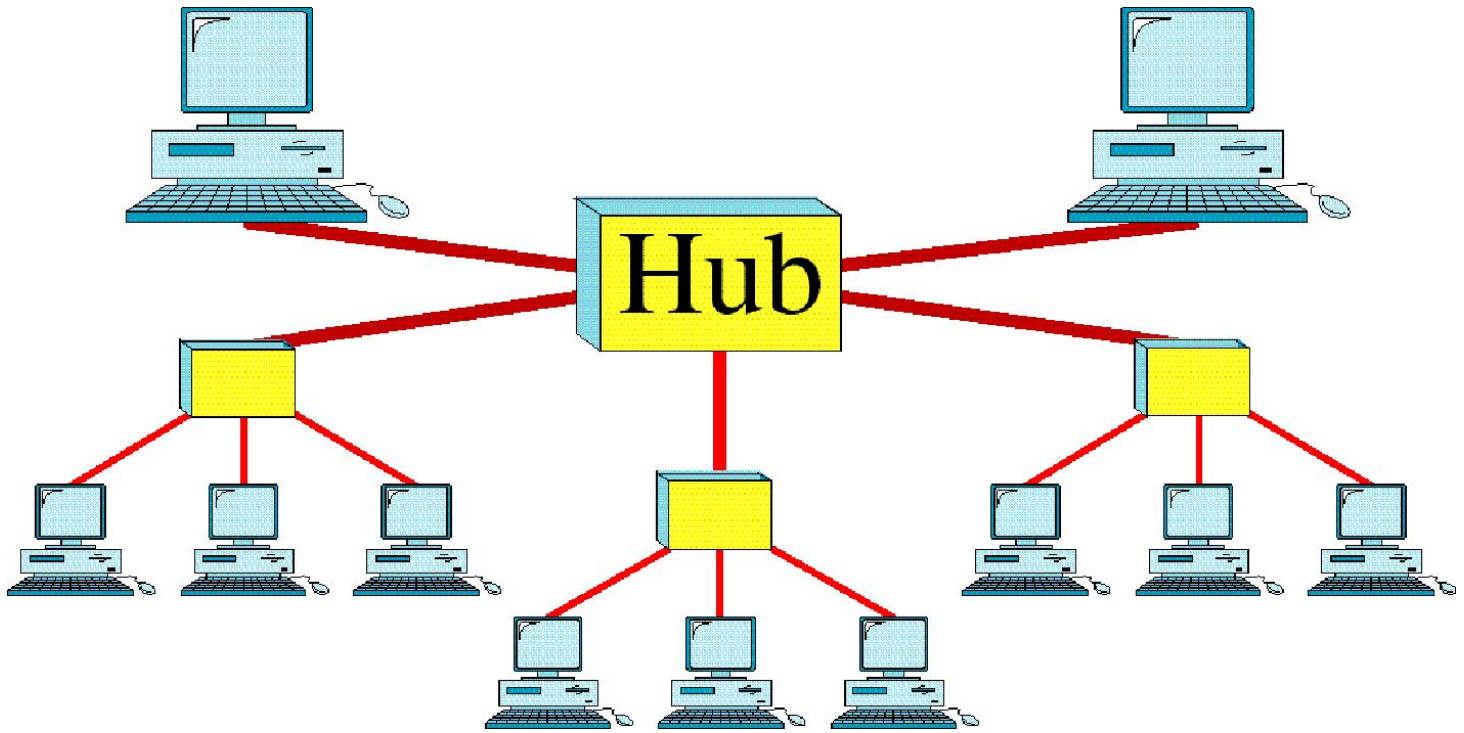


Figure 8 *A tree topology*

6. Tree Topology: A tree topology (hierarchical topology) is a collection of star networks arranged in a hierarchy.



Thank You