Computer Network

Lecture-3

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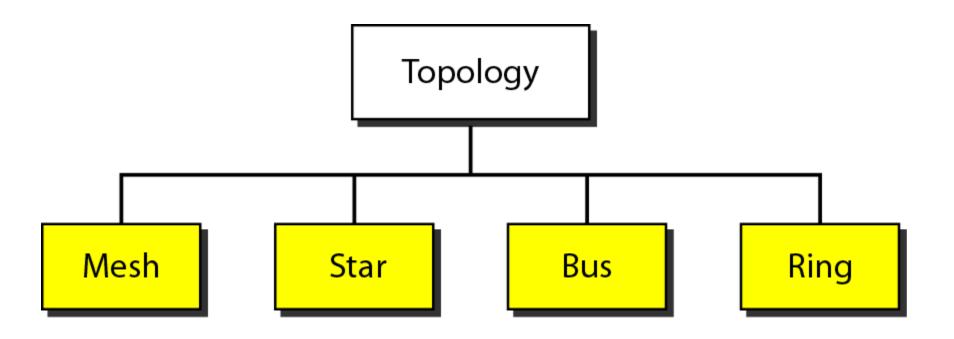
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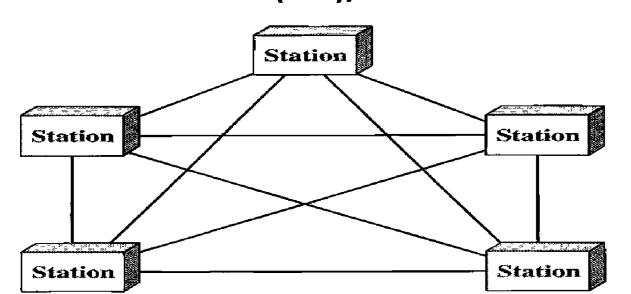
Network Topology

- The topology of a network is the geometric representation of the relationship of all the links and linking devices (usually called nodes) to one another.
- There are four basic topologies possible: mesh, star, bus, and ring.



Mesh Topology:

- In a mesh topology, every device has a dedicated point-topoint link to every other device. The term dedicated means that the link carries traffic only between the two devices it connects.
- The number of **physical links** in a fully connected mesh network with \mathbf{n} nodes = $\mathbf{n}(\mathbf{n}-\mathbf{1})/2$.



Advantages of a mesh topology

- 1. The use of dedicated links guarantees that each connection can carry its own data load, thus eliminating the traffic problems that can occur when links must be shared by multiple devices.
- 2. A mesh topology is robust. If one link becomes unusable, it does not incapacitate the entire system.
- 3. There is the advantage of privacy or security. When every message travels along a dedicated line, only the intended recipient sees it. Physical boundaries prevent other users from gaining access to messages.
- 4. Point-to-point links make fault identification and fault isolation easy. Traffic can be routed to avoid links with suspected problems. This facility enables the network manager to discover the precise location of the fault and aids in finding its cause and solution.

Disadvantages of a mesh topology

1. Since every device must be connected to every other device, therefore installation and reconnection are difficult.

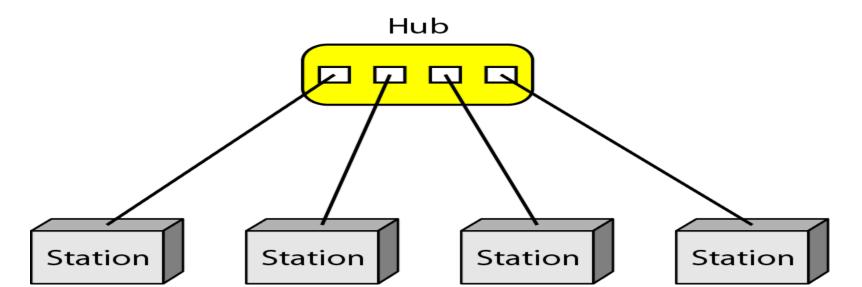
- 2. Second, the sheer bulk of the wiring can be greater than the available space (in walls, ceilings, or floors) can accommodate.
- 3. Finally, the hardware required to connect each link (I/O ports and cable) can be prohibitively expensive.

Uses of mesh topology

One practical example of a mesh topology is the connection of telephone regional offices in which each regional office needs to be connected to every other regional office.

Star Topology

- In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called a hub.
- The devices are not directly linked to one another.
- Unlike a mesh topology, a star topology does not allow direct traffic between devices.
- The controller acts as an exchange: If one device wants to send data to another, it sends the data to the controller, which then relays the data to the other connected device.



Star Topology

Advantages of Star topology

- 1. A star topology is less expensive than a mesh topology.
- 2. In a star, each device needs only one link and one I/O port to connect it to any number of others. This factor also makes it easy to install and reconfigure.
- 3. Other advantages include robustness. If one link fails, only that link is affected. All other links remain active. This factor also lends itself to easy fault identification and fault isolation. As long as the hub is working, it can be used to monitor link problems and bypass defective links.

Star Topology

Disadvantages of Star topology

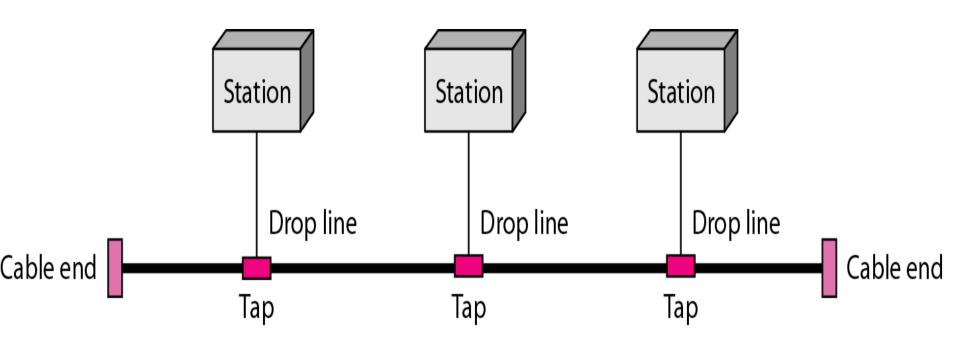
A disadvantage of a star topology is the dependency of the whole topology on one single point, the hub. If the hub goes down, the whole system is dead.

Uses:

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

High-speed LANs often use a star topology with a central hub.

Bus topology uses multipoint connection link. One long cable acts as a backbone to link all the devices in a network.



- Nodes(systems) are connected to the backbone cable by drop lines and taps.
- A drop line is a connection running between the device and the main cable.
- A tap is a connector that either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core.
- As a signal travels along the backbone, some of its energy is transformed into heat. Therefore, it becomes weaker and weaker as it travels farther and farther.
- For this reason there is a limit on the number of taps a bus can support and on the distance between those taps.

Advantages of bus topology

- **Ease of installation**
- Backbone cable can be laid along the most efficient path, then connected to the nodes by drop lines of various lengths.
- It works well when you have a small network.
- It's the easiest network topology for connecting computers or peripherals in a linear fashion.
- A bus topology uses less cabling than mesh or star topologies.

In a star, for example, four network devices in the same room require four lengths of cable reaching all the way to the hub. In a bus, this redundancy is eliminated. Only the backbone cable stretches through the entire facility. Each drop line has to reach only as far as the nearest point on the backbone.

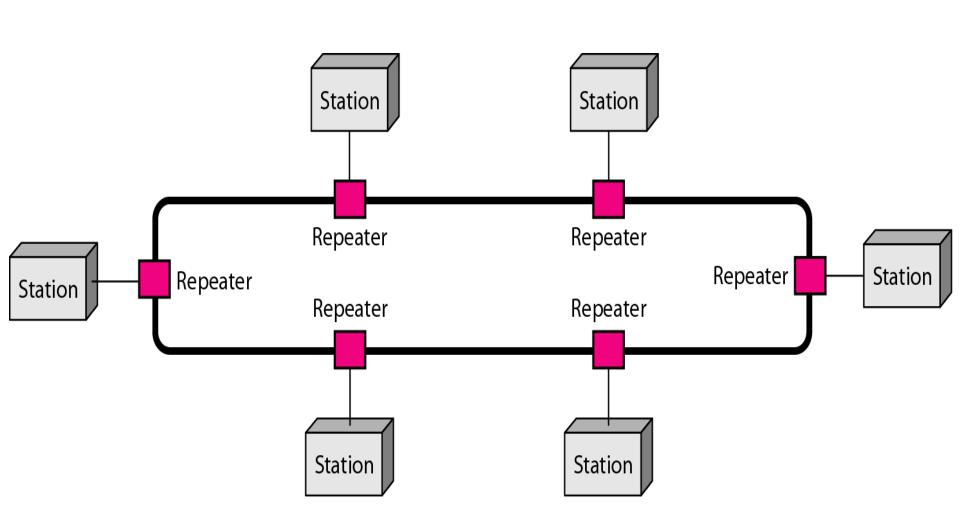
Disadvantages of bus topology

- ❖ It can be difficult to identify the problems if the whole network goes down.
- It can be hard to troubleshoot individual device issues.
- Bus topology is not great for large networks.
- Terminators are required for both ends of the main cable.
- Additional devices slow the network down.
- ❖ If a main cable is damaged, the network fails or splits into two.

Uses of bus topology

❖ Bus topology was the one of the first topologies used in the design of early local area networks.

Ethernet LANs can use a bus topology, but they are less popular now.



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

A signal is passed along the ring in one direction, from device to device, until it reaches its destination.

❖ Each device in the ring incorporates a repeater. When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.

Advantages of ring topology

❖ A ring topology is relatively easy to install and reconfigure.

Each device is linked to only its immediate neighbors (either physically or logically). To add or delete a device requires changing only two connections.

***** Fault isolation is simplified.

Generally in a ring, a signal is circulating at all times. If one device does not receive a signal within a specified period, it can issue an alarm. The alarm alerts the network operator to the problem and its location.

Disadvantages of ring topology

- Unidirectional traffic can be a disadvantage.
- In a simple ring, a break in the ring (such as a disabled station) can disable the entire network. This weakness can be solved by using a dual ring or a switch capable of closing off the break.

Uses of ring topology

Ring topology was prevalent when IBM introduced its localarea network Token Ring. Today, the need for higher-speed LANs has made this topology less popular.

Hybrid Topology

A network can be hybrid. For example, we can have a main star topology with each branch connecting several stations in a bus topology as shown in Figure:-

