



Network Topologies

- Understand what topology is
- Understand different topologies

Reference:

- <http://www.geocities.com/SiliconValley/Monitor/3131/ne/1enotes.html#Network%20Topologies>
- <http://www.cs.umd.edu/class/fall2001/cmsc411/proj01/pub/five.html>



What is topology?

- Physical connection of devices on the network



Point-to-Point (PTP)

- connect two devices directly together
- For examples:
 - Two computers communicating via modems
 - A workstation communicating along a parallel cable to a printer



- In a point-to-point link, two devices monopolize a communication medium. Because the medium is not shared, a mechanism is not needed to identify the computers. Therefore, a simple, two-device point-to-point network has no need for *addressing*.
- Point-to-point links can be *simplex*, *half-duplex*, or *full-duplex*. When devices must engage in bi-directional communication on a half-duplex link, some turnaround mechanisms must be in place to switch the roles of the sending and receiving devices.
 1. Simplex
 - signal flows in ONE direction
 - Only one station transmit and the other receive
 2. Half-duplex
 - Each station can both transmit and receive but NOT at the same time
 3. Full-duplex
 - Both stations transmit and receive simultaneously
 - Link capacity is shared between the two devices either by 2 separate transmission path
 - Channel capacity is divided for transmitting and receiving



Multi-point

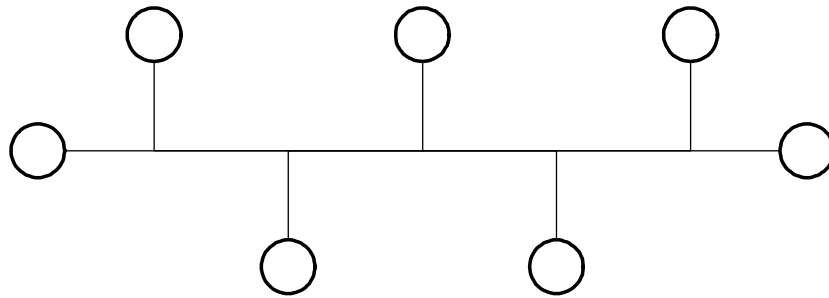
- Link three or more devices together through a single communication medium
- For sharing a common *channel*, each device needs a way to identify itself and the device to which it wants to send information. The method used to identify senders and receivers is called *addressing*.
- Three common types of multi-point topology:
 - Bus
 - Ring
 - Star

- Sharing of channel's capacity
 1. Spatial sharing – all attached devices using the link simultaneously
 2. Time sharing – devices take turn in using the link



Bus

- Devices connected to a single linear cable called a trunk



- Bus consists of a single linear cable called a trunk.
- Data is sent to all computers on the trunk. Each computer examines EVERY packet on the wire to determine who the packet is for and accepts only messages addressed to them.
- Bus is a passive topology.
- Performance degrades as more computers are added to the bus.
- Signal bounce is eliminated by a terminator at each end of the bus.
- Barrel connectors can be used to lengthen cable.
- Repeaters can be used to regenerate signals.
- Usually uses Thinnet or Thicknet
- both of these require 50 ohm terminator
- good for a temporary, small (fewer than 10 people) network
- But its difficult to isolate malfunctions and if the backbone goes down, the entire network goes down
- Terminators should be applied to both ends of the longest path
- Nodes connected to the bus cable by drop lines and taps
 1. Drop lines – connection between a node and the main cable
 2. Taps – connector either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core



Bus

- *Advantages:*

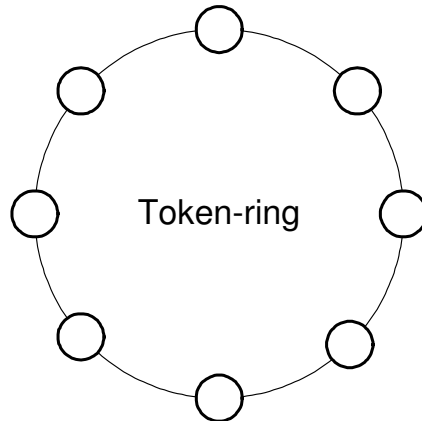
- easy to use and understand
- Less number of cable required
- inexpensive simple network
- easy to extend a network by adding cable with a repeater that boosts the signal and allows it to travel a longer distance

- *Disadvantages:*

- becomes slow by heavy network traffic with a lot of device because networks do not coordinate with each other to reserve times to transmit
- difficult to troubleshoot a bus because a cable break or loose connector will cause reflections and bring down the whole network

Ring

- Devices are connected on a single circle of cable



- Computers are connected on a single circle of cable.
- usually seen in a Token Ring or FDDI (fiber optic) network
- Each computer acts as a repeater and keeps the signal strong => no need for repeaters on a ring topology
- No termination required => because its a ring
- Token passing is used in Token Ring networks. The token is passed from one computer to the next, only the computer with the token can transmit. The receiving computer strips the data from the token and sends the token back to the sending computer with an acknowledgment. After verification, the token is regenerated.
- relatively easy to install, requiring ;minimal hardware



Ring

- *Advantages:*

- one device cannot monopolize the network
- continue to function after capacity is exceeded but the speed will be slow

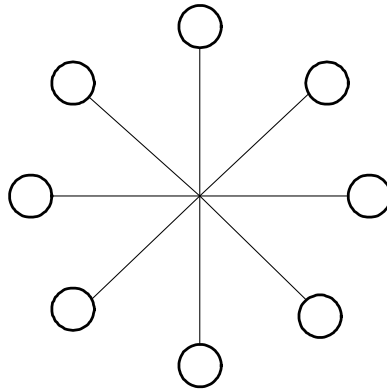
- *Disadvantages:*

- failure of one device can affect the whole network
- difficult to troubleshoot
- adding and removing devices disrupts the network.



Star

- Devices are connected by cable segments to a centralized device (e.g., hub)



- Computers are connected by cable segments to a centralized hub.
- Signal travels through the hub to all other computers.
- Requires more cable.
- If hub goes down, entire network goes down.
- If a computer goes down, the network functions normally.
- most scalable and reconfigurable of all topologies



Star

- *Advantages:*

- The failure of a single device or cable doesn't bring down the entire network
- The centralized networking equipment can reduce costs in the long run by making network management much easier
- It allows several cable types in same network with a hub that can accommodate multiple cable types

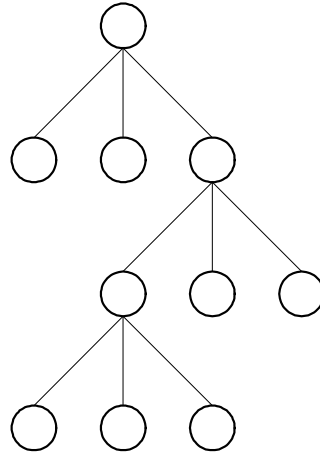
- *Disadvantages:*

- Failure of the central device (hub) causes the whole network failure
- It is slightly more expensive than using bus topology



Hierarchical (Tree)

- the most common topologies found in large corporations today



- Often mirrors corporate structure
- Use Polling



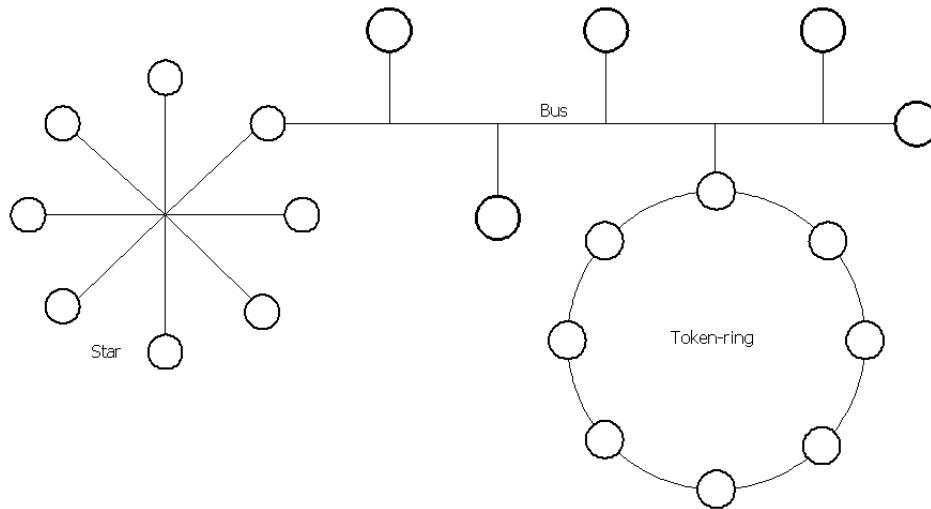
Hierarchical

- Advantages:
 - one fails, others can function independently



Hybrid

- Combination of different topologies





Hybrid

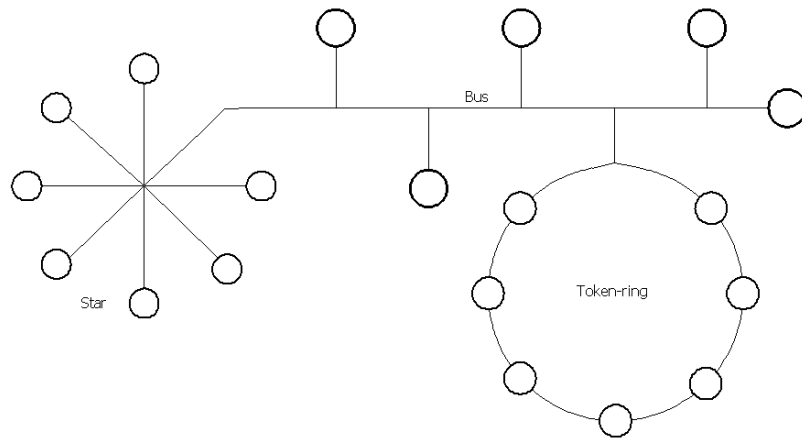
- Advantages:
 - combine the benefits of several different types of topologies
 - workgroup efficiency and traffic can be customized

- Disadvantages:
 - Devices on one topology cannot be placed into another topology without some hardware changes



Free

- Like Hybrid topology but no additional hardware required for changing data packet between topologies



LonWorks uses this type of topology



Free

- Advantages:
 - Very easy to install