Networking Topology

Lecture 2

Wrap-up..

- Why Networks?
- Classification of Computer Networks based on:
  - Transmission media
    - Guided
      - Twisted pair (UTP,STP)
      - Fiber (Multimode, Single Mode)
      - coaxial
    - Unguided (Wireless)
  - Network size
    - LAN
    - WAN
  - Management Method
    - Peer to peer
    - Client / server

What is Network Topology?

- The **physical layout** or the **geometric pattern** formed by the arrangement of interconnected computers is referred to as topology.

- **structure of a network** and may be depicted **physically or logically** (Wikipedia)

Types of Network Topology

- **Physical topology** defines how nodes in a network are **physically linked** and includes aspects such as geographic location of nodes and physical distances between nodes.

- **Logical topology** describe **how nodes communicate in a network** across its physical topology (how signals act on the network).

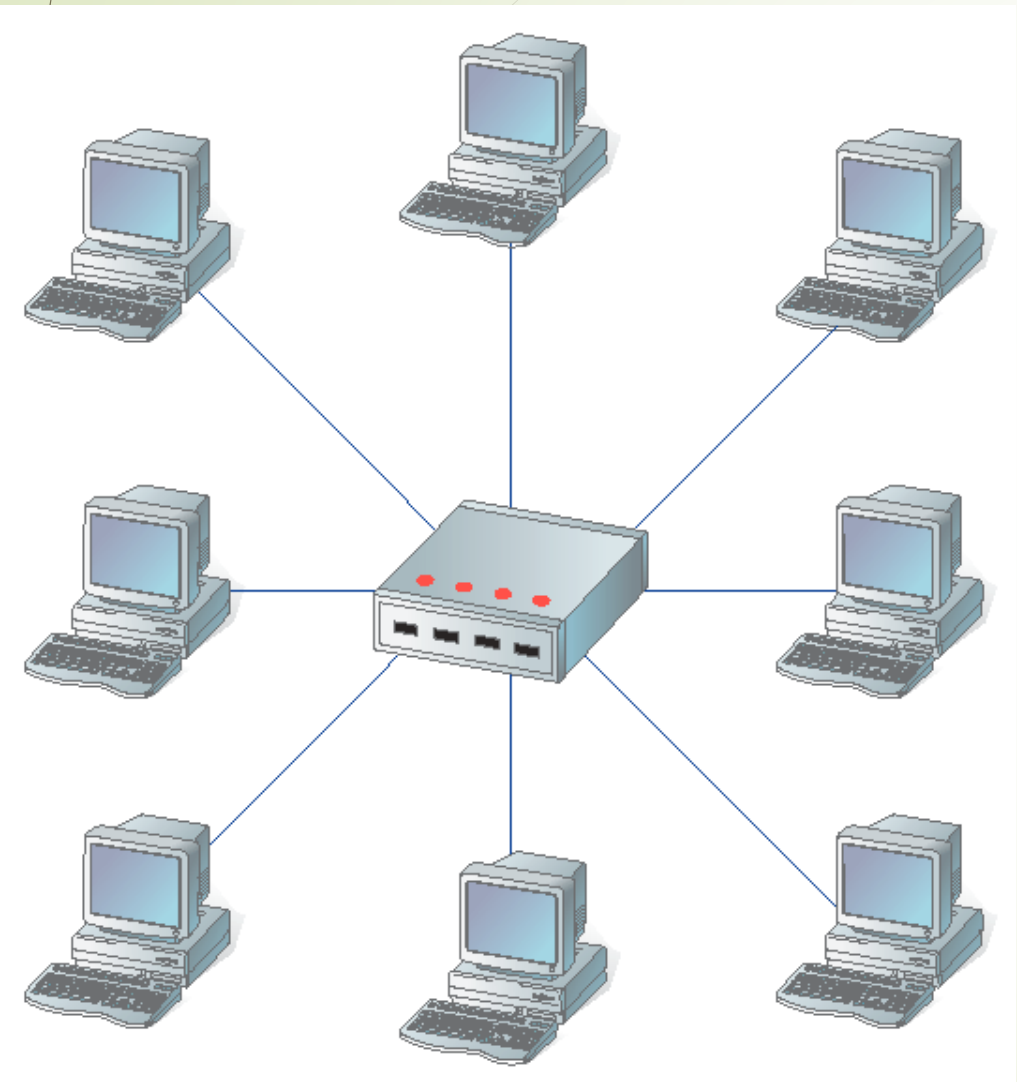
Types of Network Topology

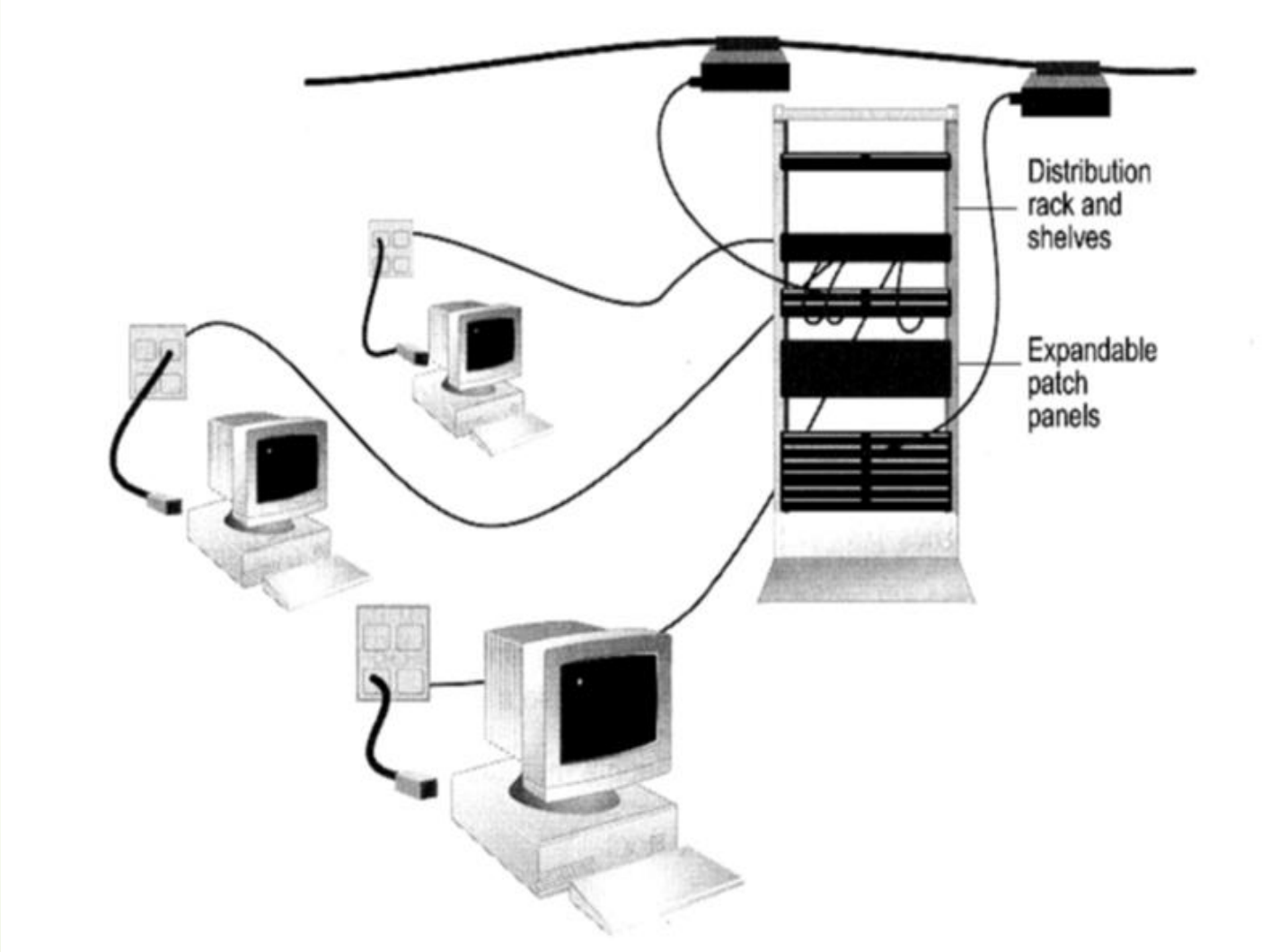
- Physical topology
  - Star
  - Bus
  - Ring
  - Mesh
  - Tree
- Logical Topology
  - Ethernet
  - Token Ring

Physical topology-Star

- Each network host is connected to a central hub/switch with a point-to-point connection.
- More cabling, hence higher cost.
- All signals transmission through the hub; if down, entire network down.
- Depending on the intelligence of hub, two or more computers may send message at the same time.

Physical topology-Star





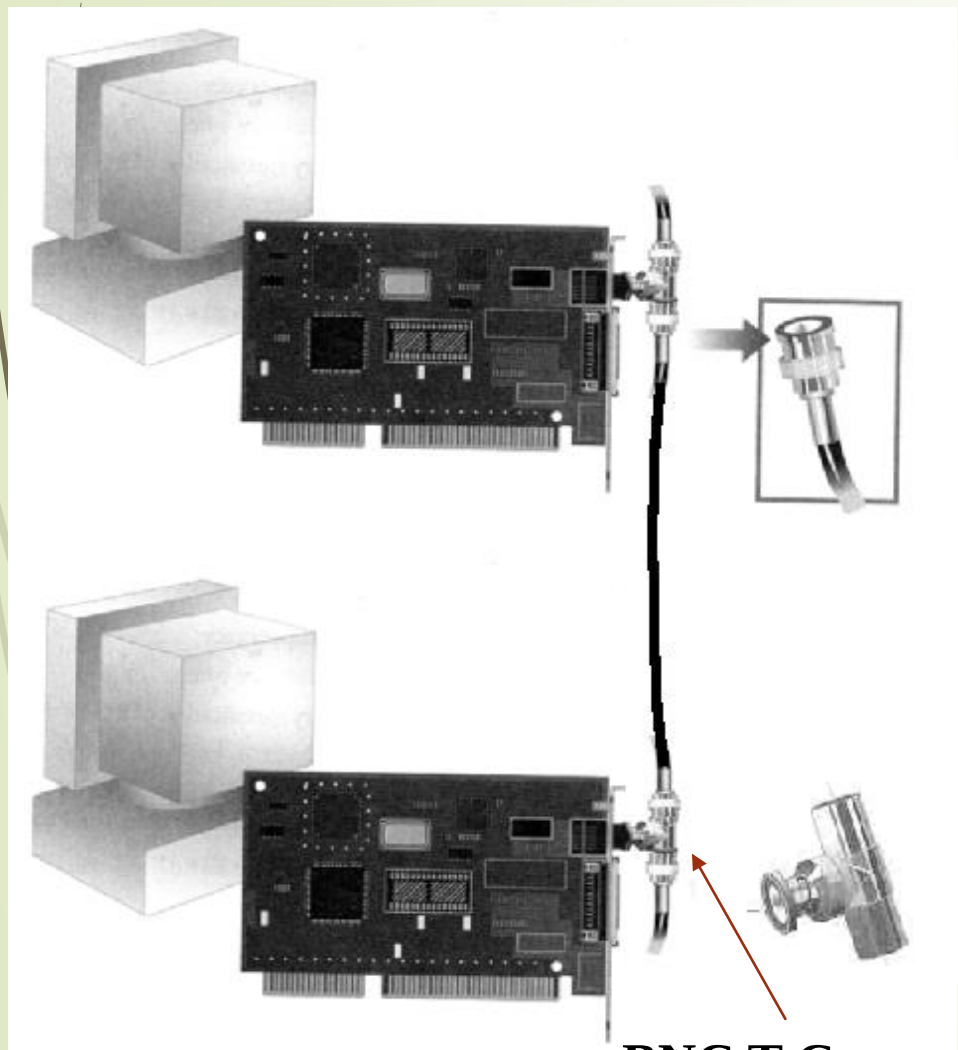
Physical topology- Bus

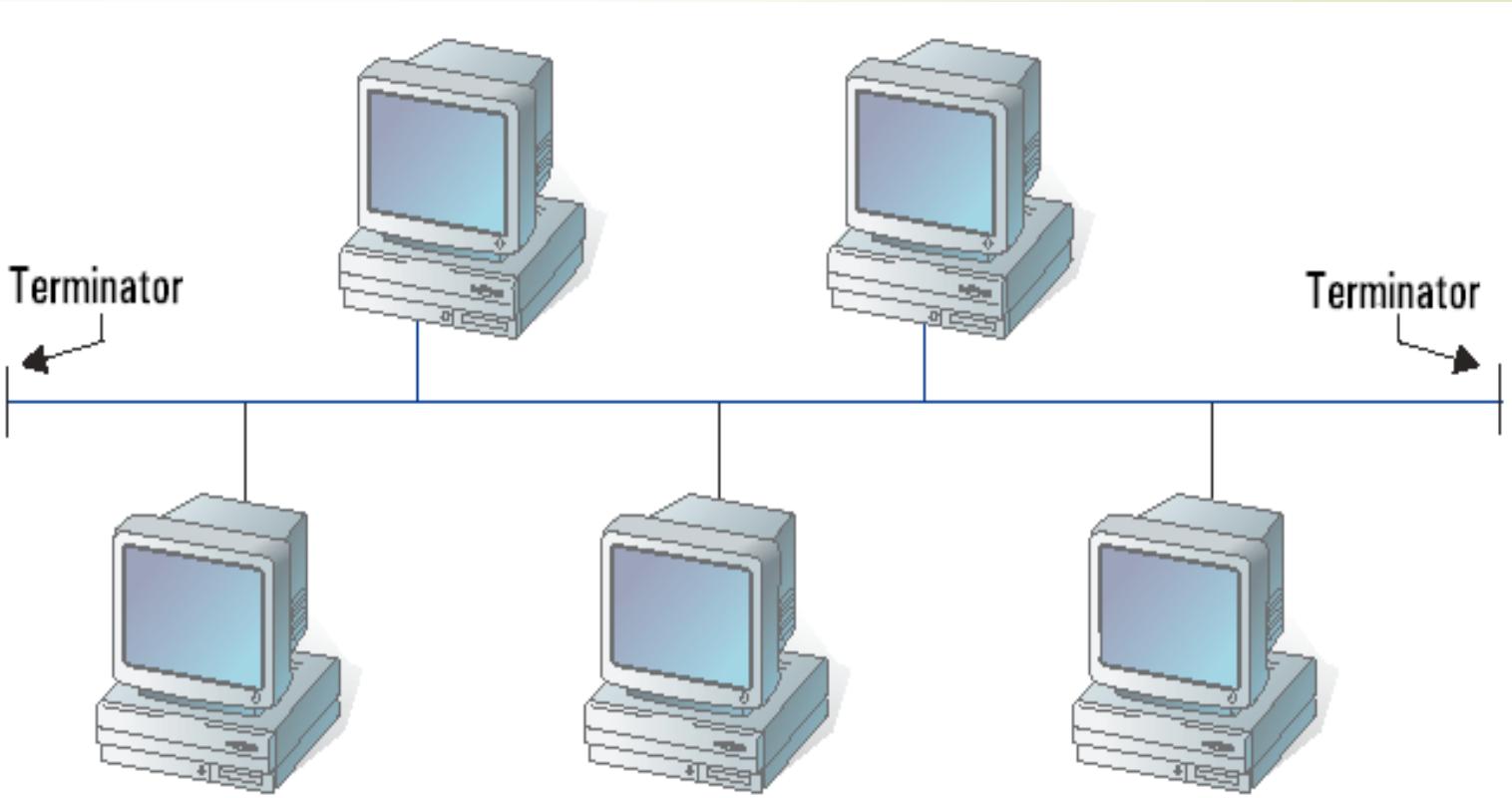
- **Simple and low-cost to implement**
- **A single cable called a trunk (backbone, bus)**
- **Only one computer can send messages at a time**
- **Each computer receives the message, but ignores it if not addressed to it.**
- **Passive topology - computer only listen for, not regenerate data.**

Physical topology- Bus

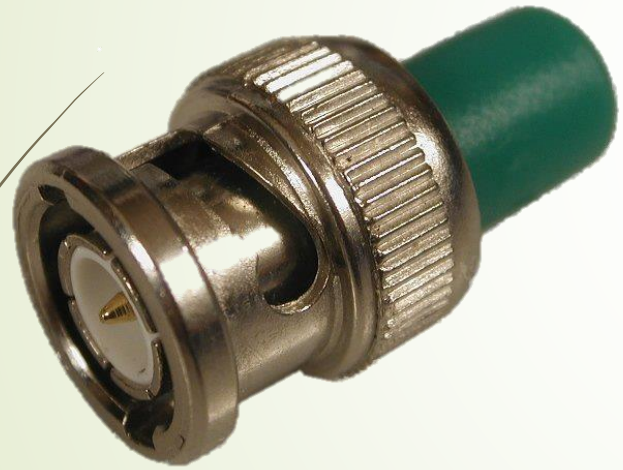
- **Bounce-back**: a phenomenon that occurs when a signal reaches the end of a cable, reverses direction, and continues along the cable. A terminator at each end of the cable is used to prevent this.
- **Terminator**: a device connected to the end of a bus to **absorb** the signal
- Terminators **used at both ends** of the trunk to absorb signals and **prevent bounce back**.

Physical topology- Bus





Bus Topology connectors



Bus connectors

- The **T-connector**: a device that looks like the letter "T." The top of the T is inserted into the cable much like a plumber taps into a pipe. The vertical bar of the letter screws onto the network card.
- **Drop-cable**: the cable that extends from a node to the bus cable.
- **Coaxial cable** can carry a signal up to 500 meters

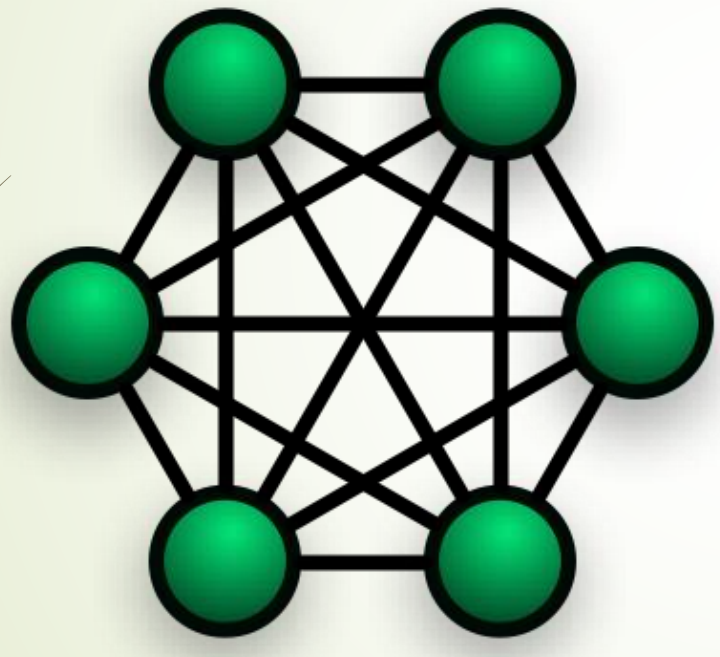
Physical topology- Ring

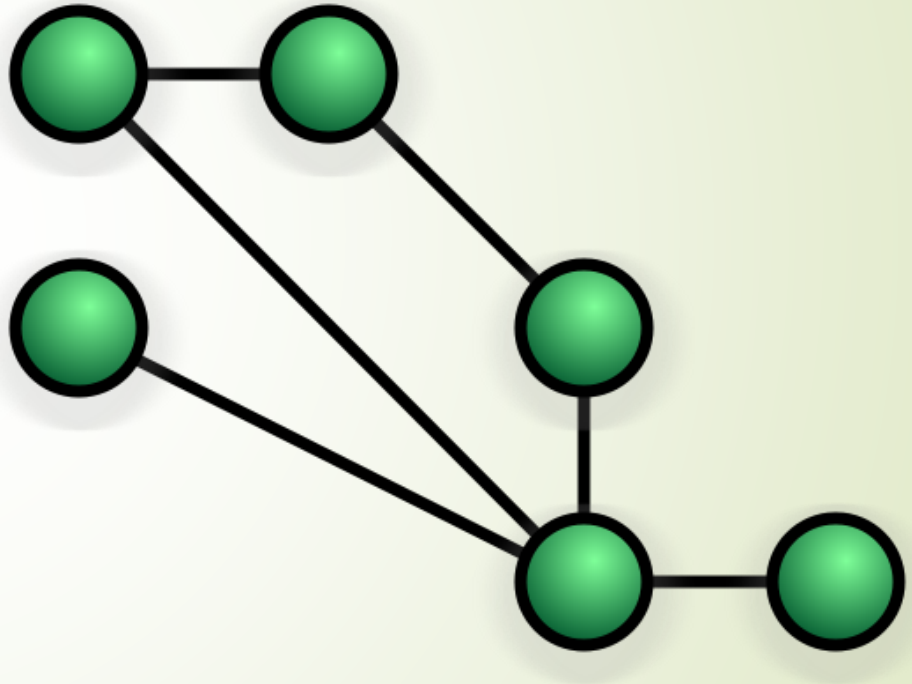
- A ring topology is a bus topology in **a closed loop**.
- Used in **peer-to-peer** networks.
- **Data travels** around the ring in **one direction**.
- The intermediate **nodes** repeat (**re transmit**) the data to keep the signal strong.
- Disadvantages: Aggregate network bandwidth is **bottlenecked** by the **weakest link** between two nodes.

Physical topology- Mesh

- Used to **connect the infrastructure nodes** (i.e. bridges, switches and other infrastructure devices) rather than clients.
- The infrastructure nodes are connected to as many other nodes as possible and cooperate with one another to **efficiently route data from/to clients**.
- The Mesh network is **typically quite reliable**, as there is often **more than one path** between a source and a destination in the network.
- **Fault tolerant:** a feature that ensures that a network continues to operate In the face of a network component failure.

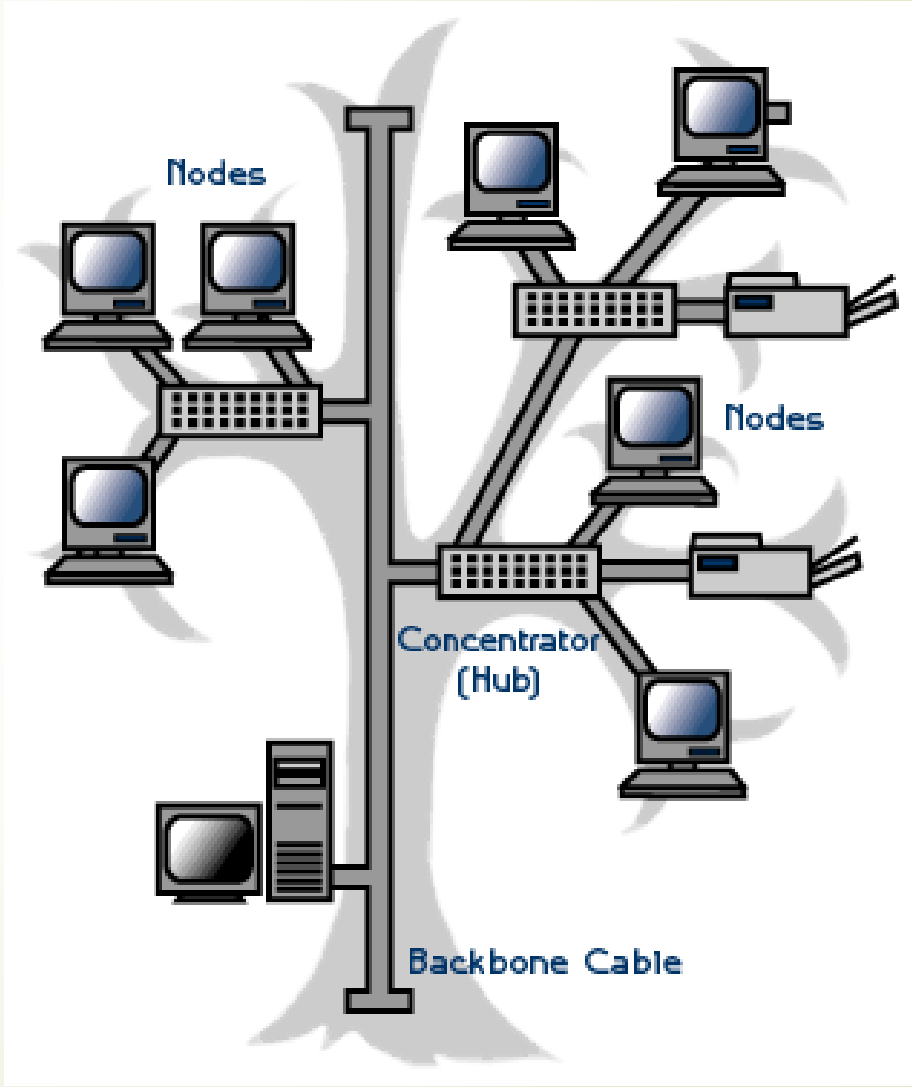
Full-mesh vs. partial-mesh





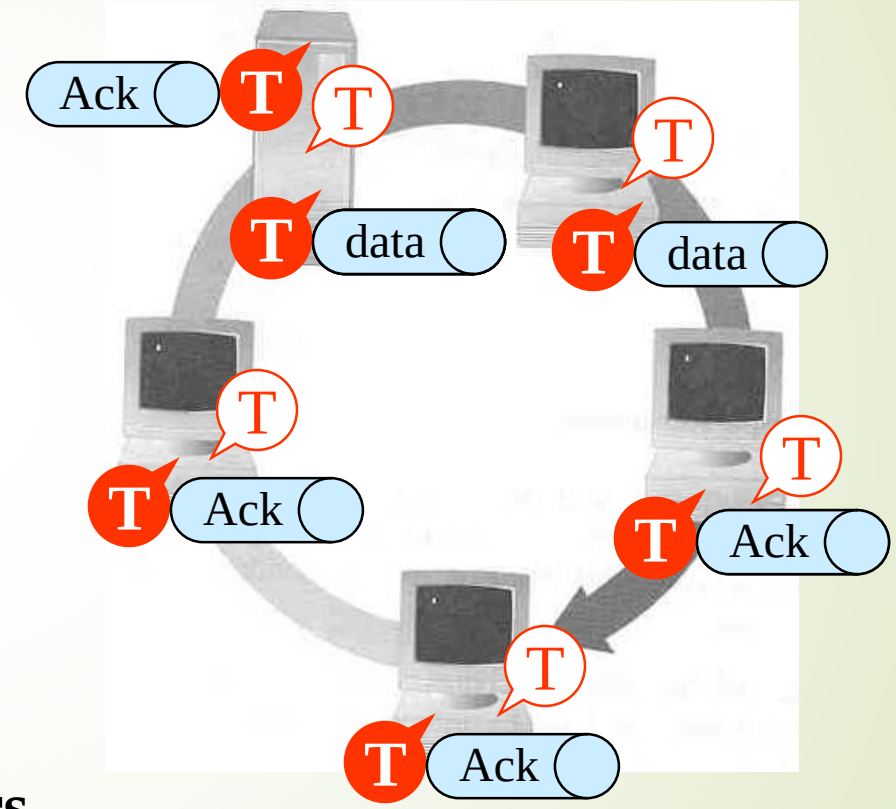
Physical topology- Tree

- It is a hybrid network topology in which star networks are interconnected via bus networks *(star-bus network)*.



Logical Topology – Token Ring

- **Ring Topology**
  - **Every computer serves as a repeater to boost signals**
  - **Typical way to send data:**
    - **Token passing**
      - **only the computer who gets the token can send data**
  - **Disadvantages**
    - **Difficult to add computers**
    - **More expensive**
    - **If one computer fails, whole network fails**



Logical Topology - Ethernet

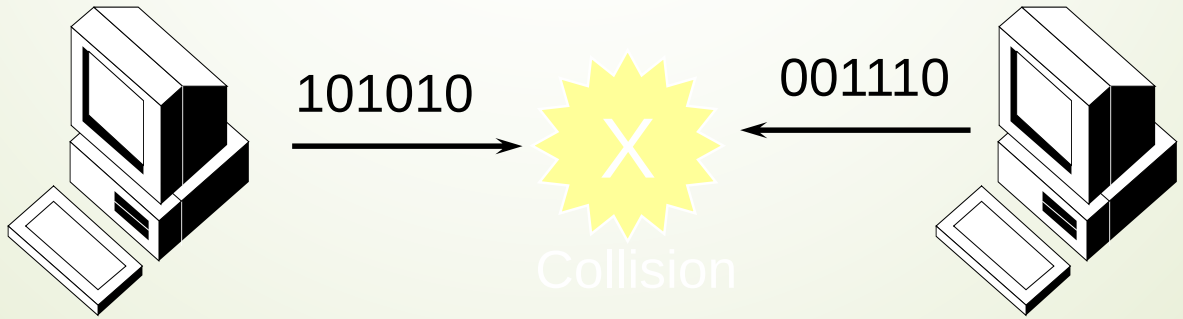
- Doesn't use tokens… it is a **shared media**
- Systems communicating over Ethernet divide a stream of data into **shorter pieces** called **frames**.
- Each frame contains source and destination addresses, and error-checking data so that **damaged frames can be detected and discarded**;
- The frame ends with a frame check sequence (FCS), which is a 32-bit cyclic redundancy check used to detect any in-transit corruption of data.

Logical Topology - Ethernet

- **100BASE-T** means: 100 Mbit/s , *BASE* denotes that baseband transmission is used. The **T** designates twisted pair cable.
- Uses carrier sense multiple access with collision detection (**CSMA/CD**) rather than tokens.
- IEEE published the **802.3 standard** as a draft in 1983 and as a standard in 1985.
- Can be used with copper(UTP) or fiber media.

CSMA/CD Media Access Control

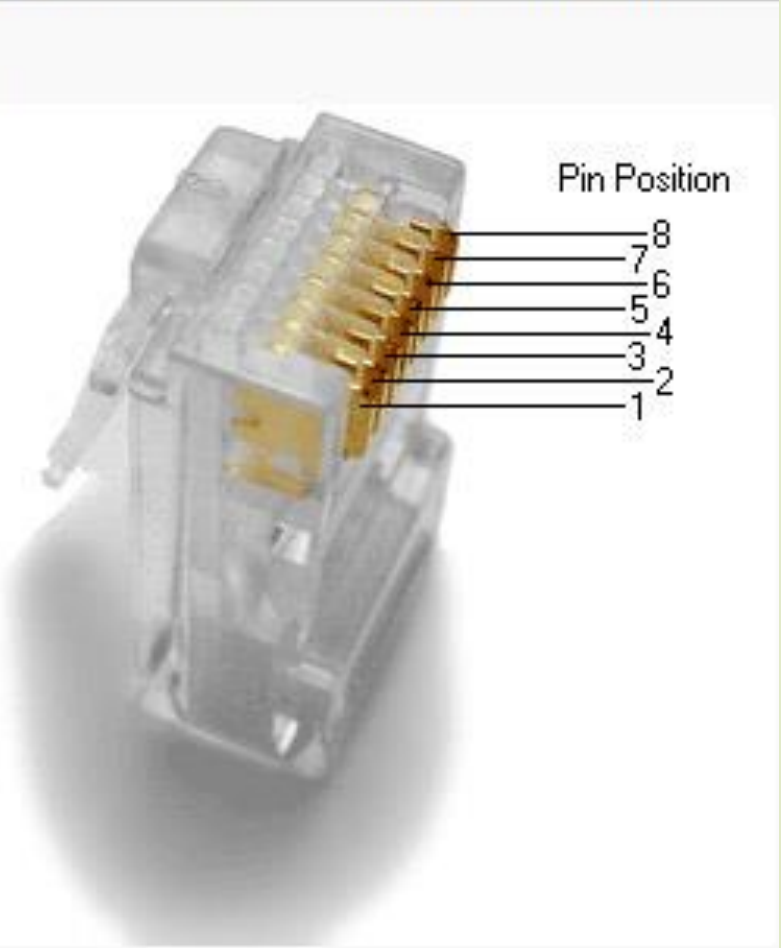
- CD: Collision Detection
  - If two stations transmit at once ….
  - Their signals collide, scrambling one another
  - Because each sender listens (senses the carrier), both know that there has been a collision
  - Both stop and wait a random amount of time.



CSMA/CD animations

- https://www.youtube.com/watch?v=nyYr3cR5BTw
- https://www.youtube.com/watch?v=iKn0GzF5-IU

RJ-45 connector for Ethernet over UTP

Pin	T568A Pair	T568B Pair	Wire	T568A Color	T568B Color	Pins on plug face (socket is reversed)
1	3	2	tip	white/green stripe	white/orange stripe	
2	3	2	ring	green solid	orange solid	
3	2	3	tip	white/orange stripe	white/green stripe	
4	1	1	ring	blue solid	blue solid	
5	1	1	tip	white/blue stripe	white/blue stripe	
6	2	3	ring	orange solid	green solid	
7	4	4	tip	white/brown stripe	white/brown stripe	
8	4	4	ring	brown solid	brown solid	

Exercise:

- Surf the internet to list the Advantages and disadvantages of network topologies