

Lecture 1 - Introduction to Computer Networking

Different types of ways to communicate and each have their own rules

Delays:

- Transmission delay → how long it takes to generate data → often dominate longer messages
- Propagation delay → distance traveled/ travel time
- Queuing delay → delay is proportional to queue data is in / traffic
- processing delay → cpu thinking about what to send

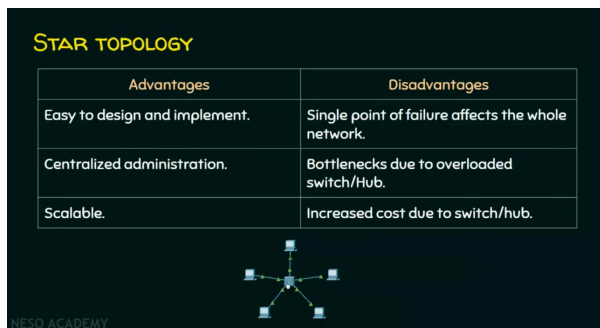
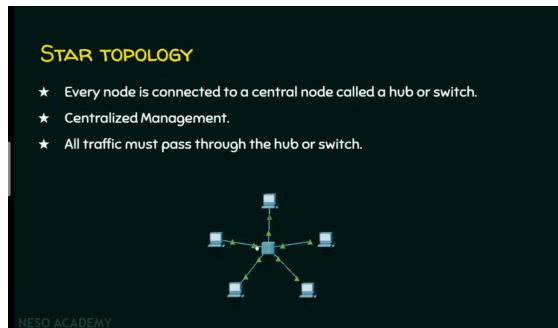
Packets → groups of data

Basic communication model:

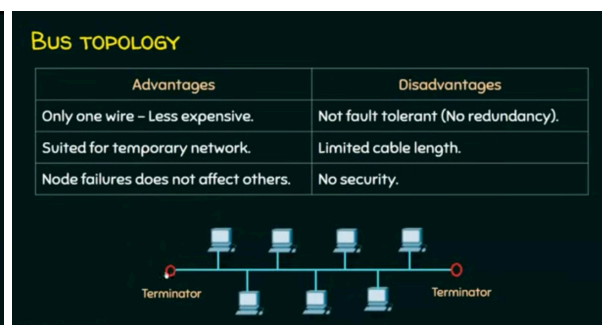
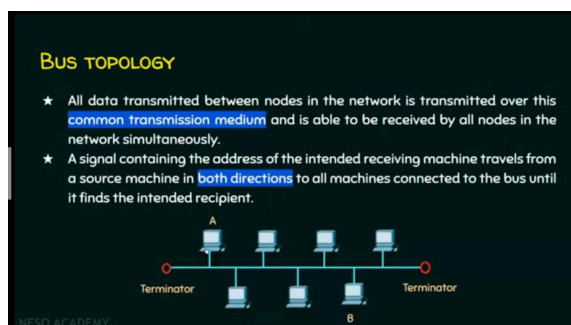
Sender → channel → receiver

Topology → arrangement of nodes and links defining data flow

- Star



- Bus



- Ring → is good if your connection is cut, you can go the other way

RING TOPOLOGY


- ★ A ring topology is a bus topology in a closed loop.
- ★ Peer-to-Peer LAN topology.
- ★ Two connections: one to each of its nearest neighbors.
- ★ Unidirectional.
- ★ Sending and receiving data takes place with the help of a **TOKEN**.



NESO ACADEMY

RING TOPOLOGY

Advantages	Disadvantages
Performance better than Bus topology.	Unidirectional. Single point of failure will affect the whole network.
Can cause bottleneck due to weak links.	↑ in load - ↓ in performance.
All nodes with equal access.	No security.




NESO ACADEMY

- Mesh → essentially best because you are always connected

MESH TOPOLOGY


- ★ Each node is directly connected to every other nodes in the network.
- ★ Fault tolerant and reliable.



NESO ACADEMY

MESH TOPOLOGY

Advantages	Disadvantages
Fault tolerant.	Issues with broadcasting messages.
Reliable.	Expensive and impractical for large networks.



NESO ACADEMY

- topology evaluation
 - Throughput
 - delay
 - Reliability
 - Security
- Scaling → big $O(n)$

Performance metrics

Throughput → how much data is actually transferred per second

- Measured in bits per second

Delay / latency → how long does it take to arrive

- Measured in millisecond or microseconds
- Transmission, queuing, propagation, processing

Reliability → can these messages get through correctly

- Packet loss rate / bit error rate

Security → how safe is it

Internet protocol stack

Application (Http/DNS/SMTP) → user facing network applications live → defines what is being communication and how they talk to each other → interact with this layer directly

Transport (TCP/UDP) → controls how data is delivered between two applications on different machines

network (IP) → figures out how packets get from one computer to another across networks

link(ethernet/Wifi) → moves data within a single local network

physical(copper/fiber/radio) → handles raw bits

↑ data flow down

↓ data flow up