

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

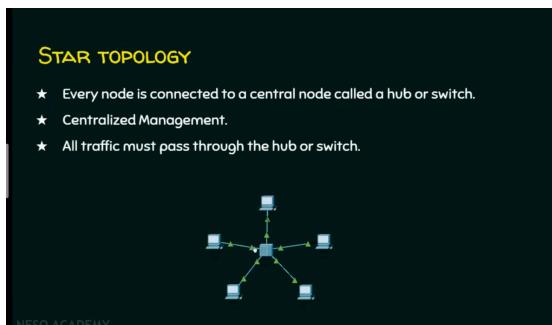
Packets → groups of data

Basic communication model:

Sender → channel → receiver

Topology → arrangement of nodes and links defining data flow

- Star

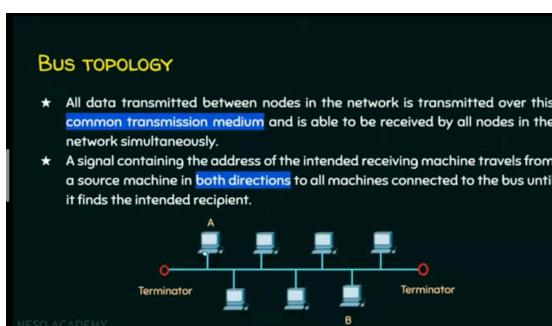


STAR TOPOLOGY

Advantages	Disadvantages
Easy to design and implement.	Single point of failure affects the whole network.
Centralized administration.	Bottlenecks due to overloaded switch/Hub.
Scalable.	Increased cost due to switch/hub.

NESO ACADEMY

- Bus

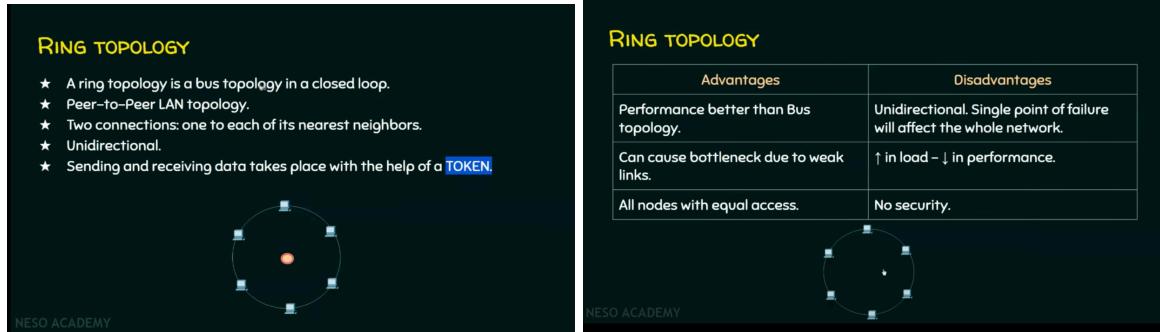


BUS TOPOLOGY

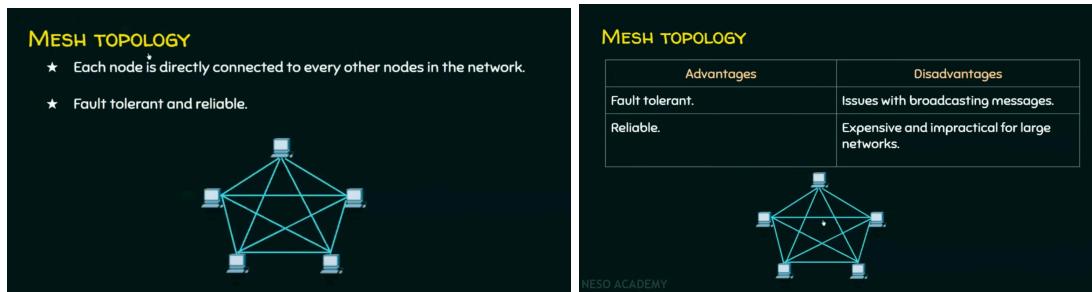
Advantages	Disadvantages
Only one wire - Less expensive.	Not fault tolerant (No redundancy).
Suited for temporary network.	Limited cable length.
Node failures does not affect others.	No security.

NESO ACADEMY

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



- Mesh → essentially best because you are always connected



- 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