

Introduction to Networks

Introduction to Networks – Study Notes

1. What Is a Network?

Term	Definition
Network	A collection of interconnected devices (nodes) that can share data, resources, and services.
Node	Any device that can send, receive, or forward information (e.g., computer, printer, router, smartphone).
Link	The physical or logical connection between nodes (cable, fiber, wireless signal, etc.).
Topology	The arrangement of nodes and links in a network (e.g., star, mesh, bus).

2. Core Network Concepts

Concept	Description	Example
Bandwidth	Maximum data rate a link can carry, measured in bits per second (bps).	100Mbps Ethernet
Latency	Time for a data packet to travel from source to destination, measured in milliseconds (ms).	20ms round-trip time for a LAN
Throughput	Actual amount of data successfully transferred per unit time.	80Mbps observed on a 100Mbps link
Protocol	A set of rules governing communication.	TCP, IP, HTTP
Addressing	Identifiers that allow devices to locate each other.	IPv4 address 192.168.1.10, MAC address 00:1A:2B:3C:4D:5E

3. Network Types by Scope

Scope	Typical Size	Common Uses
Personal Area Network (PAN)	A few meters	Bluetooth headphones, smartwatches
Local Area Network (LAN)	Up to a building or campus	Office computers, printers

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Scope	Typical Size	Common Uses
Metropolitan Area Network (MAN)	City-wide	Municipal Wi-Fi, university campuses
Wide Area Network (WAN)	Regional to global	The Internet, corporate branch connections
Storage Area Network (SAN)	Data-center focused	High-speed storage access

4. Network Topologies

Topology	Structure	Advantages	Disadvantages
Star	All nodes connect to a central hub/switch	Easy to add/remove nodes; failure isolated to a single link	Central device is a single point of failure
Bus	Nodes share a single backbone cable	Simple, inexpensive	Collisions; limited scalability
Ring	Nodes form a closed loop; data travels in one direction (or both)	Predictable performance	Failure of one link breaks the ring (unless using a dual-ring)
Mesh	Each node can connect to multiple others	High redundancy, fault tolerance	Complex, costly
Tree (Hierarchical)	Combination of star and bus; layers of switches	Scalable, organized	Requires careful planning; root failure impacts sub-trees

5. The OSI Model – 7 Layers

Layer	Primary Function	Typical Protocols / Devices
7 – Application	End-user services (email, web)	HTTP, SMTP, FTP
6 – Presentation	Data formatting, encryption, compression	TLS/SSL, JPEG, ASCII
5 – Session	Managing dialogs, synchronization	NetBIOS, RPC
4 – Transport	End-to-end reliability, flow control	TCP, UDP
3 – Network	Routing, logical addressing	IP, ICMP

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Layer	Primary Function	Typical Protocols / Devices
2 – Data Link	Frame handling, MAC addressing, error	