

Introduction to Computer Networking

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(A concise, structured overview for quick study and reference)

1. What Is a Computer Network?

- **Definition:** A collection of interconnected devices (computers, servers, phones, IoT gadgets, etc.) that can share data, resources, and services.
 - **Primary Goals**
 - **Communication:** Enable devices to exchange information.
 - **Resource Sharing:** Printers, files, applications, internet connection.
 - **Scalability & Flexibility:** Add or remove nodes without disrupting the whole system.
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2. Key Terminology

Term	Meaning
Node	Any device (host, router, switch, etc.) that participates in the network.
Link	Physical or logical connection between two nodes (cable, wireless link, virtual tunnel).
Protocol	A set of rules governing data exchange (e.g., TCP, HTTP).
Topology	Physical or logical layout of the network (star, mesh, bus, ring).
Bandwidth	Maximum data rate a link can carry (bits per second).
Latency	Time for a packet to travel from source to destination (ms).
Throughput	Actual data transferred over a period of time (often lower than bandwidth).
IP Address	Numerical identifier for a device at the network layer (IPv4/IPv6).
MAC Address	Hardware address of a network interface card (layer 2).

3. Network Types by Scope

Scope	Typical Size	Example Environments
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PAN (Personal Area Network)	< 10?m	Bluetooth headphones, smartwatches.
LAN (Local Area Network)	Building or campus	Office Ethernet, university dorms.
MAN (Metropolitan Area Network)	City?wide	Municipal fiber, cable TV networks.
WAN (Wide Area Network)	Country/Global	The Internet, corporate MPLS networks.
CAN (Campus Area Network)	Multiple LANs in a campus	University campus, corporate park.
SAN (Storage Area Network)	Specialized storage	Fibre Channel storage clusters.

4. Network Architecture Layers

4.1 OSI Model (Conceptual)

Layer	Primary Function	Typical Protocols
7 – Application	End?user services	HTTP, FTP, SMTP
6 – Presentation	Data format & encryption	TLS, JPEG, ASCII
5 – Session	Dialog control	NetBIOS, RPC
4 – Transport	End?to?end reliability	TCP, UDP
3 – Network	Routing & logical addressing	IP, ICMP
2 – Data Link	Frame handling, MAC addressing	Ethernet, PPP
1 – Physical	Bits on media	Twisted?pair, fiber, radio

4.2 TCP/IP Model (Practical)

Layer	OSI Equivalent(s)	Core Protocols
Application	5?7	HTTP, DNS, SSH
Transport	4	TCP, UDP
Internet	3	IPv4, IPv6, ICMP
Link (Network Access)	1?2	Ethernet, Wi?Fi, ARP

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5. Common Network Devices

Device	Role	Typical Placement
Hub	Broadcasts incoming frames to all ports (no intelligence)	Small LANs (legacy)
Switch		