

Overview of Computer Networking

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(A concise, structured guide for quick reference)

1. What Is a Computer Network?

- **Definition:** A collection of interconnected devices (computers, servers, smartphones, IoT gadgets, etc.) that can exchange data and share resources.
- **Primary Goals**
 - **Communication:** Transfer of information (messages, files, streaming media).
 - **Resource Sharing:** Printers, storage, applications, internet access.
 - **Scalability & Flexibility:** Add or remove devices without disrupting the whole system.

2. Basic Components

Component	Role	Typical Examples
Node	Endpoint that sends/receives data	PCs, laptops, smartphones, sensors
Link	Physical or logical pathway between nodes	Ethernet cable, fiber optic, Wi-Fi, satellite link
Switch	Connects multiple devices within a LAN, forwards frames based on MAC addresses	Ethernet switch, managed/unmanaged
Router	Connects different networks (e.g., LAN ? WAN) and routes packets using IP addresses	Home router, ISP core router
Access Point (AP)	Provides wireless connectivity to wired networks	Wi-Fi AP, hotspot
Firewall	Enforces security policies, filters traffic	Hardware firewall, software firewall
Server	Provides services (file sharing, web, email, DNS, etc.)	Web server, DNS server, DHCP server

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3. Network Types by Scope

Scope	Typical Size	Example Use?Cases
PAN (Personal Area Network)	?10?m	Bluetooth headset, smartwatch
LAN (Local Area Network)	Building or campus	Office Ethernet, school network
MAN (Metropolitan Area Network)	City?wide	Municipal Wi?Fi, fiber to the neighborhood
WAN (Wide Area Network)	Country/continent	Internet, corporate VPN across sites
CAN (Campus Area Network)	Multiple LANs on a campus	University network
SAN (Storage Area Network)	Dedicated high?speed storage	Data?center block storage
GAN (Global Area Network)	Worldwide	Satellite communications, global IoT back?haul

4. OSI & TCP/IP Reference Models

4.1 OSI 7?Layer Model

Layer	Function	Key Protocols / Devices
7 – Application	End?user services (email, web)	HTTP, FTP, SMTP
6 – Presentation	Data translation, encryption	TLS/SSL, JPEG, ASCII
5 – Session	Manage dialogs, connections	NetBIOS, RPC
4 – Transport	End?to?end reliability, flow control	TCP, UDP
3 – Network	Routing, logical addressing	IP, ICMP, routers
2 – Data Link	MAC addressing, frame error detection	Ethernet, PPP, switches
1 – Physical	Electrical/optical signaling	Cables, NICs, repeaters

4.2 TCP/IP Model (practical implementation)

Layer	OSI Equivalent(s)	Core Protocols
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Application	5–7	HTTP, DNS, SMTP
Transport	4	TCP, UDP
Internet	3	IP, ICMP, IGMP
Link	1–2	Ethernet, ARP, PPP

5. Key Networking Concepts