

Introduction to Computer Networking

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Key concepts, terminology, and foundational models

1. What Is a Computer Network?

Aspect	Description
Definition	A collection of interconnected devices (computers, phones, sensors, etc.) that can exchange data and share resources.
Purpose	Communication, resource sharing (files, printers, internet), distributed computing, and data collection.
Scale	Ranges from a few devices in a home (LAN) to millions of devices worldwide (Internet).

2. Basic Networking Terminology

Term	Meaning
Node	Any device that can send, receive, or forward data (e.g., PC, router, switch, IoT sensor).
Link	Physical or logical connection between two nodes (copper cable, fiber, wireless link).
Protocol	A set of rules governing how data is formatted, transmitted, and received (e.g., TCP, HTTP).
Topology	Physical or logical arrangement of nodes and links (star, mesh, bus, ring).
Bandwidth	Maximum data rate a link can carry, usually expressed in bits per second (bps).
Latency	Time taken for a packet to travel from source to destination (measured in milliseconds).
Throughput	Actual data rate achieved, often lower than bandwidth due to overhead and congestion.
IP Address	Unique numeric identifier for a host on an IP network (IPv4: 32-bit, IPv6: 128-bit).
MAC Address	Hardware address of a network interface card (48-bit, used in the data-link layer).

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3. Network Types by Scope

Scope	Typical Size	Example Technologies
PAN (Personal Area Network)	< 10?m	Bluetooth, ZigBee
LAN (Local Area Network)	Building or campus	Ethernet, Wi-Fi (802.11)
MAN (Metropolitan Area Network)	City-wide	Fiber-to-the-node, Metro Ethernet
WAN (Wide Area Network)	Country/continent	MPLS, leased lines, satellite
CAN (Campus Area Network)	University or corporate campus	High-speed Ethernet, fiber
Internet	Global	TCP/IP, DNS, HTTP/HTTPS

4. The OSI Reference Model

Layer	Name	Primary Function	Typical Protocols / Devices
7	Application	End-user services (email, web, file transfer)	HTTP, FTP, SMTP, DNS
6	Presentation	Data translation, encryption, compression	TLS/SSL, JPEG, ASCII
5	Session	Establishes, manages, terminates connections	NetBIOS, RPC
4	Transport	End-to-end reliability, flow control	TCP (reliable), UDP (unreliable)
3	Network	Routing, logical addressing	IP, ICMP, routers
2	Data Link	Frame formatting, MAC addressing, error detection	Ethernet, PPP, switches
1	Physical	Transmission of raw bits over a medium	Copper, fiber, radio, hubs

Why it matters: The model isolates functions, making design, troubleshooting, and protocol development systematic.

5. The TCP/IP Model (Practical Backbone)

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| Layer | OSI Equivalent(s) | Core Protocols