

Introduction to Networking

Introduction to Networking – Study Notes

1. What Is a Computer Network?

Concept	Description
Definition	A collection of interconnected devices (computers, servers, phones, IoT gadgets, etc.) that can share resources and data.
Purpose	Enable communication, resource sharing (files, printers, internet), and collaboration across distances. • Faster information exchange
Key	• Centralized data management
Benefits	• Cost-effective resource utilization • Improved reliability and scalability

2. Basic Networking Terminology

Term	Meaning
Node	Any device (host, router, switch, printer) attached to a network.
Host	A node that runs applications and provides services (e.g., a PC or server).
Link	Physical or logical connection between two nodes (cable, fiber, wireless).
Protocol	A set of rules that define how data is formatted, transmitted, and received (e.g., TCP, HTTP).
Topology	Physical or logical layout of the network (star, mesh, bus, ring, tree).
LAN	Local Area Network – confined to a single building or campus (typically < 10km).
WAN	Wide Area Network – spans cities, countries, or the globe (e.g., the Internet).
IP Address	Numerical identifier for a device on an IP network (IPv4: 192.168.1.10; IPv6: 2001:db8::1).
MAC Address	Hardware address burned into a NIC; unique per network interface (e.g., 00:1A:2B:3C:4D:5E).
Port	Logical endpoint for a specific service on a host (e.g., TCP 80 = HTTP).

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3. Network Architecture Layers

Layer (OSI Model)	Primary Function	Common Protocols / Devices
1 – Physical	Transmit raw bits over a medium (copper, fiber, radio).	Ethernet cables, fiber optics, Wi-Fi radios.
2 – Data Link	Frame creation, MAC addressing, error detection.	Ethernet (802.3), Wi-Fi (802.11), Switches, Bridges.
3 – Network	Routing, logical addressing, path selection.	IP, ICMP, Routers, Layer 3 switches.
4 – Transport	End-to-end reliability, flow control, multiplexing.	TCP, UDP.
5 – Session	Manage dialogs, synchronization.	NetBIOS, RPC.
6 – Presentation	Data translation, encryption, compression.	SSL/TLS, JPEG, ASCII & Unicode.
7 – Application	User-level services and interfaces.	HTTP, FTP, DNS, SMTP, SSH.

The **TCP/IP model** condenses these into four layers (Link, Internet, Transport, Application) and is the practical basis for most modern networks.

4. Common Network Devices

Device	Role	Typical Use Cases
Hub	Repeats incoming signals to all ports (Layer 1).	Small, legacy labs (rare today).
Switch	Forwards frames based on MAC address (Layer 2).	Core of LANs, VLAN segmentation.
Router	Routes packets between different IP subnets (	