🔗 What Is Networking?

Networking is the practice of connecting computers and other devices (like phones, printers, servers) so they can share resources and communicate.

🧱 Basic Building Blocks

1. Network Devices

- **Router**: Connects multiple networks together and routes data between them (like your home and the internet).
- **Switch**: Connects devices within the same network and forwards data only to the device that needs it.
- **Hub**: Basic device that sends data to all connected devices (less efficient than a switch).
- **Modem**: Converts digital data into signals for transmission over phone or cable lines (used for internet access).
- **Access Point (AP)**: Allows wireless devices to connect to a wired network using Wi-Fi.

🌐 Types of Networks

1. PAN (Personal Area Network)

- Very small range (e.g., Bluetooth between phone and earbuds).

2. LAN (Local Area Network)

- Covers a small geographic area like a home, office, or school.
- Devices are typically connected via Ethernet or Wi-Fi.

3. MAN (Metropolitan Area Network)

- Covers a city or a large campus.

4. WAN (Wide Area Network)

- Spans large areas, even globally. The Internet is the largest WAN.

📶 Wired vs Wireless

- **Wired**: More stable and faster (uses Ethernet cables).
- **Wireless**: More flexible and mobile (uses Wi-Fi, Bluetooth).

📬 How Devices Communicate

1. IP Address

- Unique address for each device on a network (e.g., 192.168.1.1).
- Helps identify devices on the internet or local network.

2. MAC Address

- Physical address assigned to a device's network card (e.g., 00:1A:2B:3C:4D:5E).
- Used for communication within a local network.

3. Protocols

Rules that govern how data is transferred.

- **TCP/IP** (Transmission Control Protocol/Internet Protocol): Foundation of the internet.
- **HTTP/HTTPS**: Used for accessing websites.
- **FTP**: For file transfers.
- **DNS**: Translates domain names to IP addresses.

🧭 Data Transfer Concepts

1. Packets

- Data is broken into small units called packets before being sent.

2. Ports

- Logical endpoints for sending/receiving data (e.g., HTTP uses port 80).

3. Firewall

- Security system that monitors and controls incoming and outgoing traffic.

📡 The Internet vs Intranet

- **Internet**: Public network accessible globally.
- **Intranet**: Private network within an organization.

🔒 Network Security Basics

- **Encryption**: Protects data so it can't be read without a key.
- **Firewalls**: Filter traffic based on rules.
- **VPN (Virtual Private Network)**: Secures your connection by encrypting your data and masking your IP address.

📘 Summary Table

Term	Description
IP Address	Identifies a device on a network
Router	Connects different networks
Switch	Connects devices in a LAN

LAN	Local network (home/office)
WAN	Global network (Internet)
Protocol	Rules for communication
Packet	Unit of data sent across a network
DNS	Converts domain names to IP addresses

🌐 What is an IP Address?

An **IP address** is a unique identifier for a device on a network. It can be one of two versions:

🗒️ IP Versions:

Version	Format	Length	Example
IPv4	Decimal (x.x.x.x)	32-bit	192.168.1.1
IPv6	Hexadecimal	128-bit	2001:0db8:85a3::8a2e:0370:7334

- **IPv4** is most common but has limited addresses (about 4.3 billion).
- **IPv6** was introduced to solve IPv4 exhaustion.

📦 IP Classes (IPv4 Only)

IPv4 is divided into **five classes (A to E)** based on their **starting bits** and **network size**.

Class	Starting Bits	Address Range	Default Subnet Mask	No. of Networks	Hosts per Network	Usage
A	0	1.0.0.0 to 126.255.255.255	255.0.0.0 (/8)	128	~16 million	Large networks (e.g., ISPs)

B	10	128.0.0.0 to 191.255.255.255	255.255.0.0 (/16)	16,384	~65,000	Medium networks (e.g., universities)
C	110	192.0.0.0 to 223.255.255.255	255.255.255.0 (/24)	2 million	254	Small networks (e.g., homes, SMBs)
D	1110	224.0.0.0 to 239.255.255.255	Not Applicable	N/A	N/A	Multicast
E	1111	240.0.0.0 to 255.255.255.255	Not Applicable	Reserved	Reserved	Experimental, Research

Note: IP addresses **127.x.x.x** are reserved for loopback (localhost testing).

🏠 Private IP Ranges (for internal networks):

Class	Private IP Range
A	10.0.0.0 – 10.255.255.255
B	172.16.0.0 – 172.31.255.255
C	192.168.0.0 – 192.168.255.255

These private ranges **aren't routable on the internet** — they're used inside LANs.