


# Computer Network

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## ✓ 1. What is a Computer Network?

A **Computer Network** is when two or more computers are connected to share data, resources, or communication.

 Real Life Example: WhatsApp and Instagram work because millions of devices (phones, servers) are connected via networks.

### Benefits of Networking:

- File sharing
  - Internet access
  - Communication (chat, email)
  - Resource sharing (printers, servers)
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## ✓ 2. Types of Networks

Type	Full Form	Range	Example
LAN	Local Area Network	Within a building or room	Home Wi-Fi
MAN	Metropolitan Area Network	City-wide	College Campus Wi-Fi
WAN	Wide Area Network	Country or world-wide	The Internet
PAN	Personal Area Network	Very short range	Bluetooth, Hotspot

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## ✓ 3. Network Topologies

**Topology** = How devices are connected

Topology	Description	Pros	Cons
Bus	All devices in a line	Easy setup	One failure affects all
Star	All connect to a central hub	Easy to manage	Hub failure affects all
Ring	Devices in a circle	Predictable	If one breaks, all fail
Mesh	All devices connected to all others	Very reliable	Expensive
Hybrid	Mix of all	Flexible	Complex

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# Day 1: OSI Model – The Backbone of Networking

## What is the OSI Model?

OSI stands for **Open Systems Interconnection**.

It's a **conceptual framework** that shows how data travels from one computer to another over a network. It divides the process into **7 layers**, each with a specific role.

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## 7 Layers of the OSI Model (Top to Bottom)

Layer	Layer Name	What It Does (Simple)	Example
7	Application	Interface for the user	WhatsApp, Gmail
6	Presentation	Converts data formats (encrypt, compress)	JPEG ↔ PNG, Encryption
5	Session	Manages sessions (start, end communication)	Logging in to a server
4	Transport	Ensures reliable delivery (TCP/UDP)	Splits data into chunks
3	Network	Routes data using IP addresses	Google.com → IP
2	Data Link	Transfers frames between two directly connected devices	MAC Address
1	Physical	Actual hardware and transmission (cables, signals)	Ethernet cable, Wi-Fi

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## Real-Life Analogy: Sending a Parcel

Imagine sending a parcel:

1. **Application** – You write the letter.
2. **Presentation** – You translate it (e.g., Hindi to English).
3. **Session** – You call the post office to schedule pickup.
4. **Transport** – They pack and label it.
5. **Network** – They choose the best route (road, air).
6. **Data Link** – Truck loads it and drives it locally.
7. **Physical** – The wheels move the parcel physically.

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## Remember Like This (Mnemonic):

**"All People Seem To Need Data Processing"**

(A = Application, P = Presentation, S = Session, T = Transport, N = Network, D = Data Link, P = Physical)

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# Daily CN Lesson – Day 2: TCP/IP Model

 The real-world version of the OSI model, used by the internet today.

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## What is the TCP/IP Model?

TCP/IP stands for **Transmission Control Protocol / Internet Protocol**.

It is the **practical model** that the internet and most modern networks use to communicate. While the OSI model is a reference framework, **TCP/IP is the actual implementation**.

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## Layers of the TCP/IP Model (4 Layers Only!)

Layer	OSI Equivalent	Role (Simple)	Example
4. Application	OSI Layer 5–7	Provides services to user	HTTP, FTP, SMTP
3. Transport	OSI Layer 4	Ensures reliable or fast delivery	TCP, UDP
2. Internet	OSI Layer 3	Handles addressing & routing	IP, ICMP
1. Network Access	OSI Layer 1–2	Sends bits physically	Ethernet, Wi-Fi

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## Key Differences: OSI vs TCP/IP

Feature	OSI Model	TCP/IP Model
Layers	7	4
Use	Conceptual	Practical (used in real world)
Developed By	ISO	DARPA (U.S. Dept. of Defense)
Popularity	Learning/Exams	Real-world Networking

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## Real-Life Analogy:

Let's say you want to send a message using WhatsApp:

1. **Application Layer** → You type the message.
  2. **Transport Layer** → The message is broken into packets.
  3. **Internet Layer** → The address of the destination is added.
  4. **Network Access Layer** → Message physically sent via Wi-Fi.
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## Common Protocols in TCP/IP

Layer	Protocols
Application	HTTP, HTTPS, FTP, SMTP, DNS
Transport	TCP, UDP
Internet	IP (IPv4, IPv6), ICMP
Network Access	Ethernet, Wi-Fi, ARP

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## Daily CN Lesson – Day 3: IP Addressing + Subnetting Basics

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### What is an IP Address?

An **IP (Internet Protocol) address** is a **unique identifier** for every device on a network — like a phone number for your computer.

It helps:

- **Identify** a device on the internet or network
- **Send and receive** data to/from the right place

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### Types of IP Addresses

Type	Description	Example
<b>IPv4</b>	32-bit address, widely used	192.168.1.1
<b>IPv6</b>	128-bit address, newer, more space	2001:0db8:85a3:0000:0000:8a2e:0370:7334

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### IPv4 Format

- 32 bits (divided into 4 sections or *octets*)
- Written in **dotted decimal** form: 192.168.0.1
- Each section (octet) ranges from **0 to 255**

 Example:

11000000.10101000.00000000.00000001 = 192.168.0.1

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## Public vs Private IP Addresses

Type	Used Where?	Example
Private	Inside home or office network	192.168.x.x , 10.x.x.x , 172.16.x.x
Public	Globally on the internet	Your mobile/ISP-assigned IP



Private IPs can't be accessed directly from outside the network.

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## What is Subnetting?

**Subnetting** = Breaking a large network into smaller **sub-networks (subnets)**.

Why?

- Helps in **efficient IP allocation**
  - **Improves performance** and **security**
  - Reduces **broadcast traffic**
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## Subnet Mask

A **subnet mask** defines which part of the IP address is the **network** and which part is the **host**.

Common example:

- IP: 192.168.1.10
- Subnet Mask: 255.255.255.0

That means:

- 192.168.1 = Network part
  - .10 = Host (device) part
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## CIDR Notation

Instead of writing the whole mask:

- 192.168.1.10/24 → Means **first 24 bits** are for the network.
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## Daily CN Lesson – Day 4: IP Address Classes + Default Subnets + Practice

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## Why IP Address Classes?

Back in early networking days, the internet needed a way to organize IP addresses for different **sizes of networks**. That's how **IP Classes** were introduced.

IPv4 addresses are divided into **5 classes** based on their **starting bits and range**.

## IP Address Classes (A to E)

Class	Starting Bit(s)	Range (1st Octet)	Default Subnet Mask	Use
A	0xxxxxxx	1 – 126	255.0.0.0 (/8)	Large networks
B	10xxxxxx	128 – 191	255.255.0.0 (/16)	Medium networks
C	110xxxxx	192 – 223	255.255.255.0 (/24)	Small networks
D	1110xxxx	224 – 239	N/A	Multicast
E	1111xxxx	240 – 255	N/A	Research only (Experimental)

Note: 127.x.x.x is reserved for **loopback (localhost)**

## Default Subnet Masks

Class	Subnet Mask	CIDR Notation	Usable Hosts
A	255.0.0.0	/8	~16 million
B	255.255.0.0	/16	~65,000
C	255.255.255.0	/24	254

Usable hosts =  $2^n - 2$   
( n = number of host bits)

## Day 5: Static vs Dynamic IP + DHCP + DNS + Real-World Workflow

### 1. Static vs Dynamic IP

Type	Description	Example Use Case
Static IP	Manually assigned IP that never changes	Servers, printers
Dynamic IP	Automatically assigned by DHCP	Home Wi-Fi, mobile data

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## Key Differences

Feature	Static IP	Dynamic IP
Assigned by	Admin manually	DHCP server automatically
Changes?	Never (unless manually changed)	Yes, can change any time
Cost	Usually paid	Free
Example	192.168.1.10	192.168.1.100 (changes)

⚠️ If you're hosting a website or game server, **static IP** is better.

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## 2. What is DHCP (Dynamic Host Configuration Protocol)?

DHCP automatically assigns:

- IP address
- Subnet mask
- Gateway
- DNS

👤 Without DHCP, every device must be configured **manually**.

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## DHCP Workflow (Real World Example):

1. **Device joins network**  
(e.g., You connect your phone to Wi-Fi)
2. Device sends a **DHCPDISCOVER**
3. DHCP server replies with **DHCPOFFER**
4. Device sends **DHCPREQUEST**
5. Server confirms with **DHCPACK**

✅ Your phone now has an IP and can access the internet!

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## 3. What is DNS (Domain Name System)?

DNS = Phonebook of the internet

It **converts domain names to IP addresses**.

📦 Example:

You type `www.google.com` → DNS says: "Its IP is `142.250.195.36`" → Browser connects to that

## DNS Resolution Flow (Simplified)

1. You type `www.example.com`
  2. Your device asks a **DNS Resolver**
  3. Resolver checks:
    - Local Cache
    - Root Server → TLD Server → Authoritative Server
  4. Gets IP address → sends it to your browser
  5. Browser connects to server via IP
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## Real-Life Network Flow Summary

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You → Connect to Wi-Fi
→ DHCP assigns IP, DNS
→ You open google.com
→ DNS translates domain to IP
→ Browser connects via IP
→ Server sends response
→ You see Google homepage
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