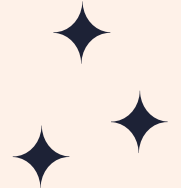


# Fundamentals Of Computer Network



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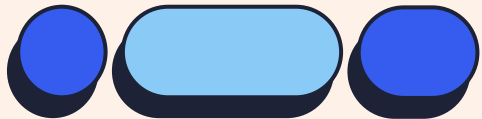
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# 01

## Computer Network and Its Types

In this section, we will explore computer networks, their types, and functionalities, highlighting their essential role in communication and resource sharing.





# Computer Networks

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## What is a Computer Network?

A computer network is a set of computers (or devices) connected through a communication channel to share resources, data, and applications. This channel could be wired (like Ethernet) or wireless (like Wi-Fi). The main purpose of a computer network is to enable communication between devices to share resources

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# Types of Computer Networks



## C O M P U T E R

### 1. Local Area Network (LAN)

A local area network is a network that interconnects devices in a limited area such as a house or an office.

It permits data and resources such as printers and file servers to be shared across machine nodes much quicker.

It is usually implemented by employing ethernet cables with a central router or switch in the center.

- Example: Office setting where computers access a file server and a printer attached to the network.

## N E T W O R K S



# Types of Computer Networks



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## 2. Wide Area Network (WAN)

A Wide Area Network (WAN) is a network that covers a large geographic area, such as a city, country, or even the entire world. WANs are used to connect multiple LANs and MANs, making global communication possible.

Employs leased telecommunication lines, satellites, or the web.

- Example: The pervasive network system connecting numerous computers and other significant networks – internet.

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# Types of Computer Networks



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## 3. Metropolitan Area Network (MAN)

A network that spans a city or a large campus. It's larger than a LAN but smaller than a WAN, designed for high-speed connectivity in metropolitan areas.

A high speed network with connectivity features for various organizations present in a specific geographical region.

Fiber optic cable or microwave transmission is utilized.

- Example: City government network for interconnection of various municipal offices.

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# Types of Computer Networks



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## 4.Storage Area Network (SAN)

It is the on-demand availability of computer system resources ,especially data storage and computing power ,without direct active management by the user.

Improves data storage efficiency and speed, especially in enterprise environments

Connects servers to storage arrays using high-speed connections.

.Example: A data center where multiple servers access centralized storage for data backup and retrieval.(Google Drive)

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# Types of Computer Networks



## C O M P U T E R

### 5. Peer to Peer Network (P2P)

A decentralized network where each device (peer) can act as both a client and a server, allowing direct resource sharing.

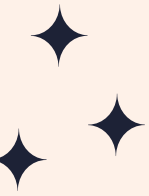
Enables direct sharing of files and applications. Reduces reliance on central servers. Offers resilience, the network remains functional if one peer fails.

Devices connect directly to share data. Protocols like BitTorrent improve download speeds by breaking files into smaller pieces.

.Examples:

File Sharing, BitTorrent for sharing files. Some apps send messages directly. Cryptocurrency, Bitcoin transactions occur on P2P networks.

## N E T W O R K S



# 02

## Elements Of Computer Network

In this section, we will focus on the key elements that comprise computer networks, essential for enabling communication and resource sharing. Understanding these elements is crucial, as they form the foundation of how data is transmitted and processed within networks.





# Elements of Computer Networks



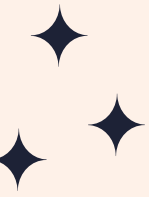
## What are the Elements of Computer Networks?

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The elements of computer networks refer to the various components that work together to enable connectivity and data exchange. These include:

- Nodes
- Network Interface Cards (NICs)
- Transmission Media
- Switches and Routers
- Protocols

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- Nodes

End Nodes(End devices)

- Computers
- Network Printers
- Security Cameras
- Mobile Handheld Devices(mobiles, tablets)
- Credit Card Reader, Bar Code Scanner

Intermediary nodes

- Switches
- Routers
- cell Tower





- Network Interface Card (NIC)

A Network Interface Card (NIC) is a hardware component that connects a computer to a network, allowing data to be sent and received between the computer and other devices. NICs are also known as Ethernet cards, LAN cards, or network adaptors

It handles data formatting, error checking, and data transmission for a device.





## Transmission Media

### Wired Media

- Twisted Pair Cables: Commonly used in local area networks (e.g., Ethernet cables).
- Coaxial Cables: Used for cable internet and television.
- Fiber Optic Cables: Use light to transmit data over long distances at high speeds.

### Wireless Media

- Radio Waves: Used for Wi-Fi and cellular communication.
- Microwaves:





## Switches and Routers

These intermediary devices manage data traffic in a network.

### Switches

- Function: Connect multiple devices in a LAN, forwarding data only to the device that needs it, thus reducing network congestion.

- Example: A network switch in an office connecting computers, printers, and servers.

### Routers:

- Function: Connect different networks and direct data packets between them using the most efficient paths.

- Example: A home router that connects local devices to the internet.





## Protocols

Protocols are the rules and standards that govern data transmission in a network. They ensure devices can communicate effectively.

- TCP/IP (Transmission Control Protocol/Internet Protocol): The fundamental suite of protocols that underpins the internet, providing standards for data transmission and routing.

- HTTP/HTTPS (Hypertext Transfer Protocol/Secure): Protocols used for transferring web pages and data securely over the internet.

- FTP (File Transfer Protocol): Used for transferring files between a client and a server.

- SMTP (Simple Mail Transfer Protocol): Protocol used for sending emails.







# 03

## IP Address And Ranges

In this section, we will explore IP addresses and their ranges, detailing their structure, types, and significance in network communication. Understanding IP addressing is essential, as it enables precise device identification and data routing within both local and global networks.





# IP Address In Computer Networks



## What is IP Address in Computer Networks?

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IP stands for internet protocol .

Every node in the computer network is identified with the help of IP address.

Identification: It uniquely identifies each device on the network.

Location Addressing: It provides a way to locate devices, ensuring data can be sent and received correctly between the source and destination.

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# IP Address In Computer Networks



## Versions of IP Address

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### IP ADDRESS(IPV4):

- Every node in the computer network is identified with the help of IP address.
- Logical address.
- It can change based on the location of the device.
- Assigned by manually or dynamically.
- Represents in decimal and it has 4 octets(x.x.x.x).
- 0.0.0.0 to 255.255.255.255(32 bits).

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# IP Address in Computer Networks

## Versions of IP Address

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### IP ADDRESS(IPV6):

A 128-bit address format designed to provide a larger address pool due to the increasing number of devices connected to the internet.

It uses eight groups of hexadecimal numbers separated by colons (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334).

### -Types of IPv6 Addresses:

- Unicast: Identifies a single device.
- Multicast: Delivers data to multiple devices simultaneously.
- Anycast: Sends data to the nearest device in a group.

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# IP Address In Computer Networks



## Types of of IP Address

### Public IP Address

- **What:** An IP address used on the internet.
- **Why:** It's required for any device to communicate on the internet.
- **How:** Assigned by your ISP. Example: 203.0.113.42.
- **Example:** Imagine the public IP is like your home address. Anyone in the world can send you mail.
- **Range:** 1.0.0.0 to 126.255.255.255

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# IP Address In Computer Networks



## Types of of IP Address

### Private IP Address

- **What:**An IP used within private networks, like home or office setups.
- **Why:**Allows devices to connect internally without being accessible from the internet.
- **How:** Assigned by your router. Example: 192.168.1.1.
- **Example:**Like an apartment number, it's for internal use only, while the building's main address (public IP) is used outside.
- **Range:**
  - 0.0.0.0 – 10.255.255.255, often used in large networks.
  - 172.16.0.0 – 172.31.255.255, commonly used in medium-sized networks.
  - 192.168.0.0 – 192.168.255.255, popular for small home and office networks.



# IP Address In Computer Networks



## Types of of IP Address

### Static IP Address

- **What:** A fixed IP address that doesn't change over time.
- **Why:** Useful for devices that need a permanent address, like servers, websites, or VPNs.
- **How:** Assigned manually by an ISP or network administrator.
- **Example:** Think of it like a permanent office address; it's always the same, so clients or services can reliably reach it.

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# IP Address In Computer Networks



## Types of of IP Address

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### Dynamic IP Address

- **What:** An IP address that changes periodically.
- **Why:** ISPs use dynamic IPs to efficiently allocate IPs to users as needed, reducing costs and managing limited IP resources.
- **How:** Assigned automatically by the ISP's DHCP server each time a device connects to the internet.
- **Example:** Like a hotel room number that changes with each visit, giving you a new address every time you reconnect.
- Dynamic IPs are allocated by DHCP (Dynamic Host Configuration Protocol), which automatically manages IP distribution.
- Dynamic IPs are common for home users, while static IPs are more often used for servers and permanent connections.

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# 04

## Network Topology

In this section, we will explore network topology, which refers to the layout of devices and connections in a network. Understanding topology is crucial because it affects how data is transmitted, how easily the network can be expanded, and how resilient it is to failures.





# Network Topology

## What is a Network Topology?

- Arrangements of nodes of a computer network.
- Topology = layout
- **Physical Topology:** Placements of various nodes.
- **Logical Topology:** Deals with the data flow in the network.

## Types Of Network Topology:

- Bus Topology
- Ring Topology
- Star Topology
- Mesh Topology
- Tree Topology
- Hybrid Topology

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# Network Topology



## Types of Network Topology

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Bus Topology:

- **What:** All data transmitted between nodes in the network is Transmitted over this common medium and is able to received by all node In the network simultaneously.
- **Why:** It requires less cables compared to other topologies.Node failure Doesn't affect others.It is best suited for temporary networks.
- **How:** A signal from a source machine travels along the bus in both directions to all connected devices until it reaches the intended recipient, which recognizes its address and processes the message.

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# Network Topology



## Types of Network Topology

Ring Topology:

- **What:** A ring topology is a network setup in a closed loop. Two connections, one to each of its nearest neighbours.
- **Why:** It is unidirectional, provides all nodes with equal access. It is efficient for small networks.
- **How:** Sending and receiving of data takes place with the help of a token. Data packets move around a ring until they reach their destination.

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# Network Topology

## Types of Network Topology

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Star Topology:

- **What:** Every node is connected to a central nodes called a hub or switch.
- **Why:** If one connection fails, it does not affect the rest of the network.Reduces data collisions by allowing direct communication between devices through the hub.
- **How:** The hub acts as a traffic controller, managing all data flow.

When a device sends data, it goes to the hub, which then routes it to the intended device.

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# Network Topology

## Types of Network Topology

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Mesh Topology:

- **What:** Every node is directly connected to every other node in the network.
- **Why:** If one connection fails, data can take alternative routes to reach its destination. Allows simultaneous data transmission across different paths, improving speed.
- **How:** The network can dynamically choose the best route based on traffic or connection status. Routing protocols help determine the best paths for data transmission.

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# Network Topology

## Types of Network Topology

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Tree Topology:

Combines elements of bus and star topologies. Nodes are arranged in a hierarchical structure, with a central “root” node and branches leading to other nodes.

Use Cases:

Large organizational networks, such as university campuses or corporate networks.

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# Network Topology

## Types of Network Topology

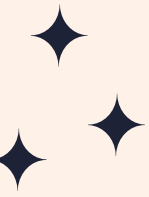
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Hybrid Topology:

- **What:** Topology where there can be one or more different topologies. The design can be tailored to meet specific requirements based on organizational needs.
- **Why:** Combines the efficient data transmission of different topologies optimizing network performance.
- **How:** Central devices can manage traffic between the various topological segments.

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# Thankyou

## Any Questions ?

