

# Network fundamentals

## What is network

A network is a collection of devices connected to communicate and share resources.

## Why we need networking?

- Better connectivity.
- Better communication.
- Helps in sharing resources.

## Types of network

### 1) Local Area Network (LAN)

- Connect hosts within a small geographical area.
- Faster and cheaper.
- Example - same room, same building, same campus.

### 2) Wide Area Network (WAN)

- Covers a large geographic area.
- Slower and expensive.
- Example - across campuses, across cities/ countries/ continents.

### 3) Metropolitan Area Network (MAN)

- Covers a large area than a LAN but is smaller than a WAN.
- Expensive, Moderate-speed.
- Example – cover campus, city's public Wi-Fi network.

### 4) Personal Area Network (PAN)

- Connects personal devices within a short range.
- Cheaper and slower.
- Example – USB, bluetooth headset, smartwatch syn with a phone.

### 5) Virtual Private Network (VPN)

- Create a tunnel to secure and encrypted connection over the internet. Allow user to hide there IP address.
- Slower and free/paid.
- Example – use for remote work, individual use them to access blocked website.

## Network Architecture

- Defines how computers and other devices interact within a network.
- It sets the rules and structure for data communication and determine how information flow

## Types of Network Architecture

### 1. Client – Server Architecture

- Centralized network model where one or more servers provide services to multiple clients.
- Example - Websites and web applications use client-server architecture.

### 2. Peer-to-Peer(P2P) Architecture

- Decentralized network, all devices (or nodes) act as both clients and servers.
- Each device can communicate without a need of central server.
- Example – Blockchain and file sharing software.

## Technologies and Protocol

### Networking Technologies

#### 1. Wired Networking

Use physical cables to transmit data, offering higher speed, stability, and security.

- Ethernet

Most widely used technology for LAN.

Follows the IEEE 802.3 standard and speed range from 10 Mbps to 400 Gbps.

Example – Office network and broadband connection.

- Fiber Optic

Uses light signal to transmit data at extremely high speed.  
Support long distance communication.

Example – Internet Service Provider (ISP) use fiber optic.

#### 2. Wireless Networking

Use radio waves to transmit data, allow devices to connect without cable.

- Wi-Fi (Wireless Fidelity)

Allow devices to be able to connect to internet.  
Provide connectivity within limited range.  
Follow IEEE 802.11 standard.

- **Bluetooth**  
It provides a way to connect nearby devices to each other.  
Used for short – distance communication, within 10 meters.
- **Cellular Network (3G, 4G, 5G)**  
Used for mobile internet and voice communication.

## Network Communication Protocol