📘 MERN Stack Development – Day 1 (Deep Notes)

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1. Networking Basics

- **Definition:** Networking is the process of connecting two or more devices (computers, mobile phones, servers, routers, etc.) so they can exchange data.
- **How it works:**
    - When you type `google.com` in your browser:
        1. Your request travels through your Wi-Fi router to your ISP (like Jio/Airtel).
        2. ISP forwards it across the internet to Google's servers.
        3. Google sends back the webpage data to your device.
- **Real-life analogy:** Think of networking like a postal system. Your laptop writes a letter (request), sends it to the post office (ISP), and the letter travels through different post offices (routers) until it reaches the recipient (server). Then the reply comes back to you.

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2. Types of Networks

1. **LAN (Local Area Network):**
    - Small area, like a house, office, or school.
    - Example: Wi-Fi in your home where multiple devices share the same router.
2. **MAN (Metropolitan Area Network):**
    - Covers a city or big campus.

    - Example: A city-wide cable internet network.

3. **WAN (Wide Area Network):**
    - Covers countries or even the whole world. The **Internet** is the biggest WAN.
4. **PAN (Personal Area Network):**
    - Very small range, for personal use.
    - Example: Bluetooth between your mobile and headphones.

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3. Ports

- A **port** is like a “door” on a computer that allows communication.
- Computers run many services (like web servers, databases, email servers). To avoid confusion, each service listens on a specific **port number**.
- **Examples of Common Ports:**
    - HTTP → Port **80**
    - HTTPS → Port **443**
    - FTP (File Transfer) → Port **21**
    - MongoDB → Port **27017**
- **Analogy:** Imagine a hotel building (computer) with many rooms (ports). Each room hosts a different service. If you want food, you go to the dining hall (port 80 for websites). If you want to check in, you go to the reception desk (another port).

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4. ISP (Internet Service Provider)

- ISP is the company that provides you access to the internet.

- Without an ISP, your device cannot connect to the outside world.
- **Examples in India:** Jio, Airtel, BSNL, Vodafone Idea.
- **How it works:**
    - Your ISP assigns you an **IP address** so your device can be recognized on the internet.
    - It routes your requests from your home to websites like YouTube, Google, etc.

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5. IP Address

- **IP (Internet Protocol) Address**: A unique number assigned to every device on a network.
- **Types:**
    - **IPv4 (32-bit):**
        - Example: `192.168.1.1`
        - Limited to around 4.3 billion addresses.
    - **IPv6 (128-bit):**
        - Example: `2001:0db8:85a3::8a2e:0370:7334`
        - Almost unlimited addresses for the modern internet.
- **Public vs Private IP:**
    - Public IP: Assigned by ISP, visible on the internet.
    - Private IP: Used inside your home/office (like `192.168.x.x`).
- **Analogy:** IP address is like your home address. Without it, no one can deliver mail (data) to your house.

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6. MAC Address

- **MAC (Media Access Control) Address:**
    - A permanent unique ID given to your device's network card by the manufacturer.
    - Looks like: `00:1B:44:11:3A:B7`
- Unlike IP, which can change, MAC address is **fixed to hardware**.
- **Analogy:** If IP is your home address, MAC is like your fingerprint—it's unique and unchangeable.

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7. Frontend (Client-side)

- **Definition:** The part of the application that the user sees and interacts with.
- **Technologies used:**
    - HTML → structure
    - CSS → design/styling
    - JavaScript → interactivity
    - React.js → modern frontend framework for building dynamic UIs
- **Example:** When you open Flipkart, the product images, search bar, cart button, and layout are all frontend.

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8. Backend (Server-side)

- **Definition:** The part of the application that the user cannot see. It handles data, business logic, and server communication.
- **Technologies used:** Node.js, Express.js.
- **Tasks of Backend:**
    - User authentication (login/signup)
    - Data processing
    - Connecting with database
    - API creation
- **Example:** When you log in to Netflix, the backend verifies your email/password, checks your subscription, and sends back the correct data.

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9. Database

- **Definition:** A structured system for storing, managing, and retrieving data.
- **In MERN Stack:** MongoDB (NoSQL database).
- **Why database?** If we store data only in memory, it gets lost when the server shuts down. Databases keep data **permanently**.
- **Types of Databases:**
    1. Relational (SQL, like MySQL, PostgreSQL) → Uses tables and relations.
    2. Non-relational (NoSQL, like MongoDB) → Stores data in JSON-like format.
- **Example:** When you register on Instagram, your details are stored in a database. Next time you log in, Instagram fetches your details from there.

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10. How MERN Stack Fits In

- **Frontend (React.js):** What users see.
- **Backend (Node.js + Express):** The logic and APIs.
- **Database (MongoDB):** Where data lives.
- **Networking Concepts:** Make sure your frontend, backend, and database can communicate over the internet.