Computer Hardware Basics

1. Motherboard (Main Board of Computer)

The motherboard is the main circuit board of the computer.

Function: Connects and allows communication between all components.
Contains:

- CPU socket
- RAM slots
- GPU slot (PCIe)
- Storage connectors (SATA/NVMe)

Analogy: Like the skeleton + nervous system of the human body — everything is connected through it.

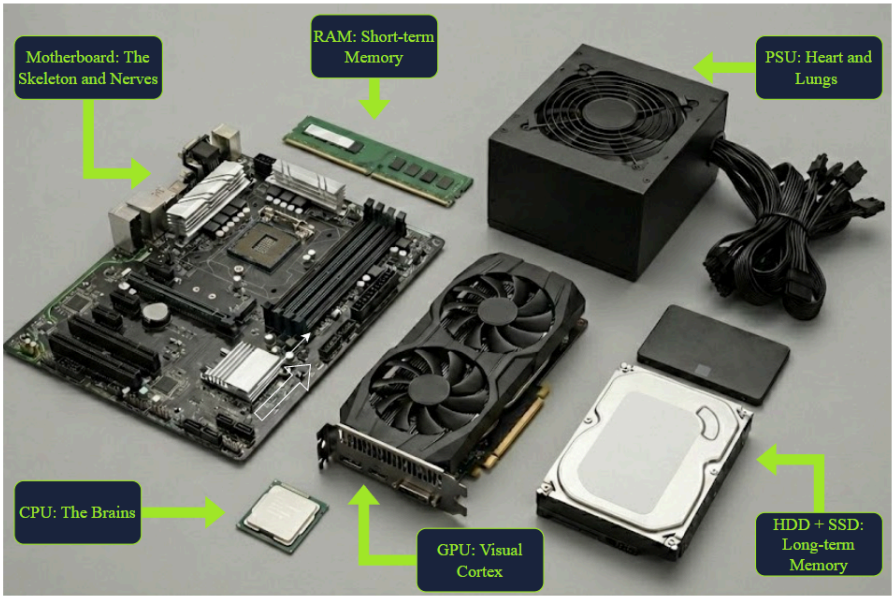
2. CPU (Central Processing Unit)

Main processor of the computer.

Function:

- Executes instructions and performs calculations.
- Running programs
- Logic operations
- System control

Analogy: Brain of the computer.



3. Storage (HDD / SSD)

HDD (Hard Disk Drive)

- Slower
- Mechanical parts
- Cheaper
- Larger storage

SSD (Solid State Drive)

- Very fast
- No moving parts
- Expensive but efficient
- Improves boot and loading time

4. RAM (Random Access Memory)

- Temporary memory used while the computer is running.
- Stores currently running programs and data.
- Volatile (data lost when power off).
- Short-term memory of the brain.

5. GPU (Graphics Processing Unit)

Processes graphics and visuals.

Function:

- Gaming
- Video editing
- Rendering
- AI/ML tasks

Analogy: Visual cortex of brain.

6. PSU (Power Supply Unit)

Provides power to all components.

Function:

- Converts AC power → DC power for PC.
- Supplies power to: Motherboard, CPU, GPU, Storage

Analogy: Heart and lungs (gives energy).

Types of Computers

Laptop: Portable computer with built-in screen & keyboard. Used for daily tasks like study, browsing, coding.
Key: portability > performance.

Desktop: Fixed computer with separate monitor & keyboard. Better cooling and power for long tasks.
Key: performance & stability.

Workstation: High-performance computer for professional work (3D design, AI, editing, simulation).
Key: precision & heavy computing.

Server: Powerful computer that provides services/data to many users over a network. Runs 24/7.
Key: serves multiple users, no direct personal use.

Everyday Computers:

Smartphone: Pocket computer with internet & apps.
Example: Android, iPhone.

Tablet: Touchscreen computer with bigger display.
Example: iPad, drawing tablet.

IoT Device: Small device connected to the internet for one task.
Example: smart doorbell, fitness tracker, thermostat.

Embedded Computer: Tiny computer inside another device.
Example: washing machine chip, coffee machine, automatic door.

IoT vs Embedded

- IoT: connected to internet/network
- Embedded: works inside device, may not use internet

Client–Server Model

1. Client & Server

Client: Device/app that sends a request.
Example: Browser.

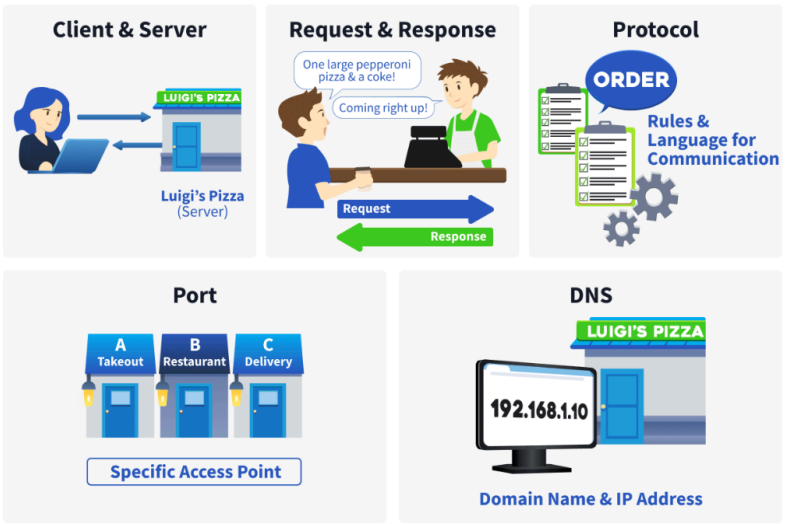
Server: System that provides the service or data.

The client always starts (initiates) the request.

2. Request & Response

Request: Client asks for something.

Response: Server replies with data or error.



Example:

1. Browser → asks for webpage
2. Server → sends webpage back
3. If something is wrong → server sends an error response.

3. Protocol

Protocol: Rules & language for communication.

Defines:

- How request is structured
- What commands are used (GET, POST)
- What response should be returned

Example: HTTP
Protocol = communication rules

4. Port

Port:

- Specific access point for a service on a server.
- A server can run multiple services using different ports.

Example:

- Web service → Port 80 / 443
- Other services → different ports

Port identifies a specific service.

5. DNS (Domain Name System)

- Converts domain name → IP address.
- Works like GPS for the internet.

Example:
google.com → 142.x.x.x (IP address)
DNS finds the server's address.

HTTP & GET

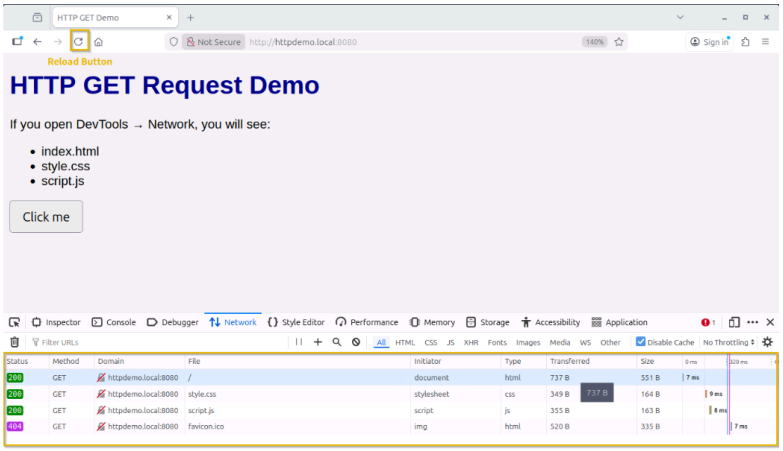
HTTP: Protocol used for web communication.

HTTPS: Secure version of HTTP (encrypted).

Stateless: Each request is independent (server doesn't remember previous requests).

HTTP Methods (Commands)

- GET → Retrieve data
- POST → Send data
- PUT → Update/replace data
- DELETE → Remove data
- PATCH → Partially update
- HEAD → Get headers only
- OPTIONS → Show allowed methods
- CONNECT → Tunnel connection
- TRACE → Debug request

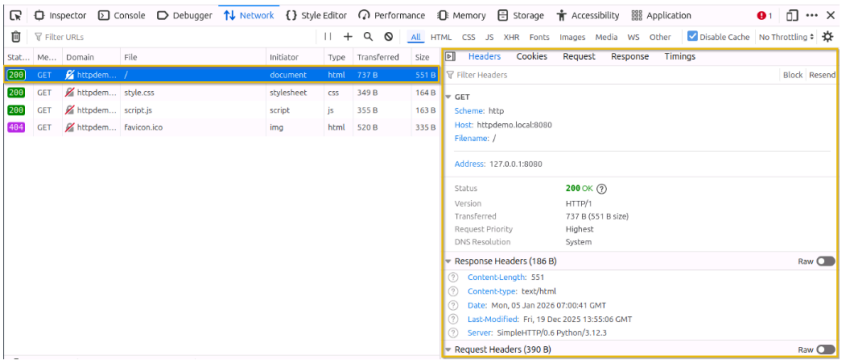


Most common: GET & POST

GET Method

- Used to request a resource from the server.
  - Example:
    GET /index.html

- Server replies with:
  - Status code (e.g., 200 OK)
  - Requested content



Important Request Fields

Scheme: HTTP or HTTPS

Host: Website name (e.g., google.com)

Filename/Path: File requested (e.g., /index.html)

Address: Server IP address

Status: Shows result (200 OK, 404, etc.)

Virtualization

Before Virtualization

Old rule: 1 server = 1 application

Problems:

- High cost (many physical servers)
- Low usage (servers mostly idle)
- Slow setup (takes days/weeks)
- Hard to scale (need new server each time)

Virtualization

Running multiple virtual computers on one physical server.

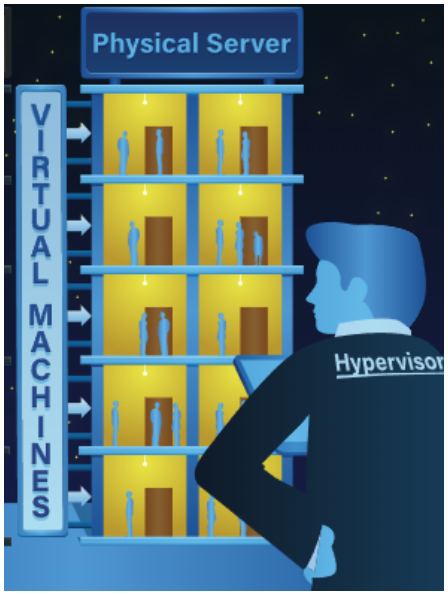
Purpose:

- Save cost
- Use hardware efficiently
- Easy scaling
- Faster deployment

Hypervisor

Software that manages virtual machines and shares hardware safely.

Acts like: manager/referee between VMs and physical server.
Example: Virtual box / VMware



Virtual Machine (VM)

Virtual computer inside a physical server.

Each VM:

- Has its own OS
- Apps and settings
- Works like real computer
- Shares same hardware

Types of Hypervisors:

Type 1 (Bare-metal):

- Runs directly on hardware
- Very fast and efficient
- Used in data centers & production servers
- Example: VMware ESXi, Hyper-V (server)

Type 2 (Hosted):

- Runs inside an existing OS
- Easy to install and use
- Used for learning/testing
- Example: VirtualBox, VMware Workstation

Containers

Lightweight isolated environment for running applications.

Function:

- Share host OS kernel
- Do NOT need full OS
- Package app + dependencies together

Advantages:

- Very fast startup
- Uses fewer resources
- Easy deployment
- Scalable
- Consistent on all machines

Example Tool: Docker

Limitation:

- Must match host OS type
- (Linux container → Linux system)

Cloud Computing

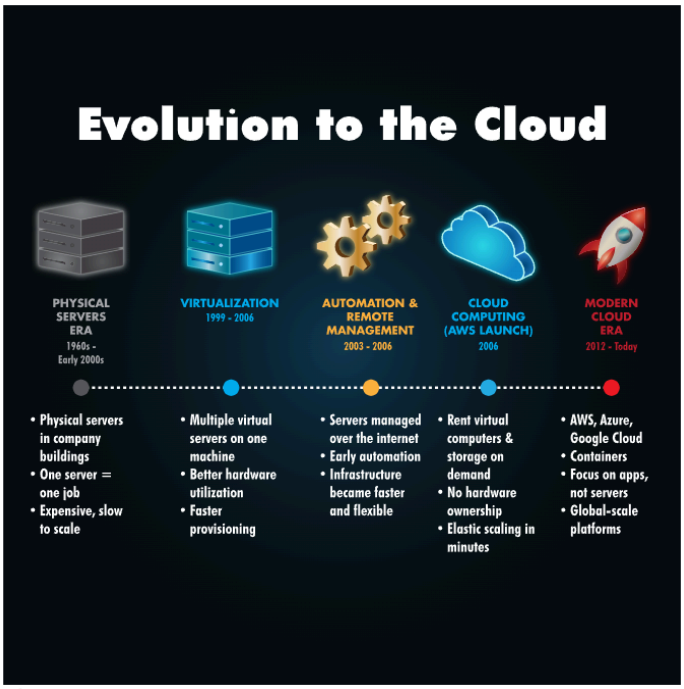
What is Cloud Computing

Using computing resources (server, storage, apps) over the internet instead of your own computer.

Example: Google Drive, AWS, Azure

Benefits of Cloud

- Scalability: Increase/decrease resources anytime
- On-demand: Create servers instantly
- Pay as you use: No upfront hardware cost
- High availability: Always online
- Security: Cloud provider protects infra
- Global access: Access from anywhere



Types of Cloud (Deployment Models)

Public Cloud

- Anyone can use
- Cheap and scalable
- Example: AWS, Google Cloud
- Used by startups & apps

Private Cloud

- Only one organization
- More control & security
- Used by banks, govt

Hybrid Cloud

- Mix of public + private
- Sensitive data private
- Other apps public

Cloud Service Models

1. IaaS (Infrastructure as a Service)

You rent:

- Virtual machines
- Storage
- Network

You manage:

- OS
- Apps
- Example: AWS EC2

2. PaaS (Platform as a Service)

Provider manages:

- Hardware
- OS
- Runtime

You manage:

- Application code only
- Example: Heroku, Google App Engine

3. SaaS (Software as a Service)

Ready software via the internet.

You just use it:

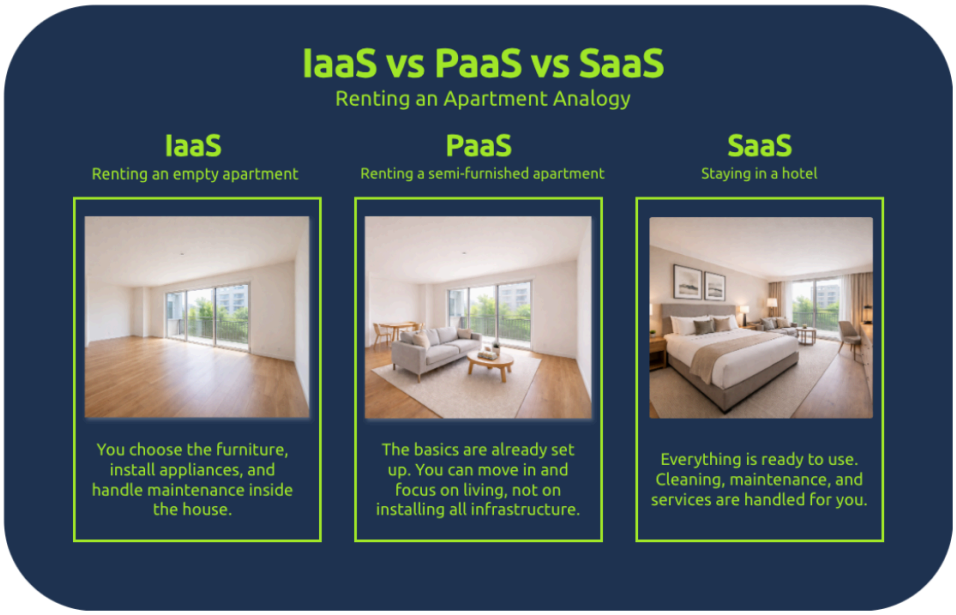
- Gmail
- Zoom
- Facebook

The provider manages everything.

IaaS → control everything

PaaS → focus on coding

SaaS → just use software



Major Cloud Providers

- AWS (most popular)
- Microsoft Azure
- Google Cloud
- Alibaba Cloud
- IBM Cloud
- Oracle Cloud

Basic Cloud Terminology (AWS)

EC2 (Elastic Compute Cloud)

- Virtual computer in cloud
- Like real PC: CPU, RAM, storage
- Used to run apps & servers
- Creating EC2 = creating a virtual machine

EC2 = cloud server

Instance Type

Shows power of virtual machines.

Examples:

- t2, t3, t3.micro → small/cheap
- m5.large → powerful/expensive
- Bigger instance → more power + more cost
- Smaller instance → less cost + less power

Region

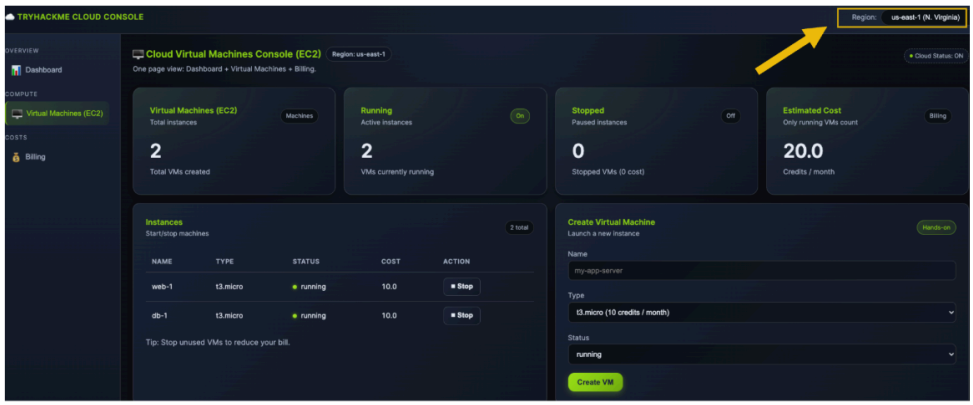
Location where cloud servers are stored.

Example:

- US-East
- Asia
- Europe

Choose region close to users for:

- Better speed
- Lower delay



Creating Virtual Machines

To run an application in cloud:

1. Create EC2 instances
2. Give name
3. Choose instance type
4. Start (running state)

Each instance = one virtual computer.

Billing

Cloud cost depends on:

- Instance type
- Running time
- Number of servers

Running VM → costs money
Stopped VM → no cost (mostly)