What is virtualization?

Virtualization is a technology that allows **one physical computer (server)** to run **multiple virtual computers** at the same time.

☐ In simple words:
"One machine behaves like many machines."

Virtualization (very simple example)

Imagine a **single powerful server** is a big house ☐
Virtualization creates **multiple independent rooms** inside it.

Each room = **Virtual Machine (VM)**
Each VM has:

- Its own OS
- Its own CPU, RAM, disk
- Its own IP address

Why virtualization is needed

Before virtualization:

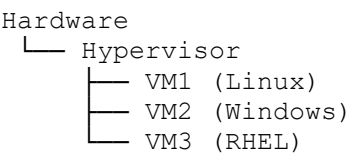- One server → One OS → One application
- Hardware wasted
- High cost

With virtualization:

- One server → Many OS → Many applications
- Better resource usage
- Lower cost

How virtualization works

1. Physical server has hardware (CPU, RAM, Disk)
2. **Hypervisor** is installed
3. Hypervisor creates and manages VMs
4. Each VM runs its own OS

```
Hardware
  └── Hypervisor
        ├── VM1 (Linux)
        ├── VM2 (Windows)
        └── VM3 (RHEL)
```

What is a Hypervisor?

A **hypervisor** is software that:

- Creates virtual machines
- Allocates CPU, RAM, disk
- Isolates VMs from each other

Types of hypervisors

1 Type 1 (Bare Metal)

- Installed directly on hardware
- Used in data centers

Examples:

- VMware ESXi
- KVM
- Hyper-V

2 Type 2 (Hosted)

- Installed on top of OS
- Used for learning/testing

Examples:

- VMware Workstation
- VirtualBox

Types of virtualization

1 Server Virtualization

- Most common
- Multiple servers on one machine

2 OS-level Virtualization (Containers)

- Shares host OS kernel

Examples:

- Docker
- Podman

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3 Storage Virtualization

- Combines multiple disks into one pool

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4 Network Virtualization

- Virtual switches, VLANs, SDN

Benefits of virtualization

✔ Saves hardware cost
✔ Better CPU & RAM usage
✔ Easy backup & snapshots
✔ Fast recovery (DR)
✔ Easy testing & labs

Real-world example

In a data center:

- 1 physical server
- 20 virtual machines:
    - Web server
    - DB server
    - DNS server
    - Backup server

All running together safely.

Virtualization vs Physical server

Physical	Virtual
1 OS	Multiple OS
Hardware heavy	Efficient
Hard to scale	Easy to scale

Important interview one-liner ☐

Virtualization is the technology that enables **multiple isolated operating systems to run on a single physical server using a hypervisor**.