

## Cloud computing

### Module -2

#### 1-What is virtualization and virtualization type?

**Virtualization** is a technology that allows us to create multiple simulated environments or **virtual machines (VMs)** on a single physical computer. It's like running several computers inside one actual computer.

Each virtual machine works like a real computer with its own operating system and applications, but they all share the same physical hardware.

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#### Types of Virtualization (Simple Explanation):

##### 1. Hardware Virtualization

- Running multiple operating systems on one physical machine using software like **VMware** or **VirtualBox**.
- Example: You can run Windows and Linux on the same computer at the same time.

##### 2. Operating System Virtualization (a.k.a. Containerization)

- Running multiple isolated applications using the same OS kernel.
- Uses tools like **Docker**.
- Faster and lighter than full VMs.

##### 3. Server Virtualization

- Divides a physical server into several virtual servers.
- Each virtual server can run its own OS and apps.
- Helps save money and resources.

##### 4. Storage Virtualization

- Combines physical storage from multiple devices into a single virtual storage system.

##### 5. Network Virtualization

- Combines hardware (like routers and switches) and software into a single software-based network.

## 2-Type of hypervisor and how to manage it?

### → Types of Hypervisor and How to Manage Them

A **hypervisor** is software that creates and runs virtual machines (VMs). It separates the physical hardware from the virtual environments.

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## Types of Hypervisors:

### 1. Type 1 Hypervisor (Bare Metal)

- Installed **directly on the physical hardware**.
- Doesn't need an operating system.
- Fast and secure — used in **data centers and servers**.

**Examples:** VMware ESXi, Microsoft Hyper-V (on server), Xen

✅ **Pros:** Better performance, stability

❌ **Cons:** Harder to set up for beginners

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### 2. Type 2 Hypervisor (Hosted)

- Installed **on top of an existing operating system** (like Windows or macOS).
- Easier for beginners — good for laptops or personal use.

**Examples:** VMware Workstation, VirtualBox, Parallels

✅ **Pros:** Easy to install and use

❌ **Cons:** Slower performance, depends on host OS

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## How to Manage a Hypervisor (Simple Steps):

### For Type 1 (Bare Metal):

1. **Install hypervisor** directly on our hardware.

2. Use a **management tool** or **web interface** to create and manage VMs (like vSphere for VMware ESXi).
3. Configure CPU, RAM, storage, and network for each VM.

#### **For Type 2 (Hosted):**

1. Install VirtualBox or VMware Workstation on our OS.
2. Open the app and **create a new VM** (choose OS, disk size, memory, etc.).
3. Start the VM and install an operating system inside it.

#### **3-Roles of virtualization in cloud computing?**

→ Virtualization plays a **big role** in cloud computing — it's the **technology that makes the cloud possible**. Here's how:

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### **Key Roles of Virtualization in Cloud Computing:**

#### **1. Resource Sharing**

- Virtualization lets cloud providers **split one physical server** into many virtual machines (VMs).
- Each user gets their own **private space** on shared hardware.

#### **2. Cost Efficiency**

- No need for a separate physical machine for every task.
- Saves money on **hardware, power, and maintenance**.

#### **3. Scalability**

- It's easy to **add or remove virtual machines** as needed.
- Cloud can grow quickly to match demand (e.g., more users, more traffic).

#### **4. Flexibility**

we can run **different operating systems or applications** on the same physical server.

- Move VMs between servers without downtime.

## 5. Disaster Recovery

- Virtual machines can be **backed up and restored** quickly.
- Makes it easier to recover from crashes or failures.

## 6. Better Use of Hardware

- Virtualization ensures **less idle time** — every server does more work.
  - Increases **performance and efficiency**.
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### In short:

Virtualization makes cloud computing **cheaper, faster, more flexible, and more reliable**.

## 4-What is container?

- A **container** is like a **lightweight box** that holds everything an app needs to run — the code, libraries, and settings — so it works the same **anywhere**.
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### Key Points (Simple):

- A container **doesn't need its own full operating system**, unlike a virtual machine.
  - It shares the **host computer's OS**, making it **faster and smaller**.
  - Containers are **quick to start**, use **less memory**, and are **easy to move** between computers.
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### Example:

Imagine we bake a cake (our app) and put it in a box with all instructions and tools. No matter where the box goes — our kitchen, a friend's house, or a bakery — it will always work the same.

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## Popular Container Tool:

- **Docker** is the most commonly used tool for creating and running containers.
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## Why Containers Are Useful:

- They make it easy to **develop, test, and deploy apps** across different systems.
- Help teams avoid the "it works on my computer!" problem.

## 5-What is high availability and live migration in virtualization?

### → High Availability (HA):

**High Availability** means our virtual machines (VMs) stay **online and running**, even if something goes wrong — like a server crashing.

#### ♦ In Simple Words:

If one computer fails, another one **automatically takes over**, so our apps and services **don't go down**.

#### ✅ Example:

Imagine a backup generator that turns on when the power goes out — that's what HA does for your VMs.

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## Live Migration:

**Live Migration** means moving a running virtual machine from one physical server to another **without turning it off**.

#### ♦ In Simple Words:

It's like moving a sleeping person from one bed to another — they don't even notice.

#### ✅ Why It's Useful:

- Keeps apps running while doing **maintenance or upgrades**.
  - Helps **balance the load** between servers.
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## Together:

High Availability + Live Migration = **Zero Downtime**

our services keep running even during failures or maintenance.

## 6-Storage configuration –describe block storage, file storage and object storage---DAS NAS and SAN

→ the main **types of storage** and the systems that use them — all in plain,

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### ♦ Types of Storage

#### 1. Block Storage

- **Stores data in blocks** (chunks) and treats each block as a separate hard drive.
- Very **fast and flexible**.
- Used by **servers and databases**.

✓ **Good for:** Databases, virtual machines

✗ **Not easy to share files directly**

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#### 2. File Storage

- Stores data as **files in folders**, like how we organize files on your PC.
- Shared through a network with **file paths**.

✓ **Good for:** Shared folders, documents, pictures

✗ **Slower than block storage**

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#### 3. Object Storage

- Stores data as **objects** (file + metadata + ID).
- Used for **massive amounts of data** like photos, videos, backups.

✓ **Good for:** Cloud storage (like Amazon S3)

✗ **Not good for traditional applications like databases**

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## ♦ Storage Systems

### 1. DAS (Direct Attached Storage)

- Storage **directly connected to one computer/server** (like an external hard drive).

✓ **Good for:** Personal or small business use

✗ **Not sharable over a network**

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### 2. NAS (Network Attached Storage)

- A storage device connected to a **network**, like a shared drive.

✓ **Good for:** File sharing between users

✗ **Not ideal for high-speed performance**

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### 3. SAN (Storage Area Network)

- A **high-speed network** that connects multiple servers to shared block storage.

✓ **Good for:** Big companies, data centers

✗ **Expensive and complex to set up**

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## 7-Describe storage allocation and provisioning. Storage Allocation

### → ♦ Storage Allocation (Simple Language)

Storage allocation means deciding how much space to give to a user, app, or virtual machine (VM) from available storage.

✓ **Think of it like this:**

You have a big hard drive, and you divide it into smaller pieces for different people or uses.

**Example:**

If you have 1 TB of storage, you might allocate:

- 300 GB for a database
- 200 GB for backups

- 100 GB for a virtual machine
  - The rest for other users
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## ◆ Storage Provisioning

Provisioning is the process of setting up and delivering that storage to where it's needed.

There are 3 types of provisioning:

### 1. Thick Provisioning

- All the allocated storage is reserved immediately, even if it's not used.
- Safe, but wastes space.

### 2. Thin Provisioning

- Storage is given out as needed, not all at once.
- Saves space, but can run out if not monitored.

### 3. Dynamic Provisioning

- Adjusts automatically based on current demand (used in cloud environments).