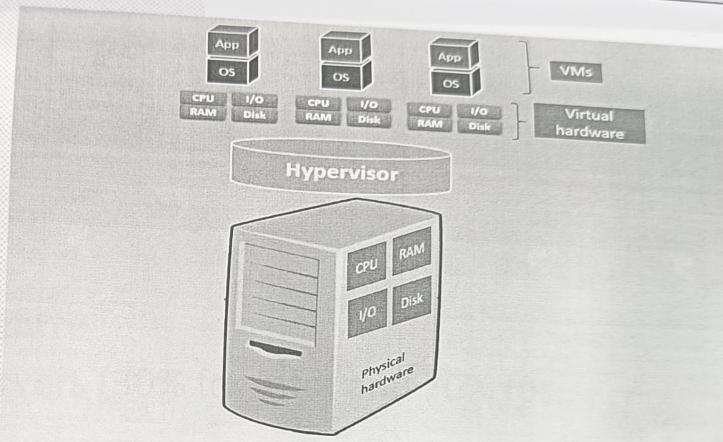


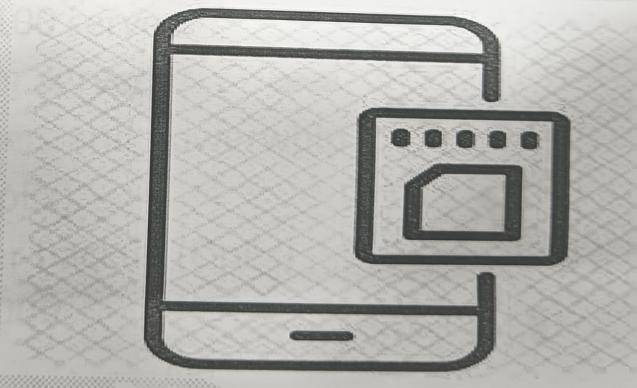
# Virtualization

- It is a technique, which allows to **share single** physical instance of an application or resource among **multiple** organizations or **tenants**.
  - Splitting a physical resource into as many logical resources as we want e.g. CPU, Memory.
  - Virtualization is a technology that transforms hardware into software.
  - Examples: Virtual classroom, Virtual-holographic 3d imagery, Virtual machine

# Splitting



- Adding (internal memory + memory card)



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# Case Study

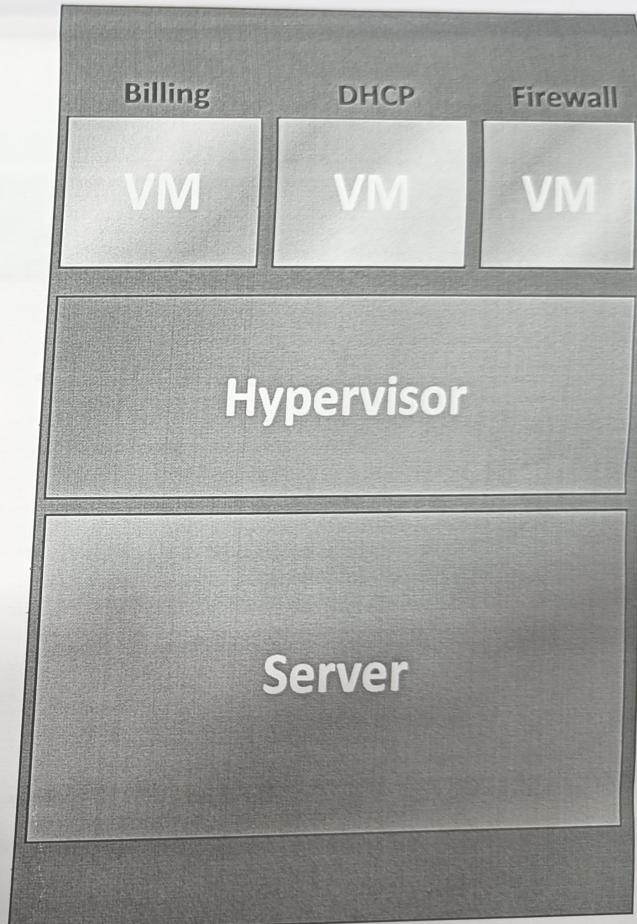
- Data centre setup
  - 2000 ft<sup>2</sup> data centre
  - 100 physical servers (30% for infra and 70% for application)
  - Cooling system for 100 servers
  - 100 physical disks for servers
  - Cabling for 100 servers and powerwhip
  - Data centre staff (OpEx)
  - Electricity and power backup (OpEx)

**Total Cost - ₹1,00,00,000**

## Virtualization of Data Centre

- **Servers - x10**
  - RAM – 64 GB
  - HDD – 2 TB
  - CPU – 32 Cores
- **Hypervisors – x1 on 1 server.**
  - Ex. – Oracle VirtualBox, VMWare Workstation etc.
- **VMs - x10 on 1 server.**
  - RAM - 4 GB Each
  - HDD – 100 GB Each
  - CPU – 2 Cores Each
  - No interaction with other VMs.

Total Cost - ₹10,00,000



# Data Centre

## Traditional Setup

✗ CapEx & OpEx for 100 Servers.

✗ Single application on single hardware.

✗ Single OS on single hardware.

## Virtualized Setup

✓ CapEx and OpEx for 10 Servers only.  
(90% less cost with no issues)

✓ Multiple applications on single hardware.

✓ Multiple OS on single hardware.

# Virtualization Concept

- Creating a virtual machine over existing operating system and hardware is referred as **Hardware Virtualization**.
- Virtual Machines provide an **environment** that is **logically separated** from the **underlying hardware**.
- The machine on which the virtual machine is created is known as **host machine** and **virtual machine** is referred as a **guest machine**.
- This virtual machine is managed by a software or firmware, which is known as **hypervisor**.

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## What are the advantages of virtualization?

- It optimizes hardware resource utilization, saves energy and costs.
- makes it possible to run multiple applications and various operating systems on the same SERVER at the same time.
- It increases the utilization, efficiency and flexibility of existing computer hardware.
- Provides ability to manage resources effectively.
- Increases efficiency of IT operations.
- Provides for easier backup and disaster recovery.
- Increases cost savings with reduced hardware expenditure.

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What are the  
disadvantages of  
virtualization?

- Software licensing costs.
- Necessity to train IT staff in virtualization.

# Hypervisor

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- Section - 2

## Hypervisor

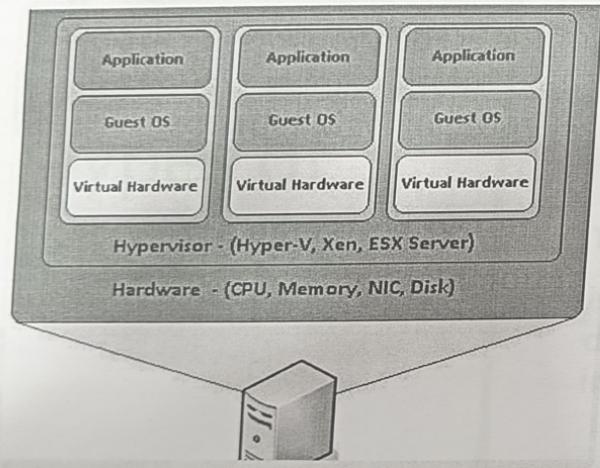
- The hypervisor is a firmware or low-level program that acts as a Virtual Machine Manager.

## CLOUD COMPUTING



The cloud computing model provides shared hardware and software resources over the Internet. The applications run on the cloud computing system. The cloud computing system provides processing power, memory, storage, bandwidth, and software resources.

# Hypervisor



- The **hypervisor** is a firmware or low-level program that acts as a Virtual Machine Manager.
- It sits between the hardware and the operating system,
  - assigns the amount of access that the applications and operating systems have with the processor and other hardware **resources**.

# Types of Hypervisor

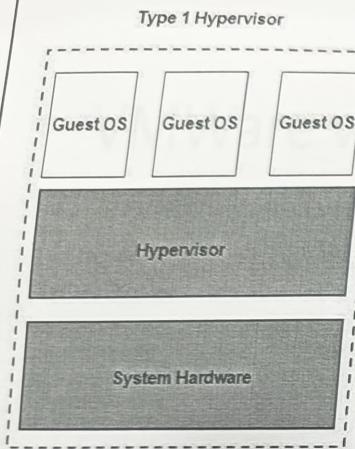
- Hypervisor is also known as a virtualization manager (VMM).
- There are two types of hypervisor:
- **Type 1 Hypervisor (firmware/bare metal Hypervisor)** executes on bare system (does not have any host OS).
  - It has direct access of hardware.
- **Type 2 Hypervisor (hosted Hypervisor)** is a **software interface** that emulates the devices with which a system normally interacts.
  - It accesses hardware through OS.
  - If OS fails, all VMs also fail (i.e. it has extra dependency).

# Types of Hypervisor

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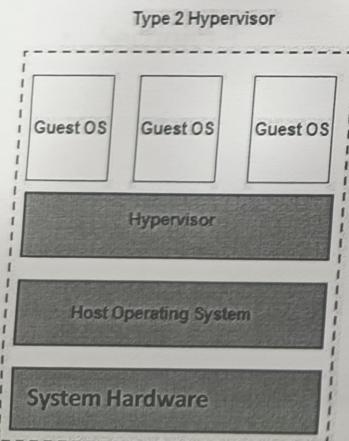
Criteria	Type -1 Hypervisor	Type-2 Hypervisor
aka	Bare Metal & Native	Hosted
Virtualization	Hardware Virtualization	OS Virtualization
Operation	Guest OS and applications run on the hypervisor	Runs as an application on the host OS.
Scalability	Better Scalability	Not so much because of its resilience on the underlying OS.
System Independence	Has direct access to hardware along with Virtual Machines it hosts.	Not allowed to directly access the host hardware and its resources.
Performance	Higher performance as there is no middle layer.	Comparatively has reduced performance rate as it runs with extra overhead.
Security	More secure	Less secure, as any problems in the base OS affect the entire system.
Example	VMWare ESXi, hyper-V, Xenserver, etc.	VMWare Workstation.

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## Organizations

LynxSecure, RTS Hypervisor, Oracle VM, Sun xVM Server, VirtualLogic VLX are examples of Type 1 Hypervisor



## Learning Testing

KVM, Microsoft Hyper V, VMWare Fusion, Virtual Server 2005 R2, Windows Virtual PC and VMWare workstation 6.0 are examples of Type 2 Hypervisor.