

SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35



Department of Computer Science and Engineering

23CST206-OPERATING SYSTEMS AND VIRTUALIZATION

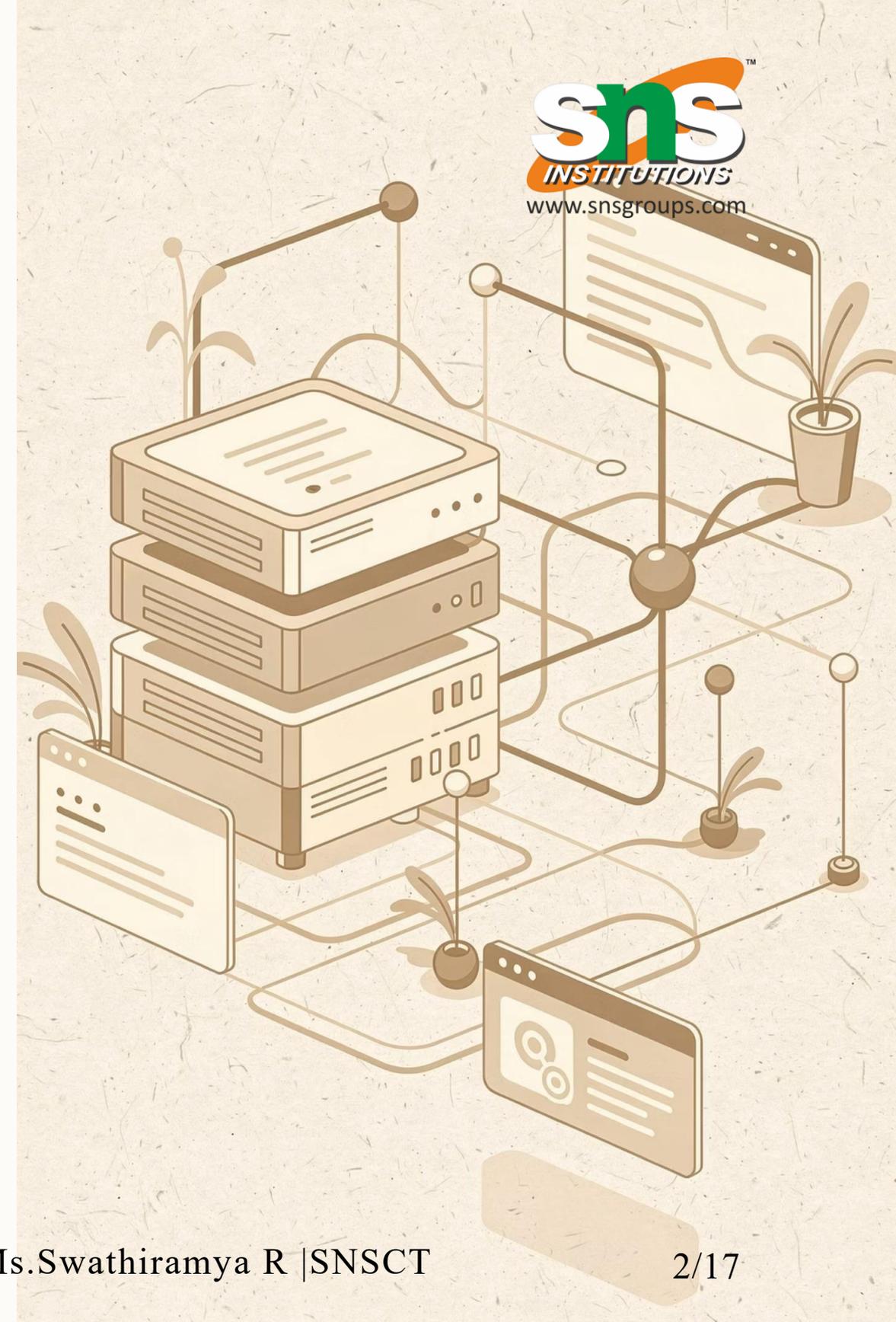
B.E- CSE /IV SEMESTER

UNIT - III MEMORY MANAGEMENT

Topic 6:Virtual Machine in OS

Virtual Machines in Operating System

Exploring the power of virtualization technology



What is a Virtual Machine?

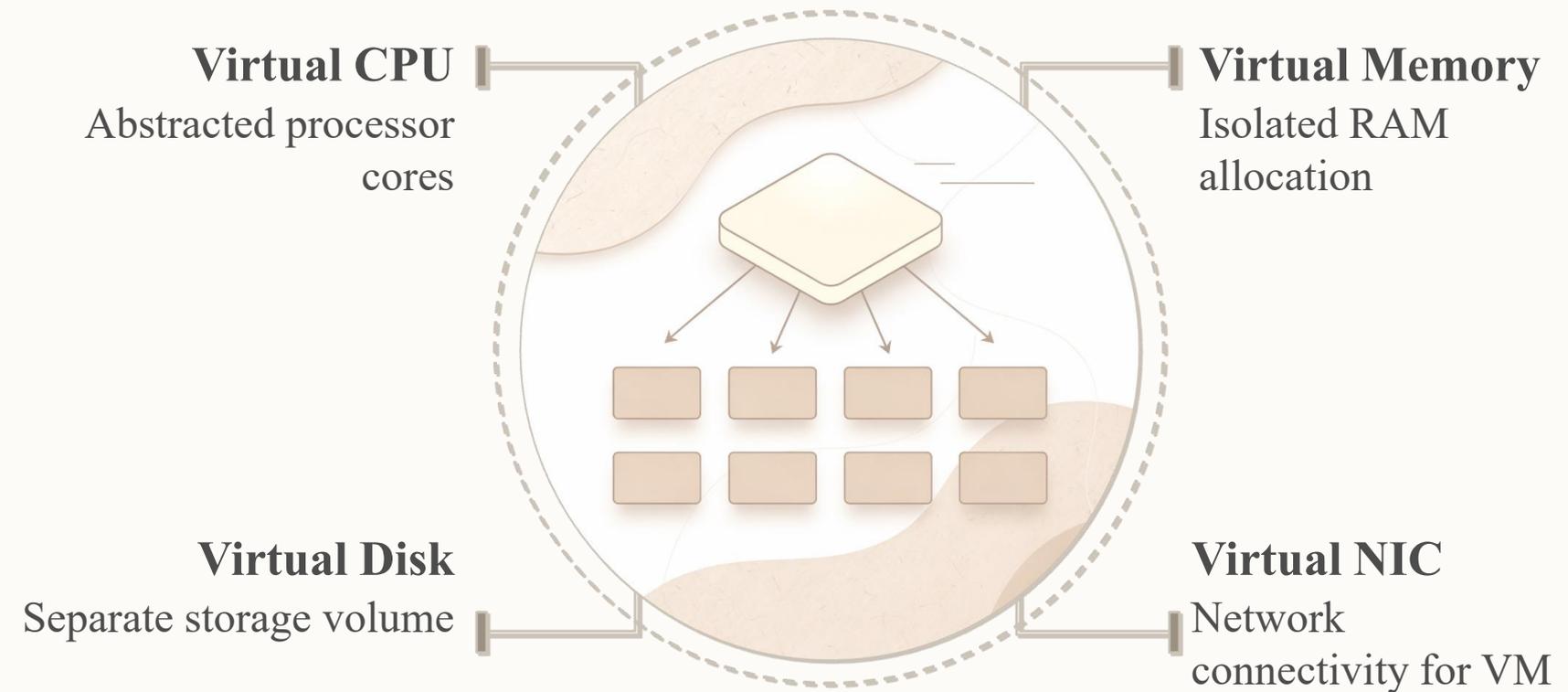
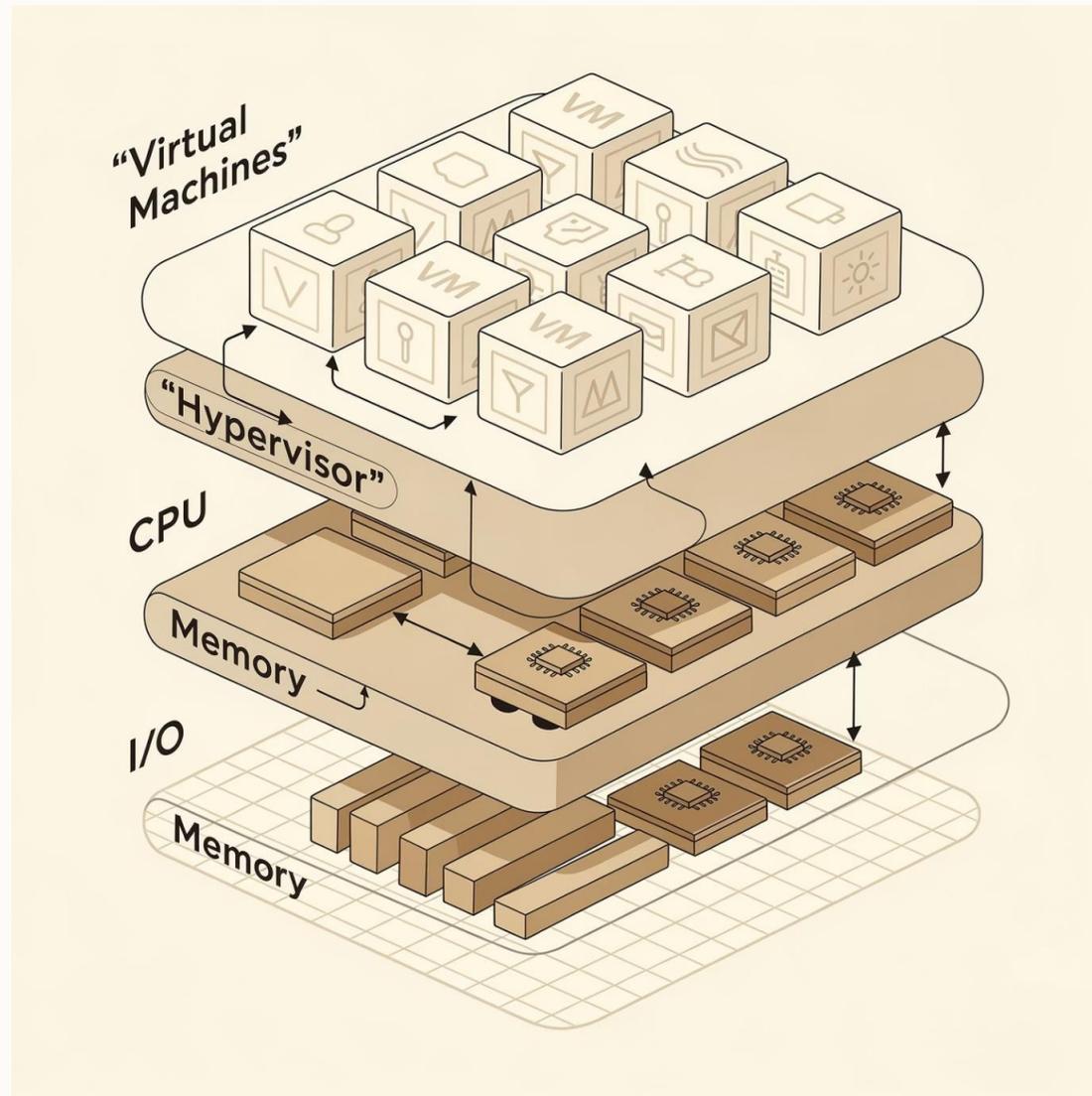
Virtual Machine (VM)

Virtual Computer inside a Physical Computer

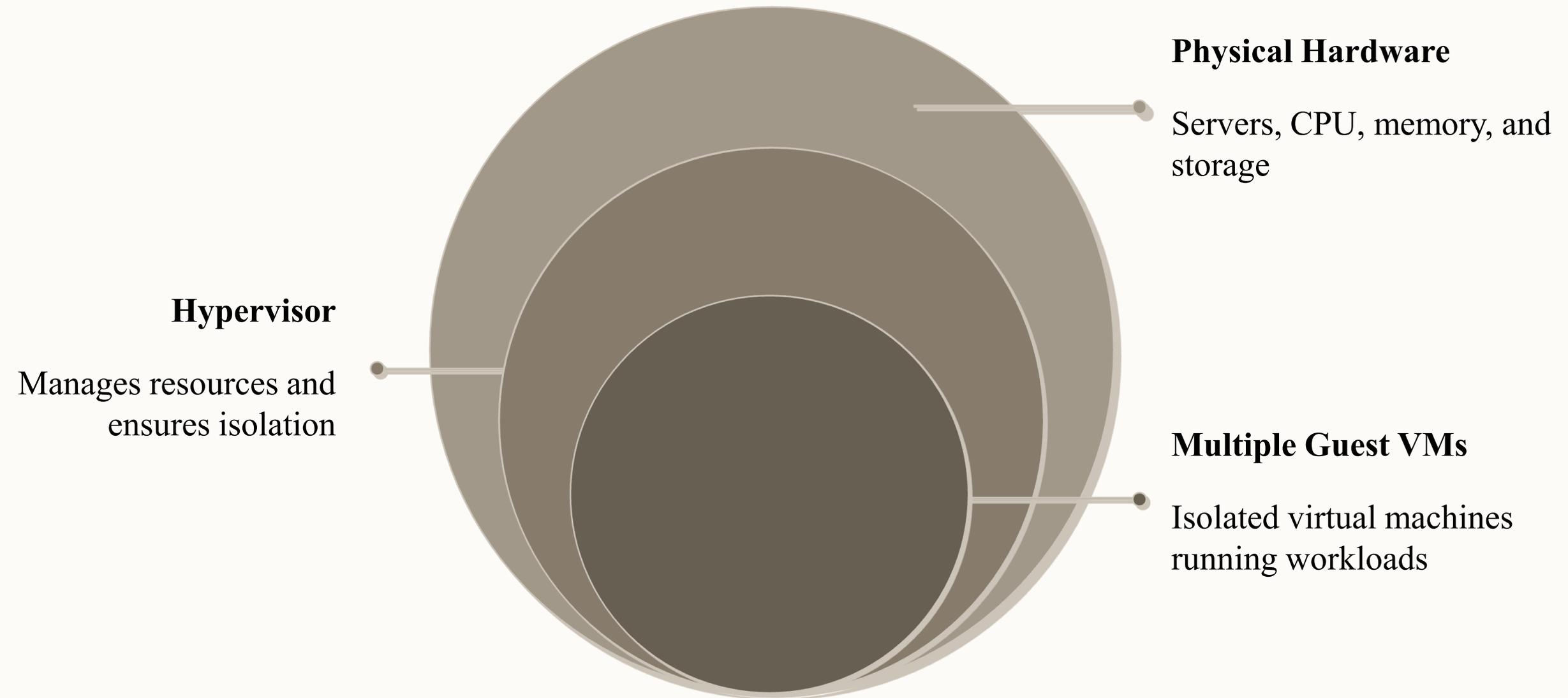


Example: **Linux VM** running inside a **Windows PC**

How Virtual Machines Work



Virtual Machine Architecture



Types of Virtual Machines

Process Virtual Machine

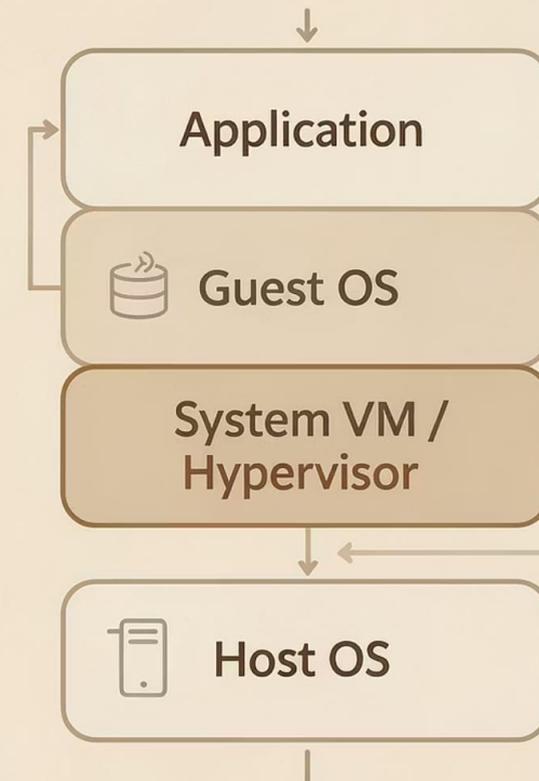
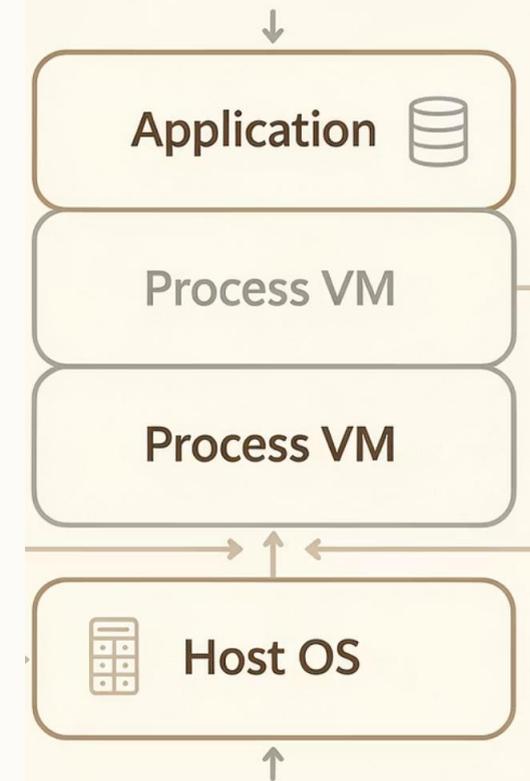
Designed to run a single application or process.

Example: Java Virtual Machine (JVM), which allows Java programs to run on any platform.

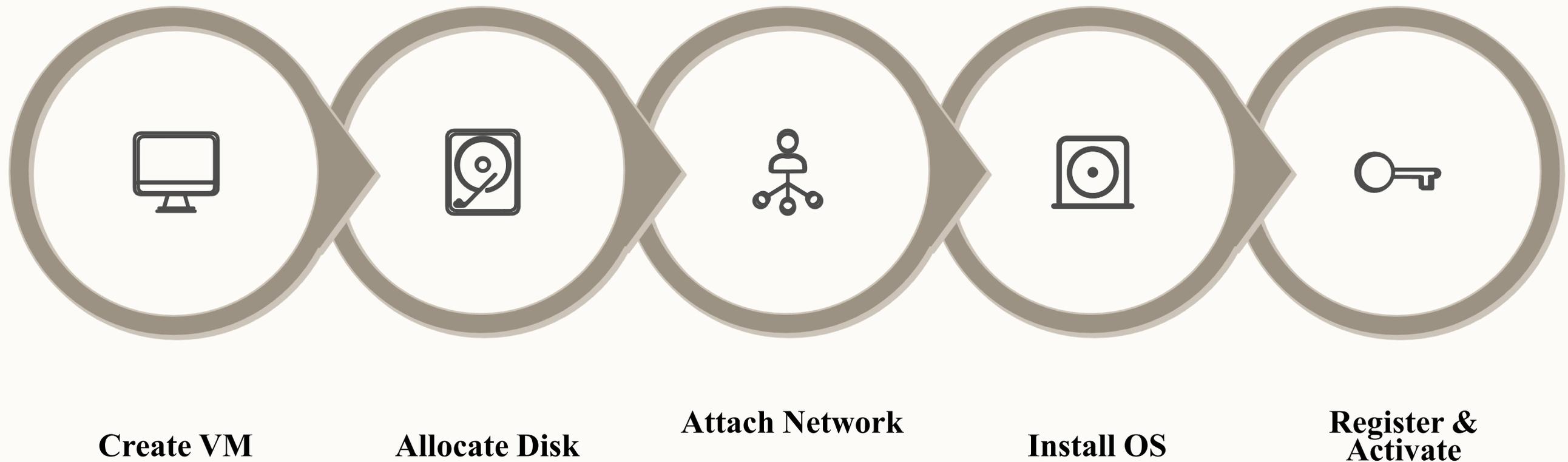
System Virtual Machine

Emulates an entire physical machine and can run a full OS.

Example: VMs created using VirtualBox, VMware, or Hyper-V.



Setting Up a Virtual Machine



Most platforms like VirtualBox or VMware offer wizards to simplify this setup process.

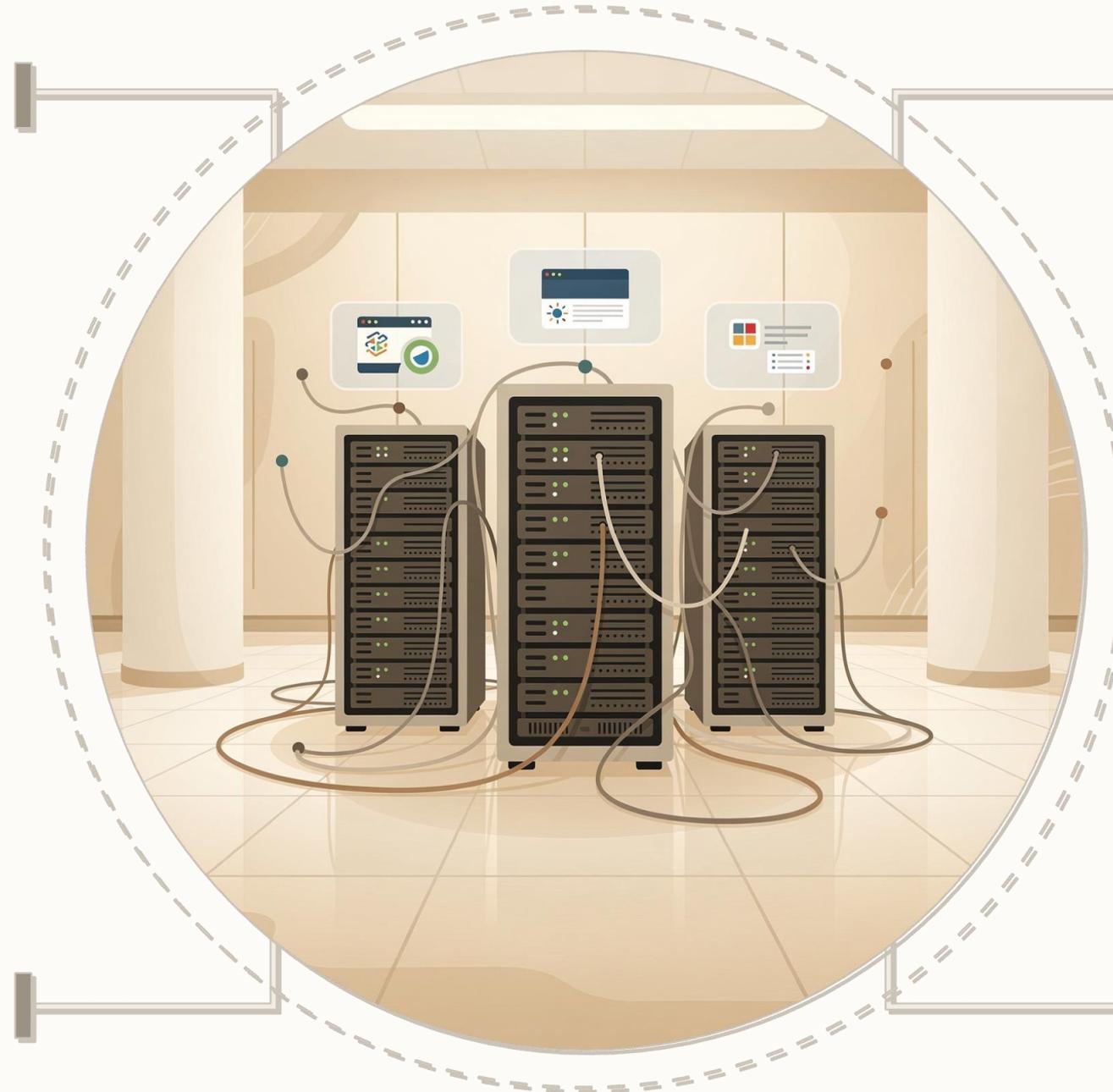
Uses of Virtual Machines

Multiple OS Support

**Run different OSes
on one machine**

Legacy Applications

**Run old apps on
modern hardware**



**Safe Testing
Environment**

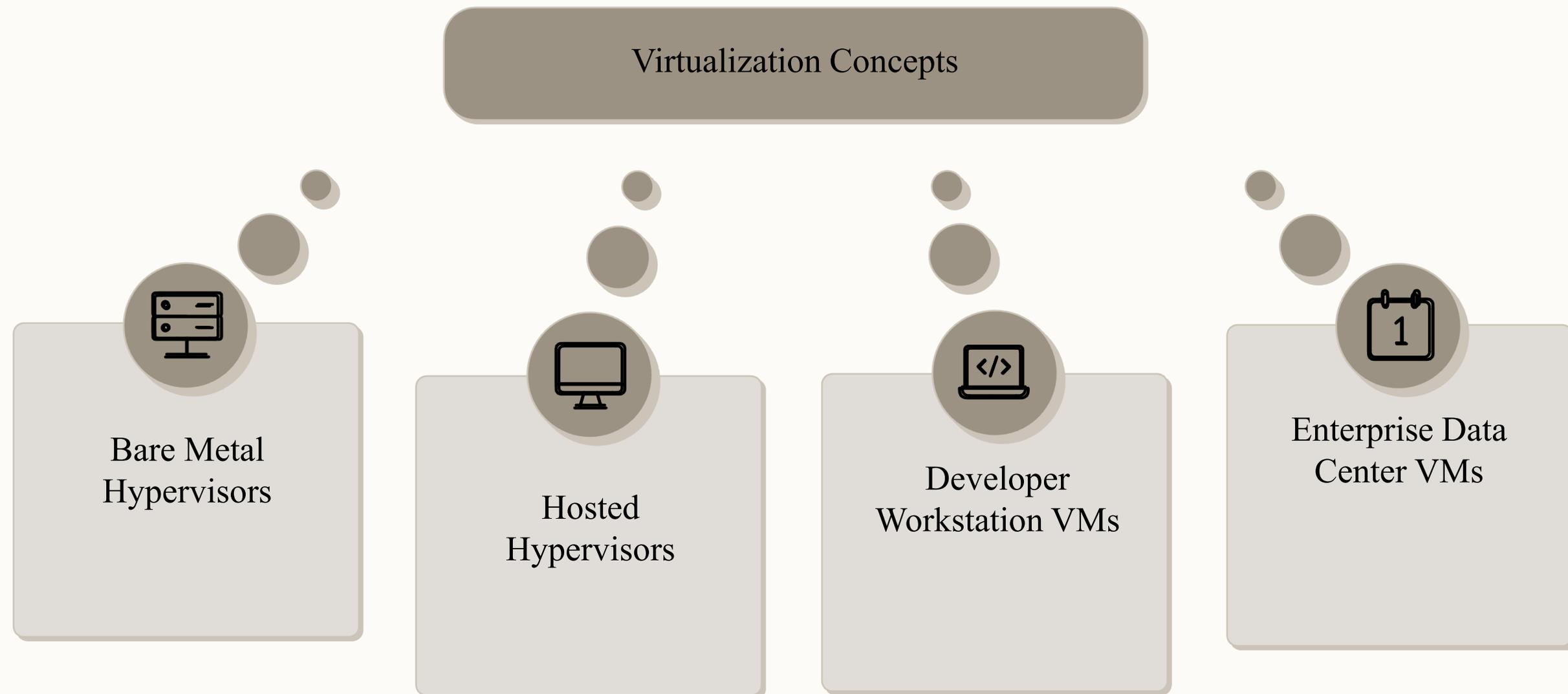
**Test software in
isolated sandboxes**

Server Virtualization

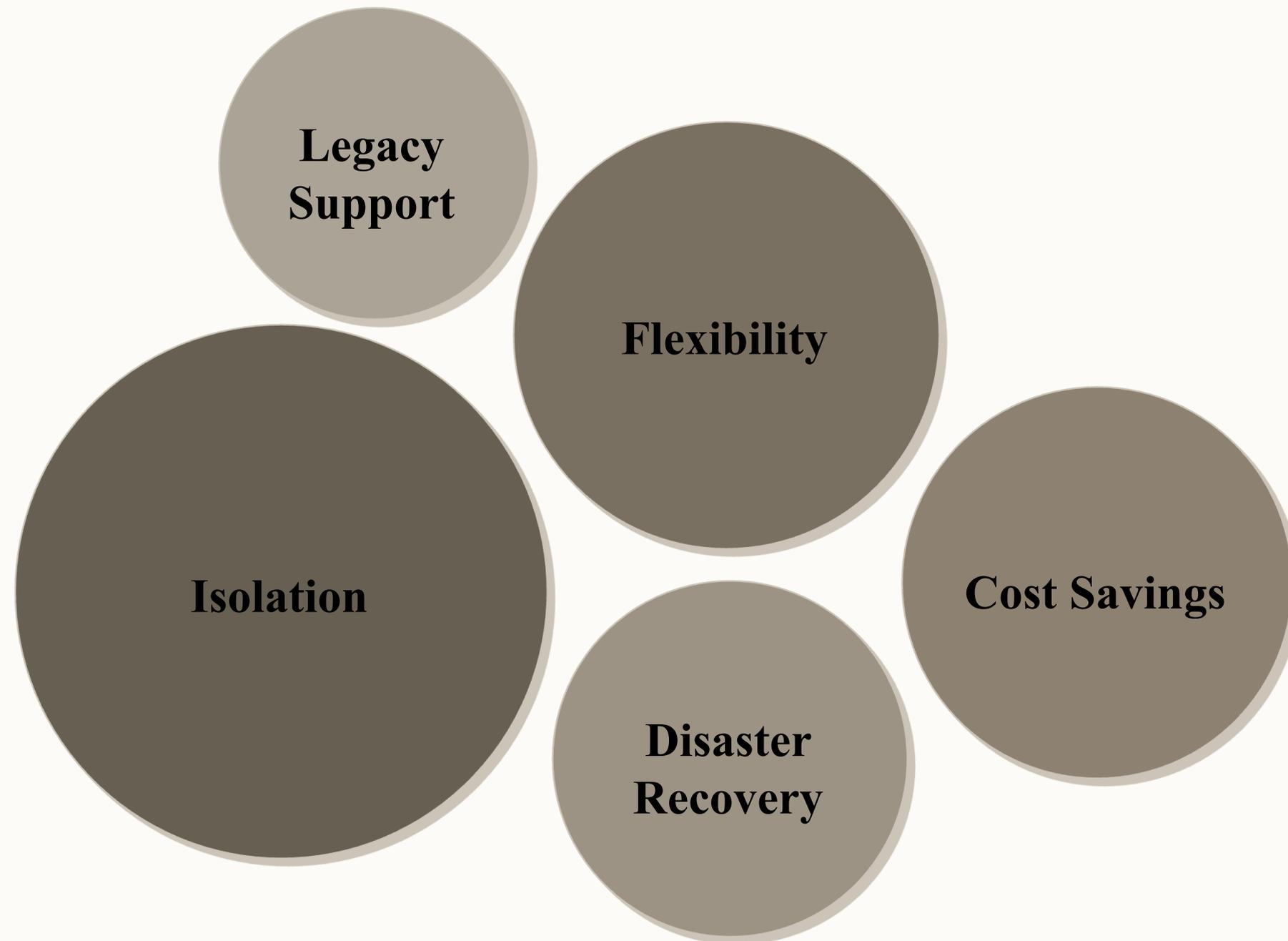
**Host many VMs on
one server**

Understanding Hypervisors

A hypervisor is software that enables virtualization by separating physical resources from VMs and managing resource allocation.



Advantages of Virtual Machines



Design Thinking Framework for VMs



Problem

Physical machines are limited; installing multiple OS on one machine is difficult. Developers need safe, portable, isolated environments.



Define

Need isolation, portability, and efficient resource utilization. Must support multiple OS/applications simultaneously.



Ideate

Use hypervisors to create VMs. Emulate hardware for guest OS. Allocate CPU, memory, and I/O resources virtually.



Prototype

Install VirtualBox or VMware. Create guest VM with assigned resources. Install guest OS inside VM.



Test

Run applications in VM. Observe performance. Check isolation: crashing one VM should not affect others.

Problem Statement

Physical machines are limited; installing multiple OS on a single machine is difficult.

Developers need safe, portable, and isolated environments.



Developers Need...



SAFE



PORTABLE

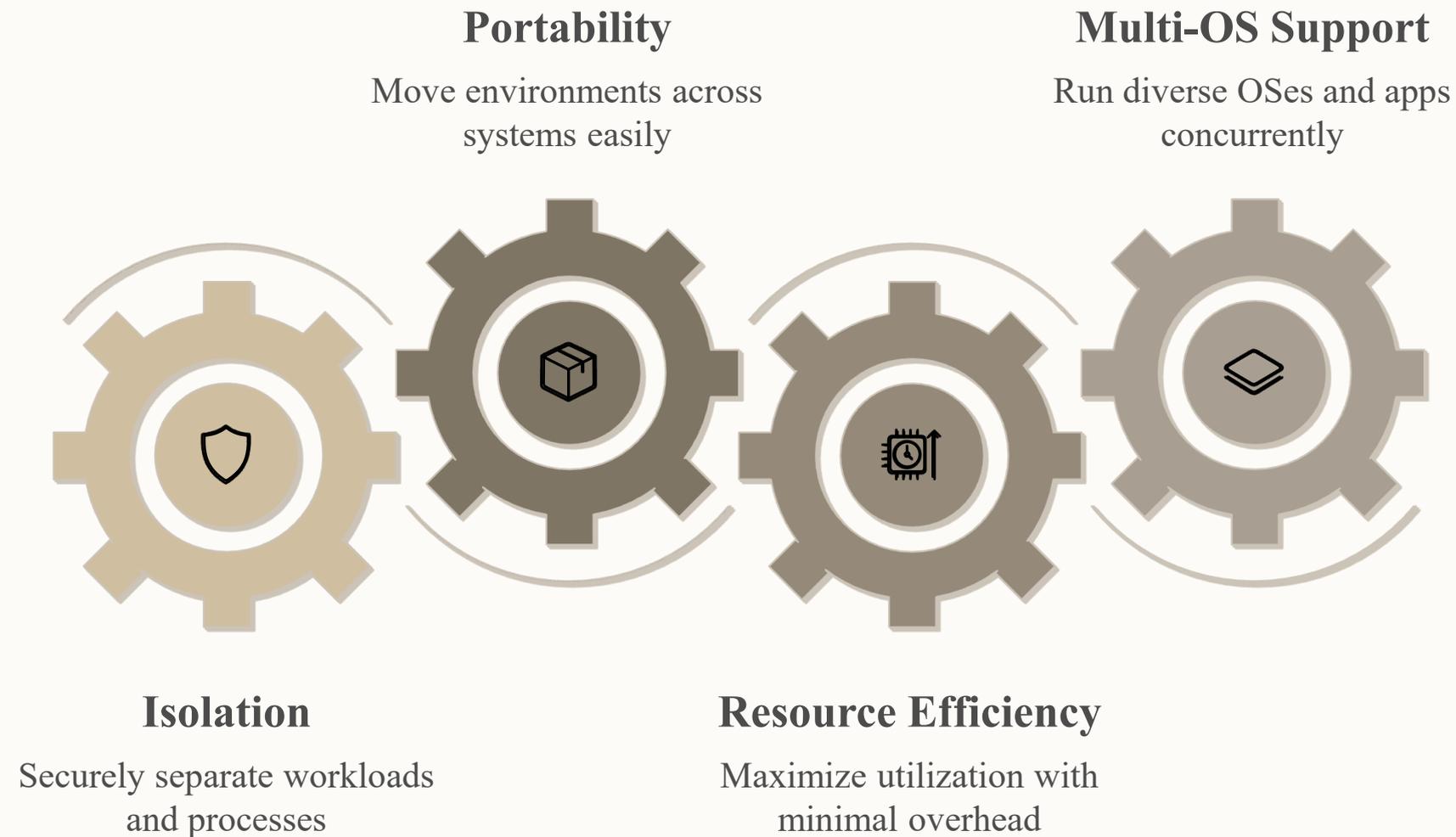


Isolated

Safe, Portable, Isolated Environments

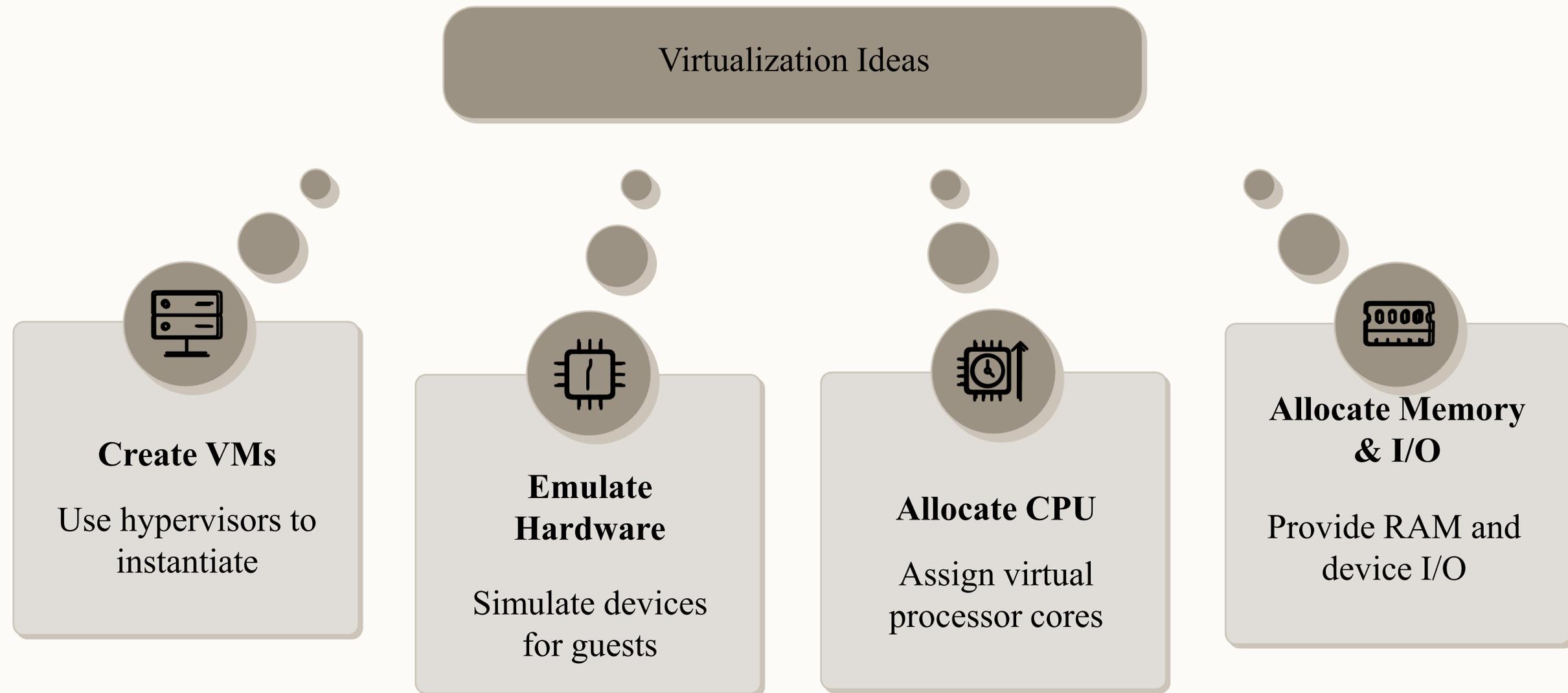
Define:

- Need isolation, portability, and efficient resource utilization.
- Must support multiple OS/applications simultaneously.



Ideate

Use hypervisors to create VMs. Emulate hardware for guest OS. Allocate CPU, memory, and I/O resources virtually.



1 Install VirtualBox or VMware on Host Machine



Install virtualization software like VirtualBox or VMware Workstation on the host system.



2 Create Guest VM with Assigned Memory, CPU, Disk



Set up a new virtual machine and allocate resources like memory, CPU cores, and disk space to it.



3 Install Guest OS Inside VM

Install your desired guest operating system (e.g., Linux, Windows) inside the virtual machine.



Test

1 Run Applications in VM

Launch and run applications within the guest VM to test functionality.



2 Observe Performance vs Physical OS

Compare the performance of the VM with the native host OS.



3 Check Isolation

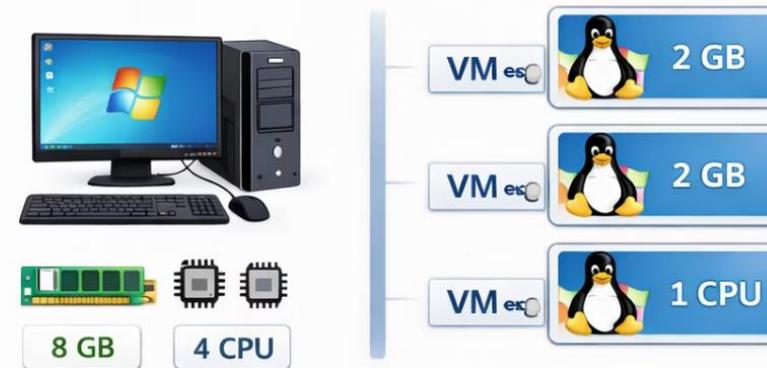
Crashing one VM should not affect others; each VM runs independently.



Puzzle (Non-MCQ)

Scenario

You have a host machine with 8 GB RAM and 4 CPU cores.
You want to run 3 VMs each with 2 GB RAM and 1 CPU core.



Question

- 1 Can all VMs run simultaneously without exceeding resources?
- 2 If one VM uses more CPU dynamically, what problem could arise?

Answer

- 1 Yes, total RAM = $2 \times 3 = 6$ GB $<$ 8 GB, CPU cores = $1 \times 3 = 3 <$ 4 cores.
- 2 Problem: CPU **contention** may occur; performance of other VMs may slow down.