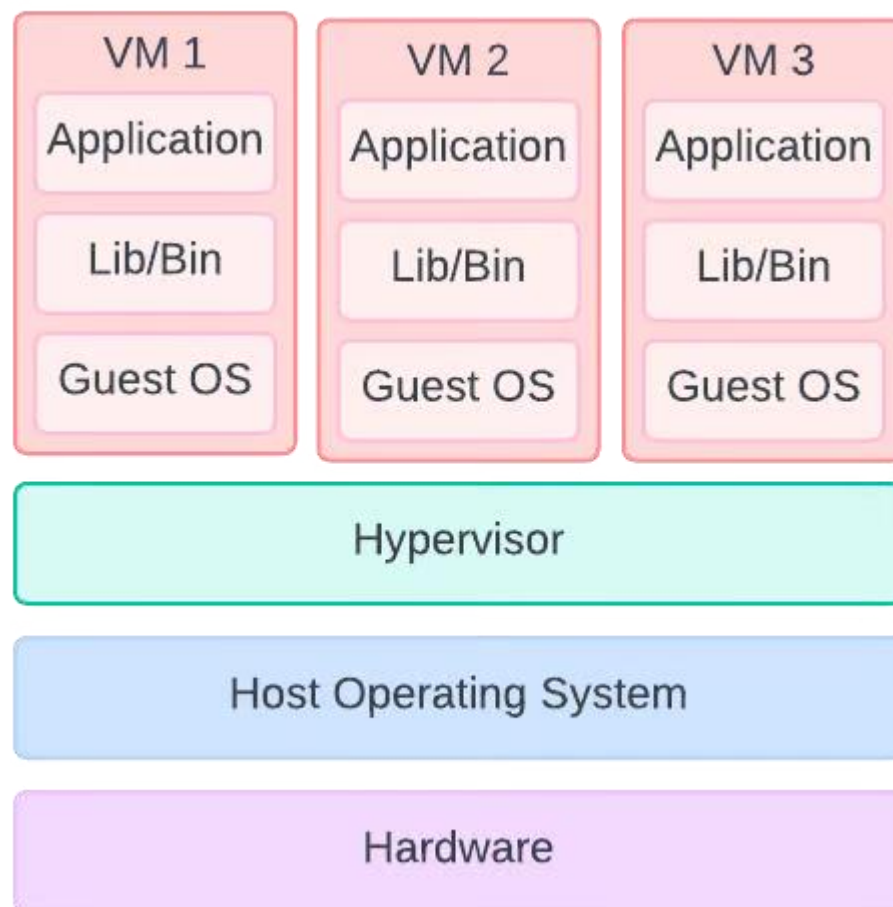


## VIRTUAL MACHINE

➔ A Virtual Machine (VM) is a software-based emulation of a physical computer. It runs an operating system and applications just like a physical computer, but it's hosted on a real (physical) machine using virtualization software like VMware, VirtualBox, or Hyper-V.

### ➔ Key Components of a Virtual Machine

1. Host Machine: The physical computer that runs the VM.
2. Guest Machine: The virtual computer running inside the host.
3. Hypervisor: Software that creates and manages VMs.
  - Type 1 (bare-metal): Runs directly on hardware (e.g., VMware ESXi, Microsoft Hyper-V Server).
  - Type 2 (hosted): Runs on top of an existing OS (e.g., VirtualBox, VMware Workstation).



## 1. Hypervisor

Generally speaking, a hypervisor is the software layer that manages and initializes virtual machines. It manages the resources between the VM and the physical machine.

There are two different types of hypervisors:

- **Type 1 hypervisors** sit on top of bare metal and run off the server itself. They usually have direct access to the server's resources.
- **Type 2 hypervisors** are generally installed on a host operating system. They do not have full control of the computer's resources and are instead managed by the host operating system.

## 2. Virtual hardware

The hypervisor will allocate virtual hardware to the VM. This means virtually separating the physical resources from the machine and giving them to the virtual environment. That might mean splitting the RAM, CPU cores, and other computing resources so that the VM can run processes.

## 3. Guest operating system

The guest operating system runs inside the VM. It does not have to be the same operating system as the host and can be any operating system. Different VMs on the same hypervisor or server may even have different operating systems depending on their use cases.

## 4. Virtual disk

VMs often have virtual disks to store information temporarily while they are running. Sometimes, we transfer data from a virtual disk to the host computer's actual storage system, but that is done carefully to prevent damage to the host.

### ➔How VMs Work

- The hypervisor allocates **hardware resources** (CPU, RAM, disk, etc.) to each VM.
- Each VM is **isolated**, meaning problems in one VM don't affect others.
- VMs can run **different operating systems** (e.g., Windows on a Linux host).

### ➔Benefits of Using Virtual Machines

- **Isolation:** VMs are sandboxed from each other.
- **Portability:** VMs can be easily moved across machines.
- **Cost efficiency:** Multiple VMs can run on one physical server.
- **Testing & Development:** Ideal for trying new OSes or software.
- **Disaster Recovery:** Easy to back up and restore.

### → Disadvantages

- **Performance Overhead:** VMs are slower than bare-metal performance.
- **Resource-Intensive:** Multiple VMs require significant system resources.
- **Complexity:** Managing many VMs can be complex.