# Comparing VMs and Containers
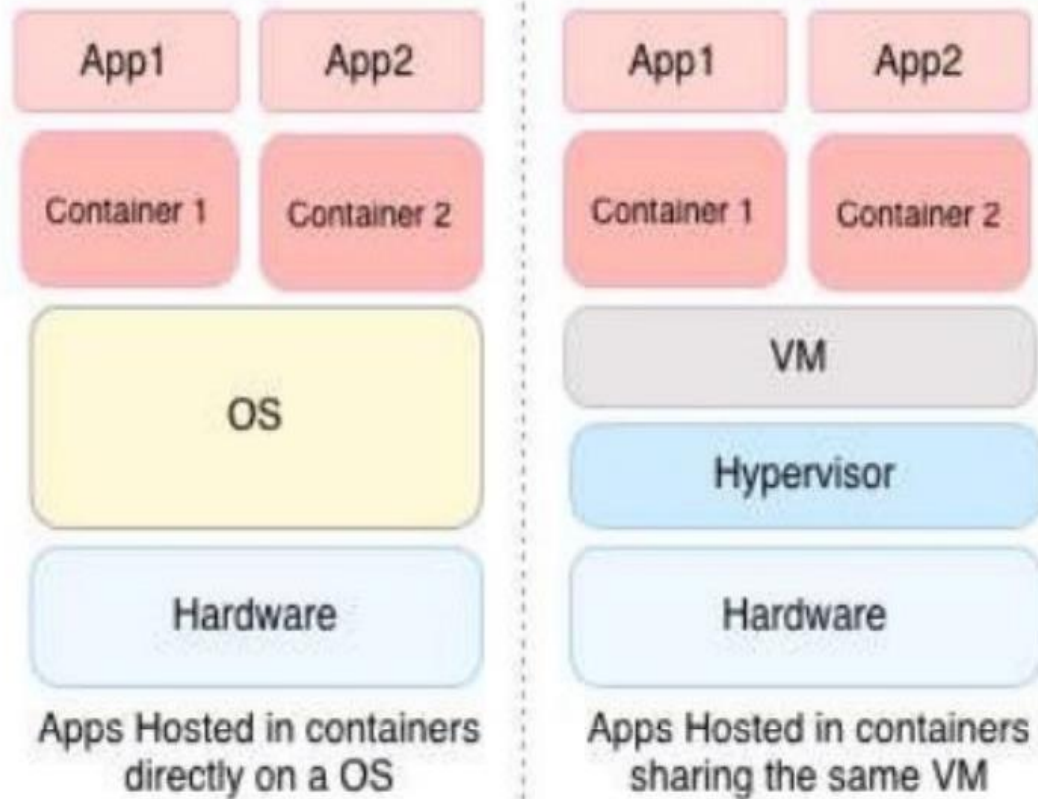
- ## Virtual Machine
  - Allow Multiple Guest OS to run together on a single machine.
  - Each Guest OS abstracts Compute, Storage and Network Components.
  - Hypervisor itself could run on bare-metal (ESXi) or be part of an OS (KVM).
  - Guest ISA is translated to Host ISA using multiple techniques like Hardware Virtualization or Binary Translation.

App1	App2
VM 1	VM 2
Hypervisor	
Hardware	

Apps Hosted in VMs
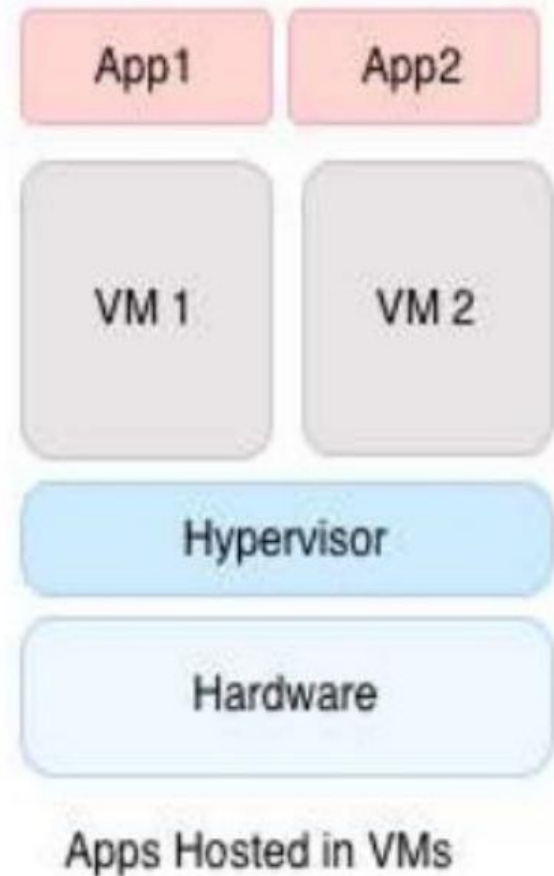
Container

- light weight containment system running
- Runs instructions native to the core CPU :
- Container shares the Kernel and Process scheduler with the Host OS
- No Binary Translation or VM exits
- Containers can be run either directly on the Host OS or in a Guest VM :

App1	App2
Container 1	Container 2

OS	

Hardware	

Apps Hosted in containers directly on a OS

App1	App2
Container 1	Container 2

VM	

Hypervisor	

Hardware	

Apps Hosted in containers sharing the same VM

Parameter	Virtual Machines	Containers
Guest OS	Each **VM runs on a hypervisor and Kernel** is loaded into in its own memory region	All the **guests share same OS and Kernel**. Kernel image is loaded into the physical memory
Networking	Can be linked to virtual or Physical switches. Hypervisors have buffers for IO performance improvement, NIC bonding etc	Leverages standard IPC mechanisms like Signals, pipes, sockets etc. Advanced features like NIC bonding etc still not available.
Security	Complete Isolation	Isolation using techniques like namespaces

Parameter	Virtual Machines	Containers
Performance	Suffer from a small overhead as the Machine instructions are translated from Guest to Host OS.	Provide near native performance as compared to the underlying Host OS.
Isolation	Higher level of Isolation –Need special techniques for file sharing	Subdirectories can be transparently mounted and can be shared
Startup time	VMs take a few minutes to boot up	Containers can be booted up in a few seconds as compared to VMs
Storage	VMs take much more storage as the whole OS kernel and its associated programs have to installed and run	Containers take lower amount of storage as the base OS is shared