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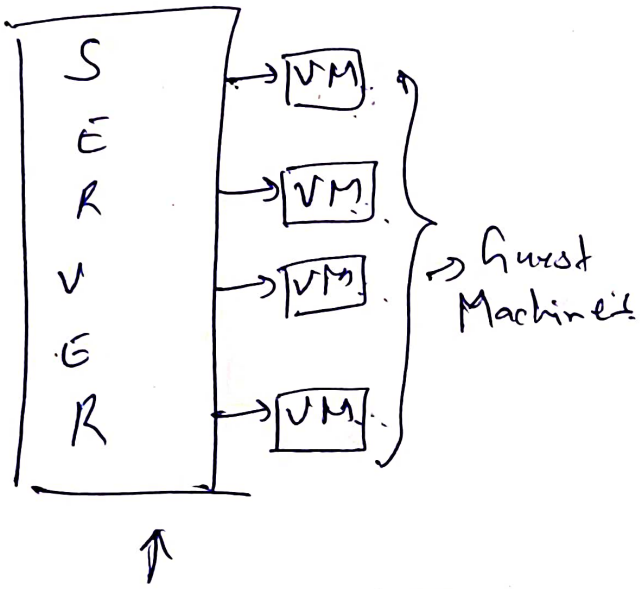
Virtualization Unit-3



Processor

RAM

ROM

Network

Hypervisor (VMM) is a software or program → Hypervisor is a virtual machine monitor. It is used to create virtual machine.

A machine on which we create virtual machines is called host machine.

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(1) Instruction Set Virtualization – Is a processor virtualization technique that enables emulation of the instruction set of one processor on a different processor. It allows the running or emulating of the instruction set architectures of different processors among each other – delivered as a virtualization layer.

(2) Hardware abstraction level Virtualization – It uses a bare hypervisor for its functioning. This level helps form the virtual machine and manages the hardware through virtualization. It enables virtualization of each hardware component such as I/O devices, processor, memory etc.

(3) OS Virtualization is a server virtualization technology that involves tailoring a standard operating system so that it can run different applications handled by multiple users on a single computer at a time.

(4) ~~API Em~~ Library level Virtualization—

This type of virtualization can create execution environments for running alien programs on a platform rather than creating a VM to run the entire operating system.

(5) Application level virtualization is a technique allowing applications to be run in runtime environments that do not natively support all the features required by such applications.

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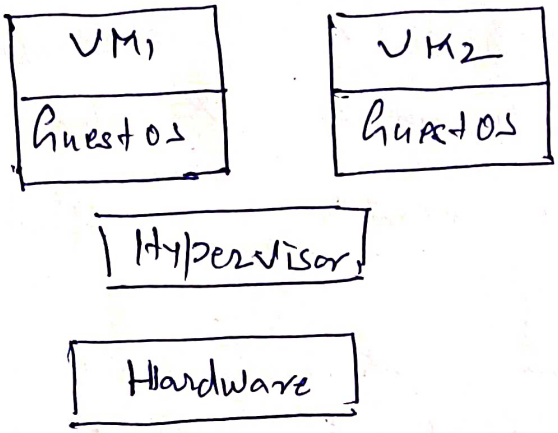
Type 1 Full Virtualization

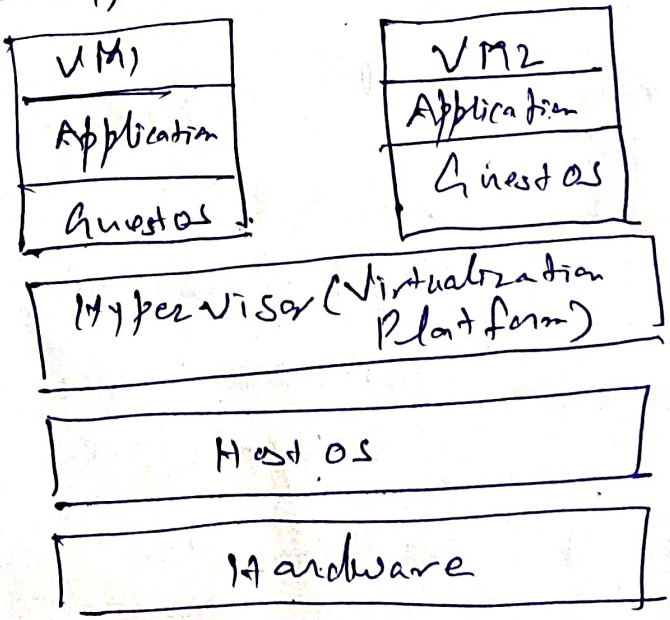


→ Directly Ran on host h/w.

→ Stability is depends on Guest OS.

Paravirtualization Type 2

→ Hosted hypervisor.



(1) Guest OS is aware about virtualization

(2) → Guest OS need to be modified.

Full Virtualization	Para Virtualization
(1) Type 1 native or bare Metal hypervisor	Type 2 or hosted hypervisor
(2) Directly runs on host hardware	Hypervisor installed over host OS.
(3) No base OS, so stability is depend on guest OS.	Stability is depends on host OS, if host OS need to reboot.
(4) Guest OS is unware that it is in virtual environment	Guest OS is Aware about Virtualization.
(5) Guest OS is not need to modify	Guest OS is modified.

Virtualization — • Abstraction of computer resources.
• It refers to the creation of virtual resource such as server, file or network.

Level of Virtualization —

Application level — JVM

Library level — LxRun

operating System Level — Virtual Environment

Hardware Abstraction layer — VMware

Instruction set architecture — BIRD

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Xen Architecture-

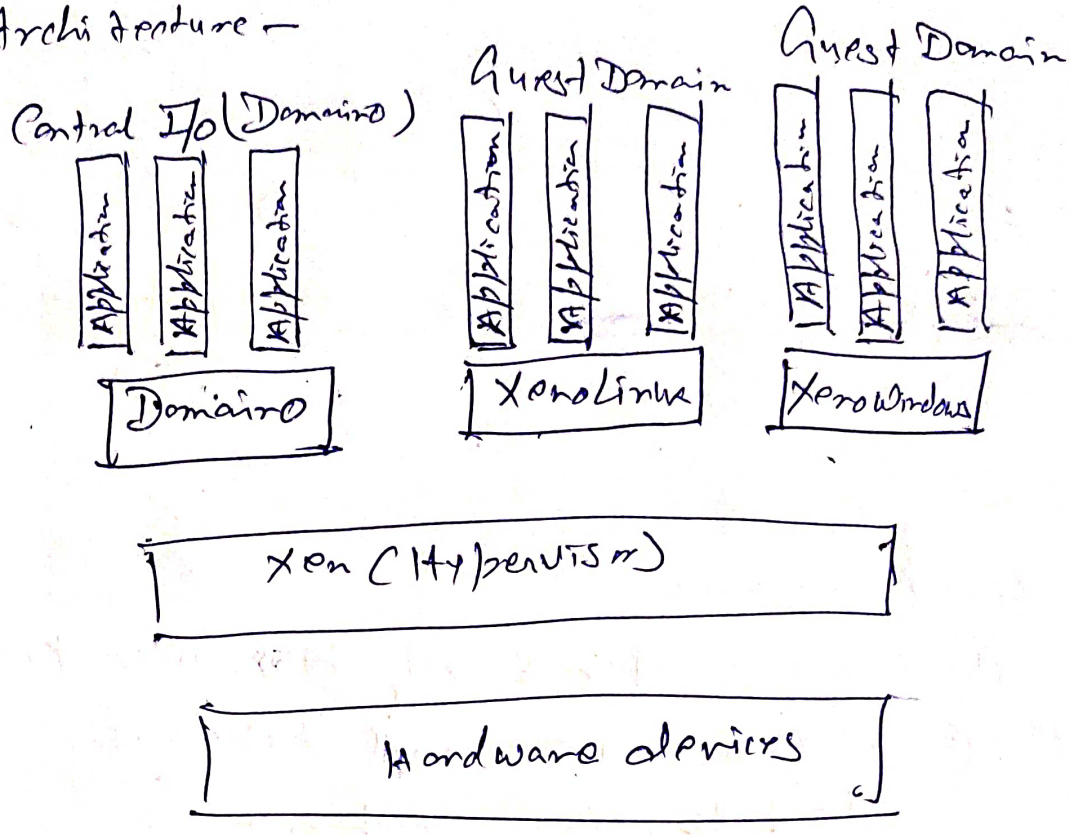
(1) Xen is a open source hypervisor program.

(2) Xen is a microkernel hypervisor, which separates the policy from mechanisms.

(3) A microkernel hypervisor includes only the basic and ~~unchanging~~ ~~mechanis~~ unchanging functions (such as physical memory management and processor scheduling. The device drivers and other changeable components are outside the hypervisor. A monolithic hypervisor implements all the unchanging functions, including those of the device drivers.

(4) Therefore the size of the hypervisor code of microkernel hypervisor is smaller than ~~out~~ that of ~~monolithic~~ monolithic hypervisor. Essentially a hypervisor must be able to convert physical devices into virtual resources dedicated for the deployed VM to use.

Xen Architecture —



The Xen architecture ~~is~~ have a special domain 0 ~~for~~ control and I/O and several guest domains for user ~~application~~ applications.

If Domain 0 is compromised the hacker can control the entire system.

KVM — Kernel Based ~~VM~~ VM — This a Linux paravirtualization system. ~~a part~~ Memory managment and scheduling activities are carried out by the existing linux kernel. KVM is a hardware assisted paravirtualization tool; which improves performance and supports unmodified guest OS's such as windows, Linux etc.

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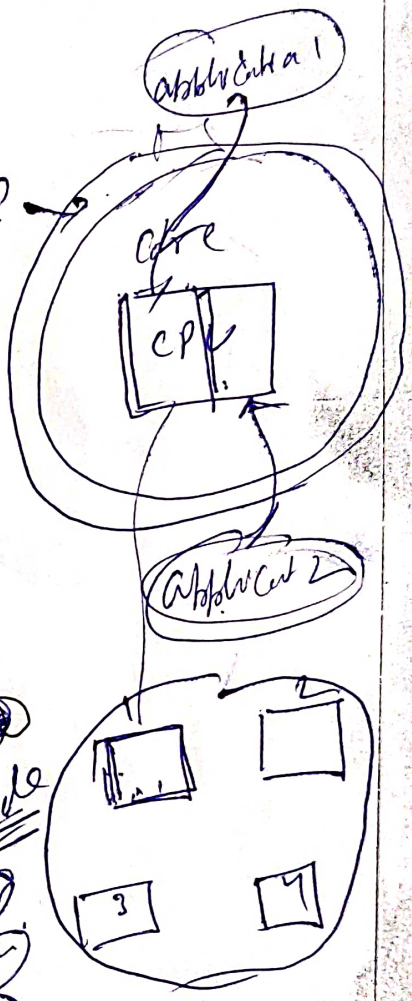
Types of CPU Virtualization —

(1) Hardware assisted CPU Virtualization —

(2) Software based CPU Virtualization — SW

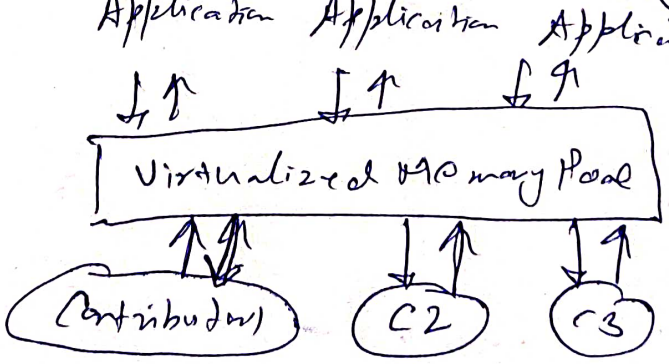


Memory Virtualization —

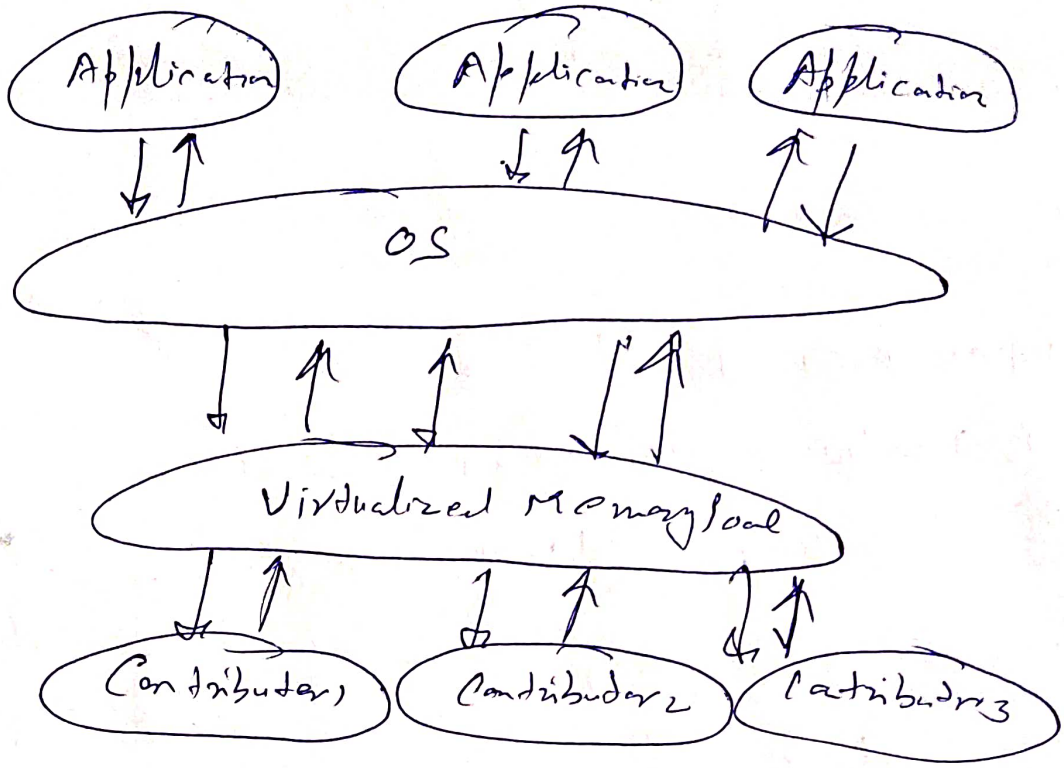
It introduces a way to decouple memory from the server to provide a shared, distributed or networked function.

Application level integration -

Applications running on connected computers directly connect to the memory pool through an API or the file system.



OS level integration- The OS first connects to the memory pool and makes that pooled memory available to applications.



Virtualization of CPU, Memory and I/O Devices.

→ To support virtualization, processors such as ~~x86~~ x86 employ a special running mode and instructions known as hardware assisted virtualization.

→ The VMM and guest OS run on different modes and all sensitive instructions of the guest OS and its applications are trapped in VMM.

→ To save processor states, mode switching is implemented in hardware.

Hardware Support for Virtualization –

→ All processors has two modes
user mode and supervisor mode

Supervisor mode → Privileged ~~mode~~ instructions.
other instructions are unprivileged instructions.

CPU Virtualization -

→ VM is a duplicate of an existing computer system.
→ Unprivileged instructions of VMs run directly on the host machine for higher efficiency.
→ A CPU architecture is virtualizable
  → If VMs unprivileged instruction run in the CPU's user mode.
  → while the VMM runs in supervisor mode.

Memory Virtualization.

→ VM Virtualization involves sharing the physical system memory i.e. RAM and dynamically allocating it to the physical memory of the VMs.

I/O Virtualization -

→ Full device Virtualization
→ Para - Virtualization
→ Direct I/O

- Guest device driver
- Virtual device

Virtualization Layer -

→ emulates the virtual device
→ remaps guest and real I/O addresses.
→ multiplexes and drives the physical device
→ I/O features

- Real Devices may be different from virtual device.

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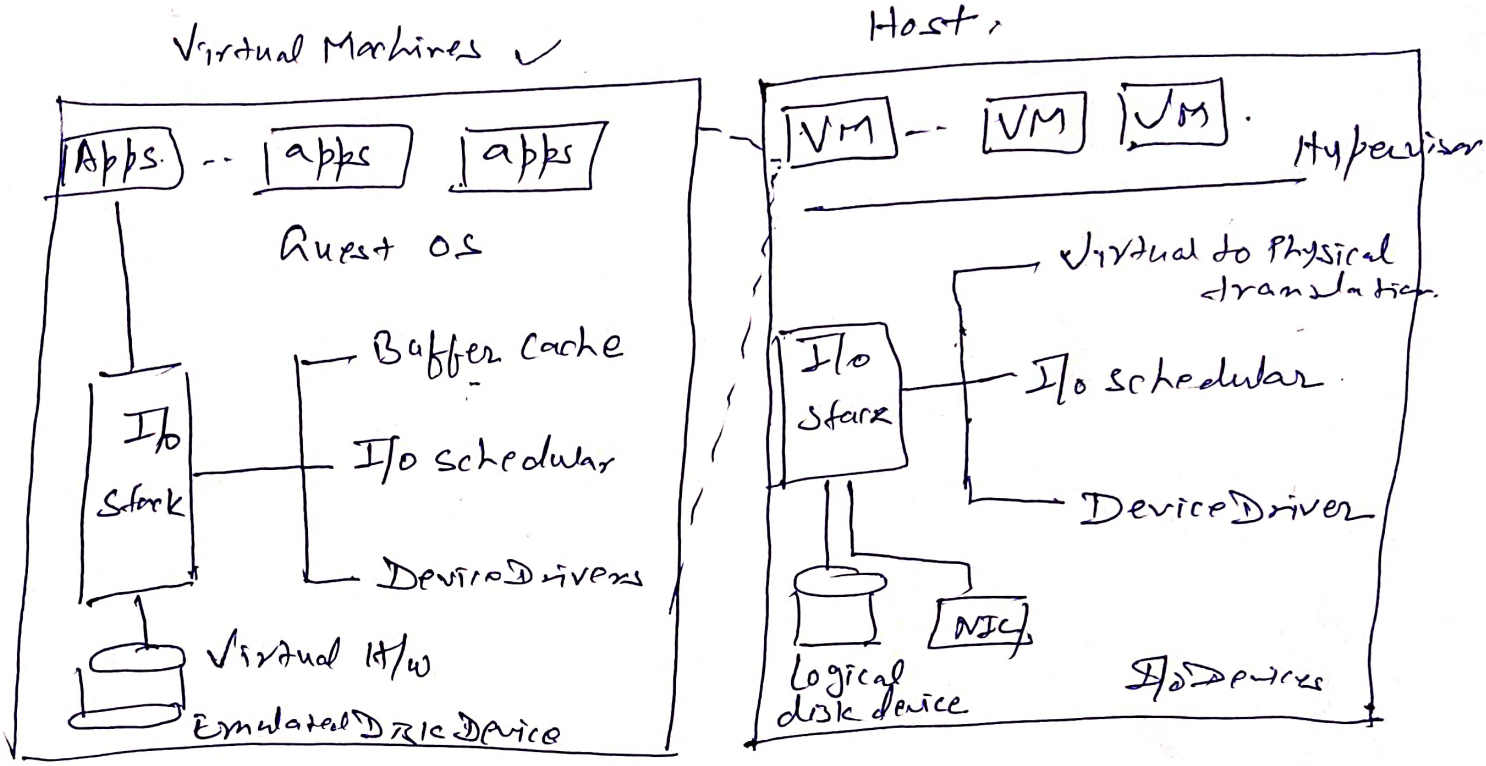
Virtualization of I/O Devices—



Virtual cluster— Virtual clusters are built with VMs installed at distributed servers from one or more physical clusters. The VMs in a virtual clusters are interconnected logically by a virtual network across several physical networks.

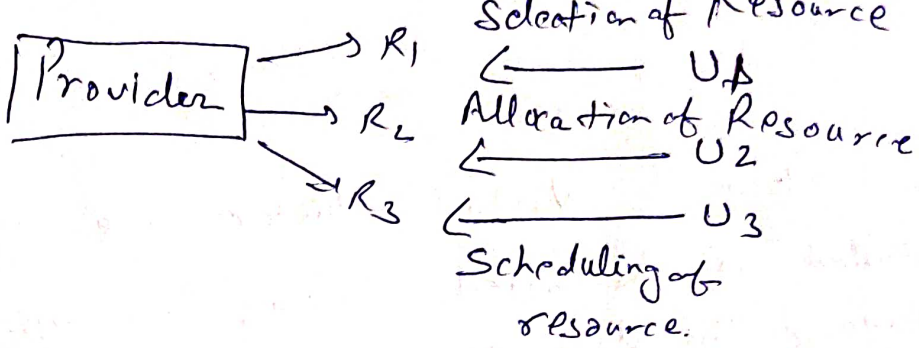
Cloud Resource managment policies and mechanisms—
The policies for CRM can be loosely grouped into five classes—

1. admission control
2. capacity control
3. load balancing
4. energy optimization
5. Quality of service guarantees.

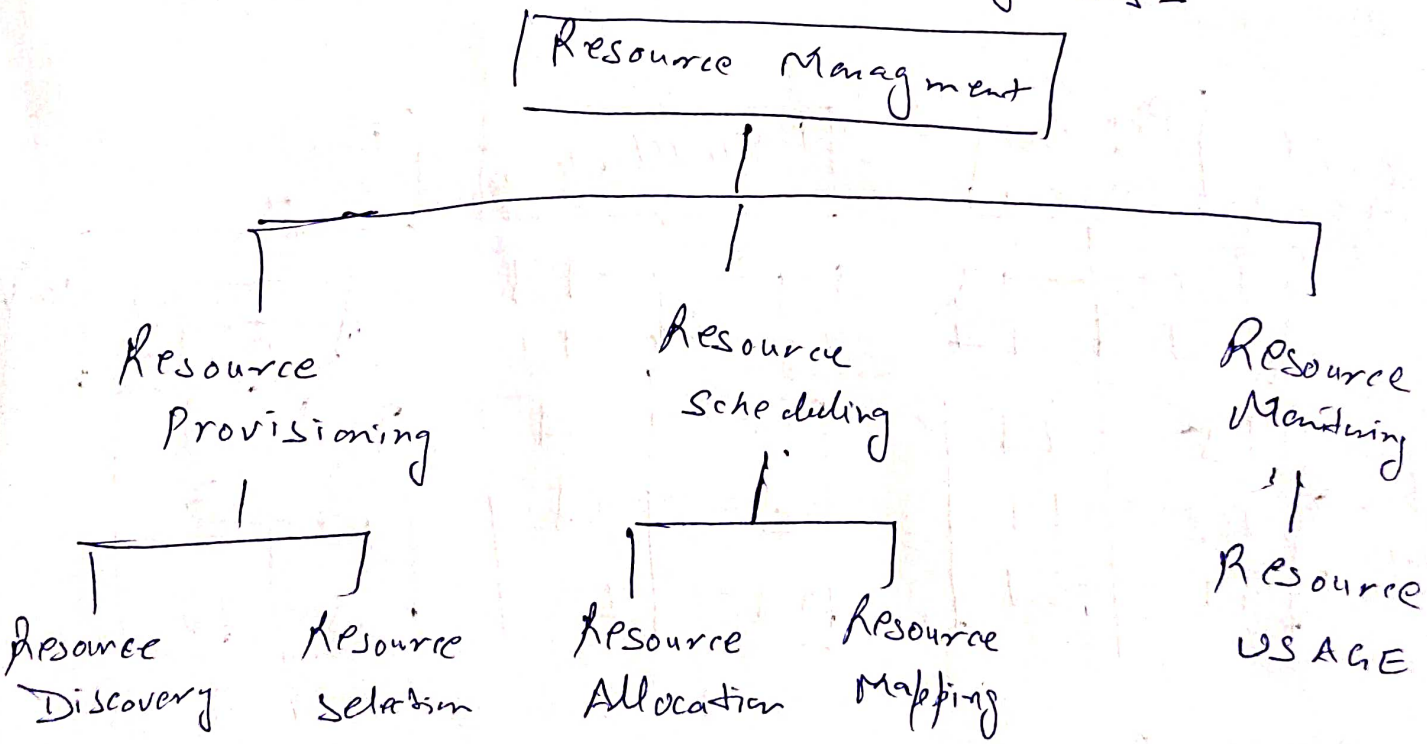
~~Resource Management~~ -

Inter cloud Resource Manggoment -

(1) Resource discovery (2) Match (3) select (4) Composition (5) Negotiate (6) Schedule (7) Monitor operations.



Texonomy of Inter cloud Resource Managments -



Server Virtualization – Is the process of dividing a physical server into multiple unique and isolated virtual servers by means of a software application. Each virtual sever can run its own operating system independently.

~~Date~~ Network Virtualization –

Network Virtualization is a process of logically grouping physical networks and making them operates as a single or multiple independent networks called virtual networks.

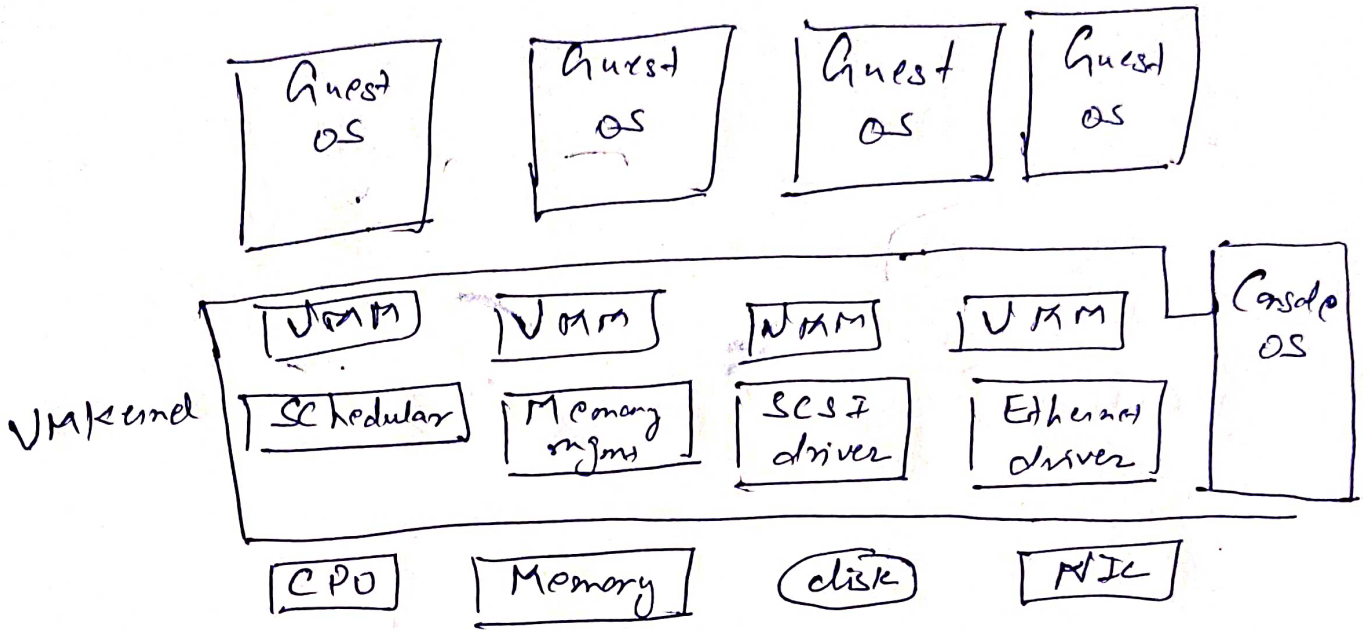
Tools for network virtualization –

Physical switch OS –
It is where the OS must have the functionality of network virtualization.

Hypervisor – It is which uses third party software or built in networking and the functionalities of network virtualization.

VM network – (1) Consists of virtual switches
(2) Provides connectivity to hypervisor kernel.
(3) Connects to the physical network.
(4) Resides inside the physical server.

VMware ESX server architecture using para virtualization —



CPU Virtualization — CPU virtualization emphasizes performance, running apps / programs, and runs directly on the processor whenever possible. All operations are controlled by an emulator that controls software to run accordingly, CPU virtualization is not the same as emulation. The emulator work the same as a normal computer machine does, it makes a copy of data and generates the same output as a physical machine does. The emulation function gives a feeling of working on multiple platforms while being on a single platform.

CPU virtualization helps all the virtual machines to behave like physical machines and distribute their physical resources like virtual machines sharing their ~~[illegible]~~ physical memories.