1) List the design challenges of cloud Computing.

1) Servio availability and data lock-in problem
2) Data privacy and Security Concerns
3) Unpredictable performance and bottlenecks
4) Distributed storage and wide-Spread Software bugs
5) cloud Scalability, interoperality and standardization
6) Software licensing and reputation Sharing.

2) What is cloud Computing?

cloud Computing is pay-per-Use model for enabling available, Convenient, on-demand network access to a shared pool of Configurable Computing resources (eg: network, services, storage, application, Services) That can be rapidly provisioned and released with minimal management effort or Service-provider interaction.

3) Write the role of CPU Virtualization

The key to Virtualize a CPU lies in the execution of the guest instruction, including both System-level and User level instruction Virtualizing a CPU can achieved in one two ways.

1) Emulation the only processor virtualization Mechanism available when the ISA of guest is different from ISA

driver owns in Domain
of the guest OS. The backend driver owns in Domain 0
is responsible for managing the real I/O devices.
--. lets the VM access

2) Direct native execution : Possible only if the ISA of host is identical to the ISA of the guest.

4) Define Virtual Cluster.

Virtual cluster are built with VMs. installed at one or more physical address clusters the VMs in a virtual cluster are interconnected by a virtual network across several physical network.

5) How is OS Virtualization is implemented.

Operating System level Virtualization provides feasible solution for hardware level Virtualization issues inserts a Virtualization layer inside an OS to part a machines physical resources.

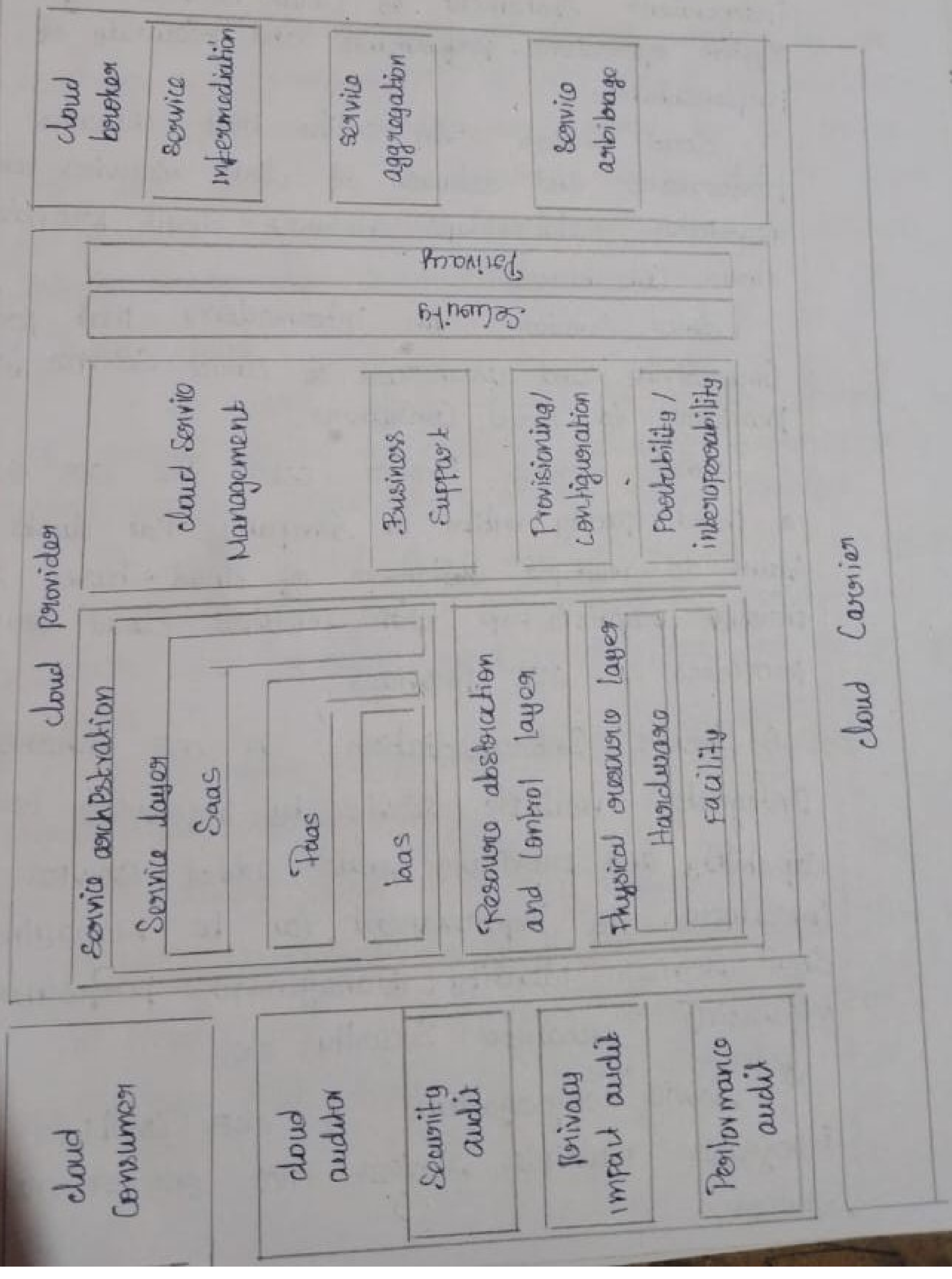
This means a virtual execution environment has own set of process file System, User account network interfaces with IP address, mounting firewall rules etc,..

PART - B

1) Draw & explain about NIST cloud reference Model.

NIST cloud computing reference architecture. It defines five major actors: cloud consumer, cloud provider, cloud carrier, cloud auditor and cloud broker.

Each actor is an entity (organization) that participates in a transaction or process and/or performs tasks in cloud computing.



...d driver ouns in Domain 0

cloud Consumer : A person or organization that maintains a business relationship with and uses services from cloud providers.

cloud provider : A person, organization, or entity responsible for making a service available to interested Parties.

cloud auditor : A party that can conduct independent Statement of cloud Services, information System operations, performance and Security of the cloud implementation.

cloud broker : An entity that manages the use, performance and delivery of cloud services and negotiates relationships between cloud providers and cloud Consumers.

cloud Carrier : An intermediary that provides Connectivity and transport of cloud Services from cloud providers to cloud Consumers.

cloud Services Broker (CSB) : The CSB is typically a third-party entity or company that looks to extend Value to multiple customers of cloud-based Services through relationship with multiple cloud service providers. A CSB provides :

1) Service Intermediation : A CSB enhance and Integrates multiple servic by improving some specific capability and providing value-added Services to cloud Consumers. The improvement can be Managing access to cloud Services. Identity Management, performance reporting, enhanced Security, etc.

2) Sevice aggregation : A CSB combines and integrates multiple Services into one or more new Services.

2. Para - V[illegible] method of I/O virtualization is taken up since software emulation runs slower than the hardware it emulates. In para-virt the frontend driver runs in Domain-U; it manages the request & [illegible] driver runs in Domain-0

3. Service arbitrage: Service arbitrage is similar to service aggregation except that the services being aggregated are not fixed. services arbitrage means a broker has the flexibility to choose services from multiple agencies.

a) Discuss the various cloud services deployment models with neat sketch.

cloud deployment models are refers to the location and Management of the clouds infrastructure.

Deployment models are defined by the ownership and control of architectural design and the degree of available customization. cloud deployment models are private public and community clouds

1. Public cloud:

=> The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

=> public cloud is a huge data centre that offers the same services to all its users. The services are accessible for everyone and much used for the consumer segment.

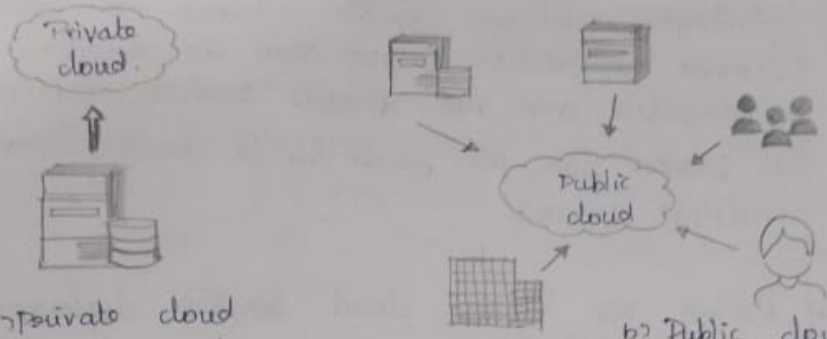
=> Examples of Public services are facebook, Google and LinkedIn.

=> Public cloud benefits:

a) low investment hurdle: pay for what user use.

b) Good. test / development environment for applications that scale to many servers.

2. Para - V[illegible] method of I[illegible] VZ as [illegible]
up Since Software emulation runs [illegible] than the hardware it emulates. In Para - VZ the frontend driver runs in Domain - U ; it manages the request [illegible] driver runs in Domain-0



a) Private cloud b) Public cloud

Cloud Deployment model.

Public cloud risks

a) Security Concerns : Multi-tenancy and transfers over the Internet.

b) IT Organization may react negatively to loss of control over data centre function.

2. Private cloud :-

=> The cloud infrastructure is operated solely for a single Organization. It may managed by the Organization or a third party and may exist on-premises, off-premises.

=> Private cloud benefits:

a) Fewer Security Concerns as existing data Center Security stays in place.

b) IT Organization retains control over data center.

=> Private cloud risks:

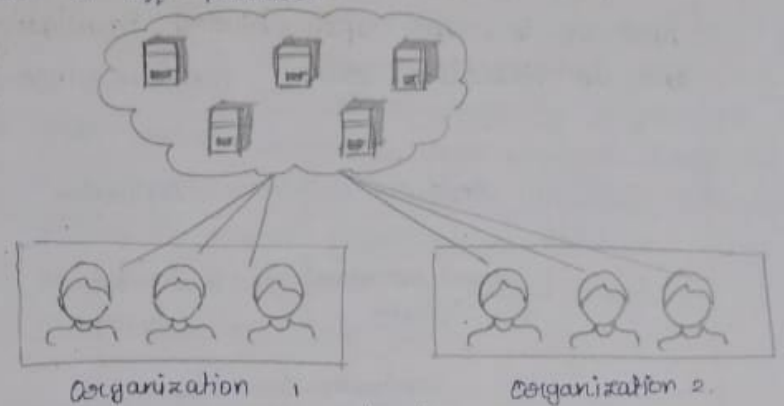
a) High investment hurdle in private cloud implementation, along with purchase of new hardware and Software.

b) New Operational processes are required : old processes not all suitable private cloud.

2. Para - V[illegible] method of I[illegible] VZ is taken up since Software emulation runs [illegible] than the [illegible] in case - VZ the frontend

3. Community cloud :

☆ The cloud infrastructure is shared by several Organizations and supports a specific community that has shared concerns (e.g. mission, security requirement, Policy compliance considerations) It may be managed by the Organizations or a Party and may exist on-premises or off-premises



Community cloud.

4. Hybrid cloud :

☆ The cloud infrastructure is a composition of two or more clouds (private, community or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application Portability

☆ Benefits :-

a) Operational flexability

b) Scalability.

☆ Risks :-

a) Hybrid Clouds are still being developed, not many in real use.

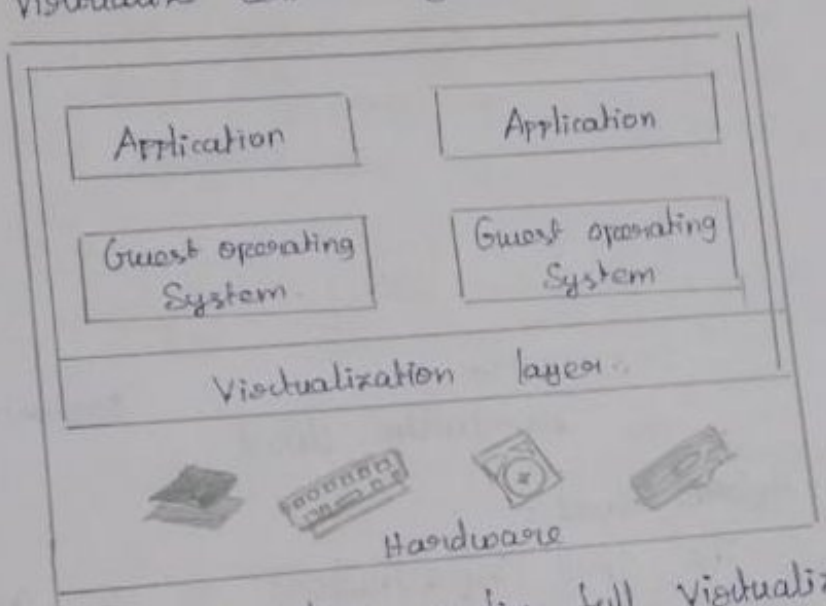
b) Control of security between private and public clouds. Some of same concerns as in public cloud.

In the Software, which itself is located in the VMM and act as a Virtual device.

3) Compare fuller virtualization, para virtualization and debit the process of virtualization cpu, memory, input, output devices, full virtualization. 5

FULL VIRTUALIZATION:

Full virtualization doesn't need to modify the host OS. it relies upon binary translation to trap and to virtualize certain sensitive instructions



=> VMware workstation applies full virtualization, which uses binary translation, mostly x86 s/w on-the-fly to replace critical instruction.

=> Normal instructions can run directly on the host OS. This is done to increase performance overhead. normal instructions are carried out in the normal manner. but the difficult and privacy sensitive are first discovered using a trap and execute in a virtual manner.

=> This is done to improve the security of the system and also to increase the performance.

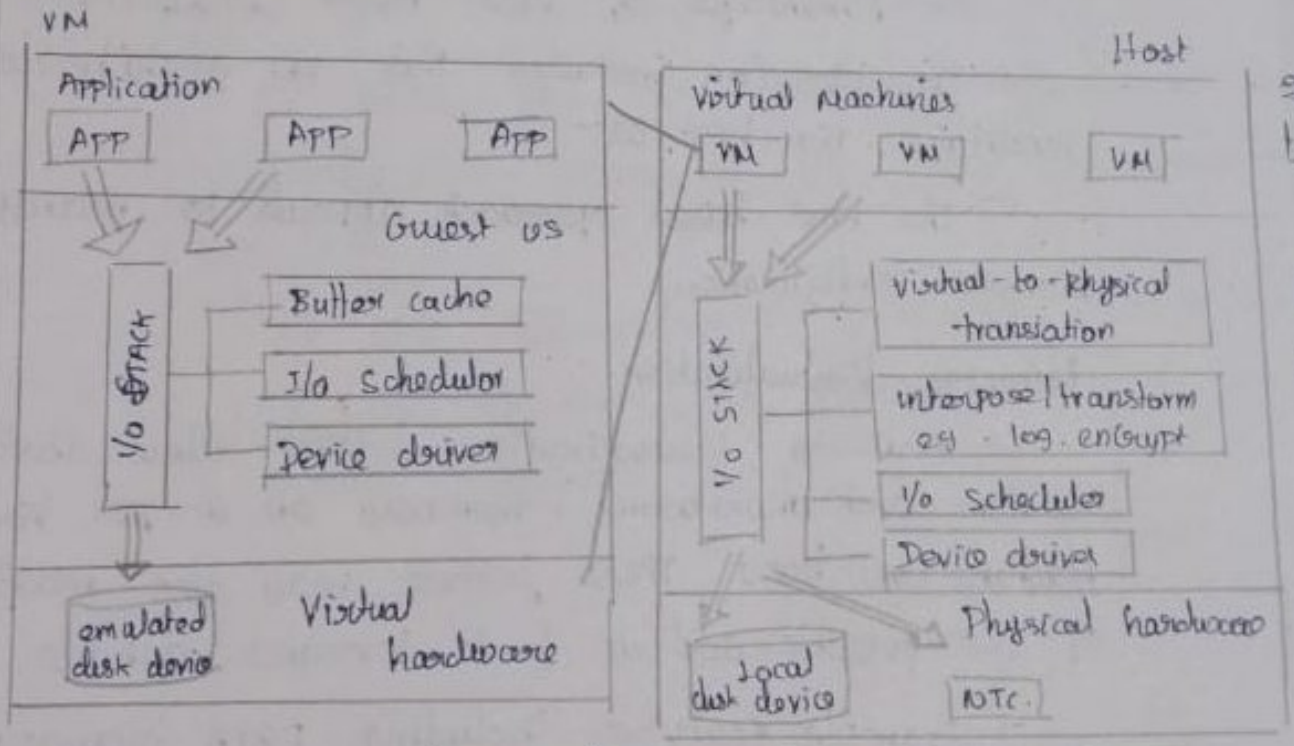
I/o Virtualization :

=> I/o Virtualization involves managing of the routing of I/o request b/w virtual devices and shared physical hardware

=> The VMM is responsible for mapping the guest physical memory to the actual machine memory

=> There are three ways to implement this are full device emulation, para VX and direct I/o.

=> I/o Virtualization features facilitate offloading of multi-core packet processing to network adapters as well as direct assignment of virtual machine to virtual functions, including disk I/o.



=> Example include Virtual Machine Device Queue (VMDQ), Single Root : I/o Virtualization.

(1) Full Device Emulation : This process emulates well-known and real-world devices. All the function of a device or bus infrastructure such as device enumeration, identification, interrupts etc. are replicated in the software, which itself is located in the VMM and act as a Virtual device.

2. Para-V[illegible] method of [illegible] VX is taken up Since Software emulation runs [illegible] than the hardware it emulates. In para-VX the frontend [illegible] it manages the request

Host based Virtualization:

=> Virtualization implemented in a host Computer rather than in a Storage subsystem or storage appliance.

=> Virtualization can be implemented either in host Computers, in Storage subsystem or storage appliances, or in specific Virtualization appliances in the inter Connect fabric.

=> The guest OS are installed and run on top of the virtualization layer. Dedicated applications may run on the VMs. Certainly, some other applications can also with the host OS directly.

=> Advantages of host-based architecture.

1) The User can installed this VM architecture w/o modifying the host OS.

2) The host based approach appeals to many host machine Configuration.

Memory Virtualization:

=> Memory Virtualization feature allow abstraction isolation and monitoring, memory on a per Virtual Machine (VM) basis. These feature may also make migration of VMs possible, add do fault tolerance, enhance security.

=> Example features including DMA remapping, Page Tables, including their extensions accessed and dirty bits

=> The VMkernel Manages all machine memory.

=> Virtual Machines use machine memory for two purposes

=> When physical Memory is full, the data for Virtual pages that are not present in physical memory are stored on disk.

2. Para-Virtualization: This method of I/O Vz is taken up since Software emulation runs slower than the hardware it emulates. In Para-Vz the frontend driver runs in Domain-U; it manages the request of the guest OS. The backend driver runs in Domain-0 and is responsible for managing the real I/O devices.

3. Direct I/O Virtualization: This lets the VM access devices directly; achieves high performance with lower costs. Currently, it is used only for the mainframe.

Virtualization of CPU

=> Certain Processors such as Intel VT provide hardware assistance for CPU Virtualization.

=> When using this assistance, the guest can use a separate mode of execution called guest OS.

=> On certain events, the processor exist out of guest mode and enters root mode.

=> When you use hardware assistance for Virtualization, there is no need to translate the code.

=> CPU Virtualization features enable faithful abstraction of the full process of Intel CPU to a virtual machine.