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at
Sathyabama Institute of Science and
Technology (Deemed to be University)

Submitted in partial fulfillment of the requirements for
the award of Bachelor of Engineering Degree in
Information Technology

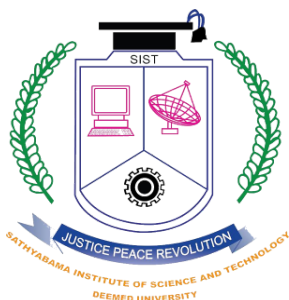
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **S.MANIKKAM (40120053)** who carried out the Project Phase-1 entitled **"Virtualization Types in Cloud Computing"** under my supervision from January 2023 to April 2023.

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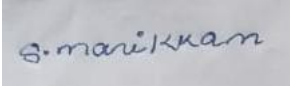
I, **S MANIKKAM** hereby declare that the project report entitled PRIDE done by me under the guidance of **Dr.R.JEBERSON RATNA RAJ,M.Tech.,Ph.D** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering Degree in Information Technology.

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SIGNATURE OF THE CANDIDATE

A rectangular box containing a handwritten signature in blue ink that reads "S. Manikkam".

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management of SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

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I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Information Technology** who were helpful in many ways for the completion of the project

TRAINING CERTIFICATE

ABSTRACT

Cloud computing, the technology that makes it possible for computing sources to be provisioned to clients / subscribers over long distances, as well as its component technology – virtualization, which makes it possible for multiple guest systems to co-reside on a single host machine and share the computing resources of the host, have both become very popular technologies that have witnessed giant improvements in the 21st century.

Virtualization in computing is creation of virtual (not real) of virtual something such as hardware, software, platform or a operating system or a storage or a network device [8]. In a virtualized environment IT enterprise has to manage many changes as the changes occur more quickly in virtual environment than in a physical environment. Because of virtualization clouds are scalable and agile.

This is a review paper that presents an overview of the virtualization and its types, to what they have today, about virtualization types of cloud computing.

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LIST OF ABBREVIATIONS

ABBREVIATION	EXPANSION
VM	VIRTUAL MACHINE
IT	INFORMATION TECHNOLOGY
SaaS	SOFTWARE AS A SERVICE
DV	DATA VIRTUALIZATION
NAS	NETWORK ATTACHED STORAGE
SAN	STORAGE AREA NETWORK
WAN	WIDE AREA NETWORK
LAN	LOCAL AREA NETWORK
UML	UNIFIED MODELING LANGUAGE
ROI	RETURN ON INVESTMENT
VME	VIRTUAL MACHINE ENVIRONMENT
VMM	VIRTUAL MACHINE MANAGEMENT
API	APPLICATION PROGRAMMING INTERFACE

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CHAPTER 1

INTRODUCTION

1.1 VIRTUALIZATION:

- Virtualization is a technique, which allows to share single physical instance of an application or resource among multiple organizations or tenants (customers).
- It does so by assigning a logical name to a physical resource and providing a pointer to that physical resource on demand.



Fig1.1 virtualization

- The term 'Virtualization' can be used in many respect of computer.
- It is the process of creating a virtual environment of something which may include hardware platforms, storage devices, OS, network resources, etc.
- One example of a virtualization program is called hypervisor, which can

virtualizes desktops, application, network components and storage.

VIRTUALIZATION PROS AND CONS:



Fig 1.2 pros and cons of virtualization

PROS	CONS
1. Uses hardware efficiently.	1. High initial investment
2. Available at all times.	2. Data can be at risk
3. Recovery is easy.	3. Quick scalability is a challenge
4. Quick and easy setup	4. performance witnesses a dip
5. Cloud migration is easier	5. Rapid deployment

Tab 1.1 virtualization pros and cons

CHAPTER 2

TYPES OF VIRTUALIZATION:

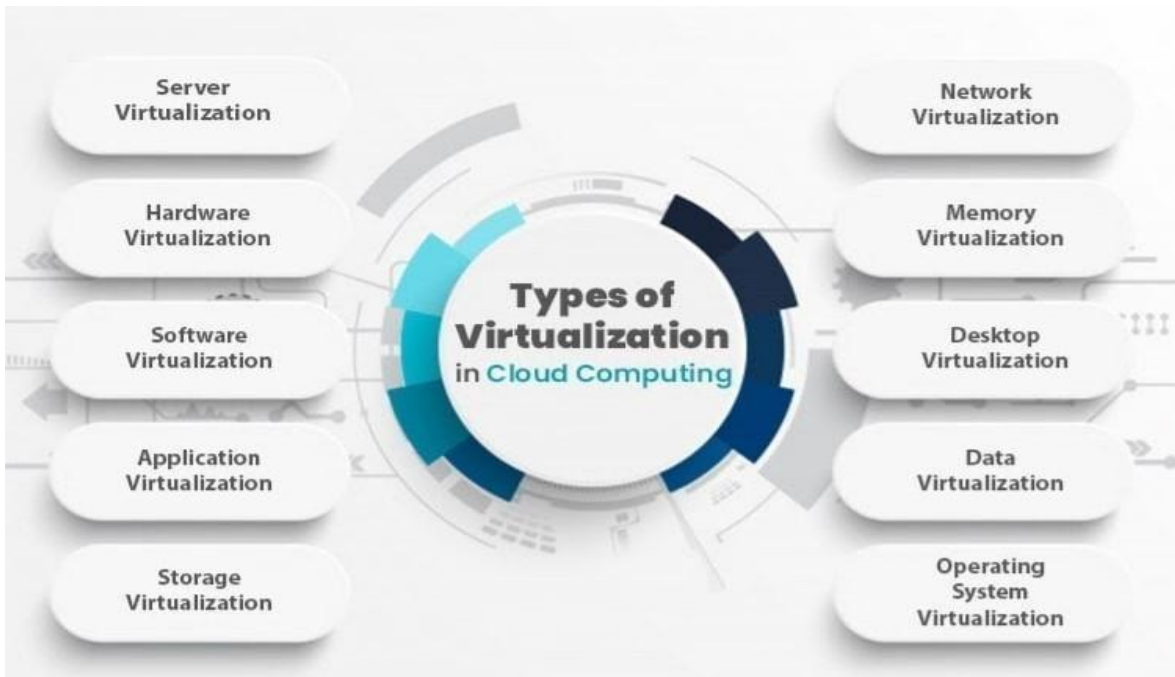


Fig 2.0 Types of virtualization

HARDWARE VIRTUALIZATION:

- Hardware virtualization is a type of virtualization; it is the abstraction of computing resources from the software that uses cloud resources
- Hardware virtualization refers to the creation of virtual versions of computers and operating system.
- Hardware virtualization has many advantages because controlling virtual machines is much easier than controlling a physical server.
- In Hardware virtualization software called hypervisor is used.
- Hypervisor relies on command set extensions in the processors to accelerate common virtualization tasks for improving the performance.
- If hardware virtualization is done for server platforms, then it is called server virtualization.



Fig:2.1 Benefits Hardware

TYPES OF HARDWARE VIRTUALIZATION:

There are various type of hardware virtualization

1. Full virtualization
- 2 .Emulation virtualization
3. Para-virtualizati

on FULL

VIRTUALIZATION:

- In full virtualization, the hardware architecture is completely simulated.
- Guest software doesn't require any change to run applications.
- Full virtualization is a virtualization technique used to provide a VME that completely simulates the underlying hardware. In this type of environment, any software capable of execution on the physical hardware can be run in the VM, and any OS supported by the underlying hardware can be run in each individual VM.
- In full virtualization, the VM simulates enough hardware to allow an unmodified guest OS to be run in isolation.

- The hypervisor provides each VM with all the services of the physical system, including a virtual BIOS, virtual devices, and virtualized memory management.
- Full virtualization offers the best isolation and security for VMs and simplifies migration and portability as the same guest OS instance can run on virtualized or native hardware.

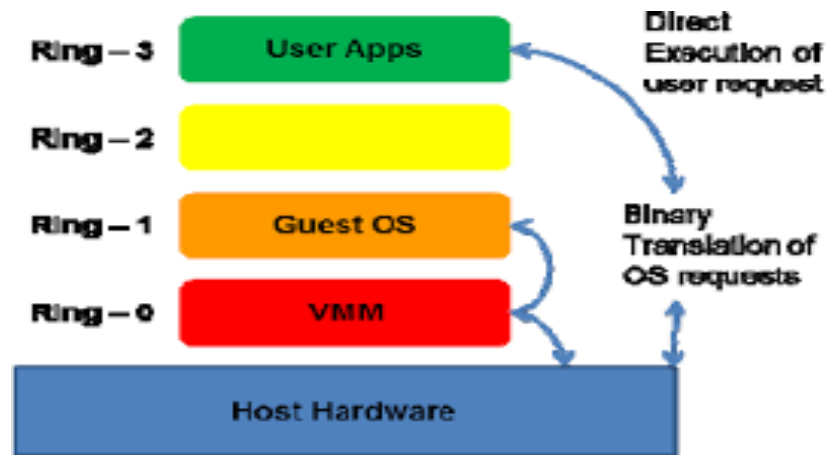


Fig:2.1.1 Full virtualization

KEY BENEFITS OF FULL VIRTUALIZATION:

- The emulation layer isolates VMs from the host OS and from each other.
- It controls individual VM access to system resources .
- prevents an unstable VM from impacting system performance.

EMULATION VIRTUALIZATION:

- The virtual machine simulates the hardware, and the guest operating system does not require any hardware.
- Emulation Virtualization. In emulation virtualization, hardware simulates by the virtual machine and it is independent.
- The guest operating system does not require any other modification.
- In this virtualizations, computer hardware as architectural support builds and manages a fully virtualized VM.

Emulation Virtualization

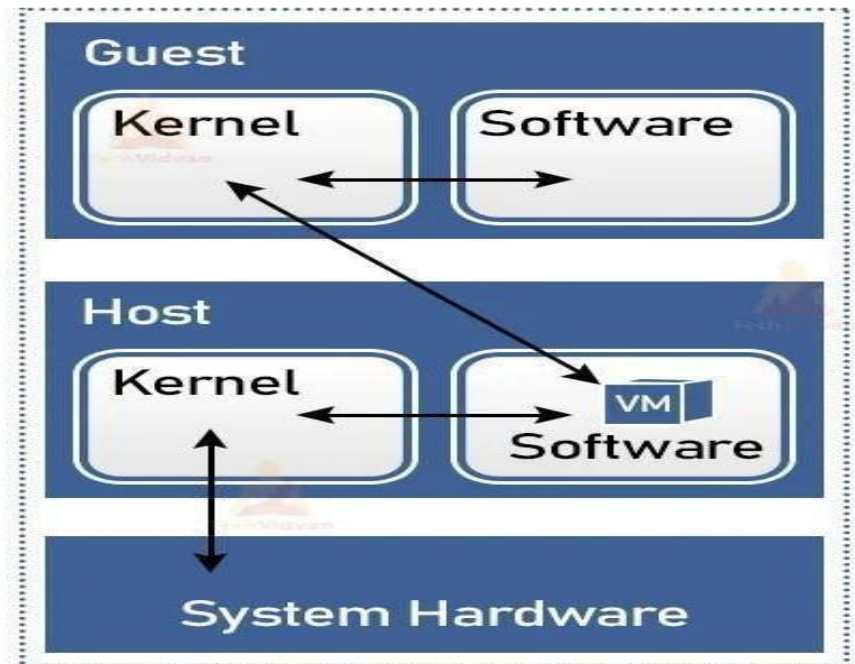


Fig:2.1.2 Emulation virtualization

PARA VIRTUALIZATION:

- In Para-virtualization, the hardware is not simulated; rather the guest software runs its isolated system
- Para virtualization is an enhancement of virtualization technology in which a guest OS is modified prior to installation inside a virtual machine (VM) in order to allow all guest OS within the system to share resources and successfully collaborate, rather than attempt to emulate an entire hardware environment.

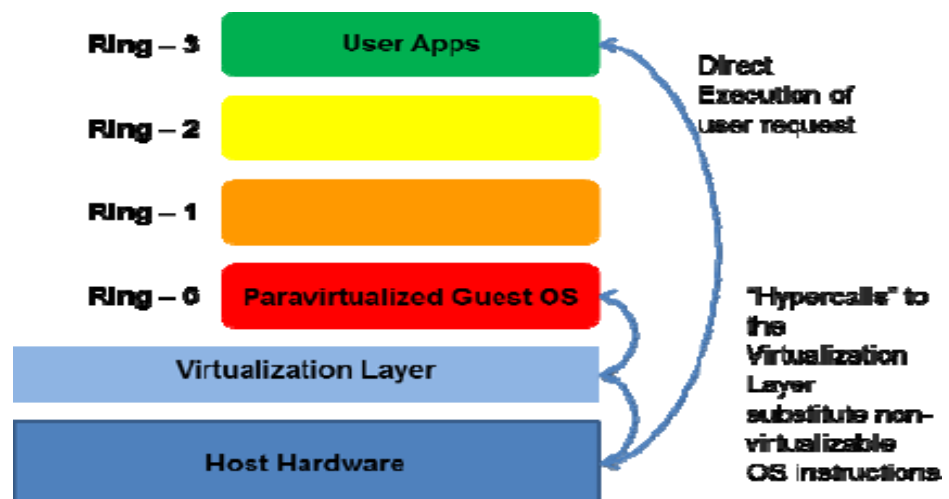


Fig:2.1.3 Para Virtualization

KEY BENEFITS OF PARA VIRTUALIZATION:

- The guest system comes closer to native performance than a fully virtualized guest
- It does not require the latest virtualization CPU support.
- It also allows for an interface to the virtual machine that can differ somewhat from that of the underlying hardware.

ADVANTAGES OF HARDWARE VIRTUALIZATION:

1. EFFICIENT RESOURCE VIRTUALIZATION:

In hardware virtualization, physical resources can be shared among virtual machines. In this, if there is need for unused resources allocated by one virtual machine can be used by another virtual machine.

2 . INCREASE IT FLEXIBILITY:

By using virtualization, the fast development of hardware resources became possible.

3. LOW COST:

Due to server consolidation, the cost is low, and multiple operating systems can exist in a single hardware.

4. ADVANCED HARDWARE VIRTUALIZATION FEATURES:

With the advancement of modern hypervisor, more difficult operations maximize the abstraction of hardware and ensure maximum

Update and this technique help to change an ongoing virtual machine from one host to another host dynamically.

SOFTWARE VIRTUALIZATION:

- Software virtualization is also called application virtualization.
- Software virtualization is the same as virtualization but can abstract the software installation procedure and create virtual software installations.
- Example: VMware software, virtual box, etc.
- Most of the applications and their distributions became difficult tasks for IT firms and departments.
- The mechanism for installing an application varies.
- So to solve this type of problem, virtualized software is introduced,

which is an application that will be installed into its self- contained unit and provide software virtualization.

ADVANTAGES OF SOFTWARE VIRTUALIZATION:

1 .CLIENT DEPLOYMENT BECAME EASIER:

We can easily install virtual software by copying a file to a work station or linking a file in a network.

2 . EASY TO MANAGE:

Software virtualization is easy to maintain. You only need to update at one place and deploy the virtual update application to all cloud.

3. SOFTWARE MIGRATION:

Without software virtualization, moving from one software platform to another platform takes more time for deploying and impact on an end-user system with the support of virtualized software environment support the– migration became easier.

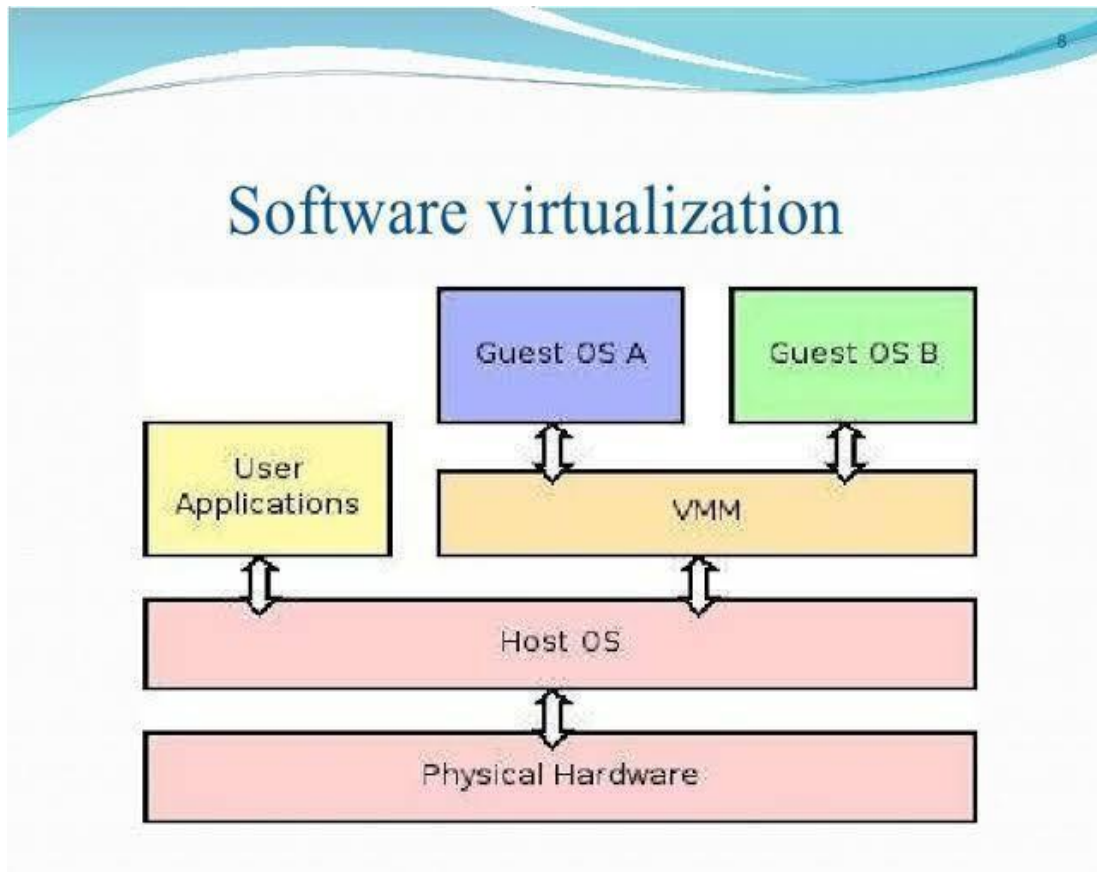


Fig:2.2 software virtualization

SERVER VIRTUALIZATION:

- Server virtualization is used to mask server resources from server users.

- This can include the number and identity of operating systems, processors, and individual physical servers
- 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 server can run its own operating systems independently.

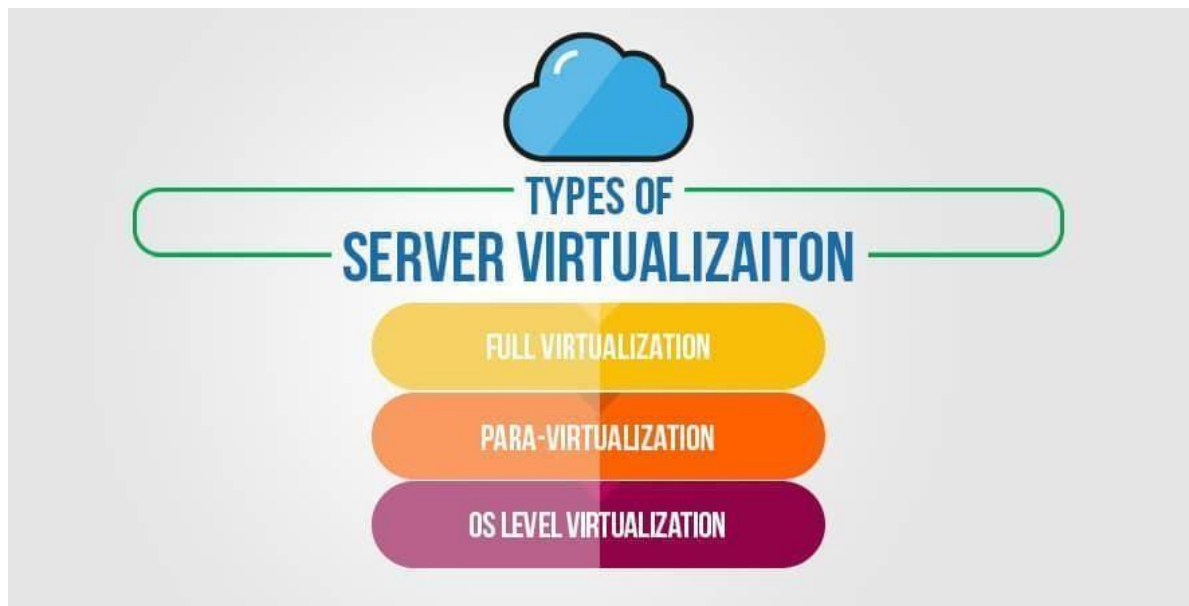


Fig :2.3 server virtualization

TYPES OF SERVER VIRTULIZATION:

- 1.Full virtualization
- 2.para virtualization
- 3.os level virtualization

1. FULL VIRTUALIZATION:

- Full virtualization uses a hypervisor, a type of software that directly communicates with a physical server's disk space and CPU.
- The hypervisor monitors the physical server's resources and keeps each virtual server independent and unaware of the other virtual servers.
- It also relays resources from the physical server to the correct virtual server as it runs applications.

- The biggest limitation of using full virtualization is that a hypervisor has its own processing needs.
- This can slow down applications and impact server performance.

2. PARA –VIRTUALIZATION:

- Unlike full virtualization, para-virtualization involves the entire network working together as a cohesive unit.
- Since each operating system on the virtual servers is aware of one another in para-virtualization, the hypervisor does not need to use as much processing power to manage the operating systems.

3. OS-LEVEL VIRTUALIZATION:

- Unlike full and para-virtualization, OS-level visualization does not use a hypervisor. Instead, the virtualization capability, which is part of the physical server operating system, performs all the tasks of a hypervisor. However, all the virtual servers must run that same operating system in this server virtualization method.

KEY BENEFITS OF SEVER VIRTUALIZATION:

- Higher server ability
- Cheaper operating costs
- Eliminate server complexity
- Increased application performance
- Deploy workload quicker

THE PRIMARY USES OF SERVER VIRTULIZATION:

- To centralize the server administration
- Improve the availability of server
- Helps in disaster recovery
- Ease in development & testing
- Make efficient use of server resource

OS LEVEL VIRTUALIZATION:

- Operating system virtualization is a part of virtualization technology and is a type of server virtualization.
- Operating system virtualizations includes a modified form than a normal operating system so that different users can operate its end use different applications. This whole process shall perform on a single computer at a time.
- In OS virtualizations, the virtual eyes environment accepts command from any of the user operating it and performs different task on the same

machine by running different applications.

- In operating system virtualizations when the application does not interfere with another one even though they are functioning in the same computer.
- The kernel of an operating system allows more than one isolated user-space instance to exist. These instances call as software containers, which are virtualizations engines.

HOW OPERATING SYSTEM VIRTUALIZATION WORKS:

- The operating system of the computer manages all the software and hardware of the computer. With the help of the operating system, several different computer programs can run at the same time.
- This is done by using the CPU of the computer. With the combination of few components of the computer which is coordinated by the operating system, every program runs successfully.

TYPES OF OS VIRTUALIZATION:

1. Linux os virtualization
2. windows os virtualization

LINUX OS VIRTUALIZATION:

- VMware Workstation software is used to virtualize Linux systems. In addition, to install any software by the means of virtualization the user will need VMware software to install first.

WINDOWS OS VIRTUALIZATION:

- This type of virtualization is also similar to the above to install any software there is a need to install VMware software firstly.

VIRTULAL MACHINENMODEL:

- Are based on host-guest paradigm, where each guest runs on a virtual replica of hardware layer.
- This technique of virtualization provides guest OS to run

without modification.

- However, it requires real computing resources from the host and for this a hypervisor or VM is required to coordinate instructions to CPU

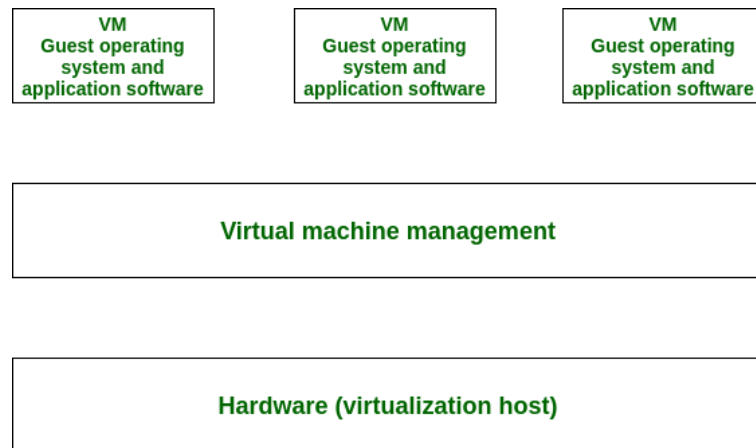


Fig:2.3.1 virtual machine model

PARA-VIRTUALIZATION MODEL:

- Is also based on host-guest paradigm & uses virtual machine monitor too.
- In this model the VMM modifies the guest operating system's code which is called 'porting'. Like that of virtual machine, similarly the Para-virtual machine is also capable of executing multiple operating systems.
- The Para-virtual model is used by both Xen & UML

OPERSTING SYSTEM VIRTUALIZATION:

- Virtualization at OS level functions in a different way and is not based on host-guest paradigm.
- In this model the host runs a single operating system kernel as its main/core and transfers its functionality to each of the guests.
- The guest must use the same operating system as the host.
- This distributed nature of architecture eliminated system calls between layers and hence reduces overhead of CPU usage.
- It is also necessary that each partition remains strictly isolated from its neighbors because any failure or security breach of one partition will not be able to affect the other partitions.



OS-Level Virtualization

- OS-level virtualization
 - kernel of an OS allows for multiple isolated user-space instances, instead of just one.
 - Each OS instance looks and feels like a real server
- OS virtualization virtualizes servers on the operating system (kernel) layer. This creates isolated containers on a single physical server and OS instance to utilize hardware, software, data center and management efforts with maximum efficiency.
- OS-level virtualization implementations that are capable of live migration can be used for dynamic load balancing of containers between nodes in a cluster.

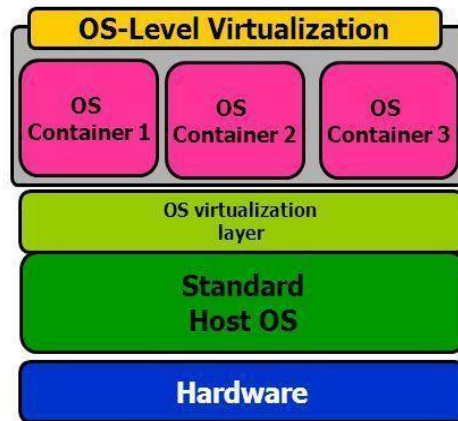


Fig :2.4 os system virtualization

ADVANTAGES OF OS VIRTUALIZATION:

- Operating system virtualizations eliminates the use of physical space which utilizes by the IT system.
- As everything is virtual it will require less space and hence it will save money. As there is no hardware required the maintenance will be less and therefore it will save both time and money.
- The number of Machines will be late so there will be lower power consumption, lower cooling requirement, low maintenance, and more electricity saving
- It also allows the companies to make enhancement in terms of efficiency to use the server hardware and thus there is a greater return on investment (ROI) on the purchase and greater operational works.
- Operating system virtualizations has quick deployment capability and the traditional environment in the traditional deployment every machine needs to load individually which is not a problem in operating system virtualization.

USES OF OPERATING SYSTEM VIRTUALIZATION:

- Operating System Virtualization uses to integrate server hardware by moving services on separate servers.
- It providing security to the hardware resources which harm by distrusting users.
- OS Virtualization uses for virtual hosting environment.
- It can separate several applications into containers.

STORAGE VIRTUALIZATION:

- Storage virtualization in Cloud Computing is nothing but the sharing of physical storage into multiple storage devices which further appears to be a single storage device.
- It can be also called as a group of an available storage device which simply manages from a central console.
- This virtualization provides numerous benefits such as easy backup, achieving, and recovery of the data.
- This whole process requires very less time and works in an efficient manner.
- Storage virtualization in Cloud Computing does not show the actual complexity of the SAN.
- This virtualization is applicable to all levels of SAN.

WHY STORAGE VIRTUALIZATION SHOULD BE IMPLEMENTED:

- If this virtualization implements in IT environment it will improve the management of the storage. As each and everything will properly store and manage there won't be any congestion and the task will perform quickly.
- There will be very less downtime as the storage availability is better. All these problems eliminate with the help of an automated management system.
- Storage virtualization will provide better storage utilization as storing most information in a particular place can cause loss of data, congestion, and any other problems. So, properly dividing storage and storing data can be useful.

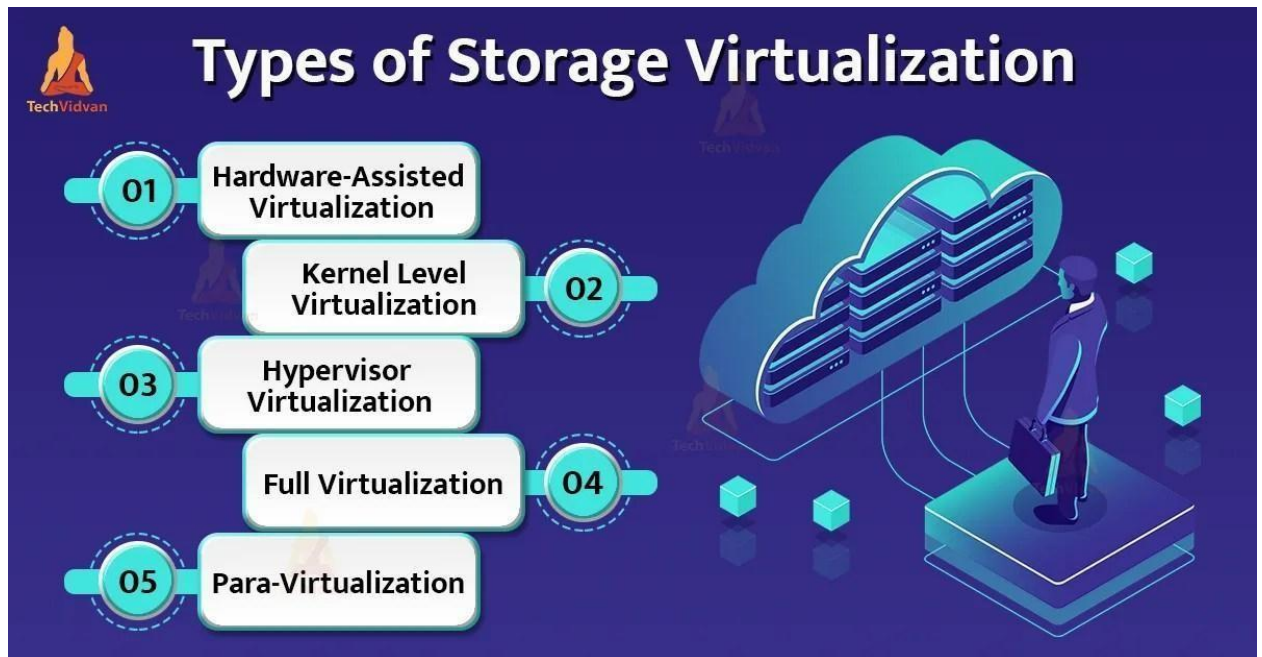


Fig:2.5 storage virtualization

TYPES OF STORAGE VIRTUALIZATION:

- Hardware Assisted Virtualization
- Kernel Level Virtualization
- Hypervisor Virtualization
- Para-Virtualization
- Full Virtualization

1.HARDWARE ASSISTED VIRTUALIZATION:

- This type of virtualization requires hardware support.
- It is similar to full Para-virtualization. Here, the unmodified OS can run as hardware support for virtualization and we can also use to handle hardware access requests and protect operations.

2. KERNEL LEVEL VIRTUALIZATION:

- It runs a separate version of the Linux Kernel.
- Kernel level allows running multiple servers in a single host.
- It uses a device driver to communicate between main Linux Kernel and the virtual machine.
- This virtualization is a special form of Server Virtualization.

3. HYPERVISOR VIRTUALIZATION:

- A hypervisor is a layer between the Operating system and hardware.

- With the help of hypervisor multiple operating systems can work.
- Moreover, it provides features and necessary services which help OS to work properly.

4.PARA-VIRTUALIZATION:

- It is based on hypervisor which handles emulation and trapping of software.
- Here, the guest operating system is modified before installing it to any further machine.
- The modified system communicates directly with the hypervisor and improves the performance.

FULL VIRTUALIZATION:

- This virtualization is similar to Para-Virtualization
- . In this, the hypervisor traps the machine operations which is used by the operating system to perform the operations
- . After trapping the operations, it emulates in particular software and the status codes returned.

STORAGE VIRTUALIZATION PROS AND CONS:

PROS	CONS
1.Less energy use	1.often violates licensing agreements
2.More disk space	2.The network system is much more complicated
3.Increased loading and backup speed	3.If one system fails, they all fail
4.cost effective in terms of not having to purchase as much additional software.	4.If one server is infected or breached, the entire network is compromised.

Tab 1.2 storage virtualization pros and cons

METHODS OF STORAGE VIRTUALIZATION:

1. FILE-BASED STORAGE VIRTUALIZATION:

- This type of virtualization is used for a specific purpose and can apply to NAS system.

- File-based storage virtualization in Cloud Computing utilizes server message block or network file system protocols and with its help of it breaks the dependency in a normal network attached storage array.
- This is done between the data being accessed and the location of the physical memory.
- It also provides a benefit of better handling file migration in the background which improves the performance.

2. BLOCK-BASED VIRTUAL STORAGE:

- The Block based virtual storage is more widely used than the virtual storage system as the virtual storage system is sometimes used for a specific purpose.
- The block-based virtual storage system uses logical storage such as drive partition from the physical memory in a storage device.
- It also abstracts the logical storage such as a hard disk drive or any solid state memory device.
- This also allows the virtualization management software to get familiar with the capacity of the available device and split them into shared resources to assign.

WHY STORAGE VIRTUALIZATION IS IMPORTANT:

1.PERFORMS TASKS:

- The appliances of storage virtualization are responsible for several tasks such as heterogeneous replication and federation.
- These devices lineup in front of arrays and create a common interface for the host.
- This allows the administrator to mix and match the protocols and array which are behind the appliances

2. WAN MANAGEMENT:

- It does not send multiple copies of the similar data over WAN.
- The WAN accelerator use to cache the data and send it LAN speed without changing the performance of WAN.

3. DISASTER RECOVERY:

- Storage virtualization in Cloud Computing can increase disk utilization and is flexible.
- This ameliorates disaster recovery and the continuity of the business.

3. STORAGE TIERING:

- Storage tiering is a technique which monitors and selects the most commonly used data and put it on its highest performing storage pool.
- The least used data is put in the weakest performance storage pool

HOW STORAGE VIRTUALIZATION APPLY:

- Host-Based
- Network-Based
- Array-Based

1. HOST BASED STORAGE VIRTUALIZATION:

- All the virtualizations and management is done at the host level with the help of software and physical storage, it can be any device or array.
- The host is made up of multiple hosts which present virtual drives of a set to the guest machines. Doesn't matter whether they are VMs in an enterprise or PCs.

2. NETWORK-BASED STORAGE VIRTUALIZATION:

- Network-based storage virtualization is the most common form which are using nowadays.
- Devices such as a smart switch or purpose-built server connect to all the storage device in a fiber channel storage network and present the storage as a virtual pool.

3. ARRAY-BASED STORAGE VIRTUALIZATION:

- Here the storage array provides different types of storage which are physical and used as storage tiers.
- The software is available which handles the amount of storage tier made up of solid-state drives hard drives.

NETWORK VIRTUALIZATION:

- Network virtualization abridges the network resources by logically aggregating numerous physical resources into a single virtual, software-based network.
- Also, it can partition one physical network into multiple independent networks.

- Network virtualization operates through third-party software that enables network administrators to transfer virtual machines across numerous domains with no need to reconfigure the network.
- Additionally, this software formulates an overlay that generates separate virtual network layers on top of the same physical network structure.
- The software aggregates the available resources in a network and split the bandwidth into different channels isolated from each other
- . Henceforth, those channels can be assigned or reassigned to a particular server or virtual machine (VM).
- It enables the users to access all the resources on a network from a single device.

TOOLS FOR VIRTUALIZATION IN CLOUD COMPUTING:

1. Physical Switch OS where the OS functions as an implementer of network virtualization.
 2. Hypervisor which is third-part software that programmatically creates, provisions, and manages networks.
- The function of OS is to provide the application with a group of instructions. On the other hand, the hypervisor creates a virtual switch and, thereafter, configure the virtual networks on it.

TPYES OF NETWORK VIRTUALIZATION IN CLOUD COMPUTING :

Mainly, there are two types of network virtualization:

- Internal Virtualization
- External Virtualization

INTERNAL NETWORK VIRTUALIZATION :

- A virtualized internal network is a network that is limited to only one machine. It is essentially built to improve the efficiency of the network.
- It enables VMs to interchange data in an environment with no need to use an external network.

EXTERNAL NETWORK VIRTUALIZATION:

- In external network virtualization, the virtual network contains at least one local network or the local network itself is split into virtual networks.
- It aims at improving the proficiency of the big data center networks utilized by corporate or enterprises.
- Virtualizing networks externally enables administrators to configure any systems attached to an equivalent local network.

- By utilizing tools switches and adapters, administrators can join systems attached to another local network into other spanning portions of a big network.

BENEFITS OF NETWORK VIRTUALIZATION IN CLOUD COMPUTING: :

- Generally, network virtualization enables businesses and corporate to take advantage of higher speed and enhanced agility and security.
- It automates and simplifies numerous processes and operations that run and manage networks and security in data centers on the cloud.

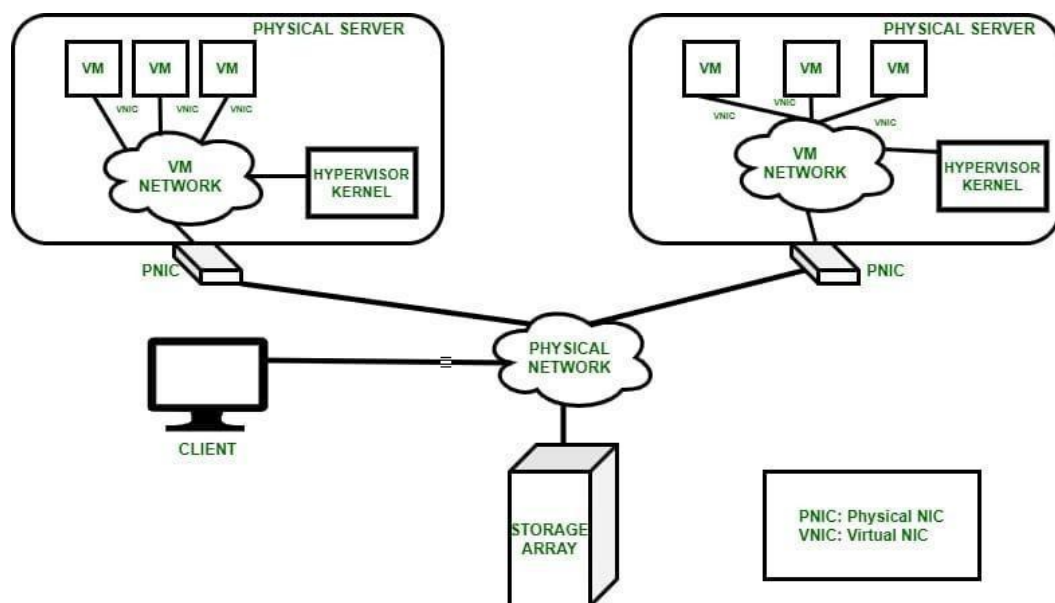


Fig:2.6 network virtualization

ADVANTAGES OF NETWORK VIRTUALIZATION IN CLOUD COMPUTING:

- Minimizing the time spent in network provisioning weeks to a few minutes.
- Enhancing the efficiency of operations by automating and streamlining manual processes.
- Positioning and migrating workloads in isolation from the physical topology.
- Achieving the utmost security with the data center.

MEMORY VIRTUALIZATION:

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

- It enhances performance by providing greater memory capacity without any addition to the main memory. That's why a portion of the disk drive serves as an extension of the main memory

IMPLEMENTATIONS

:

1.APPLICATION LEVEL INTEGRATION:

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

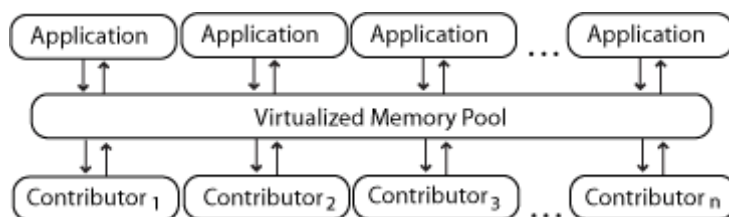


Fig:2.7 ALI

2. OPERATING SYSTEM LEVEL INTEGRATION:

The operating system first connects to the memory pool and makes that pooled memory available to applications.

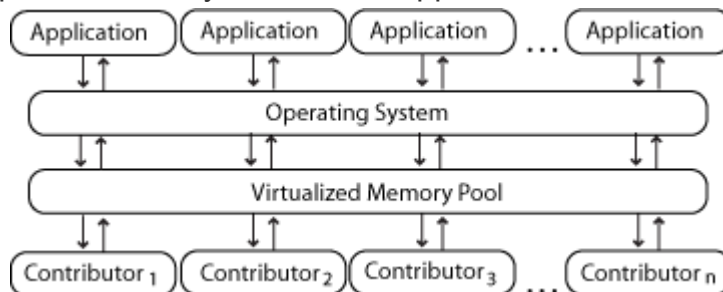


Fig:2.7.1 OSLI

DESKTOP VIRTUALIZATION:

- It provides work convenience and security.
- As one can access remotely, you are able to work from any location and on any PC
- It provides a lot of flexibility for employees to work from home or on the go.
- It also protects confidential data from being lost or stolen by keeping it safe on central servers.



Fig:2.8 Desktop virtualization

DATA VIRTUALIZATION:

- Data virtualization is the process of retrieve data from various resources without knowing its type and physical location where it is stored.
- It collects heterogeneous data from different resources and allows data users across the organization to access this data according to their work requirements. This heterogeneous data can be accessed using any application such as web portals, web services, E-commerce ,SaaS, and mobile application.
- We can use Data Virtualization in the field of data integration, business intelligence, and cloud computing

ADVANTAGES OF DATA VIRTUALIZATION

- It allows users to access the data without worrying about where it resides on the memory.
 - It offers better customer satisfaction, retention, and revenue growth.
 - It provides various security mechanism that allows users to safely store their personal and professional information.
 - It reduces costs by removing data replication.
 - It provides a user-friendly interface to develop customized views.
 - It provides various simple and fast deployment resources.
 - It increases business user efficiency by providing data in real-time.
 - It is used to perform tasks such as data integration, business integration, SOA data services, and enterprise search.

DISADVANTAGES OF DATA VIRTUALIZATION:

- It creates availability issues, because availability is maintained by third-party providers.
 - It required a high implementation cost.
 - It creates the availability and scalability issues.

- Although it saves time during the implementation phase of virtualization but it consumes more time to generate the appropriate result.

USES OF DATA VIRTUALIZATION:

1. ANALYZE PERFORMANCE:

Data virtualization is used to analyze the performance of the organization compared to previous years.

2. SEARCH AND DISCOVER INTERRELATED DATA:

DV provides a mechanism to easily search the data which is similar and internally related to each other.

3. AGILE BUSINESS INTELLIGENCE:

It is one of the most common uses of Data Virtualization. It is used in agile reporting, real-time dashboards that require timely aggregation, analyze and present the relevant data from multiple resources. Both individuals and managers use this to monitor performance, which helps to make daily operational decision processes such as sales, support, finance, logistics, legal, and compliance.

4. DATA MANAGEMENT:

Data virtualization provides a secure centralized layer to search, discover, and govern the unified data and its relationships.

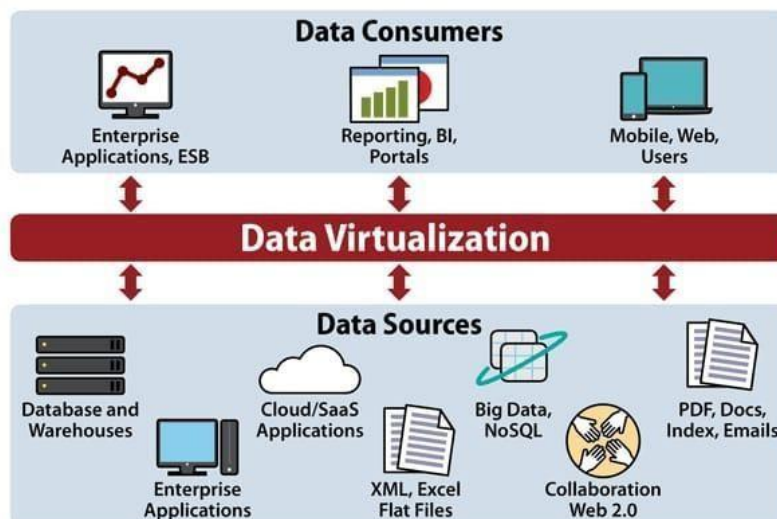


Fig:2.9 Data virtualization

APPLICATION VIRTUALIZATION:

- Application virtualization or app virtualization is technology that allows users to access and use an application from a separate computer than the one on which the application is installed.
- Using application virtualization software, IT admins can set up remote applications on a server then deliver the apps to an end user's computer.
- For the user, the experience of the virtualized app is the same as using the installed app on a physical machine.

BENEFITS OF APPLICATION VIRTUALIZATION:

1.APP MANAGEMENT:

- Application virtualization makes it much easier for IT departments to manage and maintain applications across an organization.
- Rather than manually installing applications to every users' machine, app virtualization lets IT admins install an app once on a central server and then deploy the app as needed on user devices.
- Besides saving installation time, this also makes it simpler to update or patch applications because IT only has to do so on a single server.

2.SCALABILITY:

- Application virtualization lets IT admins deploy virtual applications to all kinds of connected devices, regardless of those devices' operating systems or storage space.
- This allows thin client provisioning in which users access an application on a low-cost machine while centralized servers handle all the computing power necessary to run that application.
- As a result, the organization spends much less on computing hardware because employees only require basic machines to access the apps they need for work.
- App virtualization also allows users to access applications that normally would not work on their machines' operating system, because the app is actually running on the centralized server.
- This is commonly used to virtually run a Windows application on a Linux operating system.

3.SECURITY:

- Application virtualization software gives IT admins central control over which users can access which applications.
- If a user's app permissions within an organization change, the IT admin can simply remove that user's access to an application. Without app virtualization, the IT admin would have to physically uninstall the app from the user's device.
- This central control over app access is especially important if a user's devices are lost or stolen, because the IT admin can revoke remote access to sensitive data without having to track down the missing device.

CHAPTER 3

HYPERVISOR AND ITS TYPES:

A hypervisor, also known as a virtual machine monitor or VMM, is software that creates and runs virtual machines (VMs).

A hypervisor allows one host computer to support multiple guest VMs by virtually sharing its resources, such as memory and processing.

WHY USE A HYPERVISOR:

Hypervisors make it possible to use more of a system's available resources and provide greater IT mobility since the guest VMs are independent of the host hardware.

This means they can be easily moved between different servers.

Because multiple virtual machines can run off of one physical server with a hypervisor, a hypervisor reduces:

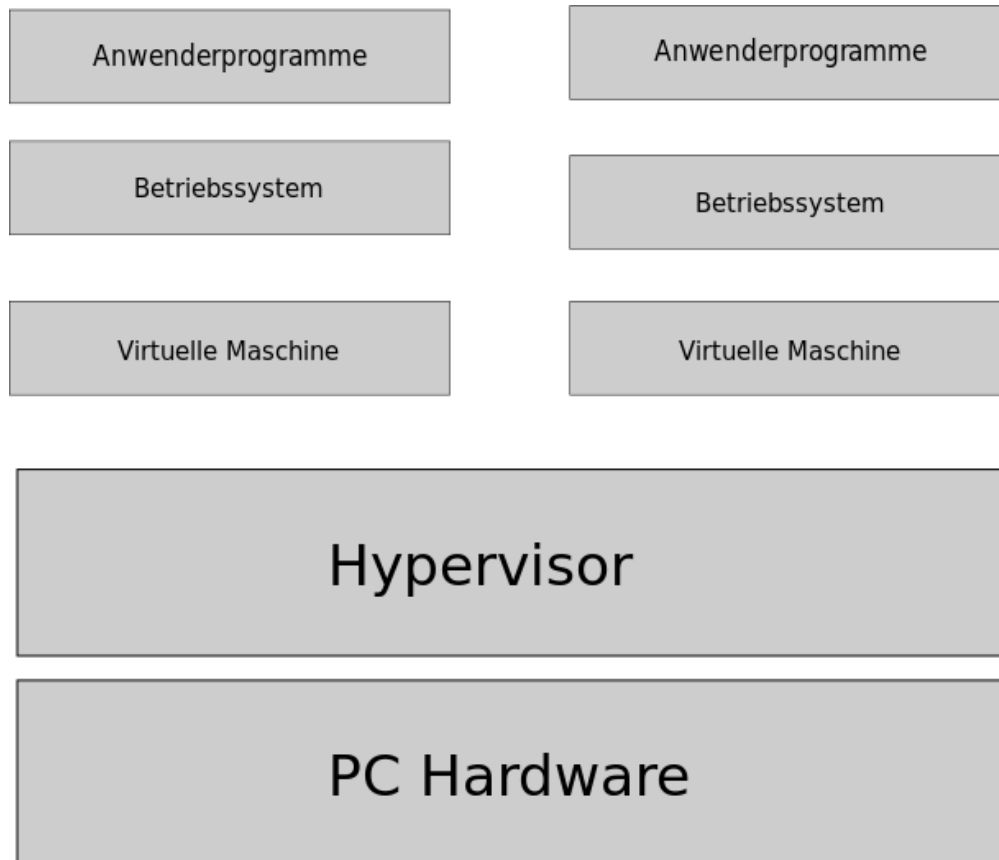
Space

Energy

Maintenance requirements

TYPES OF HYPERVISOR:

There are two main hypervisor types, referred to as "Type 1" (or "bare metal") and "Type 2" (or "hosted").



Hypervisor Typ 1

Fig:3.1 Hypervisor type-1

Moreover, the first hypervisors developed by IBM were native hypervisors. These included SIMMON test software.

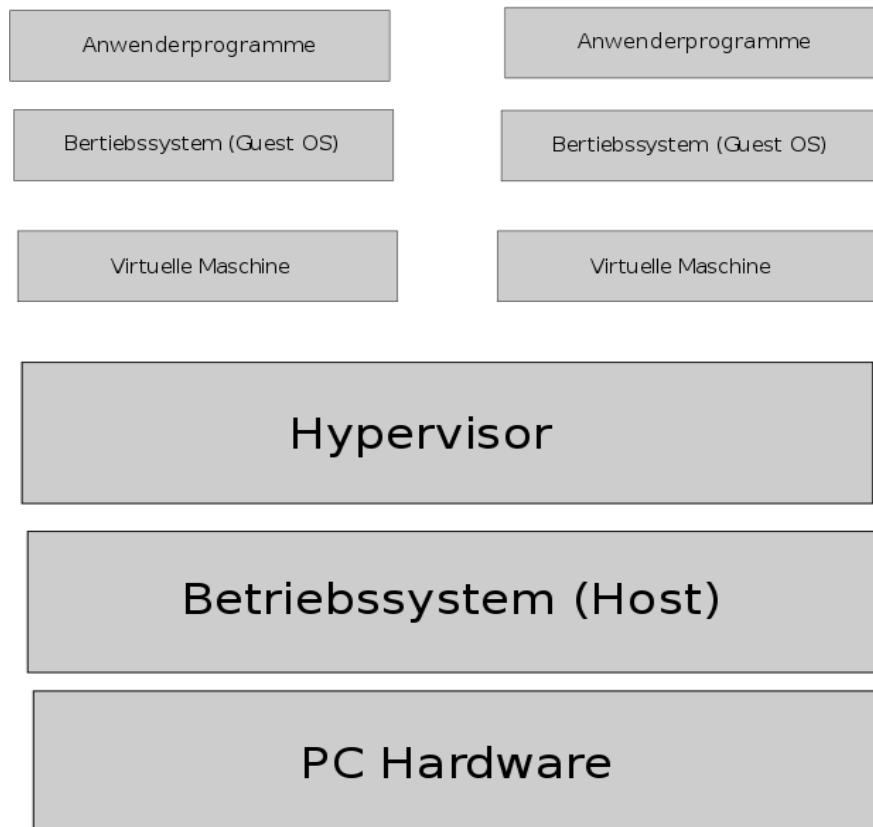
Furthermore, it also had CP/CMS operating system. AntsleOs, Xen, XCP-ng, Microsoft Hyper V, VMware ESX/ESXi, Oracle VM Server for x86 are some examples for Type 1 Hypervisors.

TYPE 2 HYPERVISOR:

Type 2 Hypervisor is called a Host OS Hypervisor. These hypervisors execute on an operating system similar to other computer programs.

For example, assume that there is an operating system. There is a hypervisor on top of the OS.

It provides an emulator environment to run another operating system. In other words, a guest operating system runs as a process on the host. Moreover, VMware, Workstation, VMware Player, Virtual Box, Parallel Desktop for Mac are some examples for Type 2 Hypervisors.



Hypervisor Typ 2

Fig :3.2 Hypervisor type-2

Type 1 hypervisor is a hypervisor that runs directly on the host's hardware to control the hardware and to manage guest operating systems while Type 2 hypervisors run on a conventional operating system just as other computer programs do. Thus, this is the main difference between Type 1 and Type 2 Hypervisor.

BENEFITS OF HYPERVISOR:

There are several benefits to using a hypervisor that hosts multiple virtual machines:

- **Speed:** Hypervisors allow virtual machines to be created instantly, unlike bare-metal servers . This makes it easier to provision resources as needed for dynamic workloads.
- **Efficiency:** Hypervisors that run several virtual machines on one physical machine's resources also allow for more efficient utilization of one physical server.

- **Flexibility:** Bare-metal hypervisors allow operating systems and their associated applications to run on a variety of hardware types because the hypervisor separates the OS from the underlying hardware, so the software no longer relies on specific hardware devices or drivers.
- **Portability:** Hypervisors allow multiple operating systems to reside on the same physical server (host machine). Because the virtual machines that the hypervisor runs are independent from the physical machine, they are portable.

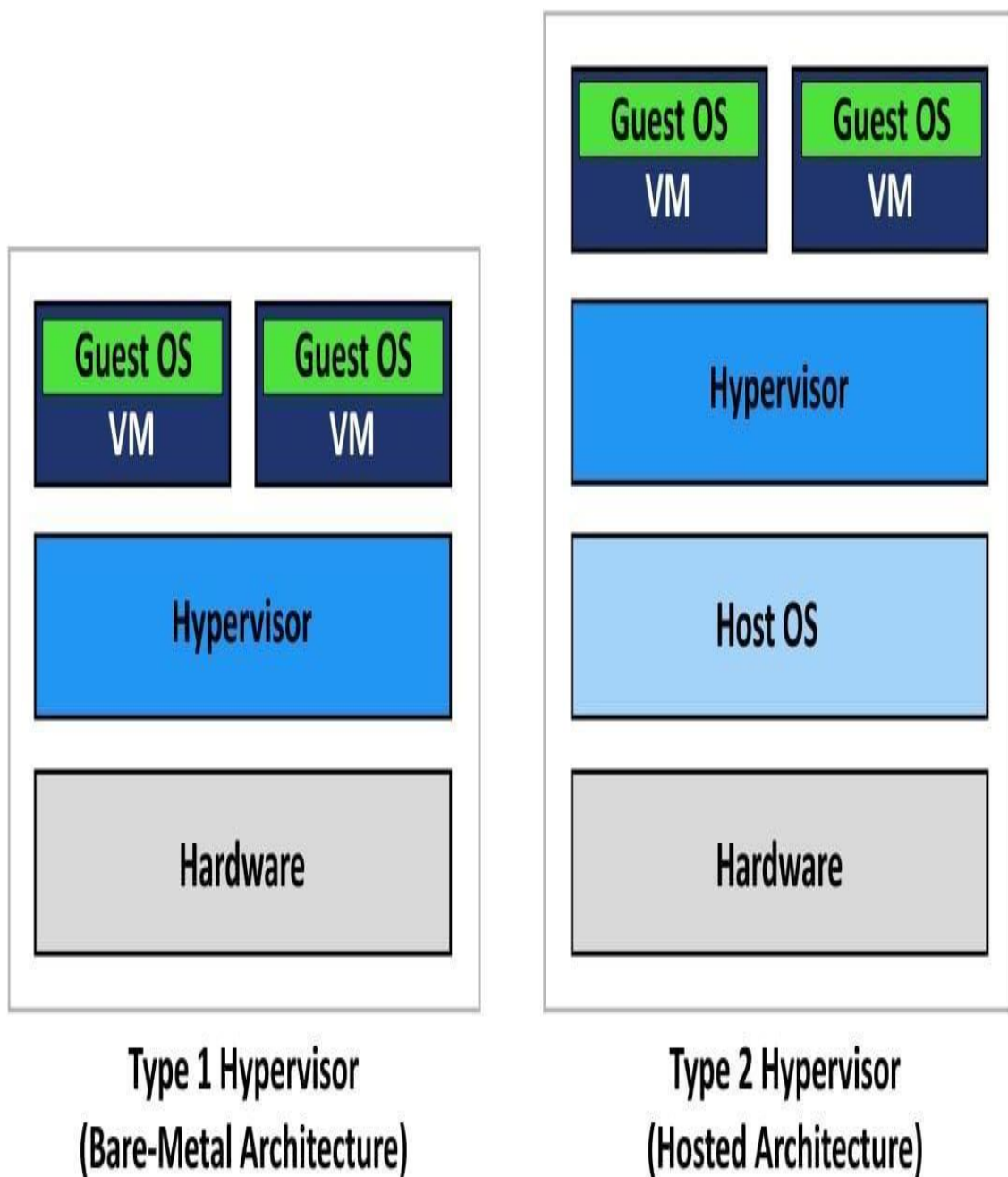


Fig :3.3 Hypervisor

CHAPTER 4

PARA VS FULL VIRTUALIZATION:

Para virtualization	Full virtualization
1.In para virtualization,virtual machine does not implement full isolation of os but rather provides a different API which is utilized when os is subjected alteration.	1.In full virtualization, virtual machine permit the execution of the instructions with running of unmodified os in an entire isolated way.
2.para virtualization is more secure than full virtualization.	2.less secure .
3.It uses hypercalls at compile time for operations.	3.It uses binary translation and direct approach as a technique for operations.
4.It is faster in operation as compared to full virtualization.	4.It is slow than para virtualization in operation.
5.It is less portable and compatible.	5.It is more portable and compatible.
6.Higher performance.	6.lower performance.
7.Allows guest os to communicate with the hypervisor	7.Allows guest os to execute independently
8.EX:VMware and Xen.	8.EX:Microsoft,parallels systems.

Tab 1.3 para vs full virtualization

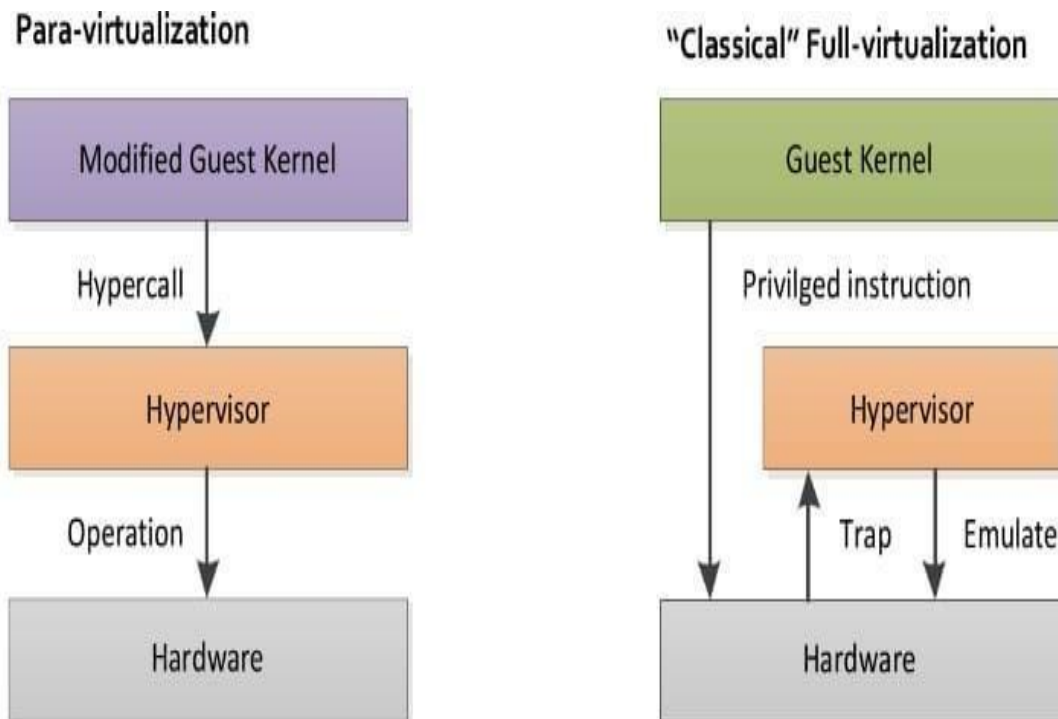
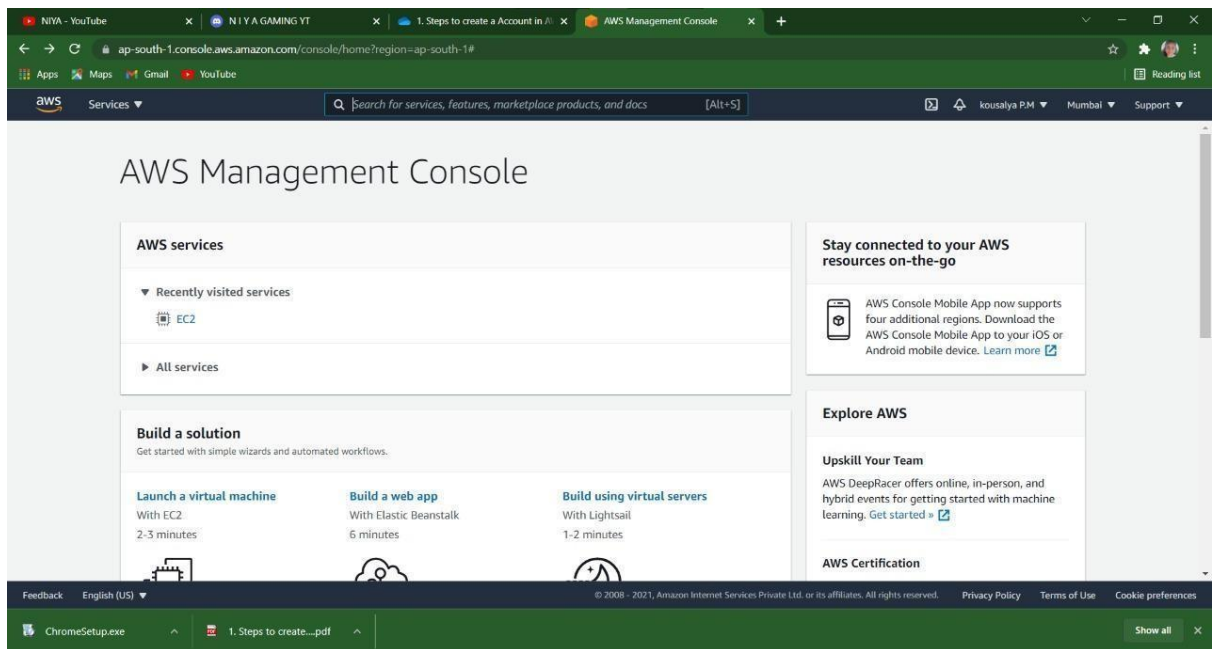


Fig: 4.1 para virtualization & Full virtualizer

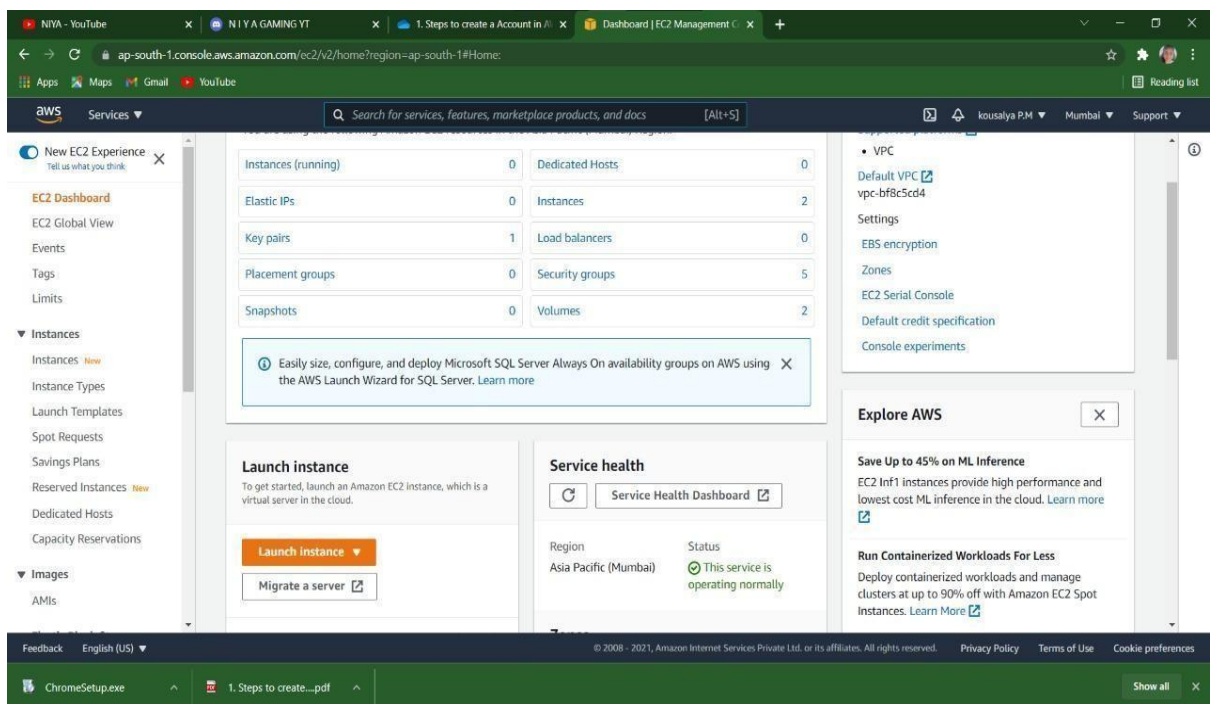
CHAPTER 5

How to create windows instance in EC2 of AWS

STEP1: First go to all services and click on EC2



STEP 2: Click on Launch instances.



STEP 3: Then select windows server 2018 from AMI

The screenshot shows the AWS Management Console interface for the 'Launch instance wizard'. The first step, 'Choose an Amazon Machine Image (AMI)', is active. It displays a list of available AMIs. The 'Microsoft Windows Server 2019 Base' AMI is selected, with its ID 'ami-0e7d76dfc4fac48d6' and architecture '64-bit (x86)'. Other options include SUSE Linux Enterprise Server, Ubuntu Server, and Microsoft Windows Server 2019 Base with Containers. The interface includes a search bar, navigation tabs, and a 'Select' button for each AMI.

STEP 4: choose instance

The screenshot shows the AWS Management Console interface for the 'Launch instance wizard'. The second step, 'Choose an Instance Type', is active. It displays a table of available instance types. The 't2.micro' instance type is selected, with its ID 't2.micro' and architecture '64-bit (x86)'. Other options include t2.nano, t2.small, t2.medium, t2.large, and t2.xlarge. The interface includes a search bar, navigation tabs, and a 'Select' button for each instance type.

Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
t2	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
t2	t2.micro	1	1	EBS only	-	Low to Moderate	Yes
t2	t2.small	1	2	EBS only	-	Low to Moderate	Yes
t2	t2.medium	2	4	EBS only	-	Low to Moderate	Yes
t2	t2.large	2	8	EBS only	-	Low to Moderate	Yes
t2	t2.xlarge	4	16	EBS only	-	Moderate	Yes

STEP 5: On configure instance details

The screenshot shows the 'Step 3: Configure Instance Details' page of the AWS Launch Instance Wizard. The page is titled 'Step 3: Configure Instance Details' and includes a sub-header: 'Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.' The page contains several configuration options:

- Number of instances:** 1 (with a 'Launch into Auto Scaling Group' link).
- Purchasing option:** ☐ Request Spot instances.
- Network:** vpc-bf8c5cd4 (default) (with a 'Create new VPC' link).
- Subnet:** No preference (default subnet in any Availability Zone) (with a 'Create new subnet' link).
- Auto-assign Public IP:** Use subnet setting (Enable).
- Placement group:** ☐ Add instance to placement group.
- Capacity Reservation:** Open.
- Domain join directory:** No directory (with a 'Create new directory' link).
- IAM role:** None (with a 'Create new IAM role' link).
- Shutdown behavior:** Stop.

At the bottom of the configuration section, there are buttons: 'Cancel', 'Previous', 'Review and Launch', and 'Next: Add Storage'.

The bottom of the screenshot shows the AWS console header with the 'Launch instance wizard | EC2 M...' title, the AWS logo, and a search bar. The footer includes 'Feedback', 'English (US)', '© 2008 - 2021, Amazon Internet Services Private Ltd. or its affiliates. All rights reserved.', 'Privacy Policy', 'Terms of Use', 'Cookie preferences', and a taskbar with 'ChromeSetup.exe' and '1. Steps to create...pdf'.

STEP 6: you can modify setting, and click on ADD STORGARE(if needed)

The screenshot shows the 'Step 4: Add Storage' page of the AWS Launch Instance Wizard. The page is titled 'Step 4: Add Storage' and includes a sub-header: 'Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. Learn more about storage options in Amazon EC2.' The page contains a table with storage settings:

Volume Type	Device	Snapshot	Size (GiB)	Volume Type	IOPS	Throughput (MB/s)	Delete on Termination	Encryption
Root	/dev/sda1	snap-0499803ae39f52c35	30	General Purpose SSD (gp2)	100 / 3000	N/A	☒	Not Encrypted

Below the table, there is a button 'Add New Volume' and a blue box with text: 'Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage. Learn more about free usage tier eligibility and usage restrictions.'

Below the blue box, there is a section titled 'Shared file systems' with a sub-header: 'You currently don't have any file systems on this instance. Select "Add file system" button below to add a file system.'

At the bottom of the configuration section, there are buttons: 'Cancel', 'Previous', 'Review and Launch', and 'Next: Add Tags'.

The bottom of the screenshot shows the AWS console header with the 'Launch instance wizard | EC2 M...' title, the AWS logo, and a search bar. The footer includes 'Feedback', 'English (US)', '© 2008 - 2021, Amazon Internet Services Private Ltd. or its affiliates. All rights reserved.', 'Privacy Policy', 'Terms of Use', 'Cookie preferences', and a taskbar with 'ChromeSetup.exe' and '1. Steps to create...pdf'.

STEP 7: Add tags if you want then click on configure security option

The screenshot shows the 'Step 5: Add Tags' page in the AWS Launch Instance Wizard. The breadcrumb trail at the top indicates the current step is '5. Add Tags'. The page title is 'Step 5: Add Tags'. Below the title, there is a brief explanation of tags and a note that tags will be applied to all instances and volumes. The main area contains a table with columns for 'Key', 'Value', 'Instances', 'Volumes', and 'Network Interfaces'. A message states 'This resource currently has no tags'. Below this, there is a button 'Add Tag' and a note '(Up to 50 tags maximum)'. A modal window is open, showing a 'Name' field with the value 'Name' and a 'Value' field with the value 'Value'. The modal also has a 'Cancel' button and a 'Save' button. At the bottom of the page, there are buttons for 'Cancel', 'Previous', 'Review and Launch', and 'Next: Configure Security Group'.

Launch instance wizard | EC2 M...

ap-south-1.console.aws.amazon.com/ec2/v2/home?region=ap-south-1#LaunchInstanceWizard:

Services Search for services, features, marketplace products, and docs [Alt+S]

1. Choose AMI 2. Choose instance type 3. Configure instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 5: Add Tags

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver. A copy of a tag can be applied to volumes, instances or both. Tags will be applied to all instances and volumes. [Learn more about tagging your Amazon EC2 resources.](#)

Key (128 characters maximum)	Value (256 characters maximum)	Instances	Volumes	Network Interfaces
This resource currently has no tags				
Choose the Add tag button or click to add a Name tag. Make sure your IAM policy includes permissions to create tags.				

Add Tag (Up to 50 tags maximum)

Cancel Previous Review and Launch Next: Configure Security Group

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ChromeSetup.exe 1. Steps to create...pdf Show all

STEP 8: configure security group

The screenshot shows the 'Step 6: Configure Security Group' page in the AWS Launch Instance Wizard. The breadcrumb trail at the top indicates the current step is '6. Configure Security Group'. The page title is 'Step 6: Configure Security Group'. Below the title, there is a brief explanation of security groups and a note that you can create a new security group or select from an existing one. The main area contains a section 'Assign a security group' with two radio buttons: 'Create a new security group' (selected) and 'Select an existing security group'. Below this, there are input fields for 'Security group name' (value: 'launch-wizard-5') and 'Description' (value: 'launch-wizard-5 created 2021-11-10T23:41:51.043+05:30'). Below the input fields, there is a table with columns for 'Type', 'Protocol', 'Port Range', 'Source', and 'Description'. The table contains one row with 'RDP' as the Type, 'TCP' as the Protocol, '3389' as the Port Range, 'My IP' as the Source, and 'e.g. SSH for Admin Desktop' as the Description. At the bottom of the page, there are buttons for 'Cancel', 'Previous', 'Review and Launch', and 'Next: Configure Security Group'.

Launch instance wizard | EC2 M...

ap-south-1.console.aws.amazon.com/ec2/v2/home?region=ap-south-1#LaunchInstanceWizard:

Services Search for services, features, marketplace products, and docs [Alt+S]

1. Choose AMI 2. Choose instance type 3. Configure instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more about Amazon EC2 security groups.](#)

Assign a security group: ☒ Create a new security group ☐ Select an existing security group

Security group name: launch-wizard-5

Description: launch-wizard-5 created 2021-11-10T23:41:51.043+05:30

Type	Protocol	Port Range	Source	Description
RDP	TCP	3389	My IP 115.99.2.208/32	e.g. SSH for Admin Desktop

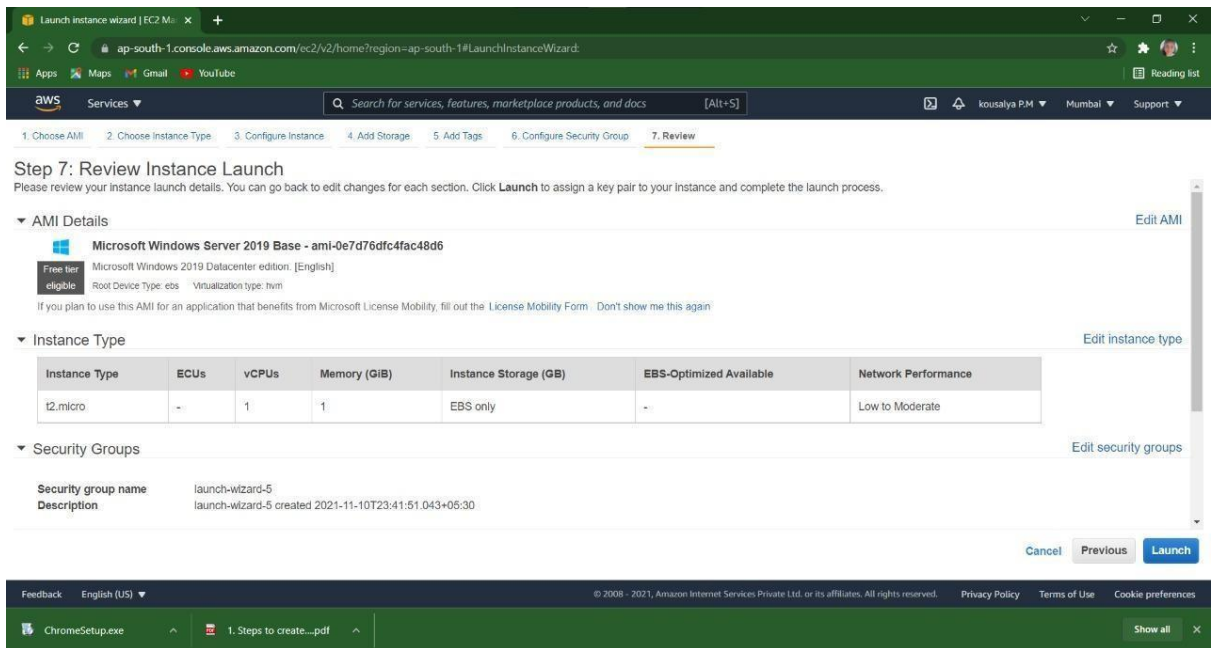
Add Rule

Cancel Previous Review and Launch

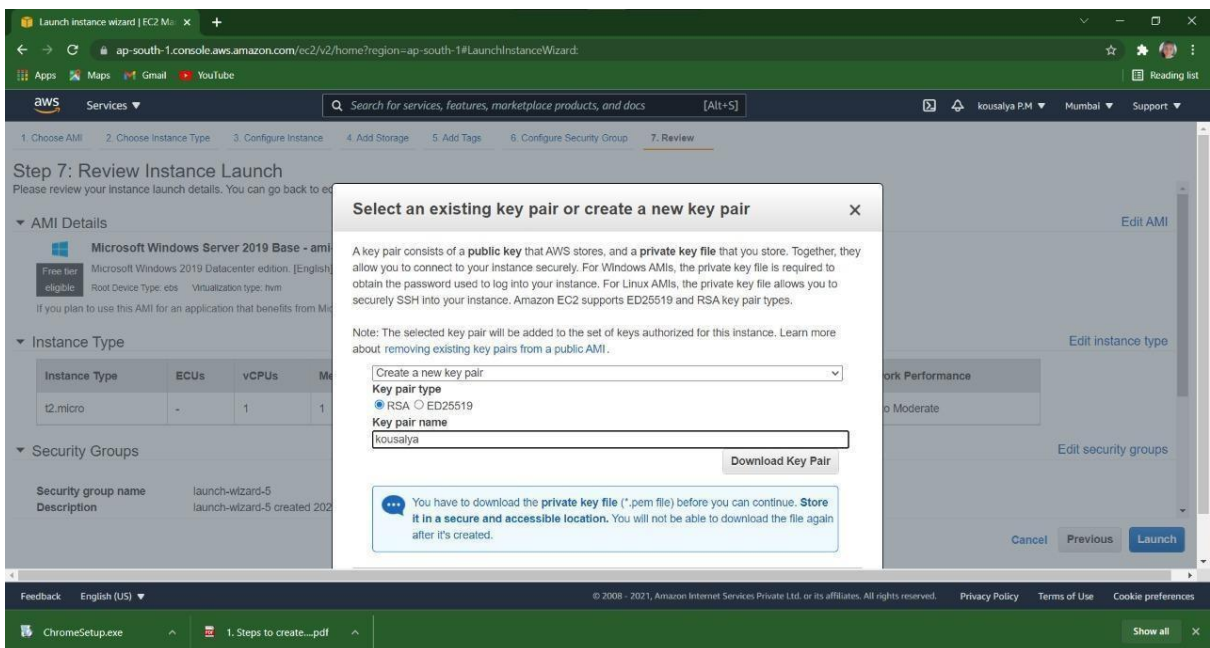
Feedback English (US) © 2008 - 2021, Amazon Internet Services Private Ltd. or its affiliates. All rights reserved. Privacy Policy Terms of Use Cookie preferences

ChromeSetup.exe 1. Steps to create...pdf Show all

STEP 9: Launch



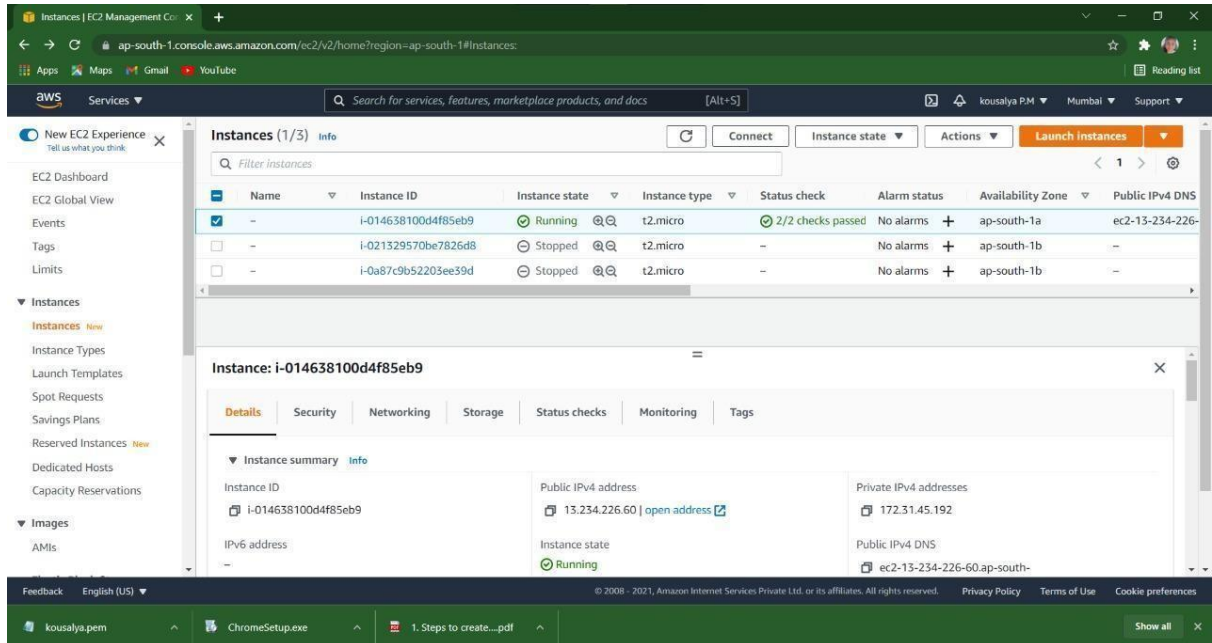
STEP 10: Here you need to download key as without key you cant access the virtual instances



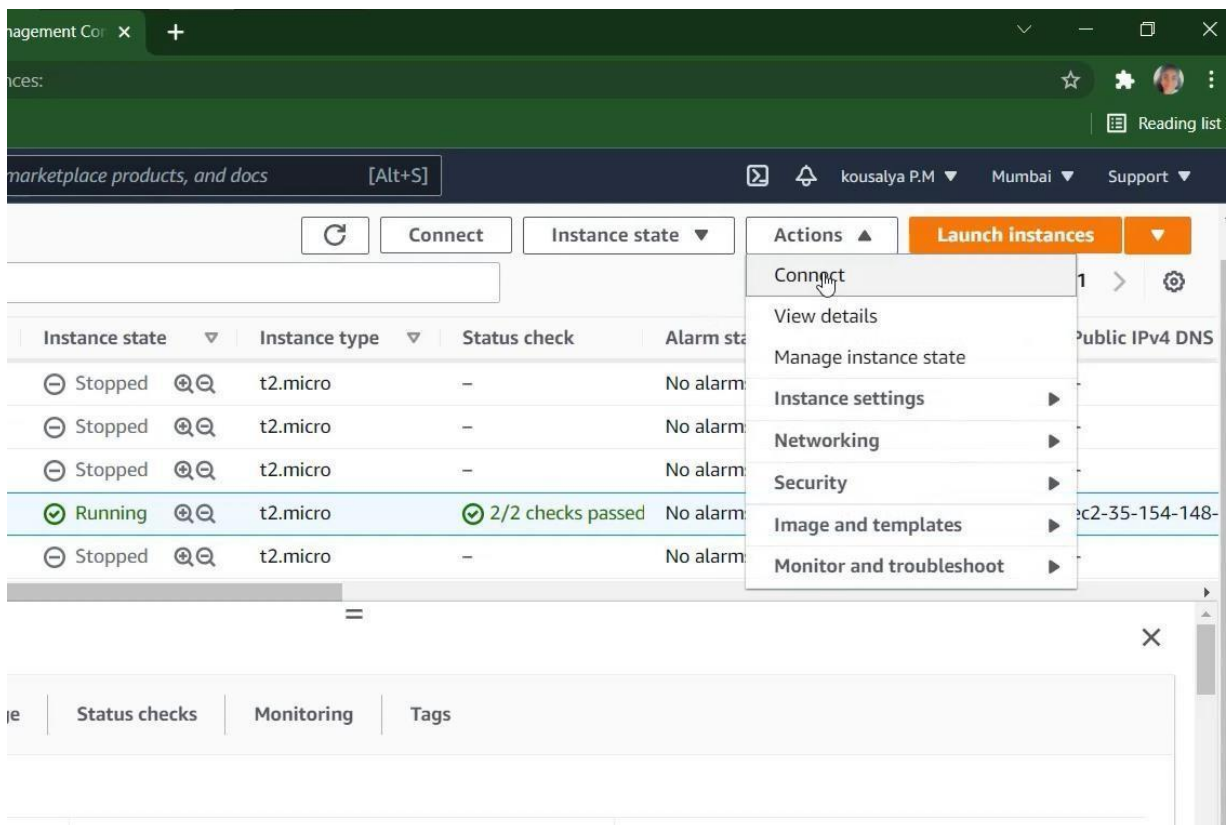
STEP 11: After key pair is downloaded, then launch instances

STEP 12: Click on view instances to check it's details

STEP 13: Wait till status check of instances is shown as 'passed' from 'Initializing'

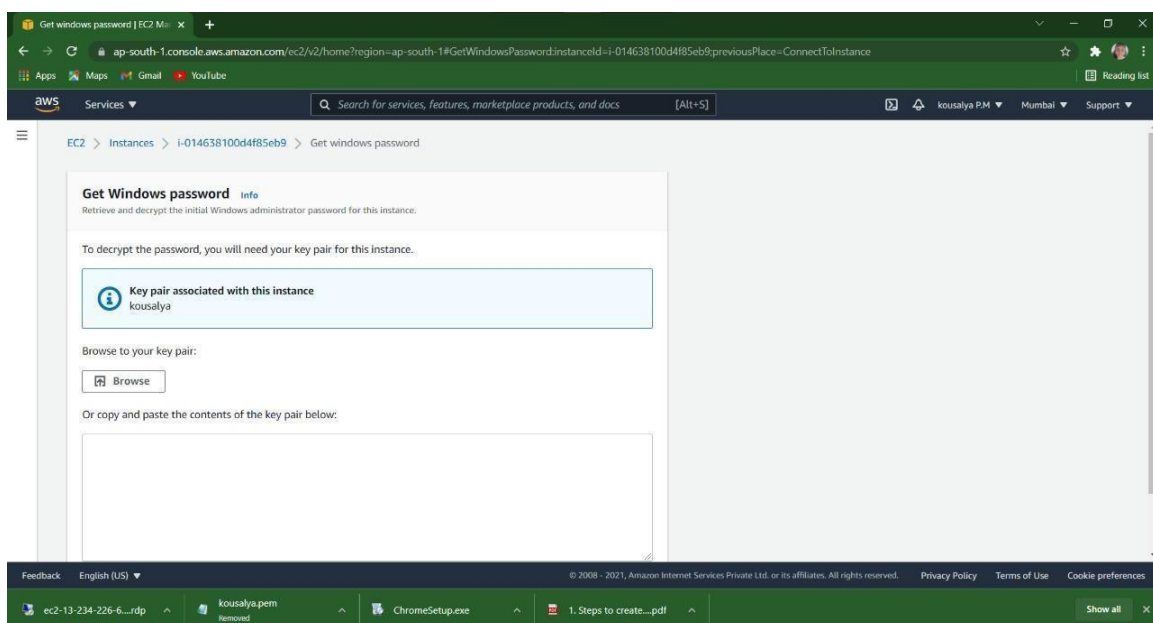


STEP 14: Now select connect option from actions menu to connect with this instances



STEP 15: Select RDP client option and click on download remote desktop file to download file and run that file. It must ask password.

STEP 16: Now you need password to connect with this machine, to get password click on Get password button.



STEP 17: It will ask for “key pair”. Browse to that location where you have saved that key and upload that key and click on decrypt.

STEP 18: copy that password and enter into RDP connection tab. System will connected then



CHAPTER 6

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