



## Skill base Lab Course : Cloud Computing

**MGM's College of Engineering and Technology,  
Kamothe, Navi Mumbai  
Department of Computer Engineering  
Academic Year :2021-22  
Final Year Computer Engineering**

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**Cloud Computing Lab Manual**  
**MGM's College of Engineering and Technology, Kamothe, Navi Mumbai**  
**Department of Computer Engineering**  
**Academic Year:2021-22**

Name of the Student:-\_\_\_\_\_

Roll No.\_\_\_\_\_ Subject:\_\_\_\_\_

Sr.no	Name of experiment	Performance date	Submission date	Remarks
01	Introduction and overview of cloud computing.			
02	To study and implement Hosted Virtualization using VirtualBox & KVM			
03	To study and Implement Bare-metal Virtualization using Xen, HyperV or VMware Esxi.			
04	To study and Implement Infrastructure as a Service using AWS/Microsoft Azure.			
05	To demonstrate installation and Configuration of Open stack Private cloud.			
06	Explore Storage as a service using own Cloud for remote file access using web interfaces..			
07	To study and Implement Database as a Service on SQL/NOSQL databases like AWS RDS, AZURE SQL/ MongoDB Lab/ Firebase			
08	To study and Implement Security as a Service on AWS/Azure			
09	To study and implement Identity and Access Management (IAM) practices on AWS/Azure cloud.			
10	Mini Project			

Software Requirements: Unix Ubuntu /Linux Operating System ,VMware, SQL/Nosql database software and internet connectivity

H\W Req: Hard Disk: 4GB RAM.2.4GHZ AMD Processor 80 GB Hard Drive



**Lab Objectives:** The course has following objectives

1. To make students familiar with key concepts of virtualization.
2. To make students familiar with various deployment models of cloud such as private, public, hybrid and community so that they start using and adopting appropriate type of cloud for their application.
3. To make students familiar with various service models such as IaaS, SaaS, PaaS, Security as a Service (SECaS) and Database as a Service.
4. To make students familiar with security and privacy issues in cloud computing and how to address them.

**Lab Outcomes:** At the end of the course, the students will be able to

1. Implement different types of virtualization techniques.
2. Analyze various cloud computing service models and implement them to solve the given problems.
3. Design and develop real world web applications and deploy them on commercial cloud(s).
4. Explain major security issues in the cloud and mechanisms to address them.
5. Explore various commercially available cloud services and recommend the appropriate one for the given application.
6. Implement the concept of containerization



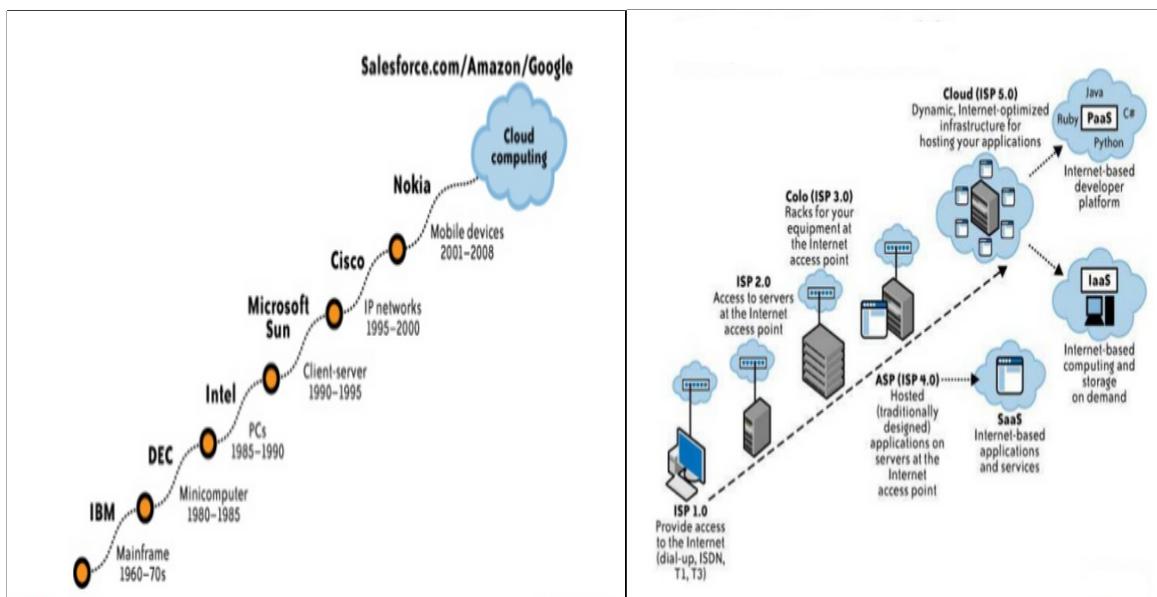
## Experiment No.1

**Title:** Introduction and overview of cloud computing.

**Objective:** To understand the origin of cloud computing, cloud cube model, NIST model, characteristics of cloud, different deployment models, service models, advantages and disadvantages.

**Explanation:** The term “Network Cloud” or “Cloud” was introduced in the early 1990s throughout the networking industry. Cloud Computing is usually Internet Based Computing. It is a style of computing in which IT-related capabilities are provided “as-a-service”, allowing users to access technology enabled services from the Internet.

According to IEEE paper published in 2008, Cloud Computing is a framework in which information is permanently stored in servers on the internet and cached temporarily on clients that includes computers, laptops, handhelds, servers, sensors etc.



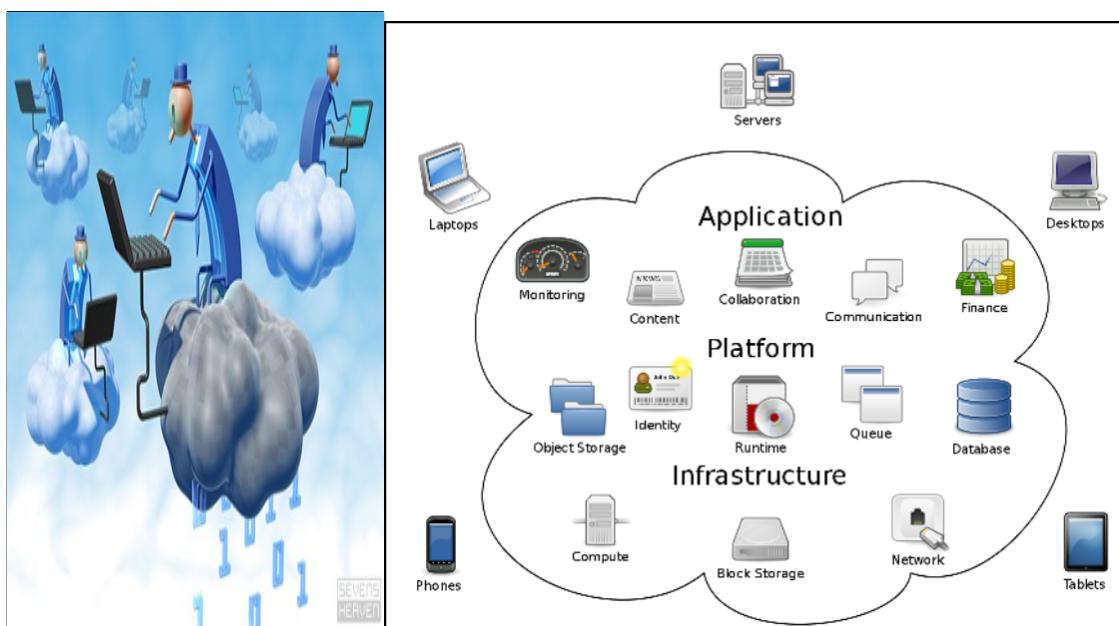
Cloud Computing is a new way of delivering computing resources, *not a new technology*.

**Cloud computing** is Internet-based computing, whereby shared resources, software and information are provided to computers and other devices on-demand, like the electricity grid. The cloud computing is a culmination of numerous attempts at large scale computing with seamless access to virtually limitless resources.on-demand computing, utility computing, ubiquitous computing, autonomic computing, platform computing, edge computing, elastic computing, **grid computing**



### Cloud Computing Definition as per NIST

Cloud Computing is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (e.g. Networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.



The cloud is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand – pay per use. Cost-effective means of virtualizing and making use of resources more effectively. Low start-up costs – pay for use helps to kick-start companies. Scaling is proportional to demand (revenue) so it's a good business model. Vast range of Cloud Computing applications. Virtual private servers, Web hosting, data servers, fail-over services, etc

#### 1.1 Essential Characteristics of Cloud Computing:

1) On-demand Self Service

2) Broad Network Access

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3) Resource Pooling(Multi-tenancy)

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4) Rapid Elasticity

5) Measured Services



### **1) On-demand self Service:**

A customer can unilaterally provision computing capabilities such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

### **2) Broad Network Access:**

Capabilities are available over the n/w and accessed through standards mechanism that promote use of use by heterogeneous thin or thick client platform (e.g. Mobile Phones, tablet ,laptops, workstations)

### **3) Resource Pooling:**

The providers computing resources are pooled to serve multiple consumers using a multitenant model, with different and physical and virtual resources dynamically assigned and reassigned according to consumer demand.

There is sense of location independence in that the customer generally has no control or knowledge over the exact abstraction.

Example of resources includes storage processing, memory and network bandwidth.

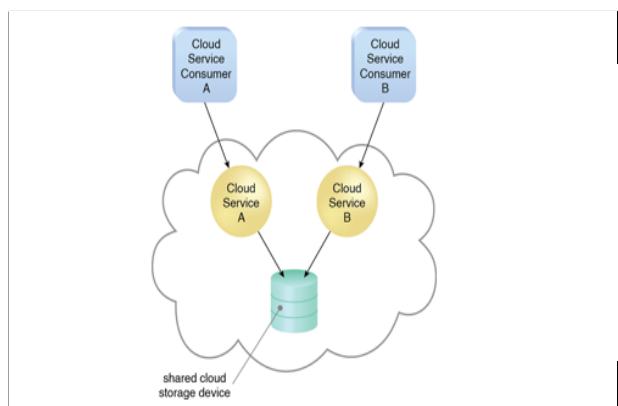


Fig. In a multitenant environment, a single instance of an IT resource, such as a cloud storage device, serves multiple consumers

### **4) Rapid Elasticity:**



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Capabilities can be elastically provisioned and released in some cases automatically to scale rapidly outward and inward commensurate with demand.

To the consumer the capabilities available for provisioning often appeared to be unlimited and can be appropriated in any quantity at time

**5) Measured Service:**

Cloud systems automatically control and optimize resource used by leveraging a metering capability at some level of abstraction appropriate to the type of service.

**6) Ubiquitous Access**

Ubiquitous Access represents the ability for a cloud service to be widely accessible. Establishing ubiquitous access for a cloud service can require support for a range of devices, transport protocols, interfaces, and security technologies. To enable this level of access generally requires that the cloud service architecture be tailored to the particular needs of different cloud service consumers.

## **1.2 Cloud deployment models:**

A cloud deployment model represents a specific type of cloud environment, primarily distinguished by ownership, size, and access.

There are four common cloud deployment models:

- Public Clouds
- Community Clouds
- Private Clouds
- Hybrid Clouds
- Other Deployment Models

**1) Public Clouds**

A public cloud is a publicly accessible cloud environment owned by a third-party cloud provider. The IT resources on public clouds are usually provisioned via the previously described cloud delivery models and are generally offered to cloud consumers at a cost or are commercialized via other avenues (such as advertisement).



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The cloud provider is responsible for the creation and on-going maintenance of the public cloud and its IT resources. Many of the scenarios and architectures explored in upcoming chapters involve public clouds and the relationship between the providers and consumers of IT resources via public clouds

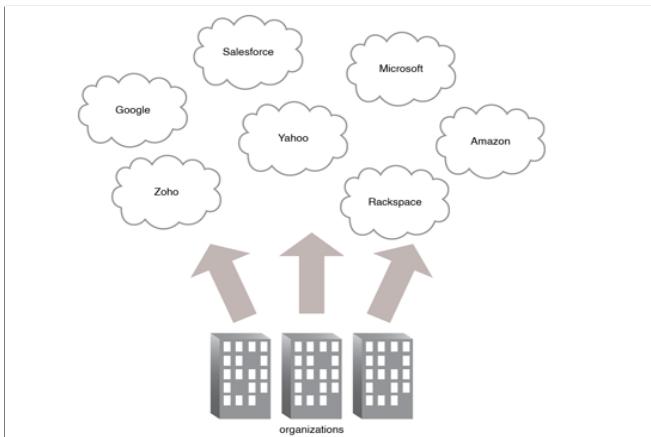


Figure shows a partial view of the public cloud landscape, highlighting some of the primary vendors in the marketplace

## 2. Community Clouds

A community cloud is similar to a public cloud except that its access is limited to a specific community of cloud consumers. The community cloud may be jointly owned by the community members or by a third-party cloud provider that provisions a public cloud with limited access. The member cloud consumers of the community typically share the responsibility for defining and evolving the community cloud.

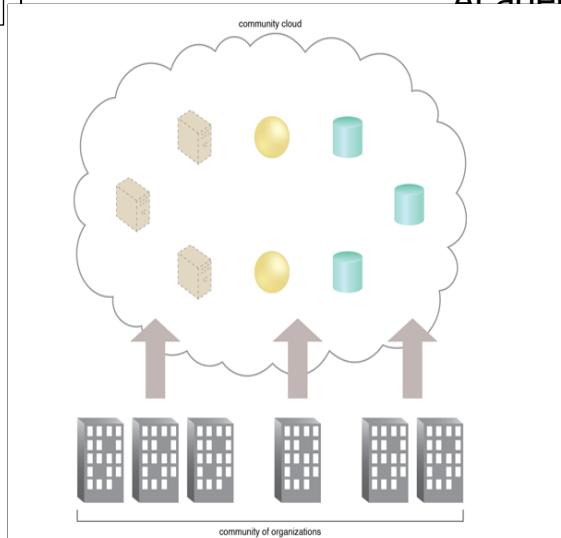


Fig. An example of a "community" of organizations accessing IT resources from a community cloud

### 3) Private Clouds

A private cloud is owned by a single organization. Private clouds enable an organization to use cloud computing technology as a means of centralizing access to IT resources by different parts, locations, or departments of the organization. When a private cloud exists as a controlled environment, the problems described in the Risks and Challenges section do not tend to apply.

With a private cloud, the same organization is technically both the cloud consumer and cloud provider (Figure 14). In order to differentiate these roles: a separate organizational department typically assumes the responsibility for provisioning the cloud (and therefore assumes the cloud provider role) departments requiring access to the private cloud assume the cloud consumer role



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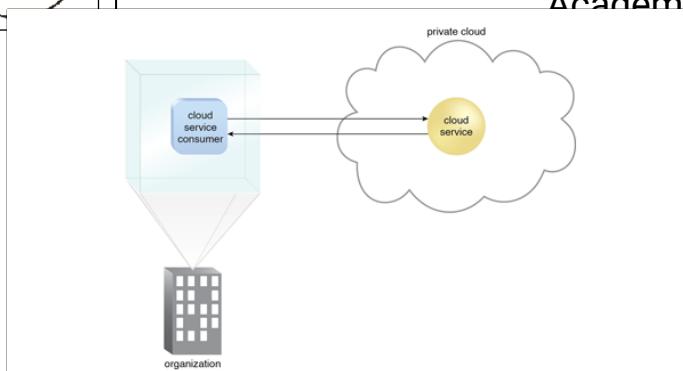


Fig. A cloud service consumer in the organization's on-premise environment accesses a cloud service hosted on the same organization's private cloud via a

## 4) Hybrid Clouds

A hybrid cloud is a cloud environment comprised of two or more different cloud deployment models. For example, a cloud consumer may choose to deploy cloud services processing sensitive data to a private cloud and other, less sensitive cloud services to a public cloud. The result of this combination is a hybrid deployment model

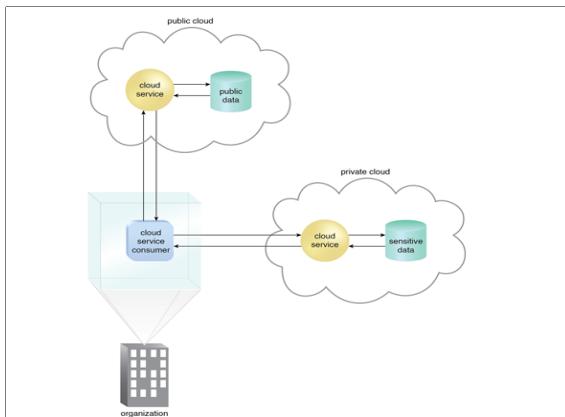


Fig. An organization using a hybrid cloud architecture that utilizes both a private and public cloud

## 5) Other Deployment Models

Additional variations of the four base cloud deployment models can exist. Examples include:

*Virtual Private Cloud* - Also known as a "dedicated cloud" or "hosted cloud," this model results in a self-contained cloud environment hosted and managed by a public cloud provider, and made available to a cloud consumer.

*Inter-Cloud* - This model is based on an architecture comprised of two or more interconnected clouds

### 1.3 Cloud Service Models



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A *cloud Service model* represents a specific, pre-packaged combination of IT resources offered by a cloud provider. Three common cloud delivery models have become widely established and formalized:

- Infrastructure-as-a-Service (IaaS)
- Platform-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)

#### 1.Infrastructure-as-a-Service (IaaS)

The IaaS delivery model represents a self-contained IT environment comprised of infrastructure-centric IT resources that can be accessed and managed via cloud service-based interfaces and tools.

This environment can include hardware, network, connectivity, operating systems, and other "raw" IT resources. In contrast to traditional hosting or outsourcing

environments, with IaaS, IT resources are typically virtualized and packaged into bundles that simplify up-front runtime scaling and customization of the infrastructure.

A central and primary IT resource within a typical IaaS environment is the virtual server. Virtual servers are leased by specifying server hardware requirements, such as processor capacity, memory, and local storage space, as shown in Figure .

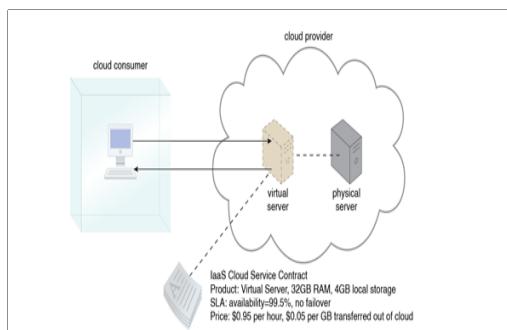


Fig. A cloud consumer is using a virtual server within an IaaS environment. Cloud consumers are provided with a range of contractual guarantees by the cloud provider, pertaining to characteristics such as capacity, performance, and availability

#### 2. Platform-as-a-Service (PaaS)

The PaaS delivery model represents a pre-defined "ready-to-use" environment typically comprised of already deployed and configured IT resources. Specifically, PaaS relies on (and is primarily defined by) the usage of a ready-made environment that establishes a set of pre-packaged products and tools used to support the entire delivery lifecycle of custom applications.

Common reasons a cloud consumer would use and invest in a PaaS environment include:

The cloud consumer wants to extend on-premise environments into the cloud for



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scalability and economic purposes.

The cloud consumer uses the ready-made environment to entirely substitute an on-premise environment.

The cloud consumer wants to become a cloud provider and deploys its own cloud services to be made available to other external cloud consumers.

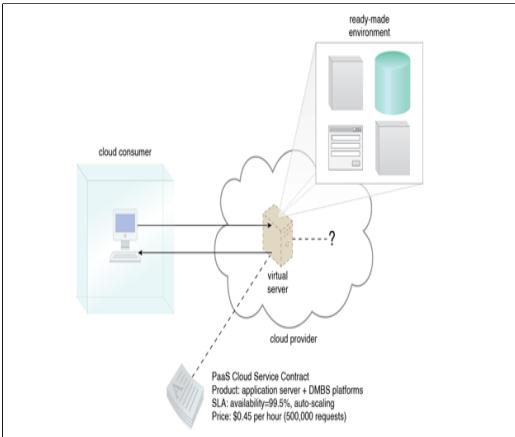


Fig. A cloud consumer is accessing a ready-made PaaS environment. The question mark indicates that the cloud consumer is intentionally shielded from the implementation details of the platform

### 3. Software-as-a-Service (SaaS)

- A software program positioned as a shared cloud service and made available as a "product" or generic utility represents the typical profile of a SaaS offering. The SaaS delivery model is typically used to make a reusable cloud service widely available (often commercially) to a range of cloud consumers. An entire marketplace exists around SaaS products that can be leased and used for different purposes and via different terms (Figure ).



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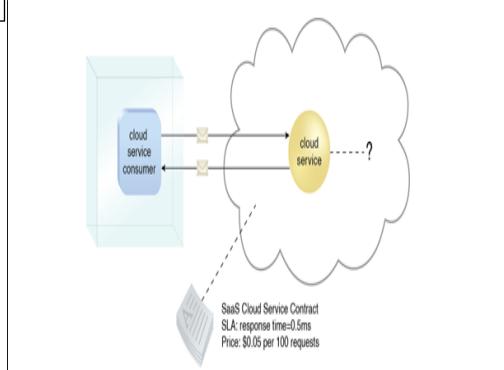


Fig. The cloud service consumer is given access to the cloud service contract, but not to any underlying IT resources or implementation details

#### 4. Comparing Cloud Delivery Models

Cloud Delivery Model	Typical Level of Control Granted to Cloud Consumer	Typical Functionality Made Available to Cloud Consumer
SaaS	usage and usage-related configuration	access to front-end user interface
PaaS	limited administrative	moderate level of administrative control over IT resources relevant to cloud consumer's usage of platform
IaaS	full administrative	full access to virtualized infrastructure-related IT resources and, possibly, to underlying physical IT resources

#### Advantages and disadvantages of Cloud Computing:

##### Advantages:

- 1) On-demand Self Service
- 2) Broad Network Access
- 3) Resource Pooling(Multi-tenancy)
- 4) Rapid Elasticity
- 5) Measured Services
- 6) Ubiquitous Access

##### Disadvantages:

- 1) Increased Security Vulnerabilities
- 2) Reduced Operational Governance Control



- 3) Limited Portability
- 4) Multi-Regional regulatory and legal issues

### **Challenges**

- Alignment with the needs of the business / user / non-computer specialists / community and society
- Need to address the scalability issue: large scale data, high performance computing, automation, response time, rapid prototyping, and rapid time to production
- Need to effectively address (i) ever shortening cycle of obsolescence, (ii) heterogeneity and (iii) rapid changes in requirements
- Transform data from diverse sources into intelligence and deliver intelligence to right people/user/systems
- What about providing all this in a cost-effective manner?

Conclusion: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Answer the following questions

1. Define Cloud Computing? Explain the characteristics of Cloud Computing  
Ans. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2.Explain the different Different Deployments Models.

Ans. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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**3.Explain the Service Delivery Model of Cloud Computing.**

Ans. -----  
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**4.Explain advantages and disadvantages of Cloud Computing.**

Ans. -----  
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## Experiment No.2

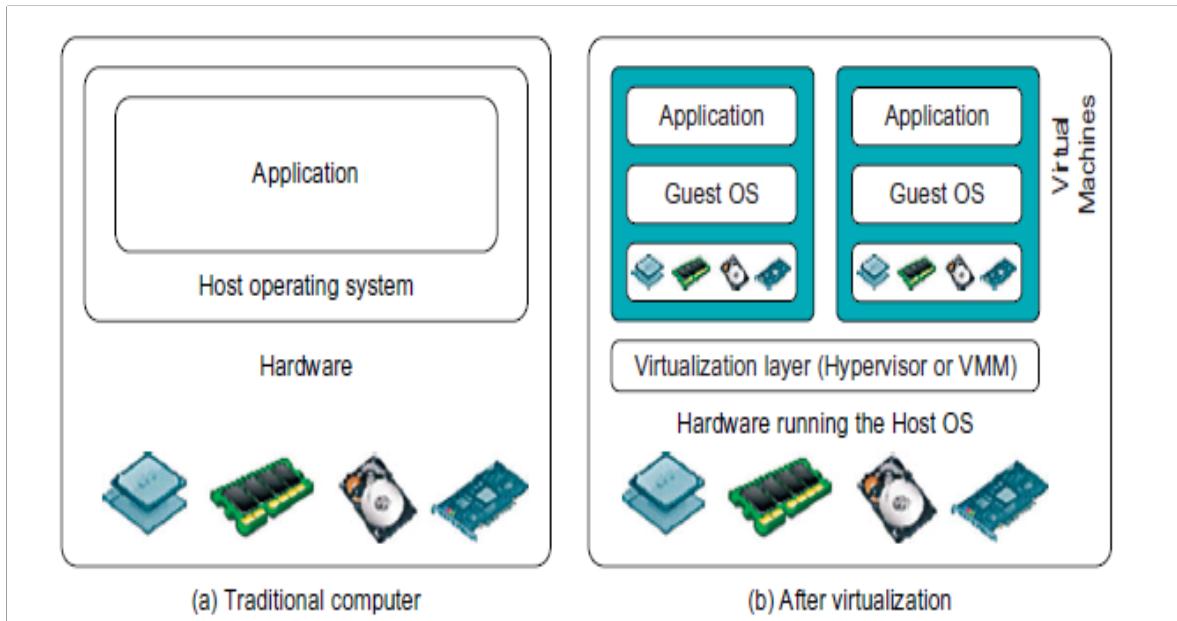
**Aim:** To study and implement Hosted Virtualization using VirtualBox & KVM

**Objective:** To know the concept of Virtualization along with their types, structures and mechanisms. This experiment should have demonstration of creating and running Virtual machines inside hosted hypervisors like Virtual Box and KVM with their comparison based on various virtualization parameters.

**2.1 Virtualization :** Virtualization is a computer architecture technology by which multiple virtual machines (VMs) are multiplexed in the same hardware machine . In computing, virtualization means to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where the framework divides the resource into one or more execution environments.

### **2.2 IMPLEMENTATION LEVELS OF VIRTUALIZATION**

- A traditional computer runs with a host operating system specially tailored for its hardware architecture.
- After virtualization, different user applications managed by their own operating systems (guest OS) can run on the same hardware, independent of the host OS. This is often done by adding additional software, called a virtualization layer.
- This virtualization layer is known as hypervisor or virtual machine monitor (VMM) . The VMs are shown in the upper boxes, where applications run with their own guest OS over the virtualized CPU, memory, and I/O resources.
- The main function of the software layer for virtualization is to virtualize the physical hardware of a host machine into virtual resources to be used by the VMs, exclusively.
- This can be implemented at various operational levels.
- The virtualization software creates the abstraction of VMs by interposing a virtualization layer at various levels of a computer system.
- Common virtualization layers include the instruction set architecture (ISA) level, hardware level, operating system level, library support level, and application level.



### 3.3 Types of Virtualization.

- 1) Instruction Set Architecture Level
  - 2) Hardware Abstraction Level
  - 3) Operating System Level
  - 4) Library Support Level
  - 5) User-Application Level
- 1) Instruction Set Architecture Level
- Virtualization with library interfaces is possible by controlling the communication link between applications and the rest of a system through API hooks.
  - The software tool WINE has implemented this approach to support Windows applications on top of UNIX hosts.
  - Another example is the vCUDA which allows applications executing within VMs to leverage GPU hardware acceleration.

2) Hardware Abstraction Level



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- Hardware-level virtualization is performed right on top of the bare hardware.
- On the one hand, this approach generates a virtual hardware environment for a VM.
- On the other hand, the process manages the underlying hardware through virtualization.

The idea is to virtualize a computer's resources, such as its processors, memory, and I/O devices. The intention is to upgrade the hardware utilization rate by multiple users concurrently

### 3) Operating System Level

- This refers to an abstraction layer between traditional OS and user applications.
- OS-level virtualization creates isolated containers on a single physical server and the OS instances to utilize the hardware and software in data centers.
- The containers behave like real servers.  
OS-level virtualization is commonly used in creating virtual hosting environments to allocate hardware resources among a large number of mutually distrusting users

### 4) Library Support Level

- Virtualization with library interfaces is possible by controlling the communication link between applications and the rest of a system through API hooks.
- The software tool WINE has implemented this approach to support Windows applications on top of UNIX hosts.  
Another example is the vCUDA which allows applications executing within VMs to leverage GPU hardware acceleration

### 5) User-Application Level

- Virtualization at the application level virtualizes an application as a VM.
- On a traditional OS, an application often runs as a process.
- Therefore, application-level virtualization is also known as process-level virtualization.
- The most popular approach is to deploy high level language (HLL) VMs.
- In this scenario, the virtualization layer sits as an application program on top of the operating system, and the layer exports an abstraction of a VM that can run programs written and compiled to a particular abstract machine definition.



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Any program written in the HLL and compiled for this VM will be able to run on it.

- The Microsoft .NET CLR and Java Virtual Machine (JVM) are two good examples of this class of VM.

### Relative Merits of Different Approaches

Level of Implementation	Higher Performance	Application Flexibility	Implementation Complexity	Application Isolation
ISA	X	xxxxx	XXX	XXX
Hardware-level virtualization	xxxxx	XXX	xxxxx	xxxx
OS-level virtualization	xxxxx	XX	XXX	XX
Runtime library support	XXX	XX	XX	XX
User application level	XX	XX	xxxxx	xxxxx

### VMM Design Requirements and Providers

Provider and References	Host CPU	Host OS	Guest OS	Architecture
VMware Workstation [71]	x86, x86-64	Windows, Linux	Windows, Linux, Solaris, FreeBSD, Netware, OS/2, SCO, BeOS, Darwin	Full Virtualization
VMware ESX Server [71]	x86, x86-64	No host OS	The same as VMware Workstation	Para-Virtualization
Xen [7,13,42]	x86, x86-64, IA-64	NetBSD, Linux, Solaris	FreeBSD, NetBSD, Linux, Solaris, Windows XP and 2003 Server	Hypervisor
KVM [31]	x86, x86-64, IA-64, S390, PowerPC	Linux	Linux, Windows, FreeBSD, Solaris	Para-Virtualization

### Implementation:

#### 1) Hosted Virtualization on Oracle Virtual Box Hypervisor



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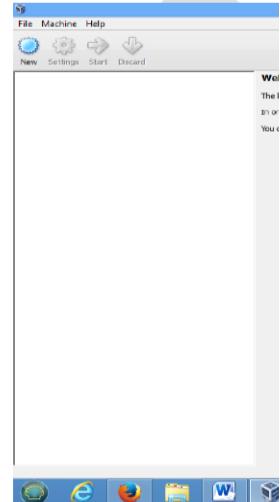
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Step 1: Download Oracle Virtual box from <https://www.virtualbox.org/wiki/Downloads>

The screenshot shows a web browser window with the URL <https://www.virtualbox.org/wiki/Downloads>. The page is titled "VirtualBox" and contains a sidebar with links to "About", "Screenshots", "Downloads", "Documentation", "End-user docs", "Technical docs", "Contribute", and "Community". The main content area is titled "Download VirtualBox" and provides links to "VirtualBox binaries" for different platforms. It includes sections for "VirtualBox platform packages", "VirtualBox Extension Pack", and "VirtualBox 4.3.28 Software Developer Kit (SDK)". A note at the bottom mentions SHA256 checksums.

Step 2: Install it in W



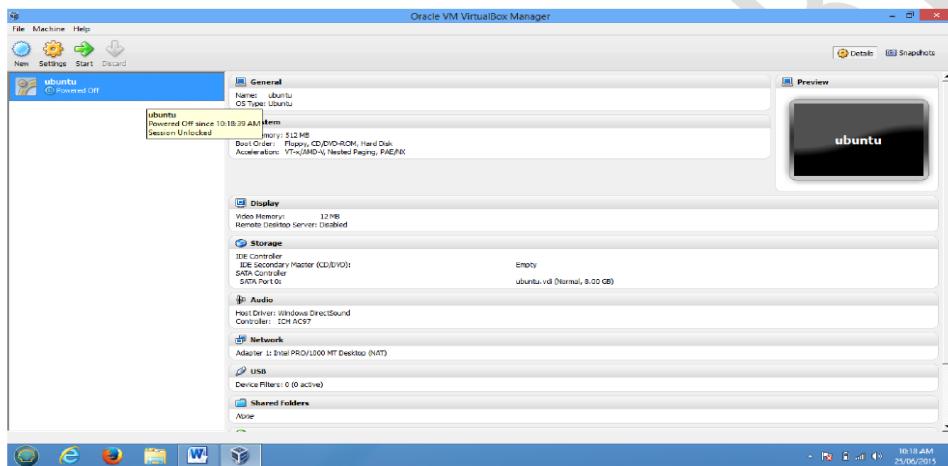
Step 3:-Create Virtual Machine by clicking on New

The screenshot shows the Oracle VM VirtualBox Manager application window. The toolbar at the top has buttons for "File", "Machine", "Help", "New", "Settings", "Start", and "Discard". The main area displays a "Welcome to VirtualBox!" message and a "Create New Virtual Machine" dialog box. The dialog box contains instructions about the wizard and buttons for "Back", "Next >", and "Cancel". To the right of the dialog box, there are icons for a butterfly and a virtual machine.

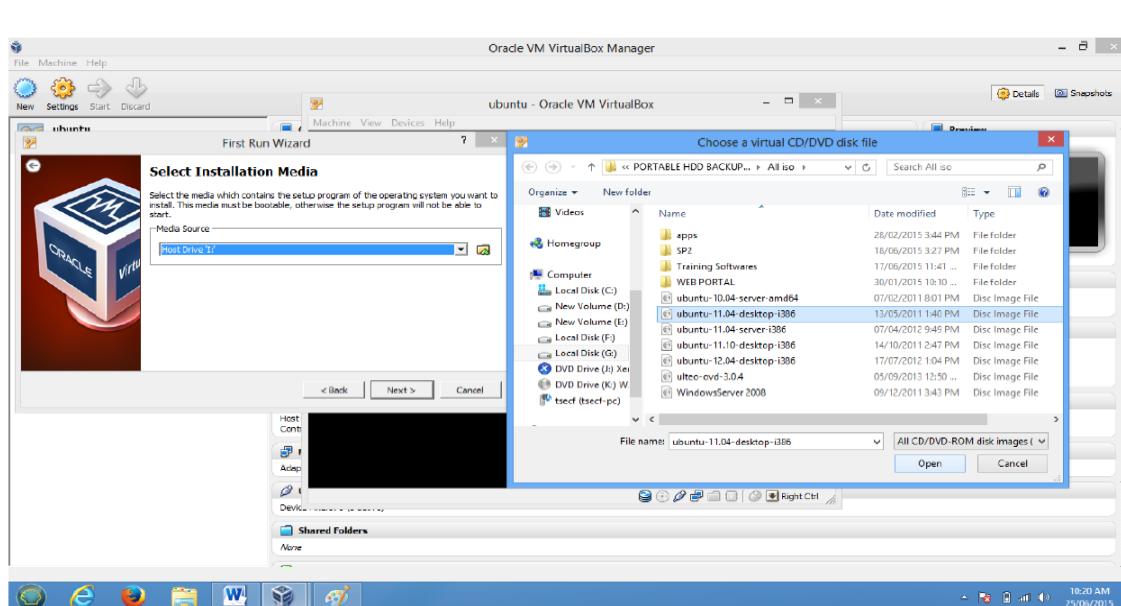


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**Step 4:- Specify RAM Size, HDD Size, and Network Configuration and Finish the wizard**



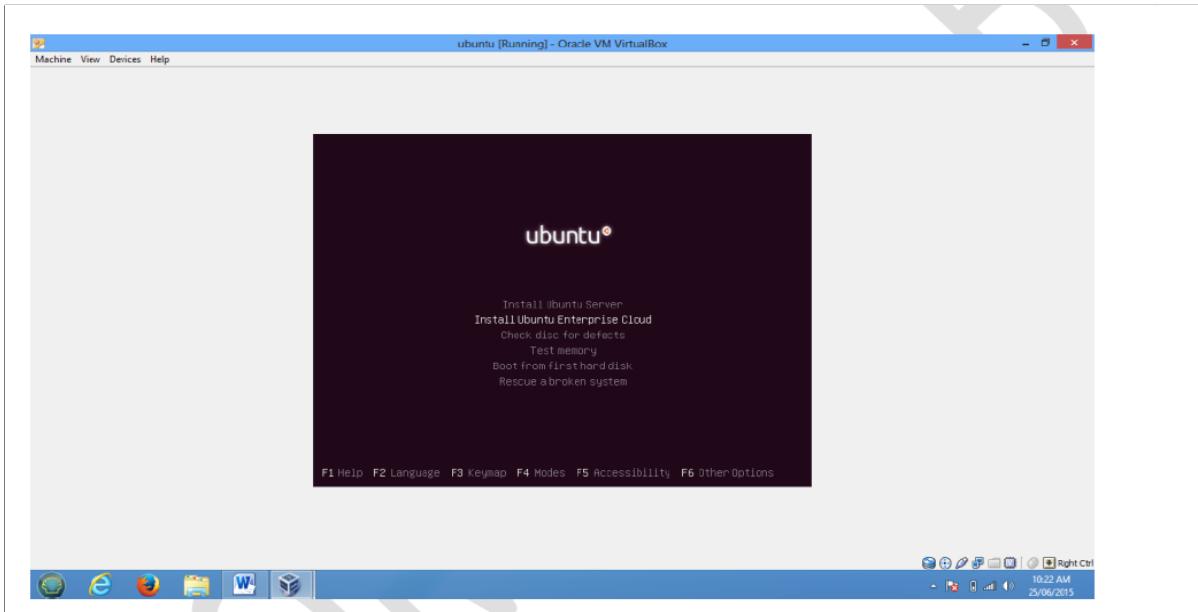
**Step 4:- To Select the media for installation Click on start and browse for iso file**



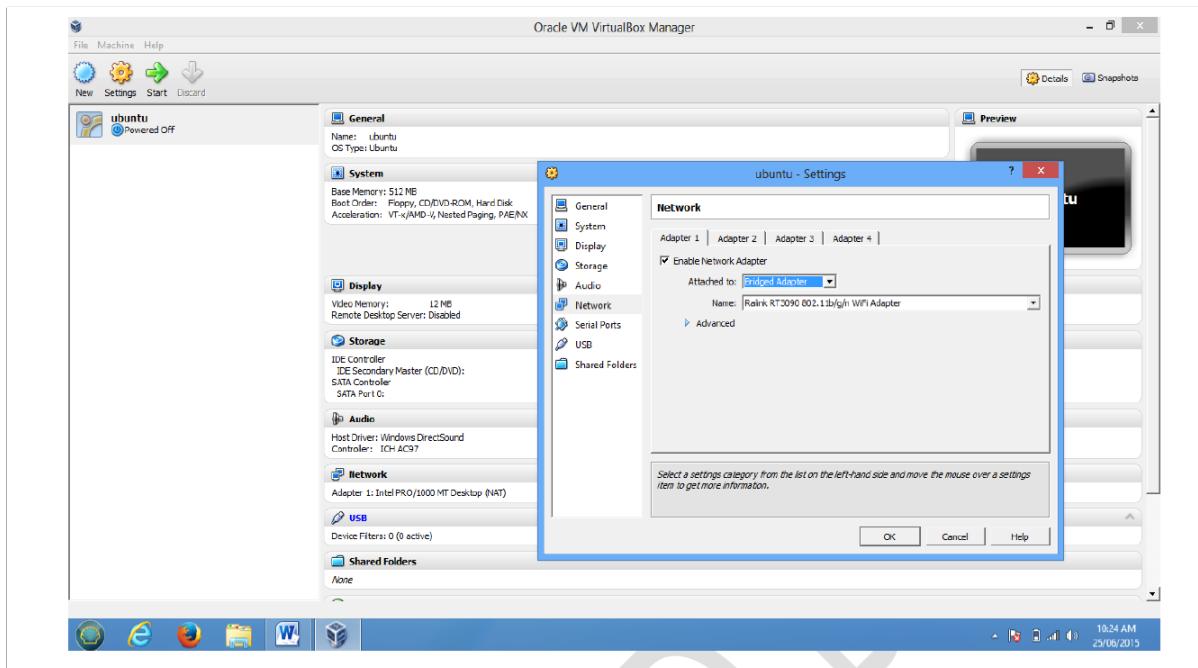
**Step 5:Complete the Installation and use it.**



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Step 6: To Connect OS to the network change network Mode to Bridge Adaptor





## **2) Hosted Virtualization on KVM Hypervisor**

The Steps to Create and run Virtual machines in KVM are as follows

### **1) Check whether CPU has hardware virtualization support.**

KVM only works if your CPU has hardware virtualization support – either Intel VT-x or AMD-V. To determine whether your CPU includes these features, run the following command:

```
#sudo grep -c "svm|vmx" /proc/cpuinfo
```

```
root@ubuntu:/home/tsec# sudo grep -c "svm\|vmx" /proc/cpuinfo
3
root@ubuntu:/home/tsec#
```

A 0 indicates that your CPU doesn't support hardware virtualization, while a 1 or more indicates that it does.

### **2) Install KVM and supporting packages.**

Virt-Manager is a graphical application for managing your virtual machines. you can use the kvm command directly, but libvirt and Virt-Manager simplify the process.

```
#sudo apt-get install qemu-kvm libvirt-bin bridge-utils virt-manager
```

```
root@ubuntu:/home/tsec# apt-get install qemu-kvm libvirt-bin bridge-utils virt-manager
```



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### **3) Create User.**

Only the root user and users in the libvирtd group have permission to use KVM virtual machines. Run the following command to add your user account to the libvирtd group:

```
#sudo adduser tsec  
#sudo adduser tsec libvирtd
```

After running this command, **log out** and **log back in as tsec**

```
root@ubuntu:/home/tsec# adduser tsec  
root@ubuntu:/home/tsec# adduser tsec libvирtd
```

### **4) Check whether everything is working correctly.**

Run following command after logging back in **as tsec** and you should see an empty list of virtual machines.

This indicates that everything is working correctly.

```
#virsh -c qemu:///system list
```

```
root@ubuntu:/home/tsec# virsh -c qemu:///system list  
Id   Name          State  
----  
root@ubuntu:/home/tsec#
```



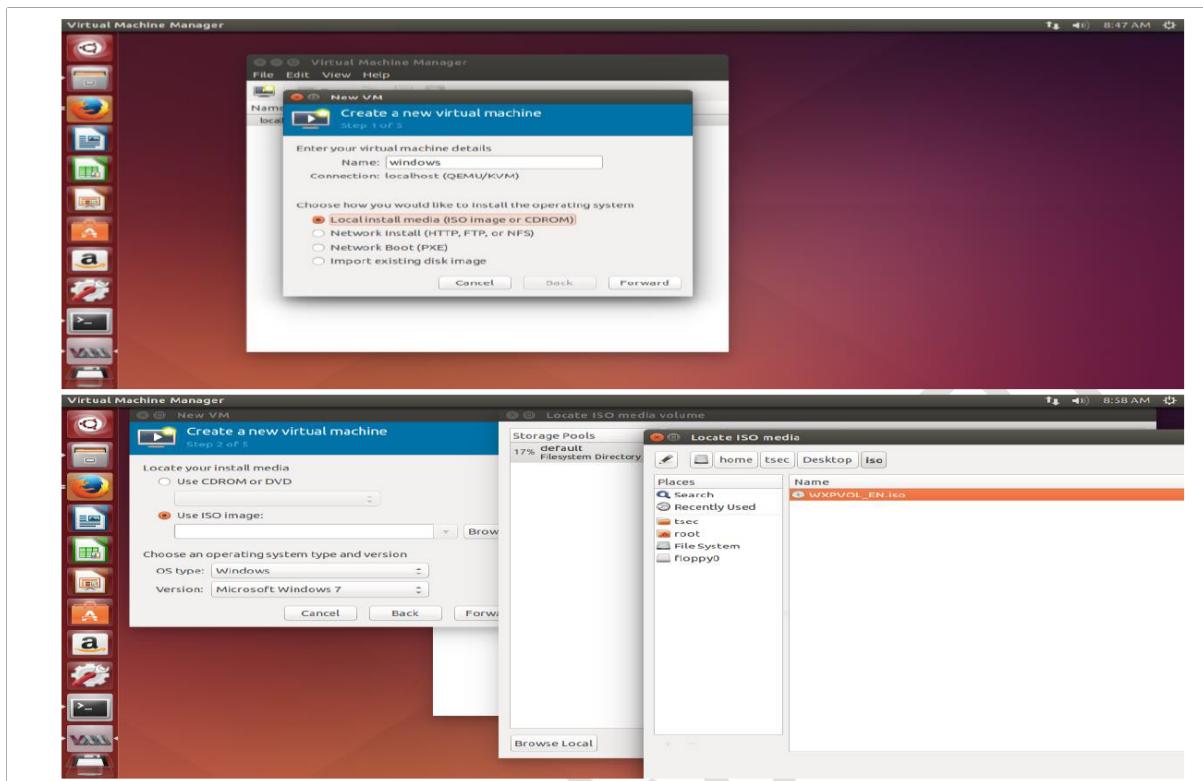
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**5)Open Virtual Machine Manager application and Create Virtual Machine**

#virt-manager

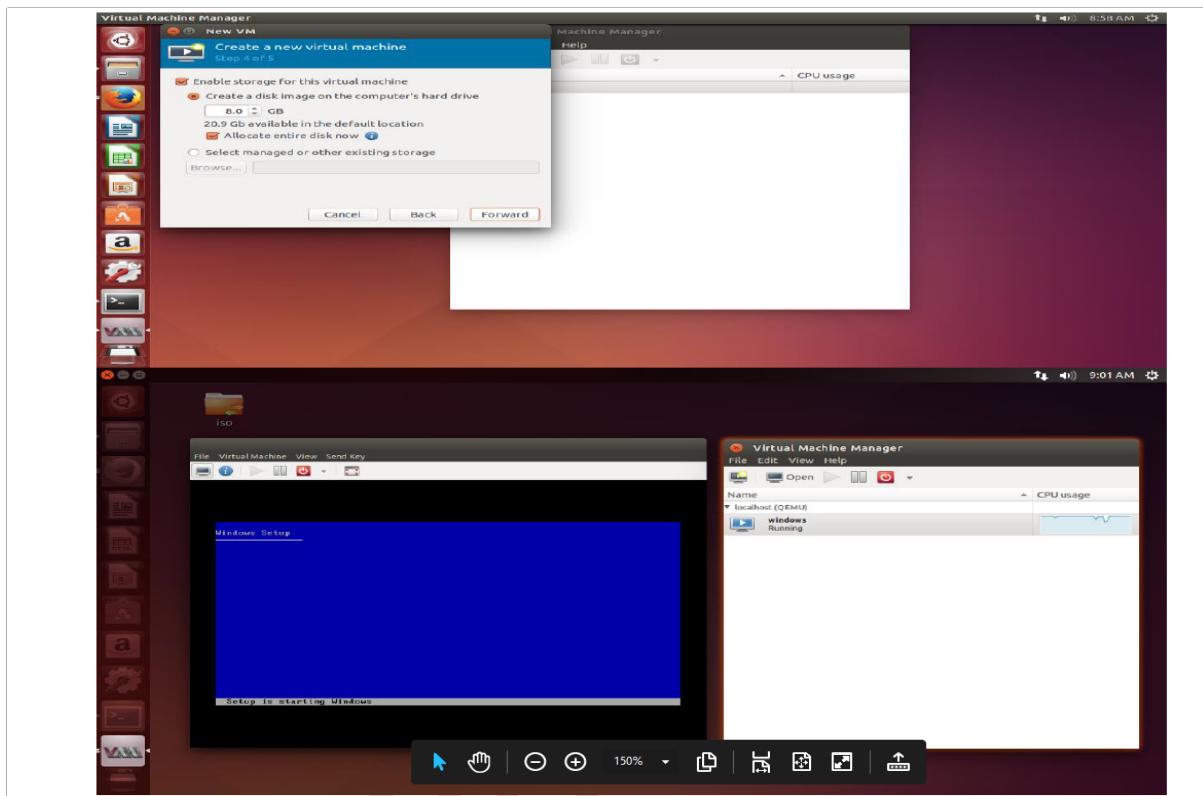
```
root@ubuntu:/home/tsec# virt-manager
```

**6) Create and run Virtual Machines**





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```
$ sudo virsh list --all
```

Id	Name	State
1	ubuntu-vm	running

```
$ virsh
```

```
Welcome to virsh, the virtualization interactive terminal.
```

```
Type: 'help' for help with commands  
      'quit' to quit
```

```
virsh #
```

```
virsh #
```

```
virsh # list --all
```

Id	Name	State
1	Windows	running

Conclusion \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Answer The Following Questions

Q1. Explain The concept of Virtual Machine.

Ans. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Q2. Explain Types of Virtualization.

Ans. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



## EXPERIMENT NO3

**Title:** To study and Implement Bare-metal Virtualization using Xen, HyperV or VMware Esxi.

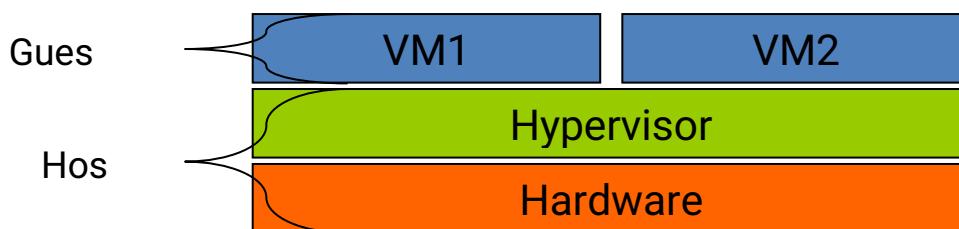
**Objective:** To understand the functionality of Bare-metal hypervisors and their relevance in cloud computing platforms. This experiment should have demonstration of install, configure and manage Bare Metal hypervisor along with instructions to create and run virtual machines inside it. It should also emphasize on accessing VMs in different environments along with additional services provided by them like Load balancing, Auto-Scaling, Security etc.

### 3.1 VIRTUALIZATION STRUCTURES/TOOLS AND MECHANISMS

#### 3.1.1. Hypervisor

- Definitions
  - **Hypervisor** (or **VMM** – Virtual Machine Monitor) is a software layer that allows several **virtual machines** to run on a **physical machine**
  - The physical OS and hardware are called the **Host**
  - The virtual machine OS and applications are called the **Guest**

#### Type 1 (bare-metal)



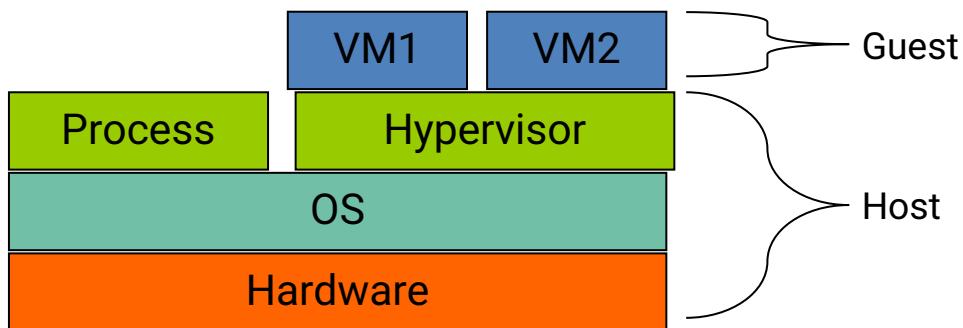
VMware ESX, Microsoft Hyper-V, Xen



### Type 1

These hypervisors run directly on the host's hardware to control the hardware and to manage guest operating systems. For this reason, they are sometimes called [bare metal](#) hypervisors. A guest operating system runs as a [process](#) on the host

### Type 2

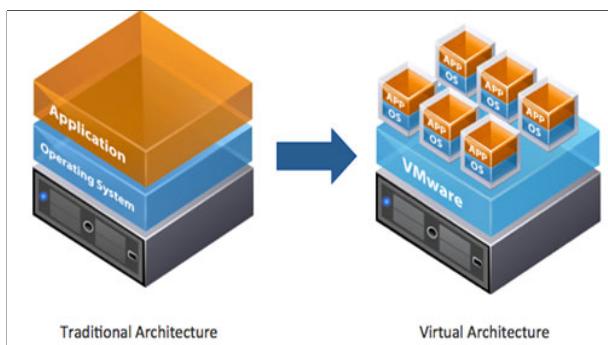


VMware Workstation, Microsoft Virtual PC, Sun VirtualBox, QEMU, KVM

### Type 2

These hypervisors run on a conventional operating system just as other computer programs do. Type-2 hypervisors abstract guest operating systems from the host operating system

## 3.2 Virtual Machine Technology





### 3.2.1 The Traditional Server Concept

- Unless there are multiple servers, if a service experiences a hardware failure, then the service is down.
- System Admins can implement clusters of servers to make them more fault tolerant. However, even clusters have limits on their scalability, and not all applications work in a clustered environment.

### 3.2.1 The Virtual Server Concept

- Virtual servers can still be referred to by their function i.e. email server, database server, etc.
- If the environment is built correctly, virtual servers will not be affected by the loss of a host.
- Hosts may be removed and introduced almost at will to accommodate maintenance.

#### 3.2.1.1.The Xen Architecture

- Xen is an open source hypervisor program developed by Cambridge University. Xen is a microkernel hypervisor, which separates the policy from the mechanism.
- The Xen hypervisor implements all the mechanisms, leaving the policy to be handled by Domain 0.
- Xen does not include any device drivers natively .
- It just provides a mechanism by which a guest OS can have direct access to the physical devices.
- As a result, the size of the Xen hypervisor is kept rather small.

Xen provides a virtual environment located between the hardware and the OS

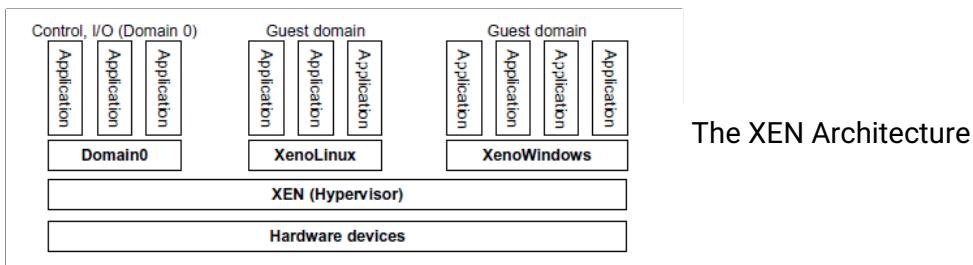
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physical devices.

- As a result, the size of the Xen hypervisor is kept rather small.
- Xen provides a virtual environment located between the hardware and the OS.
- The core components of a Xen system are the hypervisor, kernel, and applications.
- The organization of the three components is important. Like other virtualization systems, many guest OSes can run on top of the hypervisor.
- Not all guest OSes are created equal, and one in particular controls the others.
- The guest OS, which has control ability, is called Domain 0, and the others are called Domain U. Domain 0 is a privileged guest OS of Xen.
- It is first loaded when Xen boots without any file system drivers being available.
- Domain 0 is designed to access hardware directly and manage devices.
- Therefore, one of the responsibilities of Domain 0 is to allocate and map hardware resources for the guest domains (the Domain U domains).



### 3.2.1.2 Three Kinds of Virtualization

There are three ways to create virtual servers: **full virtualization**, **Para-virtualization** and **OS-level virtualization**

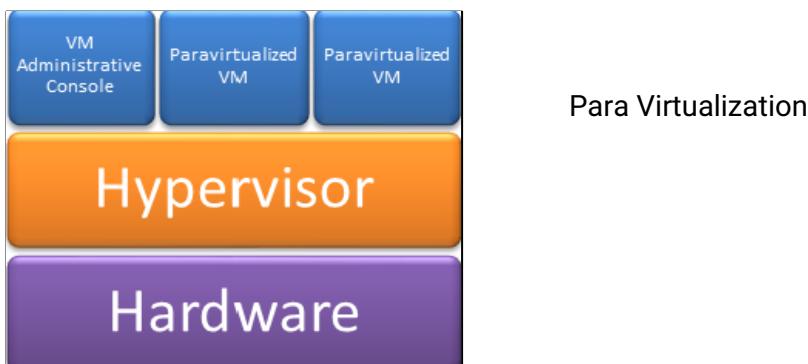
#### 1. Full virtualization

- Uses a special kind of software called a **hypervisor**. The hypervisor interacts directly with the physical server's CPU and disk space. VMWare® is a good example.
- The hypervisor keeps each virtual server completely independent and **unaware of the other virtual servers** running on the physical machine



## 2. Para virtualization:

- Para virtualization refers to communication between the guest OS and the hypervisor to improve performance and efficiency. The guest servers in a Para-virtualization system are aware of one another



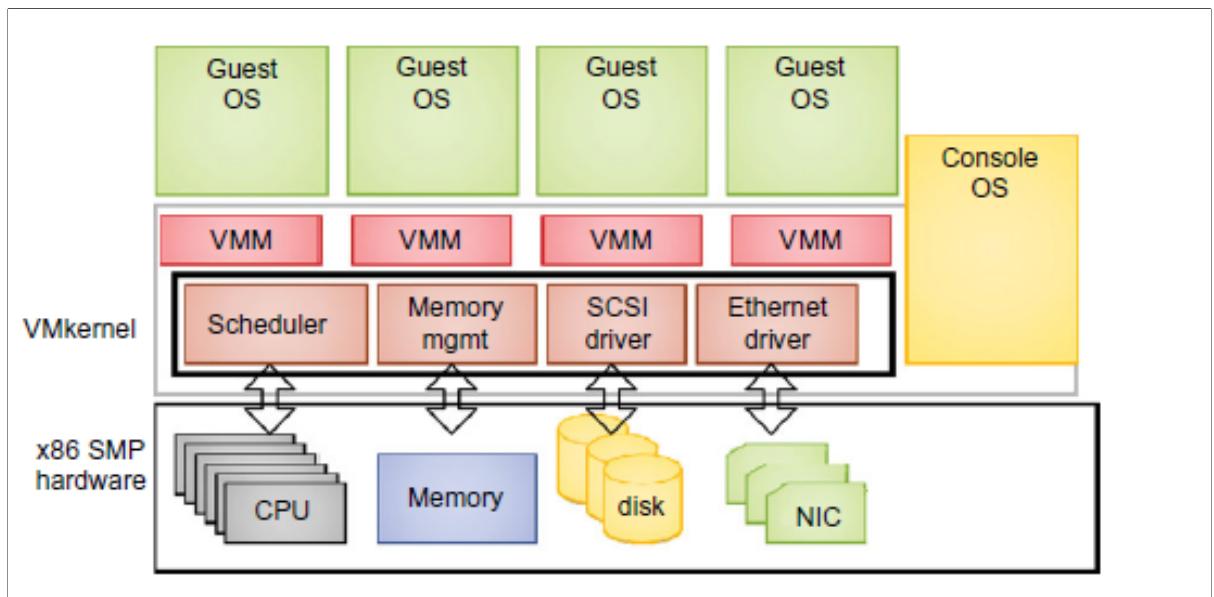
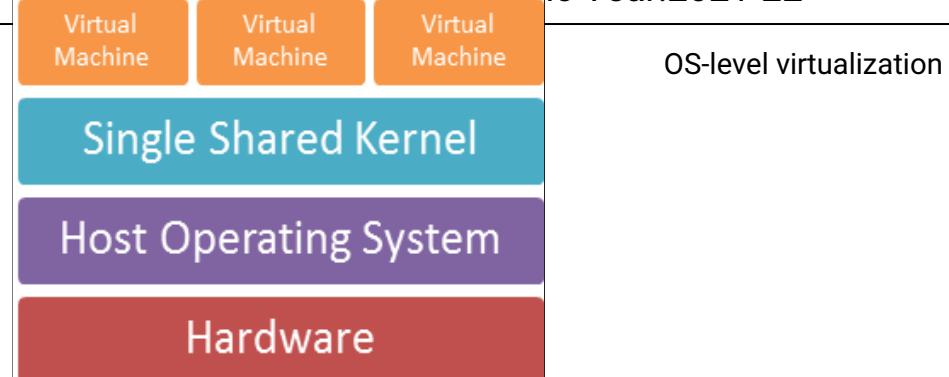


Fig.The VMware ESX server architecture using para-virtualization

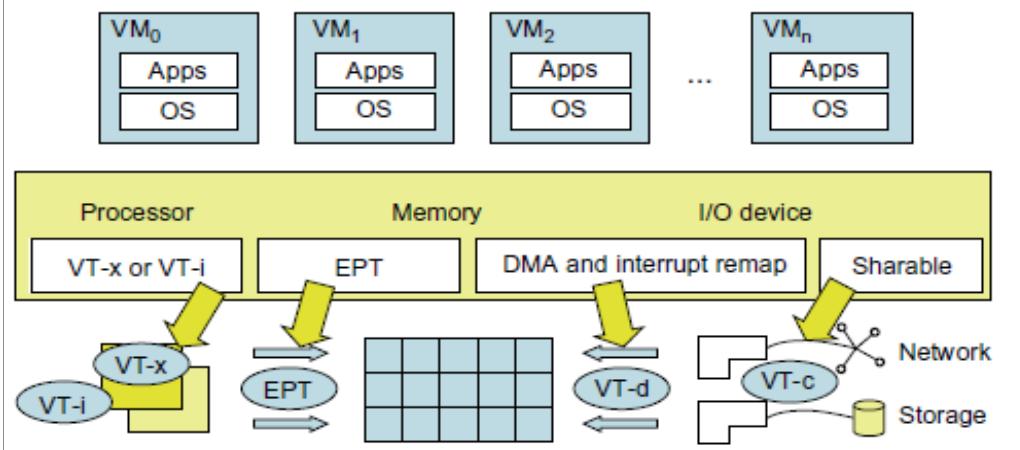
### 3. OS-level virtualization

- An OS-level virtualization approach doesn't use a hypervisor at all. Instead, the virtualization capability is part of the host OS, which performs all the functions of a fully virtualized hypervisor.
- The biggest limitation of this approach is that all the guest servers must run the same OS.



### 3.3 VIRTUALIZATION OF CPU, MEMORY, AND I/O DEVICES

- Hardware Support for Virtualization in the Intel x86 Processor
- Since software-based virtualization techniques are complicated and incur performance overhead, Intel provides a hardware-assist technique to make virtualization easy and improve performance.
- Intel offers the VT-x or VT-i technique. VT-x adds a privileged mode (VMX Root Mode) and some instructions to processors.
- This enhancement traps all sensitive instructions in the VMM automatically.
- For memory virtualization, Intel offers the EPT, which translates the virtual address to the machine's physical addresses to improve performance. For I/O virtualization, Intel implements VT-d and VT-c to support this



### Hardware Support for Virtualization in the Intel x86 Processor

#### 3.3.1 CPU Virtualization

A CPU architecture is virtualizable if it supports the ability to run the VM's privileged and unprivileged instructions in the CPU's user mode while the VMM runs in supervisor mode.

When the privileged instructions including control- and behavior-sensitive instructions of a VM are executed, they are trapped in the VMM.

In this case, the VMM acts as a unified mediator for hardware access from different VMs to guarantee the correctness and stability of the whole system. However, not all CPU architectures are virtualizable.

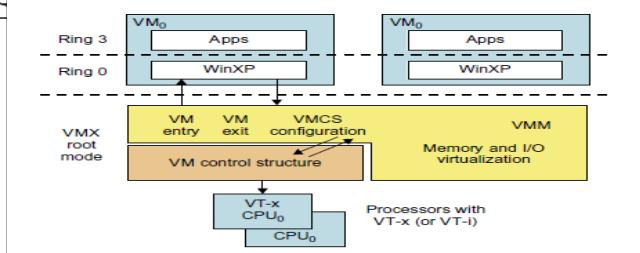
#### 3.1.1.Hardware-Assisted CPU Virtualization

- Although x86 processors are not virtualizable primarily, great effort is taken to virtualize them.
- They are used widely in comparing RISC processors that the bulk of x86-based legacy systems cannot discard easily.
- Intel's VT-x technology is an example of hardware-assisted virtualization.
- Intel calls the privilege level of x86 processors the VMX Root Mode.
- In order to control the start and stop of a VM and allocate a memory page to maintain the CPU state for VMs, a set of additional instructions is added.
- At the time of this writing, Xen, VMware, and the Microsoft Virtual PC all implement their hypervisors by using the VT-x technology.

Intel hardware-assisted CPU  
virtualization



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### 3.3.2 Memory Virtualization

- **Memory virtualization** decouples volatile (RAM) resources from individual systems in the data center, and then aggregates those resources into a virtualized memory pool available to any computer in the cluster.
- The memory pool is accessed by the operating system or applications running on top of the operating system.
- The distributed memory pool can then be utilized as a high-speed cache, a messaging layer, or a large, shared memory resource for a CPU or a GPU application

### 3.3.3 I/O Virtualization

- I/O virtualization involves managing the routing of I/O requests between virtual devices and the shared physical hardware.
- At the time of this writing, there are three ways to implement I/O virtualization: full device emulation, para-virtualization, and direct I/O.

- Full device emulation is the first approach for I/O virtualization.
- Generally, this approach emulates well-known, real-world devices.
- All the functions of a device or bus infrastructure, such as device enumeration, identification,
- interrupts, and DMA, are replicated in software. This software is located in the VMM and acts as a virtual device.
- The I/O access requests of the guest OS are trapped in the VMM which interacts with the I/O devices.

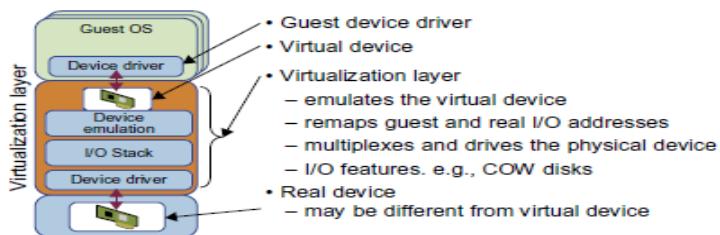


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**FIGURE 3.14**

Device emulation for I/O virtualization implemented inside the middle layer that maps real I/O devices into the virtual devices for the guest device driver to use.

## Implementation:

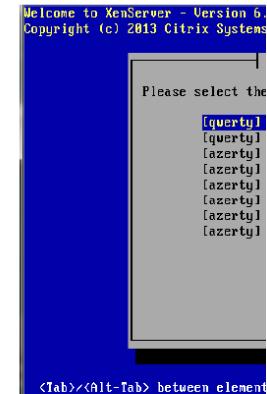
### Step 1: Install Xen Server

Step i:- Insert Bootable Xen Server CD into CDROM and Make first boot device as a CDROM from BIOS

Step ii:- press F2 to see the advanced options, otherwise press Enter to start installation



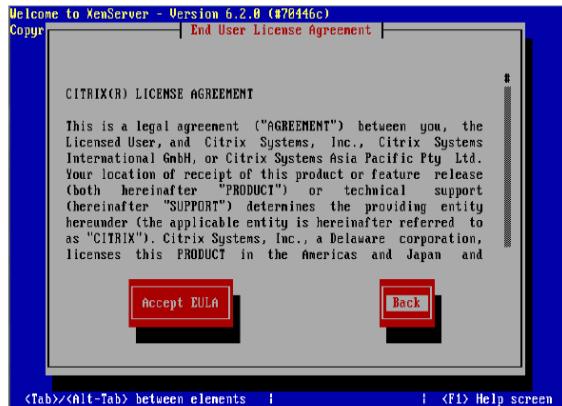
### Step iii :- Select Keyboard



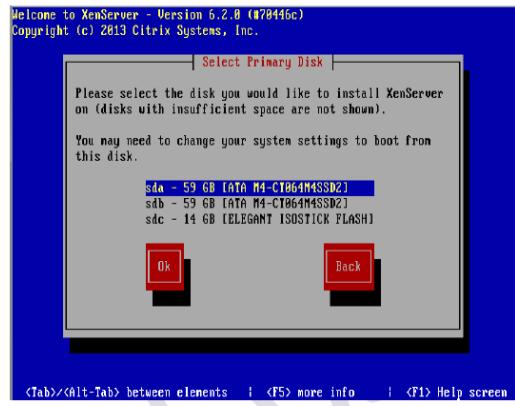
### Step v :-Press Enter to A



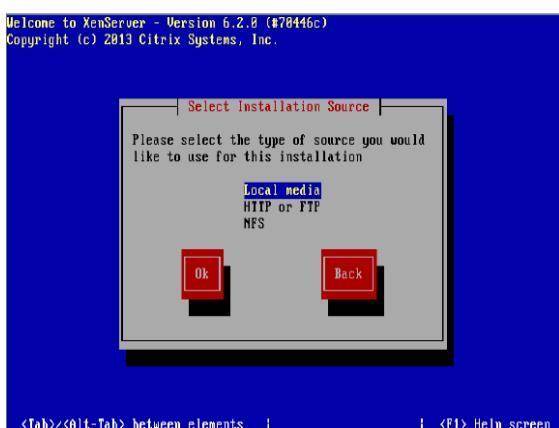
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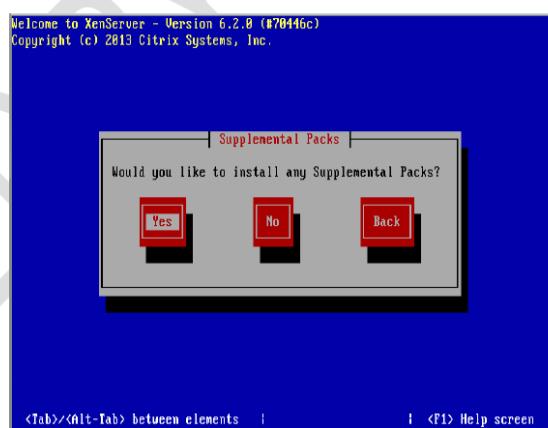
**Step vii :-Select Appropriate installation Media**



**Step viii :-Select Additional Packages for installation**



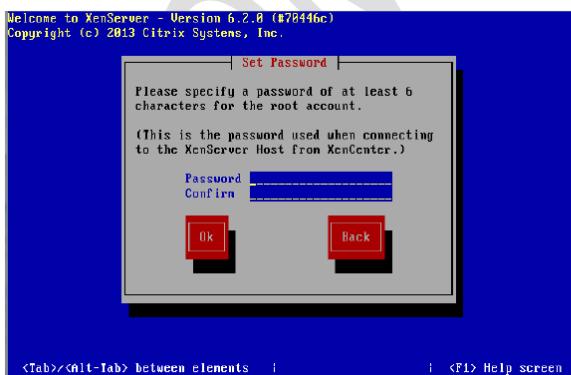
**Step ix:- Specify Root password**



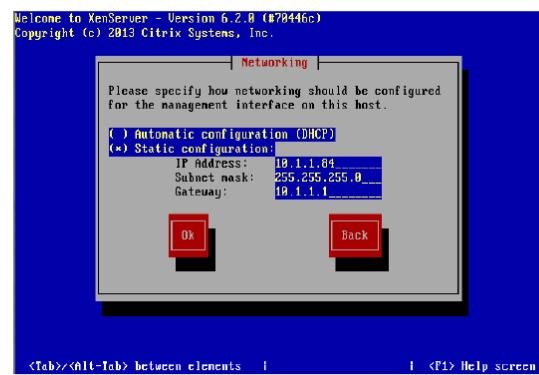
**Step x :- Specify IP Address to a Xen Server**



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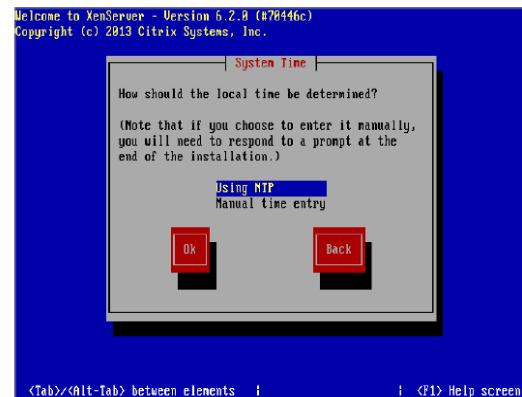
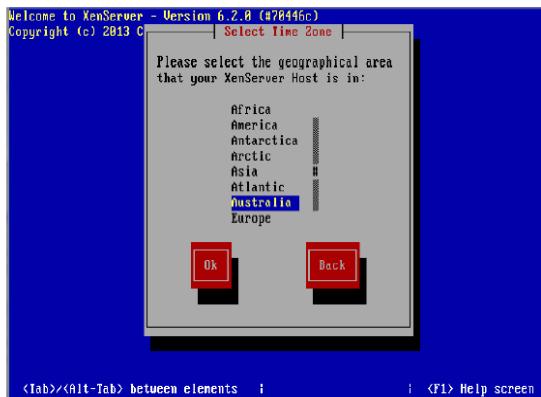


**Step xi:-Select Time Zone**



**Step xii:-Specify NTP Servers address or use manual**

**time entry then start installation**





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Once installation is done you will see the final screen shown below.



Xen Server Final Screenshot

## Step 2: Connect Xen Server to Xen Center

Firstly, download the xen center a management utily from xen server by opening the xen severs IP address as a URL on browser. Once Xen center is downloaded, install it. Open Xen center from start menu of Windows



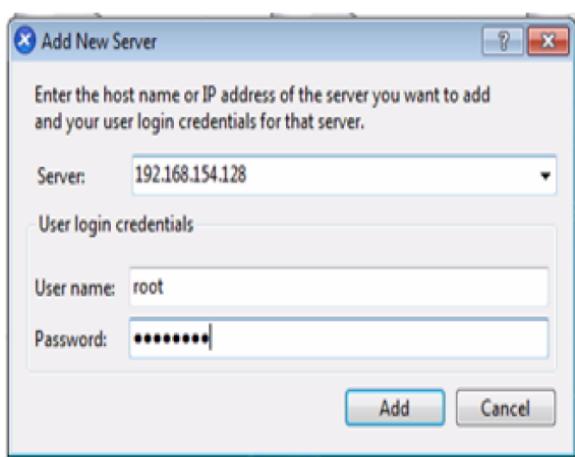
Here's how XenCenter looks like (see screenshot below) before any hosts, resource pools, and so on, are added to it. To connect to the XenServer host you configured earlier, click Add a server.



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Enter the IP address I asked you to take note of earlier. Also enter the password you assigned for your root account. Click Add.



One of the first things you want to make sure as you're adding a new XenServer to XenCenter is to save and restore the server connection state on startup. Check the box that will do just that.



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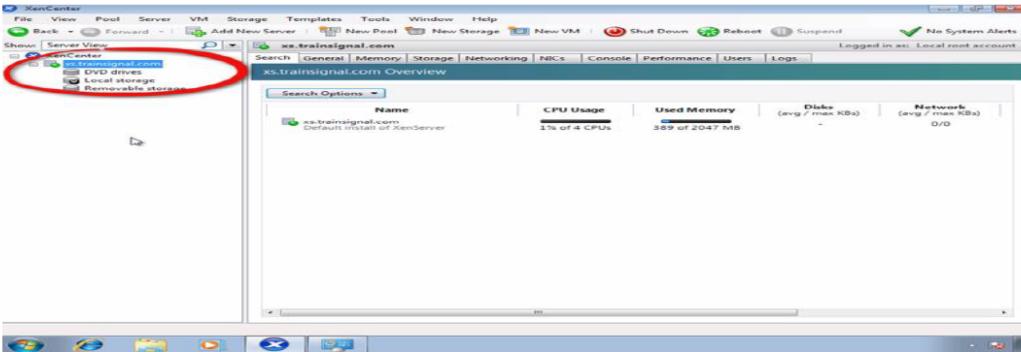
After you click OK, you'll be brought back to the main screen, where you'll see your XenServer already added to XenCenter.



Once you do that, you will be allowed to configure a master password for all the XenServers you'll be associating with this XenCenter. Click the Require a master password checkbox if that's what you want to do, and then enter your desired master password in the fields provided.



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**Step-3 Create Storage Repository and Installing VM**

Now Before Creating VM we have to Create Storage Repository first which is nothing but shared directory on Xen Center which holds all iso files and which is required to install Operating system on Xen Server its steps are as follows.Right click on Xenserver icon on xen center and click on New SR

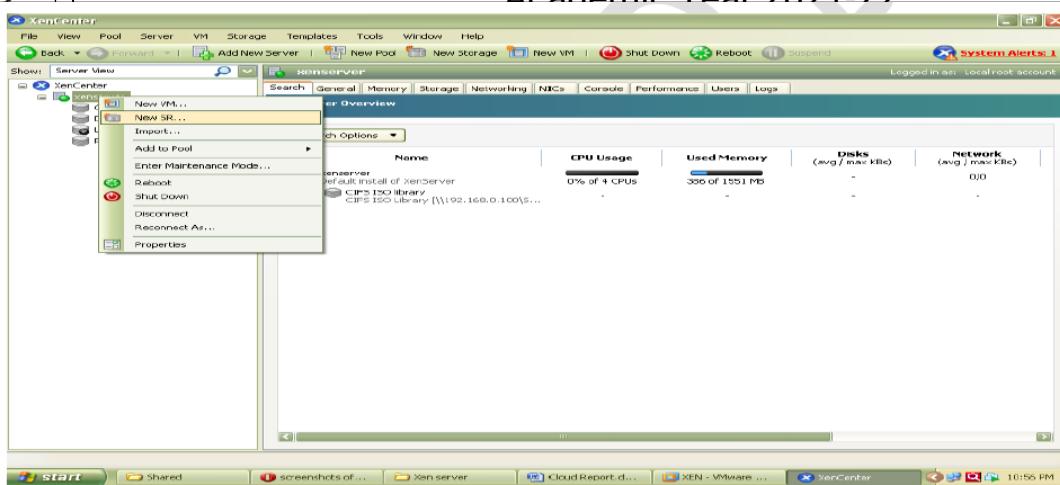


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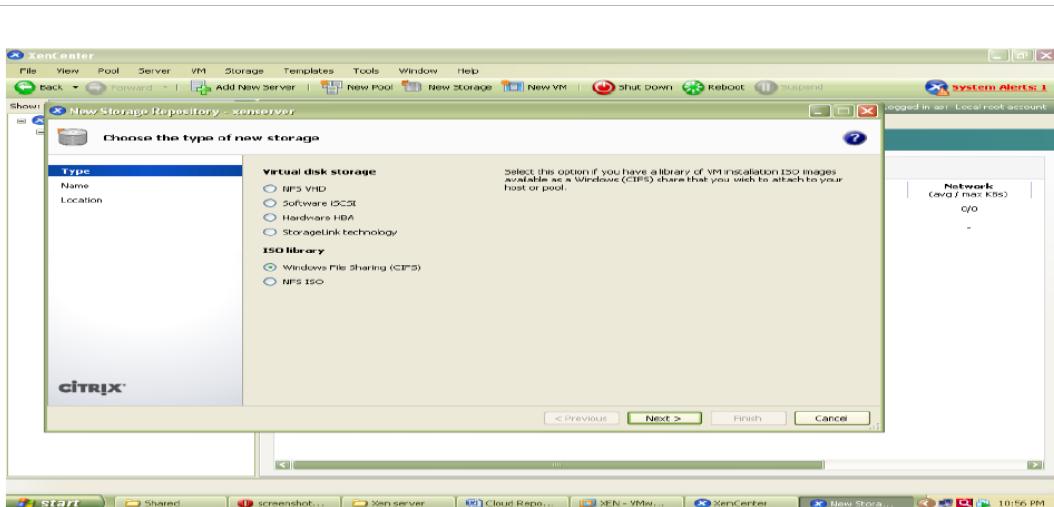
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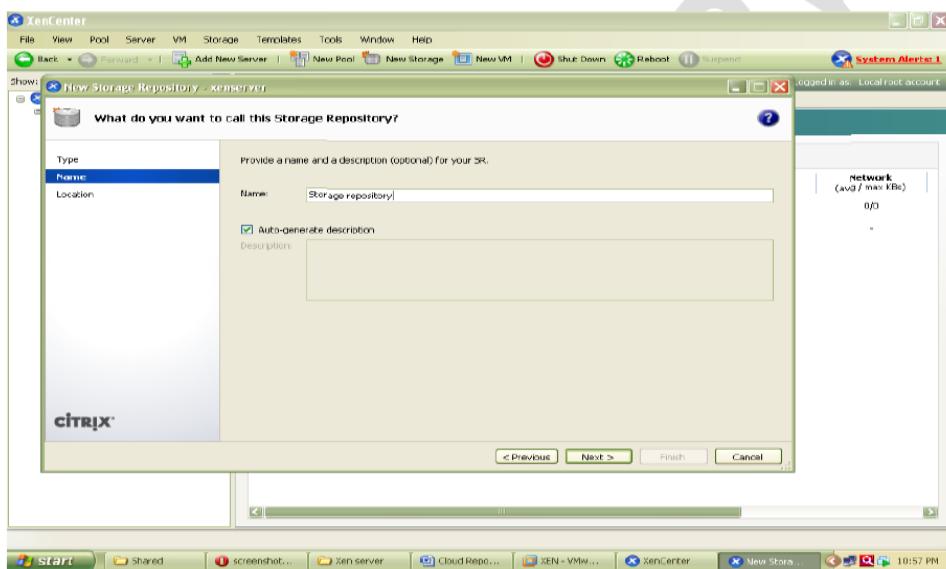
Now Select Windows CIFS library



Specify Storage Repository Name



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Now specify path of shared folder at client side which holds all iso files of os or VM which we are going to install on Xen Server.

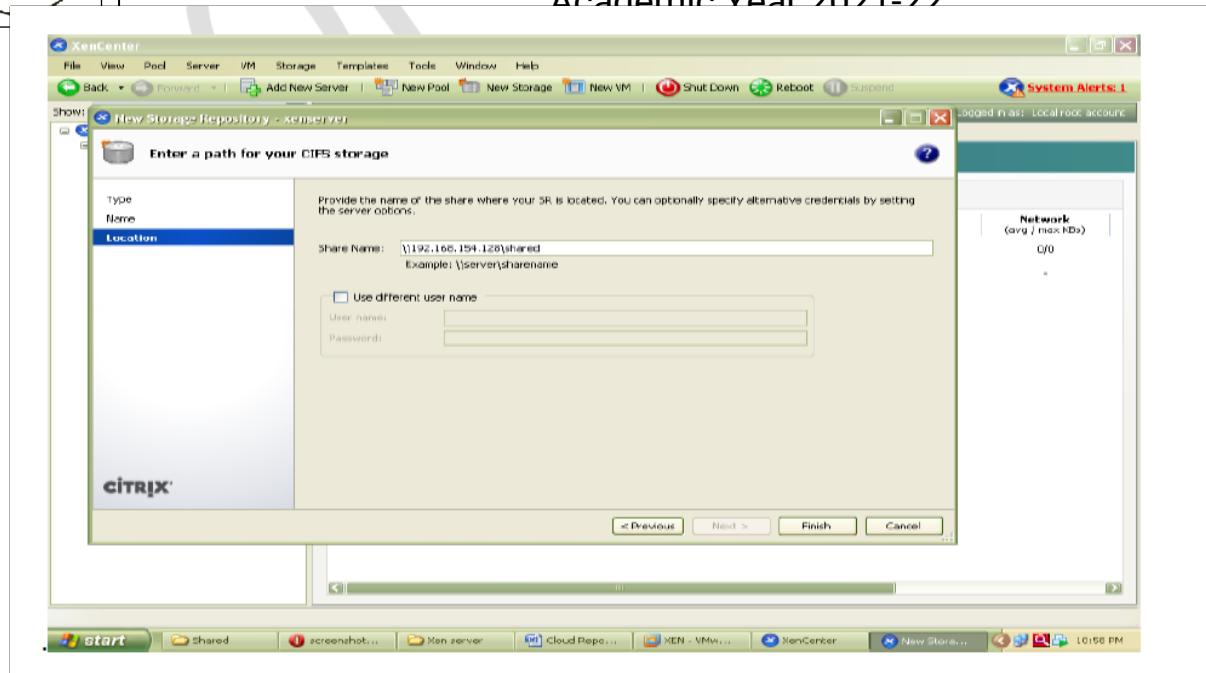


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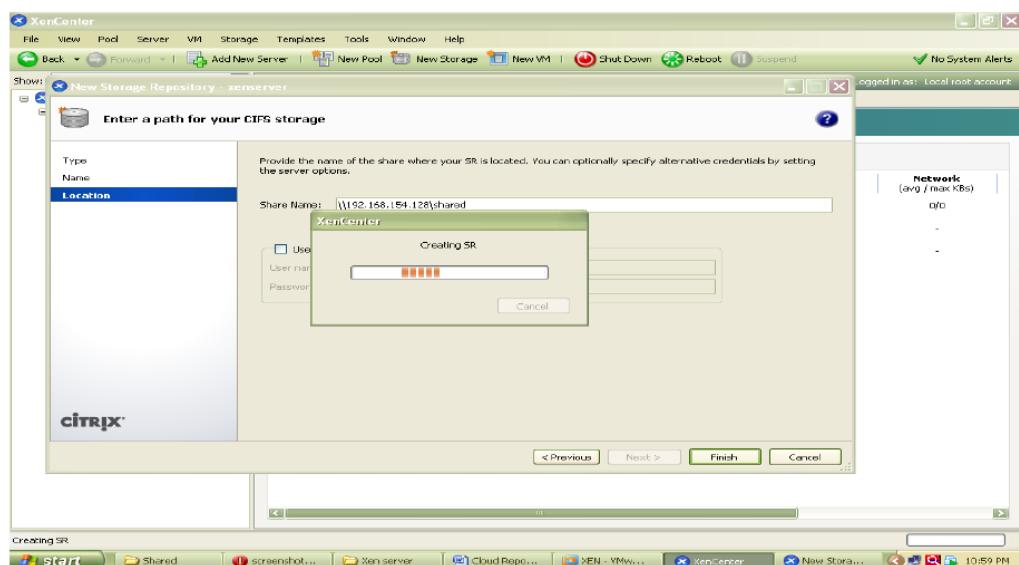
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At the end Click on finish to create SR.



To check all iso files click on CIFS library and select storage this will show you all iso files.



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Name	Description	Size	Virtual Machine
VMK3 SP1.iso		701.6 MB	
Ubuntu-11.04-desktop-i386.iso		685.3 MB	
XenDesktop55.iso		2.1 GB	
XAF_3_0_0_ML_dvdiso		1.6 GB	
Ubuntu-11.10-desktop-i386.iso		695.3 MB	
XenServer-5.0.0-install-cd.iso		500.5 MB	
Ubuntu-10.10-desktop-i386.iso		693.4 MB	
Ubuntu-10.10-server-i386.iso		627.3 MB	
Ubuntu-12.04.1-server-i386.iso		645.3 MB	
XCP-1.0-base-42052.iso		176.2 MB	
ultra-cvd-3.0-latest.iso		1.4 GB	
Win2008Ess.iso		817.1 MB	

### Installation of UBUNTU Server on Xen Server

Step 1 :- Right click on Xenserver icon on xen center and select New VM

The screenshot shows the XenCenter interface with the 'New VM...' option highlighted in the context menu for the 'xenserver' entry in the tree view. The main window displays general server statistics.

Now select an Operating System to be install here select Ubuntu Lucid Lynx and click on next



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The screenshot shows the XenCenter interface. On the left, there's a sidebar with options like Server View, XenServer, and New VM. The main area has a title bar 'Select a VM template'. On the left of this title bar is a 'Template' sidebar with categories: Name, Installation Media, Home Server, CPU & Memory, Storage, Networking, and Finish. The 'Name' section is expanded, showing 'Ubuntu Lucid Lynx 10.04 (32-bit)' selected. To the right of the sidebar is a search bar labeled 'Search...' and a list of templates. The selected template is highlighted in green. A detailed description box on the right provides information about the template, mentioning it allows VM installation from Xen-aware OEM-based media. At the bottom of the dialog are buttons for 'Copy host BIOS strings to VM', '< Previous', 'Next >', 'Finish', and 'Cancel'.

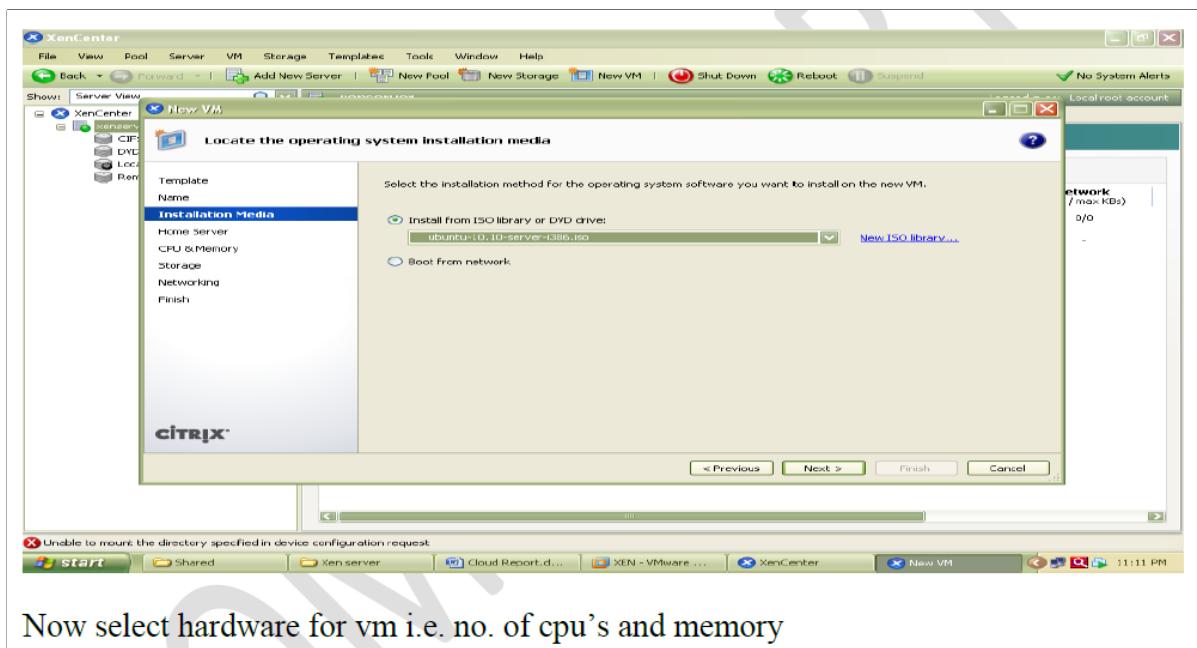
Now specify Instance Name as ubuntu server

The screenshot shows the 'Name the new virtual machine' dialog in XenCenter. The left sidebar has the 'New VM' option selected. The main area has a title bar 'Name the new virtual machine'. On the left is a 'Template' sidebar with the same categories as before. The 'Name' section is expanded, showing 'Name' set to 'Ubuntu server' and 'Description' empty. A note in the center says: 'Enter a name that will help you to identify the virtual machine later. This could be a name that describes its software and hardware such as RHEL DHCP Server, Win2003 XenApp Server or Exchange 2007 Client Access Server. This name will also be displayed in XenCenter's Resources pane and can be changed later.' Below this are 'Name:' and 'Description:' input fields. At the bottom are buttons for '< Previous', 'Next >', 'Finish', and 'Cancel'.

Select iso file of Ubuntu server 10.10 to be install



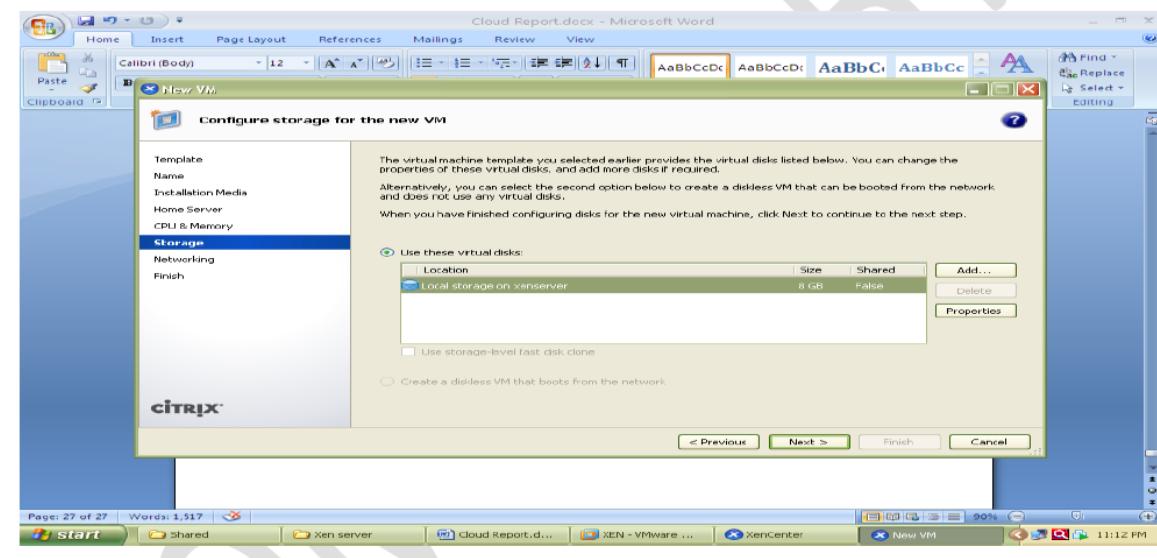
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Now select hardware for vm i.e. no. of cpu's and memory



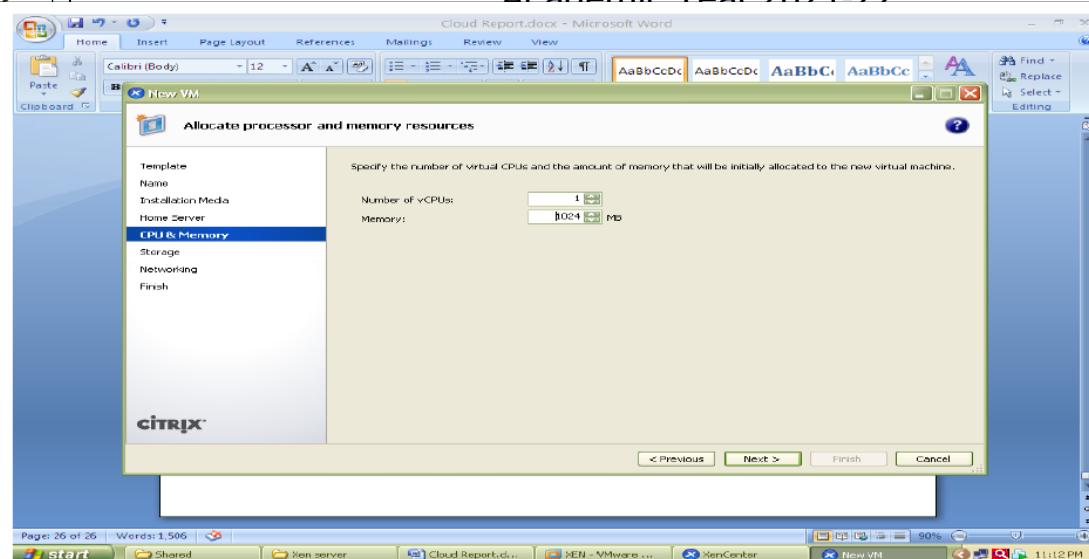
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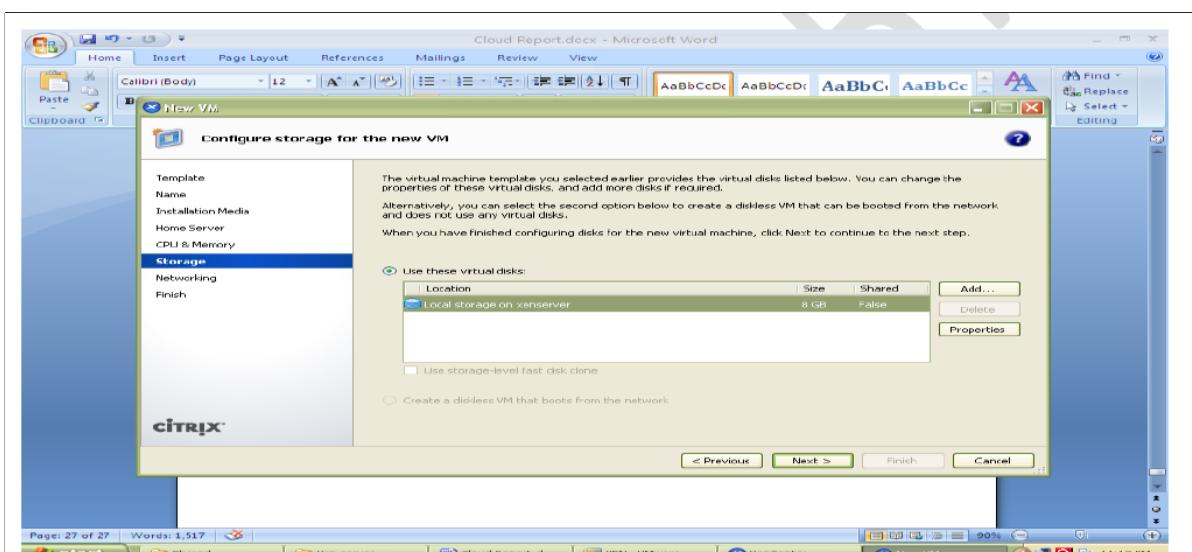
Select network



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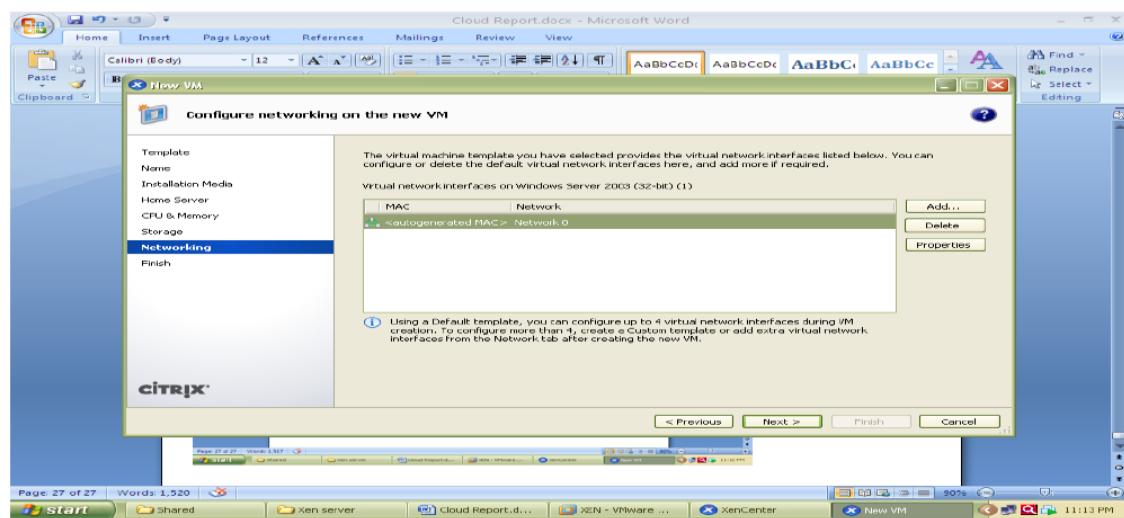
Select local storage



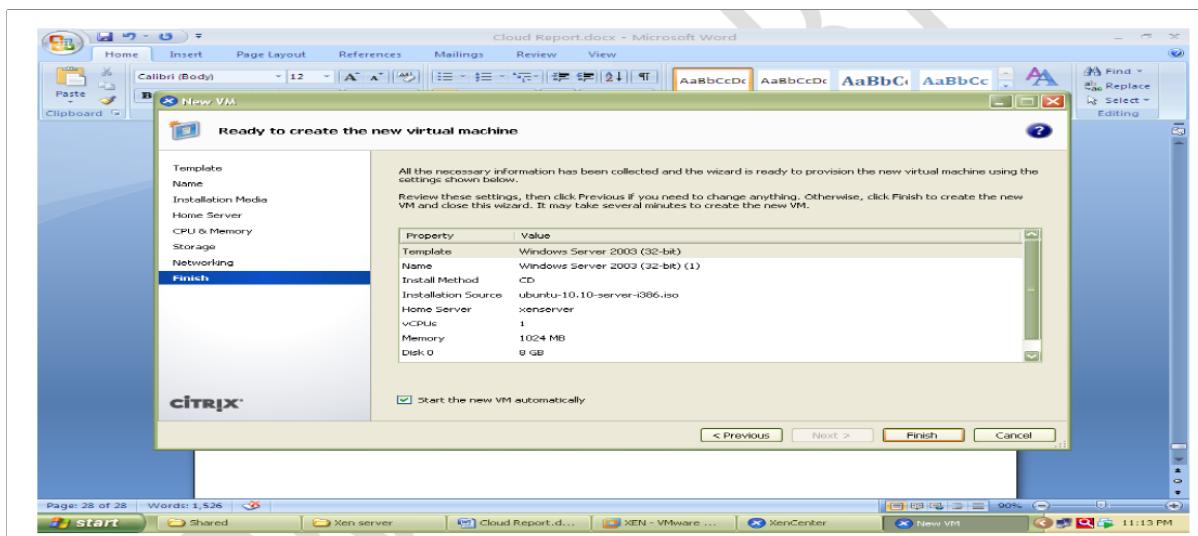
Select network



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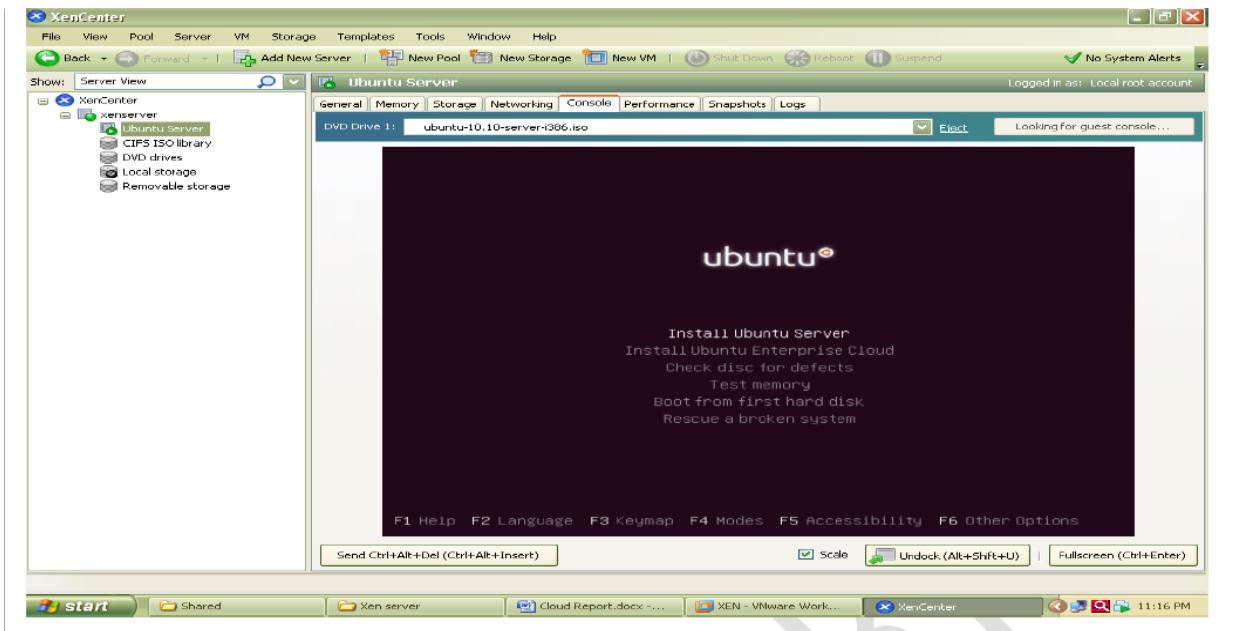
And click on finish



Now go to Console tab to install ubuntu and follow installation Steps.



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The Xen orchestra provides web based functionality of Xen Center.it provides access to all the VMs with their lifecycle management which are installed over Xen Server shown in figure 5.28



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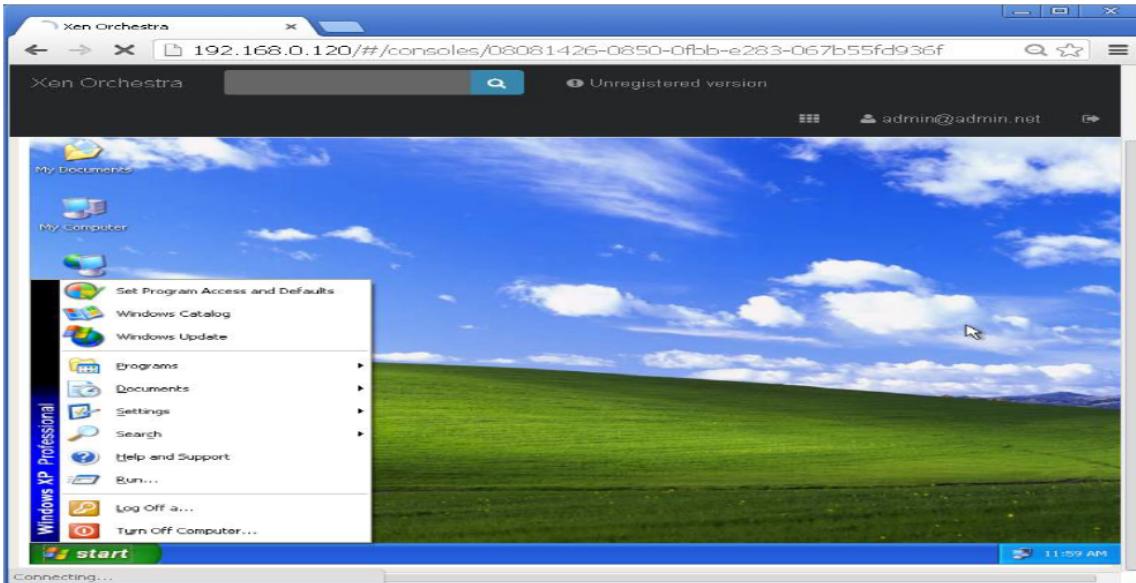
The screenshot shows the Xen Orchestra (XOA) interface running in a Google Chrome browser window. The URL in the address bar is 192.168.0.102/. The main content area displays a table of virtual machines (VMs) managed by the xenserver. The table includes columns for VM name, status, memory size, and IP address.

VM Name	Status	Memory	IP Address
XOA	Running	512MB	192.168.0.102
Transfer VM for VDI 1287a7eb-7c51-493e-b76c-83473d64a042	Running	68MB	192.168.0.102
Uteo-ovd-3.0.4-demo-appliance	Imported from an OVF/DVA package.	1GB	

**Xen Orchestra (XOA) Portal** The Windows XP image running on Xen Orchestra over Google chrome web browser is shown in following screenshot



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Windows XP running on Xen orchestra (XOA)

Conclusion \_\_\_\_\_  
-----  
-----  
-----

Answer the following questions

Q1.What is mean by Hypervisor? Explain the types of Hypervisor

Ans \_\_\_\_\_  
-----  
-----  
-----

Q2.Explain Virtual Server Concept and types of server virtualization

Ans; \_\_\_\_\_  
-----  
-----  
-----



## Experiment no 4

**Title:** To study and Implement Infrastructure as a Service using AWS/Microsoft Azure.

**Objective:** To demonstrate the steps to create and run virtual machines inside Public cloud platform. This experiment should emphasize on creating and running Linux/Windows Virtual machine inside Amazon EC2 or Microsoft Azure Compute and accessing them using RDP or



**Installation and Configuration of Ulteo to demonstrate on demand Application delivery over web browser to explore SaaS Environment**

### **Theory and Implementation**

Ulteo is an open source Virtual Desktop infrastructure project that can deliver various operating systems desktops - including Windows and Linux desktops or applications - to end users. The Open Virtual Desktop allows corporates to deploy virtualized GNU/Linux and/or Windows desktops. Parts of Ulteo products are based on Debian and Ubuntu. Ulteo Open Virtual Desktop is an open source alternative to Citrix and VMWare solutions.

The steps for installation and configuration of Ulteo are given as follows

Step 1: Install Ulteo through DVD or Open Ulteo OVF file in Vmware player by selecting import VM button

1) If you haven't an Ulteo OVD DVD-ROM yet, please download the corresponding ISO file from this place at [www.ulteo.com](http://www.ulteo.com) and burn it to a fresh DVD

2) Insert the Ulteo OVD DVD-ROM into your computer and restart it. If you selected the DVD-ROM as first boot device you'll see the boot loader Screen.

3) Select Install Ulteo Option

4) The first step is used to select the system language. Choose your language from the list and click on Forward.

5) In the second step, the system asks you to define your location. Either select a point on the map or choose one from the Selected city form and click on Forward.

6) The third step is used to define the keyboard layout. Select yours and click on Forward.

7) Then, you have to select the partitioning method. We suggest the automatic method: Erase and use the entire disk.

8) These questions are about the installed operating system itself, user login and password used to access the OS, along with the hostname of the machine.

9) Type a password and confirm it. Useful address is displayed to you for a near future use of OVD.

10) Then read carefully the installation summary, then click on Install and wait til installation completes

11) Finally, click on Restart now to finish installation process.

Step 2: In Management machine Open following URLs

<https://Ulteo-Server-ipaddress/ovd> for Client access

<https://Ulteo-Server-ipaddress/admin> for Admin access

Step 3: Login on Admin portal specify Username and Password as Admin



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The screenshot shows the 'Index' page of the OVD Admin interface. It features several sections: 'Users and Users groups' (with links to 'Users list' and 'Users groups list'), 'Servers' (with links to 'Servers list' and 'Unregistered servers list'), 'Configuration' (with a link to 'General configuration'), 'Applications and applications groups' (with links to 'Applications list', 'Applications groups list', 'Publications list', and 'Publication wizard'), 'System' (with a message 'The system is on production mode' and a button 'Switch the system to maintenance mode'), and 'Status' (listing '0 active session', '0 online server', '0 offline server', and '3 broken servers'). The bottom right corner of the page footer says 'powered by Ulteo OVD v3.0.4'.

Under server tab Register server, Click on manage to add ip address of Ulteo Server

- Go to user tab to add multiple users
- Go to User tab then select user group then create a new user group and add users in to them
- Go to Application Tab to Create Application Group

The screenshot shows the 'Applications' page of the OVD Admin interface. The 'Applications' tab is selected. On the left, there is a sidebar with 'Applications Groups' (including 'Mime-Types', 'Static applications', 'Publications', and 'Publication wizard'). The main area displays a table of applications:

Name	Description	Type	Action
Adobe Reader 9	PDF Viewer	linux	Manage
Bulk Rename	Rename Multiple File	linux	Manage
Firefox Web Browser	Browse the World Wide Web	linux	Manage
GIMP Image Editor	Create Images and edit photographs	linux	Manage
Mousepad	Simple text editor	linux	Manage
OpenOffice.org Database	Manage databases, create queries and reports to track and manage your information.	linux	Manage
OpenOffice.org Drawing	Create and edit drawings, flowcharts, and logos.	linux	Manage
OpenOffice.org Formula	Create and edit scientific formulas and equations.	linux	Manage
OpenOffice.org Impress	Create and edit presentations for slideshows, meeting and Web pages.	linux	Manage

Map User group with Application group And use the services at client side

The Administrator panel is limited to Administrator who can manage Applications, users and groups. Once admin logged in to this portal, he can create users, user groups, Application groups maps users to User group and Application group, manages applications or installs softwares based on users requirement Shown in figure 5.11.



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The screenshot shows the Ulteo Administrator panel interface. At the top, there is a navigation bar with icons for Index, Servers, Users, Applications, Configuration, Status, and Logout. The Ulteo logo is in the top right corner. Below the navigation bar, the title "Index" is displayed. The main content area is divided into several sections:

- Users and Users groups:**
  - Users list
  - Users groups list
- Servers:**
  - Servers list
  - Unregistered servers list
- Configuration:**
  - General configuration
- Applications and applications groups:**
  - Applications list
  - Applications groups list
  - Publications list
  - Publication wizard
- System:**

The system is on production mode

[Switch the system to maintenance mode](#)
- Status:**
  - 0 active session
  - 0 online server
  - 0 offline server
  - 3 broken servers

At the bottom right, it says "powered by Ulteo OVD v3.0.4". The URL in the address bar is "192.168.0.101/cvd/admin/".

**Ulteo Administrator panel**

The Application menu of admin panel shows available applications which can be mapped to users or user groups Shown in

The screenshot shows the Ulteo Application Menu. At the top, there is a navigation bar with icons for Index, Servers, Users, Applications, Configuration, Status, and Logout. The Ulteo logo is in the top right corner. Below the navigation bar, the title "Applications" is displayed. The main content area is a table titled "Applications" with columns: Name, Description, Type, and Manage. The table lists various applications:

Name	Description	Type	Manage
Adobe Reader 9	PDF Viewer	linux	<a href="#">Manage</a>
Bulk Rename	Rename Multiple Files	linux	<a href="#">Manage</a>
Firefox Web Browser	Browse the World Wide Web	linux	<a href="#">Manage</a>
GIMP Image Editor	Create images and edit photographs	linux	<a href="#">Manage</a>
Mousepad	Simple text editor	linux	<a href="#">Manage</a>
OpenOffice.org Database	Manage databases, create queries and reports to track and manage your information	linux	<a href="#">Manage</a>
OpenOffice.org Drawing	Create and edit drawings, flow charts, and logos.	linux	<a href="#">Manage</a>
OpenOffice.org Formula	Create and edit scientific formulas and equations.	linux	<a href="#">Manage</a>
OpenOffice.org Impress	Create and edit presentations for slideshows, meeting and Web pages.	linux	<a href="#">Manage</a>

On the left side, there is a sidebar with links: Applications Groups, Main Types, Static applications, Publications, and Publication wizard. The URL in the address bar is "192.168.0.101/cvd/admin/applications.php".

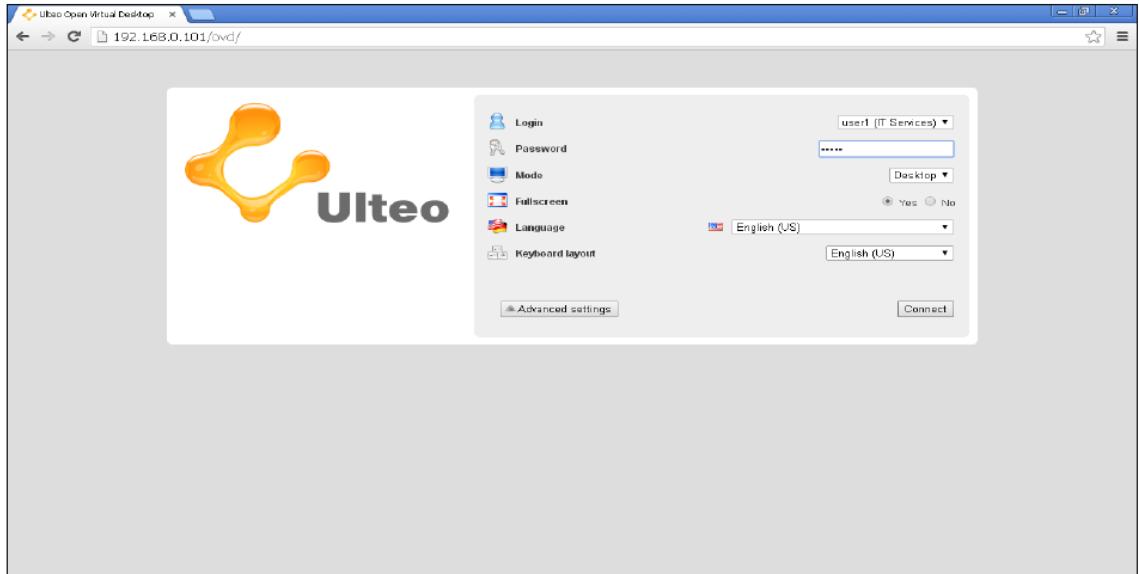
**Ulteo Application Menu**

Step 4: At client side open <https://Ulteo-Server-ipaddress/ovd> for Client access,Specify Username and Password and Access the softwares added in Application group

Once user selects Access Ulteo option it shows login page of Ulteo session manager shown below. The user can get login name and password by filling Registration form through main page of cloud portal Shown below



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**Ulteo user Login Portal**

Once user is validated he can access the services using portal mode or Desktop mode. Both the modes give access to software applications which are installed on Linux Application Server and Windows Application Server. In portal mode the user get applications in vertical pane Shown in figure 5.9.



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The screenshot shows a web-based interface for Ulteo Open Virtual Desktop. At the top, there is a header bar with icons for Back, Refresh, Home, New Tab, Download, Rename, Copy, Move, and Delete. The main area is titled "IT Services" and features a sidebar with various application icons: Adobe Reader 9, Bulk Rename, Firefox Web Browser, GIMP Image Editor, Mousepad, OpenOffice.org Database, OpenOffice.org Drawing, OpenOffice.org Presentation, OpenOffice.org Spreadsheet, OpenOffice.org Word Processor, and Thunderbird Mail. The central panel displays a file browser with a tree view of "Folders" (Desktop, Documents) and a list view showing "Filename: Desktop, Size: -, Type: Directory, Modified: 2014/03/31 14:22" and "Filename: Documents, Size: -, Type: Directory, Modified: 2014/03/31 14:22". A status bar at the bottom indicates "Folders: 2, Files: 0, Total size: 0 B".

Ulteo Portal mode

While in Desktop mode use gets full flagged Linux desktop running on browser with selected Applications Shown in

The screenshot shows a full-screen Linux desktop environment running on a browser. The desktop has a dark blue background with several application icons in the dock: Dash, Adobe Reader 9, Home, GIMP Image, Mousepad, OpenOffice.org, Firefox Web Dr., OpenOffice.org, Bulk Rename, and OpenOffice.org. A vertical sidebar on the left contains the same application icons as the portal mode. A taskbar at the bottom includes the "Logout" button and a system tray icon.

Ulteo Desktop mode



Conclusion:

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Answer the following Questions

Q1 List the IAAS services provided by Amazon AWS.

Ans \_\_\_\_\_

## Experiment No.5

**Title: To demonstrate installation and Configuration of Open stack Private cloud.**

**Theory and Implementation:**

The Open Stack installation can be done using many ways like RDO Pack stack, Mirantis or Devstack who have series of shell scripts which carries automated installation of OpenStack. The DevStack is a series of extensible scripts used to quickly bring up a complete OpenStack environment based on the latest versions of everything from git master.

To install OpenStack using Devstack the Prerequisites are Intel or AMD Multicore CPU, Minimum 6-8GB RAM, 250 GB Hard disk and preinstalled Ubuntu server/Desktop Operating system version 16.04 or above and internet speed should be minimum 4 MBPS. (The installation steps can be found at <https://docs.openstack.org/devstack/latest/>)

The steps for installing Openstack using Devstack in a single server (All in one Single machine setup) are given as follows

**Step 1:- Update the ubuntu repository and install git package**

The current version of Ubuntu OpenStack is Newton. So, that's what we are going to  
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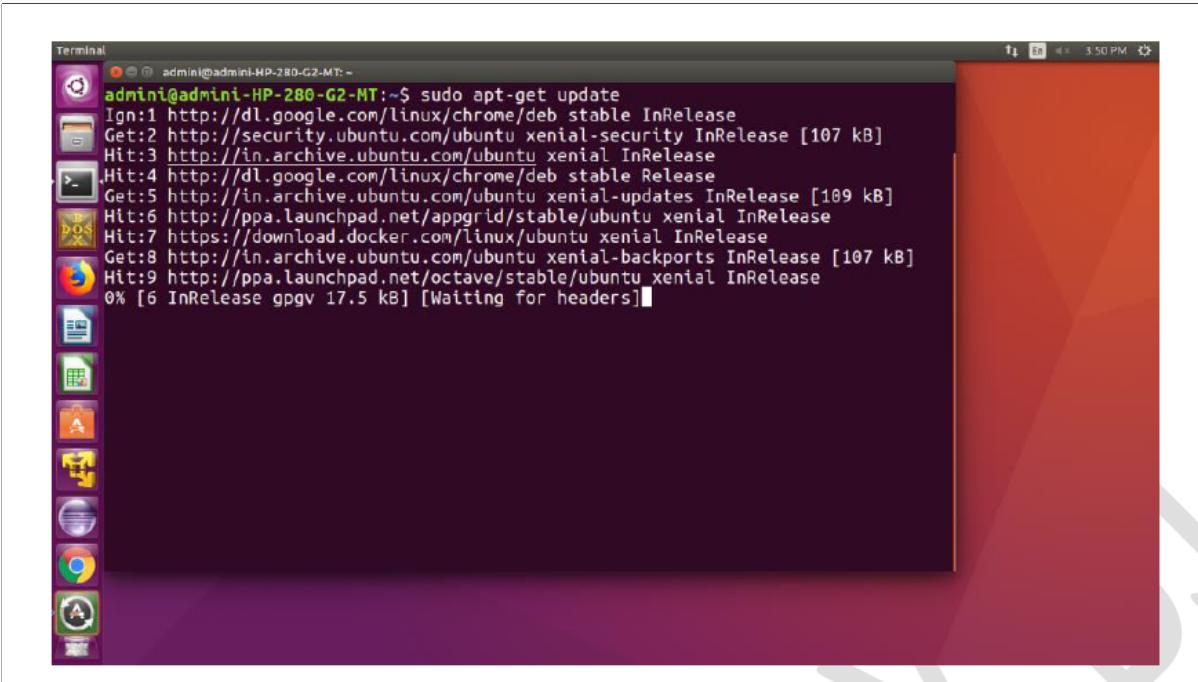


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To begin with the installation, first, we need to use the git command to clone devstack

```
$sudo apt-get update  
$sudo apt-get install git
```



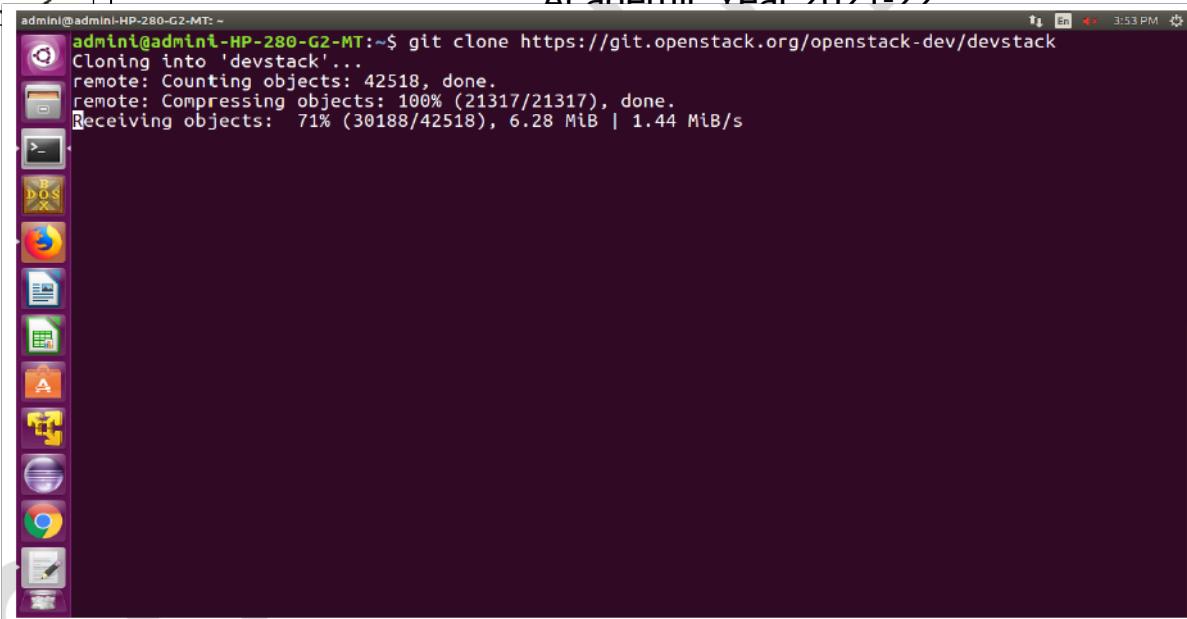
```
Terminal  
admin@admin-HP-280-G2-MT:~$ sudo apt-get update  
Ign:1 http://dl.google.com/linux/chrome/deb stable InRelease  
Get:2 http://security.ubuntu.com/ubuntu xenial-security InRelease [107 kB]  
Hit:3 http://in.archive.ubuntu.com/ubuntu xenial InRelease  
Hit:4 http://dl.google.com/linux/chrome/deb stable Release  
Get:5 http://in.archive.ubuntu.com/ubuntu xenial-updates InRelease [109 kB]  
Hit:6 http://ppa.launchpad.net/appgrid/stable/ubuntu xenial InRelease  
Hit:7 https://download.docker.com/linux/ubuntu xenial InRelease  
Get:8 http://in.archive.ubuntu.com/ubuntu xenial-backports InRelease [107 kB]  
Hit:9 http://ppa.launchpad.net/octave/stable/ubuntu xenial InRelease  
0% [6 InRelease gpgv 17.5 kB] [Waiting for headers]
```

**Step 2 :- Download the latest git repository for openstack**

```
$ git clone https://git.openstack.org/openstack-dev/devstack
```



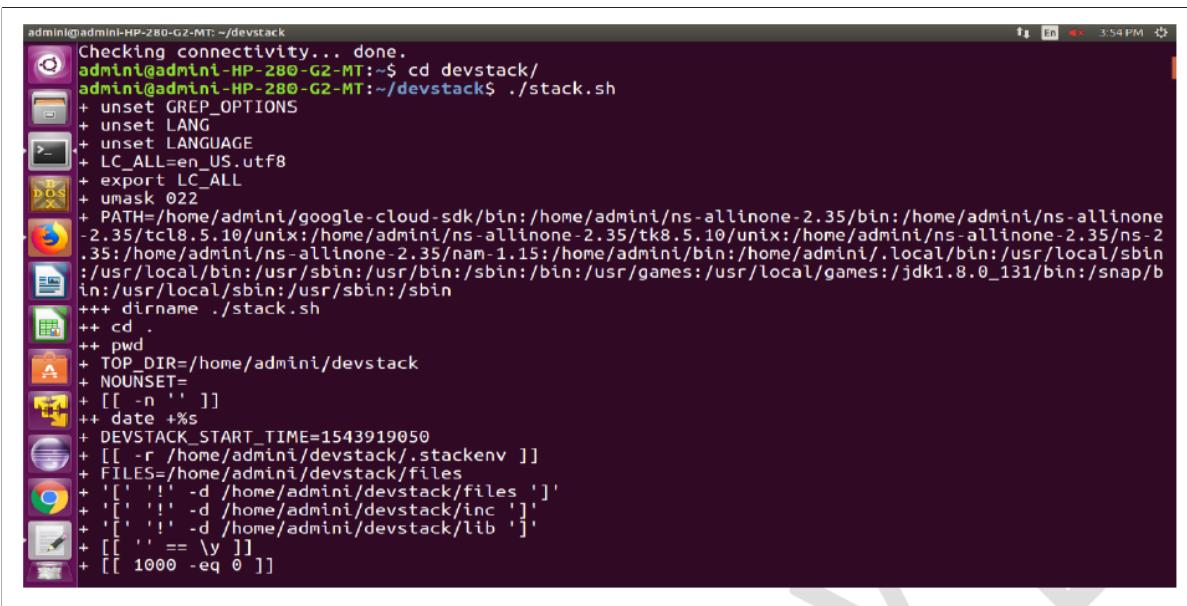
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```
admin@admin-HP-280-G2-MT: ~
admin@admin-HP-280-G2-MT: $ git clone https://git.openstack.org/openstack-dev/devstack
Cloning into 'devstack'...
remote: Counting objects: 42518, done.
remote: Compressing objects: 100% (21317/21317), done.
Receiving objects: 71% (30188/42518), 6.28 MiB | 1.44 MiB/s
```

**Step 3:- Open Devstack directory and start installation by executing stack.sh shell script**

```
$cd Devstack
$./stack.sh
```



```
admin@admin-HP-280-G2-MT: ~/devstack
Checking connectivity... done.
admin@admin-HP-280-G2-MT: ~$ cd devstack/
admin@admin-HP-280-G2-MT: ~/devstack$ ./stack.sh
+ unset GREP_OPTIONS
+ unset LANG
+ unset LANGUAGE
+ LC_ALL=en_US.UTF-8
+ export LC_ALL
+ umask 022
+ PATH=/home/admini/google-cloud-sdk/bin:/home/admini/ns-allinone-2.35/bin:/home/admini/ns-allinone-2.35/tcl8.5.10/unix:/home/admini/ns-allinone-2.35/tk8.5.10/unix:/home/admini/ns-allinone-2.35/ns-2.35:/home/admini/ns-allinone-2.35/nam-1.15:/home/admini/bin:/home/admini/.local/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/usr/games:/usr/local/games:/jdk1.8.0_131/bin:/snap/bin:/usr/local/sbin:/usr/sbin:/sbin
+ cd .
+ pwd
+ TOP_DIR=/home/admini/devstack
+ NOUNSET=
+ [[ -n '' ]]
+ date +%
+ DEVSTACK_START_TIME=1543919050
+ [[ -r /home/admini/devstack/.stackenv ]]
+ FILES=/home/admini/devstack/files
+ '[' '!' -d /home/admini/devstack/files ']'
+ '[' '!' -d /home/admini/devstack/inc ']'
+ '[' '!' -d /home/admini/devstack/lib ']'
+ [[ ' ' == '\y' ]]
+ [[ 1000 -eq 0 ]]
```



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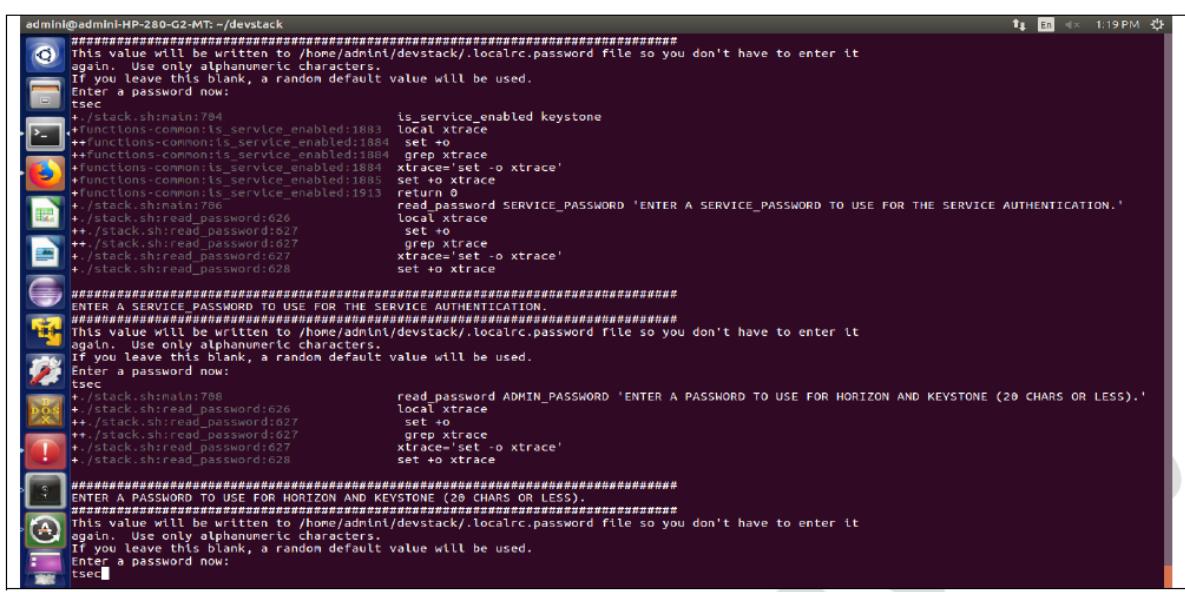
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At the initial stage, the installer will ask passwords for database, rabbit, service authentication, horizon and keystone

```
admin@admin-HP-Z80-G2-MT ~/devstack
+functions-common:verify_enabled_services:1078 [[ , --_etcd3 ]]
+functions-common:verify_disabled_services:1069 for service in ${ENABLED_SERVICES//,/ }
+functions-common:verify_disabled_services:1070 [[ , --_dstat, ]]
+lib/database:initialize_database_backends:69 local _backend_in=${DATABASE_BACKENDS}
+functions-common:is_service_enabled:1083 _c_service_enabled mysql
+functions-common:is_service_enabled:1084 local _xtrace
+functions-common:service_enabled:1084 set +o
+functions-common:service_enabled:1084 grep _xtrace
+functions-common:service_enabled:1084 xtrace=set -o xtrace
+functions-common:is_service_enabled:1085 set +o xtrace
+functions-common:is_service_enabled:1013 return 0
+lib/database:initialize_database_backends:69 DATABASE_TYPE=mysql
+lib/database:initialize_database_backends:69 for backend in ${DATABASE_BACKENDS}
+lib/database:initialize_database_backends:69 _c_service_enabled ${backend}
+functions-common:is_service_enabled:1083 _c_service_enabled postgresql
+functions-common:is_service_enabled:1084 local _xtrace
+functions-common:is_service_enabled:1084 set +o
+functions-common:is_service_enabled:1084 grep _xtrace
+functions-common:is_service_enabled:1084 xtrace=set -o xtrace
+functions-common:is_service_enabled:1085 set +o xtrace
+functions-common:is_service_enabled:1084 local _xtrace
+functions-common:is_service_enabled:1084 set +o
+functions-common:is_service_enabled:1084 grep _xtrace
+functions-common:is_service_enabled:1084 xtrace=set -o xtrace
+functions-common:is_service_enabled:1085 set +o xtrace
+functions-common:is_service_enabled:1013 return 1
+lib/database:initialize_database_backends:69 '[' -z mysql ']'
+lib/database:initialize_database_backends:69 _c_service_enabled mysql
+lib/database:initialize_database_backends:70 MYSQL_USER=root
+lib/database:initialize_database_backends:80 [[ ! 4 == 0 ]]
+lib/database:initialize_database_backends:83 DATABASE_HOST=zabbix.0.0.1
+lib/database:initialize_database_backends:80 DATABASE_USER=root
+lib/database:initialize_database_backends:81 DATABASE_PASSWORD=zabbix
+lib/database:initialize_database_backends:91 read_password DATABASE_PASSWORD 'ENTER A PASSWORD TO USE FOR THE DATABASE.'
+./stack.sh:read_password:626 local _xtrace
+./stack.sh:read_password:626 set +o
+./stack.sh:read_password:627 grep _xtrace
+./stack.sh:read_password:627 xtrace=set -o xtrace
+./stack.sh:read_password:627 set +o xtrace
+./stack.sh:read_password:628
#####
# ENTER A PASSWORD TO USE FOR THE DATABASE.
#####
# This value will be written to /home/admin1/devstack/.localrc.password file so you don't have to enter it again. Use only alphanumeric characters.
# If you leave this blank, a random default value will be used.
# Enter a password now:
tsec
admin@admin-HP-Z80-G2-MT ~/devstack
+functions-common:is_service_enabled:1083 local _xtrace
+functions-common:is_service_enabled:1084 set +o
+functions-common:is_service_enabled:1084 grep _xtrace
+functions-common:is_service_enabled:1085 xtrace=set -o xtrace
+functions-common:is_service_enabled:1084 local _xtrace
+functions-common:is_service_enabled:1084 set +o
+functions-common:is_service_enabled:1084 grep _xtrace
+functions-common:is_service_enabled:1084 xtrace=set -o xtrace
+functions-common:is_service_enabled:1085 set +o xtrace
+functions-common:is_service_enabled:1013 read_password RABBIT_PASSWORD 'ENTER A PASSWORD TO USE FOR RABBIT.'
+./stack.sh:read_password:626 local _xtrace
+./stack.sh:read_password:626 set +o
+./stack.sh:read_password:627 grep _xtrace
+./stack.sh:read_password:627 xtrace=set -o xtrace
+./stack.sh:read_password:627 set +o xtrace
+./stack.sh:read_password:628
#####
# ENTER A PASSWORD TO USE FOR RABBIT.
#####
# This value will be written to /home/admin1/devstack/.localrc.password file so you don't have to enter it again. Use only alphanumeric characters.
# If you leave this blank, a random default value will be used.
# Enter a password now:
tsec
admin@admin-HP-Z80-G2-MT ~/devstack
+./stack.sh:main:794 _c_service_enabled keystone
+functions-common:is_service_enabled:1083 local _xtrace
+functions-common:is_service_enabled:1084 set +o
+functions-common:is_service_enabled:1084 grep _xtrace
+functions-common:is_service_enabled:1084 xtrace=set -o xtrace
+functions-common:is_service_enabled:1085 set +o xtrace
+functions-common:is_service_enabled:1085 local _xtrace
+functions-common:is_service_enabled:1085 set +o
+functions-common:is_service_enabled:1085 grep _xtrace
+functions-common:is_service_enabled:1085 xtrace=set -o xtrace
+functions-common:is_service_enabled:1086 set +o xtrace
+functions-common:is_service_enabled:1086 read_password SERVICE_PASSWORD 'ENTER A SERVICE_PASSWORD TO USE FOR THE SERVICE AUTHENTICATION.'
+./stack.sh:read_password:626 local _xtrace
+./stack.sh:read_password:626 set +o
+./stack.sh:read_password:627 grep _xtrace
+./stack.sh:read_password:627 xtrace=set -o xtrace
+./stack.sh:read_password:627 set +o xtrace
+./stack.sh:read_password:628
#####
# ENTER A SERVICE_PASSWORD TO USE FOR THE SERVICE AUTHENTICATION.
#####
# This value will be written to /home/admin1/devstack/.localrc.password file so you don't have to enter it again. Use only alphanumeric characters.
# If you leave this blank, a random default value will be used.
# Enter a password now:
tsec
```



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```
admin@admin1-HP-280-G2-MT: ~/devstack
#####
# This value will be written to /home/admin1/devstack/.localrc.password file so you don't have to enter it
# again. Use only alphanumeric characters.
# If you leave this blank, a random default value will be used.
Enter a password now:
tsec
+./stack.sh:main:784      is_service_enabled keystone
+functions-common:is_service_enabled:1883  local_xtrace
++functions-common:is_service_enabled:1884  set +o
++functions-common:is_service_enabled:1884  grep xtrace
+functions-common:is_service_enabled:1884  xtrace='set -o xtrace'
+functions-common:is_service_enabled:1885  set +o xtrace
+functions-common:is_service_enabled:1885  return 0
+functions-common:is_service_enabled:1913  read_password SERVICE_PASSWORD 'ENTER A SERVICE_PASSWORD TO USE FOR THE SERVICE AUTHENTICATION.'
+functions-common:is_service_enabled:1913  local_xtrace
+functions-common:is_service_enabled:1913  set +o
+functions-common:is_service_enabled:1913  grep xtrace
+functions-common:is_service_enabled:1913  xtrace='set -o xtrace'
+functions-common:is_service_enabled:1913  set +o xtrace
#####
ENTER A SERVICE_PASSWORD TO USE FOR THE SERVICE AUTHENTICATION.
#####
# This value will be written to /home/admin1/devstack/.localrc.password file so you don't have to enter it
# again. Use only alphanumeric characters.
# If you leave this blank, a random default value will be used.
Enter a password now:
tsec
+./stack.sh:main:788      read_password ADMIN_PASSWORD 'ENTER A PASSWORD TO USE FOR HORIZON AND KEYSTONE (20 CHARS OR LESS).'
+./stack.sh:read_password:626  local_xtrace
+./stack.sh:read_password:627  set +o
+./stack.sh:read_password:627  grep xtrace
+./stack.sh:read_password:627  xtrace='set -o xtrace'
+./stack.sh:read_password:627  set +o xtrace
#####
ENTER A PASSWORD TO USE FOR HORIZON AND KEYSTONE (20 CHARS OR LESS).
#####
# This value will be written to /home/admin1/devstack/.localrc.password file so you don't have to enter it
# again. Use only alphanumeric characters.
# If you leave this blank, a random default value will be used.
Enter a password now:
tsec
```

The installer may take up to 30 minutes to complete the installation depends on the internet bandwidth. Once installation is done you may see the following screen which displays ip address of dashboard i.e. horizon through which you can gain access to open stack VMs and resources



```
nfig
2016-10-28 04:32:37.963 | +functions-common:run_plugins:1863          local_plugins=
2016-10-28 04:32:37.971 | +functions-common:run_plugins:1864          local_plugin

=====
DevStack Component Timing
=====
Total runtime      4466

run_process        58
test_with_retry    2
apt-get-update     3
pip_install        799
restart_apache_server 11
wait_for_service   13
git_timed          2037
apt-get            775
=====

This is your host IP address: 192.168.0.116
This is your host IPv6 address: ::1
Horizon is now available at http://192.168.0.116/dashboard
Keystone is serving at http://192.168.0.116/identity/
The default users are: admin and demo
The password: yourpassword
stack@cloudstack1:/devstacks
```



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As you can see, two users have been created for you; admin and demo. Your password is the password you set earlier. These are the usernames you will use to login to the OpenStack Horizon Dashboard.

Open up a **browser**, and put the **Horizon Dashboard address** in your address bar. <http://192.168.0.116/dashboard> you should see a **login page** like this.



To start with, log in with the admin users credentials. In admin panel, you will need to use the demo user, or create a new user, to create and deploy instances. As you can see, two users have been created for you; admin and demo. Your password is the password you set earlier. These are the usernames you will use to login to the OpenStack Horizon Dashboard. Take note of the Horizon web address listed in your terminal



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Name	Description	Project ID	Domain Name	Enabled	Actions
service		658a0f583a7b4a978734531968c859oc	Default	Yes	Manage Members
alt_demo		b9fb25d580c844febb3001d51182385e	Default	Yes	Manage Members
demo		c0f5b140bf0ee447ea2030a78d8996a72	Default	Yes	Manage Members
invisible_to_admin		c9609de33fdc45fe9d30b195a143a3e8	Default	Yes	Manage Members
admin	Bootstrap project for initializing the cloud.	fa715732d0cf441381194d7521f1sec2	Default	Yes	Manage Members

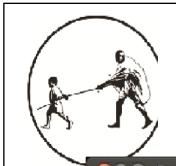
### Creating and running Instances

To launch an instance from OpenStack dashboard, first we need to finish following steps:

- Create a Project and add a member to the Project.
- Create Image and Flavor
- Create Network for the Project.
- Create Router for the Project
- Create a Key pair

#### A) Create a Project and add a member to the Project.

Login to the dashboard using Admin credentials and Go to Identity Tab → Projects and Click on Create Project.



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Click on “Create Project” , We can also set the Quota for the project from Quota Tab. To create Users , Go to Identity Tab-> Users-> Click on ‘Create User’ Button then specify User Name, email, password, Primary Project and Role and click on create user to add in to OpenStack workspace



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The screenshot shows the 'Create User' interface in the OpenStack Dashboard. The 'User Name' field is set to 'linuxtech1'. The 'Email' field contains 'linuxtech1@example.com'. The 'Primary Project' dropdown is set to 'Innovation'. The 'Role' dropdown is set to '\_member\_'. The 'Enabled' checkbox is checked. On the right, there is a table listing several users with their 'Enabled' status and 'Actions' button.

## B) Create Image and Flavor

To create a flavor login in dashboard using admin credentials, Go to Admin Tab -> Flavors -> Click on create Flavor

The screenshot shows the 'Flavors' page in the OpenStack Dashboard. The 'Admin' tab is selected in the sidebar. The 'Flavors' tab is selected in the main menu. A red box highlights the 'Create Flavor' button at the top right of the table. The table lists five existing flavors: m1.tiny, m1.small, m1.medium, m1.large, and m1.xlarge, with columns for Flavor Name, VCPUs, RAM, Root Disk, Ephemeral Disk, Swap Disk, ID, Public, Metadata, and Actions.

Specify the Flavor Name (fedora.small) , VCPU , Root Disk , Ephemeral Disk & Swap disk.



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The screenshot shows the 'Images' section of the OpenStack Dashboard. A new image is being created with the following details:

- Name: fedora-image
- Description: fedora-image
- Image Source: Image File
- Image File: [Fedora-Cloud-Base-23-20151030.x86\\_64.qcow2](https://download.fedoraproject.org/pub/fedora/linux/releases/23/Cloud/Base/x86_64/qcow2/Fedora-Cloud-Base-23-20151030.x86_64.qcow2)
- Format: QCOW2 - QEMU Emulator
- Architecture: (empty)
- Minimum Disk (GB): (empty)
- Minimum RAM (MB): (empty)
- Public: checked

The screenshot shows the 'Flavors' section of the OpenStack Dashboard. A new flavor is being created with the following details:

- Name: fedora.small
- ID: auto
- vCPUs: 1
- RAM (MB): 1024
- Root Disk (GB): 10
- Ephemeral Disk (GB): 2
- Swap Disk (MB): 512

To Create Image , Go to Admin Tab → Images—> Click on Create Image.

Specify the Image Name , Description, Image Soure ( in my case i am using Fedora Image File which i have already downloaded from fedora website with Format QCOW2)



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### C) Create Network for the Project.

To create Network and router for Innovation project sign out of admin user and login as local user in dashboard.

For my convenience i have setup my network as above

Internal Network = 10.10.10.0/24

External Network or Floating IP Network = 192.168.1.0/24

Gateway of External Network = 192.168.1.1

Now, Go to the **Network Tab** → **Click on Networks** → then **Click on Create Network**

Specify the Network Name as Internal

Create Network

Network Subnet Subnet Details

Network Name: Internal

Admin State: UP

Create Subnet:

Create a new network. In addition, a subnet associated with the network can be created in the next panel.

Cancel < Back Next >

Click on Next. Then Specify the Subnet name (sub-internal) and Network Address (10.10.0.0/24)

Create Network

Network Subnet Subnet Details

Subnet Name: sub-internal

Network Address: 10.10.0.0/24

IP Version: IPv4

Gateway IP:

Disable Gateway:

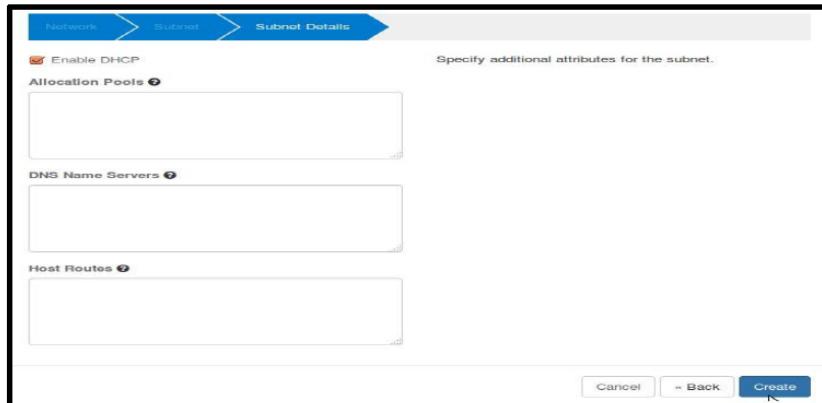
Create a subnet associated with the network. Advanced configuration is available by clicking on the "Subnet Details" tab.

Cancel < Back Next >

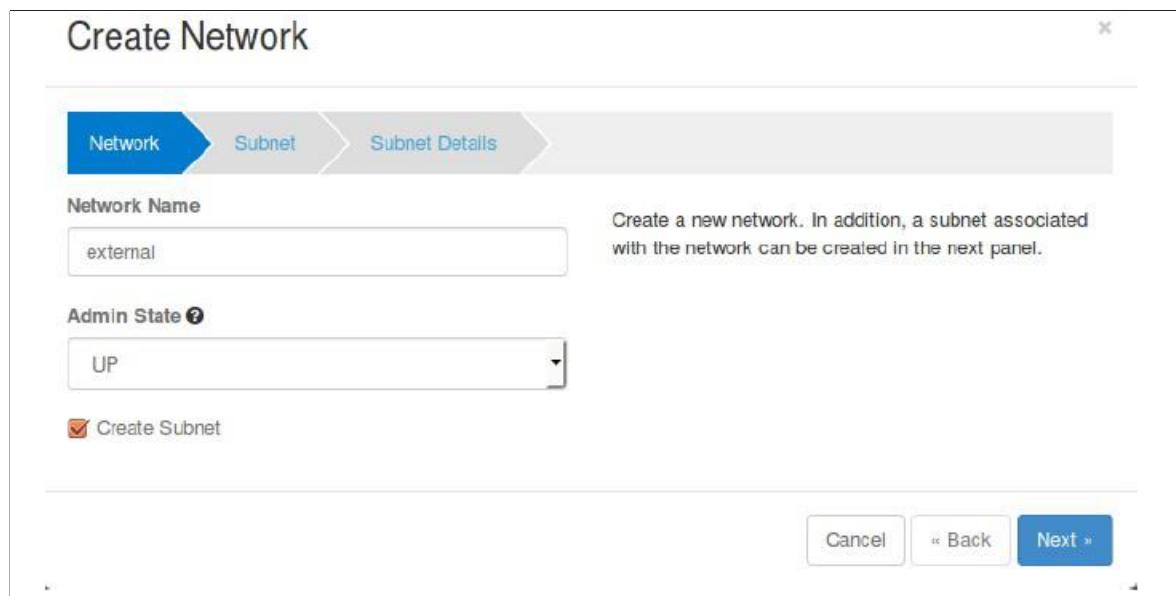
Click on Next. Now, VMs will be getting internal IP from DHCP Server because we enable DHCP option for internal network.



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Now **Create External Network**. Click on “**Create Network**” again, Specify Network Name as “**external**”





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Click on Next. Specify subnet Name as “**sub-external**” & Network Address as “**192.168.1.0/24**”

**Create Network**

Network > Subnet > Subnet Details

**Subnet Name:** sub-external  
**Network Address:** 192.168.1.0/24  
**IP Version:** IPv4  
**Gateway IP:** 192.168.1.1  
 Disable Gateway

Create a subnet associated with the network. Advanced configuration is available by clicking on the "Subnet Details" tab.

Cancel Back Next

Click on Next

Untick “**Enable DHCP**” option and Specify the ip address pool for external network.

Network > Subnet > Subnet Details

Specify additional attributes for the subnet.

Enable DHCP  
**Allocation Pools:** 192.168.1.19,192.168.1.30  
**DNS Name Servers:**  
**Host Routes:**

Cancel Back Create

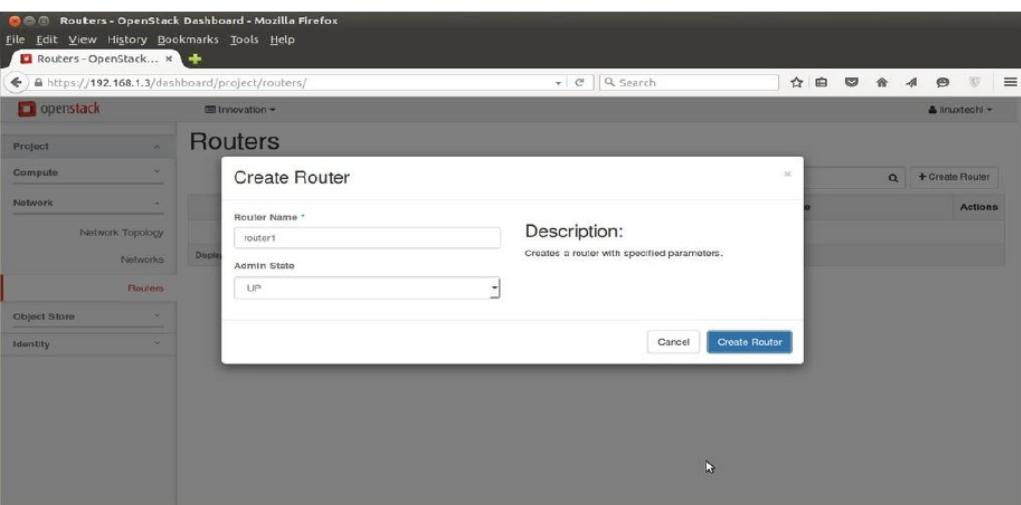
Click on Create.

**D) Create Router for the Project**

Now time to create a Router. To create router Go To Network Tab → Routers → Click on ‘+ Create Router’



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Now Mark External network as “External” , this task can be completed only from admin user , so logout from linuxtech user and login as admin.



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Go to Admin Tab —> Networks—> Click on Edit Network for “External”

The screenshot shows the OpenStack Dashboard under the 'Admin' tab. In the 'Networks' section, there is a table with two rows: one for 'Innovation' with 'external' as the network type, and another for 'Innovation' with 'internal' as the network type. A modal window titled 'Edit Network' is open for the 'external' network. It contains fields for 'Name' (set to 'external'), 'ID' (set to '8b77844b-67ec-4c54-b837-e1abb00cbcd2a'), 'Admin State' (set to 'UP'), and a checkbox labeled 'External Network' which is checked and highlighted with a red circle. There is also a 'Description' field with placeholder text. At the bottom of the modal are 'Cancel' and 'Save Changes' buttons.

Click on Save Changes. Now Logout from admin user and login as local user. Go to Network Tab —> Routers —> for Router1 click on “Set Gateway”

The screenshot shows the OpenStack Dashboard under the 'Project' tab. In the 'Routers' section, there is a table with one row for 'ROUTER1' which is 'Active'. A modal window titled 'Set Gateway' is open for 'ROUTER1'. It contains fields for 'External Network' (set to 'external'), 'Router Name' (set to 'router1'), and 'Router ID' (set to '43036923-b0ce-4e1e-b401-02cc50bc15e7'). There is also a 'Description' field with placeholder text. At the bottom of the modal are 'Cancel' and 'Set Gateway' buttons, with 'Set Gateway' being highlighted with a red circle.

Click on “Set Gateway”, this will add a interface on router and will assign the first ip of external subnet (192.168.1.0/24).



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The screenshot shows the 'Router Details - OpenStack Dashboard - Mozilla Firefox' window. The URL is https://192.168.1.3/dashboard/project/routers/43836923-bfce-4e1e-b401-62cc568c15e7/. The left sidebar has 'Project' expanded, with 'Compute', 'Network', and 'Routers' under it. The 'Routers' tab is selected. The main content area shows a 'Route' card with 'Overview' selected. A modal dialog titled 'Add Interface' is open. It contains fields for 'Subnet' (Internal: 10.10.0.0/24 (sub-internal)), 'IP Address (optional)', 'Router Name' (router1), and 'Router ID' (43836923-bfce-4e1e-b401-62cc568c15e7). A 'Description:' section explains that you can connect a specific subnet to the router. It also notes that the default IP address of the interface created is a gateway of the selected subnet. A 'Clear Gateway' button is available. At the bottom of the dialog are 'Cancel' and 'Add Interface' buttons.

Add internal interface to router as well , Click on the “**router1**” and select on “**interfaces**” and then click on “**Add interface**”

Now, Network Part is completed now & we can view Network Topology from “**Network Topology**” Tab as below.

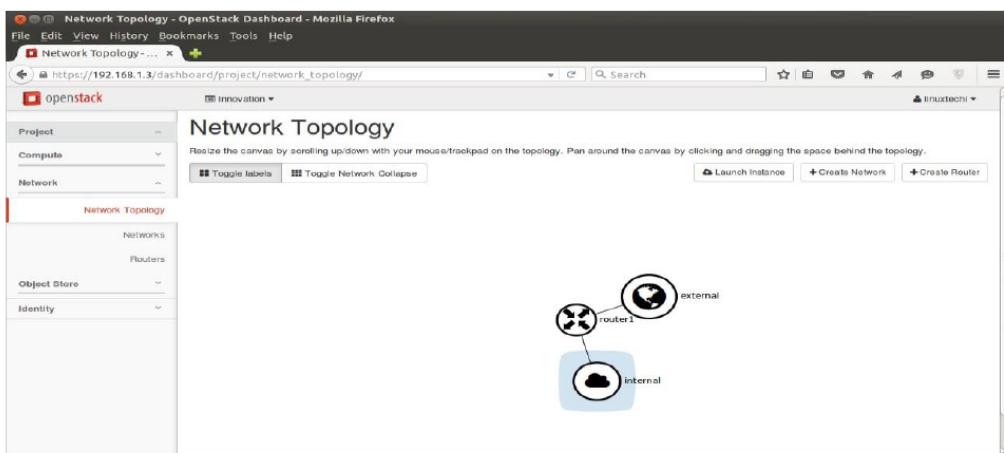


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Now Create a key pair that will be used for accessing the VM and define the Security firewall rules.

#### E) Create a key pair

Go to ‘Access & Security’ Tab —> Click on Key Pairs —> then click on ‘Create Key Pair’

The screenshot shows a 'Create Key Pair' dialog box overlaid on the Access & Security tab of the OpenStack dashboard. The dialog has a 'Key Pair Name' field containing 'myssh-keys' and a 'Description' text area with instructions about key pairs. At the bottom are 'Cancel' and 'Create Key Pair' buttons.

It will create a Key pair with name “**myssh-keys.pem**” Add a new Security Group with name ‘**fedora-rules**’ from Access & Security Tab. Allow 22 and ICMP from Internet ( 0.0.0.0 ).



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The screenshot shows the 'Access & Security - OpenStack Dashboard' interface. In the center, a modal window titled 'Create Security Group' is open. It contains fields for 'Name' (set to 'fedora-rules') and 'Description' (set to 'fedora rules'). Below these fields is a detailed description of what security groups are. At the bottom right of the modal is a blue 'Create Security Group' button.

Once the Security Group ‘fedora-rules’ created , click on Manage Rules and allow 22 & ICMP ping.

The screenshot shows the 'Manage Security Group Rules' section of the OpenStack Dashboard. A modal window titled 'Add Rule' is open. Under the 'Rule' dropdown, 'SSH' is selected. Under 'Remote', 'CIDR' is selected, and the 'CIDR' field contains '0.0.0.0/0'. To the right of the form, there is a detailed description of security group rules and a note about port ranges. At the bottom right of the modal is a blue 'Add' button.

Click on Add , Similarly add a rule for ICMP.

## F) Launch Instance



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Now finally it's time to launch an instance. To launch instance, Go to Compute Tab ->

Click on Instances -> then click on 'Launch Instance' Then Specify the Instance Name, Flavor that we created in above steps and 'Boot from image' from Instance Boot Source option and Select Image Name 'fedora-image'



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The screenshot shows the 'Launch Instance' dialog in the OpenStack Dashboard. The 'Access & Security' tab is active, displaying the selected security group 'fedora-rules' and key pair 'myssh-keys'. Other tabs like 'Networking' and 'Advanced Options' are also visible.

Click on ‘Access & Security’ and Select the Security Group ‘fedora-rules’ & Key Pair ”myssh-keys“

Now Select Networking and add ‘Internal’ Network and the Click on Launch ....

The screenshot shows the 'Launch Instance' dialog in the OpenStack Dashboard with the 'Networking' tab selected. The 'Selected networks' dropdown contains 'NIC 1 Internal'. The 'Available networks' dropdown contains 'external'. At the bottom right, there are 'Cancel' and 'Launch' buttons.



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Once the VM is launched , Associate a floating ip so that we can access the VM.

The screenshot shows the 'Instances' section of the OpenStack Dashboard. A single instance named 'Fedora23' is listed. The instance details are as follows:

Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
Fedora23	fedora-image	10.10.0.3	fedora.small	myssh-keys	Active	nova	None	Running	0 minutes	<a href="#">Create Snapshot</a> <a href="#">Associate Floating IP</a>

A context menu is open over the 'Actions' column for the 'Associate Floating IP' option.

Click on ‘Associate Floating IP‘ to get public IP addresses

The screenshot shows the 'Allocate Floating IP' dialog box. The 'Pool' dropdown is set to 'external'. The 'Description' field contains 'Allocate a floating IP from a given floating IP pool.' The 'Project Quotas' section shows 'Floating IP (0)' available. At the bottom right of the dialog are 'Cancel' and 'Allocate IP' buttons.



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Click on Allocate IP.

The screenshot shows the OpenStack Dashboard interface for managing floating IP associations. A modal window titled "Manage Floating IP Associations" is open. Inside the modal, there are fields for "IP Address" (set to 192.168.1.20) and "Port to be associated" (set to fedora23: 10.10.0.3). A success message at the top right of the modal states "Success: Allocated Floating IP 192.168.1.20." The background of the dashboard shows a sidebar with options like Project, Compute, Network, and Identity, and a main area displaying instance details.



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Click on Associate

Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
fedora23	fedora-image	10.10.0.3 Floating IP: 192.168.1.20	fedora.small	myssh-keys	Active	nova	None	Running	12 minutes	Create Snapshot

Now try to access the VM with floating IP ( 192.168.1.20) using keys.

```
[root@openstack ~]# ls -l myssh-keys.pem
-rw-r--r--. 1 root root 1683 Jan 2 12:30 myssh-keys.pem
[root@openstack ~]# chmod 600 myssh-keys.pem
[root@openstack ~]# ssh -i myssh-keys.pem 192.168.1.20 -l fedora
The authenticity of host '192.168.1.20 (192.168.1.20)' can't be established.
RSA key fingerprint is 99:d0:da:3d:d2:41:89:fc:df:97:d3:25:b9:29:9b:22.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.20' (RSA) to the list of known hosts.
[fedora@fedora23 ~]$ sudo su -
[root@fedora23 ~]# cat /etc/redhat-release
Fedora release 23 (Twenty Three)
[root@fedora23 ~]#
```

As we can see above that we are able to access the VM using keys. Our task of launching a VM from Dashboard is Completed Now.

Conclusion-----  
-----



## Experiment no 06

**Title : Explore Storage as a service using own Cloud for remote file access using web interfaces.**

### **Theory and Implementation**

ownCloud is a suite of client–server software for creating and using file hosting services. ownCloud is functionally very similar to the widely used Dropbox, with the primary functional difference being that the Server Edition of ownCloud is free and open-source, and thereby allowing anyone to install and operate it without charge on a private server. It also supports extensions that allow it to work like Google Drive, with online document editing, calendar and contact synchronization, and more. Its openness avoids enforced quotas on storage space or the number of connected clients, instead having hard limits (like on storage space or number of users) defined only by the physical capabilities of the server.

### **Installation and configuration of OwnCloud**

Own cloud can be installed over the any flavor of linux like Ubuntu, Centos, Fedora etc. but Ubuntu is preferable. The Steps for installation are as follows

#### **Step 1 – Installing ownCloud**

The ownCloud server package does not exist within the default repositories for Ubuntu. However, ownCloud maintains a dedicated repository for the distribution that we can add to our server.

To begin, download their release key using the curl command and import it with the apt-key utility with the add command:

```
$curl  
https://download.owncloud.org/download/repositories/10.0/Ubuntu_18.04/Release.key  
| sudo apt-key add -
```

The 'Release.key' file contains a PGP (Pretty Good Privacy) public key which apt will use to verify that the ownCloud package is authentic.

Now execute following commands on the terminal

```
1) $ echo 'deb http://download.owncloud.org/download/repositories/10.0/Ubuntu_18.04/' | sudo  
tee /etc/apt/sources.list.d/owncloud.list  
2) $sudo apt update  
3)$ sudo apt install php-bz2 php-curl php-gd php-imagick php-intl php-mbstring php-xml php-  
zip owncloud-files
```

#### **Step 2 :- Set the Document Root**

The ownCloud package we installed copies the web files to /var/www/owncloud on the server. Currently, the Apache virtual host configuration is set up to serve files out of a different directory. We need to change the DocumentRoot setting in our configuration to



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point to the new directory.

```
$sudo apache2ctl -t -D DUMP_VHOSTS | grep server_domain_or_IP
```

Now edit the Configuration file and add following lines so that it points to the /var/www/owncloud directory:

\$sudo nano /etc/apache2/sites-enabled/server_domain_or_IP.conf	<VirtualHost *:80> ... DocumentRoot /var/www/owncloud ... </VirtualHost>
---	--

When you are finished, check the syntax of your Apache files to make sure there were no

```
$sudo apache2ctl configtest
```

Output:- Syntax OK

Step 3 – Configuring the MySQL Database

Open mysql prompt, create database and execute following commands

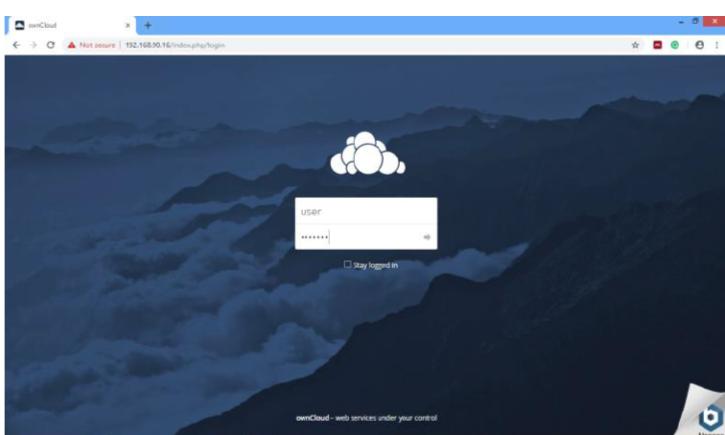


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- 1) \$mysql -u root -p
- 2) mysql>CREATE DATABASE owncloud;
- 3) mysql>GRANT ALL ON owncloud.\* to 'owncloud'@'localhost' IDENTIFIED BY 'owncloud\_database\_password';
- 4) mysql>FLUSH PRIVILEGES;

Step 4:- Configure ownCloud

To access the ownCloud web interface, open a web browser and navigate to the servers IP address as shown below



Own Cloud portal has two types of users like Admin user and local user. The admin user can create users/groups, assigns storage quota, assigns privileges and can manage users and group activities.



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The screenshot shows the openCloud web interface. On the left, the 'Files' section displays a list of files and folders: 'Document' (25 KB), 'Photos' (663 KB), and 'openCloud Manual.pdf' (3.9 MB, 2 years ago). On the right, the 'Users' section shows a table with one user entry:

User	Full Name	Password	Groups	Group Admin for	Quota
user	user	*****	admin	no group	Unlimited

The screenshot shows the 'Users' section of the openCloud interface. A modal window is open for creating a new user, with the 'Create' tab selected. The form fields are as follows:

Username	Full name	Groups	Group Admin for	Quota
u1	admin	Group1	no group	Unlimited

Below the modal, the main 'Users' table shows one existing user entry:

User	Full Name	Password	Groups	Group Admin for	Quota
user	user	*****	admin	no group	Unlimited

The screenshot shows the openCloud interface with two windows side-by-side. The left window is the 'Files' section, displaying the same file list as before. The right window is the 'FIRS' (File Information Repository System) section, showing a list of files:

Name	Size	Modified
jaip.pdf	2.1 MB	seconds ago
jaip.pdf	2.1 MB	2 years ago
openCloud Manual.pdf	3.9 MB	2 years ago
Test file	25 KB	2 years ago
Untitled	663 KB	2 years ago



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The screenshot shows two windows of the ownCloud web interface. The left window, titled 'File - ownCloud', displays a file list with items like 'juju.pdf', 'juju.txt', and 'ownCloud Manual.pdf'. The right window, titled 'Admin - ownCloud', shows 'Security setup warnings' and various configuration options under sections such as 'Sharing', 'File handling', and 'Email server'.

The local user is an restricted user who can perform local activities like upload or share files, delete local shares or can create share etc.

The screenshot shows the ownCloud login page with a dark blue background featuring a mountain landscape. It includes fields for 'User name' and 'Password', a 'Stay logged in' checkbox, and a 'Manage' link at the bottom right.



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The screenshot shows the ownCloud web interface. On the left, there is a sidebar with navigation links: All files, Favorites, Shared with you, Shared with others, Shared by link, Tags, and Deleted files. The main area displays a list of files and folders. At the top of the list is a folder named 'Documents' (35 kB, modified seconds ago). Below it is a folder named 'Photos' (663 kB, modified seconds ago). Underneath these are two files: 'Juju.pdf' (2.3 MB, shared by user, modified 2 minutes ago) and 'ownCloud Manual.pdf' (3.9 MB, modified seconds ago). A large red arrow graphic is overlaid on the right side of the interface.

Name	Size	Modified
Documents	35 kB	seconds ago
Photos	663 kB	seconds ago
Juju.pdf	2.3 MB	2 minutes ago
ownCloud Manual.pdf	3.9 MB	seconds ago

The alternate way to use own cloud is to download the readymade virtual machine from website <https://bitnami.com/stack/owncloud/cloud> which can be run directly on virtualization platform like virtual box or VMware workstation

## Conclusion



## Experiment no7

**Aim:** To study and Implement Database as a Service on SQL/NOSQL databases like AWS RDS, AZURE SQL/ MongoDB Lab/ Firebase

**Theory:** **NoSQL** (originally referring to "non SQL" or "non relational") database provides a mechanism for storage and retrieval of data that is modeled in means other than the tabular relations used in relational databases. Such databases have existed since the late 1960s, but did not obtain the "NoSQL" moniker until a surge of popularity in the early twenty-first century, triggered by the needs of Web 2.0 companies such as Facebook, Google, and Amazon.com. NoSQL databases are increasingly used in big data and real-time web applications.<sup>[6]</sup> NoSQL systems are also sometimes called "Not only SQL" to emphasize that they may support SQL-like query languages

Motivations for this approach include: simplicity of design, simpler "horizontal" scaling to clusters of machines (which is a problem for relational databases),<sup>[2]</sup> and finer control over availability. The data structures used by NoSQL databases (e.g. key-value, wide column, graph, or document) are different from those used by default in relational databases, making some operations faster in NoSQL. The particular suitability of a given NoSQL database depends on the problem it must solve. Sometimes the data structures used by NoSQL databases are also viewed as "more flexible" than relational database tables

Many NoSQL stores compromise consistency (in the sense of the CAP theorem) in favor of availability, partition tolerance, and speed. Barriers to the greater adoption of NoSQL stores include the use of low-level query languages (instead of SQL, for instance the lack of ability to perform ad-hoc joins across tables), lack of standardized interfaces, and huge previous investments in existing relational databases. Most NoSQL stores lack true ACID transactions, although a few databases, such as MarkLogic, Aerospike, FairCom c-treeACE, Google Spanner (though technically a NewSQL database), Symas LMDB, and OrientDB have made them central to their designs. (See ACID and join support.)

### **MongoDB**

**MongoDB** is a cross-platform, document oriented database that provides, high performance, high availability, and easy scalability. MongoDB works on concept of collection and document.Database

**Database** is a physical container for collections. Each database gets its own set of files on the file system. A single MongoDB server typically has multiple databases.

### **Collection**

Collection is a group of MongoDB documents. It is the equivalent of an RDBMS table. A collection exists within a single database. Collections do not enforce a schema.



within a collection can have different fields. Typically, all documents in a collection are of similar or related purpose.

## Document

A document is a set of key-value pairs. Documents have dynamic schema. Dynamic schema means that documents in the same collection do not need to have the same set of fields or structure, and common fields in a collection's documents may hold different types of data.

Sample Document Following example shows the document structure of a blog site, which is simply a comma separated key value pair.

```
{  
  "_id": ObjectId("7df78ad8902c"),  
  "title": "MongoDB Overview",  
  "description": "MongoDB is no sql database",  
  "by": "tutorials point",  
  "url": "http://www.tutorialspoint.com",  
  "tags": ["mongodb", "database", "NoSQL"],  
  "likes": 100, "comments": [ { "user": "user1", "message": "My first comment", "dateCreated": new Date(2011,1,20,2,15), "like": 0 },  
    { "user": "user2", "message": "My second comments", "dateCreated": new Date(2011,1,25,7,45), "like": 5 } ]  
}
```

`_id` is a 12 bytes hexadecimal number which assures the uniqueness of every document. You can provide `_id` while inserting the document. If you don't provide then MongoDB provides a unique id for every document. These 12 bytes first 4 bytes for the current  
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**MongoDB – Advantages:** Any relational database has a typical schema design that shows number of tables and the relationship between these tables. While in MongoDB, there is no concept of relationship

**Advantages of MongoDB over RDBMS** Schema less: MongoDB is a document database in which one collection holds different documents. Number of fields, content and size of the document can differ from one document to another. Structure of a single object is clear. No complex joins. Deep query-ability. MongoDB supports dynamic queries on documents using a document-based query language that's nearly as powerful as SQL. Tuning. Ease of scale-out: MongoDB is easy to scale. Conversion/mapping of application objects to database objects not needed. Uses internal memory for storing the (windowed) working set, enabling faster access of data

### Why Use MongoDB?

Document Oriented Storage: Data is stored in the form of JSON style documents.

Index on any attribute

Replication and high availability

Auto-sharding

Rich queries

Fast in-place updates

Professional support by MongoDB

### Where to Use MongoDB?

Big Data

Content Management and Delivery

Mobile and Social Infrastructure

User Data Management Data Hub

### MongoDB Help

To get a list of commands, type db.help() in MongoDB client. This will give you a list of commands as shown in the following screenshot.

### The use Command

MongoDB use DATABASE\_NAME is used to create database. The command will create a new database if it doesn't exist, otherwise it will return the existing database.

### Syntax

Basic syntax of use DATABASE statement is as follows:

**use DATABASE\_NAME**



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**Example** If you want to create a database with name <mydb>, then use DATABASE statement would be as follows:

**>use mydb**

switched to db mydb To check your currently selected database, use the command

**db >db mydb**

If you want to check your databases list, use the command show dbs.

**>show dbs** local 0.78125GB test 0.23012GB Your created database (mydb) is not present in list. To display database, you need to insert at least one document into it.

**>db.movie.insert({ "name": "tutorials point" })**

In MongoDB default database is test.

If you didn't create any database, then collections will be stored in test database.

#### **The dropDatabase() Method**

MongoDB db.dropDatabase() command is used to drop a existing database.

Syntax **db.dropDatabase()**

#### **The createCollection() Method**

MongoDB db.createCollection(name, options) is used to create collection

Syntax : **db.createCollection(name, options)**

In the command, name is name of collection to be created. Options is a document and is used to specify configuration of collection.

Parameter Type	Description
Name	String Name of the collection to be created
Options	Document (Optional) Specify options about memory Size and indexing.



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#### **The drop() Method**

MongoDB's db.collection.drop() is used to drop a collection from the database.

##### Syntax

**db.COLLECTION\_NAME.drop()**

MongoDB supports many datatypes. Some of them are:

- **String:** This is the most commonly used datatype to store the data. String in MongoDB must be UTF-8 valid.
- **Integer:** This type is used to store a numerical value. Integer can be 32 bit or 64 bit depending upon your server.

- **Boolean:** This type is used to store a boolean (true/ false) value.
- **Double:** This type is used to store floating point values.
- **Min/Max Keys:** This type is used to compare a value against the lowest and highest BSON elements.
- **Arrays:** This type is used to store arrays or list or multiple values into one key.
- **Timestamp:** timestamp. This can be handy for recording when a document has been modified or added.
- **Object:** This datatype is used for embedded documents.
- **Null:** This type is used to store a Null value.
- **Symbol:** This datatype is used identically to a string; however, it's generally reserved for languages that use a specific symbol type.

- **Date:** This datatype is used to store the current date or time in UNIX time format. You can specify your own date time by creating object of Date and passing day, month, year into it.
- **Object ID:** This datatype is used to store the document's ID.
- **Binarydata:** This datatype is used to store binary data.



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**Code:** This datatype is used to store JavaScript code into the document.

**Regular expression:** This datatype is used to store regular expression.

### **MongoDB – Insert Document**

#### The insert() Method

To insert data into MongoDB collection, you need to use MongoDB's insert() or save() method.

#### Syntax

The basic syntax of insert() command is as follows –

```
>db.COLLECTION_NAME.insert(document)
```

#### Syntax

```
>db.mycol.find().pretty()
```

Apart from find() method, there is **findOne()** method, that returns only one document.

#### RDBMS Where Clause Equivalents in MongoDB

To query the document on the basis of some condition, you can use following operations



## **MongoDB – Query Document**

### **The find() Method**

To query data from MongoDB collection, you need to use MongoDB's find() method.

#### **Syntax**

The basic syntax of find() method is as follows:

```
>db.COLLECTION_NAME.find()
```

find() method will display all the documents in a non-structured way.

### **The pretty() Method**

To display the results in a formatted way, you can use pretty() method.

## **Logical operators:--**

### **AND in MongoDB**

#### **Syntax**

In the find() method, if you pass multiple keys by separating them by ',' then MongoDB treats it as AND condition. Following is the basic syntax of AND –

```
>db.mycol.find({key1:value1, key2:value2}).pretty()
```



## **OR in MongoDB**

### Syntax

To query documents based on the OR condition, you need to use \$or keyword. Following is the basic syntax of OR –

```
>db.mycol.find( { $or: [ {key1: value1}, {key2:value2} ] } ).pretty()
```

### **Using AND and OR Together**

The following example will show the documents that have likes greater than 100 and whose title is either 'MongoDB Overview' or by is 'tutorials point'. Equivalent SQL where clause is 'where likes>10 AND (by = 'tutorials point' OR title = 'MongoDB Overview')'

```
db.mycol.find({ "likes": { $gt:10}, $or: [ {"by": "tutorials point"}, {"title": "MongoDB Overview"} ] }).pretty()

{ "_id": ObjectId("7df78ad8902c"),
  "title": "MongoDB Overview",
  "description": "MongoDB is no sql database",
  "by": "tutorials point",
  "url": "http://www.tutorialspoint.com",
  "tags": ["mongodb", "database", "NoSQL"],
  "likes": "100" }
```

### **MongoDB's update()**

MongoDB's update() and save() methods are used to update document into a collection. The update() method updates the values in the existing document while the save() method replaces the existing document with the document passed in save() method.



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### **MongoDB Update() Method**

The update() method updates the values in the existing document.

#### Syntax

The basic syntax of update() method is as follows:

```
>db.COLLECTION_NAME.update(SELECTIOIN_CRITERIA, UPDATED_DATA)
```

### **MongoDB Save() Method**

The save() method replaces the existing document with the new document passed in the save() method.

#### Syntax

The basic syntax of MongoDB save() method is –

```
>db.COLLECTION_NAME.save({ _id:ObjectId(),NEW_DATA}).
```

Operation	Syntax	Example	RDBMS Equivalent
Equality	{<key>:<value>}	db.mycol.find({"by":"tutorials point"}).pretty()	where by = 'tutorials point'
Less Than	{<key>:{\$lt:<value>}}	db.mycol.find({"likes":{\$lt:50}}).pretty()	where likes < 50
Less Than Equals	{<key>:{\$lte:<value>}}	db.mycol.find({"likes":{\$lte:50}}).pretty()	where likes <= 50
Greater Than	{<key>:{\$gt:<value>}}	db.mycol.find({"likes":{\$gt:50}}).pretty()	where likes > 50
Greater Than Equals	{<key>:{\$gte:<value>}}	db.mycol.find({"likes":{\$gte:50}}).pretty()	where likes >= 50
Not Equals	{<key>:{\$ne:<value>}}	db.mycol.find({"likes":{\$ne:50}}).pretty()	where likes != 50



### **The remove() Method**

MongoDB's remove() method is used to remove a document from the collection. remove() method accepts two parameters. One is deletion criteria and second is justOne flag.

- deletion criteria: (Optional) deletion criteria according to documents will be removed.
- justOne: (Optional) if set to true or 1, then remove only one document.

#### Syntax

Basic syntax of remove() method is as follows:

```
>db.COLLECTION_NAME.remove(DELLETION_CRITTERIA)
```

#### **Remove Only One**

If there are multiple records and you want to delete only the first record, then set justOne parameter in remove() method.

### **Installation steps in Fedora:**

->download the software “**mongodb-linux-x86\_64-3.4.9.tgz**”

#### **Copy to Download**

```
[root@localhost Downloads]# tar -xvzf mongodb-linux-x86_64-3.4.9.tgz  
[root@localhost Downloads]# cd mongodb-linux-x86_64-3.4.9/  
[root@localhost mongodb-linux-x86_64-3.4.9]# cd bin  
[root@localhost bin]# ./mongod -dbpath /home/admin/  
[root@localhost bin]# ./mongo
```



### **Installation steps in Windows:**

1. Install MongoDB setup
2. Open "C:\Program Files (x86)\MongoDB\Server\3.0\bin"
3. **mongod.exe** ==> Server file      ||      **mongo.exe** ==> Client file
4. Create Folder like "**D:\TE\data\db**"
5. **Run MongoDB Server**
  - > Open Command prompt as Administrator
  - > cd C:\Program Files (x86)\MongoDB\Server\3.0\bin
  - > **mongod.exe --dbpath "D:\TEB\data\db"**

### **6. Run MongoDB Client**

- > Open Second Command prompt
- > cd C:\Program Files (x86)\MongoDB\Server\3.0\bin
- > **mongo.exe**

Conclusion -----  
-----  
-----



Answer the following questions

Q1. Define MongoDB.

Q2. What are the key features of mongodb?

### Experiment No8

AIM: To study and Implement Security as a Service on AWS/Azure

#### **Theory:**

Cloud security is very similar to security in on-premises data centres - only without the costs and complexities of protecting facilities and hardware. Since you don't have to manage physical servers or storage devices in the cloud, you use software-based security tools to monitor and protect the flow of information into and out of your cloud resources.

Various high-profile hacking attacks have proven that web security remains the most critical issue to any business that conducts its operations online. Web servers are one of the most targeted public faces of an organization, because of the sensitive data they usually host. Securing a web server is as important as securing the website or web application itself and the network around it. If you have a secure web application and an insecure web server, or vice versa, it still puts your business at a huge risk. Your company's security is as strong as its weakest point.

Although securing a web server can be a daunting operation and requires specialist expertise, it is not an impossible task. Long hours of research and an overdose of coffee and take away food, can save you from long nights at the office, headaches and data breaches in the future. Irrelevant of what web server software and operating system you are running, an out of the box configuration is usually insecure. Therefore one must take some necessary steps in order to increase web server security. Below is a list of tasks one should follow when securing a web server.

#### **1. Remove Unnecessary Services**

Default operating system installations and configurations, are not secure. In a typical default installation, many network services which won't be used in a web server configuration are installed, such as remote registry services, print server service, RAS



etc. The more services running on an operating system, the more ports will be left open, thus leaving more open doors for malicious users to abuse. Switch off all unnecessary services and disable them, so next time the server is rebooted, they are not started automatically. Switching off unnecessary services will also give an extra boost to your server performances, by freeing some hardware resources.

## **2. Remote access**

Although nowadays it is not practical, when possible, server administrators should login to web servers locally. If remote access is needed, one must make sure that the remote connection is secured properly, by using tunneling and encryption protocols. Using security tokens and other single sign on equipment and software, is a very good security practice. Remote access should also be restricted to a specific number of IP's and to specific accounts only. It is also very important not to use public computers or public networks to access corporate servers remotely, such as in internet café's or public wireless networks.

## **3. Separate development / testing / production environment**

Since it is easier and faster for a developer to develop a newer version of a web application on a production server, it is quite common that development and testing of web applications are done directly on the production servers itself. It is a common occurrence on the internet to find newer versions of a specific website, or some content which should not be available to the public in directories such as /test/, /new/ or other similar sub directories. Because such web applications are in their early development stages, they tend to have a number of vulnerabilities, lack input validation and do not handle exceptions appropriately. Such applications could easily be discovered and exploited by a malicious user, by using free available tools on the internet.

To ease more the development and testing of web applications, developers tend to develop specific internal applications that give them privileged access to the web application, databases and other web server resources, which a normal anonymous user would not have. Such applications usually do not have any kind of restriction, since they are just test applications accessed that should be accessed from the developers only. Unfortunately, if development and testing is done on a production server, such applications can easily be discovered from a malicious user, which could help him compromise and gain access on the production server.

Ideally, development and testing of web applications should always be done on servers isolated from the internet, and should never use or connect to real life data and databases.

## **4. Web application content and server-side scripting**

The web application or website files and scripts should always be on a separate partition or drive other than that of the operating system, logs and any other system



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files. Through experience we've learnt that hackers who gained access to the web root directory, were able to exploit other vulnerabilities, and were able to go a step further and escalate their privileges to gain access to the data on the whole disc, including the operating system and other system files. From there onwards, the malicious users have access to execute any operating system command, resulting in complete control of the web server.

## **5. Permissions and privileges**

File and network services permissions play a vital role in web server security. If a web server engine is compromised via network service software, the malicious user can use the account on which the network service is running to carry out tasks, such as execute specific files. Therefore it is very important to always assign the least privileges needed for a specific network service to run, such as web server software. It is also very important to assign minimum privileges to the anonymous user which is needed to access the website, web application files and also backend data and databases.

## **6. Install all security patches on time**

Although having fully patched software does not necessarily mean your server is fully secure, it is still very important to update your operating system and any other software running on it with the latest security patches. Up until this day, hacking incidents still occur because hackers took advantage and exploited un-patched servers and software.

## **7. Monitor and audit the server**

All the logs present in a web server, should ideally be stored in a segregated area. All network services logs, website access logs, database server logs (e.g. Microsoft SQL Server, MySQL, Oracle) and operating system logs should be monitored and checked frequently. One should always be on the lookout for strange log entries. Log files tend to give all the information about an attempt of an attack, and even of a successful attack, but most of the times these are ignored. If one notices strange activity from the logs, this should immediately be escalated so the issue can be investigated to see what is happening.

## **8. User accounts**

Unused default user accounts created during an operating system install should be disabled. There is also a long list of software that when installed, user accounts are created on the operating system. Such accounts should also be checked properly and permissions need to be changed required. The built in administrator account should be renamed and is not to be used, same for the root user on a linux / unix installation. Every administrator accessing the web server should have his own user account, with the correct privileges needed. It is also a good security practice not to share each others' user accounts.



## **9. Remove all unused modules and application extensions**

A default Apache installation has a number of pre-defined modules enabled, which in a typical web server scenario are not used, unless they are specifically needed. Turn off such modules to prevent targeted attacks against such modules.

The same applies for Microsoft's web server; Internet Information Services. By default, IIS is configured to serve a large number of application types, e.g. ASP, ASP.NET and more. The list of application extensions should only contain a list of extensions the website or web

application will be using. Every application extension should also be restricted to use specific HTTP verbs only, where possible.

## **10. Use security tools provided with web server software**

Microsoft released a number of tools to help administrators secure IIS web server installations, such as URL scan. There is also a module called mod\_security for Apache. Although configuring such tools is a tedious process and can be time consuming, especially with custom web applications, they do add an extra bit of security and piece of mind.

## **11. Stay informed**

Nowadays, information and tips on the software and operating system being used can be found freely on the internet. It is very important to stay informed and learn about new attacks and tools, by reading security related magazines and subscribing to newsletters, forums or any other type of community.

## **12. Use Scanners**

Scanners are handy tools that help you automate and ease the process of securing a web server and web applications. Acunetix Web Vulnerability Scanner is also shipped with a port scanner, which when enabled will port scan the web server hosting the web application being scanned. Similar to a network security scanner, Acunetix WVS will launch a number of advanced security checks against the open ports and network services running on your web server.

Acunetix Web Vulnerability scanner ensures website and web server security by checking for SQL Injection, Cross site scripting, web server configuration problems and other vulnerabilities. It checks password strength on authentication pages and automatically audits shopping carts, forms, dynamic Web 2.0 content and other web applications. As the scan is completed, the software produces detailed reports that pinpoint where vulnerabilities exist.

### **Security Data Dictionary**

Several views are useful in this regard. Some of them are:

- DBA\_SYS\_PRIVS (system privileges granted to users)
- DBA\_TAB\_PRIVS (object privileges granted to users, except for those in the next view)



This constitutes another anomaly. If your manager asks you, "Can User Y update Table X?" and you check only in DBA\_TAB\_PRIVS for this, you may come up with the wrong answer. There may be no listing for that UserID in that view, if the update privilege was granted only for certain columns. Hence, in order to answer such a question, both views should be inspected.

- DBA\_ROLES (master list of all roles in the database)
- DBA\_ROLE\_PRIVS (roles granted to users)
- DBA\_USERS (master list of all users in the database)
- ROLE\_ROLE\_PRIVS (roles granted to other roles)
- ROLE\_SYS\_PRIVS (system privileges granted to roles)
- ROLE\_TAB\_PRIVS (object privileges granted to roles, including column-level ones)

### **Encryption for OwnCloud**

ownCloud uses encryption in two major ways: when transferring data to and from the server; and when storing data on an external server. The first requires the use of 'TLS', a secure communication protocol for the internet. The ownCloud installation manual contains instructions for enabling TLS encryption and it is highly recommended to do this.

For storing data encrypted on ownCloud, you need to have the ownCloud Encryption app enabled. It will then encrypt all your data with a strong, randomly generated key, which is then protected with your log-in password.

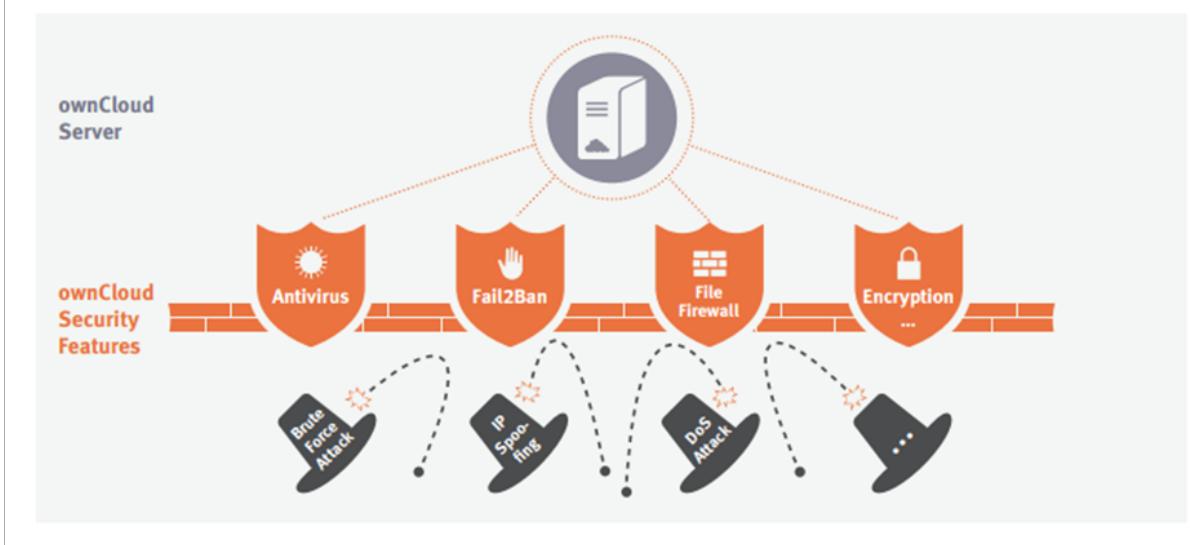
"Encryption and decryption always occurs on the server side. This enables you to continue to use all other apps to view and edit data. However, this method of encryption also means that the server administrator can intercept your data."

This makes it possible to access your files over the web interface and share files with others. To run safely on a non-trusted server, data would have to be encrypted by the client (your

computer, phone or other devices) before being sent to the non-trusted ownCloud server and you would lose the web interface access.



### OwnCloud Security Features



### Encrypting Your ownCloud Files

ownCloud includes an Encryption app, and when it is enabled by your ownCloud administrator all of your ownCloud data files are automatically encrypted.

#### **The Encryption app**

The goal of the Encryption app is to protect data on **external storage**. All files sent there will be encrypted by the ownCloud server, and upon retrieval, decrypted before serving them to you (or those you shared them with). The key to decrypt the data never leaves the ownCloud server. This makes the ownCloud Encryption app a great tool to benefit from cloud storage offered by services like Dropbox or Google Drive while ensuring security and privacy of your data!

Using the Encryption app is very simple. Just enable the app and the first time you log in again it will start to encrypt your data. If you later decide to disable the Encryption app, it will provide the option to decrypt your files in your personal settings. Please note that you should be very careful not to lose your login password as you will lose access to your files. As admin you can set a recovery password.

Keep in mind that the Encryption app only encrypts the content of your files. Filename and folder structures are not protected.

#### ▪ **Using Encryption**

ownCloud encryption is pretty much set it and forget it, but you have a few options you can use.

When your ownCloud admin enables encryption for the first time, you must log out and then log back in to create your encryption keys and encrypt your files. When encryption has been enabled on your ownCloud server you will see a yellow banner on your Files page warning you to log out and then log back in



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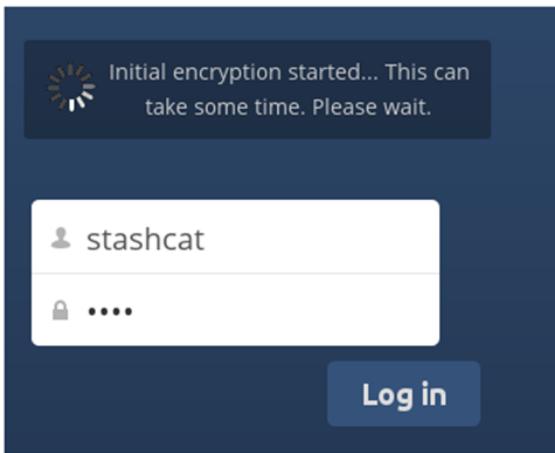
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Encryption App is enabled but your keys are not initialized, please log-out and log-in again

When you log back in it takes a few minutes to work, depending on how many files you have, and then you are returned to your default ownCloud page.



- **Sharing Encrypted Files**

Only users who have private encryption keys have access to shared encrypted files and folders. Users who have not yet created their private encryption keys will not have access to encrypted shared files; they will see folders and filenames, but will not be able to open or download the files. They will see a yellow warning banner that says "Encryption App is enabled but your keys are not initialized, please log-out and log-in again."

Share owners may need to re-share files after encryption is enabled; users trying to access the share will see a message advising them to ask the share owner to re-share the file with them. For individual shares, un-share and re-share the file. For group shares, share with any individuals who can't access the share. This updates the encryption, and then the share owner can remove the individual shares.

- **Recovery Key Password**

If your ownCloud administrator has enabled the recovery key feature, you can choose to use this feature for your account. If you enable "Password recovery" the administrator can read your data with a special password. This feature enables the administrator to recover your files in the event you lose your ownCloud password. If the recovery key is not enabled, then there is no way to restore your files if you lose your login password

#### Encryption

Enable recovery key (allow to recover users files in case of password loss):

.....	Recovery key password
.....	Repeat Recovery key password
<input checked="" type="radio"/> Enabled	
<input type="radio"/> Disabled	



- **Files Not Encrypted**

Only the data in your files is encrypted, and not the filenames or folder structures. These files are never encrypted:

- Old files in the trash bin.
- Image thumbnails from the Gallery app.
- Previews from the Files app.
- The search index from the full text search app.
- Third-party app data

There may be other files that are not encrypted; only files that are exposed to third-party storage providers are guaranteed to be encrypted.

- **Change Private Key Password**

This option is only available if your log-in password, but not your encryption password, was changed by your administrator. This can occur if your ownCloud provider uses a external user back-end (for example, LDAP) and changed your login password using that back-end configuration. In this case, you can set your encryption password to your new login password by providing your old and new login password. The Encryption app works only if your login password and your encryption password are identical.

**Conclusion:**

Hence, we learned about security of servers in cloud and security features of OwnCloud.



### Experiment No 9

**Aim:** Aim: To study and implementation of identity management

**Software Requirements:** Ubuntu operating system, Virtual machine, WAMP/ZAMP server, owncloud.

#### **Theory:**

#### **Identity Management**

Every enterprise will have its own identity management system to control access to information and computing resources. Cloud providers either integrate the customer's identity management system into their own infrastructure, using federation or SSO technology, or a biometric-based identification system, or provide an identity management solution of their own. CloudID, for instance, provides privacy-preserving cloud-based and cross-enterprise biometric identification solutions for this problem. It links the confidential information of the users to their biometrics and stores it in an encrypted fashion. Making use of a searchable encryption technique, biometric identification is performed in encrypted domain to make sure that the cloud provider or potential attackers do not gain access to any sensitive data or even the contents of the individual queries.

#### **Procedure:**

1. Deploying the own storage cloud our own cloud(SaaS)
2. reboot pc and enable vtx in bios
3. install virtual box
4. virtual box is type 2 hypervisor
  
5. cloud is install on virtual box
6. note down the IP address of system
7. we have our own cloud system ready so we will open in virtual box
8. my system 192.168.44.169
9. continuing
10. need to change the setting in the storage cloud
11. note down the ip address of server is 10.0.2.15/owncloud
12. id and password are shown bellow
13. in browser enter localhost:8888
14. local.conf specify the detail
15. =====
16. owncloud client
17. open owncloud in browser



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T8.

now open client

19. select the folder you want to upload
20. create the folder in cloud
21. now sync
22. if you check in browser you will see the paper is uploaded
23. let modify the content of folder already on cloud
24. if you add any content to folder that is sync then you can see change in cloud browser

### **Creating a New User**

- To create a user account:
- Enter the new user's Login Name and their initial Password
- Optionally, assign Groups memberships
- Click the Create button
- Reset a User's Password: You cannot recover a user's password, but you can set a new one:
- Hover your cursor over the user's Password field
- Click on the pencil icon
- Enter the user's new password in the password field, and remember to provide the user with their password

### **Renaming a User**

Each ownCloud user has two names: a unique Login Name used for authentication, and a Full Name, which is their display name. You can edit the display name of a user, but you cannot change the login name of any user.

To set or change a user's display name:

- Hover your cursor over the user's Full Name field
- Click on the Pencil icon
- Enter the user's new display name

### **Granting Administrator Privileges to a User**

ownCloud has two types of administrators: Super Administrators and Group Administrators. Group administrators have the rights to create, edit and delete users in their assigned groups. Group administrators cannot access system settings, or add or modify users in the groups that they are not Group Administrators for. Use the dropdown menus in the Group Admin column to assign group admin privileges

### **Managing Groups**

You can assign new users to groups when you create them, and create new groups when you create new users. You may also use the Add Group button at the top of the left pane to create new groups. New group members will immediately have access to file shares that belong to their new groups.

### **Setting Storage Quotas**



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Click the gear on the lower left pane to set a default storage quota. This is automatically applied to new users. You may assign a different quota to any user by selecting from the Quota dropdown, selecting either a preset value or entering a custom value. When you create custom quotas, use the normal abbreviations for your storage values such as 500 MB, 5 GB, 5 TB, and so on.

#### Deleting users

Deleting a user is easy: hover your cursor over their name on the Users page until a trashcan icon appears at the far right. Click the trashcan, and they're gone. You'll see an undo button at the top of the page, which remains until you refresh the page. When the undo button is gone you cannot recover the deleted user.

#### File Sharing

ownCloud users can share files with their ownCloud groups and other users on the same ownCloud server, and create public shares for people who are not ownCloud users. You have control of a number of user permissions on file shares:

- Allowing users to share files
- Allowing users to create public shares
- Requiring a password on public shares
- Allowing public uploads to public shares
- Requiring an expiration date on public share links
- Allowing resharing
- Restricting sharing to group members only
- Allowing email notifications of new public shares
- Excluding groups from creating shares

#### Result:

#### SNAPSHOTS

OwnCloud is open source file sync and share software for everyone from individuals operating the free ownCloud Server edition, to large enterprises and service providers operating the ownCloud Enterprise Subscription. ownCloud provides a safe, secure, and compliant file synchronization and sharing solution on servers that you control. You can share one or more files and folders on your computer, and synchronize them with your ownCloud server.



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The screenshot shows a web browser window with the URL <https://demo.owncloud.org/apps/files/>. The page has a dark blue header with a white cloud icon. Below the header is a white input field containing the text "test". At the bottom right of the input field is a small checkbox labeled "Stay logged in". The browser's address bar shows the same URL. The toolbar above the address bar includes links for Google, Gmail, Facebook, R.A.I.T. TPC, Online Fashion India, Event managers&org, Nitin Chandrakant De, and WinHex: Feature.

Step 2 :By default, the ownCloud Web interface opens to your Files page. You can add, remove, and share files, and make changes based on the access privileges set by you (if you are administering the server) or by your server administrator. You can access your ownCloud files with the ownCloud web interface and create, preview, edit, delete, share, and re-share files. Your ownCloud administrator has the option to disable these features, so if any of them are missing on your system ask your server administrator.



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**Step 3: Apps Selection Menu:** Located in the upper left corner, click the arrow to open a dropdown menu to navigate to your various available apps. **Apps Information field:** Located in the left sidebar, this provides filters and tasks associated with your selected app. **Application View:** The main central field in the ownCloud user interface. This field displays the contents or user features of your selected app

**Step 4:** Share the file or folder with a group or other users, and create public shares with hyperlinks. You can also see who you have shared with already, and revoke shares by clicking the trash can icon. If username auto-completion is enabled, when you start typing the user or group name ownCloud will automatically complete it for you. If your administrator has enabled email notifications, you can send an email



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notification of the new share from the sharing screen.

**Sharing**

Allow apps to use the Share API

Allow users to share via link

Enforce password protection

Allow public uploads

Set default expiration date

Expire after  days  Enforce expiration date

Allow resharing

Restrict users to only share with users in their groups

Allow users to send mail notification for shared files

Exclude groups from sharing

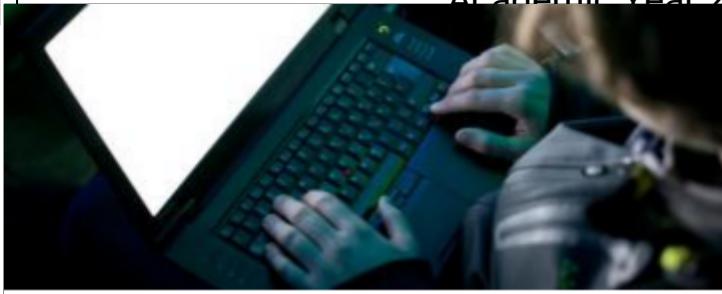
**Groups** ▾

These groups will still be able to receive shares, but not to initiate them.

The screenshot shows a cloud storage interface with a dark header bar. On the left, there is a sidebar with navigation links: All files, Favorites, Shared with you, Shared with others, Shared by link, and Tags. The main area displays a folder structure under 'Photos' containing three files: 'hacking.jpg', 'mate.jpg', and 'r0ket.jpg'. A context menu is open over the first file, listing the following options: Details, Rename, Download, and Delete.



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[hacking.jpg](#)

★ 228 KB, 9 days ago

Collaborative tags

Activities Comments **Sharing** Versions

Share with users or groups ...

Share link

<https://demo.owncloud.org/s/T0GPHINNpC5vIVp>

Password protect

Set expiration date

Activities Comments **Sharing**

Share with users or groups ...

admin (group)

can share

can edit

▼



admin

Step 5: Five Share permissions are :

Can share; allows the users you share with to re-share.

Can edit; allows the users you share with to edit your shared files, and to collaborate using the Documents app.

Create; allows the users you share with to create new files and add them to the share.

Change; allows uploading a new version of a shared file and replacing it.



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~~Delete; allows the users you share with to delete shared files~~

	Username	Password	Groups	Create
2	Username	Full Name	Password	Groups
1	my_circle	my_circle	*****	users, be_b div be_b div

### **Conclusion:**

We have studied how to use ownCloud for ensuring identity management of the users. We can create multiple groups and provide privileges to view or modify data as per defined permissions. It also enables simplified look and feel to be used by anyone.

### **Experiment No. 10**

#### **Mini Project**

**Aim:** To implement a Mini Project using concepts of cloud.

**Objectives:** From this experiment, the student will be able,

- To understand concepts of virtualization and to use cloud as Infrastructure, Platform, Software as services.
- To learn to Create a web application ,deploy it on cloud and its complexity
- To learn the efficient tools to implement the application on cloud

**Outcomes:** The learner will be able to

- Install and appreciate security features and user management for cloud using web application.
- Understand professional, ethical, legal, security and social issues and responsibilities.
- Analyze the local and global impact of computing on individuals, organizations, and society.
- Recognize the need for, and engage in life-long learning.



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**Hardware / Software Required:** Ubuntu operating system, Virtual machine,

WAMP/ZAMP server, Any tool or technology can be used for implementation of web application e.g., JAVA, PHP, etc.

### **Conclusion:**

We have uploaded the mini project on cloud so as to give access to maximum users and they can avail benefits of the same. It will be easy to add functionality in future if required. By deploying web application on cloud the web application can run on minimum hardware and software requirements.