

## Cloud Computing Practical -1

**Aim:** To study cloud architecture and cloud computing model.

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

- provide an overview of concepts of Cloud Computing .
- To encourage students to indulge into research in Cloud Computing.

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

- understand and appreciate cloud architecture.
- analyze the local and global impact of computing on individuals, organizations, and society.
- recognize the need for, and an ability to engage in life-long learning.

**Hardware / Software Required:** Ubuntu operating system, Internet

### **Theory:**

Cloud computing enables companies to consume compute resources as a utility -- just like electricity -- rather than having to build and maintain computing infrastructures in-house. Cloud computing promises several attractive benefits for businesses and end users.

### **Three of the main benefits of cloud computing include:**

- Self-service provisioning: End users can spin up computing resources for almost any type of workload on-demand.
- Elasticity: Companies can scale up as computing needs increase and then scale down again as demands decrease.
- Pay per use: Computing resources are measured at a granular level, allowing users to pay only for the resources and workloads they use.

### **Cloud computing services can be private, public or hybrid.**

Private cloud services are delivered from a business' data center to internal users. This model offers versatility and convenience, while preserving management, control and security. Internal customers may or may not be billed for services through IT chargeback.

In the public cloud model, a third-party provider delivers the cloud service over the Internet. Public cloud services are sold on-demand, typically by the minute or the hour. Customers only pay for the CPU cycles, storage or bandwidth they consume. Leading public cloud providers include Amazon

Web Services (AWS), Microsoft Azure, IBM/SoftLayer and Google Compute Engine.

### **Type of cloud computing:**

There are 3 main types of as-a-Service solutions: IaaS, PaaS, and SaaS. Each facilitates the flow of user data from front-end clients through the internet, to the cloud service provider's systems, and back—but vary by what's provided.

#### **Infrastructure as a Service (IaaS):**

IaaS means a cloud service provider manages the infrastructure for you—the actual servers, network, virtualization, and data storage—through an internet connection. The user has access through an API or dashboard, and essentially rents the infrastructure. The user manages things like the operating system, apps, and middleware while the provider takes care of any hardware, networking, hard drives, data storage, and servers; and has the responsibility of taking care of outages, repairs, and hardware issues. This is the typical deployment model of cloud storage providers.

#### **Platform as a Service (PaaS):**

PaaS means the hardware and an application-software platform are provided and managed by an outside cloud service provider, but the user handles the apps running on top of the platform and the data the app relies on. Primarily for developers and programmers, PaaS gives users a shared cloud platform for application development and management (an important DevOps component) without having to build and maintain the infrastructure usually associated with the process.

#### **Software as a Service (SaaS):**

SaaS is a service that delivers a software application—which the cloud service provider manages—to its users. Typically, SaaS apps are web applications or mobile apps that users can access via a web browser. Software updates, bug fixes, and other general software maintenance are taken care of for the user, and they connect to the cloud applications via a dashboard or API. SaaS also eliminates the need to have an app installed locally on each individual user's computer, allowing greater methods of group or team access to the software.

### **Advantages and Disadvantages of cloud computing:**

#### **Advantages:**

Cloud Computing is an emerging technology that almost every company is being switched to from its on-premise technologies.

- Cost efficiency: The biggest reason behind companies shifting to Cloud Computing is that it takes considerably less cost than any on-premise technology. Now, companies need not store data in disks anymore as the cloud offers enormous storage space, saving money and resources.
- High speed: Cloud Computing lets us deploy the service quickly in fewer clicks. This quick deployment lets us get the resources required for our system within minutes.

### **Disadvantages:**

Every technology has both positive and negative aspects that are highly important to be discussed before implementing it.

- No Redundancy: A cloud server is not redundant or backed up. Although it is an extra expense, make sure to invest in a redundancy plan as in most cases, it will be well worth it. Technology does sometimes seem to fail.
- Bandwidth issues: For better performance, it is advisable not to pack large numbers of storage devices and servers into a small set of data centers. The additional charges could be, however, significantly costly

### **Conclusion:**

Cloud computing enables a convenient and on-demand network access to a wide range of resources. The different services and also the deployment models allow flexible service provider interaction with minimal human intervention. It saves costs but also can lead to risk issues and suspension of resources when in huge quantities.

## Cloud Computing Practical - 2

**Aim:** Installation and Configuration of virtualization using KVM.

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

- Understand the concepts of virtualization.
- Understand KVM architecture and its configuration.

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

- To analyze user models and develop user centric interfaces
- To analyze the local and global impact of computing on individuals, organizations, and society.
- To engage in life-long learning development and higher studies.
- To understand, identify, analyze and design the problem, implement and
- validate the solution including both hardware and software.

**Hardware / Software Required:** Ubuntu operating system, open source software  
KVM, Internet.

### **Theory:**

Virtualization is software that separates physical infrastructures to create various dedicated resources. It is the fundamental technology that powers cloud computing.

The technology behind virtualization is known as a virtual machine monitor (VMM) or virtual manager, which separates compute environments from the actual physical infrastructure.

Virtualization makes servers, workstations, storage and other systems independent of the physical hardware layer. This is done by installing a Hypervisor on top of the hardware layer, where the systems are then installed.

**There are three areas of IT where virtualization is making headboards, network**

**virtualization, storage virtualization and server virtualization:**

- **Network virtualization** is a method of combining the available resources in a network by splitting up the available bandwidth into channels, each of which is independent from the others, and each of which can be assigned (or reassigned) to a particular server or device in real time. The idea is that virtualization disguises the true complexity of the network by

separating it into manageable parts, much like your partitioned hard drive makes it easier to manage your files.

- **Storage virtualization** is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console. Storage virtualization is commonly used in storage area networks (SANs).

- **Server virtualization** is the masking of server resources (including the number and identity of individual physical servers, processors, and operating systems) from server users. The intention is to spare the user from having to understand and manage complicated details of server resources while increasing resource sharing and utilization and maintaining the capacity to expand later.

Virtualization can be viewed as part of an overall trend in enterprise IT that includes autonomic computing, a scenario in which the IT environment will be

able to manage itself based on perceived activity, and utility computing, in which computer processing power is seen as a utility that clients can pay for only as needed. The usual goal of virtualization is to centralize administrative tasks while improving scalability and work loads.

### **Procedure:**

#### **Installation Steps :**

1. #sudo grep -c "svm\|vmx" /proc/cpuinfo
2. #sudo apt-get install qemu-kvm libvirt-bin bridge-utils virt-manager
3. #sudo adduser rait  
#sudo adduser rait libvirtd

After running this command, log out and log back in as rait

4. Run following command after logging back in as rait and you should see an

empty list of virtual machines. This indicates that everything is working correctly.

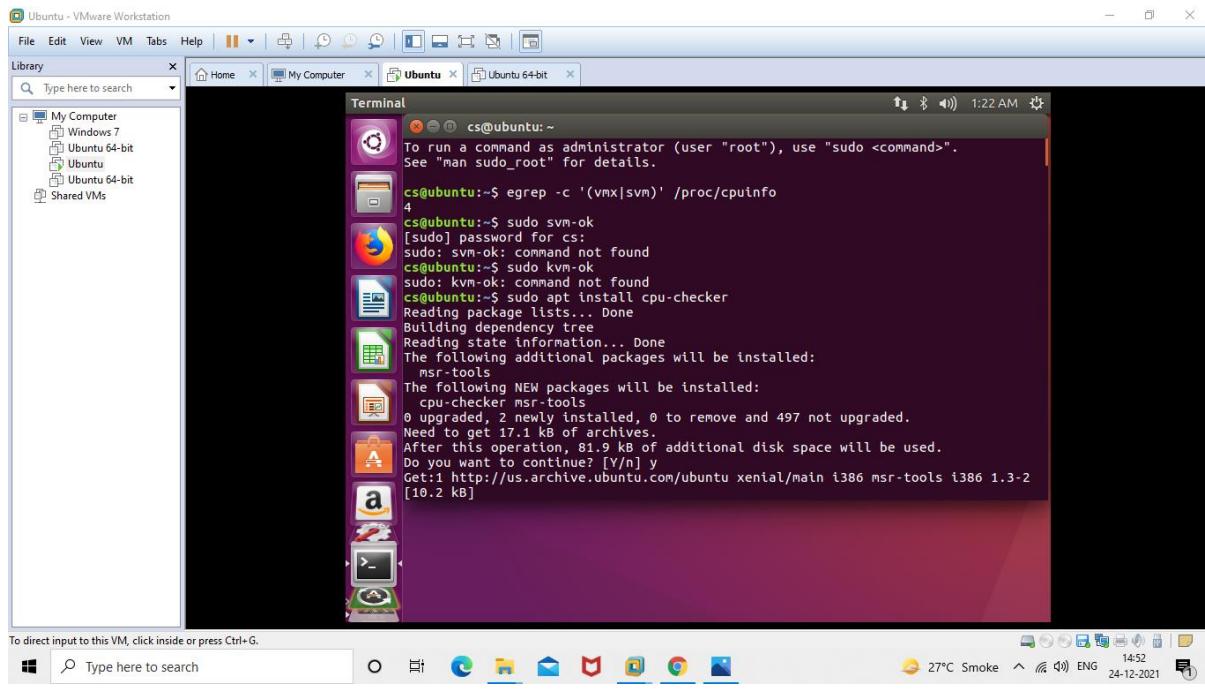
```
#virsh -c qemu:///system list
```

5. Open Virtual Machine Manager application and Create Virtual Machine  
#virt-manager

### **Result:**

**Step 1 : #sudo grep -c "svm\|vmx" /proc/cpuinfo**

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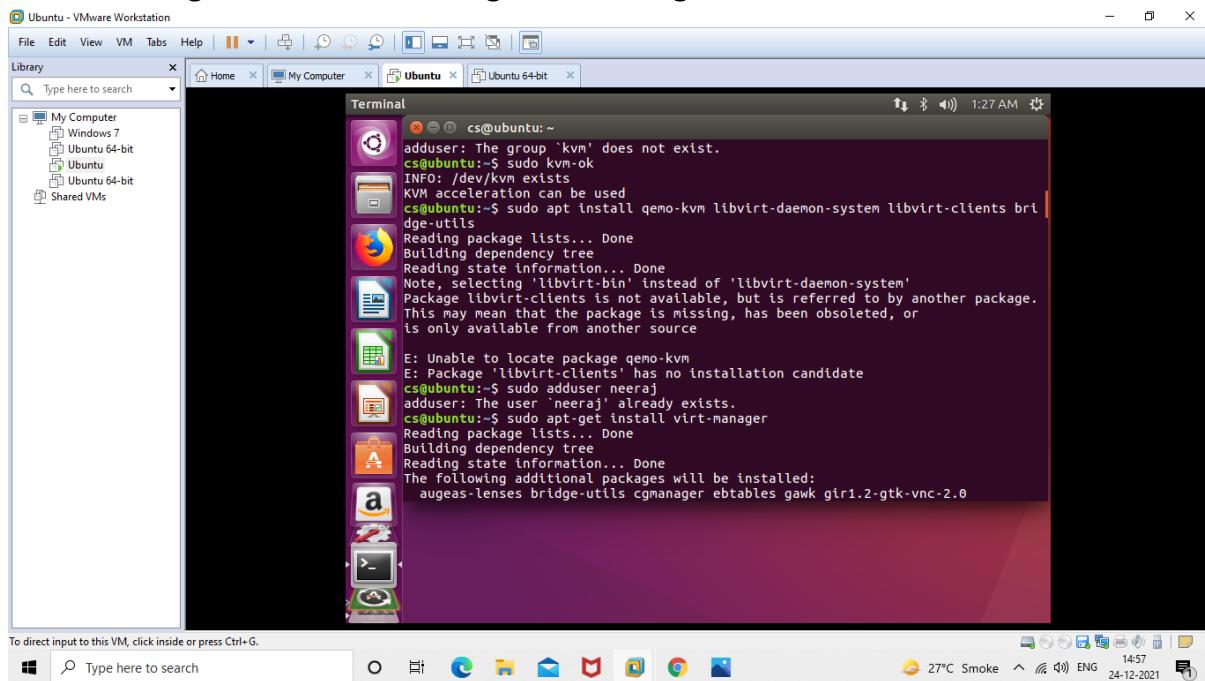


```
To run a command as administrator (user "root"), use "sudo <command>".  
See "man sudo_root" for details.  
  
cs@ubuntu:~$ egrep -c '(vmx|svm)' /proc/cpuinfo  
4  
cs@ubuntu:~$ sudo svm-ok  
[sudo] password for cs:  
sudo: svm-ok: command not found  
cs@ubuntu:~$ sudo kvm-ok  
sudo: kvm-ok: command not found  
cs@ubuntu:~$ sudo apt install cpu-checker  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:  
    msr-tools  
The following NEW packages will be installed:  
    cpu-checker msr-tools  
0 upgraded, 2 newly installed, 0 to remove and 497 not upgraded.  
Need to get 17.1 kB of archives.  
After this operation, 81.9 kB of additional disk space will be used.  
Do you want to continue? [Y/n] y  
Get:1 http://us.archive.ubuntu.com/ubuntu xenial/main i386 msr-tools i386 1.3-2  
[10.2 kB]
```

**Step 2 : #sudo apt-get install qemu-kvm libvirt-bin bridge-utils virt-manager**

**Step 3 : #sudo adduser rrait**

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



```
adduser: The group 'kvm' does not exist.  
cs@ubuntu:~$ sudo kvm-ok  
INFO: /dev/kvm exists  
KVM acceleration can be used  
cs@ubuntu:~$ sudo apt install qemo-kvm libvirt-daemon-system libvirt-clients bridge-utils  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
Note, selecting 'libvirt-bin' instead of 'libvirt-daemon-system'  
Package libvirt-clients is not available, but is referred to by another package.  
This may mean that the package is missing, has been obsoleted, or  
is only available from another source  
  
E: Unable to locate package qemo-kvm  
E: Package 'libvirt-clients' has no installation candidate  
cs@ubuntu:~$ sudo adduser neeraj  
adduser: The user 'neeraj' already exists.  
cs@ubuntu:~$ sudo apt-get install virt-manager  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:  
    augeas-lenses bridge-utils cgmanager ebtables gawk gir1.2-gtk-vnc-2.0
```

**Step 4 : #sudo adduser rrait libvirtd**

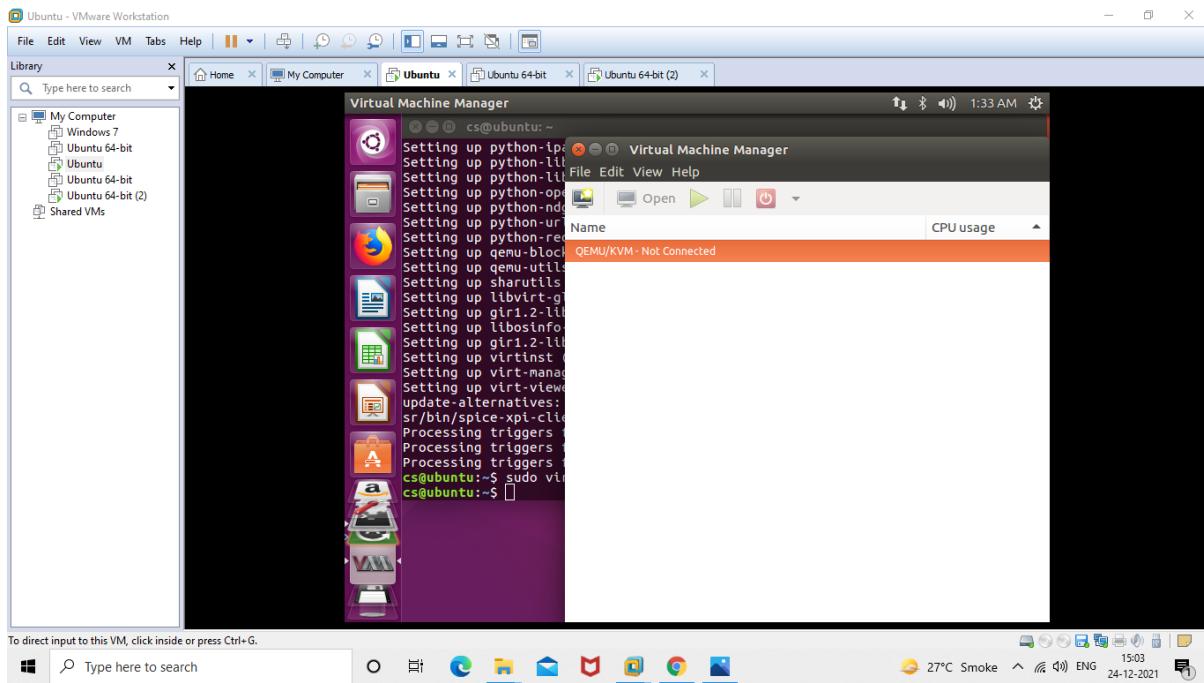
**After running this command, log out and log back in as rrait**

**Step 5 : Open Virtual Machine Manager application and Create Virtual Machine**

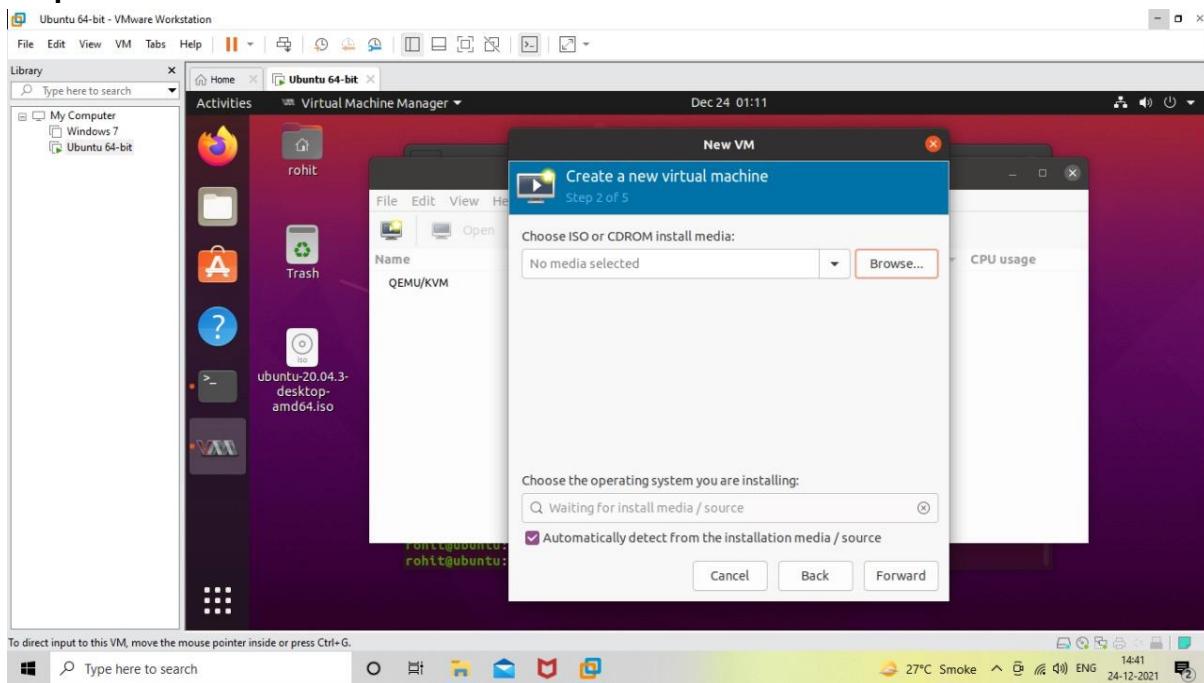
**#virt-manager as shown below**

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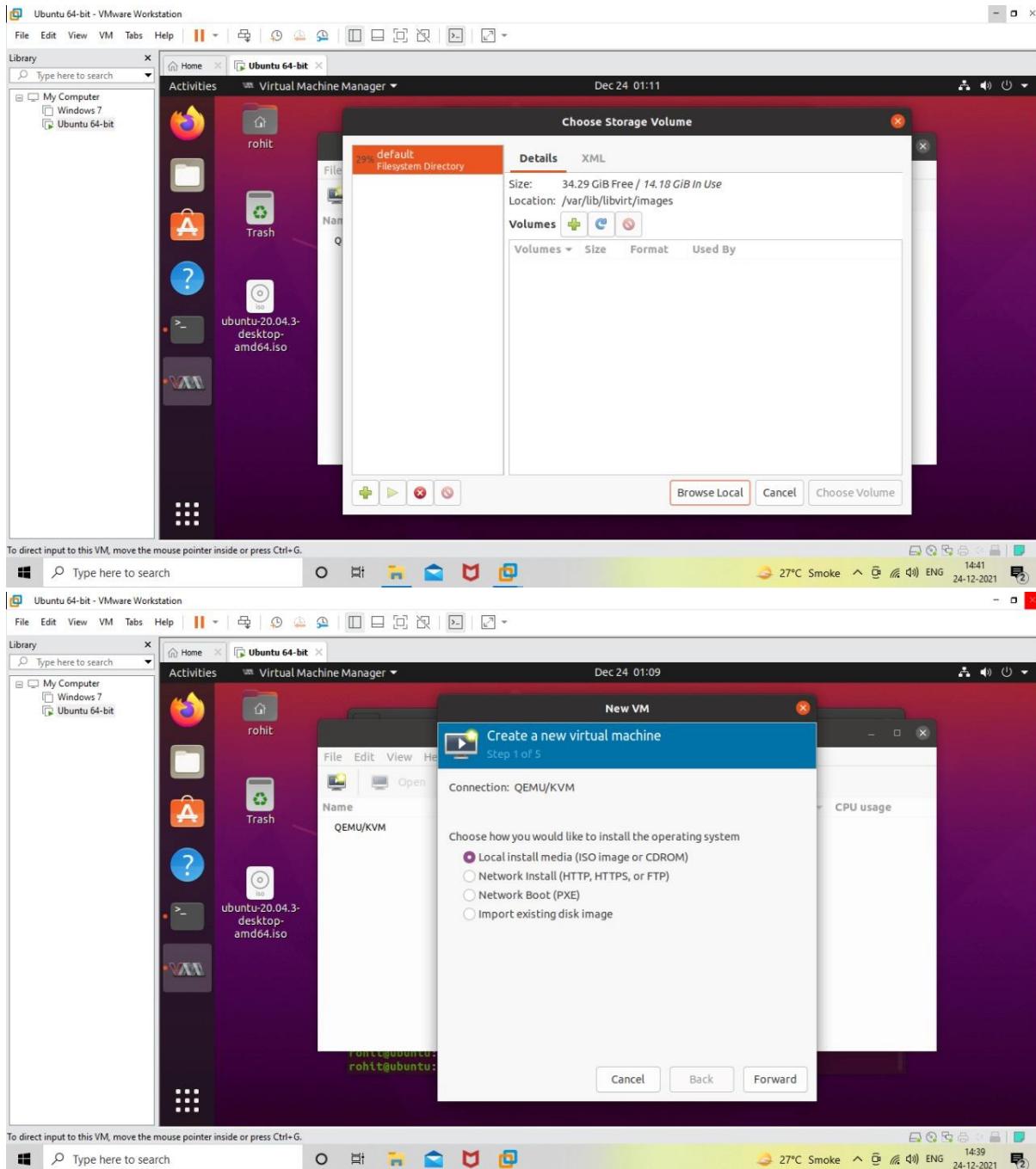
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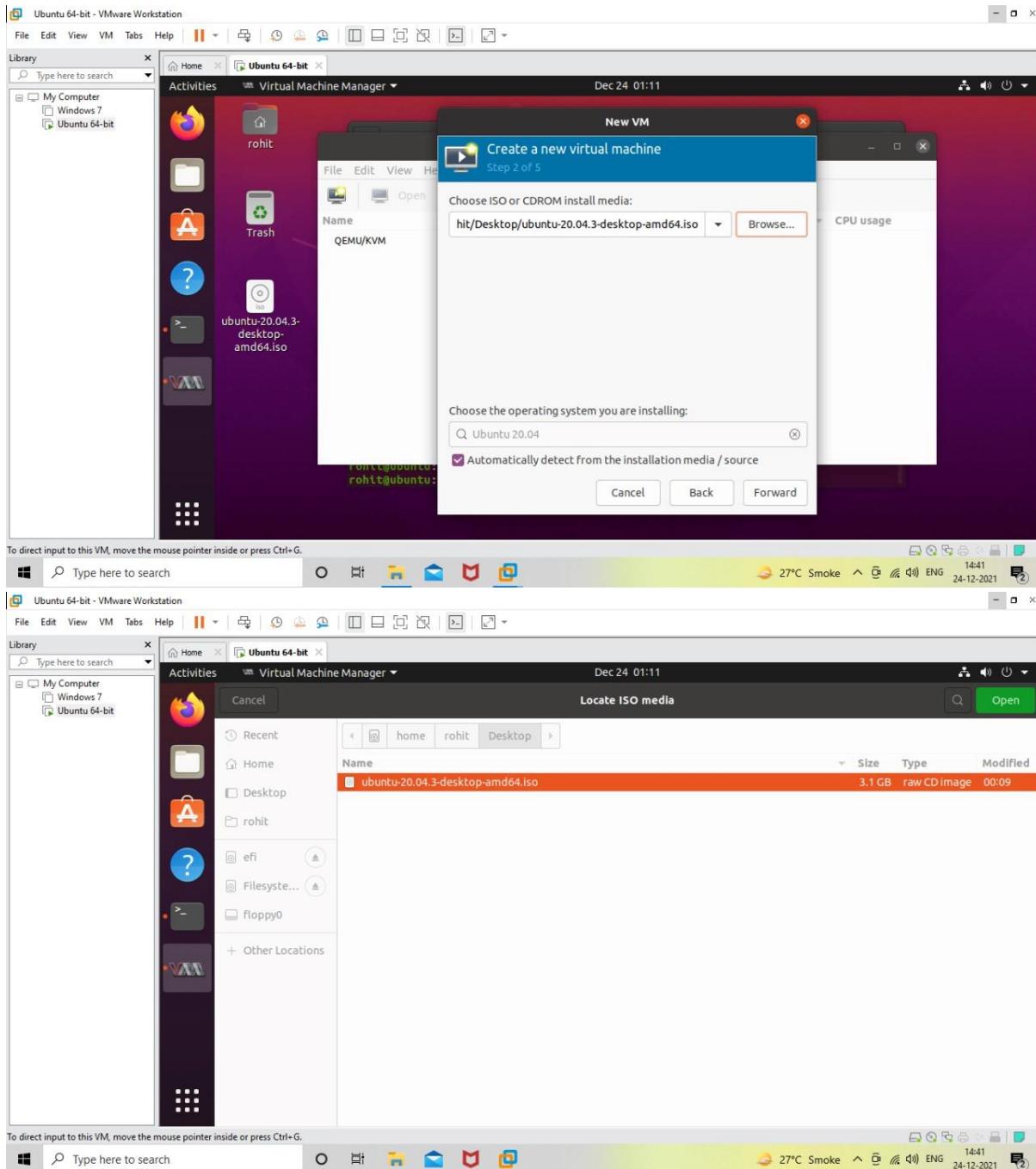
### Step 6 : Create a new virtual machine as shown below



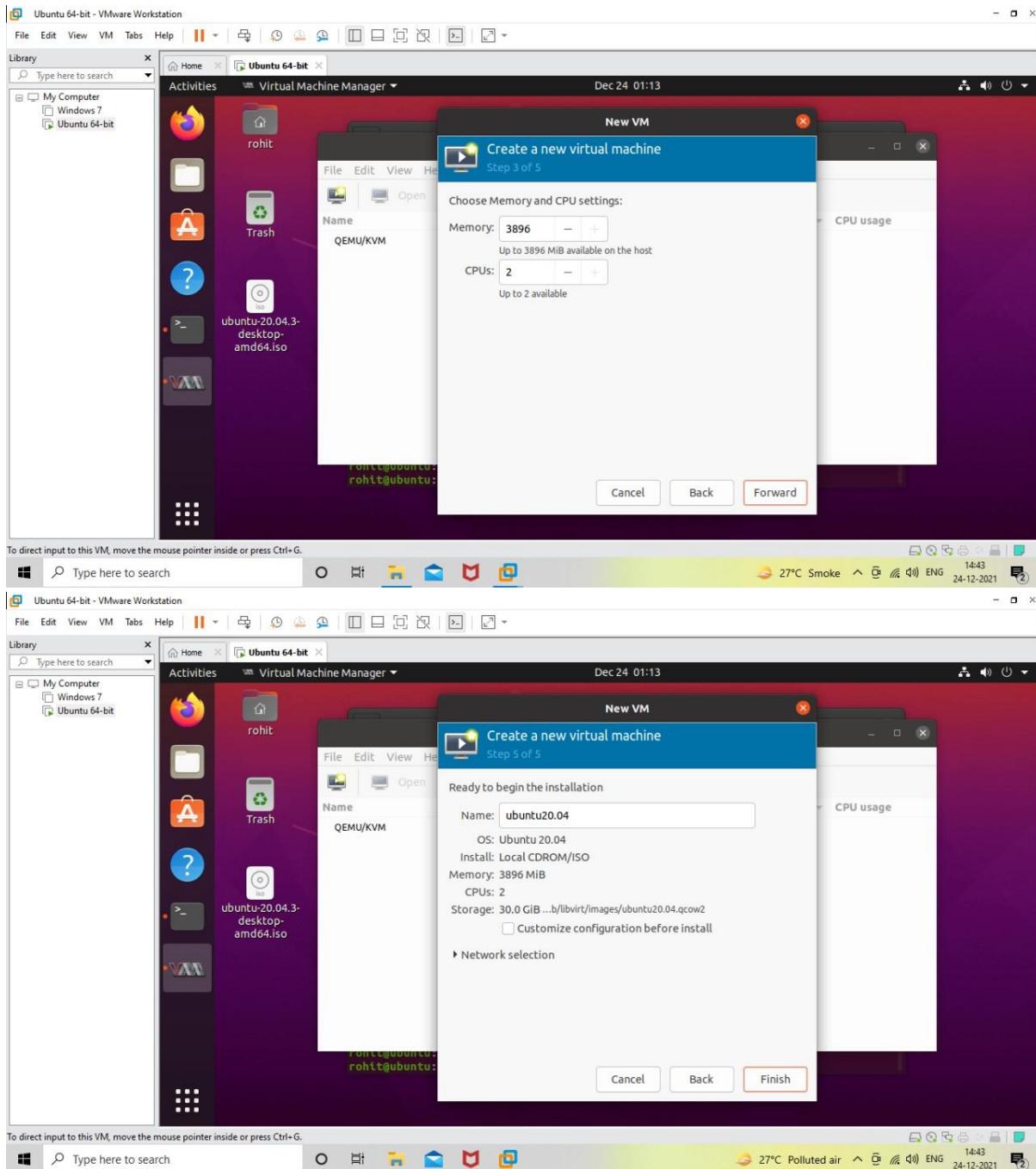
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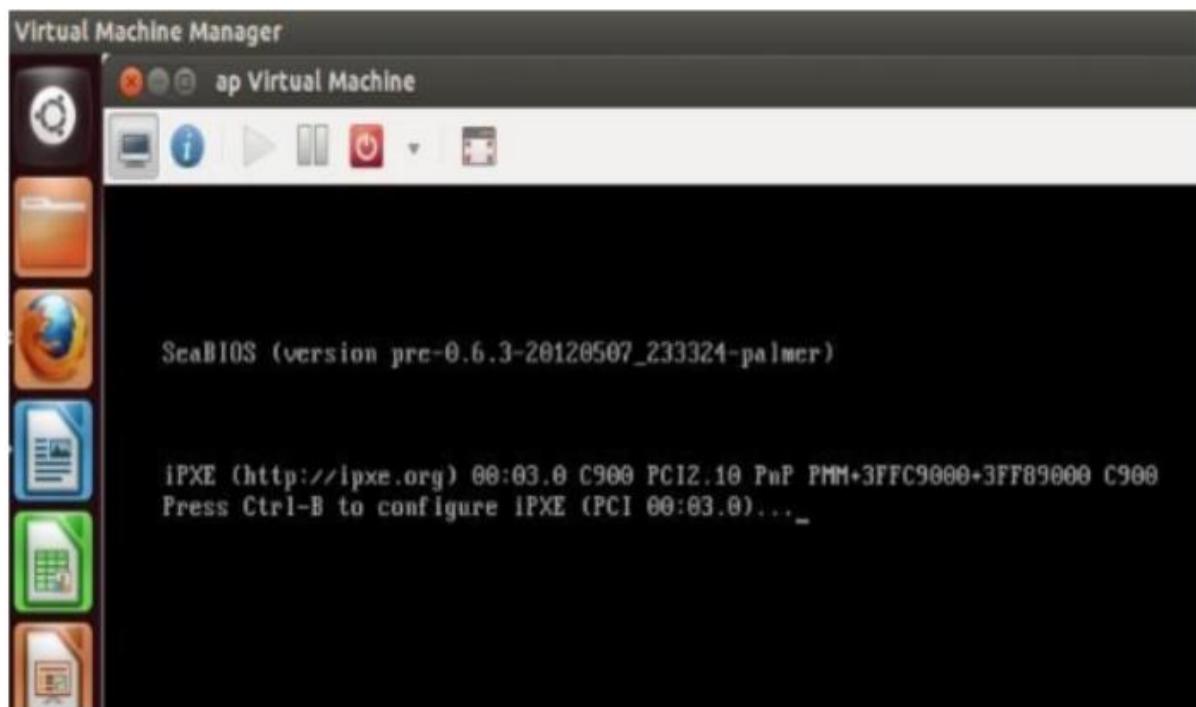
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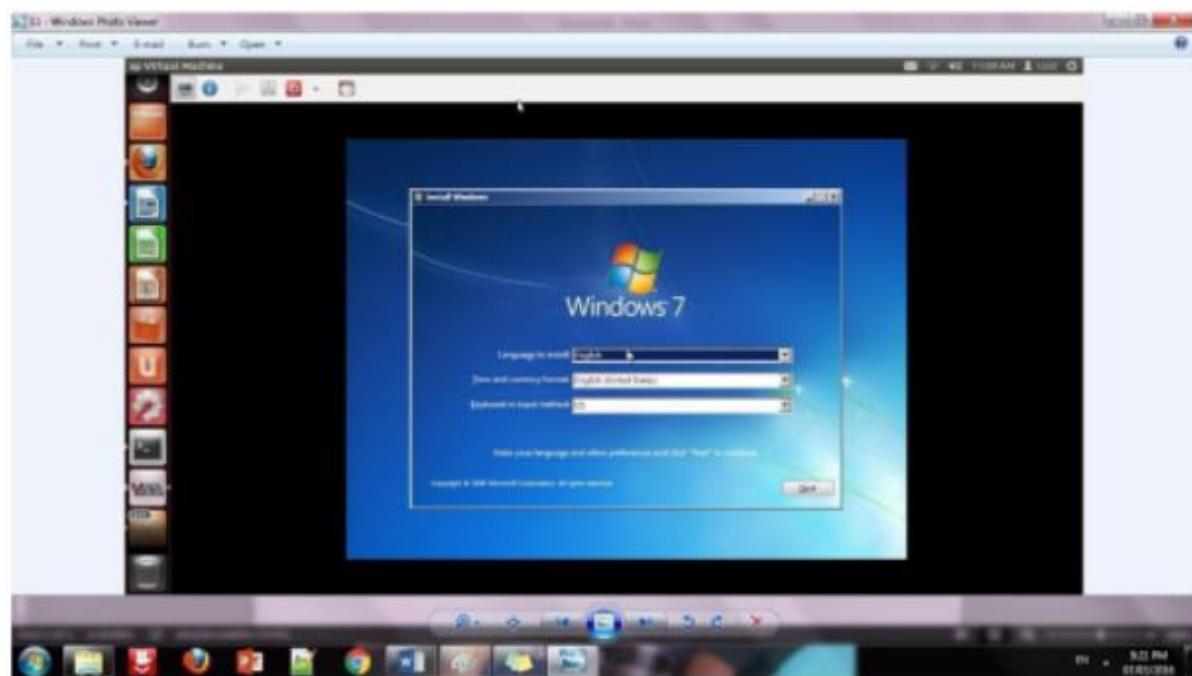
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### Step 7 : Install windows operating system on virtual machine



### Step 8: Installation of windows 7 on virtual machine



### Conclusion:

Installation and configuration of KVM have been done successfully onto Ubuntu and users added. Like this we can create as many virtual machines as possible on OS and can install any windows onto it.

## Cloud Computing Practical - 3

**Aim:** To study and implementation of Infrastructure as a Service

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

- Understand concepts of virtualization and to use cloud as Infrastructure as a services.
- Learn the technique and its complexity
- Understand the importance of this technique from application point of view

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

- To match the industry requirements in the domains of Database management,
- Programming and Networking with limited infrastructure.
- To analyze the local and global impact of computing on individuals, organizations, and society.
- To use current techniques, skills, and tools necessary for computing practice.

**Hardware / Software Required:** Ubuntu operating system, Virtual machine, WAMP/XAMPP server, Any tool or technology can be used for implementation of web application e.g., JAVA, PHP, etc.

### **Theory:**

#### **Infrastructure as a Service (IaaS):**

IaaS means a cloud service provider manages the infrastructure for you—the actual servers, network, virtualization, and data storage—through an internet connection. The user has access through an API or dashboard, and essentially rents the infrastructure. The user manages things like the operating system, apps, and middleware while the provider takes care of any hardware, networking, hard drives, data storage, and servers; and has the responsibility of taking care of outages, repairs, and hardware issues. This is the typical deployment model of cloud storage providers.

### **Procedure:**

#### **Installation Steps:**

##### **Add user**

- useradd -s /bin/bash -d /opt/stack -m stack
- apt-get install sudo -y

- echo "stack ALL=(ALL) NOPASSWD: ALL" >> /etc/sudoers
- login as stack user

### Download DevStack

- sudo apt-get install git -y || sudo yum install -y git
- git clone https://git.openstack.org/openstack-dev/devstack
- cd devstack

### Run DevStack

Now to configure stack.sh. DevStack includes a sample

**devstack/samples/local.conf**.

Create local.conf as shown below to do the following:

- Set FLOATING\_RANGE to a range not used on the local network, i.e. 192.168.1.224/27. This configures IP addresses ending in 225-254 to be used as floating IPs.
- Set FIXED\_RANGE and FIXED\_NETWORK\_SIZE to configure the internal address space used by the instances.
- Set FLAT\_INTERFACE to the Ethernet interface that connects the host to your local network. This is the interface that should be configured with the static IP address mentioned above.
- Set the administrative password. This password is used for the admin and demo accounts set up as OpenStack users.
- Set the MySQL administrative password. The default here is a random hex string which is inconvenient if you need to look at the database directly for anything.
- Set the RabbitMQ password.
- Set the service password. This is used by the OpenStack services (Nova, Glance, etc) to authenticate with Keystone.

**local.conf** should look something like this:

```
[[local | localrc]]
FLOATING_RANGE=192.168.1.224/27
FIXED_RANGE=10.11.12.0/24
FIXED_NETWORK_SIZE=256
FLAT_INTERFACE=eth0
ADMIN_PASSWORD=supersecret
DATABASE_PASSWORD=iheartdatabases
```

```
RABBIT_PASSWORD=flopsymopsy  
SERVICE_PASSWORD=iheartksl
```

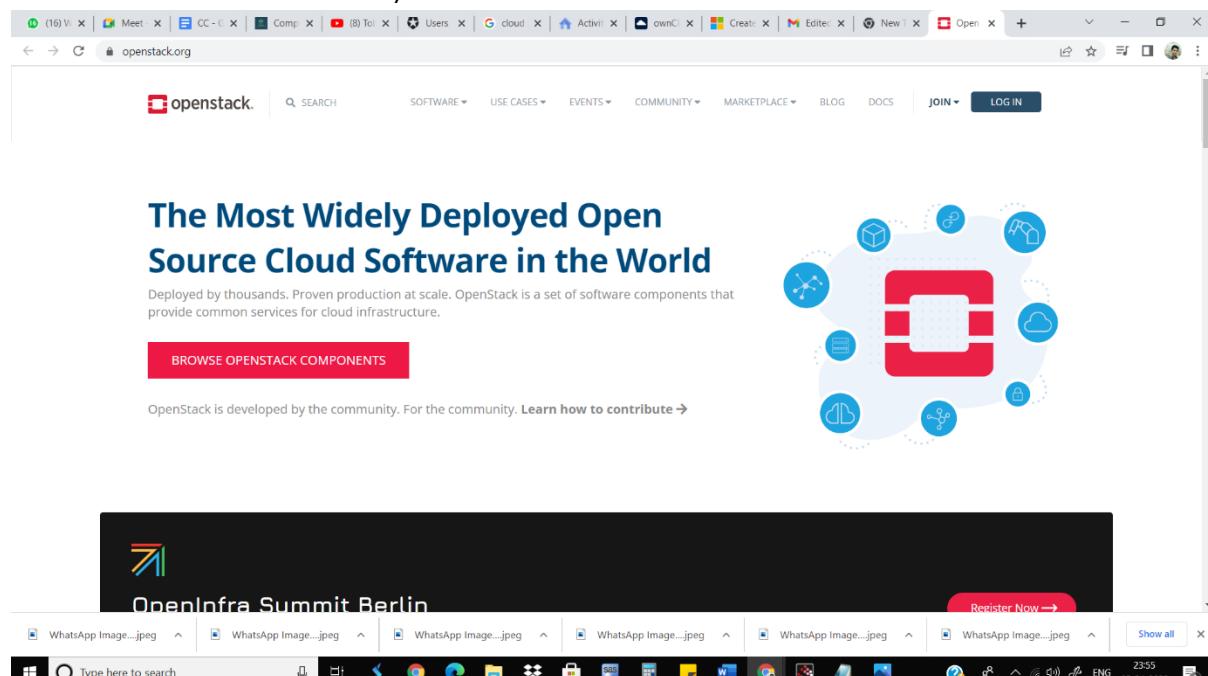
### Run DevStack:

```
./stack.sh
```

A seemingly endless stream of activity ensues. When complete you will see a summary of stack.sh's work, including the relevant URLs, accounts and passwords to poke at your shiny new OpenStack.

### Using OpenStack

At this point you should be able to access the dashboard from other computers on the local network. In this example that would be <http://192.168.43.29/> for the dashboard (aka Horizon). Launch VMs and if you give them floating IPs and security group access those VMs will be accessible from other machines on your network.



The screenshot shows the official OpenStack website at [openstack.org](https://openstack.org). The page features a navigation bar with links for Software, Use Cases, Events, Community, Marketplace, Blog, Docs, Join, and Login. The main content area has a heading "The Most Widely Deployed Open Source Cloud Software in the World" with a subtext about its deployment by thousands and its use in production at scale. It includes a "BROWSE OPENSTACK COMPONENTS" button and a call-to-action "OpenStack is developed by the community. For the community. Learn how to contribute →". To the right is a graphic of a red central node connected to various blue cloud and storage icons. At the bottom, there's a banner for the "OpenInfra Summit Berlin" with a "Register Now →" button, and a Windows taskbar at the very bottom.

### IAAS using google cloud platform:

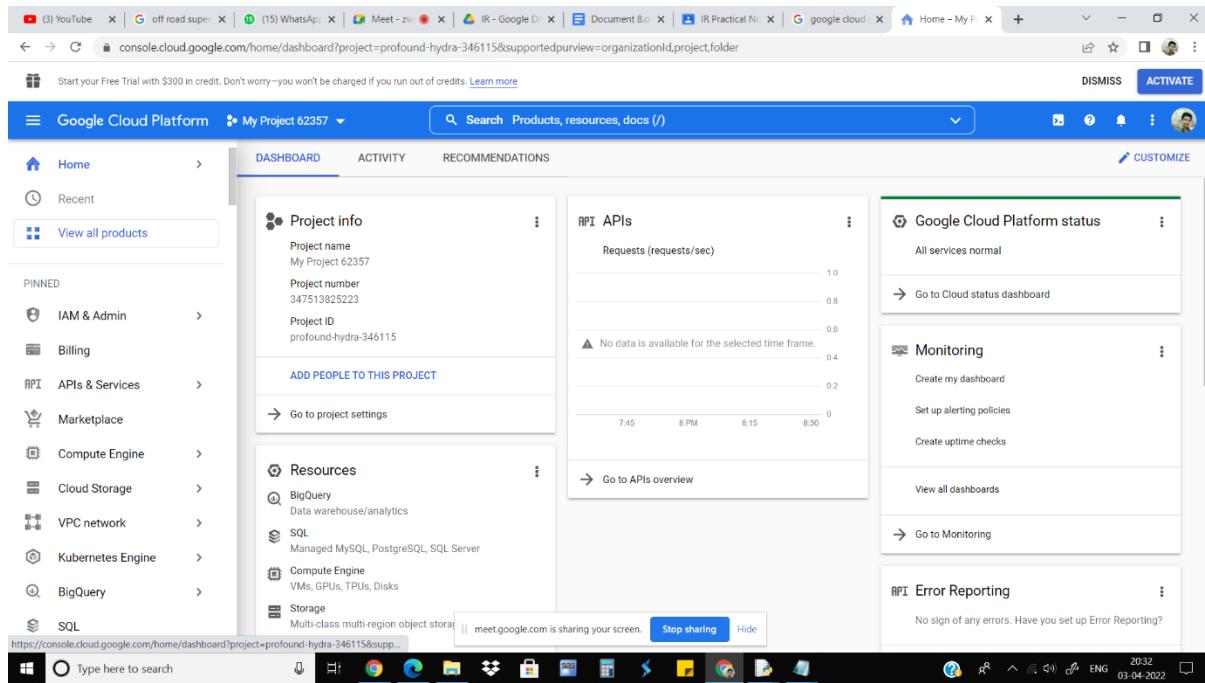
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The screenshot shows the Google Cloud homepage with a banner for 'Accelerate your transformation with Google Cloud' and another for 'Best of Next: Asia Pacific'. Below these are four service cards: 'Develop new apps and experiences faster', 'Enable smarter decision making across your organization', 'Transform how you connect and build and invest in your cloud with confidence'. The bottom half shows the Google Cloud Platform console with a sidebar menu and a main dashboard featuring 'Top Products' like Compute Engine, Cloud Storage, Cloud SQL, and Cloud Run.

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The screenshot shows two views of the Google Cloud Platform interface. The top view is the 'Dashboard' page, which displays a message 'To view this page, select a project.' and a 'CREATE PROJECT' button. The sidebar on the left lists various services under 'PINNED' and 'APIs & Services'. The bottom view is the 'ACTIVITY' tab of the dashboard, showing a list of recent events such as API calls and project creation. A 'Filters' sidebar on the right allows users to refine the activity log by user, category, and date.

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### Conclusion:

We have installed Ubuntu/Xen as a bare metal hypervisor and implemented it. It provides access to computing resources in a virtual environment. With the help of Infrastructure as a service we can build our own IT platform. We can install Windows Operating System on Ubuntu and vice versa.

## Cloud Computing Practical - 4

**Aim:** To study and implementation of Storage as a Service

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

- To make the students understand the use of cloud as Platform, Storage as services.
- To learn the efficient tools to implement the technique

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

- To create and use online infrastructure.
- To analyze the local and global impact of computing on individuals, organizations, and society.

**Hardware / Software Required:** Windows operating system, Gmail account, Google drive.

### **Theory:**

**Storage as a service (STaaS)** is a data storage business model where a provider rents storage resources to a customer through a subscription. STaaS saves you money through operating expenditure (OpEx) agility—you only pay for the storage you need, when you need it.

Buying new storage capacity can be an expensive capital expenditure (CapEx), especially if you aren't sure how much capacity you'll need in the future. You can try to predict the growth of your business and purchase with the future in mind, but it can tie up financial resources that might have more impact elsewhere in your business.

### **Benefits of STaaS:**

- Ability to quickly scale and provision storage resources to your apps as you grow
- Always-on reliability of major cloud service providers
- Simplified storage management environment

### **Result: Using Google Drive**

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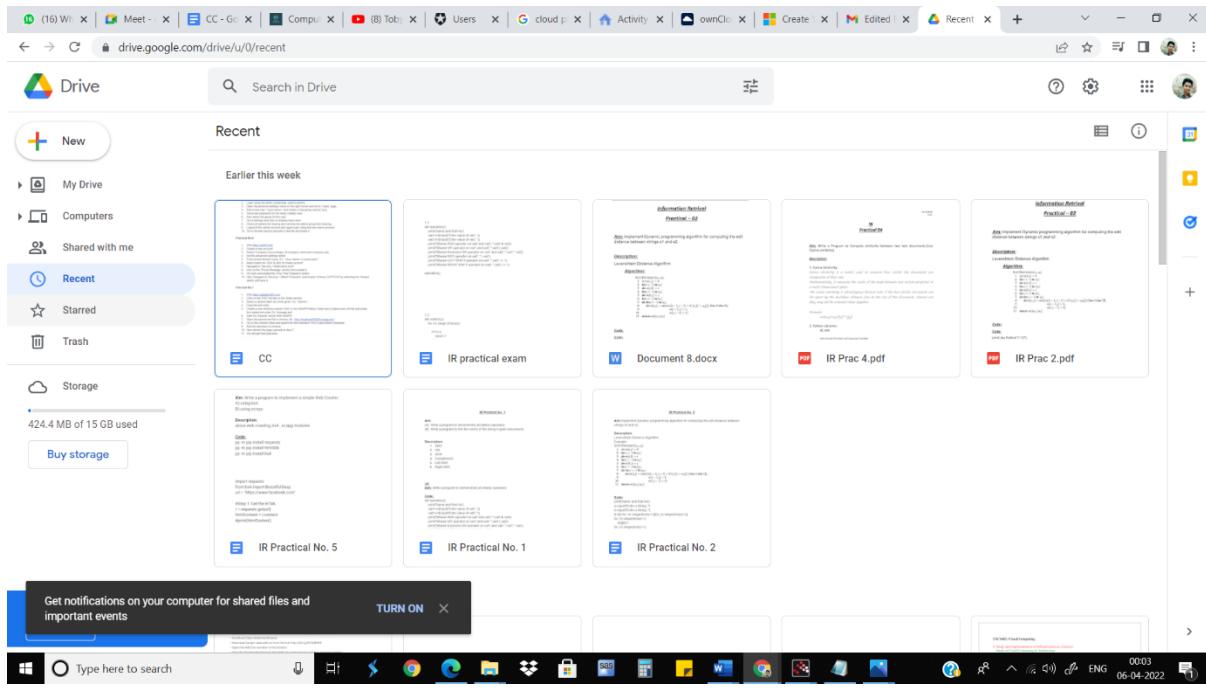
The screenshot shows a Google Drive interface with the following details:

- Left Sidebar:** My Drive, Computers, Shared with me (selected), Recent, Starred, Trash.
- Storage:** 424.4 MB of 15 GB used, Buy storage.
- Search Bar:** Search in Drive.
- File List:** A grid of files under "Shared with me > IR".
- Bottom Bar:** Notifications for shared files and important events, a "TURN ON" button, a "Stop sharing" button for a meet.google.com sharing session, and a taskbar with various application icons.
- Bottom Status Bar:** Date (2028 03-04-2022) and language (ENG).

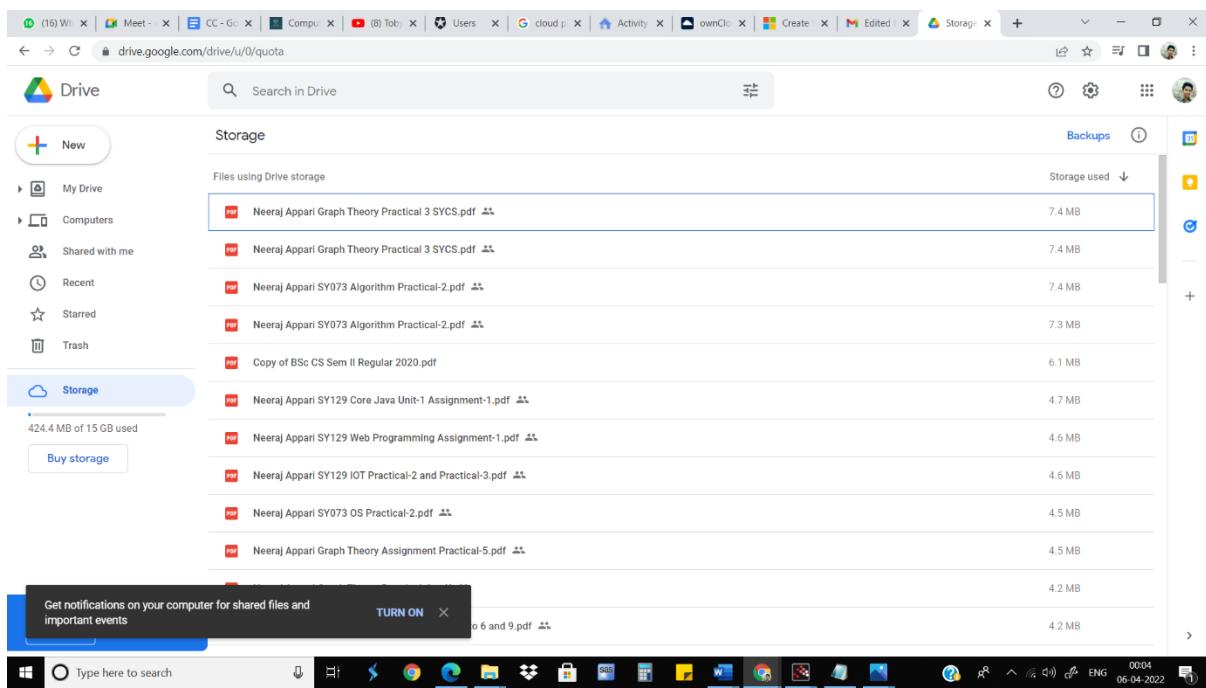
**Second Screenshot:** Similar to the first, but the "Shared with me" folder is open, showing:

- Left Sidebar:** Folder, File upload, Folder upload, Google Docs, Google Sheets, Google Slides, Google Forms, More (expanded to show Google Drawings, Google My Maps, Google Sites, Google Apps Script, Google Colaboratory, Google Jamboard, Connect more apps).
- Storage:** 424.4 MB of 15 GB used, Buy storage.
- File List:** The same grid of files under "IR".
- Bottom Bar:** "You don't have permission to edit 'IR'" message, a "Stop sharing" button, and a taskbar with various application icons.
- Bottom Status Bar:** Date (2028 03-04-2022) and language (ENG).

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The screenshot shows the Google Drive interface with the 'Recent' tab selected. It displays several documents including 'CC', 'IR practical exam', 'Information Retrieval Practical - IR', 'Document 8.docx', 'IR Prac 4.pdf', 'Information Retrieval Practical - IR', 'IR Practical No. 5', 'IR Practical No. 1', and 'IR Practical No. 2'. A notification bar at the bottom encourages users to turn on notifications for shared files and important events. The taskbar at the bottom shows various open applications like Microsoft Word, Excel, and Google Chrome.

The screenshot shows the Google Drive interface with the 'Storage' tab selected. It displays a list of files using Drive storage, including 'Neeraj Appari Graph Theory Practical 3 SYCS.pdf', 'Neeraj Appari Graph Theory Practical 3 SYCS.pdf', 'Neeraj Appari SY073 Algorithm Practical-2.pdf', 'Neeraj Appari SY073 Algorithm Practical-2.pdf', 'Copy of BSc CS Sem II Regular 2020.pdf', 'Neeraj Appari SY129 Core Java Unit-1 Assignment-1.pdf', 'Neeraj Appari SY129 Web Programming Assignment-1.pdf', 'Neeraj Appari SY129 IOT Practical-2 and Practical-3.pdf', 'Neeraj Appari SY073 OS Practical-2.pdf', and 'Neeraj Appari Graph Theory Assignment Practical-5.pdf'. A notification bar at the bottom encourages users to turn on notifications for shared files and important events. The taskbar at the bottom shows various open applications like Microsoft Word, Excel, and Google Chrome.

## Conclusion:

Google Docs provide an efficient way for storage of data. It fits well in Storage as a service (SaaS). It has varied options to create documents, presentations and also spreadsheets. It saves documents automatically after a few seconds and can be shared anywhere on the Internet at the click of a button.

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## Cloud Computing Practical - 5

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

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

- Understand concepts of virtualization and to use cloud as Infrastructure as a service.
- Learn the technique and its complexity.
- Understand the importance of this technique from an application point of view.

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

- To create and use online identity.
- To analyze the local and global impact of computing on individuals, organizations, and society and users of the company how to share and connect with each other.

**Hardware / Software Required:** Windows operating system, Gmail account, owncloud credentials

### **Theory:**

The primary goal of identity management in cloud computing is dealing with personal identity information so that a user's access to data, computer resources, applications, and services is controlled accurately.

Identity management in cloud computing is the subsequent step of identity and access management (IAM) solutions. However, it is a lot more than merely a straightforward web app single sign-on (SSO) solution. This next generation of IAM solution is a holistic move of the identity provider right to the cloud. Known as Directory-as-a-Service (DaaS), this particular service is the advanced version of the conventional and on-premises solutions, including Lightweight Directory Access Protocol (LDAP) as well as Microsoft Active Directory (AD).

ownCloud is an 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.

**Result:**

**Steps: 1.**

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.

**2.**

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.

**3.**

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 notification of the new share from the sharing screen.

**4.**

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.

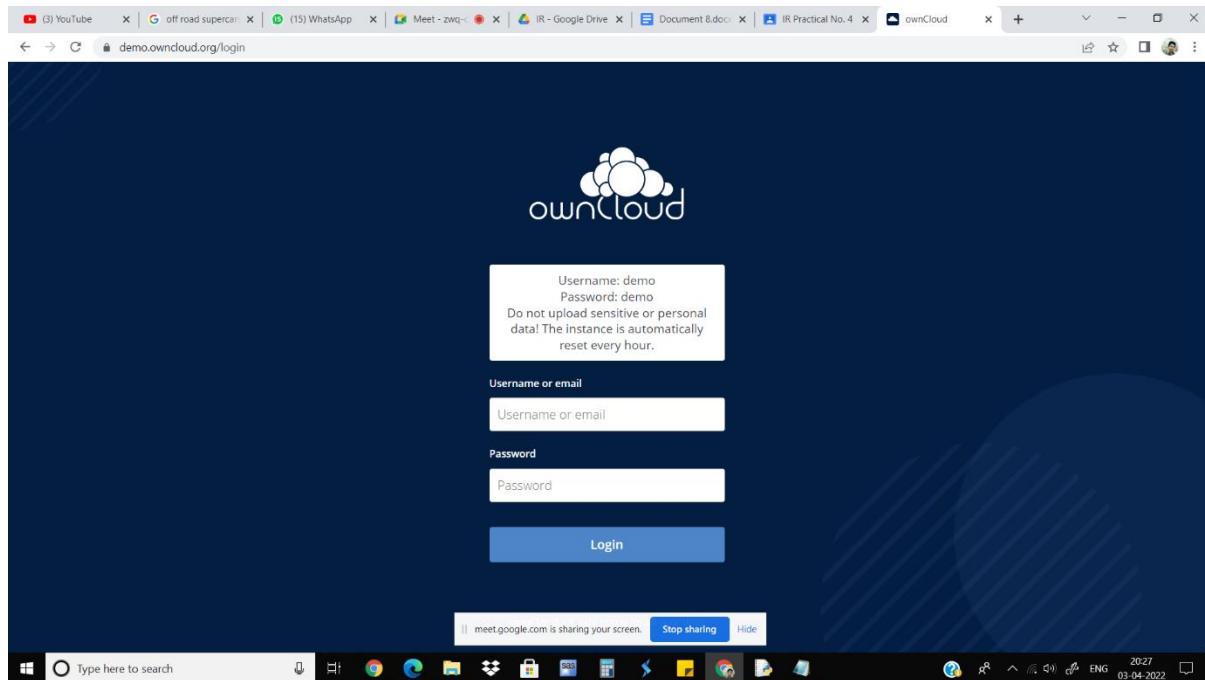
Create; allows the users you share with to create new files and add them to the share.

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

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

**Procedure:**

1. Visit <https://demo.owncloud.org>
2. Login using the admin credentials. (admin/admin)
3. Open the personal settings menu on the right corner and Go to 'Users' page.
4. Add a new user '<your name>' and create a new group named 'tycs'.
5. set a new password for the newly created user.
6. also select the group for the user.
7. Go to settings and click on sharing menu item.
8. check all options for sharing and exclude the admin group from sharing.
9. logout of the admin account and again login using the new user's account.
10. Go to the files section and add a new file and share it.



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The screenshot displays the ownCloud user management interface across two sessions. Both sessions show a list of users with their details: Username, Full Name, Password, Groups, Group Admin for, and Quota.

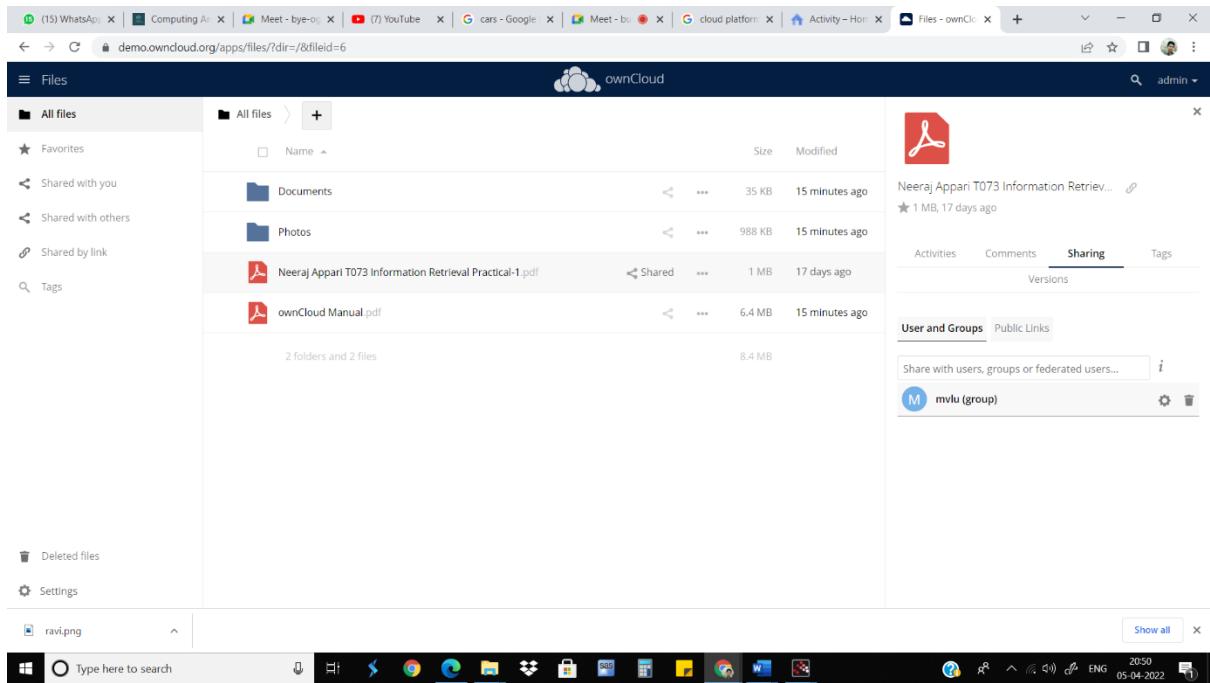
**Top Session (Initial State):**

Username	Full Name	Password	Groups	Group Admin for	Quota
admin	admin	*****	admin	no group	Default
demo	demo	*****	no group	no group	Default
test	test	*****	no group	no group	Default

**Bottom Session (After Assignment):**

Username	E-Mail	Groups	Group Admin for	Quota
admin	admin	admin	no group	Default
demo	demo	no group	no group	Default
Neeraj	Neeraj	admin	tycs mvlu	1 GB
test	test	no group	tycs mvlu	Default

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### 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.

## **Cloud Computing Practical - 6**

**Aim:** To Study Cloud Security management

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

- To understand the security features of Cloud.
- To learn the technique of application security management and its complexity.
- To understand the importance of cloud security management from application point of view.

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

- Student can study and implement single-sign-on.
- To use current techniques, skills, and tools necessary for computing practice.
- To match the industry requirements in the domains of Database management, Programming and Networking with the required management skills.

**Hardware / Software Required:** Ubuntu operating system, Virtual machine, WAMP/XAMPP server, Any tool or technology can be used for implementation of web application e.g., JAVA, PHP, etc.

### **Theory:**

Cloud computing security is the set of control-based technologies and policies designed to adhere to regulatory compliance rules and protect information, data applications and infrastructure associated with cloud computing use. Because of the cloud's very nature as a shared resource, identity management, privacy and access control are of particular concern. With more organizations using cloud computing and associated cloud providers for data operations, proper security in these and other potentially vulnerable areas have become a priority for organizations contracting with a cloud computing provider.

Cloud computing security processes should address the security controls the cloud provider will incorporate to maintain the customer's data security, privacy and compliance with necessary regulations. The processes will also

likely include a business continuity and data backup plan in the case of a cloud security breach.

### **Physical security**

Cloud service providers physically secure the IT hardware (servers, routers, cables etc.) against unauthorized access, interference, theft, fires, floods etc. and ensure that essential supplies (such as electricity) are sufficiently robust to minimize the possibility of disruption. This is normally achieved by serving cloud applications from 'world-class' (i.e. professionally specified, designed, constructed, managed, monitored and maintained) data centers.

### **Personnel security.**

Various information security concerns relating to the IT and other professionals associated with cloud services are typically handled through pre-, para- and post-employment activities such as security screening potential recruits, security awareness and training programs, proactive security monitoring and supervision, disciplinary procedures and contractual obligations embedded in employment contracts, service level agreements, codes of conduct, policies etc.

### **Application security**

Cloud providers ensure that applications available as a service via the cloud (SaaS) are secure by specifying, designing, implementing, testing and maintaining appropriate application security measures in the production environment. Note that - as with any commercial software - the controls they implement may not necessarily fully mitigate all the risks they have identified, and that they may not necessarily have identified all the risks that are of concern to customers. Consequently, customers may also need to assure themselves that cloud applications are adequately secured for their specific purposes, including their compliance obligations.

### **Procedure:**

1. Visit <https://auth0.com>
2. Create a new account
3. Select 'Company' Account type, fill company name and company size.
4. tick the advanced settings option.
5. Enter tenant domain name. Ex. '<your name><current year>'
6. select region as 'USA' & click on create account
7. Navigate to 'Security > Multi-factor Auth'
8. click on the 'Phone Message' section and enable it.
9. Go back and enable the 'One-Time Password' option.

10. Now, Navigate to 'Security > Attack Protection' and enable 'Enforce CAPTCHA' by selecting the 'Always' option and save it.

**Result:**

The image contains two screenshots of the Auth0 setup process. The top screenshot shows the 'Let's set you up for success' step. It includes fields for 'Account Type' (set to 'Company'), 'Company Name' ('Neeraj'), 'Company Size' ('1-49'), and a checkbox for 'I need advanced settings'. The bottom screenshot shows the 'Welcome to Auth0' step, where the 'Tenant Domain' is set to '.us.auth0.com' and the 'Region' is set to 'US'.

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The screenshot shows two screenshots of the Auth0 dashboard side-by-side.

**Left Screenshot (Getting Started):**

- Screenshot title: "Getting Started".
- Message: "Thank you for signing up for Auth0! You have 22 days left in your trial to experiment with features that are not in the Free plan. Like what you're seeing? Please enter your billing information here." with a "View Plans" button.
- Navigation menu on the left:
  - Getting Started
  - Activity **FIRST**
  - Applications
  - Authentication
  - Organizations
  - User Management
  - Branding
  - Security
  - Actions
  - Auth Pipeline
  - Monitoring
  - Marketplace
  - Extensions
  - Settings
  - Get support
  - Give feedback

**Right Screenshot (Attack Protection):**

- Screenshot title: "Attack Protection".
- Message: "Users are required to complete a CAPTCHA if the login is high risk." and "Always" (highlighted), both with descriptions: "Users are always required to complete a CAPTCHA to log in."
- Section: "CAPTCHA Providers" with a note: "Need help deciding? Visit our docs to learn more about our CAPTCHA solutions". Options shown: Simple CAPTCHA (selected), Google reCAPTCHA v2, and reCAPTCHA Enterprise.
- Buttons: Save and Cancel.

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The screenshot shows the Auth0 dashboard under the 'neerajt073' account. The left sidebar navigation includes: Getting Started, Activity (FIRST), Applications, Authentication, Organizations, User Management, Branding, Security (selected), Attack Protection, Multi-factor Auth (selected), Monitoring, Actions, Auth Pipeline, Monitoring, Marketplace, Extensions, Settings, and Get support.

The main content area displays several MFA configuration options:

- Use WebAuthn-compliant security keys: Disabled
- WebAuthn with FIDO Device Biometrics: Disabled
- One-time Password: Enabled (switch is green)
- Push via Auth0 Guardian: Disabled
- Phone Message: Disabled

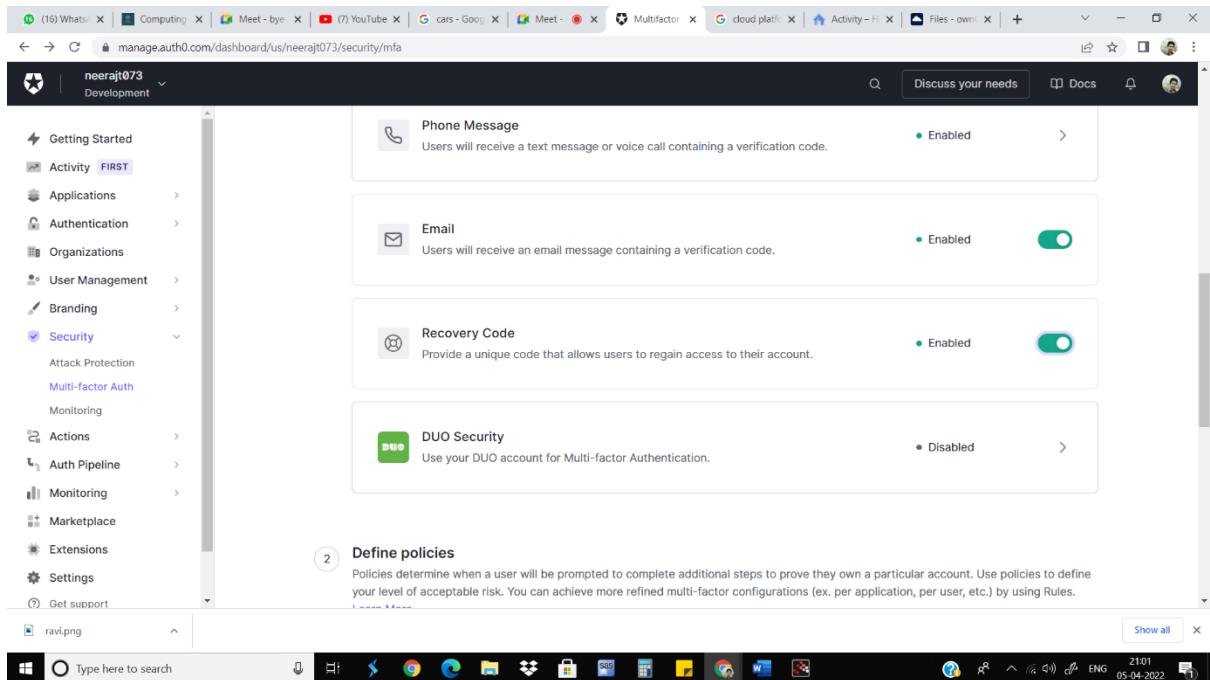
A message at the bottom states: "Phone Message is now enabled." A note indicates: "Your plan includes 100 SMS codes. Configure your SMS delivery provider to remove this limit."

The configuration section for "Phone Message" includes:

- Configure your delivery provider: Auth0 (selected)
- Choose a delivery provider: Auth0 (selected), Twilio, Custom
- Choose a delivery method: (dropdown menu)

The status bar at the bottom shows the URL <https://manage.auth0.com/dashboard/us/neerajt073/security/mfa/phone>, the date 05-04-2022, and the time 21:00.

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### Conclusion:

We have studied how to secure the cloud and its data. Amazon EWS provides the best security with its extended facilities and services like MFA device. It also gives you the ability to add your own permissions and policies for securing data more encrypted.

## Cloud Computing Practical - 7

**Aim:** Write a program for web feed

**RSS** - Really Simple Syndication

**Concept:** Web feed and RSS

**Objective:** This lab is to understand the concept of form and control validation

**Scope:** Write a program for web feed

**Technology:** XML / PHP, HTML

### **Theory:**

RSS technology is used by millions of users around the world to get the latest information from their favorite websites. RSS (RDF Site Summary or Really Simple Syndication) is a web feed that allows users and applications to access updates to websites in a standardized, computer-readable format.

Fundamentally, RSS is simply an XML text file. It's created by a website publisher and contains a running list of articles or other content published by the site, with the newest entry always at the top of the list. Each entry contains details like the article's title, description, and link to the content. RSS feeds are published and updated in real time, so if you subscribe to a site's RSS feed, you'll always have access to the newest published content. That can be handy for news sites and podcasts that are frequently updated.

### **Procedure:**

1. Visit <https://gadgets360.com>
2. Click on the 'RSS' list item in the footer section.
3. Select a random feed out of the given. Ex. 'Opinion'.
4. Copy the xml code.
5. Create a new directory named 'RSS' in the 'XAMPP/htdocs' folder and create a new xml file and paste the copied xml code. Ex. 'itvoyage.xml'
6. Start the 'Apache' server from XAMPP.
7. Open the served xml file in chrome. Ex. '<http://localhost/RSS/itvoyage.xml>'

8. Go to the Chrome Store and search for the Extension 'RSS Subscription Extension'.
9. Add the extension to chrome.
10. Now refresh the page opened on step 7.
11. You will get feed previews.

### Result:

The image contains two screenshots of the Gadgets360.com website, demonstrating the results of the steps taken.

**Screenshot 1 (Top): RSS Feeds**

This screenshot shows the 'RSS Feeds' section for the OnePlus 9RT. It lists various news categories such as All Stories, News, Reviews, Opinion, Photos, Videos, Android-Hub, Apps, Internet, India-Hub, Social, Gaming, Transportation, Tablets, Xiaomi, Contests, Culture, and Polls. To the right, there is an advertisement for SEMRUSH: 'The leading all-in-one SEO suite'.

**Screenshot 2 (Bottom): Top Stories**

This screenshot shows the 'TOP STORIES' section. It features three main news items: 'Elon Musk to Join Twitter's Board of Directors', 'India Orders Blocking of 18 YouTube-Based News Channels: Here's Why', and 'Some Ola S1 Pro Users Facing Reverse Mode Accelerator Glitch, Sudden Shutdowns'. Below these are sections for 'TRENDING' and 'IN-DEPTH' news. An advertisement for a Kesar Mango is also visible.

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This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<rss xmlns:atom="http://www.w3.org/2005/Atom" version="2.0">
  <channel>
    <atom:link href="https://gadgets360.com/rss/games/feeds" rel="self" type="application/rss+xml"/>
    <title>
      [<![CDATA[ Gadgets 360 ]]>
    </title>
    <link>https://gadgets360.com/</link>
    <description>
      [<![CDATA[ Tech News, Latest technology news daily, new best tech gadgets reviews which include mobiles, tablets, laptops, video games. Being a tech news site we cover the latest tech news daily online from India and around the world, reviews, updates on technology today from companies like google, apple, samsung and others also new and upcoming mobiles, cameras, laptops, video games. ]]>
      <language>en</language>
      <lastBuildDate>Tue, 05 Apr 2022 21:19:25 +0530</lastBuildDate>
    </description>
    <image>
      <title>
        [<![CDATA[ Gadgets 360 ]]>
      </title>
      <url>
        [<![CDATA[ https://cdn.gadgets360.com/gadgets360_logo.png ]]>
      </url>
      <link>https://gadgets360.com/</link>
    </image>
    <item>
      <guid isPermaLink="false">
        [<![CDATA[ story-2864379 ]]>
      </guid>
      <title>
        [<![CDATA[ PUBG and BGMI Are the Same, Tencent Misled Indian Government, Should Be Banned: NGO ]]>
      </title>
      <category>
        [<![CDATA[ gaming ]]>
      </category>
      <pubDate>Tue, 05 Apr 2022 18:22:05 +0530</pubDate>
      <description>
        [<![CDATA[ PUBG and BGMI are the same, and Tencent has misled the Indian government, Prahar, a non-profit organisation called Prahar has claimed, seeking a ban on PUBG/ BGMI. Citing documents with MCA, Abhay Mishra, President of Prahar, says Krafton and PUBG India Pvt. Ltd has the same representative in the country. ]]>
      </description>
    </item>
    <item>
      <guid isPermaLink="false">
        [<![CDATA[ story-2864033 ]]>
      </guid>
      <title>
        [<![CDATA[ PlayStation Boss Jim Ryan Teases More Acquisitions in Coming ]]]>
      </title>
    </item>
  </channel>
</rss>
```

OS (C) xampp htdocs rss

File name: neeraj.xml  
Save as type: All files

Encoding: UTF-8 Save Cancel

meet.google.com is sharing your screen. Stop sharing Hide

Windows 10 21:21 ENG IN 05-04-2022

localhost/rss/neeraj.xml

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<rss xmlns:atom="http://www.w3.org/2005/Atom" version="2.0">
  <channel>
    <atom:link href="https://gadgets360.com/rss/games/feeds" rel="self" type="application/rss+xml"/>
    <title>
      [<![CDATA[ Gadgets 360 ]]>
    </title>
    <link>https://gadgets360.com/</link>
    <description>
      [<![CDATA[ Tech News, Latest technology news daily, new best tech gadgets reviews which include mobiles, tablets, laptops, video games. Being a tech news site we cover the latest tech news daily online from India and around the world, reviews, updates on technology today from companies like google, apple, samsung and others also new and upcoming mobiles, cameras, laptops, video games. ]]>
      <language>en</language>
      <lastBuildDate>Tue, 05 Apr 2022 21:19:25 +0530</lastBuildDate>
    </description>
    <image>
      <title>
        [<![CDATA[ Gadgets 360 ]]>
      </title>
      <url>
        [<![CDATA[ https://cdn.gadgets360.com/gadgets360_logo.png ]]>
      </url>
      <link>https://gadgets360.com/</link>
    </image>
    <item>
      <guid isPermaLink="false">
        [<![CDATA[ story-2864379 ]]>
      </guid>
      <title>
        [<![CDATA[ PUBG and BGMI Are the Same, Tencent Misled Indian Government, Should Be Banned: NGO ]]>
      </title>
      <category>
        [<![CDATA[ gaming ]]>
      </category>
      <pubDate>Tue, 05 Apr 2022 18:22:05 +0530</pubDate>
      <description>
        [<![CDATA[ PUBG and BGMI are the same, and Tencent has misled the Indian government, Prahar, a non-profit organisation called Prahar has claimed, seeking a ban on PUBG/ BGMI. Citing documents with MCA, Abhay Mishra, President of Prahar, says Krafton and PUBG India Pvt. Ltd has the same representative in the country. ]]>
      </description>
    </item>
    <item>
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        [<![CDATA[ story-2864033 ]]>
      </guid>
      <title>
        [<![CDATA[ PlayStation Boss Jim Ryan Teases More Acquisitions in Coming ]]]>
      </title>
    </item>
  </channel>
</rss>
```

OS (C) xampp htdocs rss

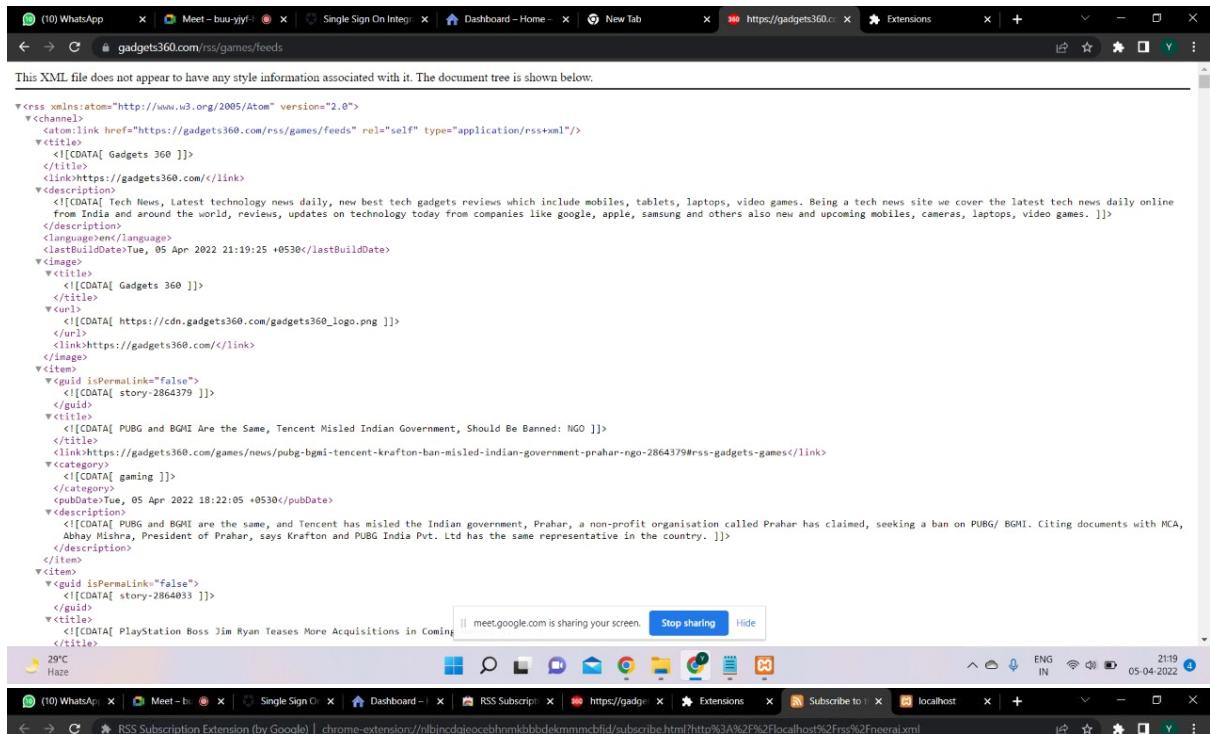
File name: neeraj.xml  
Save as type: All files

Encoding: UTF-8 Save Cancel

meet.google.com is sharing your screen. Stop sharing Hide

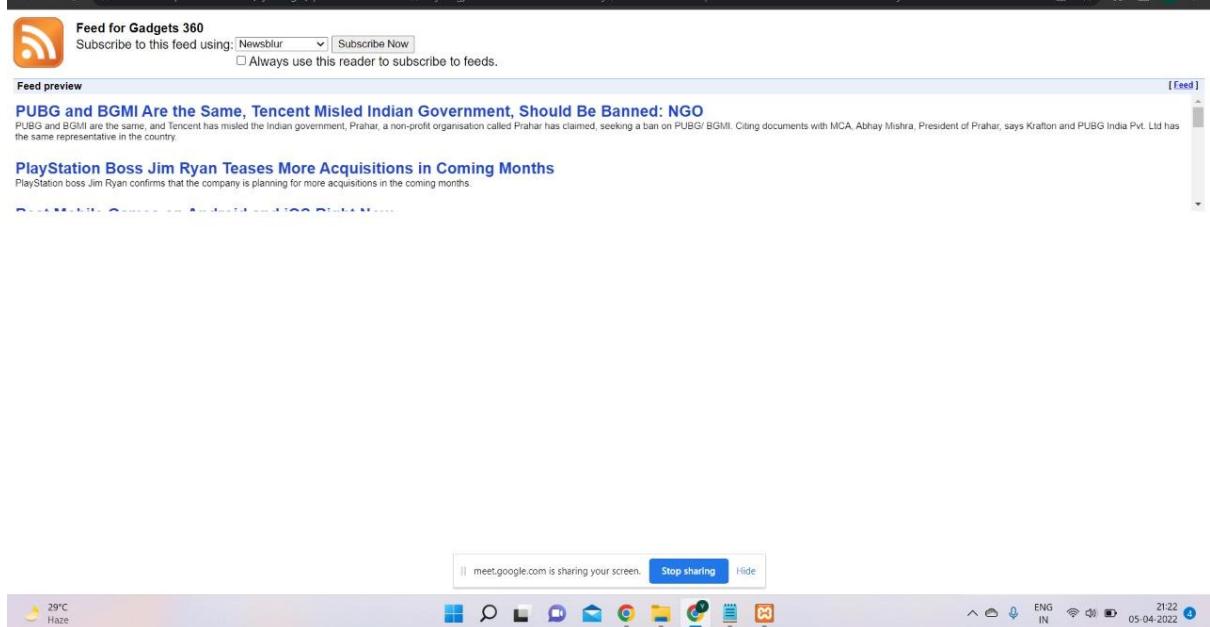
Windows 10 21:21 ENG IN 05-04-2022

## Cloud Computing – MVLU College



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```
<rss xmlns:atom="http://www.w3.org/2005/Atom" version="2.0">
  <channel>
    <atom:link href="https://gadgets360.com/rss/games/feeds" rel="self" type="application/rss+xml"/>
    <title>
      <![CDATA[ Gadgets 360 ]]>
    </title>
    <link>https://gadgets360.com/</link>
    <description>
      <![CDATA[ Tech News, Latest technology news daily, new best tech gadgets reviews which include mobiles, tablets, laptops, video games. Being a tech news site we cover the latest tech news daily online from India and around the world, reviews, updates on technology today from companies like google, apple, samsung and others also new and upcoming mobiles, cameras, laptops, video games. ]]>
    </description>
    <language>en</language>
    <lastBuildDate>Tue, 05 Apr 2022 21:19:25 +0530</lastBuildDate>
    <image>
      <title>
        <![CDATA[ Gadgets 360 ]]>
      </title>
      <url>
        <![CDATA[ https://cdn.gadgets360.com/gadgets360_logo.png ]]>
      </url>
      <link>https://gadgets360.com/</link>
    </image>
    <item>
      <guid isPermaLink="false">
        <![CDATA[ story-2864379 ]]>
      </guid>
      <title>
        <![CDATA[ PUBG and BGMI Are the Same, Tencent Misled Indian Government, Should Be Banned: NGO ]]>
      </title>
      <link>https://gadgets360.com/games/news/pubg-bgmi-tencent-krafton-ban-misled-indian-government-prahar-ngo-2864379#rss-gadgets-games</link>
      <category>
        <![CDATA[ gaming ]]>
      </category>
      <pubDate>Tue, 05 Apr 2022 18:22:05 +0530</pubDate>
      <description>
        <![CDATA[ PUBG and BGMI are the same, and Tencent has misled the Indian government, Prahar, a non-profit organisation called Prahar has claimed, seeking a ban on PUBG/ BGMI. Citing documents with MCA, Abhay Mishra, President of Prahar, says Krafton and PUBG India Pvt. Ltd has the same representative in the country. ]]>
      </description>
    </item>
    <item>
      <guid isPermaLink="false">
        <![CDATA[ story-2864093 ]]>
      </guid>
      <title>
        <![CDATA[ PlayStation Boss Jim Ryan Teases More Acquisitions in Coming Months ]]>
      </title>
    </item>
  </channel>
</rss>
```



## Conclusion:

RSS web feed can be used to open any xml feed webpage without having to see the code and direct content.

## Cloud Computing Practical - 8

**Aim:** Study and implementation of Single-Sign-On

**Concept:** Single Sign On (SSO),openID

**Objective:** is to understand the concept of access control in cloud and single sign on (SSO), Use SSO and advantages of it, and also students should able to implementation of it

**Scope:** installing and using auth0

**Technology:** auth0

### **Theory:**

Single sign-on (SSO) is a technology which combines several different application login screens into one. With SSO, a user only has to enter their login credentials (username, password, etc.) one time on a single page to access all of their SaaS applications.

SSO is often used in a business context, when user applications are assigned and managed by an internal IT team. Remote workers who use SaaS applications also benefit from using SSO.

SSO is an important aspect of many identity and access management (IAM) or access control solutions. User identity verification is crucial for knowing which permissions each user should have. Cloudflare Zero Trust is one example of an access control solution that integrates with SSO solutions for managing users' identities.

### **Procedure:**

1. Visit <https://auth0.com>
2. Create a new account
3. Select 'Company' Account type, fill company name and company size.
4. tick the advanced settings option.
5. Enter tenant domain name. Ex. '<your name><current year>'
6. select region as 'USA' & click on create account
7. Navigate to 'Applications > SSO Integrations' on the side navigation bar.
8. Click on Create 'New SSO Integration'
9. select the 'Dropbox integration' and click on continue
10. Save the integration.
11. Now again perform step 7 and you will find a new integration created.

**12. Navigate to 'Security > Multi-factor Auth'**

**13. click on 'Phone Message' section**

**Result:**

The screenshot shows the initial setup page for creating an account on auth0.com. It asks if the account is for a company or个人 (Personal). The 'Company' option is selected. The company name is entered as 'Neeraj'. The company size is selected as '1-49'. A checkbox for 'I need advanced settings' is checked. A note states that the data region is assigned to the United States and a tenant name is provided. A 'NEXT' button is at the bottom.

**Let's set you up for success**

Account Type  
Are you creating this account for yourself or on behalf of a company?  
Company Personal

Company Name  
Neeraj

Company Size  
1-49 50-200 201-999 1000+

I need advanced settings

We've assigned your data region to the United States and given you a tenant name. Check this box if you need to process your data in a different region to comply with privacy laws.

NEXT

The screenshot shows the welcome page for a new auth0 tenant. It displays the tenant domain as 'neerajt073.us.auth0.com'. A note explains that a tenant domain name is selected and can be renamed later. Below it, a 'Region' section shows options for AU, EU, Japan, and US, with US selected. A note states that data can be hosted in any region. A 'Create Account →' button is at the bottom.

Welcome to Auth0

Help us setup your first tenant and start authenticating.

Tenant Domain  
neerajt073 .us.auth0.com

To help you easily explore our product, we've selected a tenant domain name for you. Although you can't rename a tenant, you can always add more tenants to your account (for staging or production environments) later.

Region  
AU EU Japan US

We can host all of your data in any of these regions.  
Useful if you need to comply with EU Data Protection Directive

Create Account →

# Cloud Computing – MVLU College

The screenshot shows two consecutive screenshots of the Auth0 dashboard, both taken from a Windows 10 desktop environment.

**Screenshot 1: Getting Started**

The left sidebar shows the navigation menu:

- Getting Started
- Activity FIRST
- Applications
- Authentication
- Organizations
- User Management
- Branding
- Security
- Actions
- Auth Pipeline
- Monitoring
- Marketplace
- Extensions
- Settings
- Get support
- Give feedback

The main content area displays the "Getting Started" section:

- Try your Login box**: A callout box with a red arrow icon. Text: "With Auth0 your authentication experience is ready to go. Customize it to match your brand identity and try it now to see how it works." Below it is a screenshot of a login form with a red star icon and the text "Welcome". Buttons: "Log in to Auth0 to continue", "user@email.com", and "Password".
- Invite your team members**: A callout box with a blue person icon. Text: "Add additional admins to help with your integration and act as a backup account in case you lose access." Below it is a link: "Learn more about Tenant Administrator permissions →". To the right is a button: "Invite Members →".

**Screenshot 2: Single Sign On Integrations**

The left sidebar shows the navigation menu, with "SSO Integrations" highlighted in a blue box:

- Getting Started
- Activity FIRST
- Applications
- APIs
- SSO Integrations
- Authentication
- Organizations
- User Management
- Branding
- Security
- Actions
- Auth Pipeline
- Monitoring
- Marketplace
- Extensions
- Settings
- Get support

The main content area displays the "Single Sign On Integrations" section:

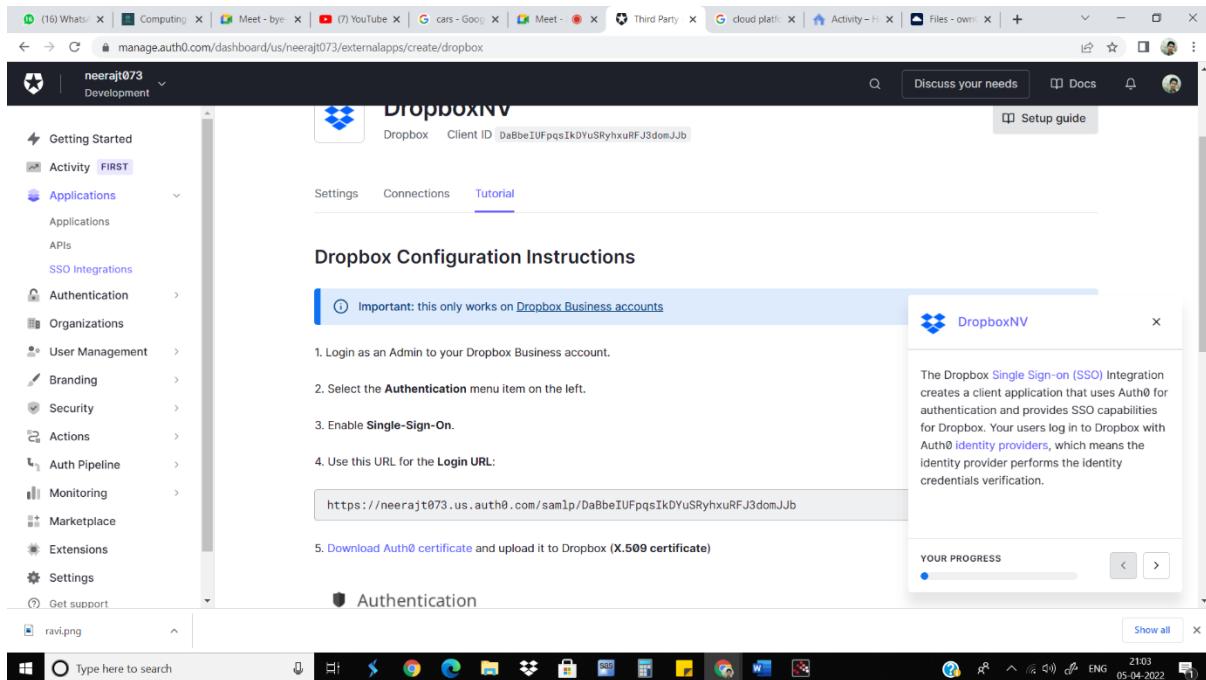
- You don't have any SSO integrations yet.**: A callout box with a green checkmark icon. Text: "SSO enables users to authenticate at Auth0 with one set of credentials to access any number of service provider applications." Below it is a button: "+ Create SSO Integration".
- Learn More**: A link to learn more about SSO integrations.

# Cloud Computing – MVLU College

The screenshot shows three sequential steps in the Auth0 dashboard for setting up a new Dropbox SSO integration:

- Step 1: Choose SSO Integration**  
The user is prompted to "Choose SSO Integration" and has selected "Dropbox". A message states: "Thank you for signing up for Auth0! You have 22 days left in your trial to experiment with features that are not in the Free plan. Like what you're seeing? Please enter your billing information here." A "View Plans" button is visible.
- Step 2: Dropbox SSO Integration by Auth0**  
The user is shown the "Dropbox SSO Integration by Auth0" configuration screen. It lists the permissions Dropbox will need access to:
  - Accept login requests from Dropbox
  - Share user profile information with DropboxA "Continue" button is present at the bottom.
- Step 3: Configuration Details**  
The user is on the "New Dropbox SSO Integration" configuration page. The "General" section shows the integration name is "DropboxNV". A "Save" button is visible. To the right, a "Setup guide" panel provides information about the Dropbox SSO integration, stating it creates a client application that uses Auth0 for authentication and provides SSO capabilities for Dropbox. It also mentions Auth0 identity providers. A progress bar indicates "YOUR PROGRESS" is at 100%.

## Cloud Computing – MVLU College



### Conclusion:

Single Sign-On is all about preventing unneeded user interaction while keeping security to the highest level necessary. There doesn't have to be a trade-off between security and usability: If done properly, SSO improves both.

## Cloud Computing Practical - 9

**Aim:** User Management in Cloud.

**Concept:** Administrative features of Cloud Management ,User Management

**Objective:** is to understand how to create, manage user and group of users accounts.

**Scope:** Installing and using Administrative features of ownCloud

**Technology:** ownCloud

### **Theory:**

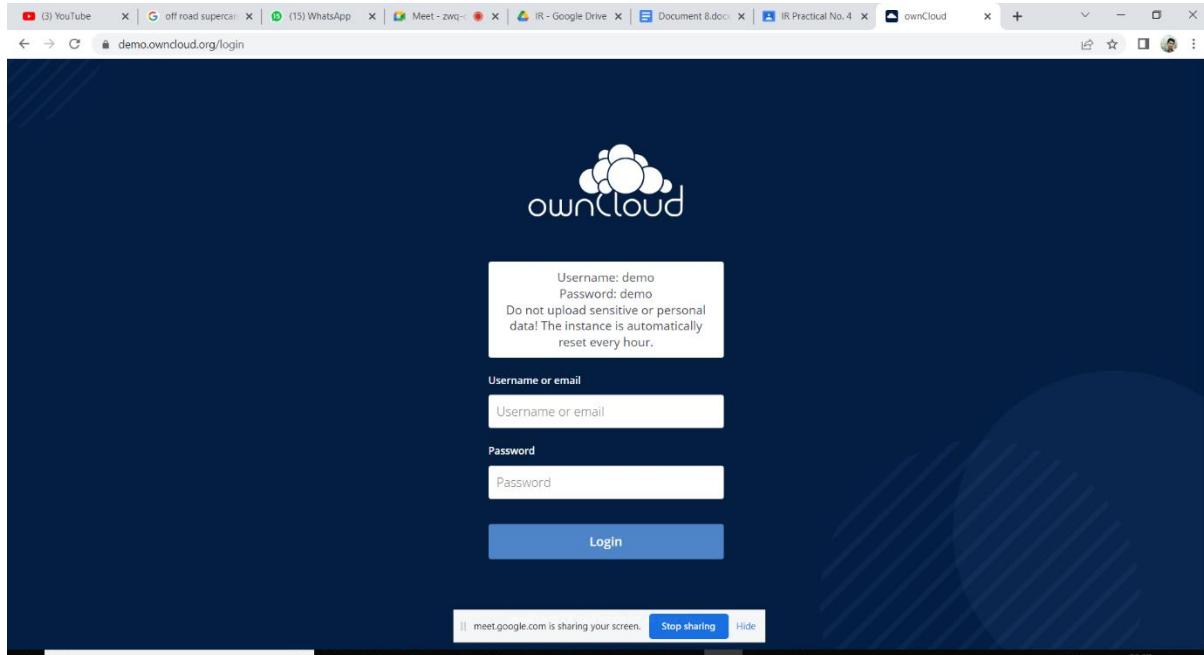
ownCloud is a suite of client–server software for creating and using file hosting services. ownCloud functionally has similarities to the widely used Dropbox. The primary functional difference between ownCloud and Dropbox is that ownCloud is primarily server software.

ownCloud supports extensions that allow it to work like Google Drive, with online office suite document editing, calendar and contact synchronization, and more. Its openness avoids enforced quotas on storage space or the number of connected clients, instead of having hard limits (for example on storage space or number of users) limits are determined by the physical capabilities of the server.

### **Procedure:**

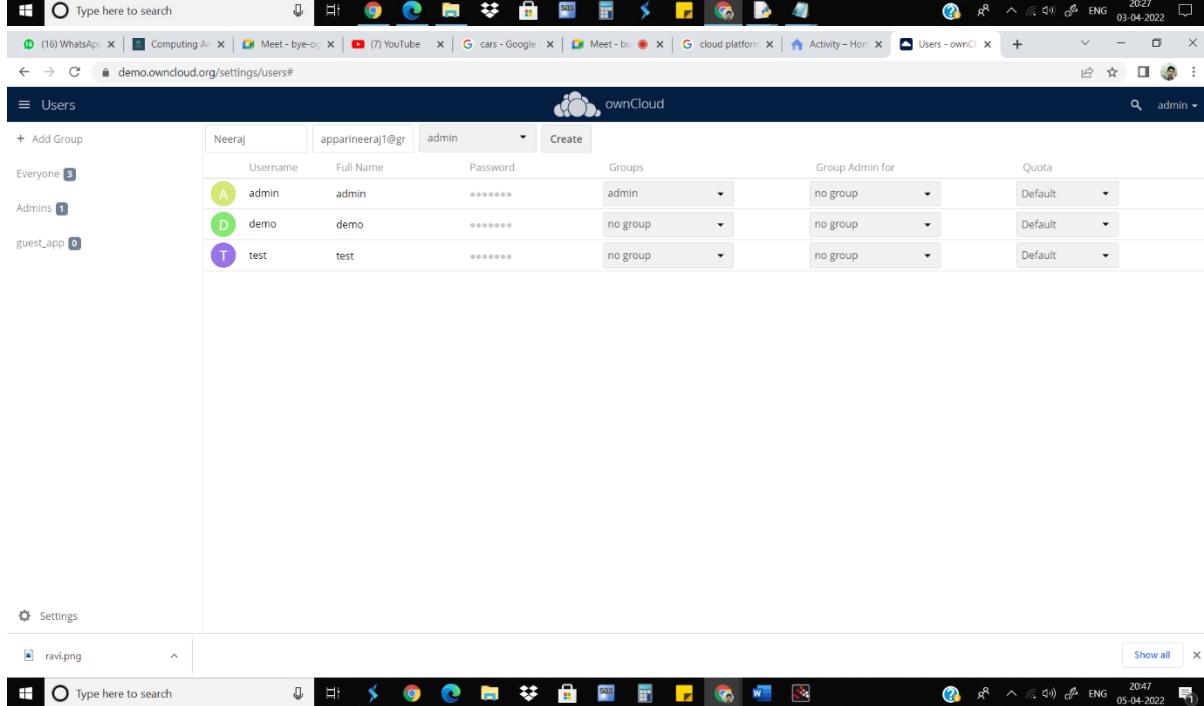
1. Visit <https://demo.owncloud.org>
2. Login using the admin credentials. (admin/admin)
3. Open the personal settings menu on the right corner and Go to 'Users' page.
4. Add a new user '<your name>' and create a new group named 'tycs'.
5. set a new password for the newly created user.
6. also select the group for the user.
7. Go to settings and click on sharing menu item.
8. check all options for sharing and exclude the admin group from sharing.
9. logout of the admin account and again login using the new user's account.
10. Go to the files section and add a new file and share it

## Result:



The screenshot shows the ownCloud login interface. At the top, there is a message box with the text: "Username: demo", "Password: demo", and "Do not upload sensitive or personal data! The instance is automatically reset every hour.". Below this is a form with fields for "Username or email" and "Password", and a "Login" button.

At the bottom of the screen, a notification bar indicates "meet.google.com is sharing your screen" with "Stop sharing" and "Hide" buttons.



The screenshot shows the ownCloud users management interface. On the left, there is a sidebar with group categories: "Everyone" (3), "Admins" (1), and "guest\_app" (0). The main area displays a table of users:

	Username	Full Name	Password	Groups	Group Admin for	Quota
A	admin	admin	*****	admin	no group	Default
D	demo	demo	*****	no group	no group	Default
T	test	test	*****	no group	no group	Default

## Cloud Computing – MVLU College

The screenshot displays the ownCloud web interface across three main sections: Users, Files, and a bottom navigation bar.

**Users Section:**

- Header: ownCloud
- Sub-header: Users
- Form: Username, E-Mail, Password, Groups, Group Admin for, Quota
- Data table:

Username	E-Mail	Groups	Group Admin for	Quota
admin	admin	admin	no group	Default
demo	demo	no group	no group	Default
Neeraj	Neeraj	admin	tycs mvlu	1 GB
test	test	no group	tycs mvlu	Default

- Buttons: + Add Group, Create
- Links: Settings, ravi.png

**Files Section:**

- Header: ownCloud
- Sub-header: Files
- Left sidebar:

  - All files
  - Favorites
  - Shared with you
  - Shared with others
  - Shared by link
  - Tags
  - Deleted files
  - Settings

- File list:

Name	Size	Modified
Documents	35 KB	15 minutes ago
Photos	988 KB	15 minutes ago
Neeraj Appari T073 Information Retrieval Practical-1.pdf	1 MB	17 days ago
ownCloud Manual.pdf	6.4 MB	15 minutes ago

- Right sidebar:

  - File preview: Neeraj Appari T073 Information Retrieval...
  - Sharing tab: Activities, Comments, Sharing, Versions
  - User and Groups: mvlu (group)

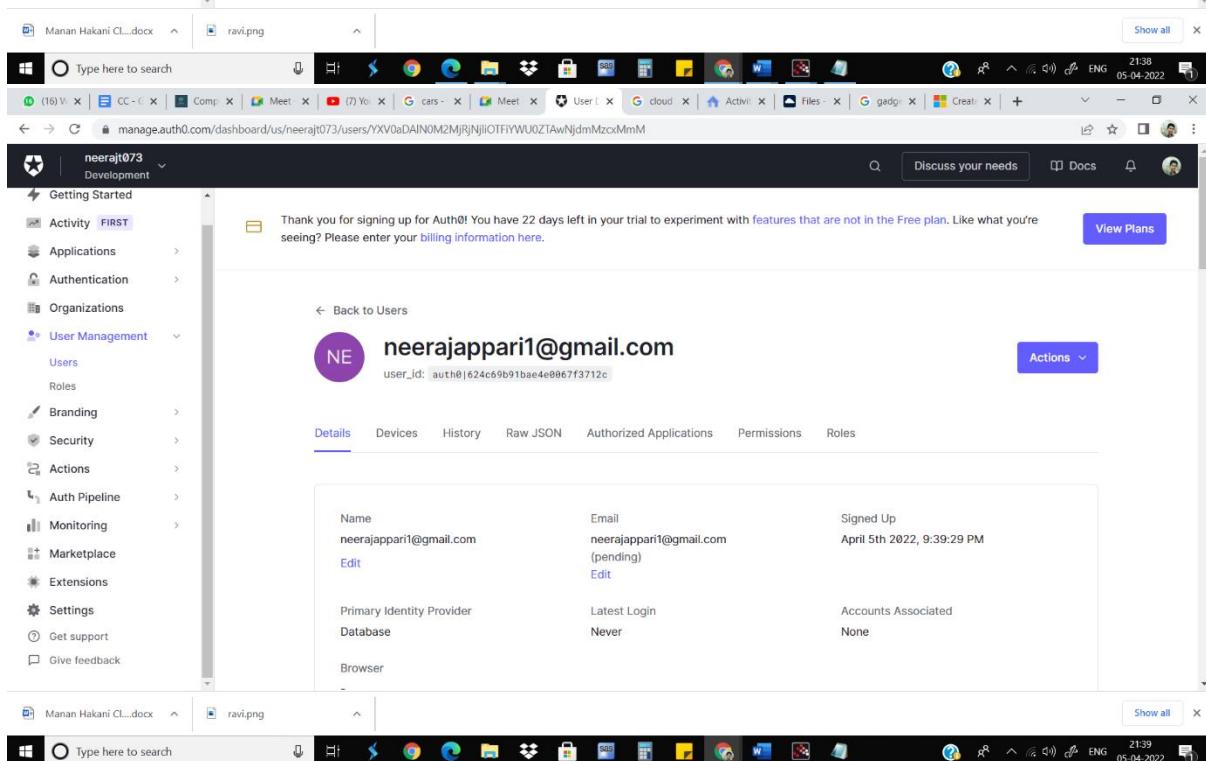
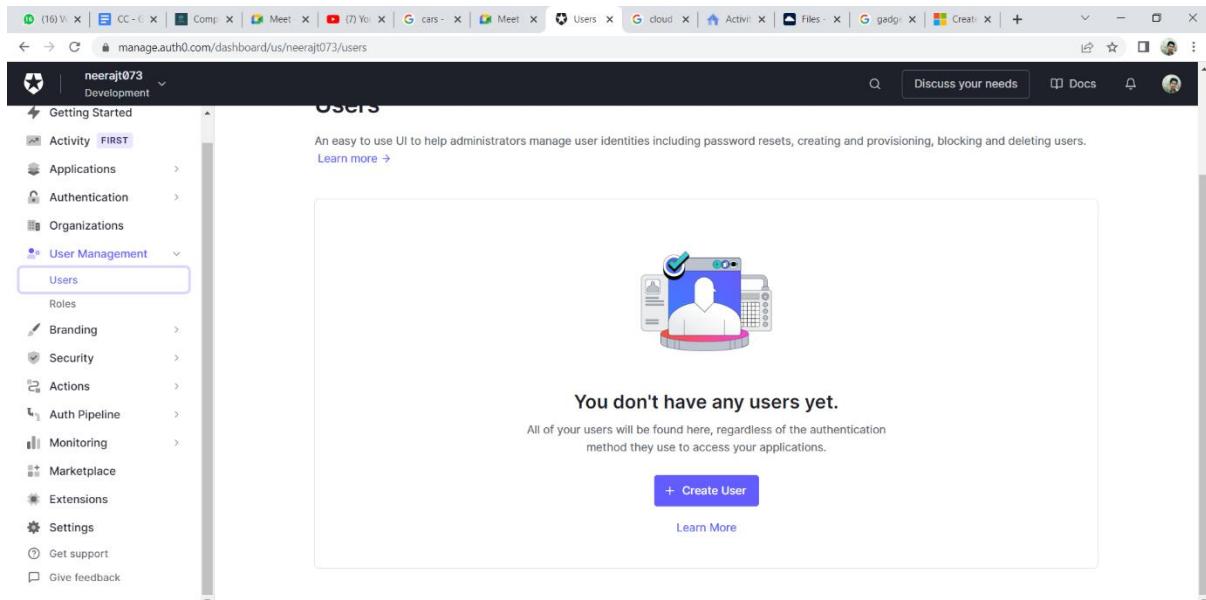
- Buttons: Show all

**Bottom Navigation Bar:**

- Type here to search
- Icons: File Explorer, Task View, Start, Taskbar icons (e.g., File Explorer, Task View, Start, Taskbar icons)
- Date and Time: 2048 05-04-2022

Neeraj Appari T073

## Cloud Computing – MVLU College



### Conclusion:

ownCloud is open by nature and designed to integrate with existing infrastructure, management and security tools. A comprehensive set of APIs and native integrations enable anytime, anywhere access to all your data, wherever it resides.

## **Cloud Computing Practical – 10**

**Aim:** Case study on Amazon EC2/Microsoft Azure/Google Cloud Platform

### **Microsoft Azure:**

Azure is a cloud computing platform and an online portal that allows you to access and manage cloud services and resources provided by Microsoft. These services and resources include storing your data and transforming it, depending on your requirements. To get access to these resources and services, all you need to have is an active internet connection and the ability to connect to the Azure portal.

Azure provides more than 200 services, are divided into 18 categories. These categories include computing, networking, storage, IoT, migration, mobile, analytics, containers, artificial intelligence, and other machine learning, integration, management tools, developer tools, security, databases, DevOps, media identity, and web services. Let's take a look at some of the major Azure services by category:

### **Compute Services**

- **Virtual Machine**

This service enables you to create a virtual machine in Windows, Linux or any other configuration in seconds.

- **Cloud Service**

This service lets you create scalable applications within the cloud. Once the application is deployed, everything, including provisioning, load balancing, and health monitoring, is taken care of by Azure.

- **Service Fabric**

With service fabric, the process of developing a microservice is immensely simplified. Microservice is an application that contains other bundled smaller applications.

- **Functions**

With functions, you can create applications in any programming language. The best part about this service is that you need not worry about hardware requirements while developing applications because Azure takes care of that. All you need to do is provide the code.

## Azure and the services it provides:

- Application development: You can create any web application in Azure.
- Testing: After developing an application successfully on the platform, you can test it.
- Application hosting: Once the testing is done, Azure can help you host the application.
- Create virtual machines: You can create virtual machines in any configuration you want with the help of Azure.
- Integrate and sync features: Azure lets you integrate and sync virtual devices and directories

