

SECTION 1 CLOUD COMPUTING LAB

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1.0 INTRODUCTION

This is the lab course, wherein you will have the hands on experience in Cloud Computing concepts. You have studied the course material (MCS-227 Cloud Computing and IoT). A separate a list of lab-sessions to be performed sessionwise are given with tentative solutions wherever possible. Please go through the general guidelines and the program documentation guidelines carefully.

1.1 OBJECTIVES

After going through this practical course, you will be able to:

- Understand and appreciate cloud architecture and cloud computing models
- Demonstrate various service models such as SaaS, IaaS and PaaS.
- Demonstrate key concepts of virtualization.
- Explore Storage as a Service for remote file access using web interface.
- Understand security of web server and data directory.
- Understand the Service level agreements (SLAs)
- Understand security and privacy issues in cloud.

1.2 INTRODUCTION TO CLOUD COMPUTING

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 includes:

- **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 decreases.

- **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 Cloud Platform.

Hybrid cloud is a combination of public cloud services and on-premises private cloud – with orchestration and automation between the two. Companies can run mission-critical workloads or sensitive applications on the private cloud while using the public cloud for workloads that must scale on-demand. The goal of hybrid cloud is to create a unified, automated, scalable environment which takes advantage of all that a public cloud infrastructure can provide, while still maintaining control over mission-critical data.

Types of cloud computing

IT people talk about three different kinds of cloud computing, where different services are being provided for you.

Infrastructure as a Service (IaaS)

Infrastructure as a service (IaaS) is a cloud computing offering in which a vendor provides users access to computing resources such as storage, networking, and servers. Organizations use their own platforms and applications within a service provider's infrastructure.

The key features of IaaS are:

- Instead of purchasing hardware outright, users pay for IaaS on demand.
- Infrastructure is scalable depending on processing and storage needs.
- Saves enterprises the costs of buying and maintaining their own hardware.
- Because data is on the cloud, there can be no single point of failure.
- Enables the virtualization of administrative tasks, freeing up time for other work.

Platform as a Service (PaaS)

Platform as a service (PaaS) is a cloud computing offering that provides users with a cloud environment in which they can develop, manage, and deliver applications. In addition to storage and other computing resources, users are able to use a suite of prebuilt tools to develop, customize, and test their own applications.

The key features of PaaS are:

- PaaS provides a platform with tools to test, develop, and host applications in the same environment.
- Enables organizations to focus on development without having to worry about underlying infrastructure.
- Providers manage security, operating systems, server software and backups.
- Facilitates collaborative work even if teams work remotely.

Software as a Service (SaaS)

Software as a service (SaaS) is a cloud computing offering that provides users with access to a vendor's cloud-based software. Users do not install applications on their local devices. Instead, the applications reside on a remote cloud network accessed through the web or an API. Through the application, users can store and analyze data and collaborate on projects.

The key features for SaaS are:

- SaaS vendors provide users with software and applications via a subscription model.
- Users do not have to manage, install or upgrade software; SaaS providers manage this.
- Data is secure in the cloud; equipment failure does not result in loss of data.
- Use of resources can be scaled depending on service needs.
- Applications are accessible from almost any internet-connected device, from virtually anywhere in the world.

In this lab course, we will study and implement all the key concepts of Cloud Computing.

1.3 GENERAL GUIDELINES

Following are some of the general guidelines:

- Observation book and Lab record are compulsory.
- You should attempt all problems/assignments given in the list at Section 1.5 session wise.
- Use only **Trail** versions / **Demo** versions for the suggested websites and software packages.
- For the tasks describe the procedure and also present screenshots wherever applicable.

- You may seek assistance in doing the lab exercises from the concerned lab instructor. Since the assignments have credits, the lab instructor is obviously not expected to tell you how to solve these, but you may ask questions concerning the concepts.
 - Add comments wherever necessary.
 - The program should be interactive, general and properly documented with real Input/ Output data.
 - If two or more submissions from different students appear to be of the same origin (i.e. are variants of essentially the same program), none of them will be counted. You are strongly advised not to copy somebody else's work.
 - It is your responsibility to create a separate directory to store all the programs, so that nobody else can read or copy.
 - The list of the programs(list of programs given at the end, session-wise) is available to you in this lab manual. For each session, you must come prepared with the algorithms and the programs written in the Observation Book. You should utilize the lab hours for executing the programs, testing for various desired outputs and enhancements of the programs.
-
- As soon as you have finished a lab exercise, contact one of the lab instructor / incharge in order to get the exercise evaluated and also get the signature from him/her on the Observation book.
 - Completed lab assignments should be submitted in the form of a Lab Record in which you have to write the algorithm, program code along with comments and output for various inputs given.
 - The total no. of lab sessions (3 hours each) are 10 and the list of assignments is provided session-wise. It is important to observe the deadline given for each assignment.

Get started with the examples given in the next section for practice and try to solve all the practical questions given in the practical sessions - sessionwise.

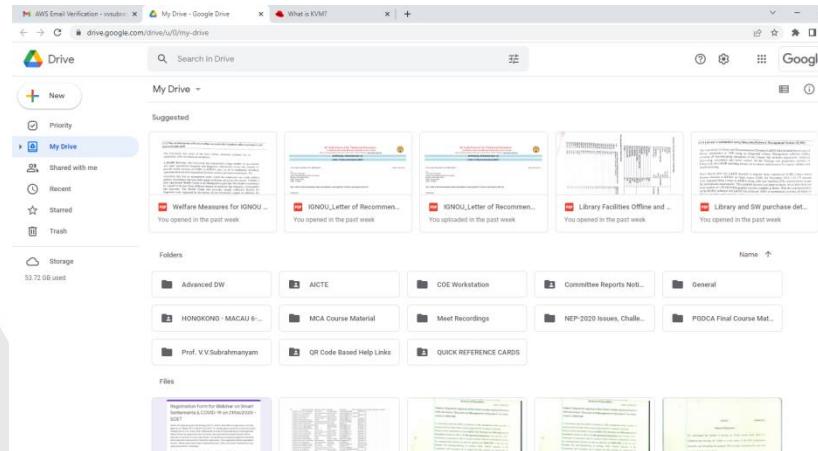
1.4 ILLUSTRATIVE EXAMPLES

Example 1: Study and implementation of Storage as a Service (IaaS)

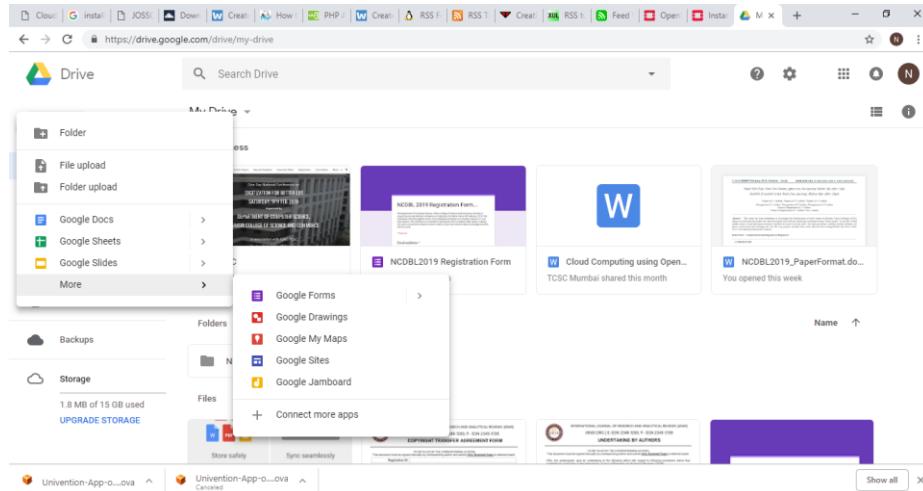
Requirement: Google Account

Google Drive is a great tool for cloud storage that allows users to backup files and easily share content and collaborate. Google Drive allows users to store up to 15GB of files for free, which is fairly generous by industry standards.

How Google Drive Works?



To get started with Google Drive, the end user must create or sign in to a Google account. Then, the user types “drive.google.com” into his or her browser. “My Drive” as shown in the figure will automatically appear, which can contain uploaded or synced files and folders, as well as Google Sheets, Slides and Docs. Then, the user can either upload files from his or her computer or create files in Google Drive. Alternatively, the end user can download a Google Drive application to one or more devices. A Google Drive folder will appear along with other folders in each device's file system. Files that the user adds to one folder are available through a Google Drive web app or the Google Drive folder on each device.



Example 2: Working with Google Docs, Sheets and Notes (SaaS)

Requirement: Google account, Internet Connection.

Google Docs is a free cloud-based suite of tools for creating documents, spreadsheets, presentations, and more. This tutorial will cover the Spreadsheets application in Google Docs, in addition to showing you howto access and store your Docs from Google Drive.

Google Docs, Sheets, and Slides are productivity apps that let you create different kinds of online documents, work on them in real time with other people, and store them in your Google Drive online — all for free. You can access the documents, spreadsheets, and presentations you create from any computer, anywhere in the world. (There's even some work you can do without an Internet connection!) This guide will give you a quick overview of the many things that you can do with Google Docs, Sheets, and Slides.

Google Docs

Google Docs is an online word processor that lets you create and format text documents and collaborate with other people in real time. Here's what you can do with Google Docs:

- Upload a Word document and convert it to a Google document
- Add flair and formatting to your documents by adjusting margins, spacing, fonts, and colors — all thatfun stuff
- Invite other people to collaborate on a document with you, giving them edit, comment or view access
- Collaborate online in real time and chat with other collaborators — right from inside the document
- View your document's revision history and roll back to any previous version
- Download a Google document to your desktop as a Word, OpenOffice, RTF, PDF, HTML or zip file
- Translate a document to a different language
- Email your documents to other people as attachments

Google Sheets

Google Sheets is an online spreadsheet app that lets you create and format spreadsheets and simultaneously work with other people. Here's what you can do with Google Sheets:

Import and convert Excel, .csv, .txt and .ods formatted data to a Google spreadsheet

- Export Excel, .csv, .txt and .ods formatted data, as well as PDF and HTML files
- Use formula editing to perform calculations on your data, and use formatting make it look the way you'd like
- Chat in real time with others who are editing your spreadsheet
- Create charts with your data
- Embed a spreadsheet — or individual sheets of your spreadsheet — on your blog or website

Google Slides

Google Slides is an online presentations app that allows you to show off your work in a visual way. Here's what you can do with Google Slides:

- Create and edit presentations
- Edit a presentation with friends or coworkers, and share it with others effortlessly
- Import .pptx and .pps files and convert them to Google presentations
- Download your presentations as a PDF, a PPT, or a .txt file
- Insert images and videos into your presentation
- Publish and embed your presentations in a website

To create, name or delete a Google document

Create a Google document

To create a new document, go to your Drive, click the Create button, and select Document.

A window with a new Google document will open, and you'll be able to edit the document, share it with other people, and collaborate on it in real-time. Google Docs saves your document automatically, and you can always access it from your Drive.

Name a document

When you create a new document, Google Docs will name it Untitled by default.

To choose a name other than Untitled, click the File menu, and select Rename. From here you can choose and confirm your document's title. You can also edit the name by clicking the title displayed at the top of the

Delete a document

- Delete an item that you own from your Drive
- From your Drive, select the item(s) you want to delete.
- From the More menu, choose Move to trash.
- If you're deleting a shared document that you own, you'll see an option to change the ownership of the document.
- The item will be moved to the Trash.
- To purge individual items from Trash, select them and choose Delete forever. To purge all your items click Empty Trash in the upper left.

Create and save a document

There are different ways of getting started using Google documents: you can create a new online document, you can upload an existing one, or you can use a template from our templates gallery.

To create a new document, go to your Drive, click the red Create button, and select Document from the drop-down menu.

As soon as you name the document or start typing, Google Docs will automatically save your work every few seconds. At the top of the document, you'll see text that indicates when your document was last saved. You can access your document at any time by opening your Drive at <http://drive.google.com>.

To save a copy of a document to your computer, you can download it. In your document, go to the File menu and point your mouse to the Download as option. Select one of the following file types: HTML (zipped), RTF, Word, Open Office, PDF, and plain text. Your document will download to your computer.

Upload a document

You can upload existing documents to Google documents at any time. When you're uploading, you can either keep your document in its original file type or convert it to Google Docs format. Converting your document to Google Docs format allows you to edit and collaborate online from any computer.

Note: When uploaded, images within a document are left as images (rather than being converted to text by Optical Character Recognition technology).

You can upload the following file types: .html, .txt, .odt, .rtf, .doc and .docx,.pdf

Follow these steps to upload a document:

- Click the Upload icon in the top left of your Documents List.
- Click Files..., and select the document you'd like to upload.
- Click Open.
- Check the box next to 'Convert documents, presentations, spreadsheets, and drawings to the corresponding Google Docs format' if you'd like to be able to edit and collaborate on the document online. Uploaded document files that are converted to Google documents format can't be larger than 1MB.
- Click Start upload. The uploaded file will appear in your Documents List.

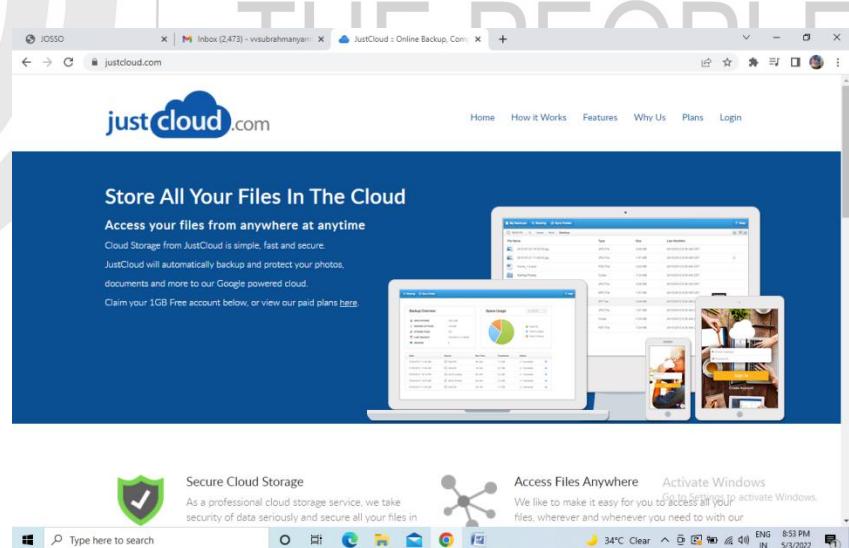
Example 3: Installation and Configuring JustCloud.

Requirement: Justcloud *exe* File

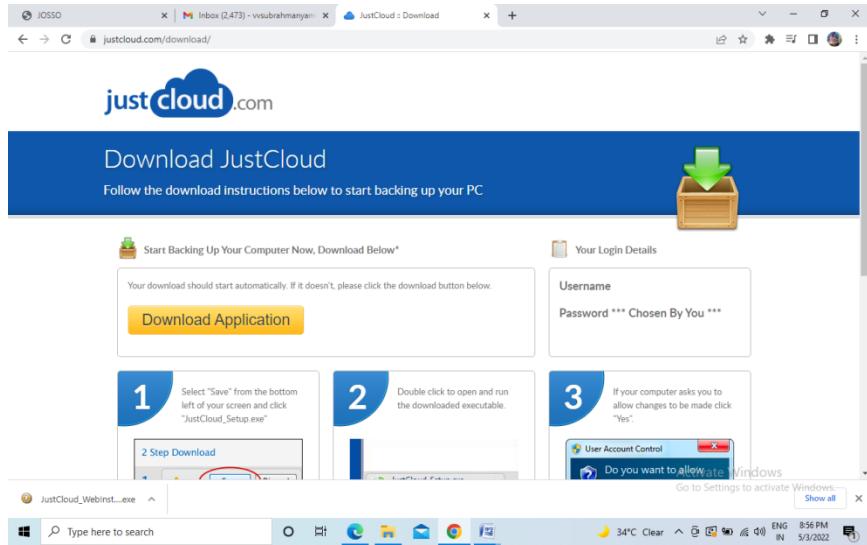
Professional Cloud Storage from JustCloud is Simple, Fast and Secure. JustCloud will automatically backup the documents, photos, music and videos stored on your computer, to the cloud so you are never without files again.

Installation :

Vist the website [justcloud.com](http://www.justcloud.com) as shown below by giving the URL www.justcloud.com



1. Download Software this link <http://www.justcloud.com/download/>



2. By following these steps you will download and install the JustCloud software application on this computer.
3. This software will automatically start backing up files from your computer and saving them securely in an online cloud user account.
4. Your free account gives you 15MB storage space or 50 files for 14 days. Once installed a sync folder will be added to your desktop for you to easily drag and drop files you wish to backup.

Example 4: Working in Cloud9 to demonstrate to work with programming languages like C, PHP, Ruby, Python, Javascript etc..

Requirement: Login account in Cloud9 (<https://aws.amazon.com/cloud9/>)

Cloud9 is an online platform for development that makes developing applications more convenient than ever. Cloud9 combines a powerful online code editor with a full Ubuntu workspace in the cloud. It supports more than 40 languages, with class A support for PHP, Ruby, Python, JavaScript, Go, and more.

Cloud9 workspaces are powered by Docker Ubuntu containers that give you full freedom over your environment, including sudo rights. Simply pick your configuration and develop your app. No need to spend valuable development time on system setup and maintenance - you can create, build and run any development stack in seconds.

Code with Just a Browser

AWS Cloud9 gives you the flexibility to run your development environment on a managed Amazon EC2 instance or any existing Linux server that supports SSH. This means that you can write, run, and debug applications with just a browser, without needing to install or maintain a local IDE. The Cloud9 code editor and integrated debugger include helpful, time-saving features such as code hinting, code completion, and step-through debugging. The Cloud9 terminal provides a browser-based shell experience enabling you to install additional software, do a git push, or enter commands.

Code Together in Real Time

AWS Cloud9 makes collaborating on code easy. You can share your development environment with your team in just a few clicks and pair program together. While collaborating, your team members can see each other type in real time, and instantly chat with one another from within the IDE.

Build Serverless Applications with Ease

AWS Cloud9 makes it easy to write, run, and debug serverless applications. It pre-configures the development environment with all the SDKs, libraries, and plug-ins needed for serverless development. Cloud9 also provides an environment for locally testing and debugging AWS Lambda functions. This allows you to iterate on your code directly, saving you time and improving the quality of your code.

Direct Terminal Access to AWS

AWS Cloud9 comes with a terminal that includes *sudo* privileges to the managed Amazon EC2 instance that is hosting your development environment and a pre-authenticated AWS Command Line Interface. This makes it easy for you to quickly run commands and directly access AWS services.

Start New Projects Quickly

AWS Cloud9 makes it easy for you to start new projects. Cloud9's development environment comes prepackaged with tooling for over 40 programming languages, including Node.js, JavaScript, Python, PHP, Ruby, Go, and C++. This enables you to start writing code for popular application stacks within minutes by eliminating the need to install or configure files, SDKs, and plug-ins for your development machine. Because Cloud9 is cloud-based, you can easily maintain multiple development environments to isolate your project's resources.

Use the URL <https://aws.amazon.com/cloud9/>

Goto Free Tier (https://aws.amazon.com/free/?all-free-tier.sort-by=item.additionalFields.SortRank&all-free-tier.sort-order=asc&awsf.Free%20Tier%20Types=*all&awsf.Free%20Tier%20Categories=*all) and create a new free account.

The screenshot shows the AWS Free Tier landing page. At the top right, there's a call-to-action box for startups: "Startups get up to \$100,000 in AWS credits". Below it, there's a section titled "Types Of Offers" with three categories: "Free trials", "12 months free", and "Always free". Each category has a small icon and a brief description.

Read the details by scrolling down the page as shown below:

The screenshot shows the AWS Free Tier products page. On the left, there's a sidebar with filters for "Tier Type" (Featured, 12 Months Free, Always Free, Trials) and "Product Categories" (Analytics, Application Integration, Business Productivity, Compute, Containers, Customer Engagement, Database, Developer tools, End User Computing, Front-End Web & Mobile, Game Tech, Internet of Things, Machine Learning, Management & Governance, Media Services). The main area displays several free services: Amazon EC2 (750 Hours), Amazon S3 (5 GB), Amazon RDS (750 Hours), Amazon DynamoDB (25 GB), Amazon SageMaker (2 Months), and AWS Lambda (1 Million free requests per month).

Log in to your account, start a new project to write a C++ program “hello.cpp”, then compile and run the program.

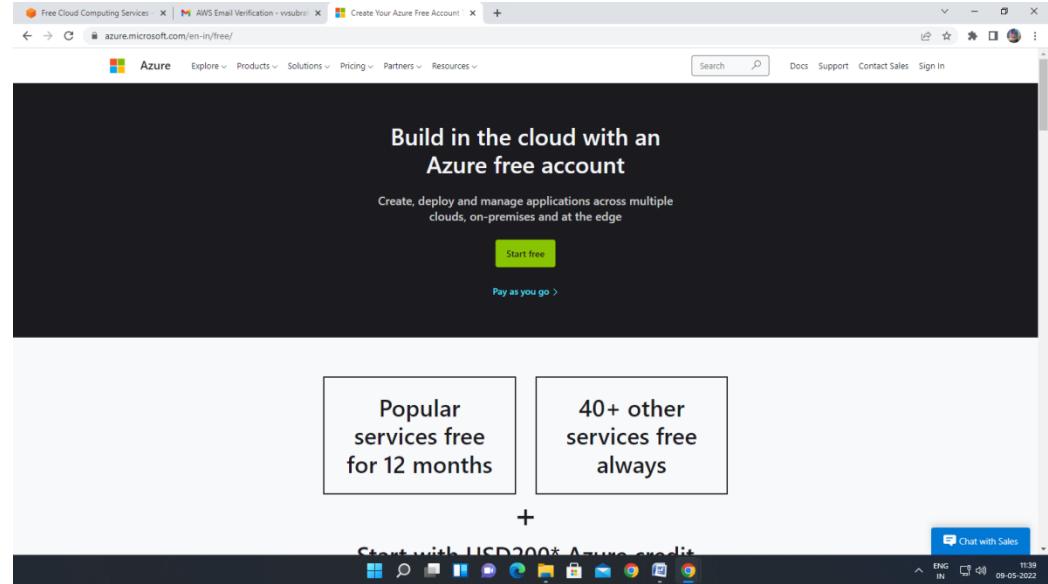
Example 5: Working with Microsoft Azure.

Requirement: Account on Microsoft Azure

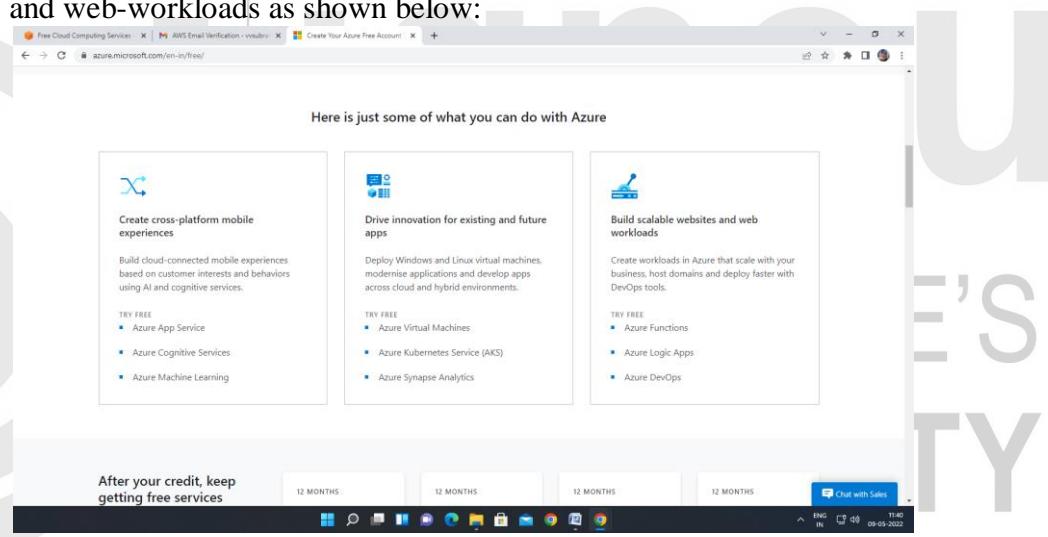
In this example we are going to explore the free Microsoft Azure cloud services for practice purpose.

Log in to the Azure portal using the below link. You can see the screen look similar to below

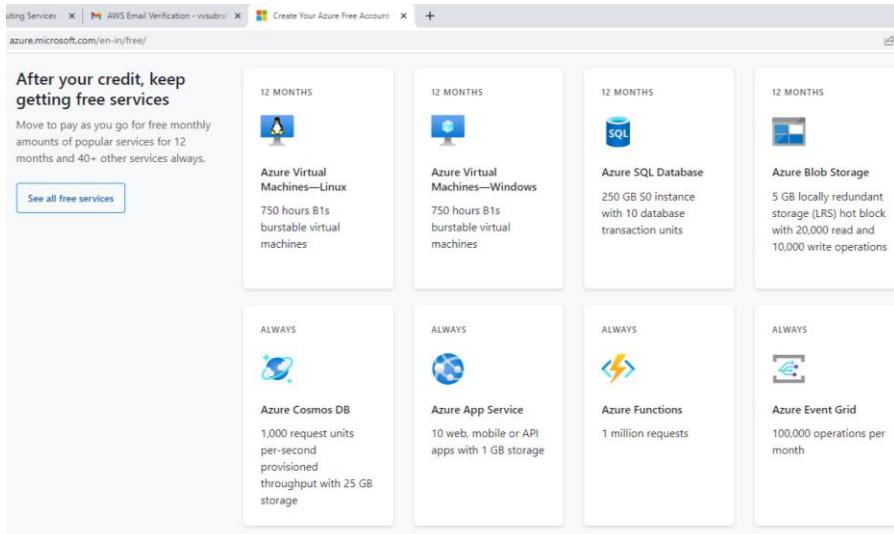
<https://azure.microsoft.com/en-in/free/>



Try to use the options like (i) create cross platform mobile experiences (ii) Drive Innovation for existing and future Apps and (iii) Build scalable web-sites and web-workloads as shown below:



In addition to the services discussed, you may explore other services listed below:



Example 6: Working with Manjrasoft Aneka Software

Requirement: ECMA Runtime Environment, Database

Aneka is a Cloud Application Development Platform (CAP) for developing and running compute and data intensive applications. As a platform it provides users with both a runtime environment for executing applications developed using any of the three supported programming models, and a set of APIs and tools that allow you to build new applications or run existing legacy code. The purpose of this document is to help you through the process of installing and setting up an Aneka Cloud environment. This document will cover everything from helping you to understand your existing infrastructure, different deployment options, installing the Management Studio, configuring Aneka Daemons and Containers, and finally running some of the samples to test your environment.

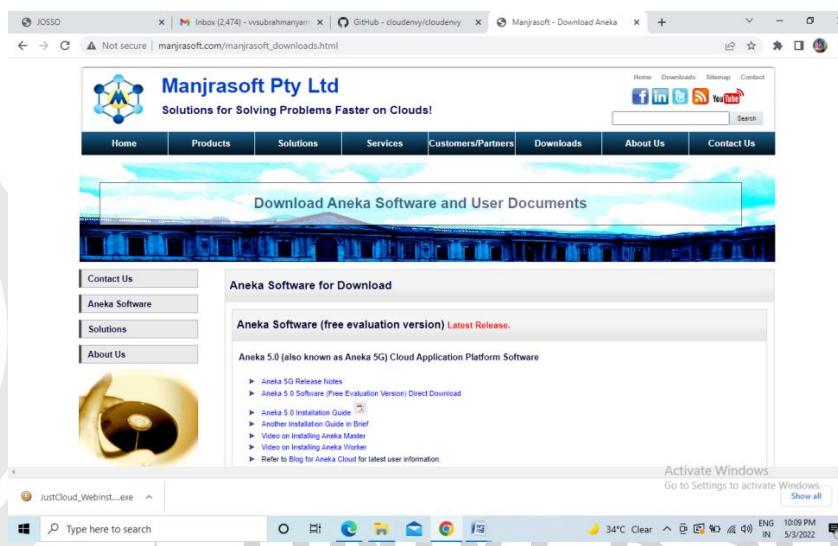
An Aneka Cloud is composed of a collection of services deployed on top of an infrastructure. This infrastructure can include both physical and virtual machines located in your local area network or Data Centre. Aneka services are hosted on Aneka Containers which are managed by Aneka Daemons. An Aneka Daemon is a background service that runs on a machine and helps you to install, start, stop, update and reconfigure Containers. A key component of the Aneka platform is the Aneka Management Studio, a portal for managing your infrastructure and clouds. Administrators use the Aneka Management Studio to define their infrastructure, deploy Aneka Daemons, and install and configure Aneka Containers. The figure below shows a high-level representation of an Aneka Cloud, composed of a Master Container that is responsible for scheduling jobs to Workers, and a group of Worker Containers that execute the jobs. Each machine is typically configured with a single instance of the Aneka Daemon and a single instance of the Aneka Container.

Installation

This section assumes that you have a copy of the Aneka distribution with you. If you do not have a copy already, you can download the latest version from Manjrasoft's Website (http://www.manjrasoft.com/manjrasoft_downloads.html). Latest release is Aneka 5.0 version.

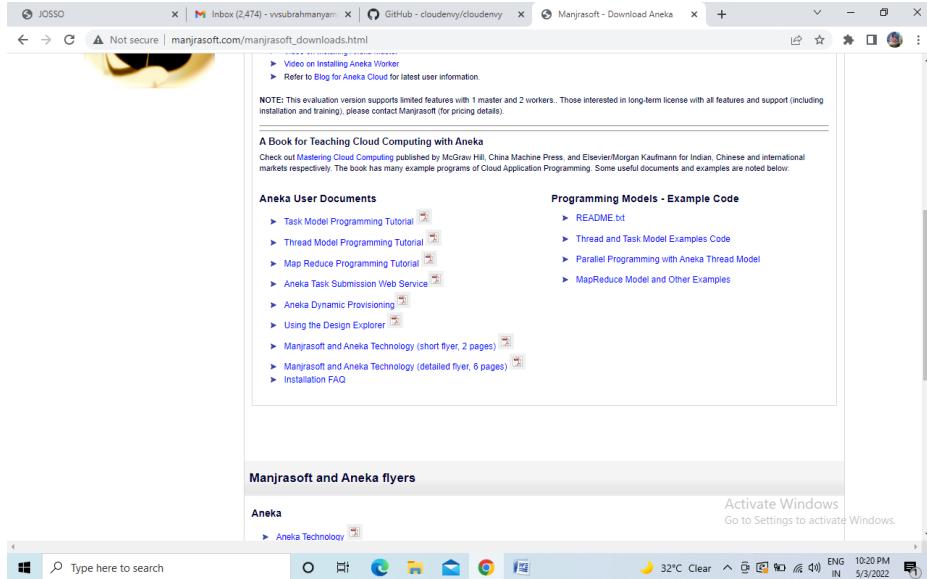
Installing Aneka Cloud Management Studio

Aneka installation begins with installing Aneka Cloud Management Studio. The Cloud Management Studio is your portal for creating, configuring and managing Aneka Clouds. Installing Aneka using the distributed Microsoft Installer Package (MSI) is a quick process involving three steps as described below:



Run the installer package to start the Setup Wizard.

Aneka User Documents are available for Model Programming Tutorial, Thread Programming Tutorial, Map Reduce Programming Tutorial, Aneka Task Scheduling Web Service, Aneka Dynamic Provisioning, Using the Design Explorer and also some programming models and example code are available as shown below:



By going through the tutorials, learners may practice using the Cloud Computing with Aneka.

Example 7: Installation and performing virtualization using KVM.

Requirements: Ubuntu operating system, open source software KVM, Internet.

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 headroads, 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 workloads.

Kernel-based Virtual Machine (KVM) is an open source virtualization technology built into Linux®. Specifically, KVM lets you turn Linux into a hypervisor that allows a host machine to run multiple, isolated virtual environments called guests or virtual machines (VMs).

KVM is part of Linux. If you've got Linux 2.6.20 or newer, you've got KVM. KVM was first announced in 2006 and merged into the mainline Linux kernel version a year later. Because KVM is part of existing Linux code, it immediately benefits from every new Linux feature, fix, and advancement without additional engineering.

How does KVM work?

KVM converts Linux into a type-1 (bare-metal) hypervisor. All hypervisors need some operating system-level components—such as a memory manager, process scheduler, input/output (I/O) stack, device drivers, security manager, a network stack, and more—to run VMs. KVM has all these components because it's part of the Linux kernel. Every VM is implemented as a regular Linux process, scheduled by the standard Linux scheduler, with dedicated virtual hardware like a network card, graphics adapter, CPU(s), memory, and disks.

Procedure:

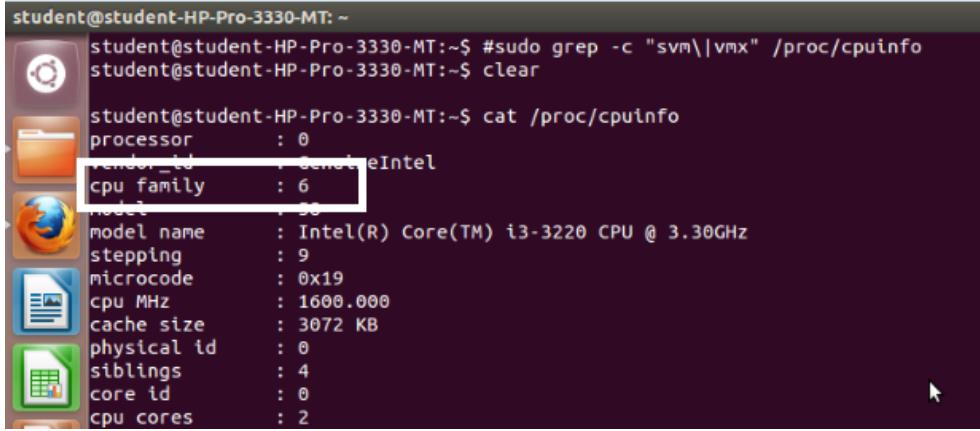
Installation Steps :

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

After running this command, log out and log back in as rrait
4. Run following command after logging back in as rrait 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

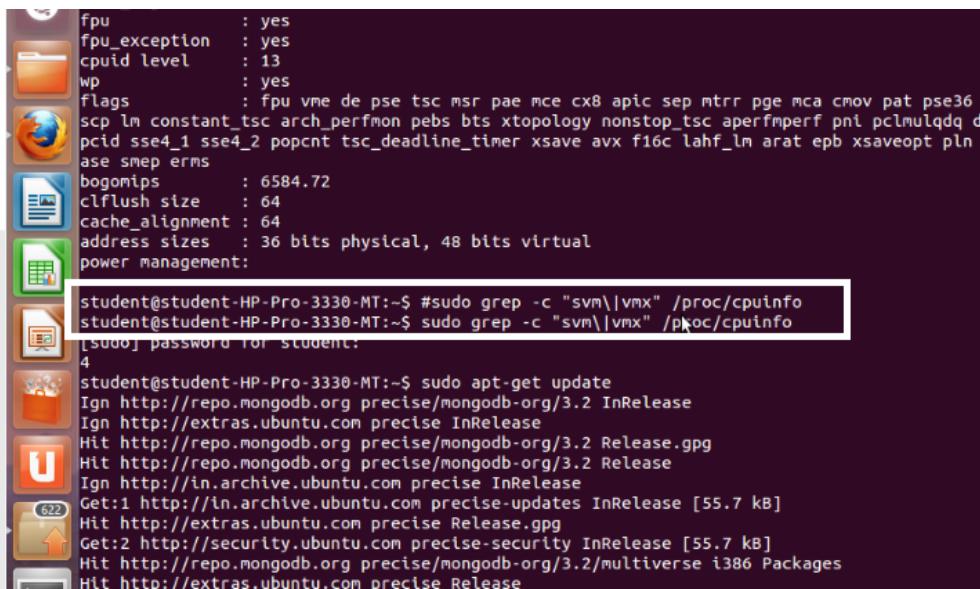
Step 1 : #sudo grep -c "svm\|vmx" /proc/cpuinfo



```
student@student-HP-Pro-3330-MT:~$ sudo grep -c "svm\|vmx" /proc/cpuinfo
student@student-HP-Pro-3330-MT:~$ clear

student@student-HP-Pro-3330-MT:~$ cat /proc/cpuinfo
processor       : 0
vendor_id      : GenuineIntel
cpu family     : 6
model          : 30
model name     : Intel(R) Core(TM) i3-3220 CPU @ 3.30GHz
stepping        : 9
microcode      : 0x19
cpu MHz        : 1600.000
cache size     : 3072 KB
physical id    : 0
siblings        : 4
core id         : 0
cpu cores      : 2
```

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

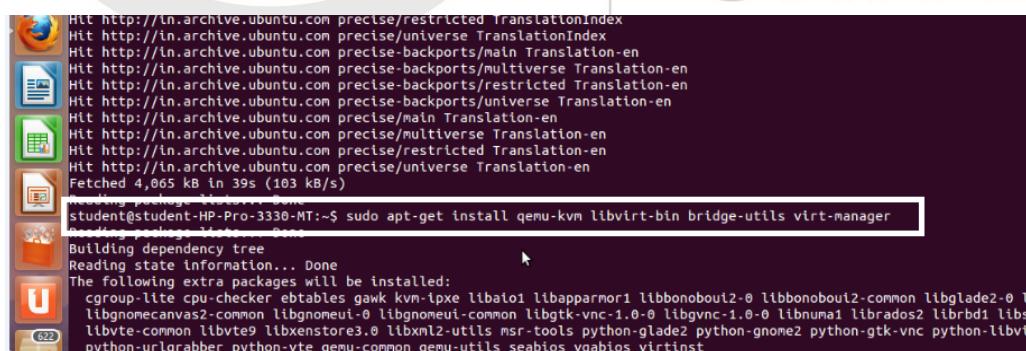


```
fpu           : yes
fpu_exception : yes
cpuid level   : 13
wp            : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 d
scp lm constant_tsc arch_perfmon pebs bts xtopology nonstop_tsc aperfmpf perf_pni pclmulqdq d
pcid sse4_1 sse4_2 popcnt tsc_deadline_timer xsave avx f16c lahf_lm arat epb xsaveopt pln
ase smep erms:
bogomips     : 6584.72
clflush size  : 64
cache_alignment: 64
address sizes : 36 bits physical, 48 bits virtual
power management:

student@student-HP-Pro-3330-MT:~$ sudo grep -c "svm\|vmx" /proc/cpuinfo
student@student-HP-Pro-3330-MT:~$ sudo grep -c "svm\|vmx" /proc/cpuinfo
[sudo] password for student:
4
student@student-HP-Pro-3330-MT:~$ sudo apt-get update
Ign http://repo.mongodb.org precise/mongodb-org/3.2 InRelease
Ign http://extras.ubuntu.com precise InRelease
Hit http://repo.mongodb.org precise/mongodb-org/3.2 Release.gpg
Hit http://repo.mongodb.org precise/mongodb-org/3.2 Release
Ign http://in.archive.ubuntu.com precise InRelease
Get:1 http://in.archive.ubuntu.com precise-updates InRelease [55.7 kB]
Hit http://extras.ubuntu.com precise Release.gpg
Get:2 http://security.ubuntu.com precise-security InRelease [55.7 kB]
Hit http://repo.mongodb.org precise/mongodb-org/3.2/multiverse i386 Packages
Hit http://extras.ubuntu.com precise Release
```

Step 3 : #sudoaddusrerrait

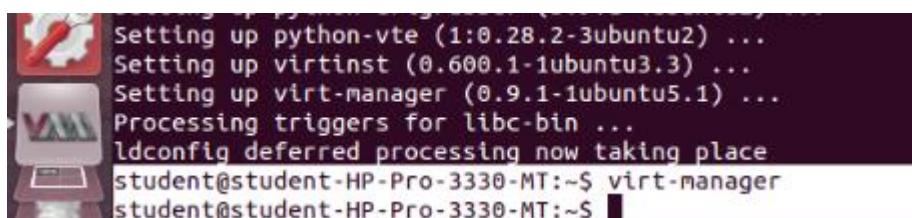
After running this command, log out and log back in as rait



```
Hit http://in.archive.ubuntu.com precise/restricted TranslationIndex
Hit http://in.archive.ubuntu.com precise/universe TranslationIndex
Hit http://in.archive.ubuntu.com precise-backports/naln Translation-en
Hit http://in.archive.ubuntu.com precise-backports/multiverse Translation-en
Hit http://in.archive.ubuntu.com precise-backports/restricted Translation-en
Hit http://in.archive.ubuntu.com precise-backports/universe Translation-en
Hit http://in.archive.ubuntu.com precise/main Translation-en
Hit http://in.archive.ubuntu.com precise/multiverse Translation-en
Hit http://in.archive.ubuntu.com precise/restricted Translation-en
Hit http://in.archive.ubuntu.com precise/universe Translation-en
Fetched 4,065 kB in 39s (103 kB/s)
student@student-HP-Pro-3330-MT:~$ sudo apt-get install qemu-kvm libvirt-bin bridge-utils virt-manager
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  group-lite cpu-checker ebttables gawk kvm-ipxe libalo1 libapparmor1 libbonoboui2-0 libbonoboui2-common libglade2-0 1
libgnomecanvas2-common libgnomeui-0 libgnomeui-common libgtk-vnc-1.0-0 libgvcn-1.0-0 libnumai librados2 librbd1 libv
libvte-common libvte9 libxenstore3.0 libxml2-utils msr-tools python-glade2 python-gnome2 python-gtk-vnc python-libv
python-urlgrabber python-vte qemu-common qemu-utils seabios vgabios virtinst
```

Step 4 : #sudoaddusrerraitlibvirtd

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

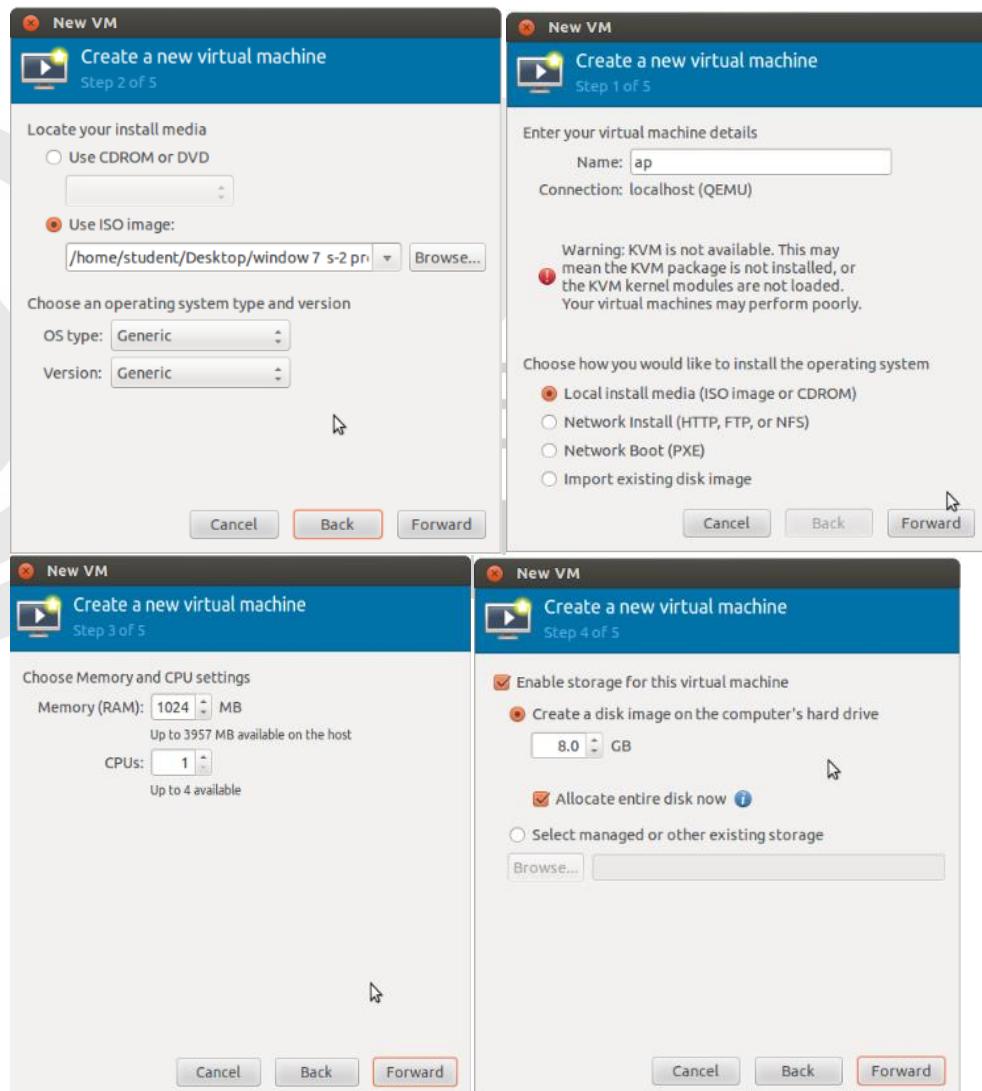


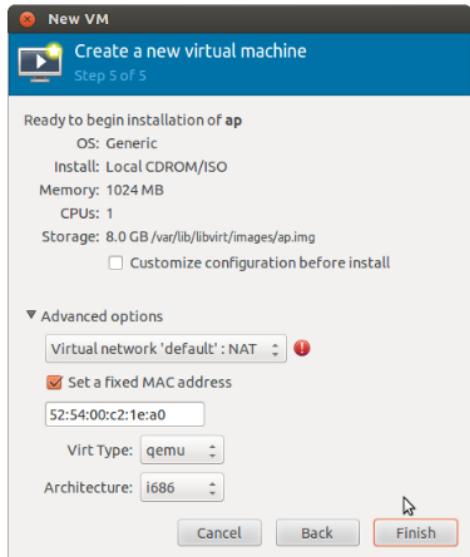
```
Setting up python-vte (1:0.28.2-3ubuntu2) ...
Setting up virtinst (0.600.1-1ubuntu3.3) ...
Setting up virt-manager (0.9.1-1ubuntu5.1) ...
Processing triggers for libc-bin ...
ldconfig deferred processing now taking place
student@student-HP-Pro-3330-MT:~$ virt-manager
student@student-HP-Pro-3330-MT:~$
```

Step 5 : Open Virtual Machine Manager application and Create Virtual Machine
#virt-manager as shown below

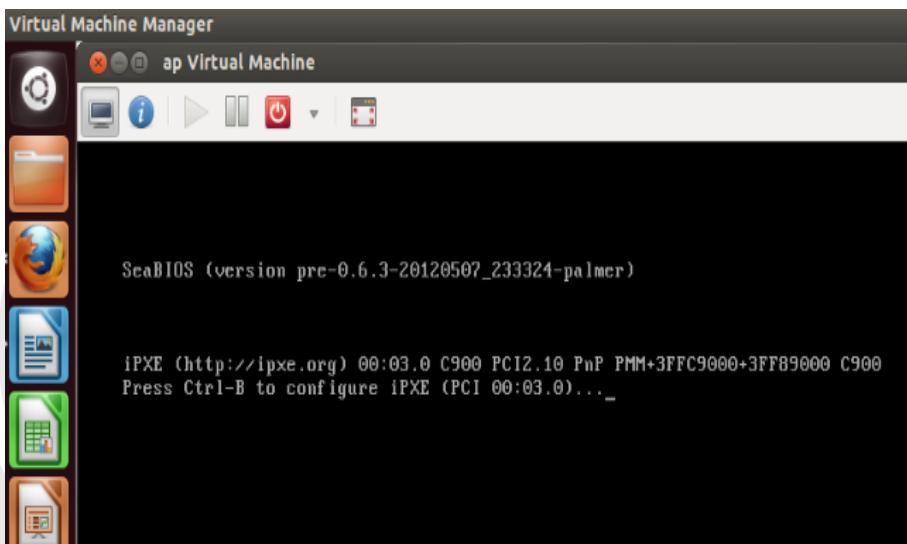


Step 6 : Create a new virtual machine as shown below:

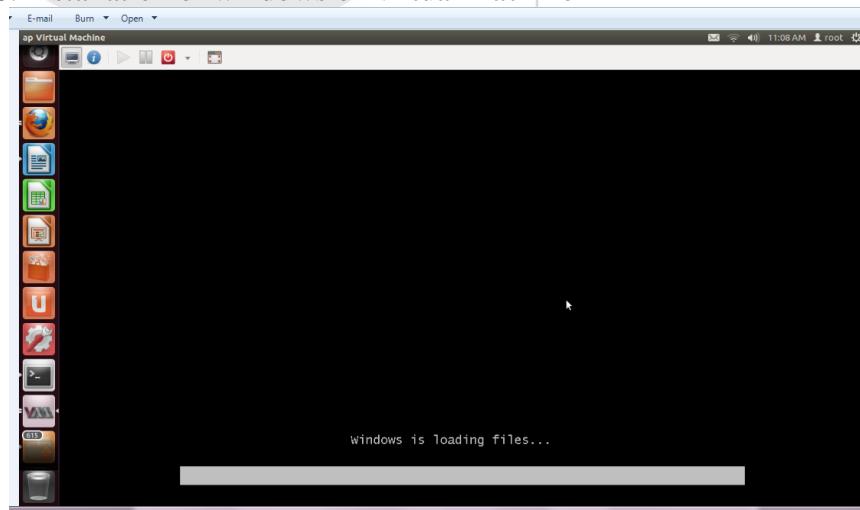




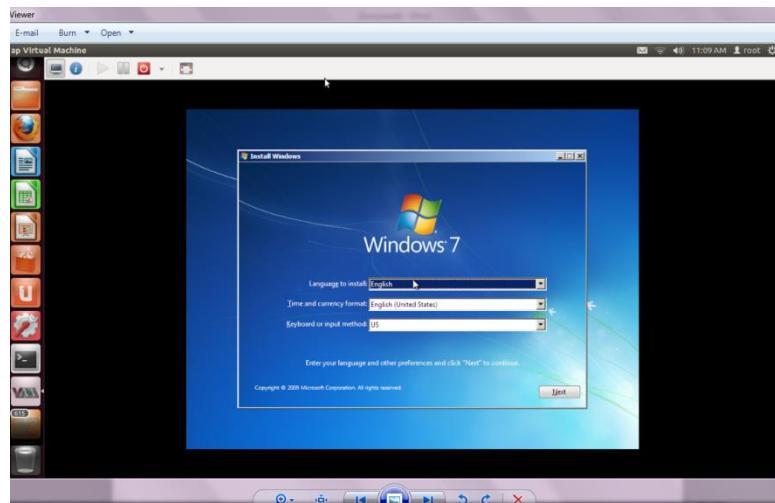
Step 7 : Install Windows operating system on virtual machine



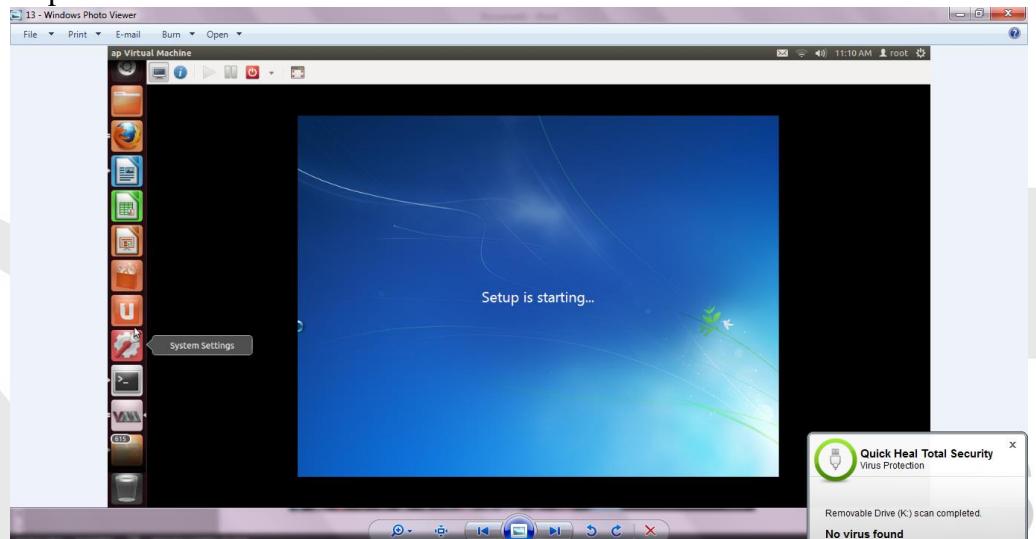
Step 8: Installation of windows on virtual machine



Step 9: Installation of windows 7 on virtual machine



Step 10: Initialization of windows on virtual machine



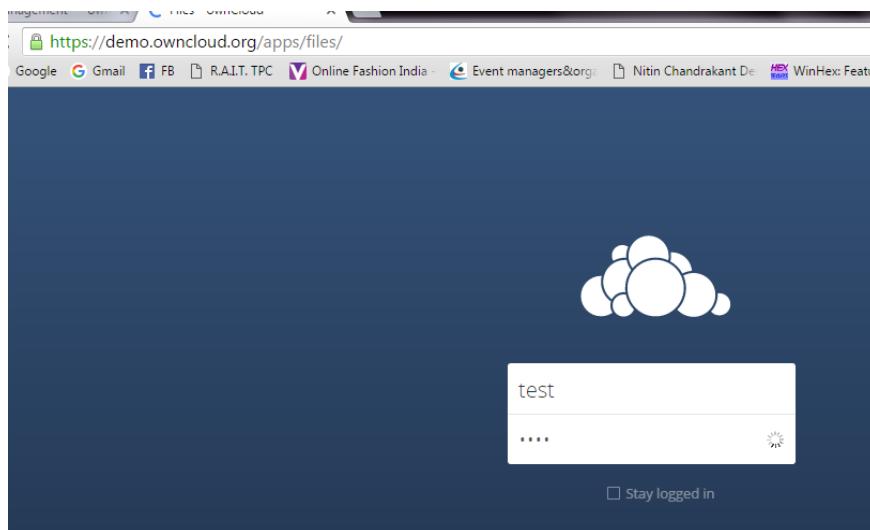
Installation and configuration of KVM have been done successfully onto Ubuntu and users added. Like this we can create as many virtual machines as possible on OS and can install any windows onto it.

Example 8: Study and implement Identity Management in ownCloud

Requirement: ownCloud account (trail account on <https://owncloud.com/>)

Identity Management

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.



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.

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.

	Username	Password	Groups	Create	
Everyone	test	*****	admin	no group	1 GB
Admins					

The screenshot shows the ownCloud 'Users' interface. At the top, there are search and filter fields for 'BE B Div' and 'be_b'. Below these are sections for 'set new password' (with a 'P' icon) and 'Full Name' (containing 'be_b'). A large watermark for 'SUSTAINABILITY' is visible across the background.

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 notification of the new share from the sharing screen.

The screenshot shows the 'Sharing' configuration page. It includes options like 'Allow apps to use the Share API' (checked), 'Allow users to share via link' (checked), and several sub-options under it: 'Enforce password protection' (checked), 'Allow public uploads' (checked), and 'Set default expiration date' (checked). There is a field to 'Expire after' 7 days with an 'Enforce expiration date' checkbox checked. Other options include 'Allow resharing', 'Restrict users to only share with users in their groups', 'Allow users to send mail notification for shared files', and 'Exclude groups from sharing'.

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

The screenshot shows the 'Files' interface with a list of three files: 'hacking.jpg', 'mate.jpg', and 'r0ket.jpg'. A context menu is open over the first file, showing options: 'Details', 'Rename', 'Download', and 'Delete'.



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

	Username	Password	Groups	Create			
2	Username	Full Name	Groups	Groups	Group Admin for	Quota	
1	my_circle	my_circle	*****	users, be_b div	be_b div	5 GB	

Music Shared with admin ... a minute ago

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.

Example 9: To study and explore Cloud Security Management in AWS

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 databackup plan in the case of a cloud security breach.

Procedure:

Security using MFA(Multi Factor Authentication) device code:

- 1) goto aws.amazon.com
- 2) click on "My Account"
- 3) select "AWS management console" and click on it
- 4) Give Email id in the required field
if you are registering first time then select "I am a new user" radio button
- 5) click on "sign in using our secure server" button
- 6) follow the instruction and complete the formalities
(Note: do not provide any credit card details or bank details)
- sign out from
- 7) Again go to "My Account"

select "AWS management console" and click on it

Sign in again by entering the user name and valid password (check "I am returning user and my password is" radio button)

Now you are logged in as a Root User

All AWS project can be viewed by you, but you cant make any changes in it or you cant create new thing as you are not paying any charges to amazon (for reason refer step:6)

To create the user in a root user follow the steps mentioned below:

- 1) click on "Identity and Access Management" in security and identity project
- 2) click in "Users" from dashboard
It will take you to "Create New Users"
click on create new user button
enter the "User Name"
(select "Generate and access key for each user" checkbox, it will create a user with a specific key)
click on "Create" button at right bottom
- 3) once the user is created click on it
- 4) go to security credentials tab
- 5) click on "Create Access Key", it will create an access key for user.
- 6) click on "Manage MFA device" it will give you one QR code displayed on the screen

you need to scan that QR code on your mobile phone using barcode scanner (install it in mobile phone) you also need to install "Google Authenticator" in your mobile phone to generate the MFA code

7) Google authenticator will keep on generating a new MFA code after every 60 seconds
that code you will have to enter while logging as a user.

Hence, the security is maintained by MFA device code...

One can not use your AWS account even if it may have your user name and password, because MFA code is on your MFA device (mobile phone in this case) and it is getting changed after every 60 seconds.

CLOUD COMPUTING LAB

Permissions in user account:

After creating the user by following above mentioned steps; you can give certain permissions to specific user

- 1) click on created user
- 2) goto "Permissions" tab
- 3) click on "Attach Policy" button
- 4) select the needed policy from given list and click on apply.

Result:

Step 1 : goto aws.amazon.com

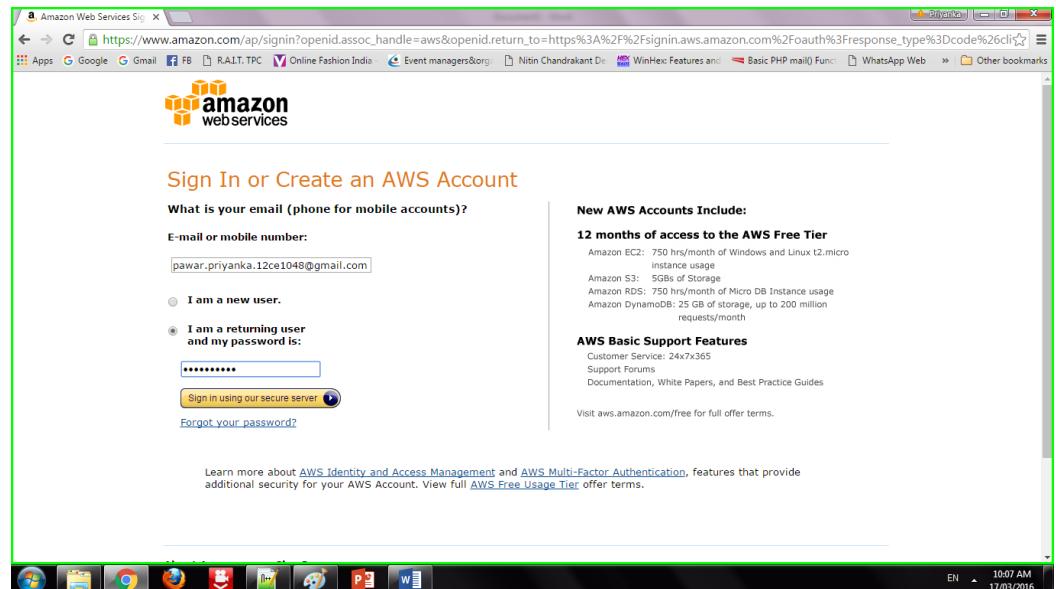
The screenshot shows the AWS Cloud Security page. The left sidebar has a 'SECURITY' section with 'AWS Cloud Security' selected. Other options include 'What is Cloud Security?', 'Benefits of AWS Security', 'Security Guidance', 'Security Bulletins', 'Security Resources', and 'Partner Solutions'. Below this is a 'RELATED LINKS' section with links to 'AWS Cloud Compliance', 'AWS Architecture', 'AWS Security Blog', 'Penetration Testing', and 'Vulnerability Reporting'. The main content area features a heading 'AWS Cloud Security' and a paragraph about AWS's job zero approach to security. To the right is a sidebar with a yellow 'Start Your Cloud Adoption' button and a small icon of a telephone and envelope.

Step 2 : Click on "My Account". Select "AWS management console" and click on it. Give Email id in the required field

Step 3: Addition of security features

The screenshot shows the 'My Account' page. The top navigation bar includes 'My Account' with a dropdown arrow pointing down. A dropdown menu is open, showing 'AWS Management Console' as the selected option, along with other options like 'Account Settings', 'Billing & Cost Management', and 'Security Credentials'. Below the dropdown is a 'Contact AWS Sales' button.

Step 4: Sign in to an AWS account



Service Catalog
Create and Use Standardized Products

Trusted Advisor
Optimize Performance and Security

Security & Identity

- Identity & Access Management**
Manage User Access and Encryption Keys
- Directory Service**
Host and Manage Active Directory
- Inspector PREVIEW**
Analyze Application Security
- WAF**

AWS Services Dashboard showing IAM Users section. The sidebar lists Details, Groups, **Users**, Roles, Policies, and Identity Providers. The main area shows a table for 'Create New Users' with columns: User Name, Groups, Password, Password Last Used, Access Keys, and Creation Time. A note says 'No records found.'

Step 5 : Creation of users

Enter User Names:

1. Priyanka
2. Mansi
3. Manan
4. Nilam
5. Santosh

Maximum 64 characters each

Generate an access key for each user

Users need access keys to make secure REST or Query protocol requests to AWS.

Create User

Your 1 User(s) have been created successfully.
 This is the last time these User security credentials will be available for download.
 You can manage and recreate these credentials any time.

[▼ Hide User Security Credentials](#)

 pawarpriyankavijay

Access Key ID: AKIAJ3BDWCXL07E3DTXA

Secret Access Key: gSsFU+4rk4U+p1G6OMh8zkPbBVt+Qj1oaWVXsvv

Step 6: Adding users to group

Search IAM

Details Groups **Users** Roles Policies Identity Providers Account Settings Credential Report

Summary

User ARN: arn:aws:iam::911721231659:user/pawarpriyankavijay
 Has Password: No
 Groups (for this user): 0
 Path: /
 Creation Time: 2016-03-17 10:12 UTC+0530

Groups Permissions Security Credentials Access Advisor

This user does not belong to any groups.

[Add User to Groups](#)

Step 7: Creating Access key

Groups Permissions **Security Credentials** Access Advisor

Access Keys

Use access keys to make secure REST or Query protocol requests to any AWS service API. For your protection, you should never share your secret keys with anyone. In addition, industry best practice recommends frequent key rotation. [Learn more about Access Keys](#)

[Create Access Key](#)

Access Key ID	Created	Last Used	Last Used Service	Last Used Region	Status	Actions
AKIAJ3BDWCXL07E3DTXA	2016-03-17 10:12 UTC+0530	N/A	N/A	N/A	Active	Make Inactive Delete

Sign-In Credentials

User Name: pawarpriyankavijay [Manage Password](#)
 Password: No

Create Access Key

Your access key has been created successfully.
This is the last time these User security credentials will be available for download.
 You can manage and recreate these credentials any time.

[▼ Hide User Security Credentials](#)

 pawarpriyankavijay

Access Key ID: AKIAJSIBMBDSFX3YMLRQ
 Secret Access Key: 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

[Close](#) [Download Credentials](#)

Manage MFA Device

Select the type of MFA device to activate:

- A virtual MFA device
- A hardware MFA device

For more information about supported MFA devices, see [AWS Multi-Factor Authentication](#).

Cancel **Next Step**

Manage MFA Device

To activate a virtual MFA device, you must first install an AWS MFA-compatible application on the user's smartphone, PC, or other device. You can find a list of AWS MFA-compatible applications [here](#). After the application is installed, click Next Step to configure the virtual MFA.

Don't show me this dialog box again.

Cancel **Previous** **Next Step**

Step 8 : Setting permissions to users

Groups

- Users**
- Roles
- Policies
- Identity Providers
- Account Settings
- Credential Report

Path: /

Creation Time: 2016-03-17 10:12 UTC+0530

Groups **Permissions** **Security Credentials** **Access Advisor**

Managed Policies

There are no managed policies attached to this user.

Attach Policy

Attach Policy

Select one or more policies to attach. Each user can have up to 10 policies attached.

Filter: Policy Type Filter Showing 193 results

	Policy Name	Attached Entities	Creation Time	Edited Time
<input checked="" type="checkbox"/>	AdministratorAccess	0	2015-02-07 00:09 UTC+0530	2015-02-07 00:09 UTC+0530
<input checked="" type="checkbox"/>	AmazonAPIGatewayAdministr...	0	2015-07-09 23:04 UTC+0530	2015-07-09 23:04 UTC+0530
<input type="checkbox"/>	AmazonAPIGatewayInvokeFul...	0	2015-07-09 23:06 UTC+0530	2015-07-09 23:06 UTC+0530
<input type="checkbox"/>	AmazonAPIGatewayPushToCl...	0	2015-11-12 05:11 UTC+0530	2015-11-12 05:11 UTC+0530

The screenshot shows the AWS IAM Policy Simulator interface. On the left, a sidebar lists navigation options: Groups, Users (selected), Roles, Policies, Identity Providers, Account Settings, Credential Report, and Encryption Keys. The main area is titled 'Managed Policies' and displays two policies: 'AdministratorAccess' and 'AmazonAPIGatewayAdministrator'. Each policy has three actions: Show Policy, Detach Policy, and Simulate Policy.

The screenshot shows the 'Editing policy: AdministratorAccess' screen. It displays the JSON code for the policy:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "*",
      "Resource": "*"
    }
  ]
}
```

On the right, the 'Policy Simulator' interface is shown with 'Global Settings' selected. It includes tabs for Action Settings and Results, Service, Action, Resource Type, Simulation Resource, and Permission.

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.

1.5 PRACTICAL SESSIONS

Sessionwise practical problems for 10 sessions are given below:

Session – 1

1. Create a word document of your counselling schedule of the study centre and store locally and on Google Drive with *doc* and *pdf* formats. Share it with your peer and faculty in *View mode*.
2. Create Google Sheet which contains employee salary information and calculate Gross salary and Net salary using,

DA=10% OF BASIC, HRA=30% OF BASIC,
PF= 10% OF BASIC IF BASIC<=3000
12% OF BASIC IF BASIC>3000
TAX=10% OF BASIC IF BASIC<=1500
11% OF BASIC IF BASIC>1500 AND BASIC<=2500
12% OF BASIC IF BASIC>2500
NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX

Session – 2

3. Using Google Slides, prepare a Presentation consisting of atleast 20 slides on Cloud Computing covering introduction, models, services, architecture, applications and security aspects.

4. Using Google Docs, create your ***Resume*** in a neat format using Google and Zoho cloud.

Session – 3

5. Explore box(<https://www.box.com/home>), Sync(<https://www.sync.com/>), JustCloud, Amazon Drive and NordLocker file storage and sharing solutions. Use only their trial versions.

6. Work with Youtube, a cloud service to upload your own educational video(s) and use appropriate settings to make it public.

7. Work with SlideShare (<http://www.slideshare.net/>) which is a cloud service for slide sharing owned and controlled by LinkedIn.

Session - 4

8. ***Virtualization:*** Install Oracle Virtual box and create two VMs on your laptop.

9. Install a C++ compiler in the virtual machine and execute a sample program.

Session - 5

10. Study and implementation of Single-Sign-On(SSO), OpenID.

JOSSO is an open source Identity and Access Management (IAM) platform for rapid and standards-based Cloud-scale Single Sign-On, web services security, strong authentication and provisioning. Install and use JOSSO (josso.org). The easiest way to try it out is by using our pre-built Vagrant-based “JOSSO Playground” which hosts everything you need to roll out a fully functional environment, along with all the required pieces. Refer to:
<http://www.josso.org/getting-started.html>

11. Install and use identity management feature of OpenStack (<https://www.openstack.org/>) .

Session – 6

12. Establish an Google Cloud Platform(<https://cloud.google.com>) account (use trail version). Explore the following:

- (i) IAM & Admin
- (ii) Billing
- (iii) Marketplace (Creating Virtual Machines)
- (iv) Compute Engine
- (v) Cloud Storage
- (vi) SQL
- (vii) Security

Session – 7

13. Use Google App Engine to

- (a) Write a Google app engine program to generate n even numbers and deploy it to Google cloud.
- (b) Write a Google app engine program to multiply two matrices.
- (c) Google app engine program to validate user; create a database login(username, password)in mysql and deploy to cloud.
- (d) Write a Google app engine program to display nth largest no from the given list of numbers and deploy it in Google cloud

Session - 8

14. Establish an AWS account(use trail version). Use the AWS Management Console to launch an Elastic Compute Cloud (EC2) instance and connect to it.

15. Explore CloudSim. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Session – 9

16. User Management in Cloud.

Install, create, manage users' accounts and use Administrative features of ownCloud

Session -10

Explore Service Level Agreements (SLA's) of popular Cloud Service Platforms:

Below are links to cloud SLAs from the major public cloud platforms. Many individual cloud services require separate SLAs, each of these vendors lists dozens of such SLAs. Study and understand them.

- AWS (https://aws.amazon.com/legal/service-level-agreements/?aws-sla-cards.sort-by=item.additionalFields.serviceNameLower&aws-sla-cards.sort-order=asc&awsf.tech-category-filter=*all)
- Microsoft Azure Services (<https://azure.microsoft.com/en-us/support/legal/sla/summary/>)
- Google Cloud Platform SLA's (<https://cloud.google.com/terms/sla>)

1.6 SUMMARY

This lab course covered the important aspects of Cloud Computing with illustrative examples. Also, sessionwise problems list is provided to the learner for solving.

1.7 FURTHER READINGS

1. Mastering Cloud Computing, Buyya, Vecchiola, Selvi, McGraw Hill Education(India) Pvt Ltd, 2013.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge, 2010.

3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley - India, 2010.
4. Getting Started with OwnCloud by Aditya Patawar , Packt Publishing Ltd, 2013.
5. Cloud Computing, A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, Mc Graw Hill, 2017.
6. Cloud Computing A Practitioners Guide, Doss, Mc Graw Hill, 2013.

1.8 WEBSITE REFERENCES

1. www.justcloud.com
2. <https://www.zoho.com/>
3. <https://aws.amazon.com/cloud9/>
4. <https://azure.microsoft.com/en-in/free/>
5. http://www.manjrasoft.com/manjrasoft_downloads.html
6. <https://owncloud.com/>
7. <https://aws.amazon.com/security/>
8. <https://www.box.com/home>
9. <https://www.sync.com/>
10. <http://www.slideshare.net/>
11. <http://www.josso.org/getting-started.html>
12. <https://www.openstack.org/>
13. <https://cloud.google.com/>
14. <https://azure.microsoft.com>
15. <https://code.google.com/archive/p/cloudsim/downloads>
16. https://aws.amazon.com/legal/service-level-agreements/?aws-sla-cards.sort-by=item.additionalFields.serviceNameLower&aws-sla-cards.sort-order=asc&awsf.tech-category-filter=*all
17. <https://azure.microsoft.com/en-us/support/legal/sla/summary/>
18. <https://cloud.google.com/terms/sla>