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Grade item	Calculated weight	Grade	Range	Percentage	Feedback	Contribution to course total
Skill Based Lab : Cloud Computing						
 ASSIGNMENT <u>Experiment No.1</u>	8.82 %	✓ 12.86	0–15	85.71 %		7.56 %
 ASSIGNMENT <u>Experiment No.2</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>Experiment No.3</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>Experiment No.4</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>Experiment No.5</u>	8.82 %	12.86	0–15	85.71 %		7.56 %
 ASSIGNMENT <u>Assignment No.1</u>	2.94 %	4.00	0–5	80.00 %		2.35 %
 ASSIGNMENT <u>EXPERIMENT NO.6</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>Experiment No.7</u>	8.82 %	12.00	0–15	80.00 %		7.06 %
 ASSIGNMENT <u>Experiment No.8</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>Experiment No.9</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>Experiment No.10</u>	8.82 %	13.00	0–15	86.67 %		7.65 %
 ASSIGNMENT <u>CC Mini Project Report</u>	5.88 %	10.00	0–10	100.00 %		5.88 %
 ASSIGNMENT <u>ASSIGNMNET NO.2</u>	2.94 %	4.00	0–5	80.00 %		2.35 %
 AGGREGATION Course total	-	146.71	0–170	86.30 %		-

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Experiment – 1

Name :- shrikrishna umbare

Roll No :-66

TE Comps Batch: C

Sub: Skill Based Lab : Cloud Computing

implement different types of virtualization techniques.	
Learning Objective:	To make students familiar with key concepts of virtualization.
Learning Outcome:	Students will be able To understand the origin of cloud computing, cloud cube model,NIST model, characteristics of cloud.
Course Outcome:	CSL605.2
Program Outcome:	3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Bloom's Taxonomy Level:	Analysis
Theory:	1.cloud cube model, NIST model 2.characteristics of cloud 3.Different deployment models, service models, 4.Advantages and Disadvantages.

Outcome :

There are several types of virtualization techniques, including:

- 1. Hardware virtualization:** This technique involves creating a virtual machine (VM) that runs on top of a physical host machine. The VM is isolated from the host machine and can run its own operating system and applications. Examples include VMware, Hyper-V, and VirtualBox.
- 2. Container virtualization:** This technique involves creating containers that share the host machine's operating system kernel. Containers are lightweight and portable, and they can be used to deploy applications quickly. Examples include Docker and Kubernetes.
- 3. Application virtualization:** This technique involves running an application in a virtual environment, separate from the host operating system. This allows the application to run on any operating system, regardless of compatibility issues. Examples include Microsoft App-V and VMware ThinApp.
- 4. Cloud virtualization:** This technique is used to create virtual resources, such as virtual machines, storage, and networks, on a cloud infrastructure. Cloud

providers like AWS, GCP, and Azure offer virtualization services.

- 5. Network virtualization:** This technique is used to create virtual networks that run on top of a physical network. This allows for the creation of multiple isolated networks on a single physical infrastructure. Examples include VXLAN and NVGRE.

Cloud Cube Model

The cloud cube model is a way of categorizing different types of cloud computing services based on the level of control and customization provided to the user. The model consists of six different layers, or "cubes," that represent different levels of control and customization:

- 1. Infrastructure as a Service (IaaS):** This is the lowest level of the cloud cube model. It provides users with access to raw computing resources, such as virtual machines, storage, and networking, which they can use to build and run their own applications.
- 2. Platform as a Service (PaaS):** This layer sits on top of IaaS and provides users with a platform for building, deploying, and managing applications. It includes services such as databases, middleware, and development tools.
- 3. Software as a Service (SaaS):** This layer sits on top of PaaS and provides users with access to ready-made applications, such as email, CRM, and ERP systems. These applications are typically accessed through a web browser.
- 4. Business Process as a Service (BPaaS):** This layer provides access to specific business processes, such as HR, finance and accounting, and customer service. It is built on top of SaaS and offers a more specific set of tools and services to support a business process.
- 5. Data as a Service (DaaS):** This layer provides access to data, such as big data analytics, data visualization, and data warehousing. It is built on top of BPaaS and SaaS and offers a more specific set of data management and analysis tools.
- 6. Function as a Service (FaaS):** This is the highest level of the cloud cube model. It enables developers to run their code in the cloud without having to provision or manage servers. This is commonly known as serverless computing.

This model helps users understand the different types of cloud computing services available and the level of control and customization they provide. It also helps organizations choose the right type of cloud service for their specific needs.

NIST model

The National Institute of Standards and Technology (NIST) has developed a cloud computing reference model, which is commonly known as the NIST cloud computing model. It provides a standardized framework for understanding and describing cloud computing services and deployments. The NIST model consists of five essential characteristics, three service models, and four deployment models:

1. Essential Characteristics:
 - a. On-demand self-service: Users can provision computing resources as needed, without requiring human interaction with the service provider.

- b. Broad network access: Resources are available over the network and can be accessed from a variety of devices.
- c. Resource pooling: The provider's computing resources are pooled to serve multiple customers, with the provider allocating and managing

- the resources dynamically.
 - d. Rapid elasticity: The capability to quickly provision and release resources as needed.
 - e. Measured service: The provider automatically controls and optimizes resource usage based on a metering capability.
2. Service Models:
 - a. Infrastructure as a Service (IaaS): Provides virtualized computing resources over the internet.
 - b. Platform as a Service (PaaS): Provides a platform for users to develop, run, and manage their own applications.
 - c. Software as a Service (SaaS): Provides access to software applications over the internet.
 3. Deployment Models:
 - a. Private cloud: The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third-party provider.
 - b. Community cloud: The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns.
 - c. Public cloud: The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.
 - d. Hybrid cloud: The cloud infrastructure is a combination of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability.

The NIST cloud computing model provides a comprehensive and consistent way of defining and describing cloud computing services, making it easier for organizations to evaluate and compare different cloud solutions.

Characteristics of cloud

The characteristics of cloud computing, as defined by the National Institute of Standards and Technology (NIST), are:

1. On-demand self-service: Users can provision computing resources as needed, without requiring human interaction with the service provider.
2. Broad network access: Resources are available over the network and can be accessed from a variety of devices, such as laptops, smartphones, and tablets.
3. Resource pooling: The provider's computing resources are pooled to serve multiple customers, with the provider allocating and managing the resources dynamically.
4. Rapid elasticity: The capability to quickly provision and release resources as needed, allowing the infrastructure to scale up or down based on the user's needs.
5. Measured service: The provider automatically controls and optimizes resource usage based on a metering capability, allowing users to pay only for the resources they use.

- | | |
|--|---|
| | <ul style="list-style-type: none">6. Scalability: Cloud computing services can easily scale up or down as required, providing businesses with the flexibility to respond to changes in demand.7. High availability: Cloud providers use multiple servers and data centers to ensure that services are always available and accessible. |
|--|---|

8. Cost-effective: Cloud computing allows organizations to pay only for the resources they use, which can be more cost-effective than maintaining their own IT infrastructure.
9. Security: Cloud providers use various security measures to protect data, such as encryption and multi-factor authentication.
10. Mobility: Cloud computing enables employees to access their data and applications from anywhere, on any device, increasing flexibility and productivity.

Advantages of cloud

1. Cost-effective: Cloud computing allows organizations to pay only for the resources they use, which can be more cost-effective than maintaining their own IT infrastructure.
2. Scalability: Cloud computing services can easily scale up or down as required, providing businesses with the flexibility to respond to changes in demand.
3. High availability: Cloud providers use multiple servers and data centers to ensure that services are always available and accessible.
4. Accessibility: Cloud computing enables employees to access their data and applications from anywhere, on any device, increasing flexibility and productivity.
5. Security: Cloud providers use various security measures to protect data, such as encryption and multi-factor authentication.
6. Automated software updates: Cloud providers often handle software updates and maintenance, reducing the burden on IT departments.
7. Backup and disaster recovery: Cloud providers often offer built-in backup and disaster recovery solutions, reducing the need for businesses to invest in their own.
8. Collaboration: Cloud-based tools and services make it easy for remote teams to collaborate and share files.

Disadvantages of cloud

1. Dependence on internet connectivity: Cloud computing requires a stable internet connection to function properly, which can be a problem for organizations in remote or rural areas.
2. Security concerns: Storing data and applications on remote servers can raise security concerns, such as data breaches and unauthorized access.
3. Limited control over data: Organizations may have limited control over their data when it's stored on a third-party server.
4. Limited customization: Organizations may have limited ability to customize their cloud-based solutions, which can make it difficult to meet specific business needs.
5. Limited portability: Some cloud-based solutions may be proprietary and therefore locked into a particular vendor, making it difficult to move data or applications to another provider.
6. Compliance and regulatory issues: Organizations may be required to comply with certain regulations or standards, and cloud-based solutions may not meet these requirements.

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| | <p>7. Service downtime: Cloud providers may experience service downtime due to maintenance, updates, or other issues, causing disruptions to the business.</p> |
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Conclusion :	Understanding different types of virtualization techniques
References:	Give References: 1. https://www.nist.gov/system/files/documents/itl/cloud/NIST_SP-500-291_Version2_2013_June18_FINAL.pdf

Experiment – 2

Name :- shrikrishna umbare

Roll No :-66

TE Comps Batch: C

Sub: Skill Based Lab : Cloud Computing

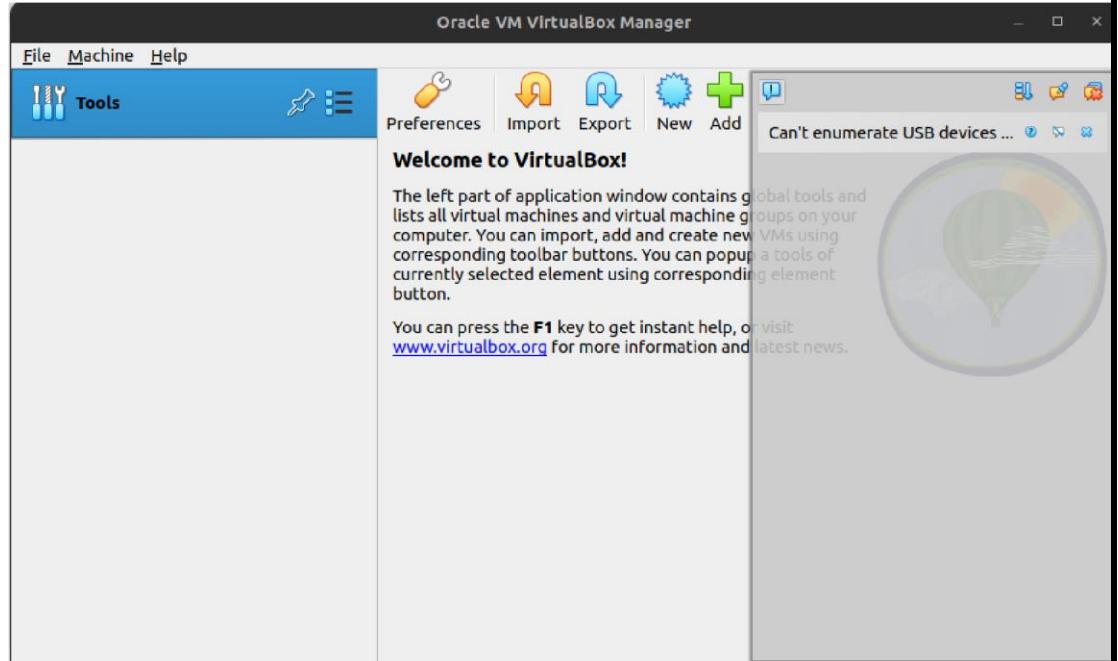
To study and implement Hosted Virtualization using VirtualBox& KVM.	
Learning Objective:	To make students familiar with virtualization software's.
Learning Outcome:	Students will be able to implement Hosted Virtualization using VirtualBox& KVM.
Course Outcome:	CSL605.1
Program Outcome:	3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. 5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Analysis,Apply

Theory:	<p>1.Explain Virtualization along with their types.</p> <p>Virtualization is the creation of a virtual version of something, such as a operating system, a server, a storage device, or network resources. It allows multiple systems to run on a single physical machine, by creating a layer of abstraction between the physical hardware and the software.</p> <p>There are several types of virtualization, including:</p> <ol style="list-style-type: none"> 1. Server virtualization: This type of virtualization allows multiple virtual servers to run on a single physical server. Each virtual server can run its own operating system and applications, as if it were a separate physical machine. 2. Desktop virtualization: This type of virtualization allows multiple virtual desktops to run on a single physical machine. Each virtual desktop can have its own operating system, applications, and user settings, as if it were a separate physical machine. 3. Network virtualization: This type of virtualization allows multiple virtual networks to run on a single physical network. Each virtual network can have its own IP addresses, routing, and security policies, as if it were a separate physical network. 4. Storage virtualization: This type of virtualization allows multiple virtual
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	<p>storage devices to run on a single physical storage device. Each virtual storage device can have its own capacity, performance, and data protection policies, as if it were a separate physical storage device.</p> <ol style="list-style-type: none"> 5. Application virtualization: This type of virtualization allows applications to run on a virtual environment, rather than directly on the host operating system. This allows multiple versions of an application or multiple applications to run on the same system without interfering with each other. 6. Hardware Virtualization: This type of virtualization allows multiple virtual machines to run on a single physical machine by creating virtual copies of the physical resources like CPU, memory, storage and network. <p>These types of virtualization have different use cases and advantages, depending on the needs of the organization. They are widely used in data centers, cloud computing, and other IT environments to improve resource utilization, increase flexibility, and reduce costs.</p>
Procedure	Creating and running Virtual machines inside hosted hypervisors like VirtualBox and KVM.

Steps	<p>1.installation steps 2. Creating and running VM.</p> <ol style="list-style-type: none">1. Download and install a virtualization software such as VMware, VirtualBox, or Hyper-V.2. Create a new virtual machine using the virtualization software and select the operating system you want to install.3. Allocate the necessary resources such as RAM and storage space to the virtual machine.4. Insert the installation media (ISO file or DVD) for the operating system you want to install.5. Start the virtual machine and begin the installation process as you would on a physical machine.6. Once the installation is complete, you can configure the virtual machine settings and start using it.
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Outcome :



Installing KVM

```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi i965-va-driver intel-media-va
  libchromaprint1 libcodec2-1.0 libflashrom1 libflite1 libftdi1-2 libgme0 libgsi
  libnvidia-common-515 libnvidia-decode-515 libnvidia-egl-wayland1 libnvidia-en
  librabbitmq4 librubberband2 libserd-0-0 libshine3 libsord-0-0 libsratom-0-0 l
  libvidstab1.1 libxnvctrl0 libxvidcore4 libzimg2 libzmq5 libzvbi-common libzvbi
  nvidia-utils-515 pkg-config pocketsphinx-en-us screen-resolution-extra va-dri
Use 'sudo apt autoremove' to remove them.
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 9 not upgraded.
Need to get 17.1 kB of archives.
After this operation, 67.6 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 msr-tools amd64 1.3-4
Get:2 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 cpu-checker amd64 0.7-1.3build1
Fetched 17.1 kB in 1s (19.2 kB/s)
Selecting previously unselected package msr-tools.
(Reading database ... 272631 files and directories currently installed.)
Preparing to unpack .../msr-tools_1.3-4_amd64.deb ...
Unpacking msr-tools (1.3-4) ...
Selecting previously unselected package cpu-checker.
Preparing to unpack .../cpu-checker_0.7-1.3build1_amd64.deb ...
Unpacking cpu-checker (0.7-1.3build1) ...
Setting up msr-tools (1.3-4) ...
Setting up cpu-checker (0.7-1.3build1) ...
Processing triggers for man-db (2.10.2-1) ...
```

```
INFO: /dev/kvm exists
KVM acceleration can be used
```

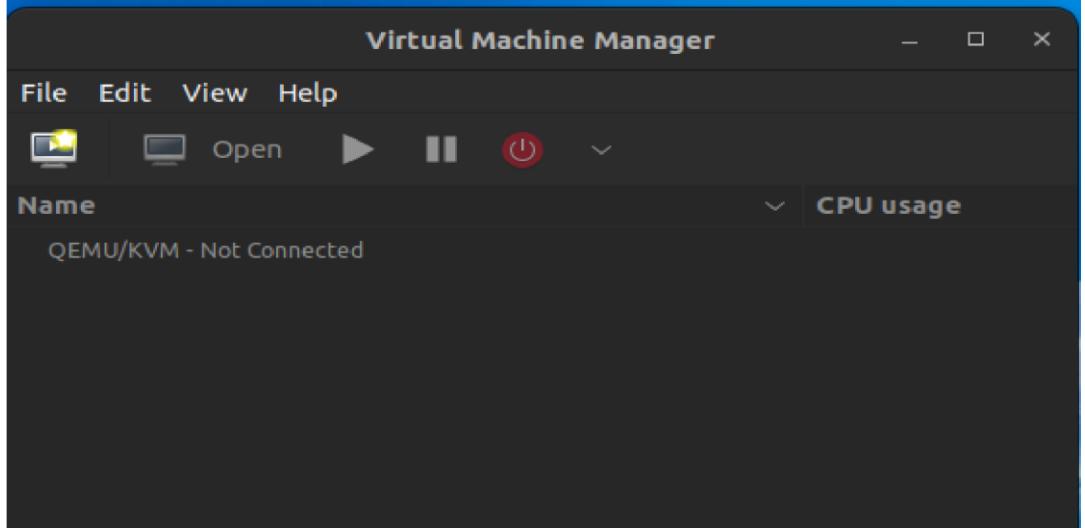
```

Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'qemu-system-x86' instead of 'qemu-kvm'
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi libaacs0 libass9 libavcodec58 libavformat58 libavutil56 libbdplus0 libbluray2 libbs2b0 libchromium-codec0 libflite1 libftdi1-2 libgnome0 libgsm1 libgstreamer-plugins-bad1.0-0 liblilyv0-0 libmfx1 libmysofa1 libnorm1 libnvidia-cfg1-515 libnvidia-common libnvidia-egl-wayland libnvidia-encode-515 libnvidia-extra-515 libnvidia-fbc1-515 libnvidia-gl-515 libopenmp0 libppm-5.3-0 libpostproc55 libshaders libshine3 libssd0-0-0 librato1.4-0-0 librato1.4-gnutls libswresample3 libwscale5 libudfread0 libva-drm2 libva-wayland2 libvdpa1 libvidstab1.1 libzvbi-common libzvbi0 mesa-vdpau-drivers nvidia-compute-utils-515 nvidia-kernel-source-515 nvidia-settings nvidia-utils-515 pkg-config pockets vdpau-driver-all xserver-xorg-video-nvidia-515
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  gir1.2-ayatanaappindicator3-0.1 gir1.2-gtk-vnc-2.0 gir1.2-libosinfo-1.0 gir1.2-libvirt-glib-1.0 gir1.2-spiceclientglib-2.0 gir1.2-spiceclientglib-2.0 ipxe-gnu-256k-compat-efi-roms jq libburn4 libcacard0 libdecor0-0 libdecor-0-plugin1-cairo libfdt1 libgapi0 libgrpc0 libgwdx0 libgtk-vnc-2.0-0 libgvnc-1.0-0 libibusvsi libiscsi7 libisoburn1 libisofs6 libjq1 libjte2 libndctl6 libnss-mymachines libosinfo-1.0-0 libphoda libpmemobj1 librados2 librdmamci libsd12-2.0-0 libslirp0 libspice-client-glib-2.0-0-8 libspice-client-gtk-3.0-5 libspice-server1 libtpms libusbredirparser1 libvirglrenderer1 libvirt-daemon libvirt-daemon-config-network libvirt-daemon-config-nwfilter libvirt-daemon-driver-qemu libvirt-glib-1.0-0 libvirt-glib-1.0-data libvirt0 libxml2-utils mdevctl osinfo-db ovmf python3 libvirt python3-qemu-block-extra qemu-system-gui qemu-utils seabios spice-client-glib-usb-acl-helper swtpm swtpm-tools systemd-container virt-viewer xorriso
Suggested packages:
  libosinfo1108 gstreamer1.0-libav gstreamer1.0-plugins-bad libvirt-login-shell libvirt-daemon-storage-gluster libvirt-daemon-driver-stc libvirt-daemon-driver-storage-rbd libvirt-daemon-driver-storage-zfs libvirt-daemon-driver-lxc libvirt-daemon-driver-vbox libvirt-daemon-driver-pm-utils systemtap zfsutils samba vde2 debootstrap trousers python3-guestfs ssh-askpass python3-argcomplete xorriso-clictk jigit cdk
The following NEW packages will be installed:
  gir1.2-ayatanaappindicator3-0.1 gir1.2-gtk-vnc-2.0 gir1.2-ipxe-gnu-2.0 gir1.2-libosinfo-1.0 gir1.2-spiceclientglib-2.0 gir1.2-spiceclientglib-2.0 ipxe-gnu-256k-compat-efi-roms jq libburn4 libcacard0 libdecor0-0 libdecor-0-plugin1-cairo libfdt1 libgapi0 libgrpc0 libgwdx0 libgtk-vnc-2.0-0 libgvnc-1.0-0 libibusvsi libiscsi7 libisoburn1 libisofs6 libjq1 libjte2 libndctl6 libnss-mymachines libosinfo-1.0-0 libphoda libpmemobj1 librados2 librdmamci libsd12-2.0-0 libslirp0 libspice-client-glib-2.0-0-8 libspice-client-gtk-3.0-5 libspice-server1 libtpms libusbredirparser1 libvirglrenderер1 libvirt-clients libvirt-daemon libvirt-daemon-config-network libvirt-daemon-config-nwfilter libvirt-daemon-driver-qemu libvirt-glib-1.0-0 libvirt-glib-1.0-data libvirt0 libxml2-utils mdevctl osinfo-db ovmf python3 libvirt python3-qemu-system-gui qemu-system-x86 qemu-utils seabios spice-client-glib-usb-acl-helper swtpm swtpm-tools systemd-container virt-upgraded, 81 newly installed, 0 to remove and 9 not upgraded.
Need to get 43.6 MB of archives.
After this operation, 162 MB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 gir1.2-ayatanaappindicator3-0.1 amd64 0.5.90-7ubuntu2 [5,822 B]
Get:2 http://in.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 libgvnc-1.0-0 amd64 1.3.0-1ubuntu1 [67.7 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 libgtk-vnc-2.0-0 amd64 1.3.0-1ubuntu1 [38.8 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 gir1.2-gtk-vnc-2.0 amd64 1.3.0-1ubuntu1 [12.2 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 spice-client-glib-usb-acl-helper swtpm swtpm-tools systemd-container virt-viewer xorriso
Get:6 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libcacard0 amd64 1.12.8.0-3build2 [38.0 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libphobos2 2.0-common all 2.5.1 [12.5 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libphobos2-2.0-0 amd64 2.5.1 [28.7 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libusbredirparser1 amd64 0.11.0-2build1 [15.9 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libusbredirhost1 amd64 0.11.0-2build1 [19.7 kB]
Get:11 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libspice-client-glib-2.0-0-8 amd64 0.39-3ubuntu1 [326 kB]
Get:12 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 gir1.2-spiceclientglib-2.0 amd64 0.39-3ubuntu1 [14.3 kB]
Get:13 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libspice-client-gtk-3.0-5 amd64 0.39-3ubuntu1 [62.0 kB]
Get:14 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 gir1.2-spiceclientglib-2.0-0-8 amd64 0.39-3ubuntu1 [5,610 B]
Get:15 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libibusvsi1 amd64 39.0-1 [69.3 kB]
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Get:17 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 ipxe-gnu all 1.21.1+git-20220113.fbbcd3926-0ubuntu1 [1,569 kB]
Get:18 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 ipxe-gnu-256k-compat-efi-roms all 1.0.0+git-20150424.a25a16d-0ubuntu4 [552 kB]
Get:19 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libjq1 amd64 1.6-2.1ubuntu3 [52.5 kB]
Get:20 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libl2l1 amd64 1.6-2.1ubuntu3 [52.5 kB]
Get:21 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libburn4 amd64 1.5.4-1 [162 kB]
Get:22 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libdaxctl1 amd64 72.1-1 [19.8 kB]
Get:23 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libdecor0-0 amd64 0.1.0-3build1 [15.1 kB]
Get:24 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libdecor-0-plugin1-cairo amd64 0.1.0-3build1 [20.4 kB]
Get:25 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libgrxdr0 amd64 10.1-1 [22.1 kB]
Get:26 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libglusters0 amd64 10.1-1 [288 kB]
Get:27 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libgrpc0 amd64 10.1-1 [47.1 kB]
Get:28 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libgrap0 amd64 10.1-1 [77.3 kB]
Get:29 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libgovirt-common all 0.3.8-1 [19.7 kB]
Get:30 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libgovirt2 amd64 0.3.8-1 [46.0 kB]
Get:31 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libdmamci1 amd64 39.0-1 [77.2 kB]
Get:32 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libiscsi7 amd64 1.19.2-0build2 [78.6 kB]
Get:33 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libjte2 amd64 1.22.3build1 [27.0 kB]
Get:34 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libisofs6 amd64 1.5.4-1 [210 kB]
Get:35 http://in.archive.ubuntu.com/ubuntu jammy/universe amd64 libisoburn1 amd64 1.5.4-2 [492 kB]
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Get:40 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 librdm1 amd64 17.2.0-0ubuntu0.22.04.2 [3,539 kB]
Get:41 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 libslirp0 amd64 2.0.29+dfsg-2ubuntu1.22.04.1 [582 kB]
Get:42 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libslirp0 amd64 4.6.1-1build1 [61.5 kB]
Get:43 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libspice-server1 amd64 0.15.0-2ubuntu4 [351 kB]
Get:44 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libtpms0 amd64 0.9.3-0ubuntu1 [384 kB]
Get:45 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 liburing2 amd64 2.1-2build1 [10.3 kB]
Get:46 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 libvirglrenderер1 amd64 0.9.1-1-exp1ubuntu2 [188 kB]
Get:47 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 libvirt0 amd64 8.0.0-1ubuntu7.4 [1,755 kB]

```

```
Setting up ipxe-qemu (1.21.1+git-20220113.fbbdc3926-0ubuntu1) ...
Setting up jq (1.6-2.1ubuntu3) ...
Setting up libdecor-0-0:amd64 (0.1.0-3build1) ...
Setting up libndctl6:amd64 (72.1-1) ...
Setting up ipxe-gemu-256k-compat-efi-roms (1.0.0+git-20150424.a25a16d-0ubuntu4) ...
Setting up libtpns0:amd64 (0.9.3-0ubuntu1) ...
Setting up libburn4:amd64 (1.5.4-1) ...
Setting up liburing2:amd64 (2.1-2build1) ...
Setting up libxml2-utils (2.9.13+dfsg-1ubuntu0.2) ...
Setting up libSDL2-2.0-0:amd64 (2.0.20+dfsg-2ubuntu1.22.04.1) ...
Setting up libvirt-daemon-config-nwfilter (8.0.0-1ubuntu7.4) ...
Setting up libpmem1:amd64 (1.11.1-3build1) ...
Setting up gir1.2-ayatanaappindicator3-0.1 (0.5.00-7ubuntu2) ...
Setting up libgtk-vnc-2.0-0:amd64 (1.3.0-1ubuntu1) ...
Setting up libgwdxdr0:amd64 (10.1-1) ...
Setting up mdevctl (0.81-1) ...
Setting up libphodav-2.0-0:amd64 (2.5-1) ...
Setting up libisofs6:amd64 (1.5.4-1) ...
Setting up librdnacm1:amd64 (39.0-1) ...
Setting up librados2 (17.2.0-0ubuntu0.22.04.2) ...
Setting up qemu-system-common (1:6.2+dfsg-2ubuntu6.6) ...
Created symlink /etc/systemd/system/multi-user.target.wants/qemu-kvm.service → /lib/systemd/system/qemu-kvm.service.
Setting up python3-libvirt (8.0.0-1build1) ...
Setting up libvirt-clients (8.0.0-1ubuntu7.4) ...
Setting up gir1.2-libvirt-glib-1.0:amd64 (4.0.0-2) ...
Setting up qemu-system-x86 (1:6.2+dfsg-2ubuntu6.6) ...
Setting up libusbredirhost1:amd64 (0.11.0-2build1) ...
Setting up libosinfo-1.0:amd64 (1.8.0-1) ...
Setting up libnss-mymachines:amd64 (249.11-0ubuntu3.6) ...
First installation detected...
Checking NSS setup...
Setting up swtpm (0.6.3-0ubuntu3) ...
Setting up libpmemobj1:amd64 (1.11.1-3build1) ...
Setting up libdecor-0-plugin-1-cairo:amd64 (0.1.0-3build1) ...
Setting up libvirt-daemon-driver-qemu (8.0.0-1ubuntu7.4) ...
Setting up gir1.2-gtk-vnc-2.0:amd64 (1.3.0-1ubuntu1) ...
Setting up libisoburn1:amd64 (1.5.4-2) ...
Setting up librbd1 (17.2.0-0ubuntu0.22.04.2) ...
Setting up libvirt-daemon-system-systemd (8.0.0-1ubuntu7.4) ...
Setting up qemu-utils (1:6.2+dfsg-2ubuntu6.6) ...
Setting up libiscsi7:amd64 (1.19.0-3build2) ...
Setting up libvirt-daemon (8.0.0-1ubuntu7.4) ...
Setting up xorriso (1.5.4-2) ...
Setting up gir1.2-libosinfo-1.0:amd64 (1.8.0-1) ...
Setting up libspice-client-glib-2.0-8:amd64 (0.39-3ubuntu1) ...
Setting up libgfrpc0:amd64 (10.1-1) ...
Setting up virtinst (1:4.0.0-1) ...
Setting up gir1.2-spiceclientglib-2.0:amd64 (0.39-3ubuntu1) ...
Setting up qemu-system-gui (1:6.2+dfsg-2ubuntu6.6) ...
Setting up swtpm-tools (0.6.3-0ubuntu3) ...
Adding group 'swtpm' (GID 142) ...
Done.
Warning: The home dir /var/lib/swtpm you specified can't be accessed: No such file or directory
Adding system user 'swtpm' (UID 132) ...
Adding new user 'swtpm' (UID 132) with group 'swtpm' ...
Not creating home directory '/var/lib/swtpm'.
Setting up virt-manager (1:4.0.0-1) ...
Setting up libspice-client-gtk-3.0-5:amd64 (0.39-3ubuntu1) ...
Setting up libgfapi0:amd64 (10.1-1) ...
Setting up gir1.2-spiceclientgtk-3.0:amd64 (0.39-3ubuntu1) ...
Setting up virt-viewer (7.0-2build2) ...
Setting up libvirt-daemon-system (8.0.0-1ubuntu7.4) ...
Adding user libvirt-qemu to group libvirt-qemu
Enabling libvirt default network
Created symlink /etc/systemd/system/multi-user.target.wants/libvirtd.service → /lib/systemd/system/libvirtd.service.
Created symlink /etc/systemd/system/sockets.target.wants/virtlockd.socket → /lib/systemd/system/virtlockd.socket.
Created symlink /etc/systemd/system/sockets.target.wants/virtlogd.socket → /lib/systemd/system/virtlogd.socket.
Created symlink /etc/systemd/system/sockets.target.wants/libvirtd.socket → /lib/systemd/system/libvirtd.socket.
Created symlink /etc/systemd/system/sockets.target.wants/libvirtd-ro.socket → /lib/systemd/system/libvirtd-ro.socket.
Created symlink /etc/systemd/system/multi-user.target.wants/libvirt-guests.service → /lib/systemd/system/libvirt-guests.service.
virtlockd.service is a disabled or a static unit, not starting it.
virtlogd.service is a disabled or a static unit, not starting it.
Created symlink /etc/systemd/system/sockets.target.wants/libvirtd-admin.socket → /lib/systemd/system/libvirtd-admin.socket.
Created symlink /etc/systemd/system/sockets.target.wants/virtlockd-admin.socket → /lib/systemd/system/virtlockd-admin.socket.
Created symlink /etc/systemd/system/sockets.target.wants/virtlogd-admin.socket → /lib/systemd/system/virtlogd-admin.socket.
Setting up libvirt-daemon dnsmasq configuration.
Setting up qemu-block-extra (1:6.2+dfsg-2ubuntu6.6) ...
Created symlink /etc/systemd/system/multi-user.target.wants/run-qemu.mount → /lib/systemd/system/run-qemu.mount.
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1ubuntu3) ...
Processing triggers for libglib2.0-0:amd64 (2.72.4-0ubuntu1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for dbus (1.12.20-2ubuntu4.1) ...
Processing triggers for shared-mime-info (2.1-2) ...
Processing triggers for install-info (6.8-4build1) ...
Processing triggers for mailcap (3.70+nmu1ubuntu1) ...
Processing triggers for desktop-file-utils (0.26-1ubuntu3) ...
bridge-utils: command not found
```

```
● libvirtd.service - Virtualization daemon
   Loaded: loaded (/lib/systemd/system/libvirtd.service; enabled; ver-
   Active: active (running) since Sun 2023-01-29 13:32:12 IST; 3min 4s
 TriggeredBy: ● libvirtd-admin.socket
               ● libvirtd.socket
               ● libvirtd-ro.socket
   Docs: man:libvirtd(8)
         https://libvirt.org
 Main PID: 52185 (libvirtd)
    Tasks: 21 (limit: 32768)
   Memory: 11.6M
      CPU: 1.593s
     CGroup: /system.slice/libvirtd.service
             ├─52185 /usr/sbin/libvirtd
             ├─52319 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsma...
             ├─52320 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsma...
Jan 29 13:32:12 HoneyBadger systemd[1]: Started Virtualization daemon.
Jan 29 13:32:13 HoneyBadger dnsmasq[52319]: started, version 2.86 cache
Jan 29 13:32:13 HoneyBadger dnsmasq[52319]: compile time options: IPv6
Jan 29 13:32:13 HoneyBadger dnsmasq-dhcp[52319]: DHCP, IP range 192.168
Jan 29 13:32:13 HoneyBadger dnsmasq-dhcp[52319]: DHCP, sockets bound e...
Jan 29 13:32:13 HoneyBadger dnsmasq[52319]: reading /etc/resolv.conf
Jan 29 13:32:13 HoneyBadger dnsmasq[52319]: using nameserver 127.0.0.5
Jan 29 13:32:13 HoneyBadger dnsmasq[52319]: read /etc/hosts - 7 address...
Jan 29 13:32:13 HoneyBadger dnsmasq[52319]: read /var/lib/libvirt/dnsm...
Jan 29 13:32:13 HoneyBadger dnsmasq-dhcp[52319]: read /var/lib/libvirt...
lines 1-27/27 (END)
```

	
Conclusion :	Using VirtualBox and KVM, I can implement and understand hosted virtualization.
References:	Give References: 1. https://www.youtube.com/watch?v=rZhMeQjpcrw

Experiment – 3

Name :- shrikrishna Umbare

Roll No :-66

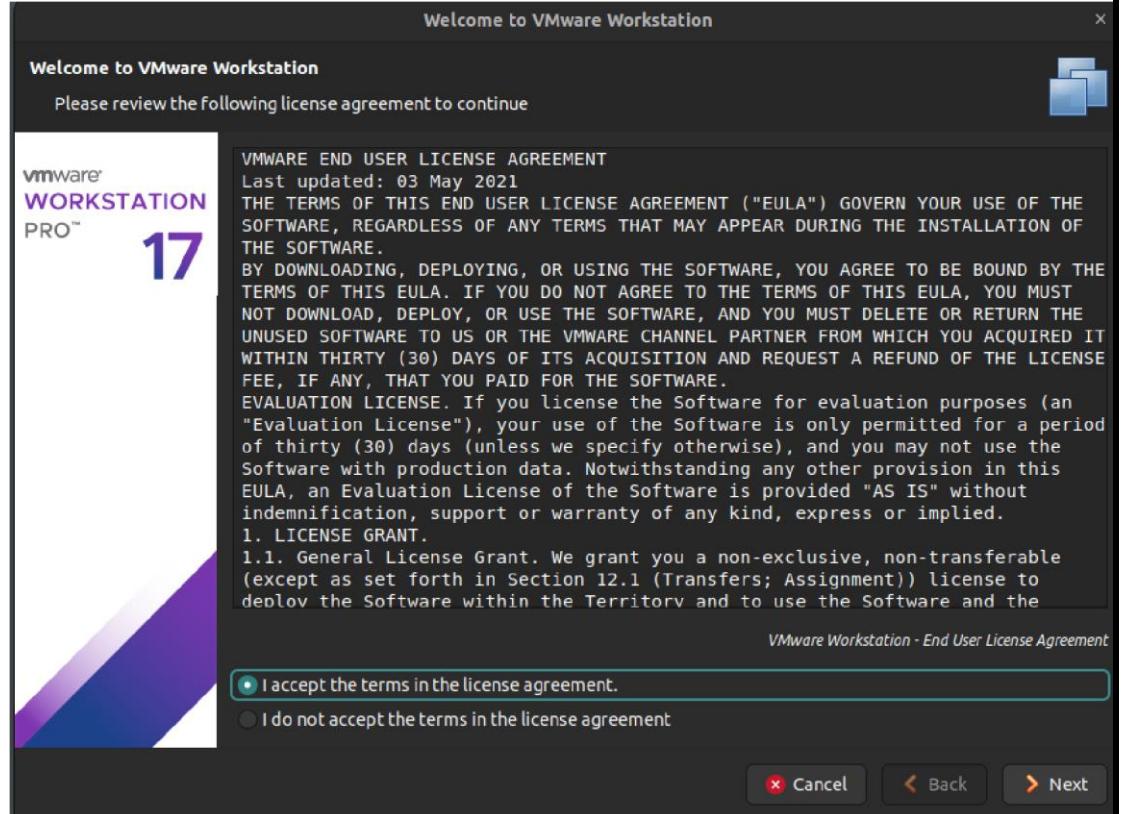
TE Comps Batch: C

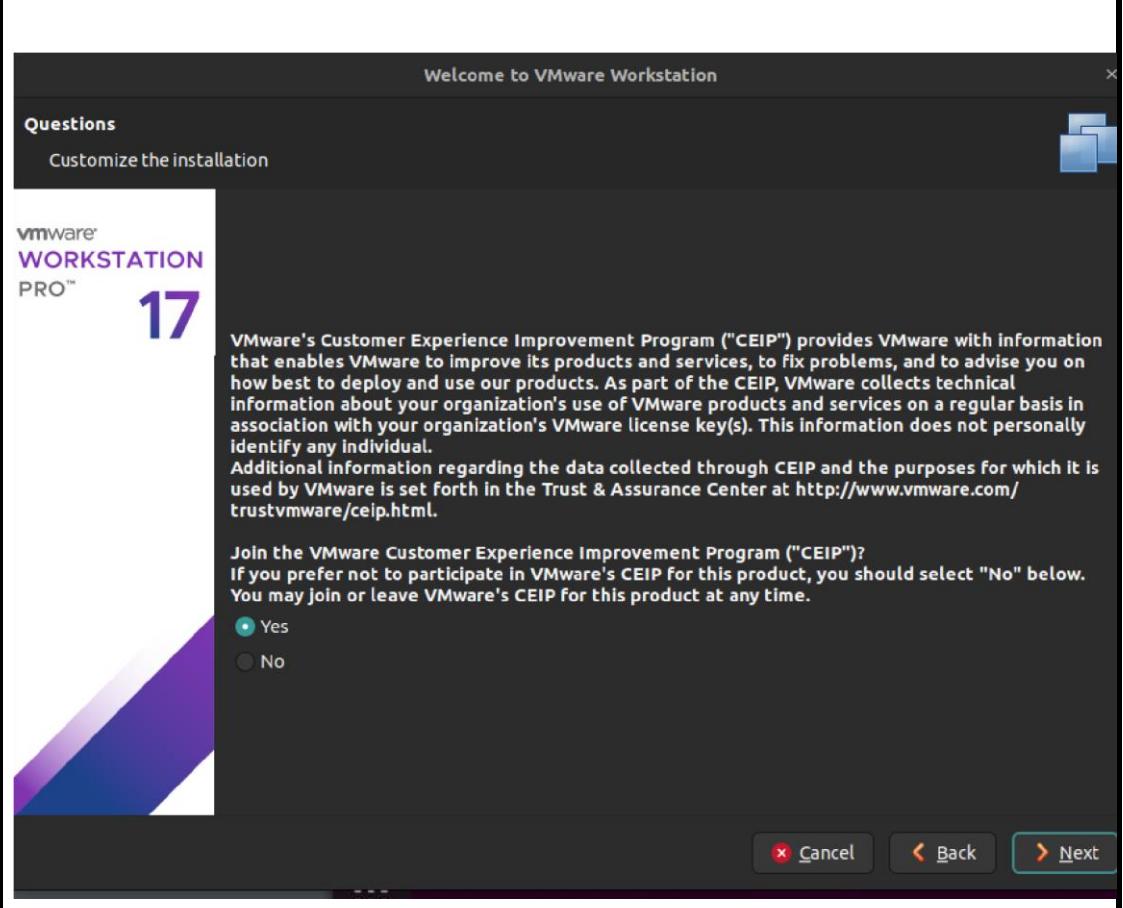
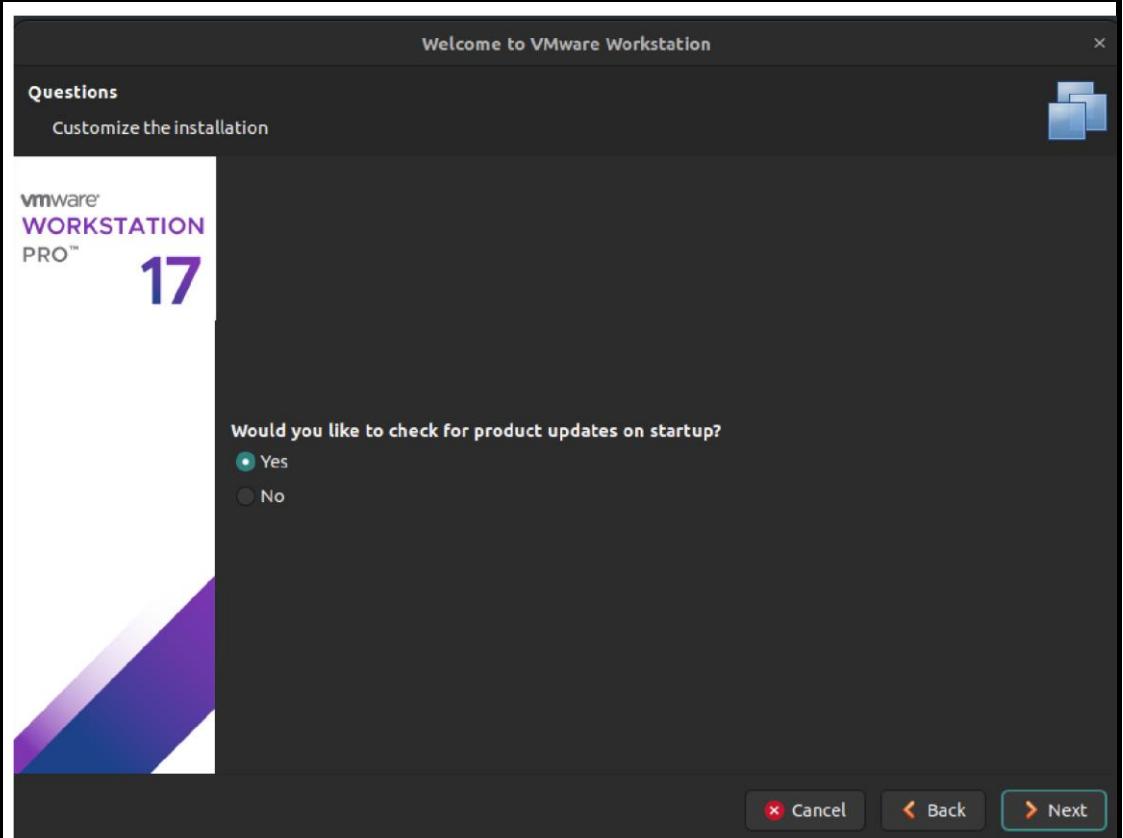
Sub: Skill Based Lab : Cloud Computing

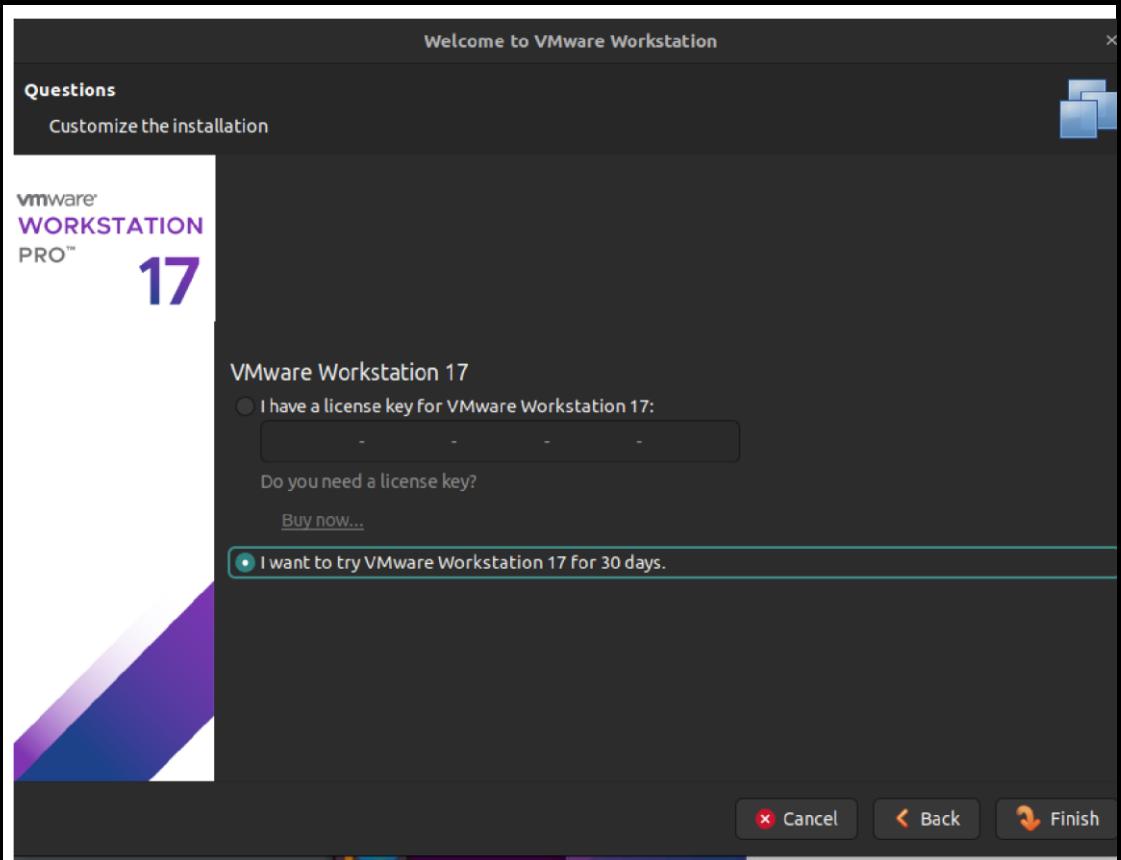
Title: To study and Implement Bare-metal Virtualization using Xen, HyperV or VMWare Esxi.	
Learning Objective:	Students are able gain practical knowledge of bare-Metal Virtualization.
Learning Outcome:	Students will be able to understand the functionality of Bare-metal hypervisors and their relevance in cloud computing platforms.
Course Outcome:	CSL605.1
Program Outcome:	3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. 5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Analysis,Apply.
Theory:	Explain Bare-metal hypervisors and their relevance in cloud computing platforms.
Procedure	Installation steps of VMWare Esxi

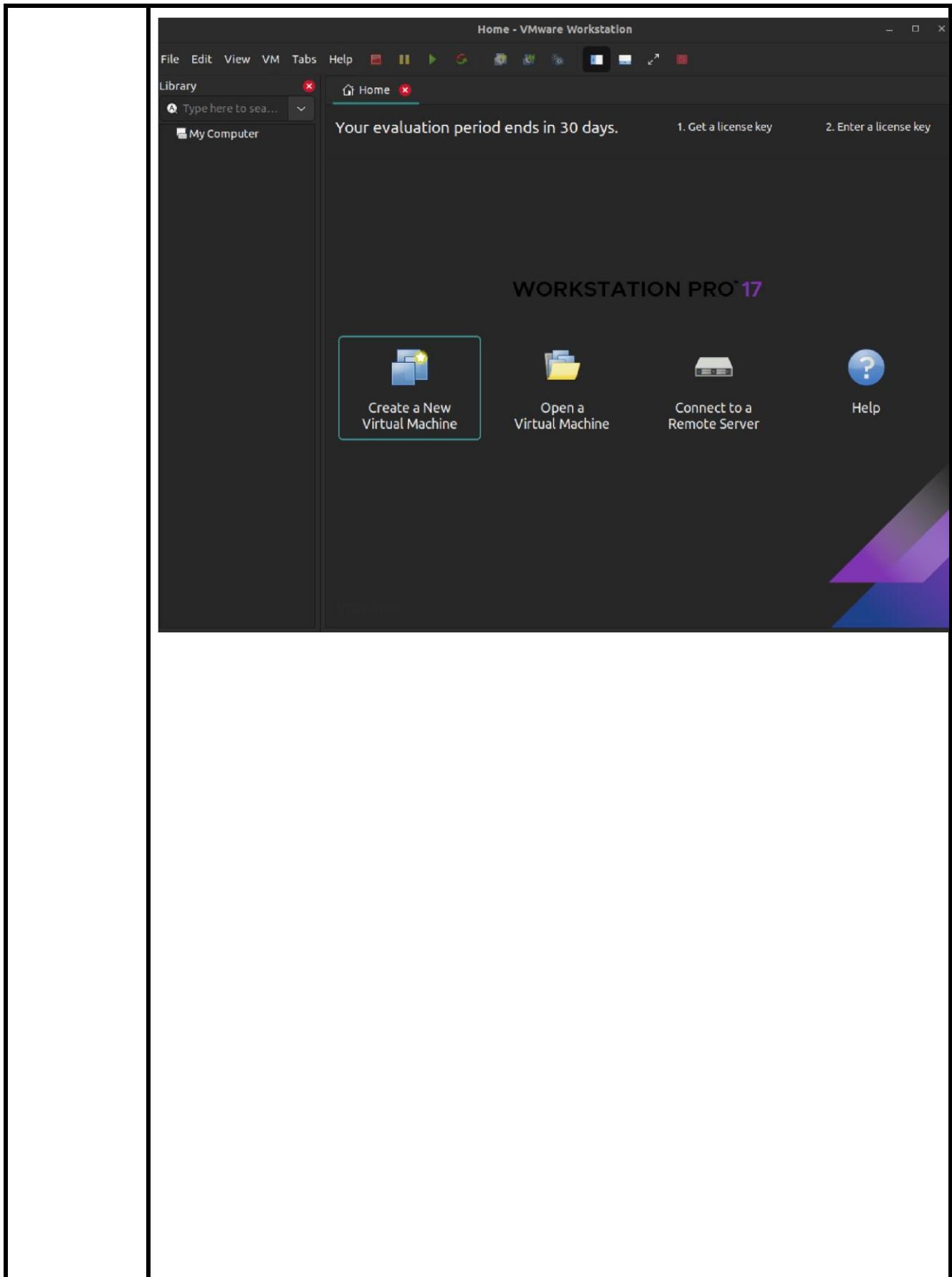
Steps	<p>Write Steps to create a virtual machine using VMWare.</p> <ol style="list-style-type: none"> 1. Install VMware on your computer: You will need to install VMware Workstation, VMware Player or VMware Fusion depending on your operating system. 2. Launch VMware: Once installed, launch the VMware software and select "Create a New Virtual Machine" from the main menu. 3. Choose virtual machine type: You will be prompted to choose the type of virtual machine you want to create. You can choose "Typical" for a basic setup, or "Custom" for advanced options. 4. Select the operating system: You will then be prompted to select the operating system you want to install on the virtual machine. VMware supports a wide range of operating systems including Windows, Linux, and macOS. 5. Assign memory and storage: After you select the operating system, you will be prompted to assign memory and storage to the virtual machine. You can adjust the amount of memory and disk space allocated to the virtual machine.
	<ol style="list-style-type: none"> 6. Configure network settings: Next, you can configure the virtual machine's network settings. You can choose between bridged, NAT, or host-only networking. 7. Install the operating system: Once the virtual machine is created, you will be prompted to install the operating system. You will need to have a installation media (ISO image, CD/DVD) or the operating system files ready to proceed with the installation. 8. Install VMware tools: After the operating system is installed, you will need to install VMware tools. VMware tools provide enhanced performance, mouse integration, and improved video support for the virtual machine. 9. Power on the virtual machine: Once the installation is complete, you can power on the virtual machine. 10. Configure the virtual machine: You can configure the virtual machine's settings such as memory, CPU, and storage according to your requirements.

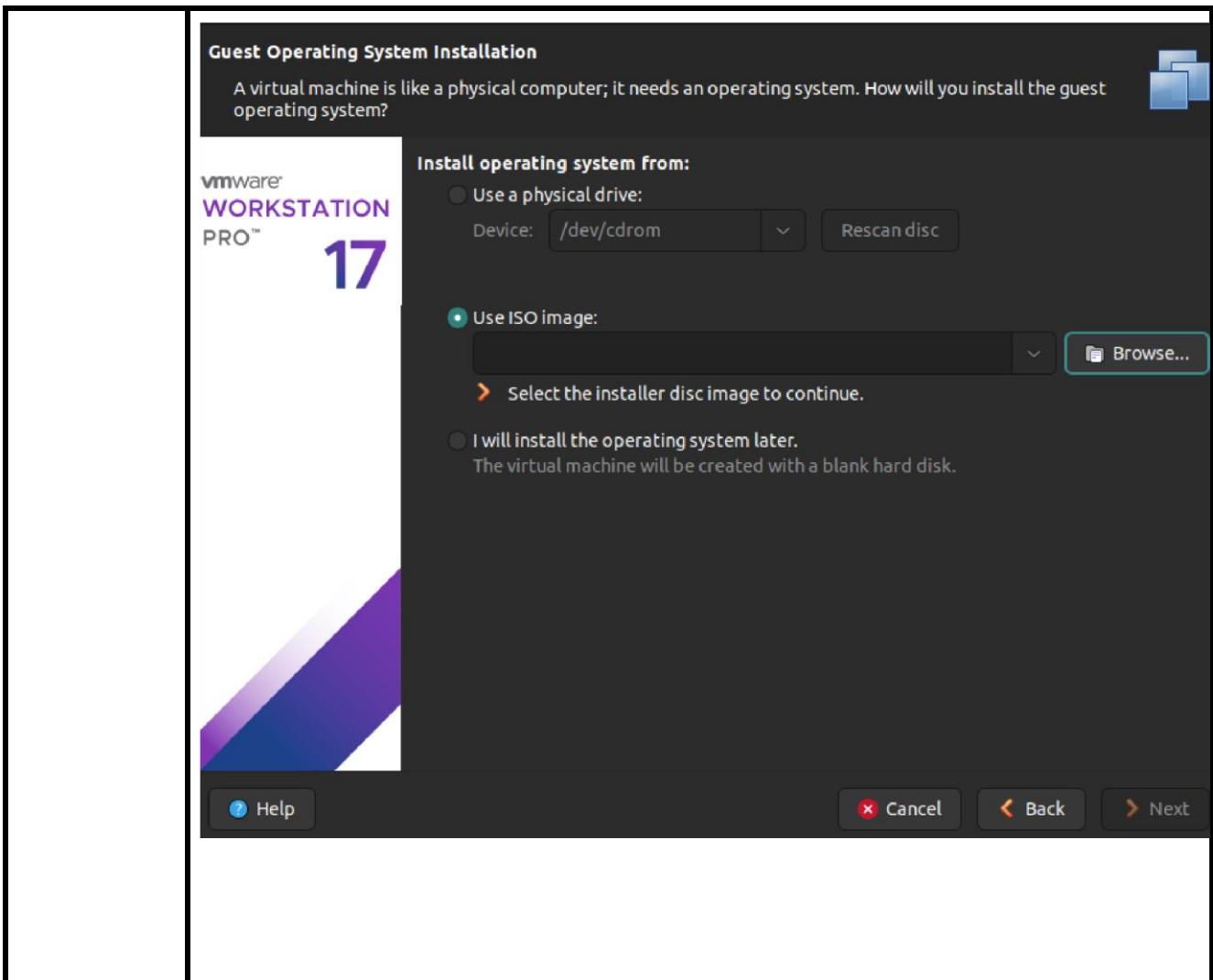
Outcome :

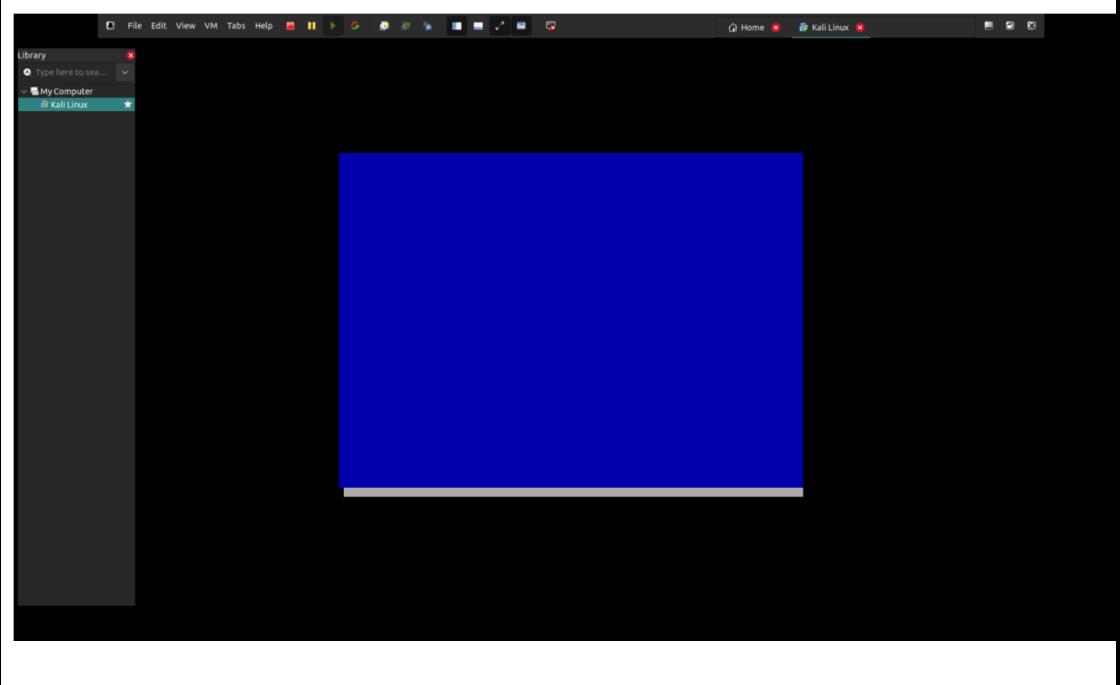
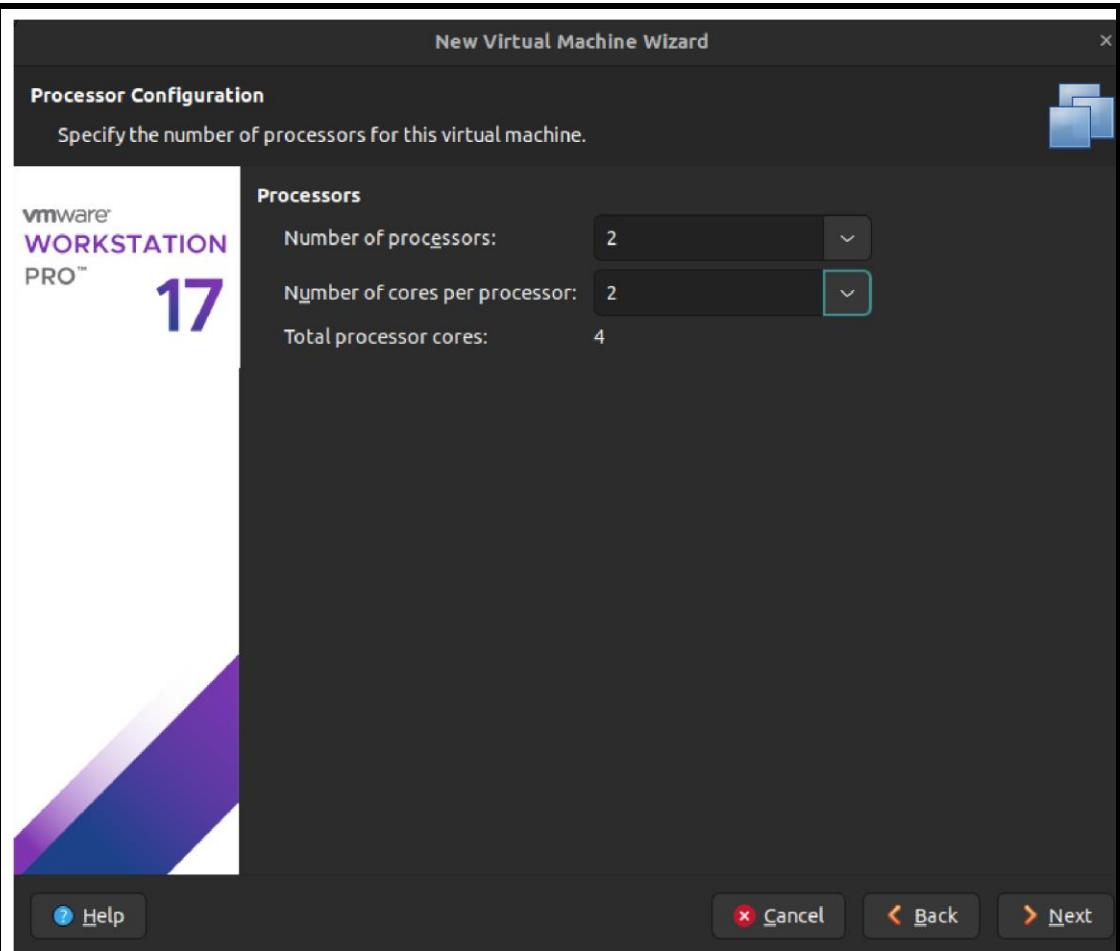












Conclusion : utilising Xen, HyperV, or VMware Esxi to comprehend and deploy bare-metal virtualization

References: Give References: <https://www.youtube.com/watch?v=BHpRTVP8upg&t=8s>

Experiment – 4

Name :- shrikrishna Umbare

Roll No :-66

TE Comps Batch: C

Sub: Skill Based Lab : Cloud Computing

Title: To study and Implement Infrastructure as a Service using AWS/Microsoft Azure.	
Learning Objective:	Student will be able to hand on creating and running Linux/Windows Virtual machine
Learning Outcome:	Students will be able To demonstrate the steps to create and run virtual machines inside the Public cloud platform.
Course Outcome:	CSL605.2
Program Outcome:	3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. 5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Analysis, Apply.
Procedure	Creating and running Linux/Windows Virtual machines inside Amazon EC2 or Microsoft Azure Compute and accessing them using RDP or VNC tools.
Steps	1.Do Registration using GitHub students developer pack for Azure Or 1.Do registration in AWS cloud making Virtual debit card 2.Once registration over then Create Instances for running virtual machines. 3. Run the instance 4.Create virtual machine

Outcome :

Steps to create Virtual Machine:

This subscription may not be eligible to deploy VMs of certain sizes in certain regions.

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * Resource group * Create new

Instance details

Virtual machine name * Region * Availability options Security type Image * See all images | Configure VM generation
VM architecture Arm64 x64
Arm64 is not supported with the selected image.

Run with Azure Spot discount

Review + create < Previous Next : Disks >

Administrator account

Username * Password * Confirm password *

Inbound port rules

Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

Public inbound ports * None Allow selected ports
Select inbound ports *

⚠️ This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.

Licensing

Save up to 49% with a license you already own using Azure Hybrid Benefit. Learn more ⓘ
Would you like to use an existing Windows Server license? *
Review Azure hybrid benefit compliance ⓘ

Review + create < Previous Next : Disks >

Microsoft Azure

Home > Create a resource >

Create a virtual machine ...

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Azure VMs have one operating system disk and a temporary disk for short-term storage. You can attach additional data disks. The size of the VM determines the type of storage you can use and the number of data disks allowed. [Learn more](#)

VM disk encryption

Azure disk storage encryption automatically encrypts your data stored on Azure managed disks (OS and data disks) at rest by default when persisting it to the cloud.

Encryption at host (Encryption at host is not registered for the selected subscription. [Learn more about enabling this feature](#))

OS disk

OS disk type * The selected VM size supports premium disks. We recommend Premium SSD for high IOPS workloads. Virtual machines with Premium SSD disks qualify for the 99.9% connectivity SLA.

Delete with VM

Key management

Enable Ultra Disk compatibility Ultra disk is supported in Availability Zone(s) 1,2,3 for the selected VM size Standard_DS2_v3.

Data disks for vpu11

You can add and configure additional data disks for your virtual machine or attach existing disks. This VM also comes with a temporary disk.

LUN	Name	Size (GB)	Disk type	Host caching	Delete with VM

Review + create < Previous Next : Networking > Give feedback

Microsoft Azure

Home > Create a resource >

Create a virtual machine ...

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Define network connectivity for your virtual machine by configuring network interface card (NIC) settings. You can control ports, inbound and outbound connectivity with security group rules, or place behind an existing load balancing solution. [Learn more](#)

Network interface

When creating a virtual machine, a network interface will be created for you.

Virtual network * Create new

Subnet * Manage subnet configuration

Public IP Create new

NIC network security group None Basic Advanced

Public inbound ports * None Allow selected ports

Select inbound ports *

⚠ This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.

Review + create < Previous Next : Management > Give feedback

portal.azure.com/#create/Microsoft.VirtualMachine-ARM

Microsoft Azure

Home > Create a resource >

Create a virtual machine

Management

Configure management options for your VM.

Microsoft Defender for Cloud

Microsoft Defender for Cloud provides unified security management and advanced threat protection across hybrid cloud workloads. [Learn more](#)

Your subscription is protected by Microsoft Defender for Cloud basic plan.

Identity

Enable system assigned managed identity

Azure AD

Login with Azure AD

RBAC role assignment of Virtual Machine Administrator Login or Virtual Machine User Login is required when using Azure AD login. [Learn more](#)

Auto-shutdown

Enable auto-shutdown

Site Recovery

Enable Disaster Recovery

Guest OS updates

Enable hotpatch

[Review + create](#) < Previous Next : Monitoring > Give feedback

Type here to search

portal.azure.com/#create/Microsoft.VirtualMachine-ARM

Microsoft Azure

Home > Create a resource >

Create a virtual machine

Monitoring

Configure monitoring options for your VM.

Alerts

Enable recommended alert rules

Diagnostics

Boot diagnostics Enable with managed storage account (recommended) Enable with custom storage account Disable

Enable OS guest diagnostics

[Review + create](#) < Previous Next : Advanced > Give feedback

Type here to search

portal.azure.com/#create/Microsoft.VirtualMachine-ARM

Microsoft Azure Search resources, services, and docs (G+)

Home > Create a resource > Create a virtual machine ...

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Add additional configuration agents, scripts or applications via virtual machine extensions or cloud-init.

Extensions Extensions provide post-deployment configuration and automation.

Extensions Select an extension to install

VM applications VM applications contain application files that are securely and reliably downloaded on your VM after deployment. In addition to the application files, an install and uninstall script are included in the application. You can easily add or remove applications on your VM after create. Learn more ↗

Select a VM application to install

Custom data Pass a script, configuration file, or other data into the virtual machine while it is being provisioned. The data will be saved on the VM in a known location. Learn more about custom data for VMs ↗

Custom data

Your image must have a code to support consumption of custom data. If your image supports cloud-init, custom-data will be processed by cloud-init. Learn more about custom data for VMs ↗

User data

Review + create < Previous Next : Tags > Give feedback

Windows Type here to search Cloud 28°C ENG 12:14 29-01-2023

portal.azure.com/#create/Microsoft.VirtualMachine-ARM

Microsoft Azure Search resources, services, and docs (G+)

Home > Create a resource > Create a virtual machine ...

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Tags are name/value pairs that enable you to categorize resources and view consolidated billing by applying the same tag to multiple resources and resource groups. Learn more about tags ↗

Note that if you create tag and then change resource settings on other tabs, your tags will be automatically updated.

Name <input type="text"/>	Value <input type="text"/>	Resource <input type="button"/>
vipul	vipul	13 selected
		13 selected

Review + create < Previous Next : Review + create > Give feedback

Windows Type here to search Cloud 28°C ENG 12:14 29-01-2023

portal.azure.com/#create/Microsoft.VirtualMachine-ARM

Create a virtual machine

Validation passed

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Cost given below is an estimate and not the final price. Please use [Pricing calculator](#) for all your pricing needs.

PRODUCT DETAILS

1 X Standard D2s v3 by Microsoft Subscription credits apply 13.5445 INR/Rupee pricing for other VM sizes

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the Azure Marketplace Terms for additional details.

Basics

Subscription Azure for Students

Create < Previous Next > Download a template for automation

Type here to search

Give feedback

12:15 29-01-2023

Configuration of Virtual Machine:

portal.azure.com/#@221vipul0007dbit.onmicrosoft.com/resource/subscriptions/6c4851a2-4bb2-4fd9-8cb6-d51b69c7cb12/resourceGroups/vipul/providers/Microsoft.Compute/virtualMachines/vipul

vipul Virtual machine

Overview Activity log Access control (IAM) Tags Diagnose and solve problems Settings Networking Connect Windows Admin Center Disks Size Microsoft Defender for Cloud Advisor recommendations Extensions + applications Continuous delivery Availability + scaling Configuration

Connect Start Restart Stop Capture Delete Refresh Open in mobile CLI / PS Feedback

vipul virtual machine agent status is not ready. Troubleshoot the issue →

Essentials

Resource group (move) : CC	Operating system : Windows
Status : Running	Size : Standard D2s v3 (2 vcpus, 8 GB memory)
Location : East US	Public IP address : 52.255.140.117
Subscription (move) : Azure for Students	Virtual network/subnet : CC-vnet/default
Subscription ID : 6c4851a2-4bb2-4fd9-8cb6-d51b69c7cb12	DNS name : Not configured
Tags (edit) : Click here to add tags	

Properties Monitoring Capabilities (8) Recommendations Tutorials

Virtual machine

Computer name	vipul
Health state	-
Operating system	Windows
Publisher	MicrosoftWindowsServer
Offer	WindowsServer
Plan	2022-datacenter-azure-edition
VM generation	V2

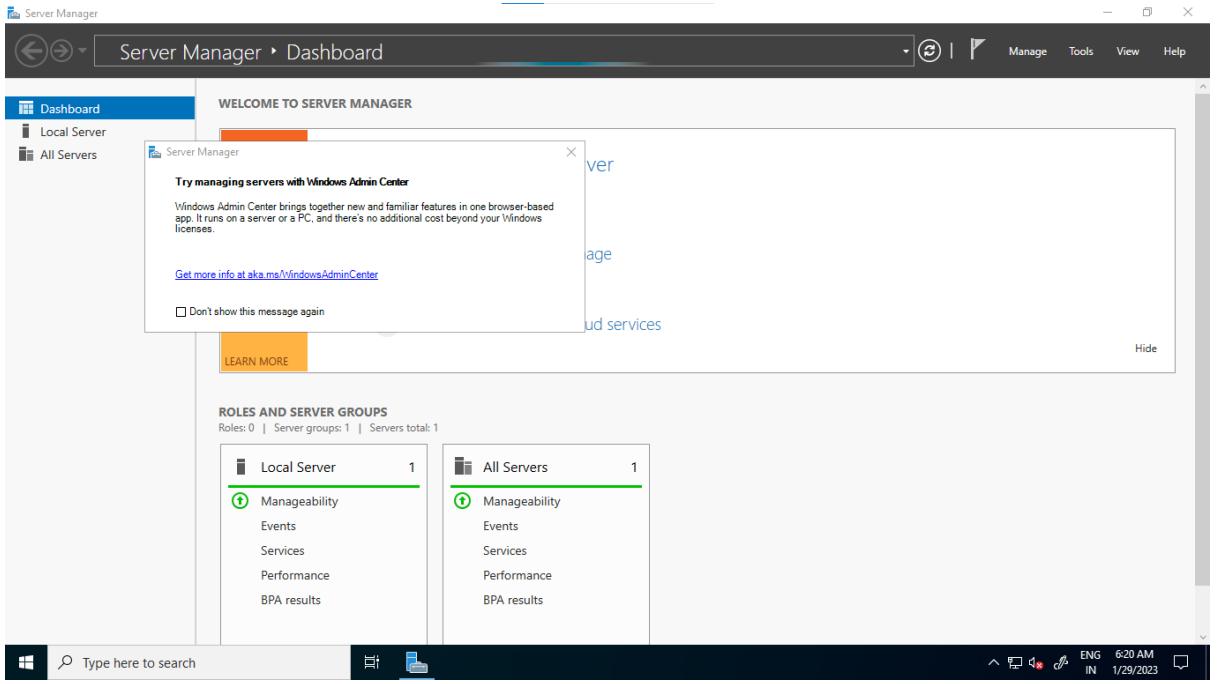
Networking

Public IP address	52.255.140.117
Public IP address (IPv6)	-
Private IP address	10.0.0.4
Private IP address (IPv6)	-
Virtual network/subnet	CC-vnet/default
DNS name	Configure

Type here to search

Give feedback

11:50 29-01-2023

	<p>Virtual Machine:</p>  <p>The screenshot shows the Microsoft Server Manager Dashboard. At the top, there's a navigation bar with 'Server Manager' and 'Dashboard'. Below it, a message box says 'WELCOME TO SERVER MANAGER' and 'Try managing servers with Windows Admin Center'. It includes a link to 'Get more info at aka.ms/windowsAdminCenter' and a checkbox for 'Don't show this message again'. A 'LEARN MORE' button is also present. The main area displays 'ROLES AND SERVER GROUPS' with two sections: 'Local Server' (1 item) and 'All Servers' (1 item). Both sections under 'Manageability' include 'Events', 'Services', 'Performance', and 'BPA results'. At the bottom, there's a search bar with 'Type here to search' and a system status bar with icons and the text 'ENG IN 8:20 AM 17/09/2023'.</p>
Conclusion :	<ol style="list-style-type: none"> 1. Acquired knowledge of Azure software. 2. Implemented windows virtual machine using Microsoft Azure.
References:	Give References: https://www.youtube.com/watch?v=PrkEulPOV4s&t=104s

Rubrics for Assessment

Timely Submission	Submitted after 2 weeks 0	Submitted after deadline 1	On time Submission 2
Understanding	Student is confused about the concept 0	Students has justifiably understood the concept 2	Students is very clear about the concepts 3
Performance	Students has not performed the Experiment 0	Student has performed with help 2	Student has independently performed the experiment 3
Development	Students struggle to run virtual machines. 0	Student can write steps the requirement stated 1	Student can write exceptional steps with his own ideas 2

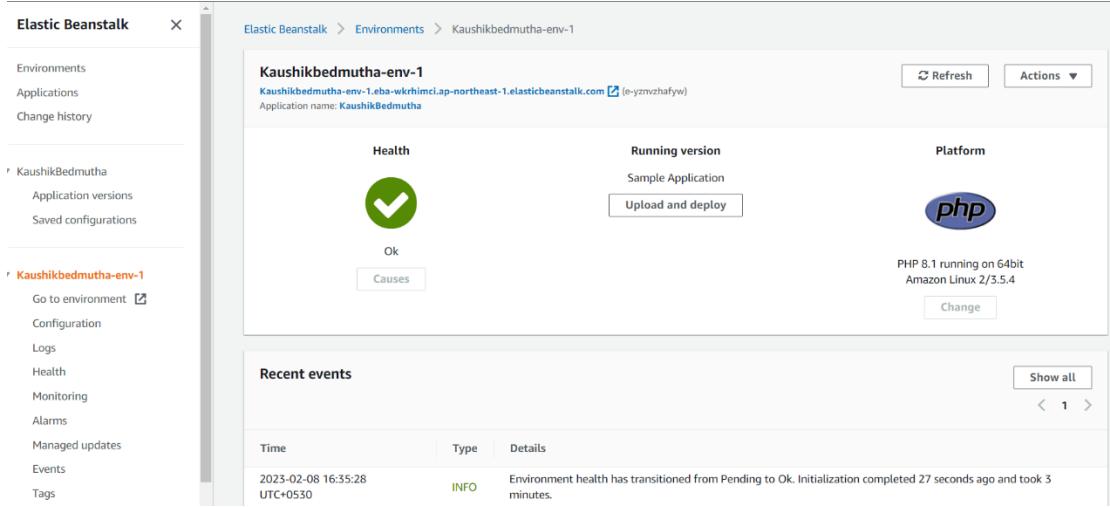
Experiment – 5

Name : shrikrishna Umbare

Roll no : 66

Batch : C

To study and Implement Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service.	
Learning Objective:	Students will be demonstrating on Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service.
Learning Outcome:	Students will be able to demonstrate the steps to deploy Web applications or Web services written in different languages on AWS Elastic Beanstalk/ Microsoft Azure App Service.
Course Outcome:	CSL605.3
Program Outcome:	3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. 5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Analysis,Apply.
Theory:	Explain Elastic Beanstalk. Elastic Beanstalk is a fully managed service provided by Amazon Web Services (AWS) for deploying and running web applications. It abstracts the infrastructure management, allowing developers to focus on writing code, and automatically handles deployment, capacity provisioning, load balancing, auto-scaling, and application health. Elastic Beanstalk supports multiple programming languages and web application platforms, including Java, .NET, PHP, Node.js, Python, Ruby, and Go. It integrates with other AWS services, such as S3, RDS, and CloudWatch, to provide a complete solution for web application hosting.
Procedure	Implement Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service.
Steps	<p>Log in to the AWS Management Console.</p> <p>Select the Elastic Beanstalk service from the list of services.</p> <p>Choose the desired platform and programming language for the application.</p> <p>Provide a unique name for the application environment and choose the region.</p> <p>Select the desired instance type and configure the environment resources.</p> <p>Upload the application code or select an existing application code stored in S3.</p>

	<p>Configure the environment's security settings, if desired.</p> <p>Review the environment settings and launch the environment.</p> <p>Wait for the environment to become fully operational and verify the application is running correctly.</p> <p>Use the AWS Management Console, AWS CLI, or SDKs to monitor, manage, and update the application and its environment as needed.</p>
Outcome :	<p>Created sample Application :</p>  <p>Congratulations! Your AWS Elastic Beanstalk <i>PHP</i> application is now running on your own dedicated environment in the AWS Cloud You are running PHP version 8.1.14 This environment is launched with Elastic Beanstalk PHP Platform</p> <p>What's Next?</p> <ul style="list-style-type: none"> ▪ AWS Elastic Beanstalk overview ▪ Deploying AWS Elastic Beanstalk Applications in PHP Using Eb and Git ▪ Using Amazon RDS with PHP ▪ Customizing the Software on EC2 Instances ▪ Customizing Environment Resources <p>AWS SDK for PHP</p> <ul style="list-style-type: none"> ▪ AWS SDK for PHP home ▪ PHP developer center ▪ AWS SDK for PHP on GitHub
Conclusion :	<p>Learning points</p> <ol style="list-style-type: none"> 1) Managed Service: Elastic Beanstalk is a fully managed service by AWS, which means the user does not have to worry about infrastructure management, system administration, and maintenance. 2) Multi-Language Support: Elastic Beanstalk supports multiple programming languages such as Java, .NET, PHP, Node.js, Python, Ruby, and Go. 3) Auto-Scaling and Load Balancing: Elastic Beanstalk automatically handles load balancing and auto-scaling, which means the application can automatically scale

	<p>up or down based on demand.</p> <p>4) Integration with other AWS Services: Elastic Beanstalk integrates with other AWS services such as S3, RDS, and CloudWatch to provide a complete solution for web application hosting.</p>
References:	Give References: https://www.youtube.com/watch?v=51YwXvJ9LOE

Rubrics for Assessment

Timely Submission	Submitted after 2 weeks 0	Submitted after deadline 1	On time Submission 2
Understanding	Student is confused about the concept 0	Students has justifiably understood the concept 2	Students is very clear about the concepts 3
Performance	Students has not performed the Experiment 0	Student has performed with help 2	Student has independently performed the experiment 3
Development	Students struggle to run virtual machines. 0	Student can write steps the requirement stated 1	Student can write exceptional steps with his own ideas 2

Experiment – 6

NAME : Shrikrishna Umbare

ROLL NO: 66

YEAR : 2023

SUBJECT NAME AND CODE: CSL605 Cloud Computing

Learning Objective:	To study and Implement Storage as a Service using Own Cloud/ AWS S3, Glaciers/ Azure Storage.
Learning Outcome:	Students will be able to To understand the concept of Cloud storage and to demonstrate the different types of storages like object storage, block level storages etc
Course Outcome:	CSL605.2
Program Outcome:	<ol style="list-style-type: none"> 1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. 2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. 4. Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Analysis
Theory:	<p>What is Storage as Service ? Explain different features.</p> <p>Storage as a Service (STaaS) is a cloud computing model that provides users with on-demand storage capacity over the internet. Rather than owning and maintaining physical storage infrastructure, users can pay for the amount of storage they need and access it from any location with an internet connection.</p> <ol style="list-style-type: none"> 1. Scalability: One of the key features of STaaS is its ability to scale up or down depending on the storage needs of a user. This means that users can easily adjust their storage requirements to match their current needs without having to worry about hardware limitations.

	<p>2. Accessibility: STaaS enables users to access their data from anywhere with an internet connection. This feature is particularly useful for businesses with remote workers, as it allows them to access and share data without the need for a physical office.</p> <p>3. Data Backup and Recovery: STaaS providers usually offer backup and recovery services as part of their package. This means that users can rest assured that their data is safe and can be recovered in the event of a disaster.</p> <p>4. Security: STaaS providers implement robust security measures to protect their users' data. These measures may include encryption, access controls, and monitoring for suspicious activity.</p> <p>5. Cost Savings: STaaS eliminates the need for users to purchase and maintain their own storage infrastructure, which can be expensive. Instead, they pay for only the storage they need, which can result in significant cost savings.</p> <p>6. Service Level Agreements (SLAs): STaaS providers typically offer SLAs that guarantee a certain level of uptime, performance, and data availability. These SLAs ensure that users receive a reliable and consistent service.</p>
Procedure	Demonstrate the different types of storages like object storage, block level storages etc. supported by Cloud Platforms like Own Cloud/ AWS S3, Glaciers/ Azure Storage.
Steps	<ol style="list-style-type: none"> 1. Create an AWS account: If you don't already have one, create an AWS account. You will need to provide a credit card to create an account, but AWS has a free tier that you can use for 12 months. 2. Create an S3 bucket: Once you have an AWS account, go to the S3 console and create a new bucket. A bucket is like a folder where you can store files. Give the bucket a name and select the region you want it to be in. You can also configure options such as versioning and encryption. 3. Configure bucket permissions: By default, your bucket is private, meaning that only you can access it. You can add permissions to allow other AWS accounts or users to access your bucket, either with or without authentication. 4. Upload files to your bucket: You can upload files to your bucket using the S3 console, the AWS CLI, or an SDK. You can also configure lifecycle policies to automatically delete or move files after a certain period of time. 5. Access your bucket: Once you have uploaded files to your bucket, you can access them via a URL or programmatically using the AWS SDK or API. You can also configure CloudFront, AWS's content delivery network, to serve your files faster and more efficiently.
Outcome :	

Create bucket Info

Buckets are containers for data stored in S3. [Learn more](#)

General configuration

Bucket name Bucket name must be globally unique and must not contain spaces or uppercase letters. [See rules for bucket naming](#)

AWS Region

Copy settings from existing bucket - optional
Only the bucket settings in the following configuration are copied.

[Choose bucket](#)

Object Ownership

Control ownership of objects written to this bucket from other AWS accounts and the use of access control lists (ACLs). Object ownership determines who can specify access to objects.

ACLs disabled (recommended)
All objects in this bucket are owned by this account. Access to this bucket and its objects is specified using [Server-side encryption](#).

ACLs enabled
Objects in this bucket can be owned by other AWS accounts. Access to this bucket and its objects can be controlled using ACLs.

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No tags associated with this bucket. [Add tag](#)

Default encryption

Server-side encryption is automatically applied to new objects stored in this bucket.

Encryption key type [Info](#)

Amazon S3-managed keys (SSE-S3)

AWS Key Management Service key (SSE-KMS)

Bucket Key
When KMS encryption is used to encrypt new objects in this bucket, the bucket key reduces encryption costs by lowering calls to AWS KMS.
[Learn more](#)

Disable
 Enable

[Advanced settings](#)

After creating the bucket you can upload files and folders to the bucket, and configure additional bucket settings.

[Create bucket](#)

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Successfully created bucket "boris-edison"
To upload files and folders, or to configure additional bucket settings choose [View details](#).

[View details](#)

Amazon S3

Buckets

- Access Points
- Object Lambda Access Points
- Multi-Region Access Points
- Batch Operations
- IAM Access Analyzer for S3

Block Public Access settings for this account

Storage Lens

- Dashboards
- AWS Organizations settings

Feature spotlight

AWS Marketplace for S3

Amazon S3 > Buckets

Account snapshot
Storage lens provides visibility into storage usage and activity trends. [Learn more](#)

Buckets (2) [Info](#)
Buckets are containers for data stored in S3. [Learn more](#)

Name	AWS Region	Access	Creation date
boris-edison	ap-northeast-1	Public	February 27, 2023, 12:49:17 (UTC+05:30)
elasticbeanstalk-ap-northeast-1-523719879178	ap-northeast-1	Public	February 8, 2023, 15:50:41 (UTC+05:30)

[View Storage Lens dashboard](#)

[Create bucket](#)

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aws Services Search [Alt+S] Global ▾ Boris Edison ▾

Amazon S3 Buckets boris-edison

Objects Properties Permissions Metrics Management Access Points

Objects (0)

No objects

You don't have any objects in this bucket.

Upload

Find objects by prefix

Name Type Last modified Size Storage class

Find objects by prefix

Upload

https://s3.console.aws.amazon.com/s3/get-started?region=ap-northeast-1

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Amazon S3 Buckets boris-edison Upload

Upload Info

Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. Learn more ↗

Drag and drop files and folders you want to upload here, or choose Add files, or Add folders.

Files and folders (0)

All files and folders in this table will be uploaded.

Find by name

Name Folder Type Size

No files or folders

You have not chosen any files or folders to upload.

Destination

Destination s3://boris-edison

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Amazon S3 Buckets boris-edison Upload

Upload Info

Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. Learn more ↗

Drag and drop files and folders you want to upload here, or choose Add files, or Add folders.

Files and folders (1 Total, 189.6 KB)

All files and folders in this table will be uploaded.

Find by name

Name Folder Type Size

Screenshot from 2023-02-27 12:41:38.png image/png 189.6 KB

Destination

Destination s3://boris-edison

▶ Destination details

Bucket settings that impact new objects stored in the specified destination.

Feedback Language

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The screenshot shows the AWS S3 console interface. At the top, there's a progress bar indicating 'Uploading' with '0%' completion. Below it, a message says 'Total remaining: 1 file: 189.6 KB(100.00%)' and 'Estimated time remaining: calculating...'. A transfer rate of '0 B/s' is also shown. The main area is titled 'Upload: status' with a 'Close' button. A warning message in a blue box states: 'The information below will no longer be available after you navigate away from this page.' Below this is a 'Summary' section with three columns: 'Destination' (s3://boris-edison), 'Succeeded' (0 files, 0 B (0%)), and 'Failed' (0 files, 0 B (0%)). There are two tabs at the bottom: 'Files and folders' (selected) and 'Configuration'. Under 'Files and folders', a table lists one file: 'Screenshot from 2023-02-27 12-41-38.png' with details: Type: Image/png, Size: 189.6 KB, Status: Pending. The footer includes links for Feedback, Language, and copyright information: '© 2023, Amazon Web Services India Private Limited or its affiliates. Privacy Terms Cookie preferences'.

This screenshot shows the AWS S3 console after a successful upload. A green banner at the top says 'Upload succeeded' with a link to 'View details below.'. Below this is the same 'Upload: status' interface as the previous screenshot. The 'Summary' table now shows 'Succeeded' with a green checkmark and '1 file, 189.6 KB (100.00%)'. The 'Files and folders' table shows the same file as before, but its status is now 'Succeeded' with a green checkmark. The footer remains the same with 'Feedback', 'Language', and copyright information.

Conclusion : Understanding and Implementing Storage as a service using AWS S3

References: Give References: <https://www.youtube.com/watch?v=lyBs2rhpVnE>

Experiment – 7

NAME : Shrikrishna Umbare

ROLL NO: 66

YEAR : 2023

SUBJECT NAME AND CODE: CSL605 Cloud Computing

Learning Objective:	To study and Implement Database as a Service on SQL/NOSQL databases like AWS RDS, AZURE SQL/ MongoDB Lab/ Firebase.
Learning Outcome:	Students will be able to To understand the concept of Cloud storage and to demonstrate the different types of storages like object storage, block level storages etc
Course Outcome:	CSL605.2
Program Outcome:	<p>1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</p> <p>2.Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</p> <p>3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</p> <p>4.Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</p> <p>5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.</p>
Bloom's Taxonomy Level:	Analysis,Apply
Theory:	<p>Difference between SQL and NOSQL</p> <ul style="list-style-type: none"> ● Data Model: SQL databases are based on a relational data model, where data is organized into tables with predefined relationships between them. In contrast, NoSQL databases use a non-relational data model that can be document-based, key-value pairs, graph-based, or other data models. ● Schema: SQL databases have a rigid schema that defines the structure of the data in the database. The schema has to be defined before any data can be inserted into the database. NoSQL databases, on the other hand, are schema-less, meaning the structure of the data can be changed without altering the database schema. ● Query Language: SQL databases use the Structured Query Language (SQL)

	<p>to query and manipulate data. NoSQL databases do not use a standardized query language, and each database has its own way of querying data.</p> <ul style="list-style-type: none"> ● Scalability: SQL databases are vertically scalable, which means that increasing their capacity requires upgrading the hardware. NoSQL databases are horizontally scalable, which means that they can handle increased traffic by adding more servers to a cluster. ● ACID Compliance: SQL databases are designed to ensure that data is consistent, reliable, and accurate, and they adhere to ACID (Atomicity, Consistency, Isolation, and Durability) properties. NoSQL databases may not be ACID compliant and trade off some ACID properties for better performance and scalability. ● Use Cases: SQL databases are best suited for complex transactions, reporting, and applications that require data integrity. NoSQL databases are better suited for real-time data processing, high-volume, and high-velocity applications, and applications that require flexibility and scalability. ● Cost: SQL databases are typically more expensive to operate than NoSQL databases, mainly because they require more maintenance and hardware resources to operate. NoSQL databases, on the other hand, are more cost-effective to operate, mainly because they are designed to be horizontally scalable and can handle large volumes of data without requiring expensive hardware upgrades.
Procedure	To know the concept of Database as a Service running on cloud and to demonstrate the CRUD operations on different SQL and NOSQL databases running on cloud like AWS RDS, AZURE SQL/ Mongo Lab/ Firebase.
Steps	<ol style="list-style-type: none"> 1. Choose a cloud provider: Choose a cloud provider such as AWS, Azure, or Google Cloud Platform, depending on your preferences and requirements. 2. Choose a database type: Decide which type of database you want to create, such as SQL or NoSQL. Each cloud provider offers a range of database services that support different database types, such as Amazon RDS for SQL databases or Amazon DocumentDB for NoSQL databases. 3. Choose a region: Select a region where you want to host your database service. The region you choose can impact the performance and latency of your database, so it's important to choose a region that's closest to your users. 4. Configure security settings: Configure security settings such as firewalls, access control, and encryption to protect your data from unauthorized access. 5. Create your database instance: Create your database instance using the cloud provider's console or API. Specify the database type, instance size, storage size, and other configuration settings. 6. Connect to your database: Once your database instance is created, you can connect to it using a database client or web interface. You can use standard protocols such as JDBC or ODBC to connect to SQL databases or APIs such as REST to connect to NoSQL databases.
Outcome :	

Create database

Choose a database creation method [Info](#)

Standard create
You set all of the configuration options, including ones for availability, security, backups, and maintenance.

Easy create
Use recommended best-practice configurations. Some configuration options can be changed after the database is created.

Engine options

Engine type [Info](#)

Aurora (MySQL Compatible) 

Aurora (PostgreSQL Compatible) 

MySQL 

MariaDB 

PostgreSQL 

Oracle 

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Show versions that support the Multi-AZ DB cluster [Info](#)
Create a Multi-AZ DB cluster with one primary DB instance and two readable standby DB instances. Multi-AZ DB clusters provide up to 2x faster transaction commit latency and automatic failover in typically under 35 seconds.

Show versions that support the Amazon RDS Optimized Writes [Info](#)
Amazon RDS Optimized Writes improves write throughput by up to 2x at no additional cost.

Engine Version [MySQL 8.0.28](#)

Templates
Choose a sample template to meet your use case.

Production
Use defaults for high availability and fast, consistent performance.

Dev/Test
This instance is intended for development use outside of a production environment.

Free tier
Use RDS Free Tier to develop new applications, test existing applications, or gain hands-on experience with Amazon RDS. [Info](#)

Availability and durability

Deployment options [Info](#)
The deployment options below are limited to those supported by the engine you selected above.

Multi-AZ DB Cluster - new
Creates a DB cluster with a primary DB instance and two readable standby DB instances, with each DB instance in a different Availability Zone (AZ). Provides high availability, data redundancy and increases capacity to serve read workloads.

Multi-AZ DB instance (not supported for Multi-AZ DB cluster snapshot)
Creates a primary DB instance and a standby DB instance in a different AZ. Provides high availability and data redundancy, but the standby DB instance doesn't support connections for read workloads.

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Availability and durability

Deployment options [Info](#)
The deployment options below are limited to those supported by the engine you selected above.

Multi-AZ DB Cluster - new
Creates a DB cluster with a primary DB instance and two readable standby DB instances, with each DB instance in a different Availability Zone (AZ). Provides high availability, data redundancy and increases capacity to serve read workloads.

Multi-AZ DB instance (not supported for Multi-AZ DB cluster snapshot)
Creates a primary DB instance and a standby DB instance in a different AZ. Provides high availability and data redundancy, but the standby DB instance doesn't support connections for read workloads.

Single DB instance (not supported for Multi-AZ DB cluster snapshot)
Creates a single DB instance with no standby DB instances.

Settings

DB instance identifier [Info](#)
Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.

The DB instance identifier is case-insensitive, but is stored as all lowercase (as in 'mydbinstance'). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

Credentials Settings

Master username [Info](#)
Type a login ID for the master user of your DB instance.

1 to 16 alphanumeric characters. First character must be a letter.

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Instance configuration

The DB instance configuration options below are limited to those supported by the engine that you selected above.

DB instance class [Info](#)

- Standard classes (includes m classes)
- Memory optimized classes (includes r and x classes)
- Burstable classes (includes t classes)

db.t2.micro
1 vCPUs 1 GiB RAM Not EBS Optimized

Include previous generation classes

Storage

Storage type [Info](#)

General Purpose SSD (gp2)
Baseline performance determined by volume size

Allocated storage [Info](#)

20 GiB

The minimum value is 20 GiB and the maximum value is 6,144 GiB

MySQL

MySQL is the most popular open source database in the world. MySQL on RDS offers the rich features of the MySQL Community edition with the flexibility to easily scale compute resources or storage capacity for your database.

- Supports database size up to 64 TiB.
- Supports General Purpose, Memory Optimized, and Burstable Performance instance classes.
- Supports automated backup and point-in-time recovery.
- Supports up to 15 Read Replicas per instance, within a single Region or 5 read replicas cross-region.

Compute resource

Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

Don't connect to an EC2 compute resource
Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.

Connect to an EC2 compute resource
Set up a connection to an EC2 compute resource for this database.

Virtual private cloud (VPC) [Info](#)

Choose the VPC. The VPC defines the virtual networking environment for this DB instance.

Default VPC (vpc-0abf6846fdc79c67a)

Only VPCs with a corresponding DB subnet group are listed.

After a database is created, you can't change its VPC.

DB subnet group [Info](#)

Choose the DB subnet group. The DB subnet group defines which subnets and IP ranges the DB instance can use in the VPC that you selected.

default

Public access [Info](#)

Yes
RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside of the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.

No
RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

VPC security group (firewall) [Info](#)

Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.

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Monitoring

Enable Enhanced monitoring
Enabling Enhanced monitoring metrics are useful when you want to see how different processes or threads use the CPU.

Additional configuration

Database options, backup turned on, backtrack turned off, maintenance, CloudWatch Logs, delete protection turned off.

Estimated monthly costs

The Amazon RDS Free Tier is available to you for 12 months. Each calendar month, the free tier will allow you to use the Amazon RDS resources listed below for free:

- 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro instance.
- 20 GB of General Purpose Storage (SSD).
- 20 GB for automated backup storage and any user-initiated DB Snapshots.

[Learn more about AWS Free Tier](#)

When your free usage expires or if your application use exceeds the free usage tiers, you simply pay standard, pay-as-you-go service rates as described in the [Amazon RDS Pricing page](#).

MySQL

MySQL is the most popular open source database in the world. MySQL on RDS offers the rich features of the MySQL community edition with the flexibility to easily scale compute resources or storage capacity for your database.

- Supports database size up to 64 TiB.
- Supports General Purpose, Memory Optimized, and Burstable Performance instance classes.
- Supports automated backup and point-in-time recovery.
- Supports up to 15 Read Replicas per instance, within a single Region or 5 read replicas cross-region.

Cancel **Create database**

Amazon RDS

Databases

Dashboard Query Editor Performance insights Snapshots Exports in Amazon S3 Automated backups Reserved instances Proxies Subnet groups Parameter groups Option groups Custom engine versions Events Event subscriptions Recommendations (0) Certificate update

C Creating database database-1

Your database might take a few minutes to launch.
How was your experience creating an Amazon RDS database? [Provide feedback](#)

RDS > Databases

Consider creating a Blue/Green Deployment to minimize downtime during upgrades

You may want to consider using Amazon RDS Blue/Green Deployments and minimize your downtime during upgrades. A Blue/Green Deployment provides a staging environment for changes to production databases. [RDS User Guide](#) [Aurora User Guide](#)

Databases

DB identifier

DB identifier	Role	Engine	Region & AZ	Size	Status	Actions
database-1	Instance	MySQL Community	-	db.t2.micro	Creating	-

View credential details

Amazon RDS

Databases

Dashboard Query Editor Performance insights Snapshots Exports in Amazon S3 Automated backups Reserved instances Proxies Subnet groups Parameter groups Option groups Custom engine versions Events Event subscriptions Recommendations (0) Certificate update

C Creating database database-1

Your database might take a few minutes to launch.
How was your experience creating an Amazon RDS database? [Provide feedback](#)

RDS > Databases > database-1

database-1

Summary

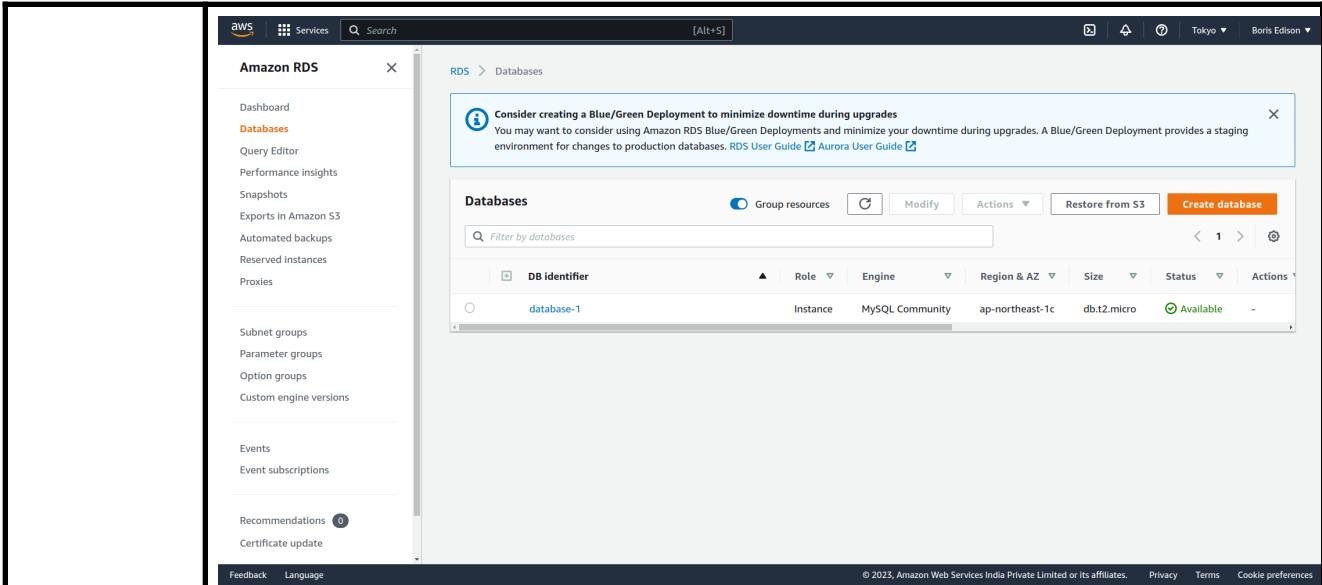
DB identifier	CPU	Status	Class
database-1	-	Creating	db.t2.micro
Role	Current activity	Engine	Region & AZ
Instance	MySQL Community	MySQL Community	-

Connectivity & security **Monitoring** **Logs & events** **Configuration** **Maintenance & backups** **Tags**

Connectivity & security

Endpoint & port	Networking	Security
Endpoint	Availability Zone	VPC security groups default (sg-08f61666fc537e5ec) Action

View credential details



Conclusion :	Understanding and implementing Database as a Service on SQL/NOSQL databases like AWS RDS, AZURE SQL/ MongoDB Lab/ Firebase.
References:	<p>Give References:</p> <p>https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_Tutorials.WebServerDB.CreateDBInstance.html</p>

Experiment – 8

NAME : Shrikrishna Umbare

ROLL NO: 66

YEAR : 2023

SUBJECT NAME AND CODE: CSL605 Cloud Computing

Learning Objective:	To study and Implement Security as a Service on AWS/Azure
Learning Outcome:	Students will be able to understand the Security practices available in public cloud platforms and to demonstrate various Threat detection,
Course Outcome:	CSL605.2
Program Outcome:	<p>1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</p> <p>2.Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</p> <p>3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</p> <p>4.Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</p> <p>5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.</p>
Bloom's Taxonomy Level:	Analysis,Apply
Theory:	<p>Explain Security as services in terms of IAM,Data Protection,Data Detection infrastructure protection with examples</p> <ol style="list-style-type: none"> 1. IAM: Identity and Access Management is a SECaaS that ensures secure and authorized access to resources in the cloud environment. IAM solutions provide a centralized platform to manage user identities and access privileges, which helps businesses to control user access to sensitive data and applications. Some popular IAM solutions include Okta, Auth0, and Azure Active Directory. 2. Data Protection: SECaaS for Data Protection includes encryption, tokenization, and other techniques that protect data against unauthorized

	<p>access and data breaches. This service helps to secure data at rest and in transit. Cloud providers like AWS, Azure, and Google Cloud offer a range of data protection solutions, such as Amazon Key Management Service (KMS), Azure Key Vault, and Google Cloud Key Management Service.</p> <ol style="list-style-type: none"> 3. Data Detection: Data Detection SECaaS helps to identify and classify sensitive data in the cloud environment. It uses advanced techniques like machine learning, artificial intelligence, and data analytics to monitor and detect suspicious activities in real-time. Solutions like Symantec Data Loss Prevention, McAfee Data Loss Prevention, and Forcepoint DLP are some popular examples of Data Detection SECaaS. 4. Infrastructure Protection: SECaaS for Infrastructure Protection is designed to protect cloud-based infrastructure against cyber attacks, malware, and other security threats. It includes features like firewalls, intrusion detection, and prevention systems, and security information and event management (SIEM). AWS Security Hub, Azure Security Center, and Google Cloud Security Command Center are some of the popular SECaaS solutions for Infrastructure Protection.
Procedure	To know the Security practices available in public cloud platforms and to demonstrate various Threat detection, Data protection and Infrastructure protection services in AWS and Azure.
Steps	<ol style="list-style-type: none"> 1. Identify Security Requirements: Start by identifying the security requirements of your business. Consider factors such as the type of data you store, access control requirements, and compliance regulations that apply to your industry. 2. Configure IAM: In both AWS and Azure, Identity and Access Management (IAM) services are used to manage user identities, roles, and access privileges. Create and configure user accounts, assign roles and permissions based on the principle of least privilege. 3. Use Encryption: Encryption is an important security measure that can be used to protect data at rest and in transit. AWS and Azure offer various encryption services, such as AWS Key Management Service (KMS) and Azure Key Vault. Use these services to encrypt sensitive data and to manage the encryption keys. 4. Enable Logging and Monitoring: Enable logging and monitoring services in AWS and Azure to detect security incidents and identify vulnerabilities. Use AWS CloudTrail and Azure Monitor to track user activity, monitor network traffic, and alert you to potential security threats. 5. Use Threat Detection Services: AWS and Azure provide various threat detection services such as Amazon GuardDuty and Azure Security Center to identify and mitigate potential security threats. These services use machine learning and AI algorithms to analyze network activity and identify anomalies. 6. Use Infrastructure Protection Services: Use services like AWS Shield and Azure DDoS Protection to protect your infrastructure against DDoS attacks. These services provide real-time protection and automatic detection and mitigation of DDoS attacks. 7. Conduct Regular Security Audits: Conduct regular security audits of your cloud infrastructure to identify potential vulnerabilities and ensure that security best practices are being followed.

8. Demonstrate Security Services: To demonstrate the various security services in AWS and Azure, create a test environment and perform various activities like enabling logging, configuring IAM, enabling encryption, and using threat detection and infrastructure protection services.

Outcome :

The screenshot shows the AWS Management Console with the 'Identity and Access Management (IAM)' service selected. The left sidebar lists several services under 'Recently visited' and 'Favorites'. The main content area displays a list of recently visited services, including RDS, EC2, S3, IAM, Lambda, and CloudWatch. A modal window titled 'Recently visited' is open, showing the same list of services.

The screenshot shows the AWS IAM dashboard. On the left, there's a sidebar with options like 'Dashboard', 'Access management', 'Access reports', and 'Related consoles'. The main area has sections for 'Security recommendations', 'IAM resources' (with counts for User groups, Users, Roles, Policies, and Identity providers), and 'What's new'. The right side features a sidebar with sections for 'AWS Account' (Account ID, Account Alias, Sign-in URL), 'Quick Links' (My security credentials, Policy simulator, Web identity federation playground), 'Tools' (IAM documentation, Videos, IAM release history, and additional resources), and 'Additional information' (Best practices for Identity and Access Management).

Introducing the new Users list experience
We've redesigned the Users list experience to make it easier to use. Let us know what you think.

Users (0) Info

An IAM user is an identity with long-term credentials that is used to interact with AWS in an account.

Find users by username or access key

User name	Groups	Last activity	MFA	Password age	Active key age
No resources to display					

Related services

- IAM Identity Center New
- AWS Organizations

Feedback Language

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Specify user details

User details

User name
The user name can have up to 64 characters. Valid characters: A-Z, a-z, 0-9, and + = . @ _ - / (hyphen)

Provide user access to the AWS Management Console - optional
If you're providing console access to a person, it's a best practice New to manage their access in IAM Identity Center.

If you are creating programmatic access through access keys or service-specific credentials for AWS CodeCommit or Amazon Keyspaces, you can generate them after you create this IAM user. Learn more New

Cancel **Next**

Feedback Language

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Set permissions

Add user to an existing group or create a new one. Using groups is a best-practice way to manage user's permissions by job functions. [Learn more](#)

Permissions options

- Add user to group Add user to an existing group, or create a new group. We recommend using groups to manage user permissions by job function.
- Copy permissions Copy all group memberships, attached managed policies, and inline policies from an existing user.
- Attach policies directly Attach a managed policy directly to a user. As a best practice, we recommend attaching policies to a group instead. Then, add the user to the appropriate group.

Permissions policies (1050)

Choose one or more policies to attach to your new user.

Policy name	Type	Attached entities
AccessAnalyzerServiceRolePolicy	AWS managed	0
AdministratorAccess	AWS managed - job function	0
AdministratorAccess-Amplify	AWS managed	0
AdministratorAccess-AWSElasticBeanstalk	AWS managed	0
AlexaForBusinessDeviceSetup	AWS managed	0
AlexaForBusinessFullAccess	AWS managed	0
AlexaForBusinessGatewayExecution	AWS managed	0
AlexaForBusinessIotDelegatedAccessPolicy	AWS managed	0
AlexaForBusinessNetworkProfileServicePolicy	AWS managed	0

Review and create

Add user to group Add user to an existing group, or create a new group. We recommend using groups to manage user permissions by job function.

Copy permissions Copy all group memberships, attached managed policies, and inline policies from an existing user.

Attach policies directly Attach a managed policy directly to a user. As a best practice, we recommend attaching policies to a group instead. Then, add the user to the appropriate group.

Permissions policies (1/1050)

Choose one or more policies to attach to your new user.

Policy name	Type	Attached entities
IAMFullAccess	AWS managed	0
IAMReadOnlyAccess	AWS managed	0
IAMAccessAdvisorReadOnly	AWS managed	0
IAMAccessAnalyzerFullAccess	AWS managed	0
IAMAccessAnalyzerReadOnlyAccess	AWS managed	0

Permissions boundary - optional

Set a permissions boundary to control the maximum permissions for this user. Use this advanced feature used to delegate permission management to others. [Learn more](#)

Review and create

Review your choices. After you create the user, you can view and download the autogenerated password, if enabled.

User details

User name	Console password type	Require password reset
boris	None	No

Permissions summary

Name	Type	Used as
IAMFullAccess	AWS managed	Permissions policy

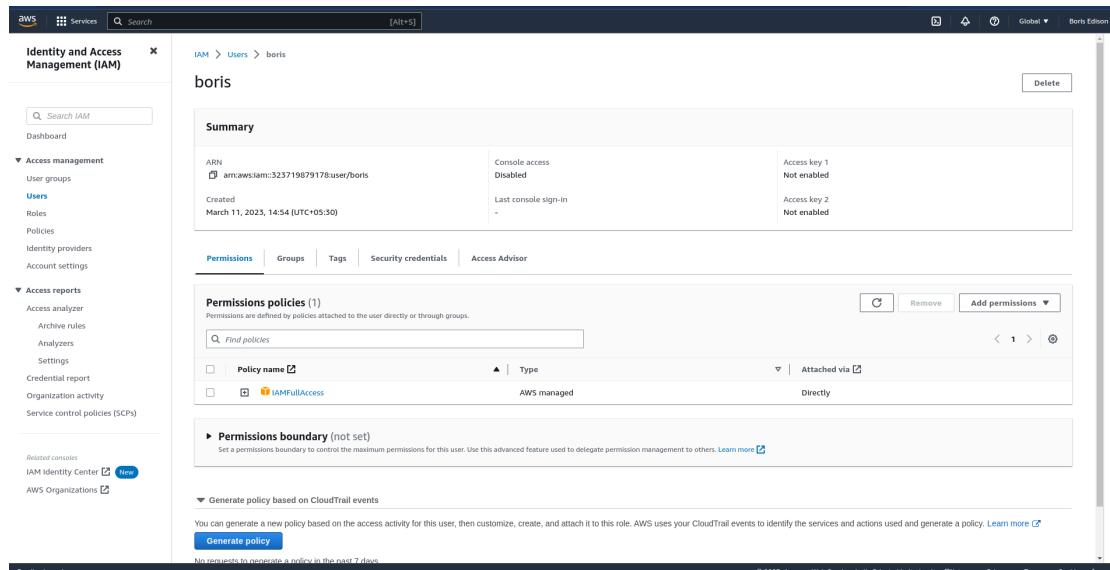
Tags - optional

Tags are key-value pairs you can add to AWS resources to help identify, organize, or search for resources. Choose any tags you want to associate with this user.

No tags associated with the resource.

[Add new tag](#)

You can add up to 50 more tags.

	 <p>The screenshot shows the AWS IAM 'boris' user details page. It includes sections for Summary (ARN, Created), Permissions (Permissions policies, Permissions boundary), and Generate policy based on CloudTrail events. The 'Permissions' tab is selected.</p>
Conclusion :	Understanding and implementing Security as a Service on AWS/Azure
References:	Give References: https://docs.aws.amazon.com/iam/index.html

Experiment – 9

Name: Shrikrishna Umbare

Roll No: 66

Batch: C

Subject: Cloud Computing

Title: Implement Containerization using Docker	
Learning Objective:	To study and Implement Containerization using Docker
Learning Outcome:	Students will be able to understand the Security practices available in public cloud platforms and to demonstrate various Threat detection.
Course Outcome:	CSL605 .6
Program Outcome:	<ol style="list-style-type: none">1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Apply

Theory:

Docker is a software platform that allows developers to create, deploy, and run applications in containers. It is an open-source platform that provides an isolated environment for running applications, making it easier to manage and deploy software across different environments. Here are some key concepts and features of Docker:

1. Containerization: Docker uses containerization technology to create an isolated environment for applications to run in. Containers are lightweight and self-contained, which means they can run anywhere, regardless of the underlying operating system.
2. Docker Image: A Docker image is a lightweight, standalone, and executable package

	<p>that contains all the necessary components to run an application. It includes the application code, libraries, dependencies, and configuration files. Docker images can be built and shared easily, making it easier to deploy applications across different environments.</p> <ol style="list-style-type: none"> 3. Docker Hub: Docker Hub is a cloud-based registry that allows developers to store, share, and manage Docker images. It provides a centralized location for managing Docker images, making it easier to collaborate with other developers and share applications. 4. Dockerfile: A Dockerfile is a text file that contains instructions for building a Docker image. It includes a set of commands that define how the Docker image should be built, what software should be installed, and how the application should be configured. 5. Docker Compose: Docker Compose is a tool that allows developers to define and run multi-container Docker applications. It simplifies the process of running complex applications by defining all the necessary components in a single file. 6. Portability: Docker provides a high level of portability, allowing developers to run applications in different environments without modification. Docker containers can be easily moved between different machines or cloud platforms, making it easier to deploy applications in different environments. 7. Scalability: Docker provides a scalable infrastructure for running applications. Developers can easily spin up multiple containers to handle increased traffic or load, and Docker's orchestration tools make it easier to manage and scale container-based applications. <p>Overall, Docker provides a powerful platform for managing and deploying applications, with features like containerization, Docker images, Docker Hub, Dockerfile, Docker Compose, portability, and scalability. These features make it easier for developers to build, deploy, and manage applications across different environments, leading to faster development cycles and more efficient operations.</p>
Procedure	Students will be able to know the basic differences between Virtual machine and Container. It involves demonstration of creating, finding, building, installing, and running Linux/Windows application containers inside local machine or cloud platform

Steps	<p>Here are the basic steps for using Docker:</p> <ol style="list-style-type: none">1. Install Docker: To use Docker, you first need to install it on your computer or server. Docker provides installation packages for Windows, Mac, and Linux operating systems. You can download the installation package from the Docker website and follow the installation instructions.2. Create a Dockerfile: A Dockerfile is a text file that contains instructions for building a Docker image. You can create a Dockerfile using a text editor or an integrated development environment (IDE). The Dockerfile contains a set of commands that define how the Docker image should be built, what software should be installed, and
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how the application should be configured.

3. Build a Docker image: Once you have created a Dockerfile, you can use the docker build command to build a Docker image. The docker build command reads the Dockerfile and builds an image based on the instructions in the file. The Docker image is a lightweight, standalone, and executable package that contains all the necessary components to run an application.
4. Run a Docker container: To run a Docker container, you can use the docker run command. The docker run command creates a new container based on the Docker image and starts the application inside the container. You can specify various options with the docker run command, such as the port mappings, environment variables, and volume mounts.
5. Manage Docker containers: You can use various Docker commands to manage Docker containers. For example, you can use the docker ps command to list all running containers, the docker stop command to stop a container, and the docker rm command to remove a container.
6. Use Docker Compose: Docker Compose is a tool that allows you to define and run multi-container Docker applications. You can create a docker-compose.yml file that defines all the necessary components of your application and use the docker-compose up command to start the application.

These are the basic steps for using Docker. Once you have mastered these steps, you can explore more advanced Docker features, such as Docker networking, Docker volumes, and Docker swarm mode.

Outcome:

```
dbit@complab1-13:~$ sudo apt install docker
[sudo] password for dbit:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras
  docker-compose-plugin docker-scan-plugin gir1.2-goa-1.0 libfwupdplugin1
  libxmlb1 pigz slirp4netns
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  wmdocker
The following NEW packages will be installed:
  docker wmdocker
0 upgraded, 2 newly installed, 0 to remove and 6 not upgraded.
Need to get 14.3 kB of archives.
After this operation, 58.4 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 wmdocker amd64 1.5-2 [13.0 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 docker all 1.5-2 [1,316 B]
Fetched 14.3 kB in 0s (34.1 kB/s)
Selecting previously unselected package wmdocker.
(Reading database ... 223452 files and directories currently installed.)
Preparing to unpack .../wmdocker_1.5-2_amd64.deb ...
Unpacking wmdocker (1.5-2) ...
Selecting previously unselected package docker.
Preparing to unpack .../archives/docker_1.5-2_all.deb ...
Unpacking docker (1.5-2) ...
Setting up wmdocker (1.5-2) ...
Setting up docker (1.5-2) ...
Processing triggers for man-db (2.9.1-1) ...
dbit@complab1-13:~$ mkdir hello-docker
dbit@complab1-13:~$ cd hello-docker
```

```
dbit@complab1-13:~/hello-docker$ nano app.py
dbit@complab1-13:~/hello-docker$ python app.py
```

Command 'python' not found, did you mean:

```
  command 'python3' from deb python3
  command 'python' from deb python-is-python3
```

```
dbit@complab1-13:~/hello-docker$ python3 app.py
25
```

GNU nano 4.8

```
a=15
b=10
c = a+b
print(c)
```

app.py

```
dbit@complab1-13:~/hello-docker$ docker build -t hello-docker
ERROR: "docker buildx build" requires exactly 1 argument.
See 'docker buildx build --help'.
```

Usage: docker buildx build [OPTIONS] PATH | URL | -

Start a build

```
dbit@complab1-13:~/hello-docker$ sudo chmod 666 /var/run/docker.sock
```

```

dbit@complab1-13:~/hello-docker$ nano dockerfile
dbit@complab1-13:~/hello-docker$ docker build -t hello-docker .
[+] Building 12.7s (8/8) FINISHED
=> [internal] load build definition from dockerfile
=> => transferring dockerfile: 99B
=> [internal] load .dockerignore
=> => transferring context: 28
=> [internal] load metadata for docker.io/library/python:alpine
=> [1/3] FROM docker.io/library/python:alpine@sha256:cf1bda3cbfe9a65c5c1541233e75e4ad7384b60e592d3afc16b50b0197fe98b8
=> => resolve docker.io/library/python:alpine@sha256:cf1bda3cbfe9a65c5c1541233e75e4ad7384b60e592d3afc16b50b0197fe98b8
=> => sha250:faa02a21887cc0ce0730e40a70103b17132a4cebc1650e1efbf719961392572ic 6.32kB / 6.32kB 0.05
=> => sha250:cf1bda3cbfe9a65c5c1541233e75e4ad7384b60e592d3afc16b50b0197fe98b8 1.65kB / 1.65kB 0.05
=> => sha250:d811538650b665bbba49b3ac2c3fc8a5187e24cd510a34d7e905d7ec4534fb89 1.37kB / 1.37kB 0.05
=> => sha250:e9f9cfs029d271a7f108bbcada050e3772c5047c61a0e1f7413bc751dc4f01653 622.93kB / 622.93kB 1.35
=> => sha256:d47ea573a7911457dc1b9f91c991dd2360e30b455251f21e0d0b3a056b3a4c4 14.63MB / 14.63MB 3.25
=> => sha256:37906e0a7ae6f773bfe2bc087c5fa77cb2150296f96a8d7ecb9cc5d4eeaa59 241B / 241B 1.05
=> => extracting sha256:e9f9cfs029d271a7f108bbcada050e3772c5047c01a6e1f7413bc751dc4f01653 0.25
=> => sha250:ab9f45de3756d3acbc bac0257fc4686a28fc5ada48917ee9eb477faf9ce011d 3.08MB / 3.08MB 2.05
=> => extracting sha256:d47ea573a7911457dc1b9f91c991dd2360e30b455251f21e0d0b3a056b3a4c4 0.25
=> => extracting sha256:37906e0a7a2e6f773bfe2bc087c5fa77cb2150296f96a8d7ecb9cc5d4eeaa59 0.05
=> => extracting sha256:ab9f45de3756d3acbc bac0257fc4686a28fc5ada48917ee9eb4477faf9ce011d 0.25
=> [internal] load build context 0.05
=> => transferring context: 1648 0.05
=> [2/3] COPY . /app 0.95
=> [3/3] WORKDIR /app 0.45
=> exporting to Image 0.85
=> => writing image sha256:5b7c5ed6c54e134c0cdc4287541c167534a014c7c174bcb1883c3489e5b1a510 0.65
=> => naming to docker.io/library/hello-docker 0.05
dbit@complab1-13:~/hello-docker$ docker run hello-docker
25

```

<pre> GNU nano 4.8 FROM python:alpine COPY . /app WORKDIR /app CMD python app.py </pre>	dockerfile
---	------------

Conclusion:	Docker provides a consistent and isolated environment for running tasks, reducing variability and improving reproducibility. By leveraging containerization technology, Docker can also enable faster deployment and scaling of experiments, allowing for more efficient use of resources and better experimental outcomes.
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References:	https://youtu.be/pTFZFx4hOI
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Rubrics for Assessment

Timely Submission	Submitted after 2weeks 0	Submitted after deadline 1	On time Submission 2
Understanding	Student is confused aboutthe concept 0	Students has justifiably understood the concept 2	Students is veryclear about the concepts 3
Performance	Students has not performed the Experiment 0	Student has performed withhelp 2	Student has independently performed the experiment 3
Development	Students struggleto run virtual machines. 0	Student can writesteps the requirement stated 1	Student can write exceptional steps with his own ideas 2

Experiment – 10

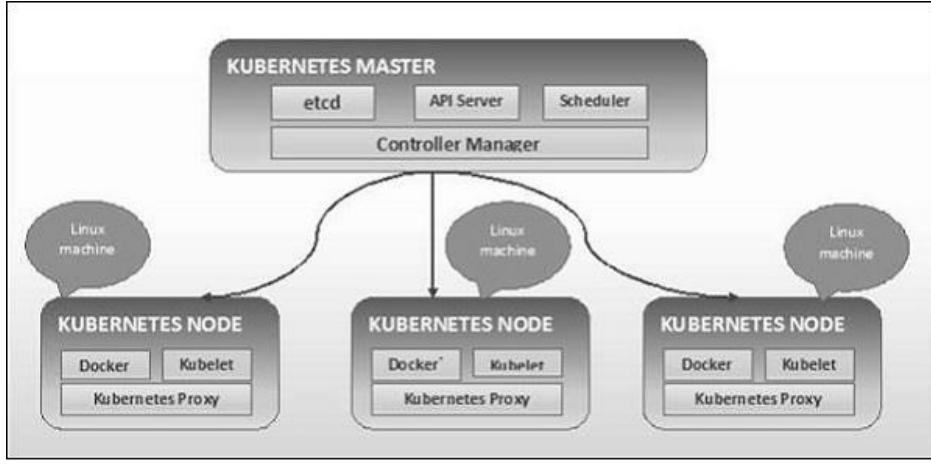
Name :- Shrikrishna Umbare

Roll No :-66

TE Comps Batch: C

Sub: Skill Based Lab : Cloud Computing

To study and implement container orchestration using Kubernetes.	
Learning Objective:	To study and implement container orchestration using Kubernetes
Learning Outcome:	Students will be able to understand the container orchestration using kubernetes on local machine or cloud system
Course Outcome:	CSL605.6
Program Outcome:	<ol style="list-style-type: none">1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.4. Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
Bloom's Taxonomy Level:	Analysis, Apply

Theory:	<p>Explain Concept and feature of Kubernetes in details</p> <p>Kubernetes is an open source container management tool hosted by Cloud Native Computing Foundation (CNCF). This is also known as the enhanced version of Borg which was developed at Google to manage both long running processes and batch jobs, which was earlier handled by separate systems.</p> <p>Kubernetes comes with a capability of automating deployment, scaling of application, and operations of application containers across clusters. It is capable of creating container centric infrastructure.</p> <p>the basic architecture of Kubernetes.</p> <p>Kubernetes - Cluster Architecture</p> <p>As seen in the following diagram, Kubernetes follows client-server architecture. Wherein, we have master installed on one machine and the node on separate Linux machines.</p>  <p>The key components of master and node are defined in the following section.</p> <p>Kubernetes - Master Machine Components</p> <p>Following are the components of Kubernetes Master Machine.</p>
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	<p>etcd</p> <p>It stores the configuration information which can be used by each of the nodes in the cluster. It is a high availability key value store that can be distributed among multiple nodes. It is accessible only by Kubernetes API server as it may have some sensitive information. It is a distributed key value Store which is accessible to all.</p> <p>API Server</p> <p>Kubernetes is an API server which provides all the operation on cluster using the API. API server implements an interface, which means different tools and libraries can readily communicate with it. Kubeconfig is a package along with the server side tools that can be used for communication. It exposes Kubernetes API.</p> <p>Controller Manager</p> <p>This component is responsible for most of the collectors that regulates the state of cluster and performs a task. In general, it can be considered as a daemon which runs in nonterminating loop and is responsible for collecting and sending information to API server. It works toward getting the shared state of cluster and then make changes to bring the current status of the server to the desired state. The key controllers are replication controller, endpoint controller, namespace controller, and service account controller. The controller manager runs different kind of controllers to handle nodes, endpoints, etc.</p> <p>Scheduler</p> <p>This is one of the key components of Kubernetes master. It is a service in master responsible for distributing the workload. It is responsible for tracking utilization of working load on cluster nodes and then placing the workload on which resources are available and accept the workload. In other words, this is the mechanism responsible for allocating pods to available nodes. The scheduler is responsible for workload utilization and allocating pod to new node.</p>
--	---

Kubernetes - Node Components

Following are the key components of Node server which are necessary to communicate with Kubernetes master.

Docker

The first requirement of each node is Docker which helps in running the encapsulated application containers in a relatively isolated but lightweight operating environment.

Kubelet Service

This is a small service in each node responsible for relaying information to and from control plane service. It interacts with **etcd** store to read configuration details and wright values. This communicates with the master component to receive commands and work. The **kubelet** process then assumes responsibility for maintaining the state of work and the node server. It manages network rules, port forwarding, etc.

Kubernetes Proxy Service

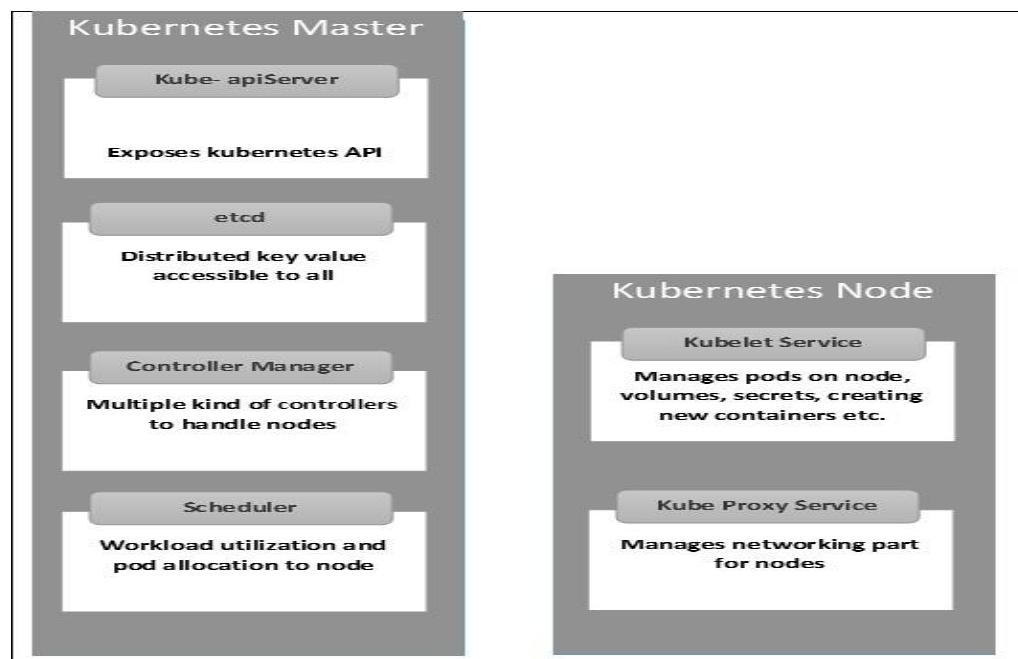
This is a proxy service which runs on each node and helps in making services available to the external host. It helps in forwarding the request to correct containers and is capable of performing primitive load balancing. It makes sure that the networking environment is predictable and accessible and at the same time it is isolated as well. It manages pods on node, volumes, secrets, creating new containers' health checkup, etc.

Kubernetes - Master and Node Structure

It is important to set up the Virtual Datacenter (vDC) before setting up Kubernetes. This can be considered as a set of machines where they can communicate with each other via the network. For hands-on approach, you can set up vDC on PROFITBRICKS if you do not have a physical or cloud infrastructure set up.

Once the IaaS setup on any cloud is complete, you need to configure the **Master** and the **Node**.

The following illustrations show the structure of Kubernetes Master and Node.



Kubernetes - Setup

Features of Kubernetes

- Continues development, integration and deployment
- Containerized infrastructure
- Application-centric management
- Auto-scalable infrastructure
- Environment consistency across development testing and production
- Loosely coupled infrastructure, where each component can act as a separate unit
- Higher density of resource utilization
- Predictable infrastructure which is going to be created

Procedure	To understand the steps to deploy Kubernetes Cluster on local systems, deploy applications on Kubernetes, creating a Service in Kubernetes, develop Kubernetes
-----------	--

	configuration files in YAML and creating a deployment in Kubernetes using YAML,
Steps	<p>Step 1 - Update Ubuntu</p> <p>Always recommended updating the system packages.</p> <p>So let's go to the command:</p> <pre>#sudo apt update</pre> <p>Then type:</p> <pre>#sudo apt upgrade</pre> <p>Step 2 - Install Docker</p> <p>Kubernetes requires an existing Docker installation.</p> <p>Install Docker with the command:</p> <pre>#sudo apt install docker.io</pre> <p>Repeat the process on each server that will act as a node.</p> <p>Check the installation (and version) by entering the following:</p> <pre>#docker --version</pre> <p>Step 3 - Start and Enable Docker</p> <p>Set Docker to launch at boot by entering the following:</p> <pre>#sudo systemctl enable docker</pre> <pre>#sudo systemctl start docker</pre> <p>Verify Docker is running:</p> <pre>#sudo systemctl status docker</pre> <ul style="list-style-type: none"> ● docker.service - Docker Application Container Engine Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled) Active: active (running) since Sat 2020-10-20 13:53:02 -03; 2h 54min ago TriggeredBy: ● docker.socket Docs: https://docs.docker.com

Main PID: 2282 (dockerd)
Tasks: 21
Memory: 146.3M
CGroup: /system.slice/docker.service
└─2282 /usr/bin/dockerd -H fd:// --
containerd=/run/containerd/containerd.sock
To start Docker if it's not running:
#sudo systemctl start docker
Repeat on all the other nodes
.

Step 4 - Install Kubernetes

As we are downloading Kubernetes from a non-standard repository, it is essential to ensure that the software is authentic. This is done by adding a subscription key.

Enter the following to add a signing key in you on Ubuntu:

```
#curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add  
Then repeat the previous command to install the signing keys.
```

Repeat for each server node.

Step 5 - Add Software Repositories

Kubernetes is not included in the default repositories. To add them, enter the following:

```
#sudo apt-add-repository "deb http://apt.kubernetes.io/kubernetes-xenial main"  
Repeat for each server node.
```

Step 6 - Kubernetes Installation Tools

Kubernetes Admin or [Kubeadm](#) is a tool that helps initialize a cluster. Its fast-track setup by using community-sourced best practices. Kubelet is the work package, which runs on every node and starts containers. The tool gives you command-line access to clusters.

Install Kubernetes tools with the command:

```
#sudo apt-get install kubeadm kubelet kubectl  
#sudo apt-mark hold kubeadm kubelet kubectl
```

Allow the process to complete.

Verify the installation with:

```
#kubeadm version
```

Repeat for each server node.

Step 7 - Kubernetes Deployment

Begin Kubernetes Deployment

Start by disabling the swap memory on each server:

```
#sudo swapoff -a
```

Step 8 - Assign Unique Hostname for Each Server Node

Decide which server to set as the master node. Then enter the command:

```
#sudo hostnamectl set-hostname master-node
```

Next, set a worker node hostname by entering the following on the worker server:

```
#sudo hostnamectl set-hostname w1
```

If you have additional worker nodes, use this process to set a unique hostname on each.

Step 9 - Initialize Kubernetes on Master Node

Switch to the master server node, and enter the following:

```
#sudo kubeadm init --pod-network-cidr=10.244.0.0/16
```

Once this command finishes, it will display a kubeadm join message at the end.

Make a note of the whole entry. This will be used to join the worker nodes to the cluster.

Next, enter the following to create a directory for the cluster:

```
kubernetes-master:~$ kubernetes-master:~$ kubernetes-master:~$
```

```
mkdir -p $HOME/.kube
```

```
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
```

```
sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

Step 10 - Deploy Pod Network to Cluster

A Pod Network is a way to allow communication between different nodes in the cluster. This tutorial uses the flannel virtual network.

Enter the following:

```
#sudo kubectl apply -f
```

```
https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml
```

Allow the process to complete.

Verify that everything is running and communicating:

```
#
```

```
kubectl get pods --all-namespaces
```

Step 11 - Join the Worker Node to Cluster

As indicated in Step 7, you can enter the kubeadm join command on each worker node to connect it to the cluster.

Switch to the w1 system and enter the command you noted from Step 8:

```
#kubeadm join --discovery-token abcdef.1234567890abcdef --discovery-token-ca-cert-hash sha256:1234..cdef 1.2.3.4:6443
```

Replace the alphanumeric codes with those from your master server. Repeat for each worker node on the cluster. Wait a few minutes; then you can check the status of the nodes.

Switch to the master server, and enter:

```
#kubectl get nodes
```

The system should display the worker nodes that you joined to the cluster.

Node	Hostname	IP Address	vCPUs	RAM (GB)	OS
Master	master.letscloud.io	192.168.51.111	2	3.75	Ubuntu 20.04
W1	w1.letscloud.io	192.168.52.8	2	3.75	Ubuntu 20.04
W2	w2.letscloud.io	192.168.58.6	2	3.75	Ubuntu 20.04

Outcome :

```
marko@pnap:~$ sudo apt install docker.io -y
[sudo] password for marko:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base libidn11 pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-doc rinse
  zfs-fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base docker.io libidn11 pigz runc
  ubuntu-fan
0 upgraded, 9 newly installed, 0 to remove and 67 not upgraded.
```

```
marko@pnap:~$ sudo systemctl status docker
● docker.service - Docker Application Container Engine
   Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2022-11-24 11:26:27 UTC; 3min 26s ago
     TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
      Main PID: 2887 (dockerd)
        Tasks: 8
       Memory: 29.2M
      CGroup: /system.slice/docker.service
              └─2887 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock
```

```
marko@pnap:~$ sudo apt install kubeadm kubelet kubectl -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  conntrack cri-tools ebttables kubernetes-cni socat
Suggested packages:
  nftables
The following NEW packages will be installed:
  conntrack cri-tools ebttables kubeadm kubelet kubernetes-cni socat
0 upgraded, 8 newly installed, 0 to remove and 67 not upgraded.
Need to get 81.6 MB of archives.
After this operation, 327 MB of additional disk space will be used.
```

```
marko@pnap:~$ sudo apt-mark hold kubeadm kubelet kubectl
kubeadm set on hold.
kubelet set on hold.
kubectl set on hold.
marko@pnap:~$
```

```
marko@pnap:~$ kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"25", GitVersion:"v1.25.4", GitCommit:"872a965c6c6526caa949f0c6ac028ef7aff3fb78", GitTreeState:"clean", BuildDate:"2022-11-09T13:35:06Z", GoVersion:"go1.19.3", Compiler:"gc", Platform:"linux/amd64"}
marko@pnap:~$
```

```
GNU nano 4.8          /etc/modules-load.d/containerd.conf          Modified
overlay
br_netfilter ←

^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text  ^J Justify  ^C Cur Pos
^X Exit      ^R Read File   ^L Replace    ^U Paste Text ^T To Spell  ^A Go To Line
```

```
GNU nano 4.8          /etc/sysctl.d/kubernetes.conf          Modified
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1 ←

^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text  ^J Justify  ^C Cur Pos
^X Exit      ^R Read File   ^L Replace    ^U Paste Text ^T To Spell  ^A Go To Line
```

```

marko@pnap:~$ sudo sysctl --system
* Applying /etc/sysctl.d/99-sysctl.conf ...
* Applying /etc/sysctl.d/kubernetes.conf ...
net.bridge.bridge-nf-call-iptables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
* Applying /usr/lib/sysctl.d/protect-links.conf ...
fs.protected_fifos = 1
fs.protected_hardlinks = 1
fs.protected_regular = 2
fs.protected_symlinks = 1
* Applying /etc/sysctl.conf ...
marko@pnap:~$ █

```

```

GNU nano 4.8                               /etc/hosts                               Modified
127.0.0.1 localhost
127.0.1.1 master-node
10.240.12.32 master-node
10.240.12.50 worker01

# The following lines are desirable for IPv6 capable hosts
::1      ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters

^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos
^X Exit       ^R Read File    ^\ Replace    ^U Paste Text  ^T To Spell  ^_ Go To Line

```

```

marko@master-node:~$ systemctl daemon-reload
==== AUTHENTICATING FOR org.freedesktop.systemd1.reload-daemon ===
Authentication is required to reload the systemd state.
Authenticating as: Marko Aleksic (marko)
Password:
==== AUTHENTICATION COMPLETE ===
marko@master-node:~$ █

```

```

GNU nano 4.8                               /etc/docker/daemon.json                               Modified
{
  "exec-opts": [ "native.cgroupdriver=systemd" ],
  "log-driver": "json-file",
  "log-opt": {
    "max-size": "100m"
  },
  "storage-driver": "overlay2"

^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos
^X Exit       ^R Read File    ^\ Replace    ^U Paste Text  ^T To Spell  ^_ Go To Line

```

```

GNU nano 4.8      /etc/systemd/system/kubelet.service.d/10-kubeadm.conf      Modified
# Note: This dropin only works with kubeadm and kubelet v1.11+
[Service]
Environment="KUBELET_KUBECONFIG_ARGS=--bootstrap-kubeconfig=/etc/kubernetes/bootstrap->
Environment="KUBELET_CONFIG_ARGS=--config=/var/lib/kubelet/config.yaml"
Environment="KUBELET_EXTRA_ARGS=--fail-swap-on=false" ←
# This is a file that "kubeadm init" and "kubeadm join" generates at runtime, populati>
EnvironmentFile=/var/lib/kubelet/kubeadm-flags.env
# This is a file that the user can use for overrides of the kubelet args as a last res>
# the .NodeRegistration.KubeletExtraArgs object in the configuration files instead. KU>
EnvironmentFile=/etc/default/kubelet
ExecStart=
ExecStart=/usr/bin/kubelet $KUBELET_KUBECONFIG_ARGS $KUBELET_CONFIG_ARGS $KUBELET_KUBE>

^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos
^X Exit       ^R Read File    ^\ Replace    ^U Paste Text  ^T To Spell  ^_ Go To Line

```

```

Your Kubernetes control-plane has initialized successfully!

To start using your cluster, you need to run the following as a regular user:

mkdir -p $HOME/.kube
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config

You should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
https://kubernetes.io/docs/concepts/cluster-administration/addons/

Please note that the certificate-key gives access to cluster sensitive data, keep it secret!
As a safeguard, uploaded-certs will be deleted in two hours; If necessary, you can use
"kubeadm init phase upload-certs --upload-certs" to reload certs afterward.

Then you can join any number of worker nodes by running the following on each as root:

kubeadm join master-node:6443 --token eew3l4.5nwu6cdvssnei38 \
    --discovery-token-ca-cert-hash sha256:0776739870dd4af9c7c23050db371f8a8b1d2129
80e39e28a0f8dce36469774
marko@master-node:~$
```

```

This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

Run 'kubectl get nodes' on the control-plane to see this node join the cluster.

marko@worker01:~$
```

```

marko@master-node:~$ kubectl get nodes
NAME     STATUS   ROLES      AGE     VERSION
master-node   Ready    control-plane   18m    v1.25.4
worker01     Ready    <none>    92s    v1.25.4
marko@master-node:~$
```

Conclusion : Kubernetes is an open source container management tool hosted by Cloud Native Computing Foundation (CNCF). This is also known as the enhanced version of Borg which was developed at Google to manage both long running processes and batch jobs, which was earlier handled by separate systems.

Kubernetes comes with a capability of automating deployment, scaling of application, and operations of application containers across clusters. It is capable of creating container centric infrastructure.

References:

- [1] <https://www.tutorialspoint.com/kubernetes/index.htm>
- [2] https://www.tutorialspoint.com/kubernetes/kubernetes_architecture.htm

Rubrics for Assessment

Timely Submission	Submitted after 2 weeks 0	Submitted after deadline 1	On time Submission 2
Understanding	Student is confused about the concept 0	Students has justifiably understood the concept 2	Students is very clear about the concepts 3
Performance	Students has not performed the Experiment 0	Student has performed with help 2	Student has independently performed the experiment 3
Development	Students struggle to run virtual machines. 0	Student can write steps the requirement stated 1	Student can write exceptional steps with his own ideas 2

Shrikrishna Umbare

Roll No: 66

CC Assignment No. 01

Q.Explore and compare the similar type of services provided by AWS and Azure [Any ten services]

● **Compute Services:**

AWS: Amazon Elastic Compute Cloud (EC2)

Azure: Azure Virtual Machines

Both services provide scalable computing resources in the cloud, allowing users to easily provision, scale, and manage virtual machines on-demand.

● **Storage Services:**

AWS: Amazon Simple Storage Service (S3)

Azure: Azure Blob Storage

Both services provide scalable object storage in the cloud, allowing users to store and retrieve large amounts of data.

● **Database Services:**

AWS: Amazon Relational Database Service (RDS)

Azure: Azure SQL Database

Both services provide managed database services in the cloud, allowing users to easily create, manage, and scale relational databases.

● **Networking Services:**

AWS: Amazon Virtual Private Cloud (VPC)

Azure: Azure Virtual Network

Both services provide networking capabilities in the cloud, allowing users to create private, isolated networks with customizable IP addresses, subnets, and routing tables.

● **Content Delivery Services:**

AWS: Amazon CloudFront

Azure: Azure Content Delivery Network (CDN)

Both services provide content delivery networks in the cloud, allowing users to distribute static and dynamic content to users around the world with low latency and high performance.

● **Identity and Access Management Services:**

AWS: AWS Identity and Access Management (IAM)

Azure: Azure Active Directory (AD)

Both services provide identity and access management capabilities in the cloud, allowing users to manage user identities, permissions, and roles.

● **Serverless Computing Services:**

AWS: AWS Lambda

Azure: Azure Functions

Both services provide serverless computing capabilities in the cloud, allowing users to run code without provisioning or managing servers.

- **Analytics and Business Intelligence Services:**

AWS: Amazon Redshift

Azure: Azure Synapse Analytics

Both services provide managed analytics and business intelligence services in the cloud, allowing users to easily analyze large amounts of data and gain insights.

- **Internet of Things (IoT) Services:**

AWS: AWS IoT

Azure: Azure IoT Hub

Both services provide IoT services in the cloud, allowing users to connect, monitor, and manage IoT devices at scale.

- **Machine Learning Services:**

AWS: Amazon SageMaker

Azure: Azure Machine Learning

Both services provide machine learning services in the cloud, allowing users to build, train, and deploy machine learning models at scale.

Q.Comparative study of different hosted and bare metal Hypervisors with suitable parameters along with their use in public/private cloud platform

Here is a comparative study of different hosted and bare-metal hypervisors with suitable parameters and their use in public/private cloud platform:

- **VMware ESXi (Bare-Metal Hypervisor):**

Type: Type-1 or bare-metal hypervisor

Suitable Parameters:

Excellent performance and security

Supports a wide range of hardware and operating systems

Provides advanced features like live migration, high availability, and disaster recovery

Use in Public/Private Cloud Platform:

VMware ESXi is a popular hypervisor used in both public and private cloud platforms. It is used to provide virtualization services for servers, desktops, and applications.

- **Microsoft Hyper-V (Bare-Metal Hypervisor):**

Type: Type-1 or bare-metal hypervisor

Suitable Parameters:

Integration with Microsoft Windows operating systems and infrastructure

Provides advanced features like live migration, high availability, and disaster recovery

Supports a wide range of hardware and operating systems

Use in Public/Private Cloud Platform:

Microsoft Hyper-V is a popular hypervisor used in both public and private cloud platforms. It is used to provide virtualization services for servers, desktops, and applications.

- **Citrix Hypervisor (Bare-Metal Hypervisor):**

Type: Type-1 or bare-metal hypervisor

Suitable Parameters:

High performance and security

Supports a wide range of hardware and operating systems

Provides advanced features like live migration, high availability, and disaster recovery

Use in Public/Private Cloud Platform:

Citrix Hypervisor is a popular hypervisor used in both public and private cloud platforms. It is used to provide virtualization services for servers, desktops, and applications.

- **Oracle VirtualBox (Hosted Hypervisor):**

Type: Type-2 or hosted hypervisor

Suitable Parameters:

Easy to use and install

Supports a wide range of operating systems

Free and open-source

Use in Public/Private Cloud Platform:

Oracle VirtualBox is primarily used for local testing and development environments, and is not commonly used in public or private cloud platforms.

- **VMware Workstation (Hosted Hypervisor):**

Type: Type-2 or hosted hypervisor

Suitable Parameters:

Easy to use and install

Supports a wide range of operating systems

Provides advanced features like snapshots, cloning, and testing tools

Use in Public/Private Cloud Platform:

VMware Workstation is primarily used for local testing and development environments, and is not commonly used in public or private cloud platforms.

Name : Shrikrishna Umbare

Roll No. : 66

CC ASSIGNMENT 2

1. Assignment on recent trends in cloud computing and related technologies.

Recent trends in cloud computing and related technologies are shaping the future of computing and changing the way businesses and individuals interact with technology. Here are some of the latest trends in cloud computing:

1. Hybrid Cloud Adoption: Hybrid cloud computing has emerged as a popular solution for businesses that want to take advantage of the benefits of cloud computing while maintaining some of their legacy systems on-premises. This approach combines public cloud services with private cloud infrastructure, providing a more flexible and scalable IT environment.
2. Serverless Computing: Serverless computing allows developers to write and run code without worrying about infrastructure management. This trend is gaining traction as it simplifies the development and deployment process, and helps reduce costs.
3. Multi-Cloud Strategy: Many businesses are adopting a multi-cloud strategy, which involves using multiple cloud providers to meet their specific needs. This trend is driven by the need to avoid vendor lock-in, and the desire to leverage the unique capabilities of different cloud providers.
4. Edge Computing: Edge computing involves processing data and performing computation at the edge of the network, closer to the source of the data. This approach is gaining popularity as it reduces latency, improves performance, and increases security.
5. Kubernetes: Kubernetes is an open-source container orchestration platform that automates the deployment, scaling, and management of containerized applications. It has become a popular tool for managing cloud-native applications and is widely used in cloud computing environments.
6. Artificial Intelligence and Machine Learning: Cloud computing is increasingly being used to support artificial intelligence and machine learning applications. Cloud providers are offering services that allow businesses to build, train, and deploy machine learning models in the cloud, without requiring extensive knowledge of the underlying infrastructure.
7. Blockchain: Blockchain technology is being integrated with cloud computing to create more secure and transparent systems. This approach is being used in industries such as finance, healthcare, and supply chain management.

DON BOSCO INSTITUTE OF TECHNOLOGY



Skill based Lab Course: Cloud Computing MINI PROJECT REPORT

On

**“Portfolio Website”
2022-23**

Submitted By:

Andrea Alvares	02
Sanika Chaudhari	09
Shrikrishna Umbare	66

**Under the guidance of
Mr. Dashrath Kale**

Mini Project Title : **Portfolio Website**
Institute Name : Don Bosco Institute of Technology.

Institute Address : Premier Automobiles Road,
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Department : Computer Engineering

Class : T.E.

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Date of Submission : 3rd April, 2023

Internal Guide : Mr. Dashrath Kale

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CHAPTER 1

INTRODUCTION

In the competitive world of business and freelancing, a portfolio website can be a powerful tool to showcase one's skills, experience, and accomplishments. It allows professionals to create an online presence, reach a wider audience, and make a lasting impression on potential clients or employers. A portfolio website typically includes a collection of work samples, a bio or about me page, contact information, and testimonials from satisfied clients or employers.

However, creating a website is only half the battle; hosting it is equally important. Hosting refers to the process of storing website files and making them accessible to visitors over the internet. It can be a complex and technical process that requires a deep understanding of web servers, domain names, and network infrastructure. Fortunately, cloud services like AWS have made website hosting more accessible and affordable than ever before. AWS provides a range of hosting options, including static website hosting, serverless hosting, and managed hosting services. With AWS, anyone can host a website, regardless of their technical skills or budget.

AWS offers a range of features and tools that can enhance the performance and security of a portfolio website. For instance, AWS provides content delivery network (CDN) services that can speed up website loading times and reduce latency for users accessing the website from different parts of the world. AWS also offers advanced security features, such as DDoS protection and web application firewalls, which can help protect a website from malicious attacks.

Overall, hosting a portfolio website on AWS can offer several benefits, including scalability, reliability, affordability, and enhanced security. However, it is essential to understand the various AWS services involved and the potential challenges associated with hosting a website on the platform. This report aims to provide a comprehensive guide to hosting a portfolio website on AWS, covering everything from setting up an AWS account to deploying a website and managing it over time.

CHAPTER 2

PROBLEM DEFINITION MODULES

Hosting a website on AWS requires some technical knowledge and expertise, such as knowledge of web servers, domain names, and network infrastructure. Users who are not familiar with these concepts may face challenges in setting up and managing their portfolio website on AWS. However, AWS provides various resources and documentation to help users learn about these concepts and guide them through the setup process. Additionally, AWS offers a range of hosting options, including static website hosting, serverless hosting, and managed hosting services, allowing users to choose the hosting plan that best suits their technical expertise and budget.

While AWS hosting options are generally affordable, the cost of hosting a website can vary depending on the chosen hosting plan and the level of traffic the website receives. Users must consider the cost implications of their chosen hosting plan and ensure they can afford the ongoing costs associated with hosting a portfolio website on AWS. Fortunately, AWS offers various pricing models, such as pay-as-you-go and reserved instances, which can help users control their hosting costs. Additionally, users can take advantage of AWS tools and services, such as Amazon CloudFront and Amazon S3, to optimize their website's performance and reduce hosting costs.

AWS provides advanced security features, such as DDoS protection and web application firewalls, to protect websites hosted on the platform. However, users must still take steps to secure their website, such as implementing secure passwords, regularly updating software, and monitoring for suspicious activity. AWS also provides tools and services, such as Amazon Inspector and AWS Security Hub, to help users manage and improve their website's security. Users must ensure that their website is always available and accessible to visitors. AWS provides reliable hosting services, but users must take steps to monitor their website's uptime and ensure that they have a plan in place to address any downtime or availability issues.

CHAPTER 3

IMPLEMENTATION

1. **Setting up an AWS account:** The first step in hosting a portfolio website on AWS is to create an AWS account. This involves providing basic information, such as name, address, and credit card details, and verifying the account through email or phone. Once the account is set up, individuals can access the AWS Management Console and start using AWS services.
2. **Choosing a hosting option:** AWS offers various hosting options, including static website hosting, serverless hosting, and managed hosting services. Individuals need to evaluate their website's requirements, such as traffic volume, storage, and computing resources, and choose the appropriate hosting option. For example, a static website may be suitable for a portfolio website with minimal dynamic content and low traffic.
3. **Configuring AWS services:** Once the hosting option is selected, individuals need to configure various AWS services, such as Amazon S3, Amazon EC2, or AWS Lambda, depending on the hosting option chosen. This includes setting up a domain name, configuring SSL certificates, and configuring access policies and permissions.
4. **Deploying the website:** After configuring the AWS services, individuals need to deploy the website files to the appropriate AWS service, such as Amazon S3 or Amazon EC2. This involves uploading the website files, configuring DNS settings, and testing the website to ensure that it is accessible and functional.

CHAPTER 4

RESULTS

Step 1 : Created AWS Account and generated an EC2 instance in it.

The screenshot shows the AWS EC2 Instances page with the instance summary for i-071bead5b73926a81. The instance is running and has a public IP of 18.207.221.212 and a private IP of 172.31.87.87. It is associated with a t2.micro instance type and is part of a VPC with a subnet ID of subnet-0ae31f7d4059e307b. The instance was created less than a minute ago.

Instance summary for i-071bead5b73926a81 (shree) Info	
Updated less than a minute ago	
Instance ID i-071bead5b73926a81 (shree)	Public IPv4 address 18.207.221.212 open address
IPv6 address -	Instance state Running
Hostname type IP name: ip-172-31-87-87.ec2.internal	Private IP DNS name (IPv4 only) ip-172-31-87-87.ec2.internal
Answer private resource DNS name IPv4 (A)	Instance type t2.micro
Auto-assigned IP address 18.207.221.212 [Public IP]	VPC ID vpc-0444dafb9da1bafce
IAM Role -	Subnet ID subnet-0ae31f7d4059e307b
IMDSv2 Optional	

Details Security Networking Storage Status checks Monitoring Tags

▼ Instance details [Info](#)

Step 2 : The Ec2 instance was then opened in browser

The screenshot shows a terminal window with the AWS logo and 'Services' button at the top. The terminal displays system statistics and a message about Ubuntu Pro security features. It also shows a warning about ESM Apps and ends with a login history.

```
aws | Services | Search [Alt+S]
System load: 0.080078125 Processes: 101
Usage of /: 23.0% of 7.57GB Users logged in: 0
Memory usage: 25% IPv4 address for eth0: 172.31.87.87
Swap usage: 0%

* Ubuntu Pro delivers the most comprehensive open source security and compliance features.

https://ubuntu.com/aws/pro

* Introducing Expanded Security Maintenance for Applications.
  Receive updates to over 25,000 software packages with your Ubuntu Pro subscription. Free for personal use.

https://ubuntu.com/aws/pro

xpanded Security Maintenance for Applications is not enabled.

updates can be applied immediately.
of these updates are standard security updates.
o see these additional updates run: apt list --upgradable

nable ESM Apps to receive additional future security updates.
ee https://ubuntu.com/esm or run: sudo pro status

ast login: Fri Mar 31 10:13:22 2023 from 18.206.107.29
buntu@ip-172-31-87-87:~$
```

Step 3 :

First, the Apache 2 web server was installed on the system using the following command:

```
sudo apt-get install apache2
```

After the installation, the Apache 2 service was restarted using the command:

```
sudo systemctl restart apache2
```

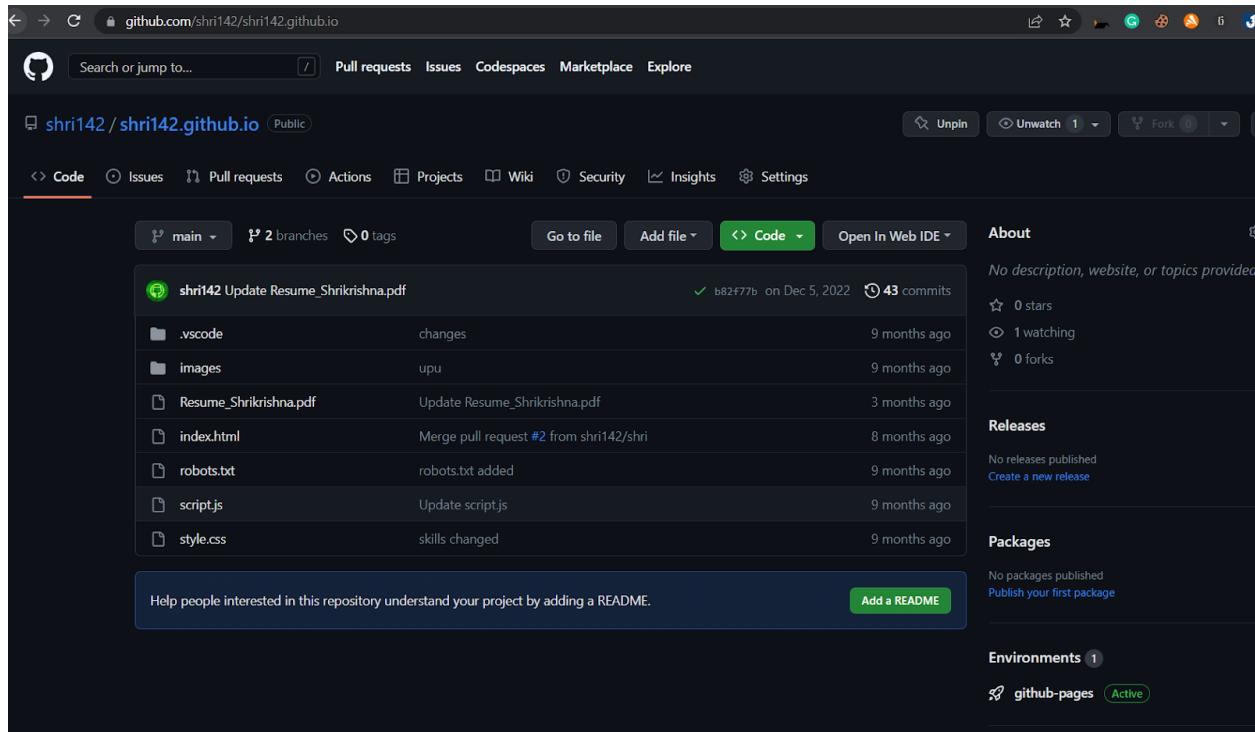
Next, we navigated to the following directory where the Apache web server stores the default document root for serving web pages:

```
cd /var/www/html/
```

Then, the user cloned a GitHub repository that contains the website files into the current directory using the command:

```
git clone [URL of the GitHub repository]
```

This cloned the website files from the GitHub repository to the local system, in the directory /var/www/html/.



Step 4:

We then opened a text file called 000-default.conf located in the /etc/apache2/sites-available/ directory using the nano text editor and the sudo command to run it with administrative privileges:

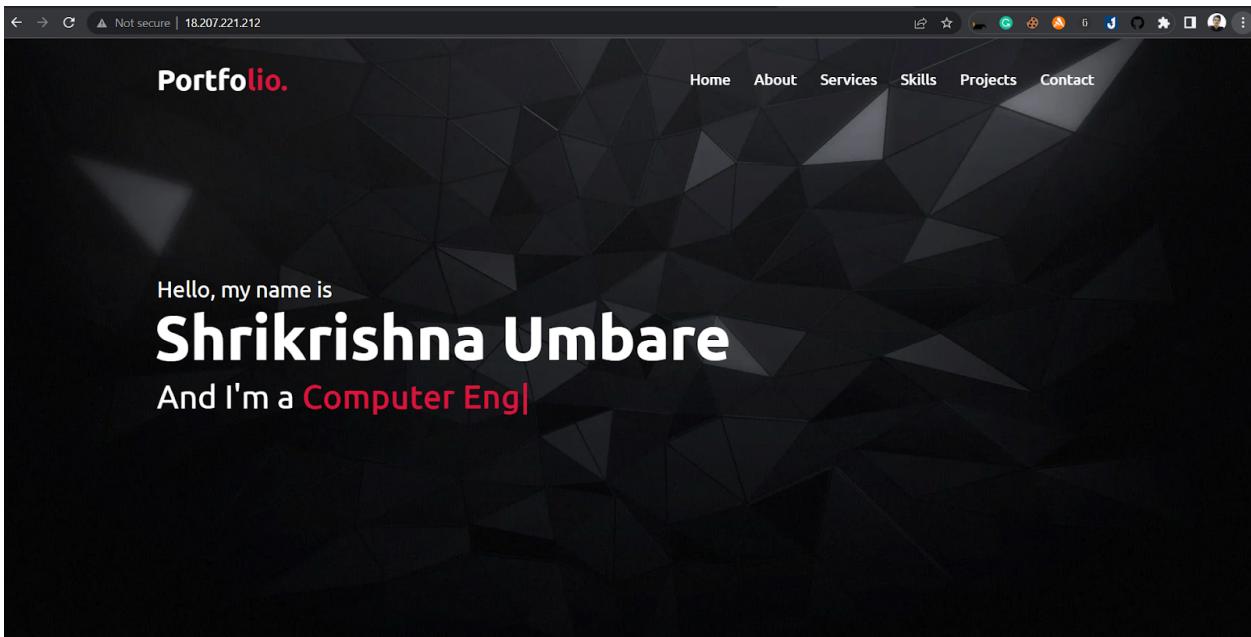
sudo nano /etc/apache2/sites-available/000-default.conf

Then, the user made modifications to the configuration file, presumably to point Apache 2 to the website files that were previously cloned into the /var/www/html/ directory.

```
Last login: Fri Mar 31 10:13:22 2023 from 18.206.107.29
ubuntu@ip-172-31-87-87:~$ pwd
/home/ubuntu
ubuntu@ip-172-31-87-87:~$ cd ..
ubuntu@ip-172-31-87-87:/home$ cd ..
ubuntu@ip-172-31-87-87:/$ cd var
ubuntu@ip-172-31-87-87:/var$ cd www
ubuntu@ip-172-31-87-87:/var/www$ cd html
ubuntu@ip-172-31-87-87:/var/www/html$ cd shri142.github.io
ubuntu@ip-172-31-87-87:/var/www/html/shri142.github.io$ ls
Resume_Shrikrishna.pdf  images  index.html  robots.txt  script.js  style.css
ubuntu@ip-172-31-87-87:/var/www/html/shri142.github.io$ █
```

Step 5:

After making the necessary modifications to the Apache 2 configuration file, we restarted the Apache 2 service to apply the changes using the appropriate command. Once the service was restarted, the website became accessible to anyone on the internet using the public IP address of the server.



A screenshot of a web browser showing a red-themed services page from the same portfolio website. The title 'Portfolio.' is at the top left. A navigation bar at the top right includes links for Home, About, Services, Skills, Projects, and Contact. The main content area has a red header with the text 'My services' and '— what i provide —'. Below this, there are three dark cards with white text and icons: 'System Security Advisor' with a shield icon, 'Web Testing' with a checkmark icon, and 'Mentor For Programming' with a code bracket icon. Each card also contains a brief description of the services provided.

Mv Skills And Experiences

CHAPTER 5

CONCLUSION

Creating a portfolio website is an essential tool for professionals who want to showcase their skills, experience, and accomplishments to a broader audience. However, hosting a website can be complex and technical, requiring a deep understanding of web servers, domain names, and network infrastructure. AWS provides a range of hosting options that are accessible and affordable, making it an ideal platform for hosting a portfolio website.

Hosting a portfolio website on AWS offers several benefits, including scalability, reliability, affordability, and enhanced security. AWS provides a range of hosting options, such as static website hosting, serverless hosting, and managed hosting services. These hosting options allow professionals to choose the best hosting plan that suits their website's needs and budget.

Additionally, AWS provides a range of features and tools that can enhance the performance and security of a portfolio website. For instance, AWS provides content delivery network (CDN) services that can speed up website loading times and reduce latency for users accessing the website from different parts of the world. AWS also offers advanced security features, such as DDoS protection and web application firewalls, which can help protect a website from malicious attacks.

While hosting a website on AWS may involve technical challenges, this report provides a comprehensive guide to help professionals set up, deploy, and manage their portfolio website on the platform. This guide covers everything from setting up an AWS account, choosing a hosting plan, deploying a website, and managing it over time. With AWS, professionals can create an online presence that can help them stand out in a competitive business or freelance environment.

CHAPTER 6

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