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PRACTICAL NO 1

Aim: Study and implementation of Infrastructure as a Service (IaaS)

Theory:

Infrastructure as a Service:

IaaS is also known as Hardware as a Service (HaaS). It is one of the layers of the cloud computing platform. It allows customers to outsource their IT infrastructures such as servers, networking, processing, storage, virtual machines, and other resources. Customers access these resources on the Internet using a pay-as-per use model.

In traditional hosting services, IT infrastructure was rented out for a specific period of time, with pre-determined hardware configuration. The client paid for the configuration and time, regardless of the actual use. With the help of the IaaS cloud computing platform layer, clients can dynamically scale the configuration to meet changing requirements and are billed only for the services actually used.

Pre-requirements:

1. Foss cloud iso
2. VirtualBox

Steps to perform:

- Open VirtualBox and create a new virtual machine named as FOSS.
- Allocate the memory above 5 GB and the virtual disk above 130 GB.
- Now once it is done go to settings click on network change from

NAT to Bridged Network.

- Now go to system and you'll see that Enable Nested VT is not available if you are using latest version of VirtualBox.
- To make it happen go to Program files > Oracle > VirtualBox > At the navbar type cmd.
- Write the command **VBoxManage modifyvm <VirtualMachineName> --nested-hw-virt on** under virtual machine enter the name of your machine. And hit enter
- Now you can see it is available and enabled.
- Start the machine.
- Type yes for installation.
- Then type 1 to install Demo-System.
- Then enter sda as device name
- Type yes to install from scratch
- Write the ethernet device name which is available there in my case it is np0s3.
- Write no for default DHCP configuration
- Enter the hostname and domain name of your choice the domain should end with .com

For eg: If I choose Atlanta then domain name will be Atlanta.com

- Now go to the command prompt of windows and check the IP from which you are connected

For eg: If Windows IPv4 is 192.168.1.46 then for FOSS it will be 192.168.1.47

And if default gateway is 192.168.1.1 then for FOSS it will be 192.168.1.2

For subnet mask

If it is 255.0.0.0 then enter 8 in FOSS

If it is 255.255.0.0 then enter 16 in FOSS

If it is 255.255.255.0 then enter 24 in FOSS

To enter broadcast, take starting 2 digits of IPv4 and 2 digits of subnet mask

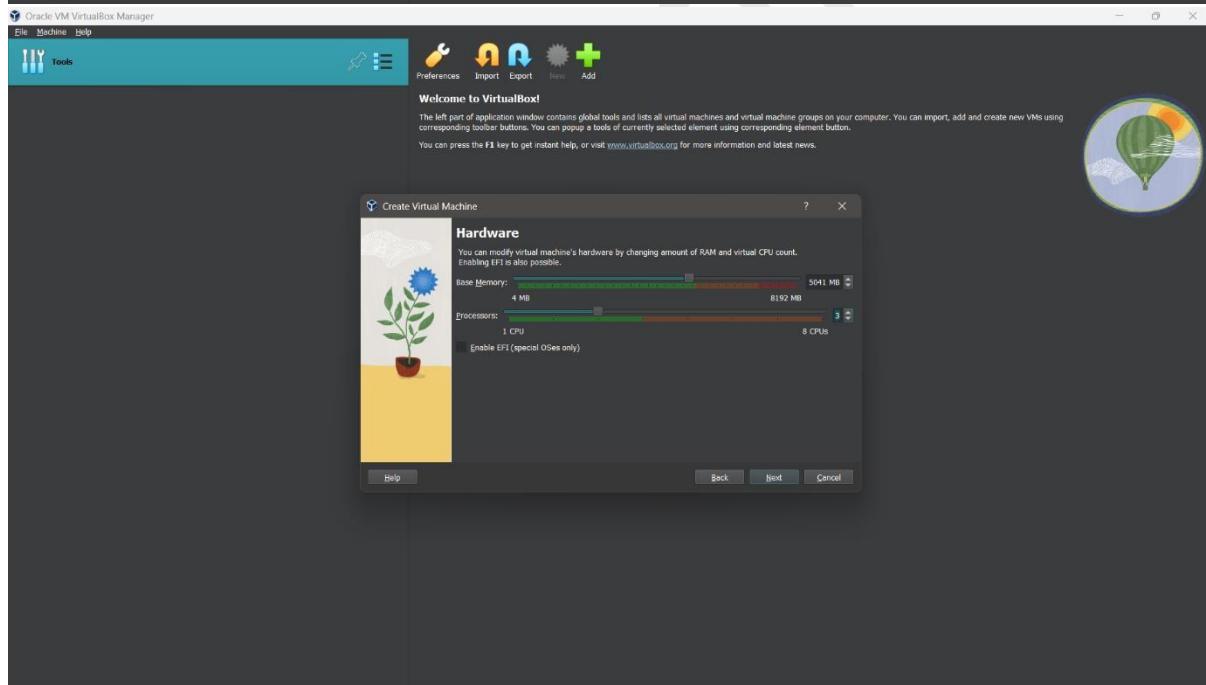
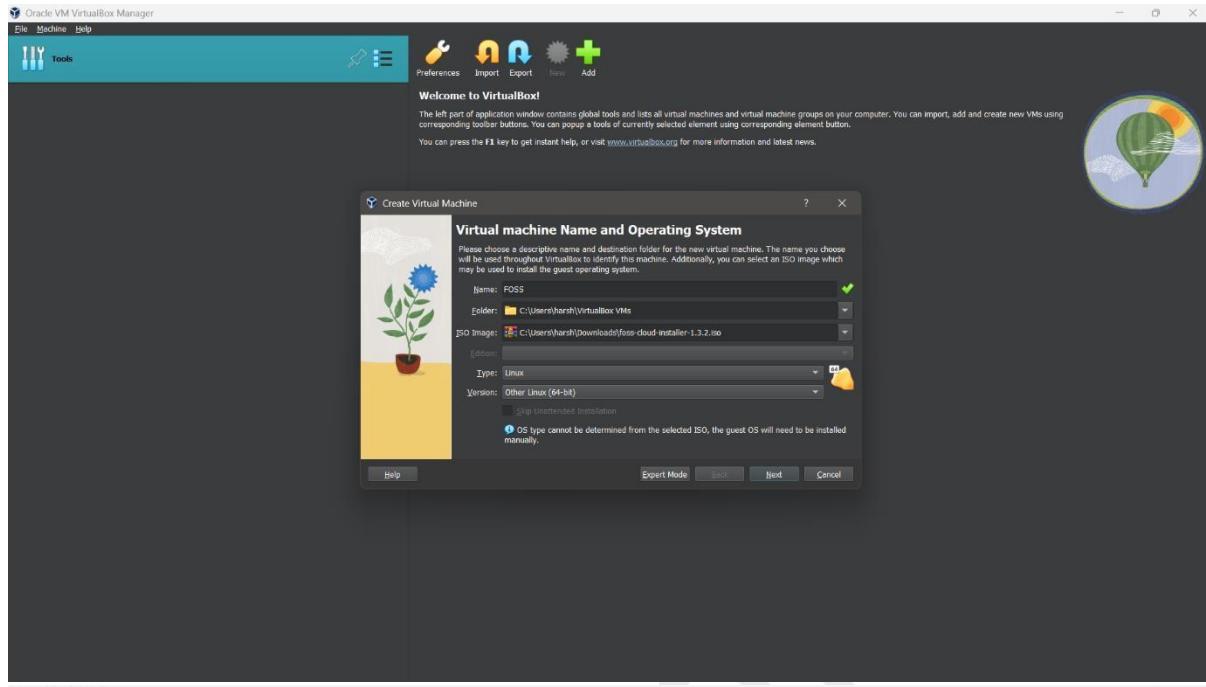
Like if IPv4 is 192.168.1.46 and subnet mask is 255.255.255.0 then broadcast will be 192.168.255.255

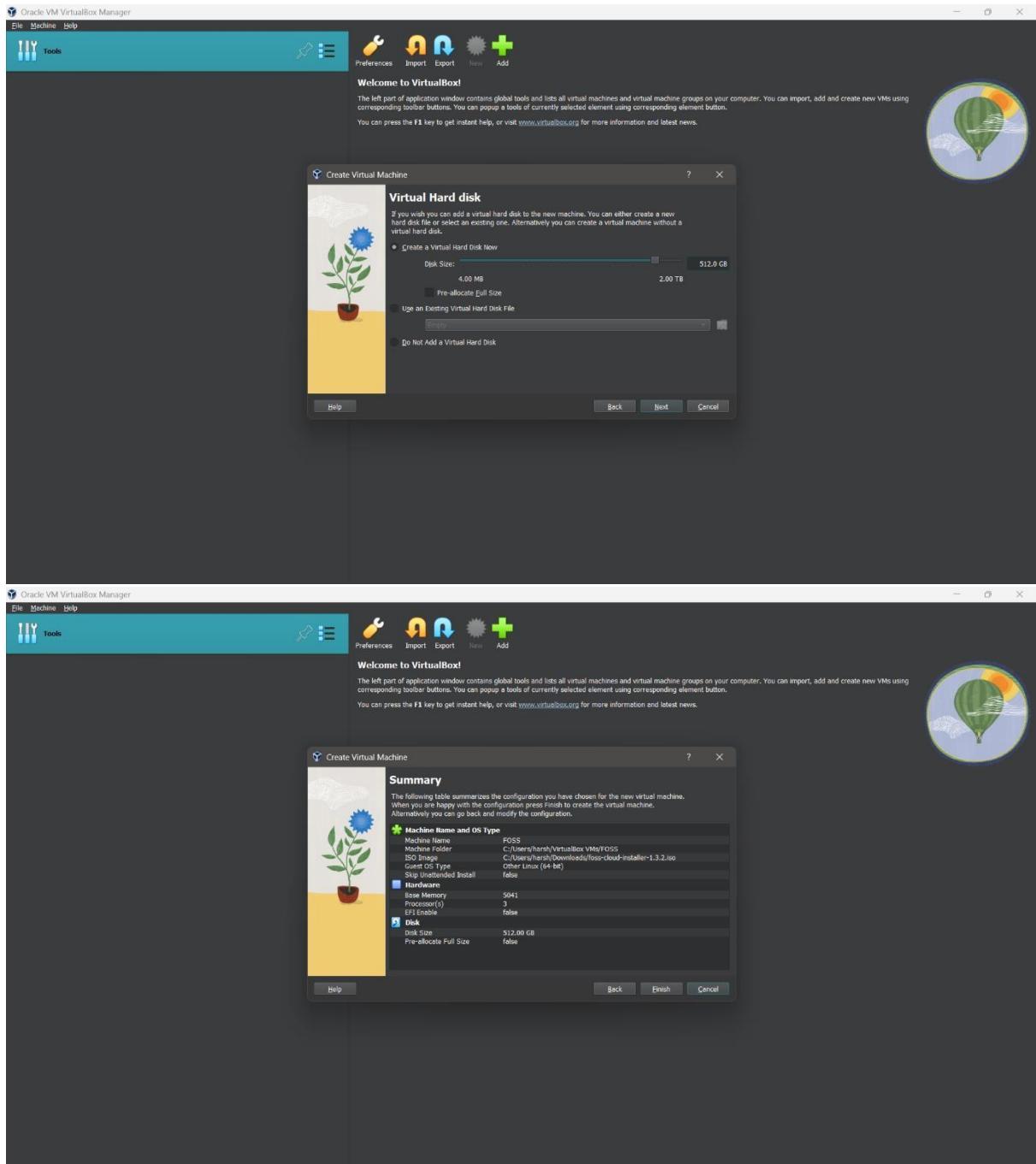
- Then enter DNS as 8.8.8.8.
- Type no to set DNS resolver.
- Type yes to verify the input.
- Type yes to reboot.
- After reboot Select Boot from first hard disk.
- Enter username as root and password as admin.
- Type ifconfig and see whether the manual configuration is displayed or not.
- Then type fc-node-configuration -n demo-system --password admin
- Now open the browser in window and type

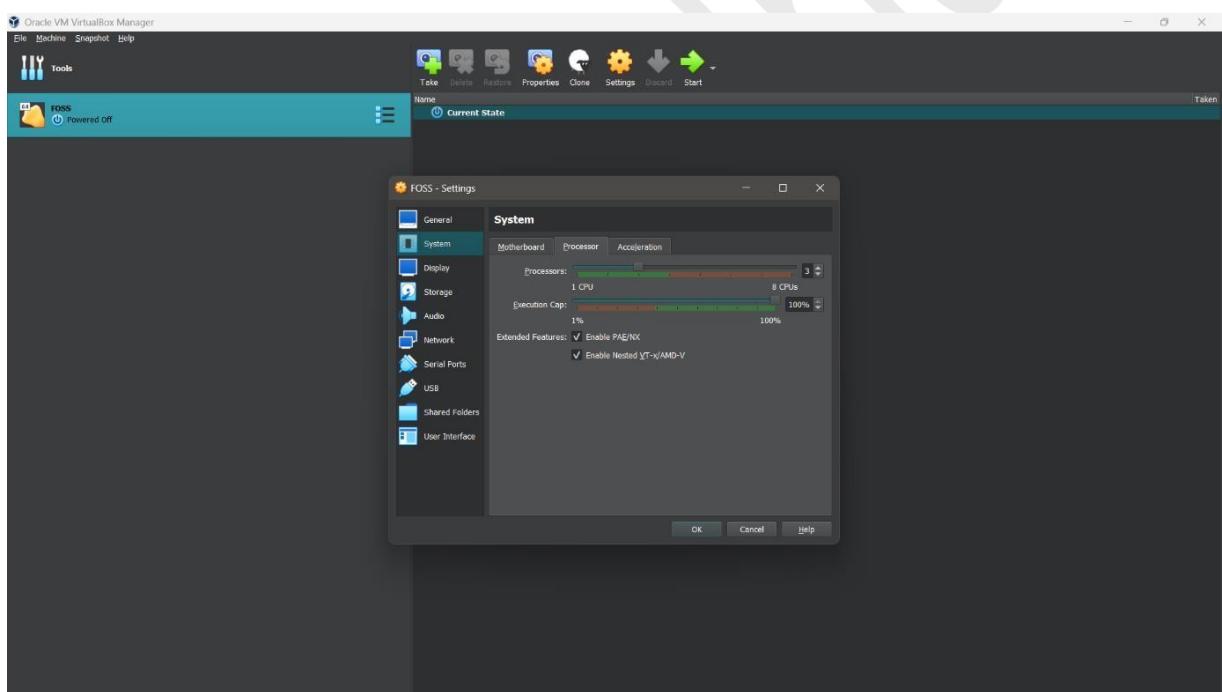
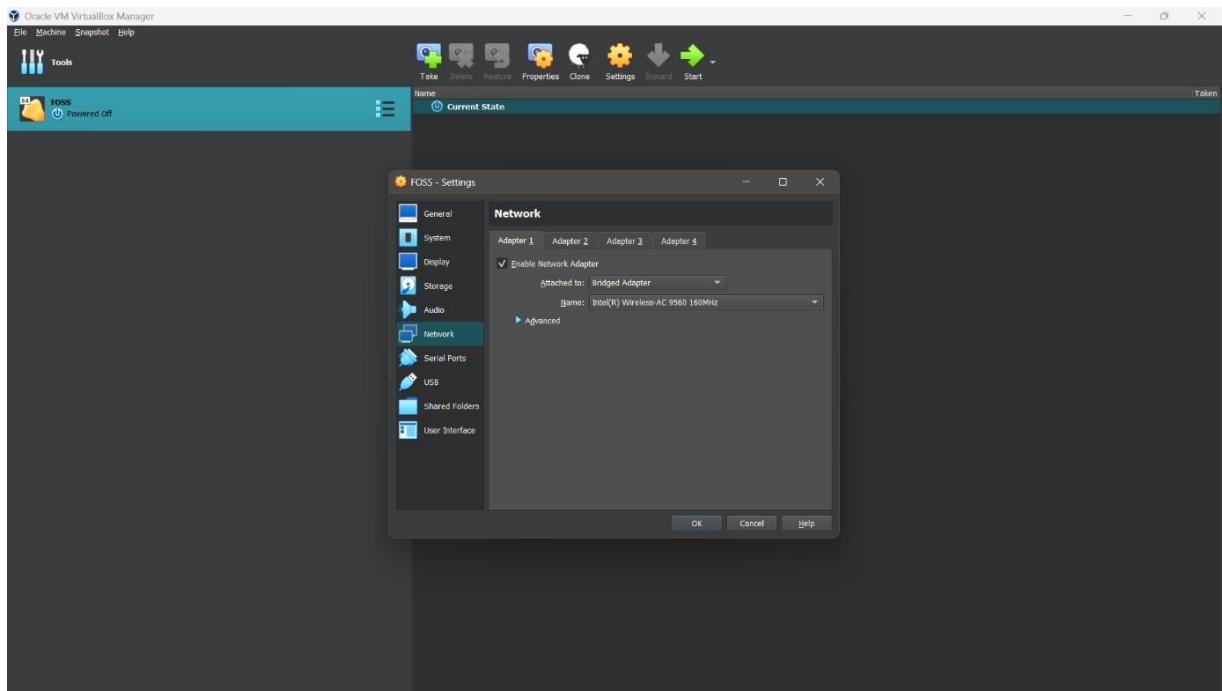
<http://192.168.1.46> and hit enter

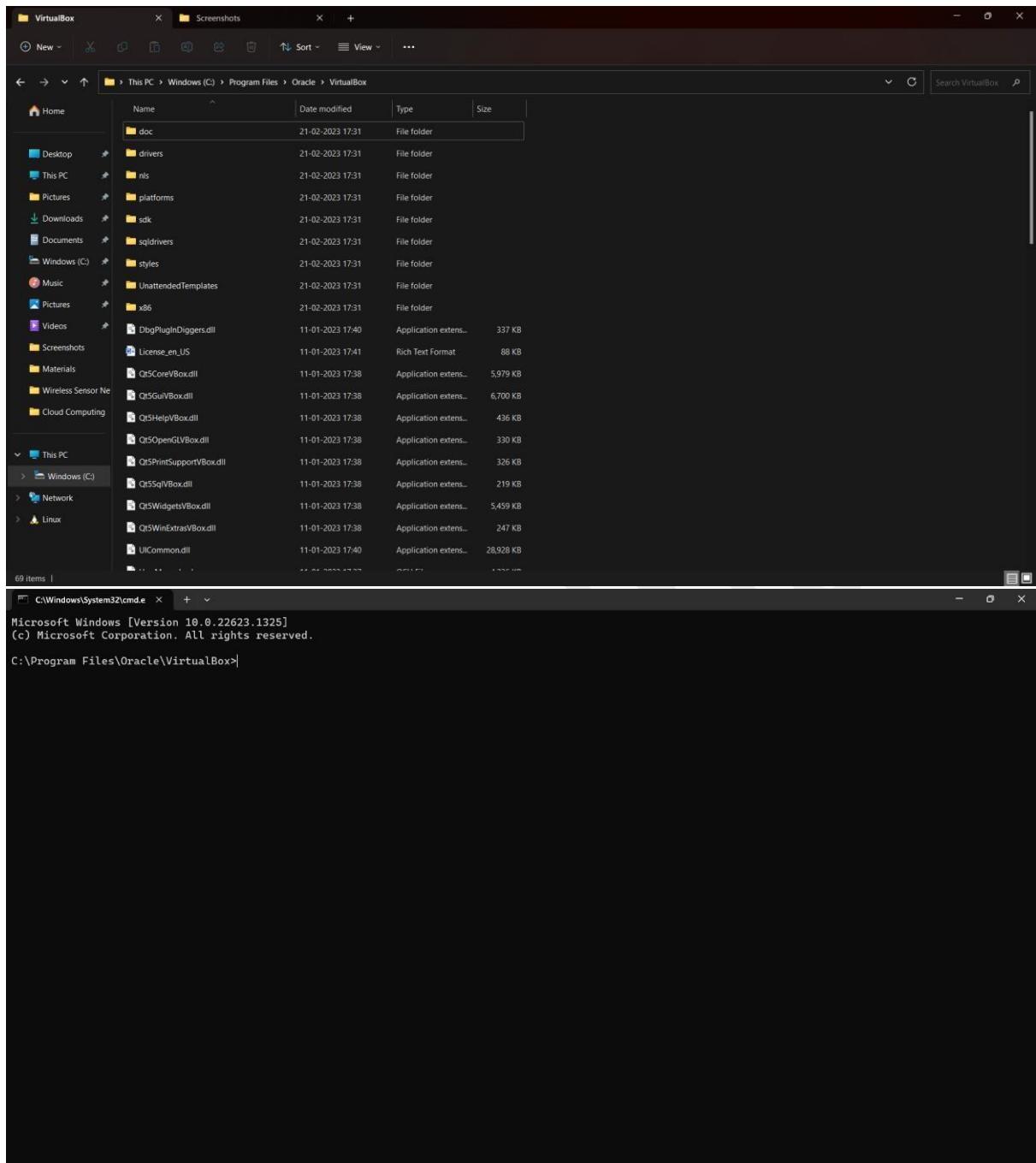
- Enter username and password as admin.
- At the left side go to Virtual Machines Click on Profiles Click on Upload ISO File Browse the ISO file give the file name and upload it.
- Now under Profiles go to create expand the linux expand i686 and select multi.
- You'll see the iso file which you have uploaded select it. Add a suitable name and description allocate memory as 1GB and click on create.
- Now under VM Templates go to create and click on the + of linux then again click on + of the hostname then click + of i686 and select multi.
- Click on the node which is available under the node section
- Allocate memory as 1 GB
- No of displays as 1
- Click on create
- Now start the machine
- Go to diagnostics Click on VMpool Template click on the virtual machine name which you have given copy the Spice ID link and paste it in the Remote viewer software and then click on connect.

Outputs:









```
C:\Windows\System32\cmd.e < + <
Microsoft Windows [version 10.0.2623.1325]
(c) Microsoft Corporation. All rights reserved.

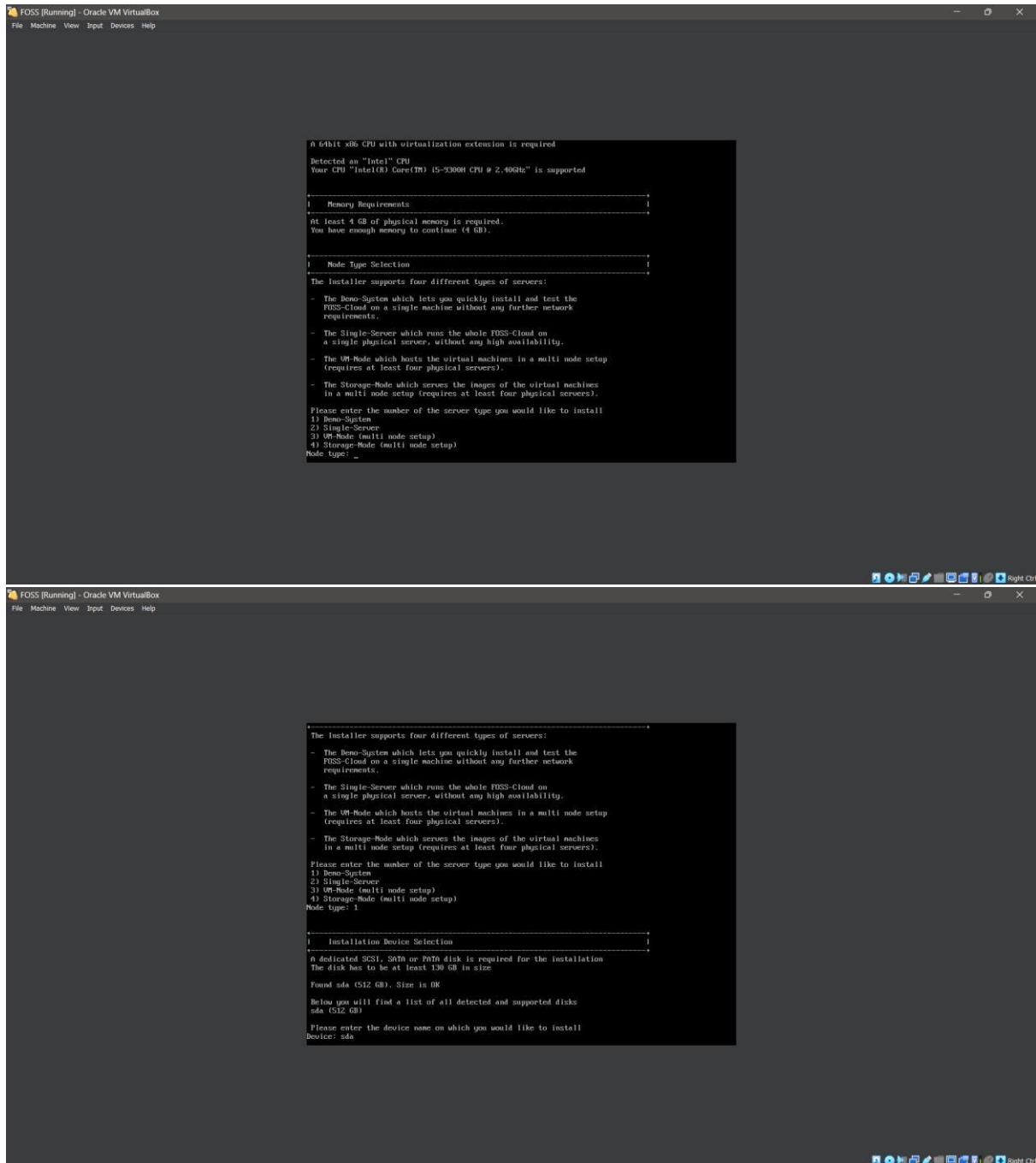
C:\Program Files\Oracle\VirtualBox>VBoxManage modifyvm FOSS --nested-hw-virt on
C:\Program Files\Oracle\VirtualBox>

FOSS [Running] Oracle VM VirtualBox
File Machine View Input Devices Help

[  88 938653] sr 2:8:8:0: Attached scsi generic sg1 type S
[  88 934382] Freeing unused kernel memory: 9764K (fffffff801f3f000 - ffffff00
28c9000)
[  88 935680] Write protecting the kernel read-only data: 1432K
[  88 937270] Freeing unused kernel memory: 292K (ffff800001717000 - ffff800001
600000)
[  88 940940] Freeing unused kernel memory: 1992K (ffff800001c0e000 - ffff80000
1e00000)
[  88 941088] Loading kernel modules...
>>> Waiting 1 seconds...
>>> Loading keymaps
Please select the keymap from the following list by typing in the appropriate
name or number. You should prefer the name to the number (for example
type 'fr' instead of '16'). Hit Enter for the default 'us' keymap.

1 azerty  2 be      3 bg      4 br-a    5 br-l    6 by      7 cf
8 croat   9 cz      10 de     11 dk     12 dvorak 13 es    14 et
15 fi     16 fr      17 gr     18 hu     19 il     20 is     21 it
22 jp     23 kr      24 lt     25 nl     26 nn     27 no     28 pt
29 sl     30 ro      31 ru     32 se     33 sg     34 sk-u   35 sk-z
36 slovene 37 trf   38 us     39 uk     40 us     41 us     42 wangbe 43 fr_CH
44 spedup 45 cs_CZ   46 de_CH 47 sg-latin48 fr-bepo 49 colemak 50 de_neo

default choice (US keymap) will be used if no action within 28 seconds
<< Load keymap (Enter for default): 41_
```



```
FOSS [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

A dedicated SCSI, SATA or PATA disk is required for the installation
The disk has to be at least 130 GB in size
Found sda (512 GB). Size is OK
Below you will find a list of all detected and supported disks
sda (512 GB)
Please enter the device name on which you would like to install
Device: sda
'sda' will be used as the installation device.

[ Logical Volume Cleanup and Preparation ]
Checking for existing volume groups and physical volumes
No volume groups found
No volume groups found

[ Installation Device Partitioning ]
Below is the existing partition layout of your selected device
Error: /dev/sda: unrecognised disk label
Model: ATA VBOX HARDDISK (scsi)
Disk /dev/sda: 550GB
Sector size (logical/physical): 512B/512B
Partition Table: unknown
Disk Flags:

All existing partitions have to be deleted in order to continue
THIS MEANS THAT ALL DATA ON THIS DISK WILL BE LOST
Do you want to continue?
yes or no?: yes

FOSS [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

[ Logical Volume Setup ]
Setup LVM environment and volumes
No volume groups found
Using default configuration successfully created
Logical volume "home" created
Logical volume "var" created
Logical volume "tmp" created
Logical volume "root" created
Logical volume "virtualization" created
All LVM volumes created successfully

[ Filesystem Creation ]
Creating filesystems
mke2fs 1.42.13 (17-May-2015)
Filesystem creation was successful

[ Mounting Filesystems ]
Mounting of filesystems was successful

[ Staged Installation ]
Unpacking staged tarball
This will take a while - please be patient
```

```
FOSS [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

Logical volume "virtualization" created
All LVM volumes created successfully

| Filesystem Creation
| Creating filesystems
mkfs2fs 1.42.13 (17-May-2015)
Filesystem creation was successful

| Mounting Filesystems
Mounting of filesystems was successful

| Staged Installation
| Unpacking staged tarball
This will take a while - please be patient
Unpacking of staged tarball was successful

| Network Device Selection
Please enter the device which you would like to use
Available ethernet devices: enp0s3
Device #0: enp0s3

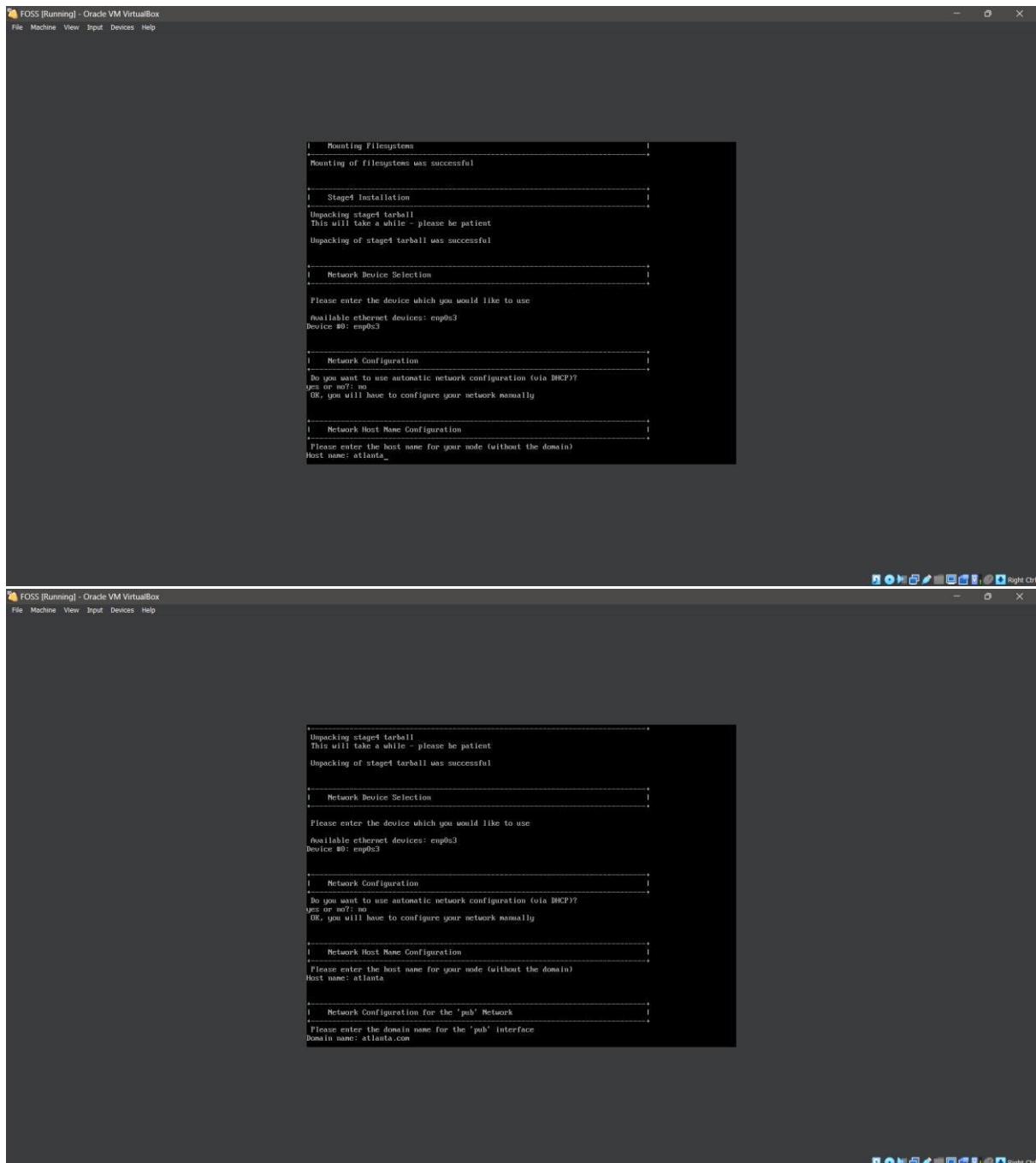
Creating filesystems
mkfs2fs 1.42.13 (17-May-2015)
Filesystem creation was successful

| Mounting Filesystems
Mounting of filesystems was successful

| Stage4 Installation
| Unpacking staged tarball
This will take a while - please be patient
Unpacking of staged tarball was successful

| Network Device Selection
Please enter the device which you would like to use
Available ethernet devices: enp0s3
Device #0: enp0s3

| Network Configuration
Do you want to use automatic network configuration (via DHCP)?
yes or no?: no
```



```
Command Prompt + 
Ethernet adapter Ethernet 2:
Connection-specific DNS Suffix . . .
Link-local IPv6 Address . . . . . : fe80::1eb2:e980:8e91:db2b%10
IPv4 Address . . . . . : 192.168.56.1
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

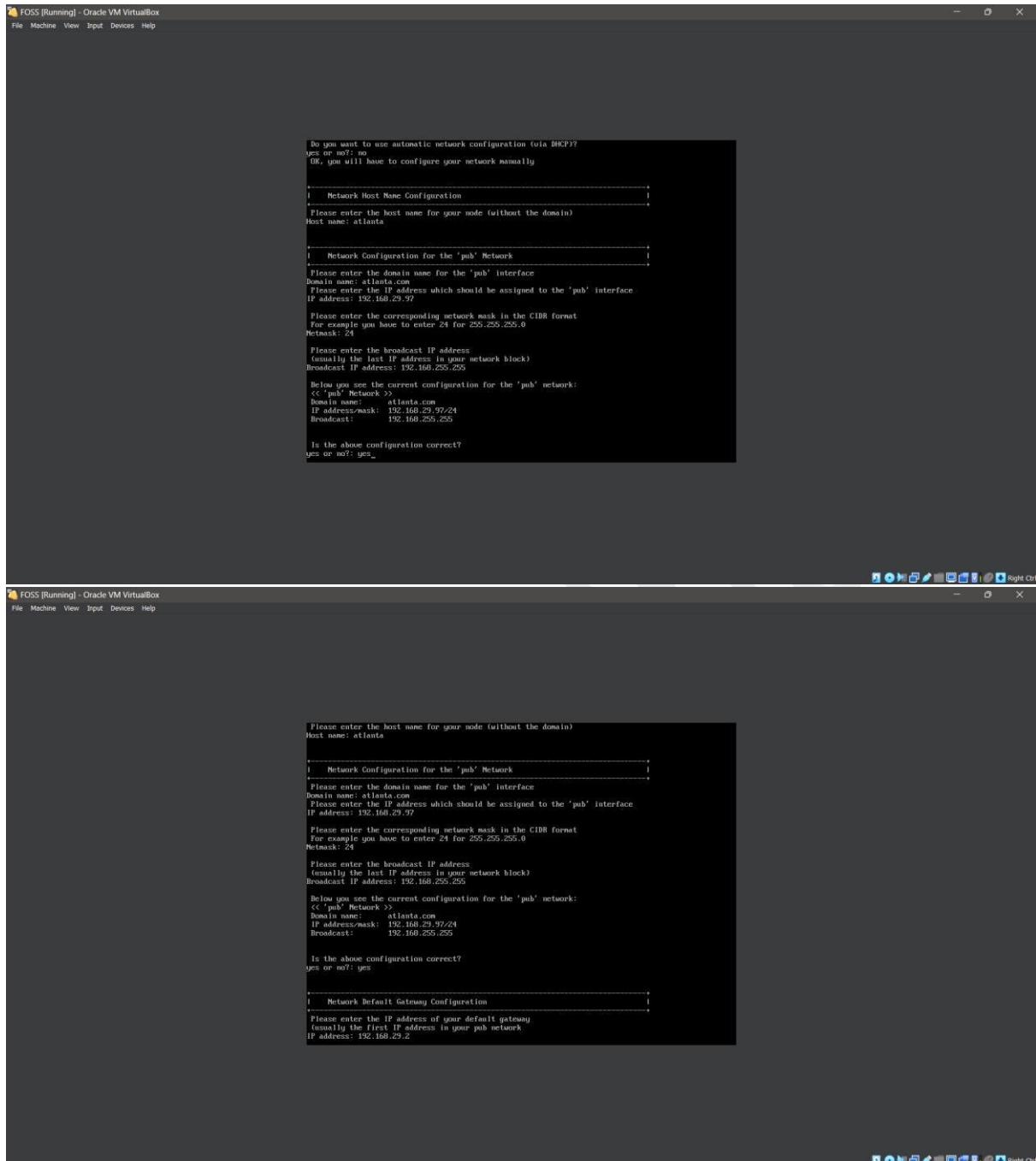
Wireless LAN adapter Local Area Connection* 1:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . .

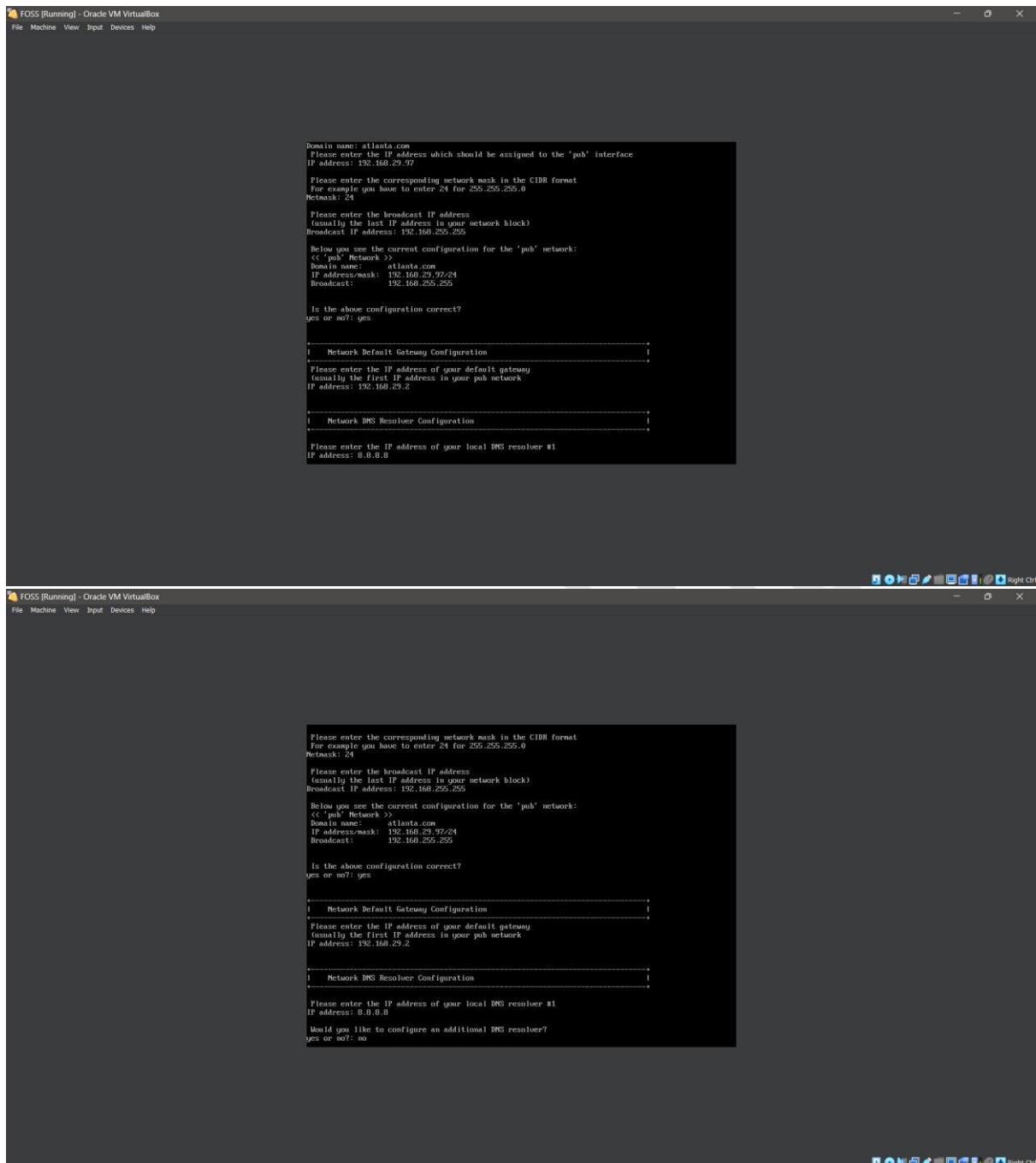
Wireless LAN adapter Local Area Connection* 2:
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . .

Wireless LAN adapter Wi-Fi:
Connection-specific DNS Suffix . . .
IPv6 Address . . . . . : 2405:201:37:a044:7680:d512:f109:ec29
Temporary IPv6 Address. . . . . : 2405:201:37:a044:f80a:22f3:2620:887c
Link-local IPv6 Address . . . . . : fe80::14d8:673c:4b1b:bbbe%2
IPv4 Address . . . . . : 192.168.29.96
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : fe80::b6a7:c6ff:fe76:4bc%2
192.168.29.1

C:\Users\harsh>
```







```
FOSS [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

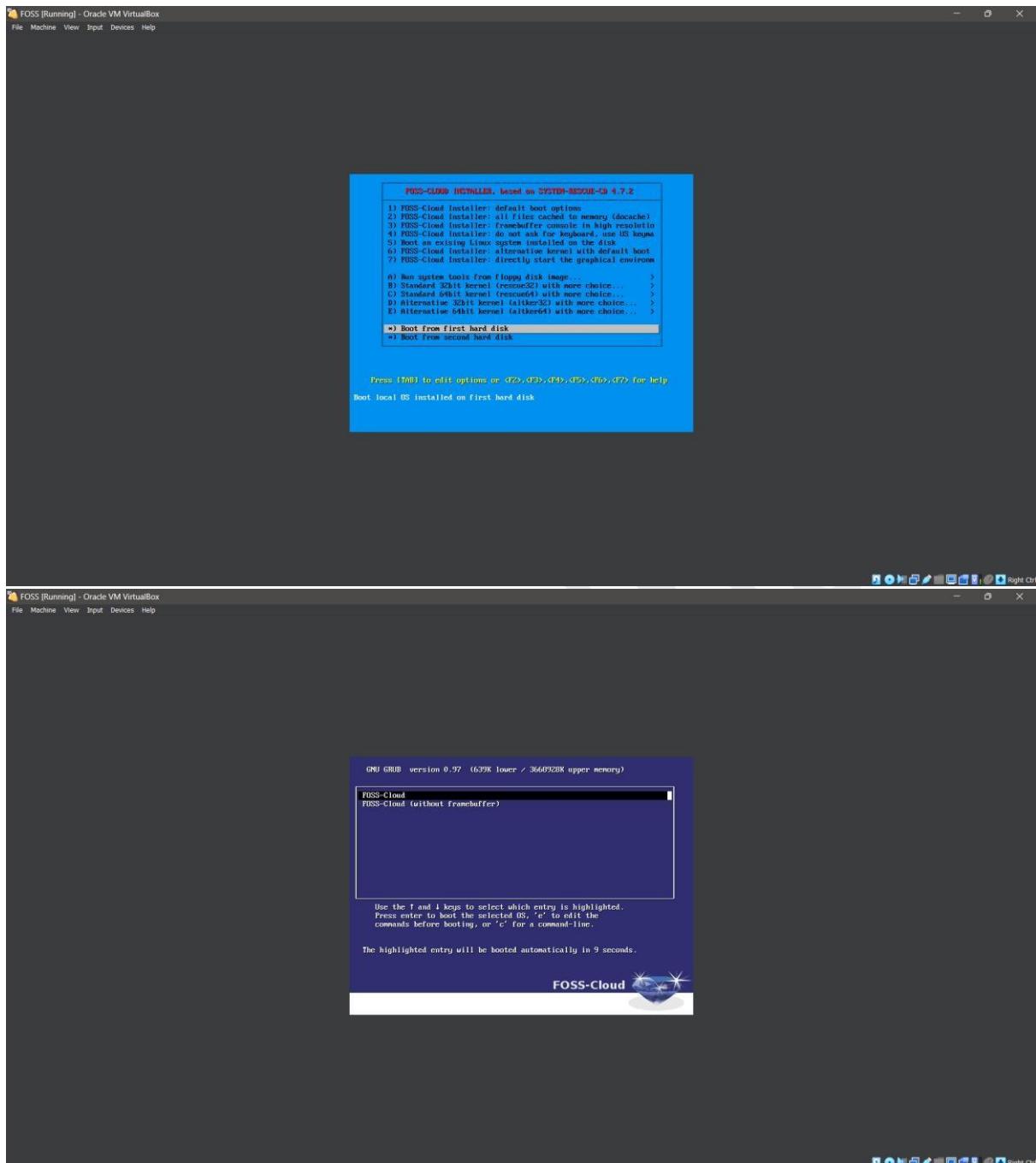
Network Default Gateway Configuration
Please enter the IP address of your default gateway
(usually the first IP address in your pub network)
IP address: 192.168.29.2

Network DNS Resolver Configuration
Please enter the IP address of your local DNS resolver #1
IP address: 0.0.0.0
Would you like to configure an additional DNS resolver?
yes or no?: no
Below you see the overall network configuration:
<< Host Name >>
Host name: atlanta
<< 'pub' Network >>
Domain name: atlanta.com
IP address/mask: 192.168.29.97/24
Broadcast: 192.168.255.255
<< DNS Resolvers >>
DNS Resolver: 0.0.0.0
<< Default Gateway >>
Default Gateway: 192.168.29.2
Is the above configuration correct?
yes or no?: yes

Below you see the overall network configuration:
<< Host Name >>
Host name: atlanta
<< 'pub' Network >>
Domain name: atlanta.com
IP address/mask: 192.168.29.97/24
Broadcast: 192.168.255.255
<< DNS Resolvers >>
DNS Resolver: 0.0.0.0
<< Default Gateway >>
Default Gateway: 192.168.29.2
Is the above configuration correct?
yes or no?: yes
rm: cannot remove /mnt/usb0/etc/udev/rules.d/*: No such file or directory

Boot Loader Installation
Detecting the grub boot partition name
Installing grub into master boot record
Boot Loader installation was successful

Installation Complete
Congratulations! You have finished the installation of FOSS-Cloud
Now all you need to do is reboot the system and remove the CD-ROM
Do you want to reboot your system?
yes or no?: yes_
```



FOSS-Cloud

demo-node v1.3.2

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<http://www.foss-group.de>

Direct your web browser to:
---> <http://192.168.29.97> <---
user: admin password: admin

Console/SSH-Login
user: root password: admin

Documentation: <http://wiki.foss-cloud.org>

This is atlanta.atlanta.com (Linux x86_64 4.10.1-gentoo) 19:25:47

```
atlanta login: root
Password:
atlanta ~ #
```

```
demo-node v1.3.2

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http://www.foss-group.de

Direct your web browser to:
--> http://192.168.29.97 <---
user: admin password: admin

Console/SSH-Login
user: root password: admin

Documentation: http://wiki.foss-cloud.org

=====
This is atlanta.atlanta.com (Linux x86_64 4.10.1-gentoo) 19:25:47

atlanta login: root
Password:
atlanta ~ # ifconfig
em0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.29.97 netmask 255.255.255.0 broadcast 192.168.255.255
        ether 00:00:27:c4:41:5f txqueuelen 1000 (Ethernet)
            RX packets 101 bytes 7692 (7.5 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 113 bytes 6791 (6.6 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
        loop txqueuelen 1000 (Local Loopback)
            RX packets 34 bytes 3534 (3.4 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 34 bytes 3534 (3.4 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

umbr0: flags=4419<UP,BROADCAST,RUNNING,PROMISC,MULTICAST> mtu 1500
    inet 172.31.255.1 netmask 255.255.255.0 broadcast 172.31.255.255
        ether b6:bf:85:bf:0b:11 txqueuelen 1000 (Ethernet)
            RX packets 0 bytes 0 (0.0 B)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 0 bytes 0 (0.0 B)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

atlanta ~ # fc-node-configuration -n demo-system --password admin
```

```
Working on /etc/foss-cloud/fc-brokerd.template-primary-master ...
Setting the proper permissions on the file /etc/foss-cloud/broker.conf ...

Starting the daemon fc-brokerd ...
Executing: /etc/init.d/fc-brokerd start...
 * Starting FOSS-Cloud Broker Daemon ...
Started fc-brokerd successfully!

Adding the daemon fc-brokerd to the runlevel default ...
Executing: rc-update add fc-brokerd default ...
Added fc-brokerd successfully to runlevel default!

Starting the daemon precursor ...
Executing: /etc/init.d/precursor start...
 * Starting PowerDNS Recursor ...
Started precursor successfully!

Adding the daemon precursor to the runlevel default ...
Executing: rc-update add precursor default ...
Added precursor successfully to runlevel default!

Starting the daemon dhcpcd ...
Executing: /etc/init.d/dhcpcd start...
 * /var/run/dhcp: creating directory
 * /var/run/dhcp: correcting owner
 * /var/lib/dhcp: correcting owner
 * /var/lib/dhcp/dhcpcd.leases: creating file
 * /var/lib/dhcp/dhcpcd.leases: correcting mode
 * /var/lib/dhcp/dhcpcd.leases: correcting owner
 * Starting dhcpcd ...
Started dhcpcd successfully!

Adding the daemon dhcpcd to the runlevel default ...
Executing: rc-update add dhcpcd default ...
Added dhcpcd successfully to runlevel default!

Directory /var/virtualization/backup created

Created backup directory symlink: /var/backup --> /var/virtualization/backup, if you want to change the backup direc
do so by modifying this symlink.
File /etc/local.d/50-foss-cloud-firstrun.start deleted

Congratulations, you have finished the installation and configuration of this Node!
atlanta ~ #
```

FOSS-Cloud - Login

Not secure | 192.168.29.97/vm-manager/

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Home About Contact

Login

Please fill out the following form with your login credentials:

Fields with * are required.

Username *

Password *

Remember me next time

Version 1.3.2
on 2023-01-10
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FOSS-Cloud - Uploadiso VmProfile

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Virtual Machine

- Persistent VMs
- Dynamic VMs
- VM Templates
 - Create
 - Profiles
 - Create

VM Pool

Storage Pool

Node

Network

User

Configuration

Diagnostics

Assigned VMs

Upload ISO File

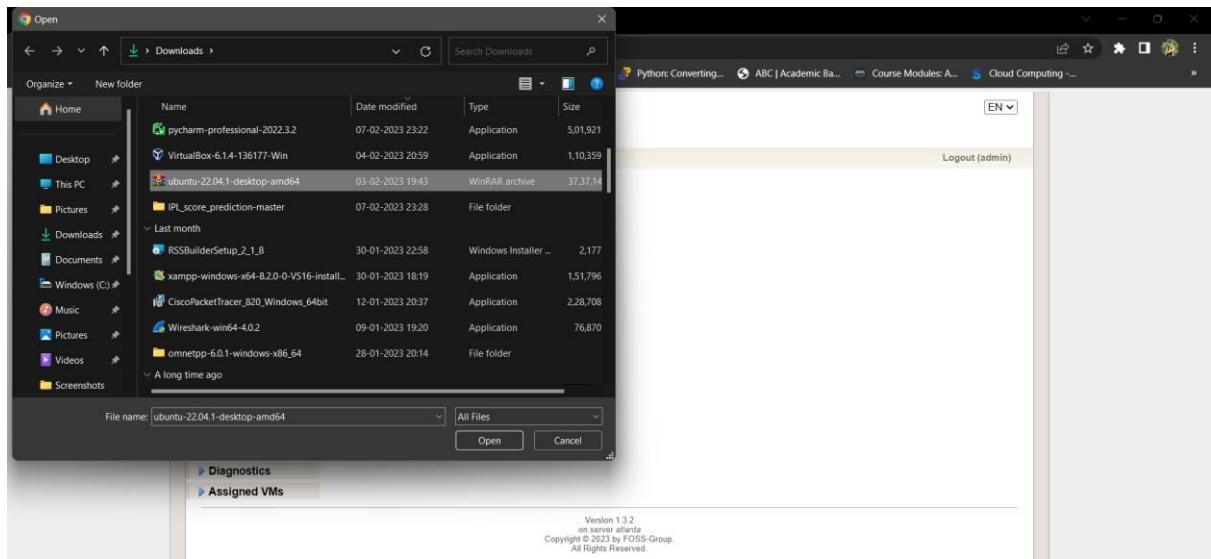
Fields with * are required.

Alternative upload method

Iso File No file chosen

File Name

Version 1.3.2
on 2023-01-10
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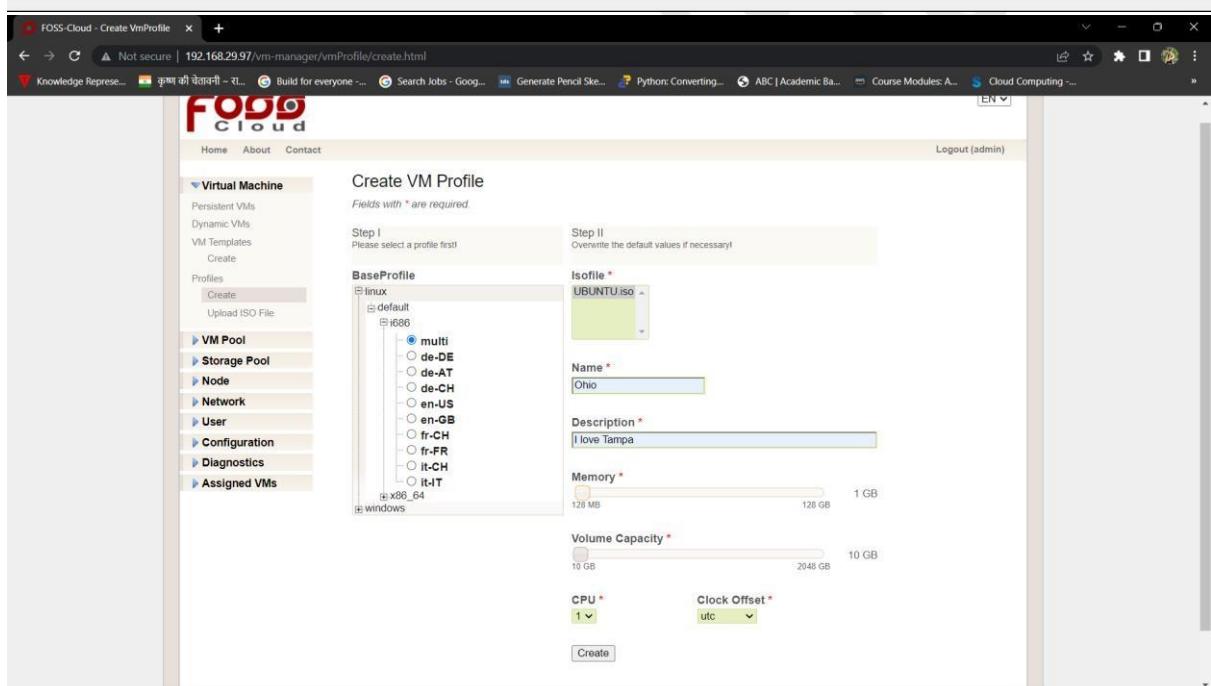
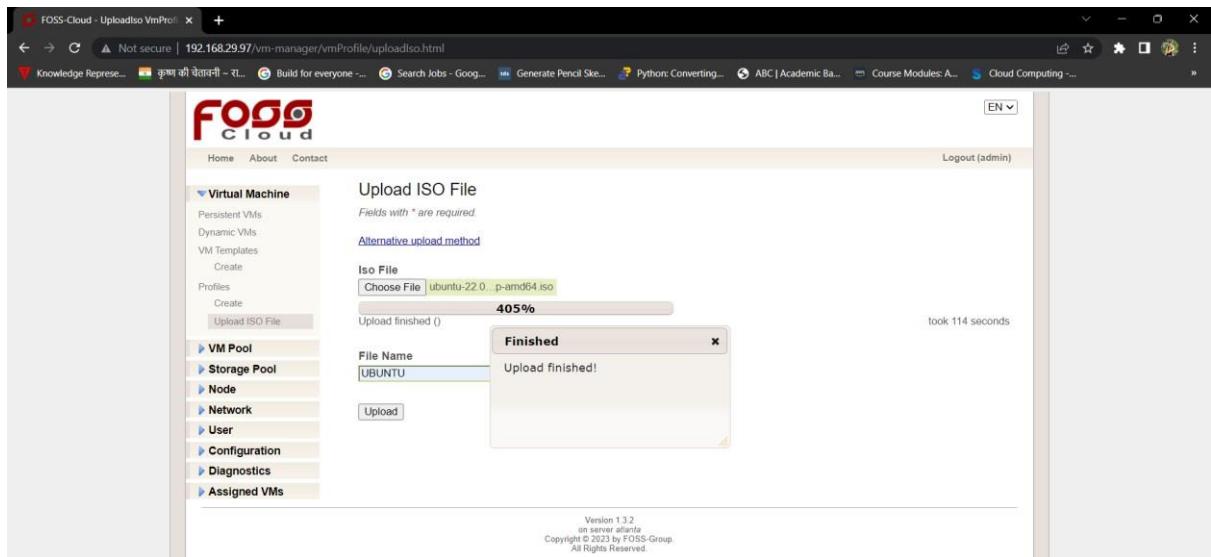


A screenshot of a web-based interface titled "FOSS Cloud - Uploadiso VmPro". The URL is "192.168.29.97/vm-manager/vmProfile/uploadiso.html". The page has a sidebar with navigation links like "Home", "About", "Contact", "Virtual Machine", "VM Pool", "Storage Pool", "Node", "Network", "User", "Configuration", "Diagnostics", and "Assigned VMs".

The main form is titled "Upload ISO File" and contains the following fields:

- "Iso File": A file input field with "ubuntu-22.0...p-amd64.iso" selected.
- "File Name": An input field containing "UBUNTU".
- "Upload" button: A button to upload the file.

At the bottom of the form, there's a copyright notice: "Version 1.3.2 on server atlanta Copyright © 2023 by FOSS-Group. All Rights Reserved."



FOSS-Cloud - VmProfile

Not secure | 192.168.29.97/vm-manager/vmProfile/index.html?copyaction=12806

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Manage VMProfiles

No. Name Architecture Language Description Action

1 Qbtq linux / i686 multi I love Tampa

Check ISO Copy

Copy of ISO file still running!

Version 1.3.2
on server at 192.168.29.97
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Virtual Machine Persistent VMs Dynamic VMs VM Templates Create Profiles Create Upload ISO File VM Pool Storage Pool Node Network User Configuration Diagnostics Assigned VMs

FOSS-Cloud - Create VmTemplate

Not secure | 192.168.29.97/vm-manager/vmTemplate/create.html

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Create VmTemplate

Fields with * are required.

Step I
Please select a profile first

Profile Vmpool * Node *

Name * Description *

Memory * 1 B

Volume Capacity * 1 B

CPU * Clock Offset *

Virtual Machine Persistent VMs Dynamic VMs VM Templates Create Profiles Create Upload ISO File VM Pool Storage Pool Node Network User Configuration Diagnostics Assigned VMs

F OSS-Cloud - Create VmTemplate | Not secure | 192.168.29.97/vm-manager/vmTemplate/create.html

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Create VmTemplate

Fields with * are required.

Step I
Please select a profile first.

Profile

VM Pool

VM Templates

Create

Profiles

Create

Upload ISO File

VM Pool

Storage Pool

Node

Network

User

Configuration

Diagnostics

Assigned VMs

Vmpool *

vm-template-virtual-machine-pool-01

Node *

atlanta atlanta.com

Name *

Ohio

Description *

I love Tampa

Memory *

128 MB 1 GB

Volume Capacity *

10 GB 2048 GB

CPU *

1

Clock Offset *

utc

Number of displays

1

Create

F OSS-Cloud - VmTemplate | Not secure | 192.168.29.97/vm-manager/vmTemplate/index.html

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FOSS Cloud

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Manage VMTemplates

Vm Pool vm-template-virtual-machine-pool-01

No.	DisplayName	Status	Run Action	Memory	Node	Action
1	Ohio	stopped	→ ↶ ⚡ 🛡	---	atlanta.atlanta.com	🔗 🌐 🏠 🏢 🏢 🏢

Page 1 of 1 Refresh 10

Links

Download Spice Client

Version 1.3.2
on server atlanta
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F OSS-Cloud - Vmtemplateinfos | +

Not secure | 192.168.29.97/vm-manager/diagnostics/vmtemplateinfos.html?dn=sstVirtualMachine=e770e7a7-df3c-4850-a2f2-1faa8361367b.ou=virtual%20machines.ou=virtualization,ou=se...

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Logout (admin) EN

FOSS Cloud

Home About Contact

VM Template Infos

>> Ohio

- Libvirt URI: qemu+tcp://127.0.0.1/system
- SPICE URI: spice://192.168.29.97?port=5900&password=FoSS-Group
- Start XML:

```
<domain type="kvm">
    <name>e770e7a7-df3c-4850-a2f2-1faa8361367b</name>
    <uuid>e770e7a7-df3c-4850-a2f2-1faa8361367b</uuid>
    <memory>1048576</memory>
    <vcpu>1</vcpu>
    <os>
        <type arch="i686" machine="pc">hvm</type>
        <boot dev="cdrom"/>
        <smbios mode="sysinfo"/>
    </os>
    <sysinfo type="smbios">
        <bios>
            <entry name="vendor">FOSS-Group</entry>
        </bios>
        <system>
            <entry name="manufacturer">FOSS-Group</entry>
            <entry name="vendor">FOSS-Group</entry>
            <entry name="serial">e770e7a7-df3c-4850-a2f2-1faa8361367b</entry>
        </system>
    </sysinfo>

```

F OSS-Cloud - VmTemplate | +

Not secure | 192.168.29.97/vm-manager/vmTemplate/index.html

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FOSS Cloud

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Manage VM Templates

Vm Pool: vm-template-virtual-machine-pool-01

No.	DisplayName	Status	Run Action	Memory	Node	Action
1	Ohio	running	Stop	1 GB / 1 GB	atlanta.atlanta.com	

Links: Download Spice Client

Version 1.3.2
on server atlanta
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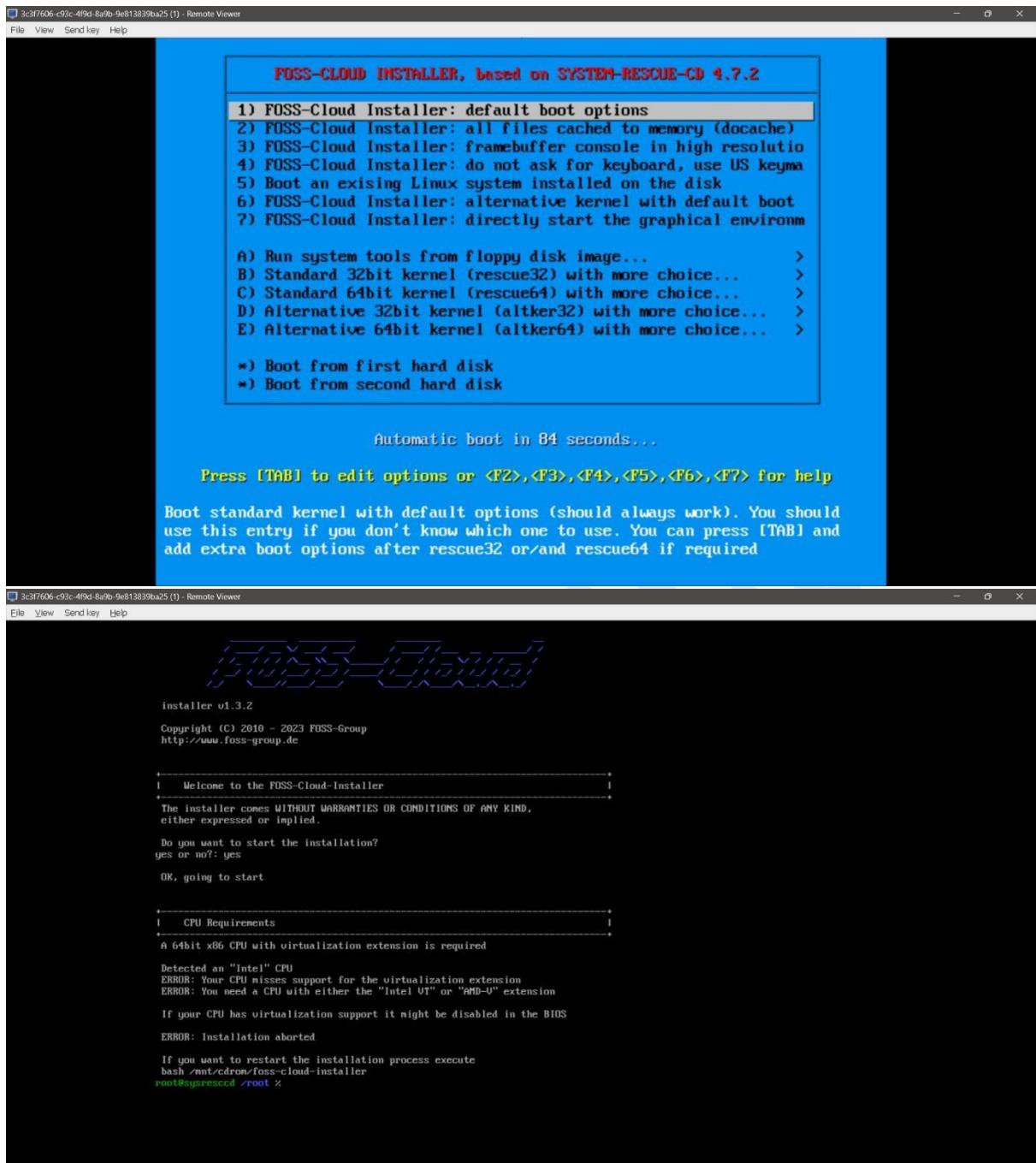
The screenshot shows a web browser window for 'FOSS-Cloud - Vmtemplateinfos'. The URL is 192.168.29.97/vm-manager/diagnostics/vmtemplateinfos.html?dn=sstVirtualMachine=1bbdcc40-62c5-4deb-8b79-3ff5dd42d0e9.ou=virtual%20machines.ou=virtualization.ou=s...'. The page title is 'VM Template Infos' under the 'Diagnostics' section of the sidebar. The main content area displays the following XML configuration:

```
spice://192.168.29.97?port=5900&password=K02chn6Da9mr

<domain type="kvm">
    <name>1bbdcc40-62c5-4deb-8b79-3ff5dd42d0e9</name>
    <uuid>1bbdcc40-62c5-4deb-8b79-3ff5dd42d0e9</uuid>
    <memory>1048576</memory>
    <vcpu>1</vcpu>
    <os>
        <type arch="i686" machine="pc">hvm</type>
        <boot dev="cdrom"/>
        <mbios mode="sysinfo"/>
    </os>
    <sysinfo type="smbios">
        <bios>
            <entry name="vendor">FOSS-Group</entry>
        </bios>
        <system>
            <entry name="manufacturer">FOSS-Group</entry>
            <entry name="vendor">FOSS-Group</entry>
            <entry name="serial">1bbdcc40-62c5-4deb-8b79-3ff5dd42d0e9</entry>
        </system>
    </sysinfo>

```





Conclusion: Hence we have successfully performed IAAS

PRACTICAL NO 2

Aim: Study and Implementation of Platform as a Service

Theory:

KVM (Kernel Virtual Machine)

KVM is a type of hypervisor that enables, emulates and provides for the creation of virtual machines on operating systems. These machines are built on top of the Linux kernel, using operating systems such as Linux, Ubuntu and Fedora. KVM can be installed on all x86 processors and provide separate instruction set extensions for Intel and AMD processors.

KVM supports multiple different guest operating system images including Linux Kernel, Windows, BSD and Solaris. It also allocates separate virtualized computing resources for each virtual machine such as the processor, storage, memory, etc.

Steps to perform:

- Open Terminal
- Write command sudo adduser sahil
- Enter the host password
- Set a password for new username
- Press enter and then Atlast type Y
- Write command su sahil
- sudo usermod -aG sudo sahil and then enter the password

**(In case you face an error of this incident will be reported
follow the steps to resolve it**

**Write the command su name of the host, then write sudo
usermod -aG sudo newusername and then enter the
password its done)**

- sudo kvm-ok
- Write sudo adduser sahil kvm
- Write sudo systemctl status libvirtd
- Write sudo virt-manger
- Add the iso file of the virtual machine
- Give the CPUs
- And lastly run it
- Click on Try Ubuntu

Output:

Activities Terminal Feb 18 12:18 sahil@harsh-sawant: /home/harsh/Desktop

```
harsh@harsh-sawant:~/Desktop$ sudo adduser sahil
[sudo] password for harsh:
Adding new user `sahil' (1001) ...
Adding new group `sahil' (1001) ...
Creating home directory `/home/sahil' ...
Copying files from `/etc/skel' ...
New password:
BAD PASSWORD: The password contains the user name in some form
Retype new password:
passwd: password updated successfully
Changing the user information for sahil
Enter the user's full name [Full Name []]:
Enter the user's room number [Room Number []]:
Enter the user's work phone [Work Phone []]:
Enter the user's home phone [Home Phone []]:
Other []:
Is the information correct? [Y/n] Y
sahil@harsh-sawant:~/Desktop$ sudo usermod -aG sudo sahil
sahil@harsh-sawant:~/Desktop$ sudo kvm-ok
INFO: /dev/kvm exists
KVM acceleration can be used
sahil@harsh-sawant:~/Desktop$ sudo adduser sahil kvm
Adding user `sahil' to group `kvm' ...
Adding user sahil to group kvm
done.
sahil@harsh-sawant:~/Desktop$ sudo systemctl status libvirdt
● libvirdt.service - Virtualization daemon
   Loaded: loaded (/lib/systemd/system/libvirdt.service; enabled; vendor preset: enabled)
     Active: active (running) since Sat 2023-02-18 17:43:32 IST; 5h 25min left
    TriggeredBy: ● libvirdt-admin.socket
      ● libvirdt-ro.socket
      Docs: man:libvirdt(8)
           https://libvirt.org
     Main PID: 1184 (libvirdt)
       Tasks: 21 (limit: 32768)
      Memory: 20.1M
        CPU: 47ms
       CGroup: /system.slice/libvirdt.service
               └─ 1184 /usr/sbin/libvirdt
      ├─ 1442 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsmasq/default.conf --leasefile-ro --dhcp-script=/usr/lib/libvirt/libvirt_leaseshelper
      ├─ 1443 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsmasq/default.conf --leasefile-ro --dhcp-script=/usr/lib/libvirt/libvirt_leaseshelper
```

Activities Terminal Feb 18 12:18 sahil@harsh-sawant: /home/harsh/Desktop

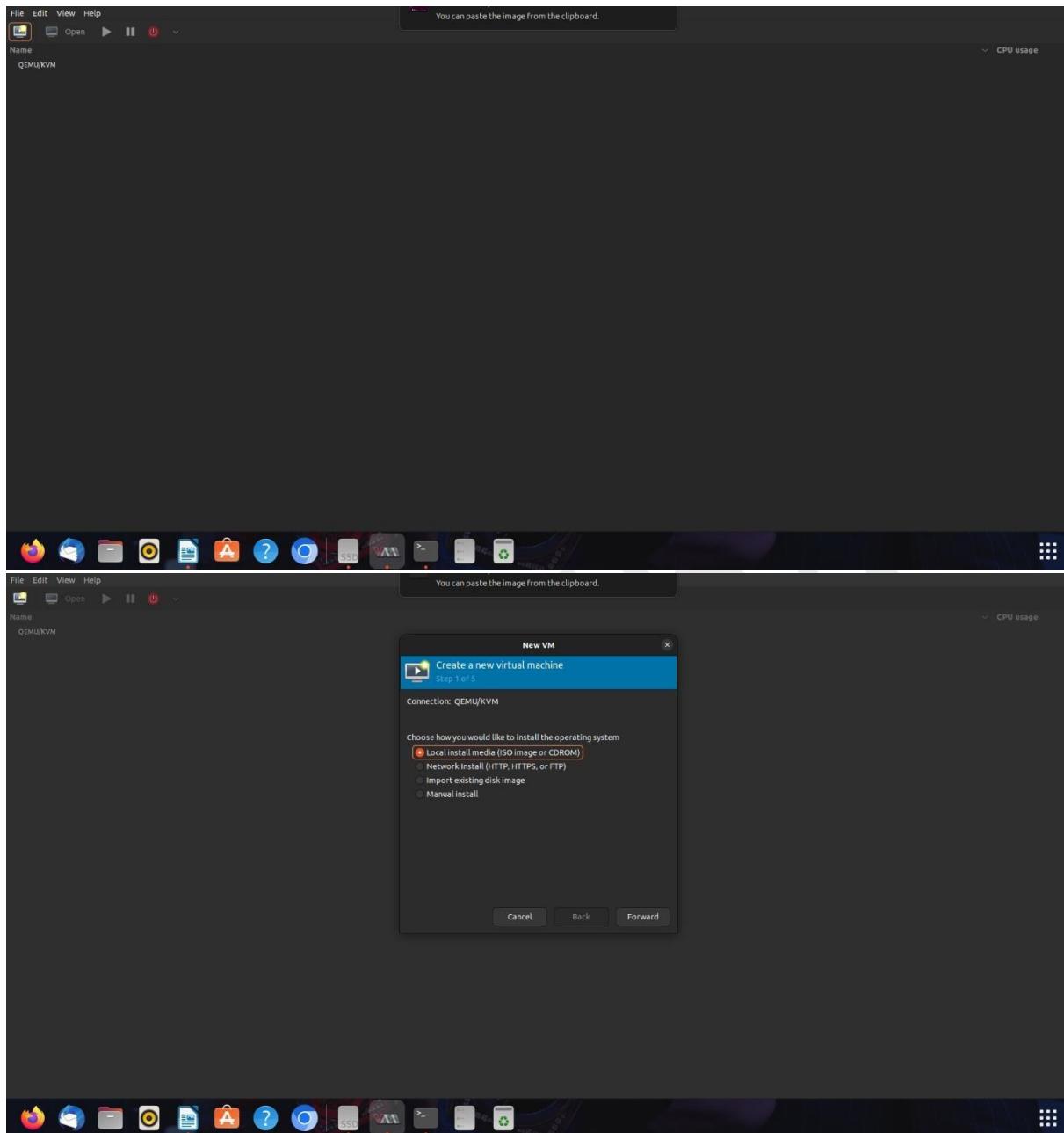
Screenshot captured You can paste the image from the clipboard.

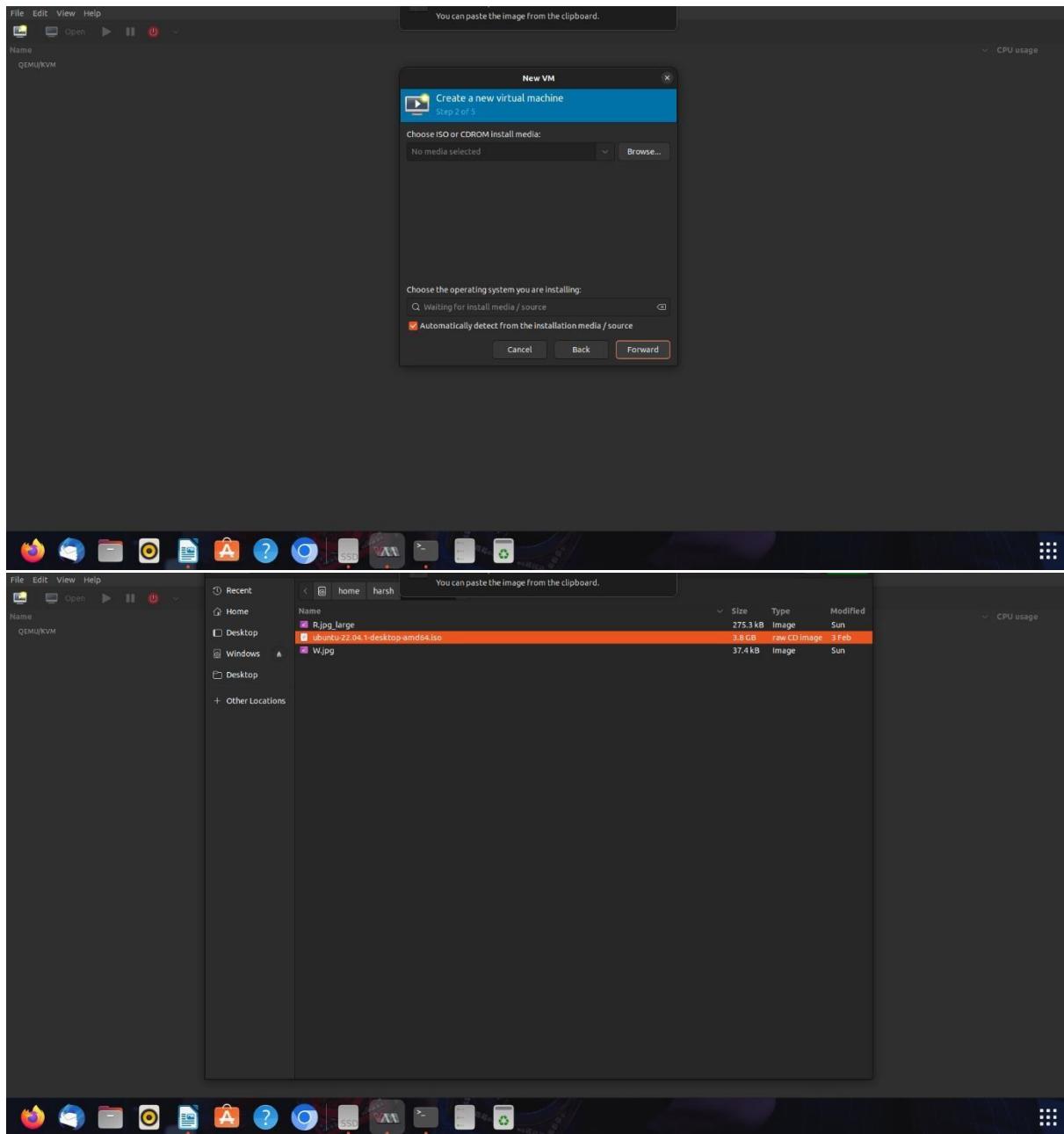
```
Full Name []:
Room Number []:
Work Phone []:
Home Phone []:
Other []

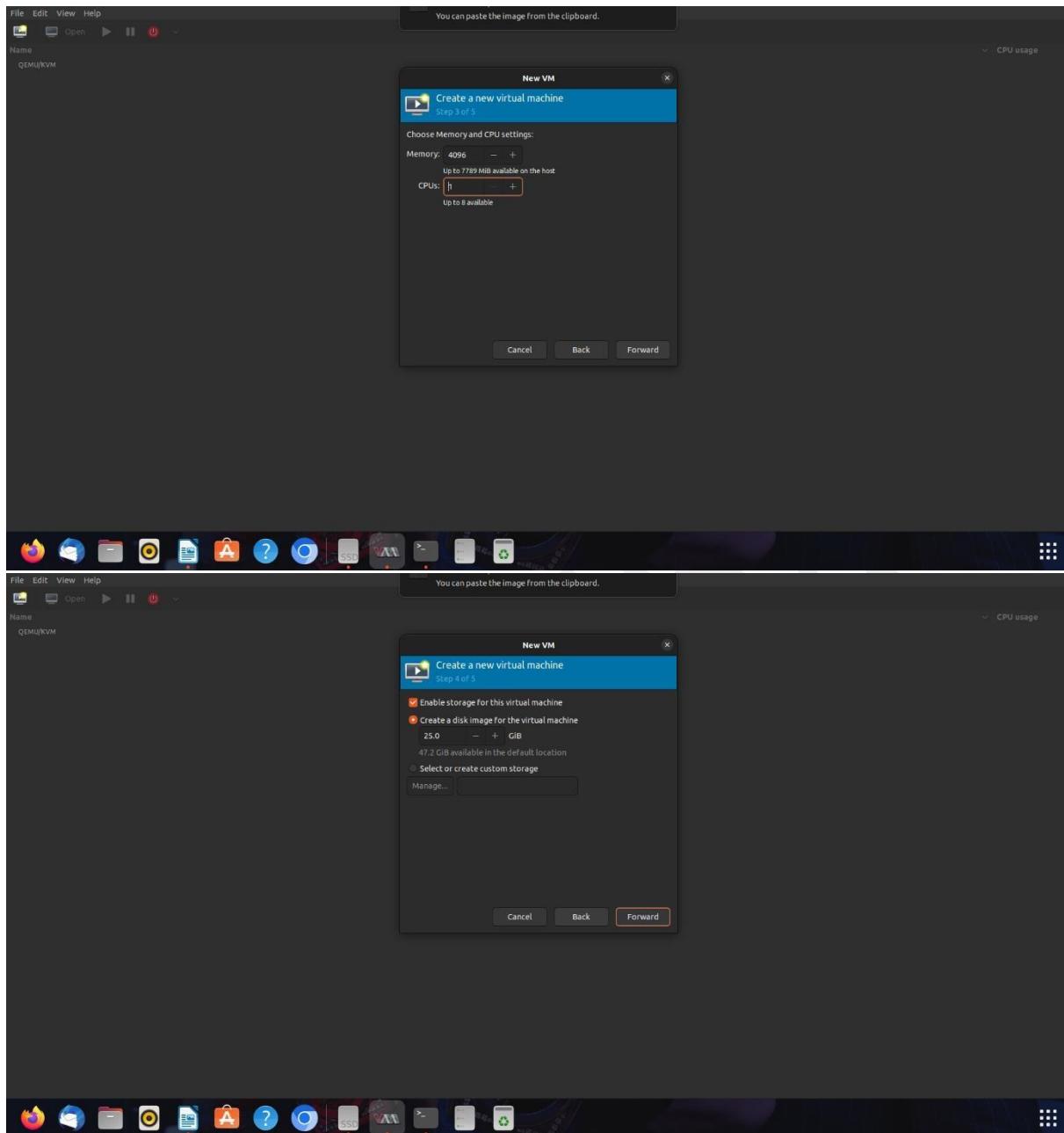
Is the information correct? [Y/n] Y
sahil@harsh-sawant:~/Desktop$ sudo usermod -aG sudo sahil
sahil@harsh-sawant:~/Desktop$ su sahil
Password:
To run a command as administrator (user "root"), use "sudo <command>".
see "man sudo_root" for details.

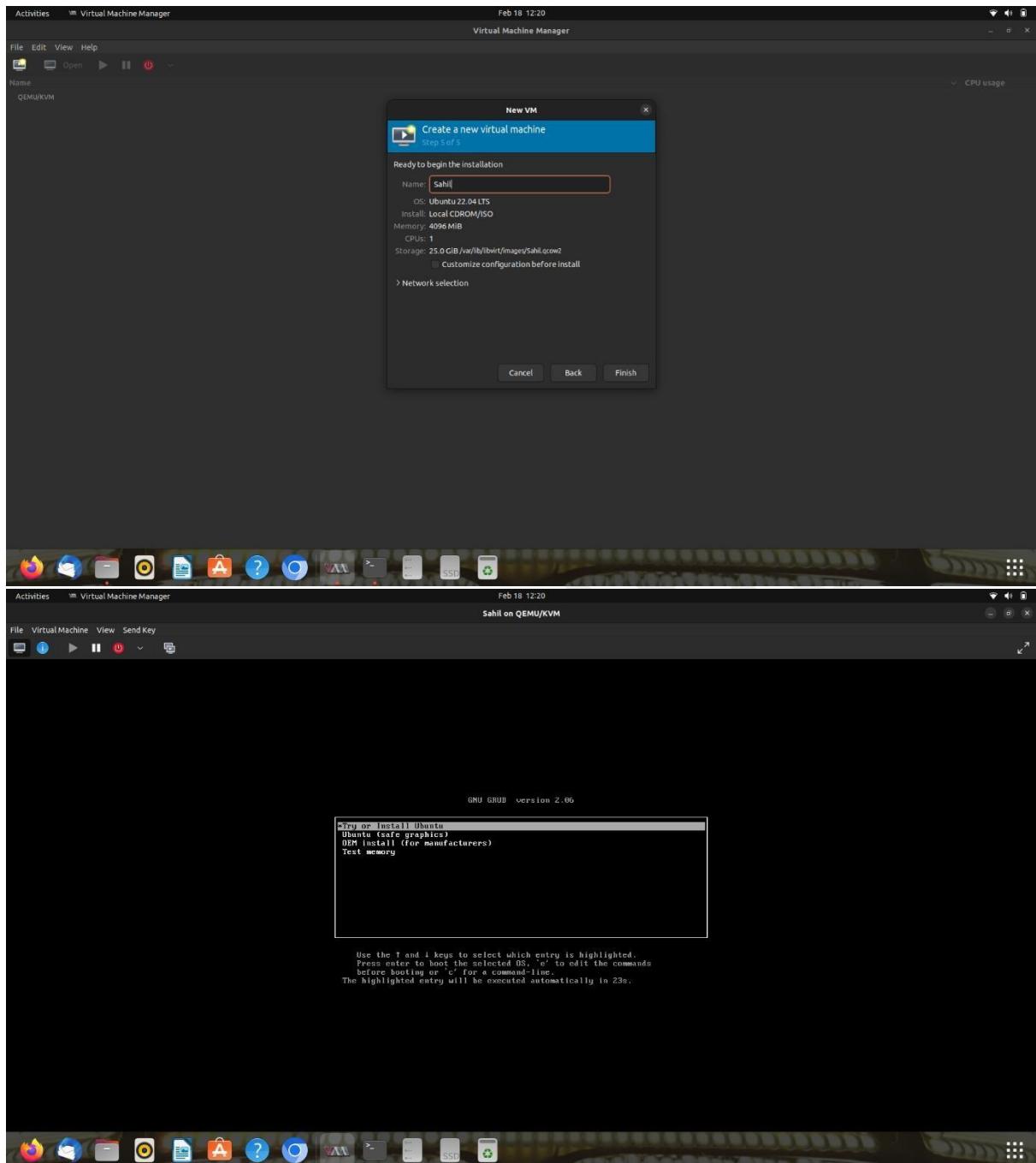
sahil@harsh-sawant:~/Desktop$ sudo usermod -aG sudo sahil
[sudo] password for sahil:
sahil@harsh-sawant:~/Desktop$ sudo kvm-ok
INFO: /dev/kvm exists
KVM acceleration can be used
sahil@harsh-sawant:~/Desktop$ sudo adduser sahil kvm
Adding user `sahil' to group `kvm' ...
Adding user sahil to group kvm
done.
sahil@harsh-sawant:~/Desktop$ sudo systemctl status libvirdt
● libvirdt.service - Virtualization daemon
   Loaded: loaded (/lib/systemd/system/libvirdt.service; enabled; vendor preset: enabled)
     Active: active (running) since Sat 2023-02-18 17:43:32 IST; 5h 25min left
    TriggeredBy: ● libvirdt-admin.socket
      ● libvirdt-ro.socket
      Docs: man:libvirdt(8)
           https://libvirt.org
     Main PID: 1184 (libvirdt)
       Tasks: 21 (limit: 32768)
      Memory: 20.1M
        CPU: 47ms
       CGroup: /system.slice/libvirdt.service
               └─ 1184 /usr/sbin/libvirdt
      ├─ 1442 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsmasq/default.conf --leasefile-ro --dhcp-script=/usr/lib/libvirt/libvirt_leaseshelper
      ├─ 1443 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsmasq/default.conf --leasefile-ro --dhcp-script=/usr/lib/libvirt/libvirt_leaseshelper
```

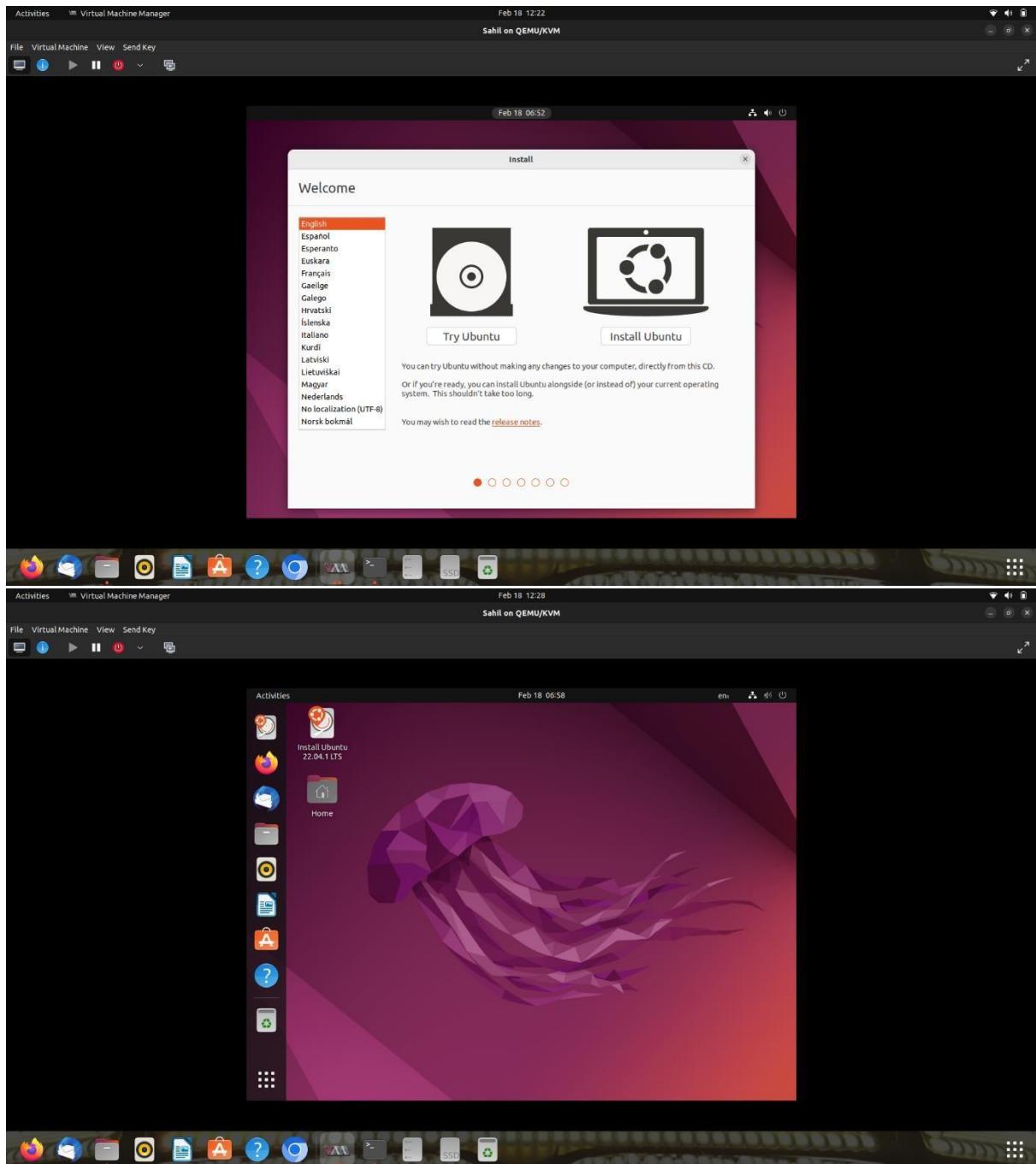
Feb 18 17:43:32 harsh-sawant dnsmasq-dhcp[1442]: DHCP sockets bound exclusively to interface virbr0
Feb 18 17:43:32 harsh-sawant dnsmasq[1442]: using /var/run/dnsmasq.pid
Feb 18 17:43:32 harsh-sawant dnsmasq[1442]: using nameserver 127.0.0.53#53
Feb 18 17:43:32 harsh-sawant dnsmasq[1442]: read /etc/hosts - 7 addresses
Feb 18 17:43:32 harsh-sawant dnsmasq[1442]: read /var/lib/libvirt/dnsmasq/default.addnhosts - 0 addresses
Feb 18 17:43:32 harsh-sawant dnsmasq-dhcp[1442]: read /var/lib/libvirt/dnsmasq/default.hostfile
Feb 18 17:43:32 harsh-sawant dnsmasq-dhcp[1442]: libvirt version 2.0.0, package: libubuntu7.4 (Christian Ehrhardt <christian.ehrhardt@canonical.com> Tue, 22 Nov 2022 15:59:28 +0100)
Feb 18 17:43:32 harsh-sawant libvirdt[1189]: hostname: harsh-sawant
Feb 18 17:43:32 harsh-sawant libvirdt[1189]: internal error: Failed to autostart storage pool 'Downloads': cannot open directory '/media/harsh/Windows/Users/harsh/Downloads': No such file or directory
Feb 18 17:43:32 harsh-sawant libvirdt[1189]: internal error: Failed to autostart storage pool 'Downloads': No such file or directory
sahil@harsh-sawant:~/Desktop\$ sudo vrt-manager
sahil@harsh-sawant:~/Desktop\$











Conclusion: Hence we have successfully performed PAAS

PRACTICAL NO 3

Aim: Study and implementation of Software as a Service.

Theory:

SaaS is also known as "On-Demand Software". It is a software distribution model in which services are hosted by a cloud service provider. These services are available to end-users over the internet so, the end-users do not need to install any software on their devices to access these services.

Advantages of SaaS cloud computing layer

1) SaaS is easy to buy

SaaS pricing is based on a monthly fee or annual fee subscription, so it allows organizations to access business functionality at a low cost, which is less than licensed applications.

Unlike traditional software, which is sold as a licensed based with an up-front cost (and often an optional ongoing support fee), SaaS providers are generally pricing the applications using a subscription fee, most commonly a monthly or annually fee.

2. One to Many

SaaS services are offered as a one-to-many model means a single instance of the application is shared by multiple users.

3. Less hardware required for SaaS

The software is hosted remotely, so organizations do not need to invest in additional hardware.

4. Low maintenance required for SaaS

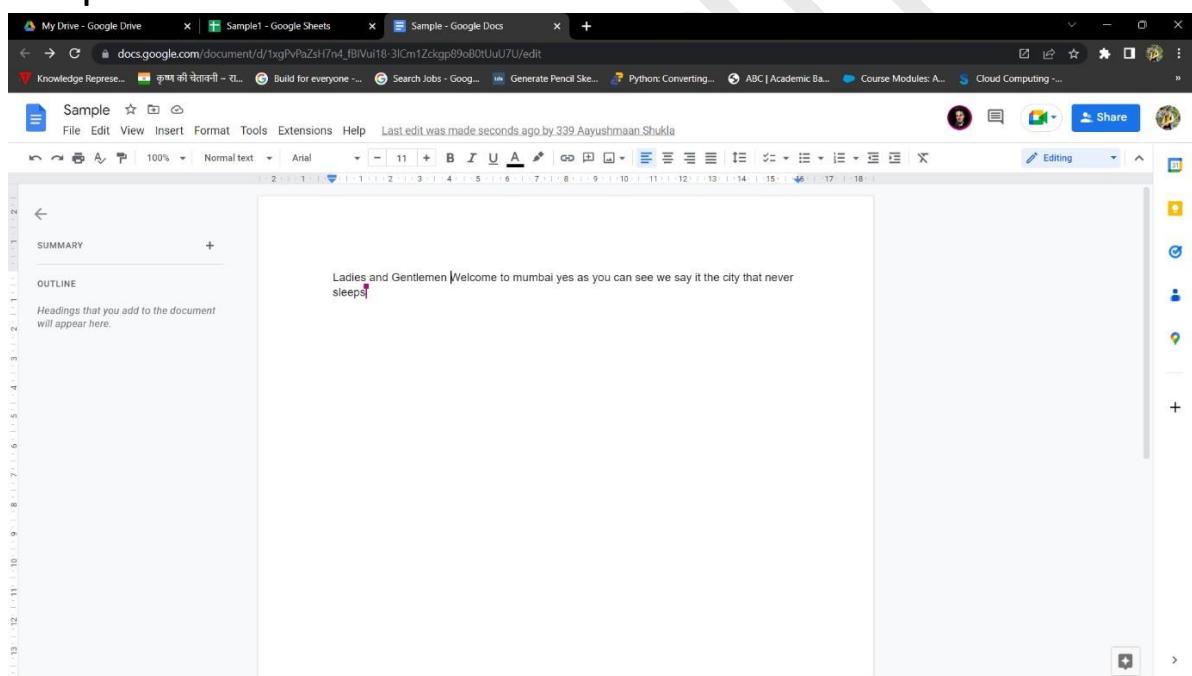
Software as a service removes the need for installation, set-up, and daily maintenance for the organizations. The initial set-up cost for SaaS is typically less than the enterprise software. SaaS vendors are pricing their applications based on some usage parameters, such as a number of users using the application. So, SaaS does easy to monitor and automatic updates.

In these practical we can see the live editing of the documents and sheets using the google software when we enter the mail of the user and assign the role to it.

Steps to perform:

1. Go to Google drive and create Google doc and Google Sheet.
2. In Google doc prepare a content and share it and appoint a role.
3. Same do this with the Google sheets.
4. Now you can see the person whom you have shared the docs and sheets is online and editing, viewing and commenting on the document and sheets.
5. This how the software as a service works.

Outputs:

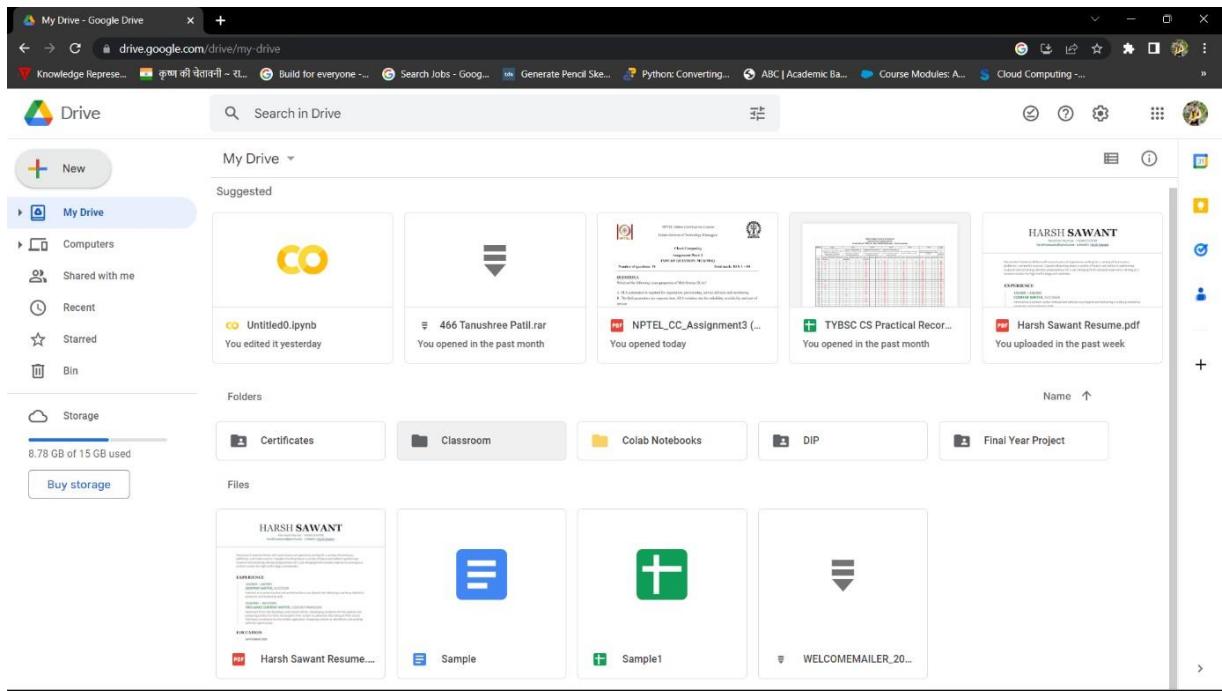


The image displays two screenshots of Google Sheets documents side-by-side. Both screenshots show a single sheet named 'Sheet1'. The top screenshot shows the following data in cells A4 and A5:

TATA IPL 2023
MI VS RCB

The bottom screenshot shows the following data in cells A4 and A5:

jai Maharashtra
jai Maharashtra



Conclusion: Hence we have successfully performed SAAS

PRACTICAL NO 4

Aim: Study and implementation of Storage as a Service.

Theory:

The cloud storage is a computer data storage model in which the data that is digital in format is stored, and hence it is said to be on the cloud, in logical pools. This physical storage consists of multiple servers which can be located in the different parts of the country or may be in different parts of the world depends on many factors. The maintenance of these servers is owned by some private companies.

The cloud storage services are also responsible for keeping the data available and accessible 24x7, and it also safeguard the data and run the physical environment. In order to store user, entity, or application information, individuals and organisations purchase or lease storage capacity from providers.

The Cloud storage resources, for example a cloud desktop storage, a cloud storage portal or a Network-based content management system in the cloud. These all can be easily accessed with the help of a co-located cloud computing service or it can be a web service application programming interface which in general is known by the name of API or applications that use the API.

Steps to perform

- 1.** Open google drive
- 2.** Click on new
- 3.** If you want to upload a single file, click on file upload and if you want to upload multiple files, then it is good to store it in the folder of your host machine and click on upload a folder.
- 4.** Then browse the file and upload it in your drive.

Outputs:

My Drive - Google Drive

drive.google.com/drive/my-drive

Suggested

- Untitled0.ipynb (You edited it yesterday)
- 466 Tanushree Patil.rar (You opened in the past month)
- NPTEL_CC_Assignment3 (You opened today)
- TYBSC CS Practical Recor... (You opened in the past month)
- Harsh Sawant Resume.pdf (You uploaded in the past week)

Folders

- Certificates
- Classroom
- Colab Notebooks
- DIP
- Final Year Project

Files

- Harsh Sawant Resume...
- Sample
- Sample1
- WELCOMEMAILER_20...

My Drive - Google Drive

drive.google.com/drive/my-drive

Suggested

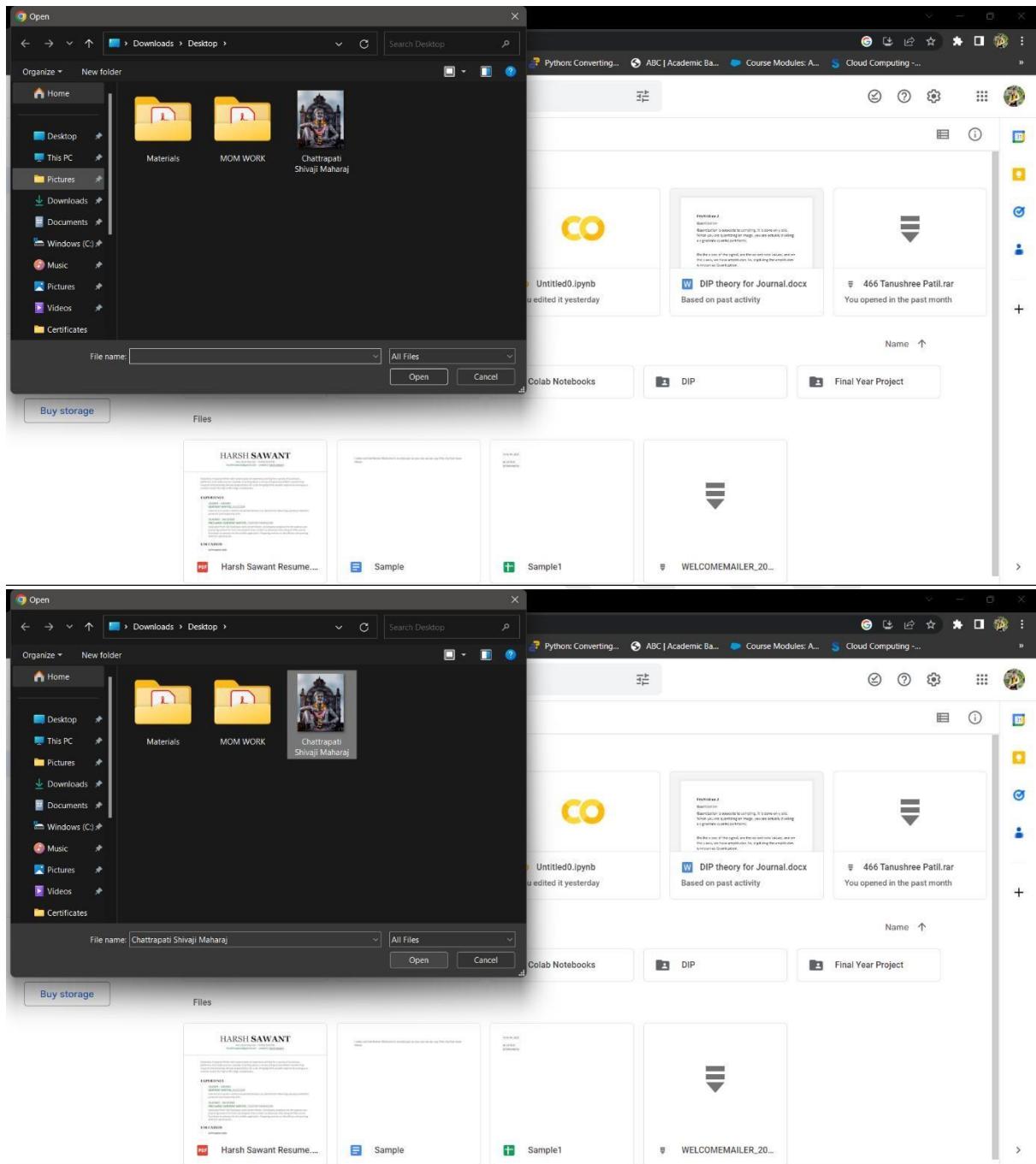
- Sample1 (Edited just now by 339 Aayushmaan...)
- Sample (Edited today by 339 Aayushmaan...)
- Untitled0.ipynb (You edited it yesterday)
- DIP theory for Journal.docx (Based on past activity)
- 466 Tanushree Patil.rar (You opened in the past month)

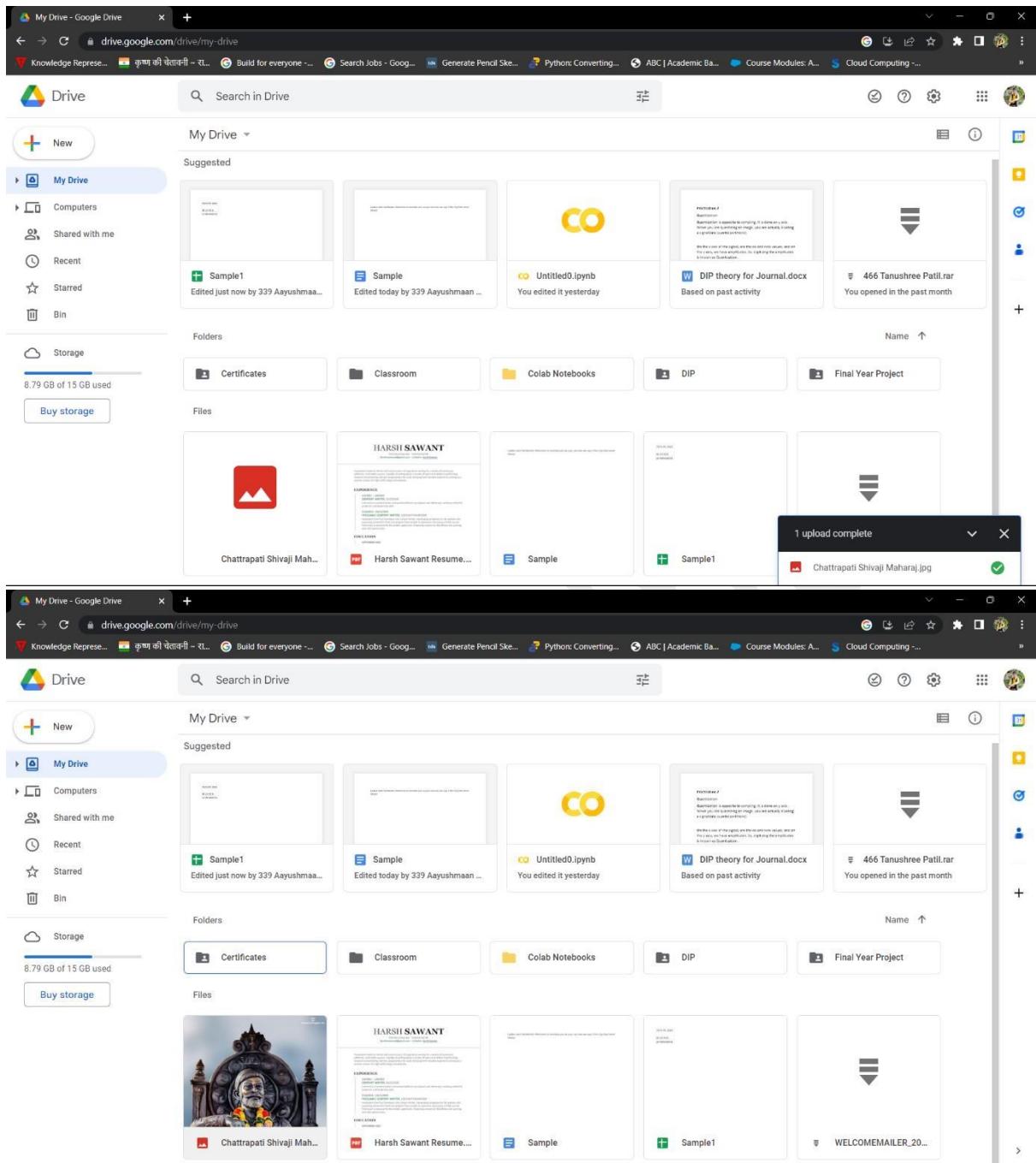
Folders

- Certificates
- Classroom
- Colab Notebooks
- DIP
- Final Year Project

Files

- Harsh Sawant Resume...
- Sample
- Sample1
- WELCOMEMAILER_20...





Conclusion: Hence we have successfully performed SAAS

PRACTICAL NO 5

Aim: User Management in Cloud.

Theory:

User management describes the ability for administrators to manage devices, systems, applications, storage systems, networks, SaaS services, and user access to other various IT resources. User management is a core part to any identity and access management (IAM) solution, in particular directory services tools. Controlling and managing user access to IT resources is a fundamental security essential for any organization. A user management system enables admins to control user access and on-board and off-board users to and from IT resources. Subsequently a directory service will then authenticate, authorize, and audit user access to IT resources based on what the IT admin had dictated.

Steps to perform:

- Go to jump cloud and login in as administrator.
- Create a user assign a display name email id and a password.
- Make a group and add that user in it.
- Take SSO as IAM of AWS and add it in the group which is created.
- Now log out and log in as portal admin
- You'll see the Software is there which is allotted to the

user.

Outputs:

The image shows two screenshots of the JumpCloud Admin Portal. The top screenshot is a login page titled "Administrator Login" with fields for "Email" and "Password", and options for "Administrator Login" or "Sign in with Google". The bottom screenshot shows the "Users" page with a table listing one user: Schrer, Adam, who is Active, has the email bottle85@gmail.com, and is NOT ENROLLED for MFA. A success message "Saved Adam Schrer activated successfully." is visible in a green box.

User State	Name	Email	Password Status	MFA: TOTP
Active	Schrer, Adam	bottle85@gmail.com	—	NOT ENROLLED

JumpCloud Admin Portal | New Tab | console.jumpcloud.com/#/devices/overview

Knowledge Represe... कृष्ण की बेटाबनी ~ रा... Build for everyone ~ Search Jobs - Google... Generate Pencil Sketch Python: Converting... ABC | Academic Ba... Course Modules: A... Cloud Computing ~

Devices

Overview Devices

Activity Windows

Fleet distribution > Windows

100% of fleet 1 device 1 OS version

Time frame: Last 7 Days View All Devices

Name Build Count

Windows, Version 1325	22623.1325	1
-----------------------	------------	---

Event Frequency Manage OS Patch Policies & Policy

JumpCloud Admin Portal | New Tab | console.jumpcloud.com/#/configurations

Knowledge Represe... कृष्ण की बेटाबनी ~ रा... Build for everyone ~ Search Jobs - Google... Generate Pencil Sketch Python: Converting... ABC | Academic Ba... Course Modules: A... Cloud Computing ~

Policy Management

All Patch Management

+ Search filter by Requirements 1 policy delete

Type Name

Built-in Administrator Account Status Built-in Administrator Account Status

JumpCloud Admin Portal | New Tab | console.jumpcloud.com/#/managedSoftware/windows/new

Knowledge Represe... कृष्ण की बेटायनी - रा... Build for everyone -... Search Jobs - Google... Generate Pencil Sketch Python: Converting... ABC | Academic Ba... Course Modules: A... Cloud Computing -...

Software Management

Windows App

New Managed Software

Details Device Groups Devices

Deploy to the following devices:

Search show bound devices Run Users To Devices Report

Status	Device Name	OS
<input type="checkbox"/>	PHENOMENAL	Windows 11 Home Single Language (22623.1325)

cancel save

This screenshot shows the 'Software Management' section of the JumpCloud Admin Portal. It displays a list of devices to which software can be deployed. One device, 'PHENOMENAL', is selected and shown in detail, running Windows 11 Home Single Language (version 22623.1325). The interface includes tabs for Details, Device Groups, and Devices, along with search and reporting tools.

JumpCloud Admin Portal | New Tab | console.jumpcloud.com/#/groups/device/63f8e0f5336591000197ff1d7/details

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Device Groups

Type

Windows Devices

Details Devices User Groups Policies Policy Groups

Windows Devices contains the following devices:

Search 1 of 1 devices bound show bound Device (1) Run Users To Devices Report

Status	Device Name	OS
<input checked="" type="checkbox"/>	PHENOMENAL	Windows 11 Home Single Language (22623.1325)

cancel save

This screenshot shows the 'Device Groups' section of the JumpCloud Admin Portal. It lists devices assigned to a group named 'Windows Devices'. The device 'PHENOMENAL' is selected and shown in detail, running Windows 11 Home Single Language (version 22623.1325). The interface includes tabs for Details, Devices, User Groups, Policies, and Policy Groups, along with search and reporting tools.

JumpCloud Admin Portal | New Tab | console.jumpcloud.com/#/groups/user

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User Groups

+ Search

Type Group Global Admin/Sudo Global Passwordless Sudo

ALASKA Group of Users

Run Users To User Groups Report

filter by 1 group delete

Product Tour Pricing Alerts What's New Support Checklist HS

JumpCloud Admin Portal | New Tab | console.jumpcloud.com/#/ssologin

Knowledge Represe... कृष्ण की बेटाबी - रा... Build for everyone ... Search Jobs - Google... Generate Pencil Sketch Python: Converting... ABC | Academic Ba... Course Modules: A... Cloud Computing ...

SSO

Configured Applications

+ Add New Application Search Configured Applications

1 of 1 Application Selected Export Metadata Delete

Run Users To SSO Applications Report

Status Logo Display Label Show In User Portal Supported Functionality IdP Certificate Status

AWS IAM Identity Center TYCS Yes Identity Management Expires 02-25-2028

1 - 1 of 1

Discover Home

Users User Groups

LDAP RADIUS SSO Password Manager

Devices Device Groups Policy Management Policy Groups Commands MDM Software Management

Live Chat Settings Account Collapse Menu

The screenshot displays two browser windows for the JumpCloud Admin Portal.

Top Window (JumpCloud Admin Portal):

- Left Sidebar:** Includes links for Discover, Home, User Management (Users, User Groups), User Authentication (LDAP, RADIUS, SSO, Password Manager), Device Management (Devices, Device Groups, Policy Management, Policy Groups, Commands), Live Chat, Settings, Account, and Collapse Menu.
- Center Content:** Titled "User Groups". It shows a circular icon with three people and the text "... Loading". Below it, a table lists applications bound to the ALASKA user group. The table has columns for Status, Name, Display Label, and Supported Functionality. One row is visible for "aws IAM Identity Center" with status "Active", name "aws IAM Identity Center", display label "TYCS", and supported functionality "Identity Management".
- Bottom Right:** Buttons for "cancel" and "save".

Bottom Window (JumpCloud User Portal):

- Left Sidebar:** Applications (selected), Profile, Security.
- Center Content:** Titled "Applications". It shows a card for "aws IAM Identity Center" with the label "TYCS".

Conclusion: Hence we have successfully performed User Management in Cloud.

PRACTICAL NO 6

Aim: Study and implement Identity and Access Management (IAM).

Theory:

Identity and access management (IAM) ensures that the right people and job roles in your organization (identities) can access the tools they need to do their jobs. Identity management and access systems enable your organization to manage employee apps without logging into each app as an administrator. Identity and access management systems enable your organization to manage a range of identities including people, software, and hardware like robotics and IoT devices.

Steps:

- Go to own cloud
- Login with username and password as demo
- Import an image
- While sharing set the privileges like whether user can download it or not view it or not edit it or not.
- And send it on the mail id of the user.

Output:

The image consists of two screenshots of the ownCloud web interface.

Top Screenshot (Login Page):

- The title bar says "ownCloud".
- The URL is "demo.owncloud.org/login".
- The ownCloud logo is at the top center.
- A message box contains:
 - Username: demo
 - Password: demo
 - Do not upload sensitive or personal data! The instance is automatically reset every hour.
- Form fields for "Username or email" (demo) and "Password" (****).
- A blue "Login" button.
- The footer says "ownCloud - A safe home for all your data".

Bottom Screenshot (File List Page):

- The title bar says "Files - ownCloud".
- The URL is "demo.owncloud.org/apps/files/?dir=%2F&fileId=6".
- The ownCloud logo is at the top center.
- The left sidebar includes:
 - All files
 - Favorites
 - Shared with you
 - Shared with others
 - Shared by link
 - Tags
- The main area shows a file list:

Name	Size	Modified
Documents	35 KB	33 minutes ago
Learn more about ownCloud	3.5 MB	33 minutes ago
Photos	514.5 MB	15 minutes ago
Chattrapati Shivaji Maharaj.jpg	143 KB	a year ago
- The right side shows a preview of the file "Chattrapati Shivaji Maharaj.jpg" (a portrait of a man in traditional Indian attire) and its details:
 - File name: Chattrapati Shivaji Maharaj.jpg
 - Size: 143 KB
 - Modified: a year ago
- The sharing tab is selected in the top right, showing options for Activities, Comments, Sharing, and Tags.
- The bottom navigation includes Deleted files and Settings.

Screenshot of the ownCloud web interface showing a file list and sharing options.

The left sidebar shows:

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

The main area shows a file list:

Name	Size	Modified
Documents	35 KB	33 minutes ago
Learn more about ownCloud	3.5 MB	33 minutes ago
Photos	514.5 MB	15 minutes ago
Chatrapati Shivaji Maharaj.jpg	143 KB	a year ago

Total: 3 folders and 1 file, 518.1 MB

Sharing tab is selected. A sharing dialog is open for the file "Chatrapati Shivaji Maharaj.jpg".

User and Groups: Public Links

Recipient email: aayushmaanbelle@gmail.com

Screenshot of the ownCloud web interface showing a file list and a sharing dialog.

The left sidebar shows:

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

The main area shows a file list:

Name	Size	Modified
Documents	KB	33 minutes ago
Learn more about ownCloud	MB	33 minutes ago
Photos	MB	15 minutes ago
Chatrapati Shivaji Maharaj.jpg	KB	a year ago

Total: 3 folders and 1 file, 518.1 MB

A sharing dialog is open for the file "Chatrapati Shivaji Maharaj.jpg".

Create link share: /Chatrapati Shivaji Maharaj.jpg

Link name: Swaraj

Download / View: Recipients can view or download contents.

Download / Edit: Recipients can view, download and edit contents.

Password:

Expiration: 28-02-2023

Cancel Share

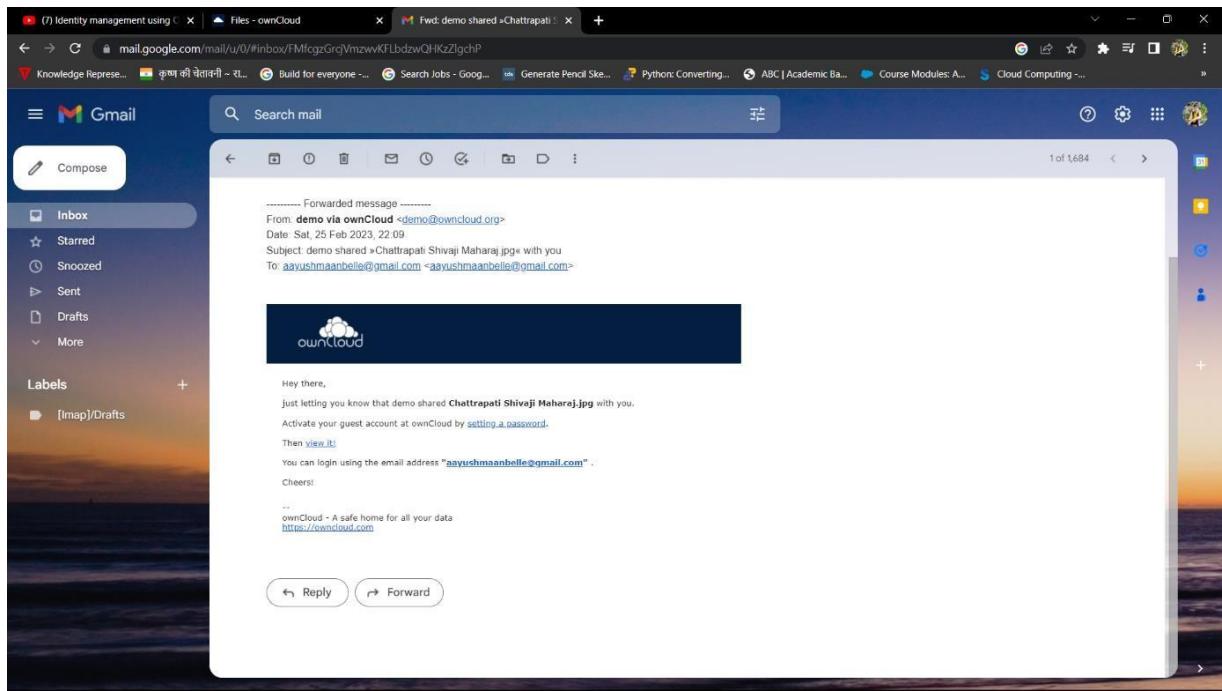
Sharing tab is selected. A sharing dialog is open for the file "Chatrapati Shivaji Maharaj.jpg".

User and Groups: Public Links

There are currently no link shares, you can create one.

Create public link

Anyone with the link has access to the file/folder



Conclusion: Hence we have successfully performed IAM

PRACTICAL NO 7

Aim: Study and implement MFA in the environment of popular Cloud Service Provider

Theory:

Improvement in computational techniques over the last few decades and the flood of data over the Internet has led to a complex structure called multi-cloud. Multi-cloud is an advanced form of fog or heterogeneous cloud computing. A blend of various techniques, services, deployment models, cloud infrastructure, and vendor-based cloud architecture all are combined under the umbrella of multi-cloud infrastructure. Multi-cloud ensures the scaling and processing of on-demand services of cloud consumers from various environments. With its extensive controls, multi-cloud also provides security and access control transparency of data or services over the web to end users. Multi-cloud deployment helps to mitigate cybersecurity threats and energy demands on cloud service provider's end through transparent access control over the hosted services and applications.

Multi-cloud is an efficient way to reduce ossification of cloud services by providing all essential cloud facilities using a shared space model. It may require the allocation of both virtual and physical resources to overcome a particular need. Due to the robustness and distributed nature of multi-cloud,

security related issues regarding resources allocation are still unexplored. In our research, we provide a novel approach to address these data security and access control risks.

Because the cloud paradigm has very dense and diverse usability in the current information technology era, therefore reliance on username/password identity alone is not enough to ensure security on a shared pool of resources. Due to the diverse nature of the multi-cloud infrastructure and deployment model on vendors, security has been enhanced as multifactor authentication (MFA).

Steps:

- To perform MFA, we just need to create account in AWS console
- Then we need to authenticate the device to use MFA,
- For that there are 3 ways by scanning QR, Key, Hardware
- Click on QR
- Download the Google Authenticator scan the QR
- After scanning enter the 6-digit code 2 times
- Login out and Log in again to AWS and you'll find that MFA has been enabled.

Outputs:

The screenshot shows the AWS Sign-in page. On the left, there's a 'Sign in' form with two radio button options: 'Root user' (selected) and 'IAM user'. Below the radio buttons is a 'Root user email address' input field containing 'codewithphenom@gmail.com'. A 'Next' button is visible below the input fields. To the right of the form is a dark sidebar titled 'AWS Training and Certification' with the subtext 'Propel your career. Get AWS certified'. It features a 'LEARN MORE' button and a stylized graphic of a person standing next to a gear and a ribbon.

The screenshot shows the AWS Sign-in page with a 'Security check' step. It displays a CAPTCHA image with the characters 'wn8yrw' and a text input field where 'wn8yrw' has been typed. A 'Submit' button is below the input field. To the right of the security check is the same 'AWS Training and Certification' sidebar as in the previous screenshot.

(7) How to Setup MFA on AWS / Amazon Web Services Sign-In

signin.aws.amazon.com/signin?redirect_uri=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3FhashArgs%3D%252326isAuthCode%3Dtrue%26nc2%3Dh_ct%26s...

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aws

Root user sign in i

Email: codewithphenom@gmail.com

Password Forgot password?

Sign in

Sign in to a different account

Create a new AWS account

AWS Training and Certification

Propel your career. Get AWS certified

LEARN MORE

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English ▾



This screenshot shows the AWS sign-in page for a root user. The URL is signin.aws.amazon.com/signin?redirect_uri=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3FhashArgs%3D%252326isAuthCode%3Dtrue%26nc2%3Dh_ct%26s.... The page includes fields for email and password, and links for sign-in, forgot password, and creating a new account. To the right, there is a large promotional banner for "AWS Training and Certification" with the tagline "Propel your career. Get AWS certified". The banner features a graphic of a certificate with a seal and stars. Below the banner are "LEARN MORE" and "Sign in" buttons.

(7) How to Setup MFA on AWS / AWS Management Console

ap-northeast-1.console.aws.amazon.com/console/home?nc2=h_ct®ion=ap-northeast-1&src=header-signin#

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AWS Services Search [Alt+S] Tokyo CWP25

Console Home Info

Recently visited Info

No recently visited services

Explore one of these commonly visited AWS services.

IAM EC2 S3 RDS Lambda

View all services

Welcome to AWS

Getting started with AWS i

Learn the fundamentals and find valuable information to get the most out of AWS.

Training and certification i

Learn from AWS experts and advance your skills and knowledge.

What's new with AWS? i

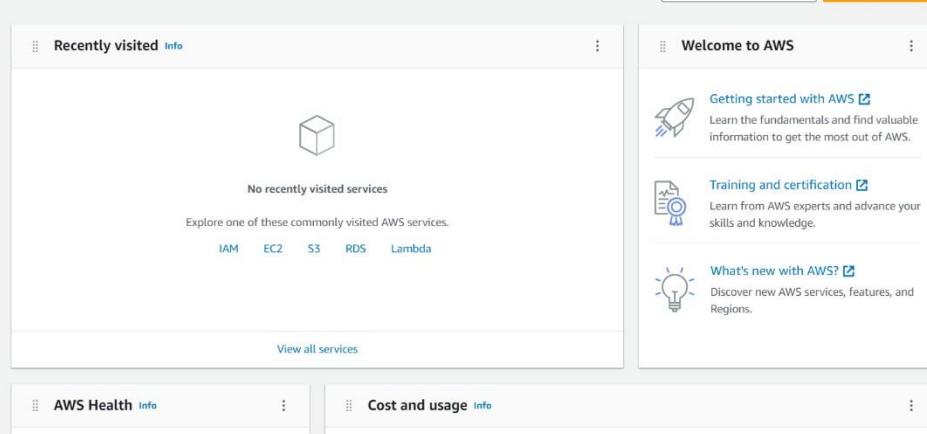
Discover new AWS services, features, and Regions.

AWS Health Info

Open issues 0 Past 7 days

Cost and usage Info

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This screenshot shows the AWS Management Console home page for the ap-northeast-1 region. The URL is ap-northeast-1.console.aws.amazon.com/console/home?nc2=h_ct®ion=ap-northeast-1&src=header-signin#. The page includes a search bar, navigation tabs for AWS Services and Search, and a language selector for English. The main content area is titled "Console Home" and features sections for "Recently visited" (with a note that no services have been visited), "Welcome to AWS" (with links to "Getting started with AWS", "Training and certification", and "What's new with AWS?"), and "AWS Health" and "Cost and usage" dashboards. At the bottom, there are links for Feedback, Language, and various legal and policy documents.

The screenshot shows two screenshots of the AWS IAM Management Console. The top screenshot is titled 'Specify MFA device name' and shows a form where the device name 'Phendmenal' has been entered. Below it, the 'Select MFA device' section offers three options: 'Authenticator app' (selected), 'Security Key', and 'Hardware TOTP token'. The bottom screenshot shows the 'My security credentials (root user)' page, indicating that an MFA device has been assigned. It displays account details (Account name: CWP25, Email address: codewithphenom@gmail.com, AWS account ID: 091460354725, Canonical user ID: b9c3a95f565e3a49ca54ce04fce689aaa209b24574b989175f60e43940f05502) and a section for Multi-factor authentication (MFA).

How to Setup MFA on AWS / Amazon Web Services Sign-In Settings - Password Manager

signin.aws.amazon.com/signin?redirect_url=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3FhashArgs%3D%2523%26isAuthCode%3Dtrue%26state%3DhashArg... Knowledge Represe... कृष्ण की बेटायनी ~ रा... Build for everyone ... Search Jobs - Google... Generate Pencil Sketch Python: Converting... ABC | Academic Ba... Course Modules: A... Cloud Computing ...

aws

Multi-factor authentication

Your account is secured using multi-factor authentication (MFA). To finish signing in, turn on or view your MFA device and type the authentication code below.

Email address: codewithphenom@gmail.com

MFA code

Submit

Troubleshoot MFA Cancel

AWS Skill Builder Your new learning center to access 500+ free digital courses GET STARTED

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How to Setup MFA on AWS / Amazon Web Services Sign-In Settings - Password Manager

signin.aws.amazon.com/signin?redirect_url=https%3A%2F%2Fconsole.aws.amazon.com%2Fconsole%2Fhome%3FhashArgs%3D%2523%26isAuthCode%3Dtrue%26state%3DhashArg... Knowledge Represe... कृष्ण की बेटायनी ~ रा... Build for everyone ... Search Jobs - Google... Generate Pencil Sketch Python: Converting... ABC | Academic Ba... Course Modules: A... Cloud Computing ...

aws

Multi-factor authentication

Your account is secured using multi-factor authentication (MFA). To finish signing in, turn on or view your MFA device and type the authentication code below.

Email address: codewithphenom@gmail.com

MFA code

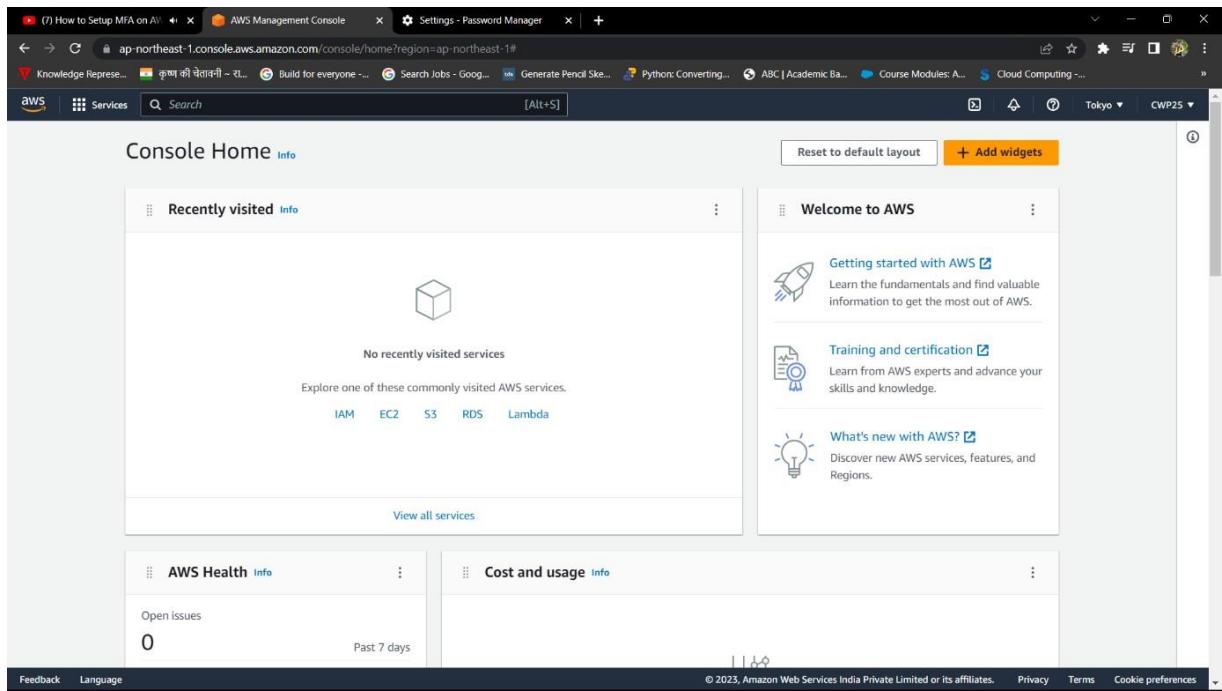
Submit

Troubleshoot MFA Cancel

AWS Skill Builder Your new learning center to access 500+ free digital courses GET STARTED

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Waiting for signin.aws.amazon.com...



Conclusion: Hence we have successfully performed MFA in Cloud Service Provider.

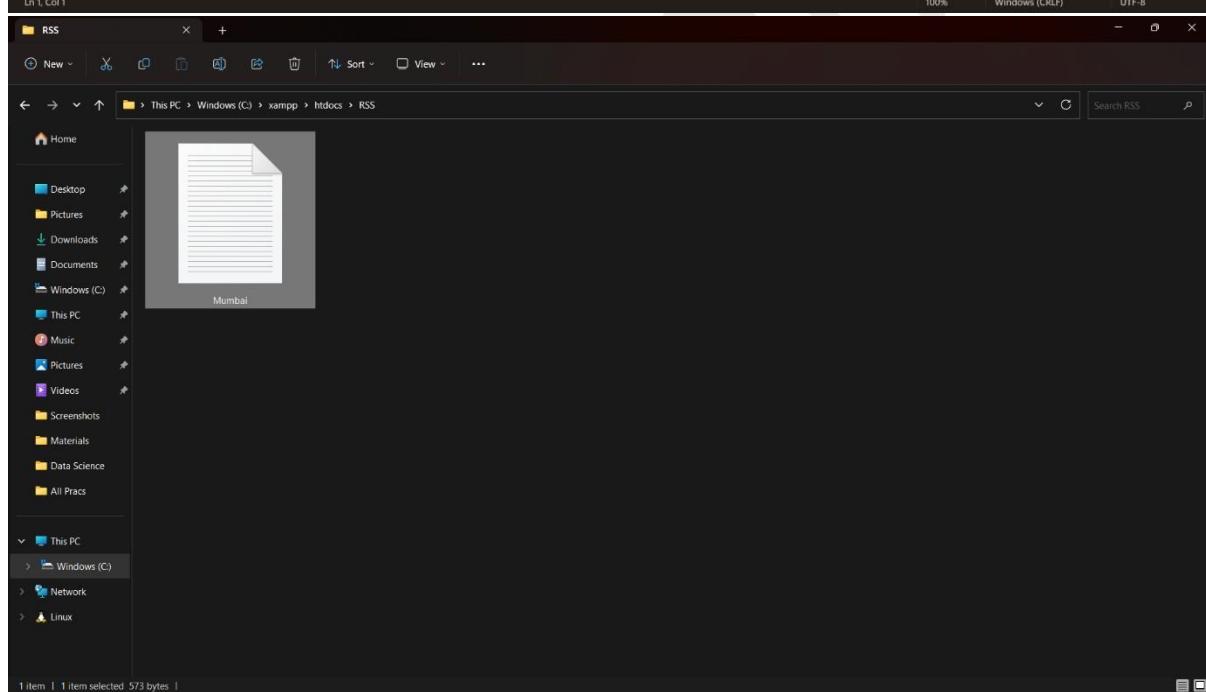
PRACTICAL NO 8

Aim: Write a program for Web Feed.

Steps:

1. Write an xml code in any text editor.
2. Save it as Mumbai.xml extension.
3. Locate that file inside the htdocs under a new folder named RSS.
4. Switch on the Apache Server using XAMPP Control Panel.
5. Go to Chrome and write localhost.
6. Once the welcome to XAMPP page appears it simplifies that your XAMPP is working good.
7. Then install a XAMPP extension.
8. Then open new tab and write localhost/RSS/Mumbai.xml.
9. And you'll get the output.

Output:



```
<?xml version="1.0" encoding="UTF-8" ?>
<rss version="2.0">

<channel>
    <title>W3Schools Home Page</title>
    <link>https://www.w3schools.com</link>
    <description>Free web building tutorials</description>
    <item>
        <title>RSS Tutorial</title>
        <link>https://www.w3schools.com/xml/xml_rss.asp</link>
        <description>New RSS tutorial on W3Schools</description>
    </item>
    <item>
        <title>XML Tutorial</title>
        <link>https://www.w3schools.com/xml</link>
        <description>New XML tutorial on W3Schools</description>
    </item>
</channel>

</rss>
```

XAMPP Control Panel v3.3.0 [Compiled: Apr 6th 2021]

Module	Service	Module	PID(s)	Port(s)	Actions
		Apache	9812 11936	80, 443	Stop Admin Config Logs Start Admin Config Logs Start Admin Config Logs Start Admin Config Logs Start Admin Config Logs
		MySQL			Start Admin Config Logs Netstat Shell Explorer Services Help Out
		FileZilla			Start Admin Config Logs
		Mercury			Start Admin Config Logs
		Tomcat			Start Admin Config Logs

```

08:54:57 [main] Initializing Control Panel
08:54:57 [main] Windows Version: Home 64-bit
08:54:57 [main] XAMPP Version: 8.2.0
08:54:57 [main] Control Panel Version: 3.3.0 [ Compiled: Apr 6th 2021 ]
08:54:57 [main] You are not running with administrator rights! This will work for
08:54:57 [main] most applications but if you do something with services
08:54:57 [main] there can be a security dialogue or things will break! So think
08:54:57 [main] about running this application with administrator rights!
08:54:57 [main] XAMPP Installation Directory: "C:\xampp"
08:54:57 [main] Checking for prerequisites
08:55:00 [main] All prerequisites found
08:55:00 [main] Initializing Module
08:55:00 [mysql] Problem detected!
08:55:00 [mysql] Port 3306 in use by "Unable to open process"
08:55:00 [mysql] MySQL needs to start without the configured ports free!
08:55:00 [mysql] You need to unmap/unable/reconfigure the blocking application
08:55:00 [mysql] or reconfigure MySQL and the Control Panel to listen on a different port
08:55:00 [main] Starting Check-Timer
08:55:00 [main] Control Panel Ready
08:55:04 [Apache] Attempting to start Apache app...
08:55:04 [Apache] Status change detected: running

```

Welcome to XAMPP

XAMPP Apache + MariaDB + PHP + Perl

Welcome to XAMPP for Windows 8.2.0

You have successfully installed XAMPP on this system! Now you can start using Apache, MariaDB, PHP and other components. You can find more info in the FAQs section or check the HOW-TO Guides for getting started with PHP applications.

XAMPP is meant only for development purposes. It has certain configuration settings that make it easy to develop locally but that are insecure if you want to have your installation accessible to others.

Start the XAMPP Control Panel to check the server status.

Community

XAMPP has been around for more than 10 years – there is a huge community behind it. You can get involved by joining our Forums, liking us on Facebook, or following our exploits on Twitter.

[Blog](#) [Privacy Policy](#) [CDN provided by fastly](#)

The screenshot shows a web browser window with the title "Welcome to XAMPP". The address bar displays the URL "http://localhost/rss%2Fmumbai.xml". The page content is the "Feed for W3Schools Home Page", which includes an RSS icon, a "Subscribe Now" button, and two sections: "RSS Tutorial" and "XML Tutorial".

Feed for W3Schools Home Page

Subscribe to this feed using: Newsblur | Subscribe Now | Always use this reader to subscribe to feeds.

RSS Tutorial
New RSS tutorial on W3Schools.

XML Tutorial
New XML tutorial on W3Schools.

Conclusion: Hence we have successfully performed Web feed program.

Practical no 9

Aim: Study and implementation of Single-Sign-On (SSO).

Theory:

Single sign-on (SSO) is an authentication scheme that enables users to log in to a session once, using a single set of login credentials, and gain secure access to multiple related applications and services during that session without logging in again.

SSO is used commonly to manage authentication in company intranets or extranets, student portals, public cloud services, and other environments where users need to move between multiple applications to get their work done. It's also used increasingly in customer-facing web sites and apps – such as banking and e-commerce sites – to combine applications from third-party providers into seamless, uninterrupted user experiences.

Single sign-on is based on a digital trust relationship between a group of related, trusted applications, web sites and services, called service providers, and an SSO solution, called an identity provider. The SSO solution is often part of a larger IAM (identity and access management) solution.

In general, SSO authentication works as follows:

A user logs into one of the trusted applications - or into a central portal connecting all the trusted applications (such as an employee portal or college student web site) - using SSO log in credentials.

When the user is successfully authenticated, the SSO solution generates a session authentication token containing specific information about the user's identity - a username, email address, etc. This token is stored with the user's web browser, or on the SSO or IAM server.

When the user attempts to access another of the trusted applications, the application checks with the SSO or IAM server to determine if user is already authenticated for the session. If so, the SSO solution validates the user by signing the authentication token with a digital certificate, and the user is granted access to the application.

Steps:

- Log in to AWS.
- See the available AWS accounts.
- Customize the SSO dashboard.
- Grant the permission to the AWS user
- Add the user of your choice
- Now logout
- And log in again as a user and you'll see that it has assigned you a AWS SSO

Outputs:

The screenshot shows the AWS Single Sign-on (SSO) Getting Started page. It features a flow diagram with four steps: 1. Enable AWS SSO (Setup AWS Organizations, then enable AWS SSO in the AWS Management Console). 2. Connect your corporate identities (Connect your corporate Active Directory (AD) using AWS Directory Service). 3. Grant SSO access to your accounts and applications (Grant AD users and groups SSO access to AWS accounts and business applications). 4. Manage user permissions centrally (Assign and maintain user permissions across your AWS accounts). To the right, there is a sidebar titled "Get started" with links to "Enable AWS SSO", "Getting started with AWS SSO", "AWS SSO prerequisites", "More resources" (Documentation, FAQ, AWS SSO forum, Contact us), and a "Feedback" section.

AWS Single Sign-on (SSO)
Centrally manage access for your workforce to multiple AWS accounts or applications.

AWS Single Sign-On (AWS SSO) is where you create, or connect, your workforce identities in AWS once and manage access centrally across your AWS organization.

Getting started

Enable AWS SSO
Setup AWS Organizations, then enable AWS SSO in the AWS Management Console

Connect your corporate identities
Connect your corporate Active Directory (AD) using AWS Directory Service

Grant SSO access to your accounts and applications
Grant AD users and groups SSO access to AWS accounts and business applications

Manage user permissions centrally
Assign and maintain user permissions across your AWS accounts

Benefits and features

Feedback Looking for language selection? Find it in the new [Unified Settings](#)

AWS Organizations > AWS accounts

AWS accounts

Add an AWS account

The accounts listed below are members of your organization. The organization's management account is responsible for paying the bills for all accounts in the organization. You can use the tools provided by AWS Organizations to centrally manage these accounts. [Learn more](#)

Organization
Organizational units (OUs) enable you to group several accounts together and administer them as a single unit instead of one at a time.

Hierarchy **List**

Organizational structure

Account created/joined date

Root
Joined 2020/12/29

CloudDeepDive **management account**
611970090933 | clouddeepdive@gmail.com

Feedback Looking for language selection? Find it in the new [Unified Settings](#)

The screenshot shows the AWS Single Sign-On (SSO) dashboard. On the left, there's a sidebar with 'Single Sign-On' selected. The main content area has a heading 'AWS Single Sign-On dashboard' with a sub-section 'Recommended setup steps'. This section contains three steps: Step 1 ('Choose your identity source'), Step 2 ('Manage SSO access to your AWS accounts'), and Step 3 ('Manage SSO access to your cloud applications'). To the right of the steps is a 'Settings summary' panel. It includes sections for 'Identity source' (set to 'Region US East (N. Virginia) | us-east-1'), 'User portal URL' (set to 'https://d-90674ae7c0.awsapps.com/start'), and a 'Customize' button.

AWS Single Sign-On dashboard

AWS Single Sign-On (SSO) enables you to manage SSO access to your AWS accounts, resources, and cloud applications centrally, for users from your preferred identity source. [Learn more](#)

Recommended setup steps

Step 1
Choose your identity source
The identity source is where you administer users and groups, and is the service that authenticates your users.

Step 2
Manage SSO access to your AWS accounts
Give your users and groups access to specific AWS accounts and roles within your AWS organization.

Step 3
Manage SSO access to your cloud applications
Give your users and groups access to your cloud applications and any SAML 2.0-based custom applications.

Settings summary

Identity source
Region
US East (N. Virginia) | us-east-1

User portal URL
<https://d-90674ae7c0.awsapps.com/start>

Customize

The screenshot shows the same AWS SSO dashboard as above, but with a modal window open over it. The modal is titled 'Customize user portal URL'. It contains a text input field 'Enter a subdomain' with the value 'awsapps.com/start' and a confirmation input field 'Type your subdomain to confirm:' below it. At the bottom of the modal are 'Cancel' and 'Save' buttons.

Customize user portal URL

Enter a custom subdomain for the user portal sign-in page where your authenticated users will access their assigned AWS accounts and applications.

User portal URL
Once saved, you will not be able to change this later.

Type your subdomain to confirm:

Cancel **Save**

AWS Organizations | **IAM Management Console** | **AWS SSO**

Search for services, features, blogs, docs, and more [Option+S]

AWS accounts

AWS Organization

Select one or more AWS accounts in your AWS organization to provide SSO access to users and groups. Learn more [\(Optional\)](#)

Assign users or groups

Hierarchy **List**

Organizational structure

Root

- IT** (ou-7xkf-rnfh0gq)
 - CloudDeepDiveTest** (947420749972 | clouddeepdive+1@gmail.com)
 - DevAccount** (595832592688 | devclouddeepdive@gmail.com)
 - QAAccount** (602285428013 | qaclouddeepdive@gmail.com)
 - CloudDeepDive** (611910009033 | clouddeepdive@gmail.com)

AWS SSO > **Permission sets**

Create permission set

Step 1: Select permission set type

A permission set contains policies that determine a user's permissions to access an AWS account. When you assign a user or group to a permission set in an AWS account, AWS SSO creates an IAM role in the account and attaches the policies specified in the permission set to that role. Select an option to specify the permission set type. [Learn more](#)

Step 2: Specify permission set details

Step 3: Review and create

Permission set type

Types

Predefined permission set
Create a permission set by choosing an AWS-defined template. This template enables you to select a single AWS managed policy. For example, you can select a policy that grants permissions for a common job function, such as Billing, or a specific level of access to AWS services and resources, such as ViewOnlyAccess. You can update the permission set as your needs evolve.

Custom permission set
Create a permission set that has custom permissions. You can select up to 10 AWS managed policies. You can also create an inline policy that has permissions that you define. The permission set can include either or both policy types.

Policy for predefined permission set

Select an AWS managed policy

AdministratorAccess
Provides full access to AWS services and resources.

Billing
Grants permissions for billing and cost management. This includes viewing account usage and viewing and modifying budgets and pricing methods.

DatabaseAdministrator
 Grants full access permissions to AWS services and actions required to set up and configure AWS database services.

DataScientist
 Grants permissions to AWS data analytics services.

NetworkAdministrator
 Grants full access permissions to AWS services and actions required to set up and configure AWS network resources.

PowerUserAccess
 Provides full access to AWS services and resources, but does not allow management of Users and groups.

SecurityAudit
 The security audit template grants access to read security configuration metadata. It is useful for software that audits the configuration of an AWS account.

SupportUser
 This policy grants permissions to troubleshoot and resolve issues in an AWS account. This policy also enables the user to contact AWS support to create and manage cases.

The image consists of three vertically stacked screenshots from the AWS SSO console.

Screenshot 1: Specifying Policies

This screenshot shows the "Specify policies" step of creating a permission set. It includes sections for "AWS managed policies (not set)" and "Inline policy (not set)". The "Edit statement" section is open, showing a placeholder for a new statement and a button to "Add new statement".

Screenshot 2: Applications Page

This screenshot shows the "Applications" page under the AWS SSO service. It displays a table with columns for "Application name", "Status", and "Certificate expiration". A message at the bottom states, "You have not yet added any applications." There is a "Add a new application" button.

Screenshot 3: Applications Page (Continuation)

This is a continuation of the applications page, showing the same interface and table structure. A large, semi-transparent circular loading or download indicator is visible in the center of the screen.

The screenshot shows the AWS SSO User Management interface. On the left, a sidebar titled "Single Sign-On" lists "Dashboard", "AWS accounts", "Permission sets", "Applications", "Users" (which is selected), and "Groups". The main area is titled "AWS SSO > Users". A search bar at the top right says "Search for services, features, blogs, docs, and more [Option+S]". Below it, a button says "Delete users" and a blue button says "Add user". A table header includes columns for "Username", "Display name", "Status", "MFA devices", and "Created by". A message below the table says "No users found".

Specify user details

Primary information

Username: DemoDevUser

Password: Choose how you would like this user to get their password. [Learn more](#)

Send an email to the user with password setup instructions.

Generate a one-time password that you can share with the user.

Email address: cdd@gmail.com

Confirm email address: cdd@gmail.com

First name: Cdd

Last name: Cdd

Display name: This is typically the full name of the user (first and last name), is searchable, and appears in the Users list.

Contact methods - optional

Screenshot of the AWS Single Sign-On (SSO) User Management interface. The page shows a list of users under the 'AWS SSO > Users' section. A single user, 'DemoDevUser', is listed with the following details:

Username	Display name	Status	MFA devices	Created by
DemoDevUser	odd cdd	Enabled	None	Manual

The interface includes a search bar, pagination controls (1 of 1), and buttons for 'Delete users' and 'Add user'.

AWS SSO > AWS accounts > Assign users and groups

Step 1 Select users and groups

Step 2 Select permission sets

Step 3 Review and submit

Assign users and groups to "DevAccount"

Select one or more users and groups that you want to give SSO access to.

Groups (1/1)

Group name Description

DevGroup

Selected users and groups (1)

Remove

Cancel Next

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AWS SSO > AWS accounts > Assign users and groups

Step 1 Select users and groups

Step 2 Select permission sets

Step 3 Review and submit

Assign permission sets to "DevAccount"

Permission sets define the level of access that users and groups have to an AWS account. You can assign more than one permission set to a user. To ensure least privilege access to AWS accounts, users with multiple permission sets on an AWS account must pick a specific permission set when accessing the account and then return to the user portal to pick a different set when necessary. Learn more

Permission sets (1/1)

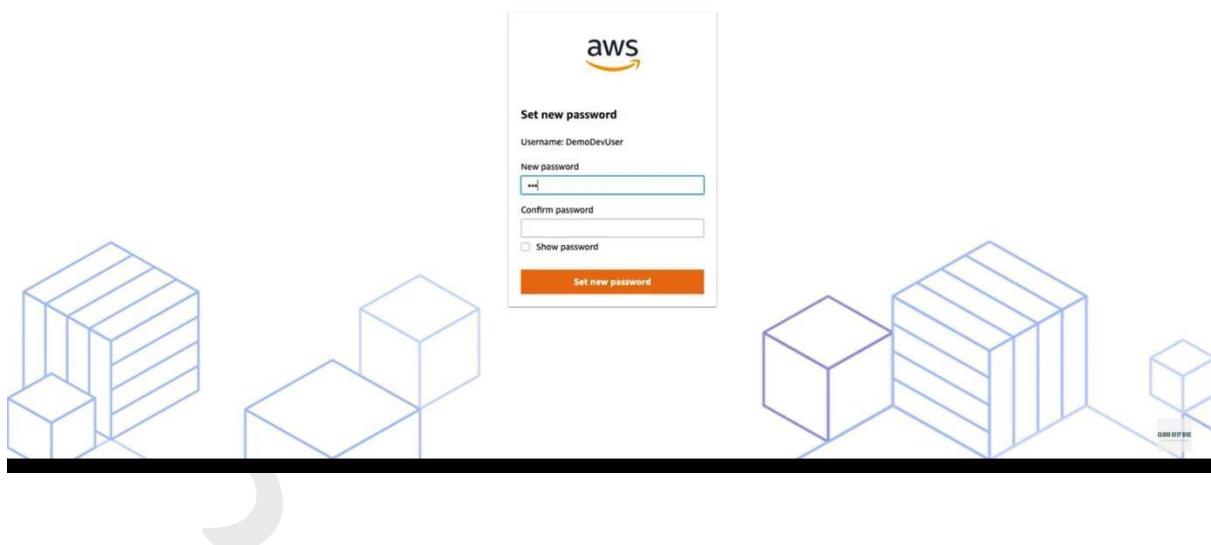
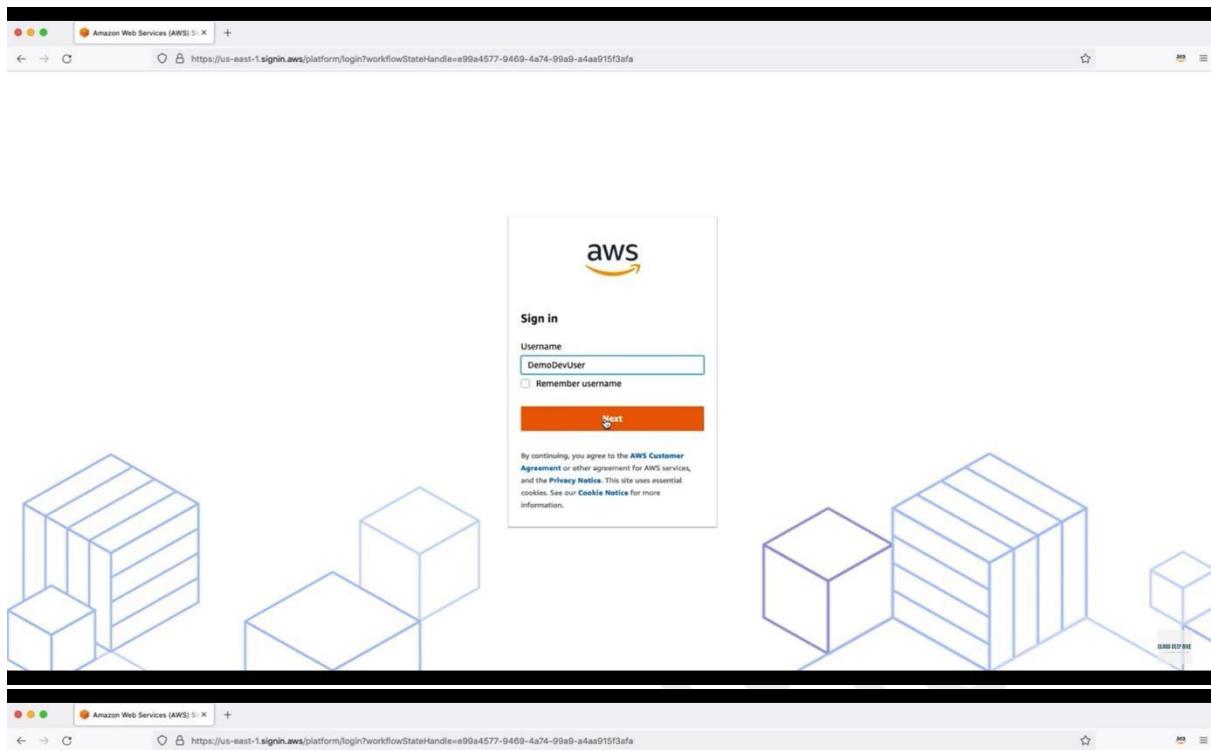
Permission set Description ARN

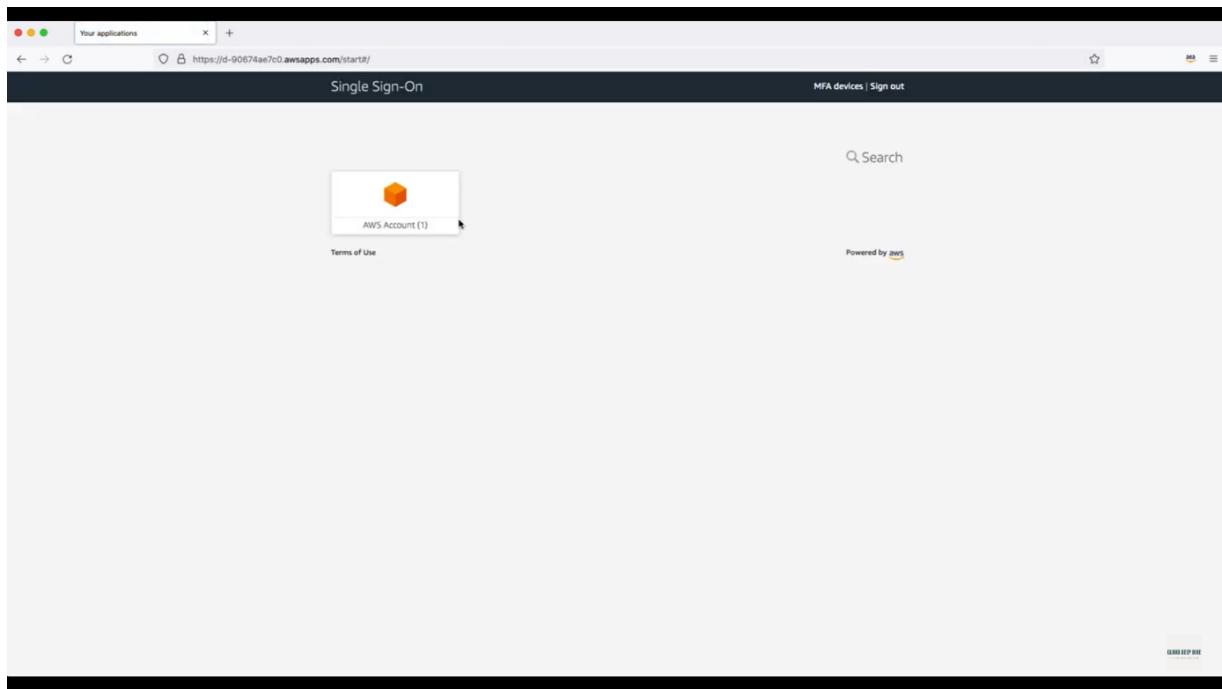
AdministratorAccess am:aws:sso::permissionSet/ssoms-7223b5711dad8e80/ps-df916081e32cf60d

Cancel Previous Next

Feedback Looking for language selection? Find it in the new Unified Settings

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Conclusion: Hence we have successfully performed SSO

Practical no 10

Aim: Case Study on Microsoft Azure

Theory:

What Is Microsoft Azure?

Microsoft Azure is a Microsoft cloud service provider that provides cloud computing services like computation, storage, security and many other domains. Microsoft is one of the global leaders when it comes to Cloud solutions and global cloud infrastructure. Microsoft Azure provides services in 60+ global regions and serves in 140 countries. It provides services in the form of Infrastructure as a service, Platform as a Service and Software as a service. It even provides serverless computing meaning, you just put your code and all your backend activities as managed by Microsoft Azure.

It easily integrates with Microsoft Products making it very popular using Microsoft products. This platform is now 10 years old and it picked up to compete with the best of the best.

Let us now go ahead and see what benefits Microsoft Azure offers. You can also take up a Microsoft azure certification free course and learn more about the tool that has made an enormous stride in the cloud domain.

On-Demand Scalability

When we talk of Application Hosting we can never be sure of how many resources are enough and how many are too much. This is the nature of businesses that rely on varying traffics. What it does is forces businesses to plan a lot and invest a lot of money doing it. Microsoft Azure helps you save all this effort.

Microsoft Azure ensures your applications and data is distributed well enough that means you never run short of Server space. It also means your applications do not run on a single server making them available even in dire situations. Since these resources are properly clustered out and they can scale at will and in no time, your applications function very differently than they would in an on-premise architecture.

Cost Effective

One of the major benefits with cloud service providers is the cut down of upfront costs. Since you can configure and scale at will, you are not required to invest heavily here. Microsoft Azure ensures small scale investment does not require upfront costs. Also when it comes to people who have signed

up contracts, they get heavy discounts. It also offers to Pay as go, model, meaning you get cost-cutting in the right sense.

Hybrid Environments

They say cloud is not a one fit solution for all. It is true indeed because every business will have its own set of problems. And not all businesses will always be in a state where they can migrate to the cloud entirely. While other platforms suffer here, as people either have to migrate to those platforms or call it off totally, Microsoft Azure benefits with its Hybrid approach. Meaning, with Microsoft Azure you can build Hybrid infrastructures, where your resources can partially reside on the cloud and can partially operate from an on-premise infrastructure. Hence you are safe from costly workaround.

Big data Applications

Hadoop and Big data are the need of the hour. With data increasing exponentially we need applications that can help process this data. Microsoft Azure brings this capability of processing large volumes of data on top of its cloud platform. Azure HDInsight ensures you can use Apache Hadoop as a cloud solution. This is a power-packed service that lets you

deal with large data volumes. That means your data crunching becomes easier.

It also readily integrates with data visualization tools and also lets you move your data to excel. This means your data visualization concerns are resolved quickly. With excel you can create visualizations and with PowerBI integrating with Microsoft Azure your data be converted into any visual that you require.

Integration Capabilities

Microsoft has been in the software industry for decades. It has wide reach in the software market and not many can compete with it when it comes to customer base and stack of products it offers. The advantage for Microsoft Azure here is that it readily integrates with most of these products. Be it, connecting to SaaS, PaaS, IaaS applications or even something like Visual Studio or Active Directory, Microsoft Azure has you covered. Hence you can now leverage ERPs and CRMs to enhance your business capacity to a greater level.

So should you be worrying if you do not use Microsoft Products. The answer is ‘NO’. You can even connect to or

integrate many third party applications and services to widen your business reach.

Storage and Security

Storage is very critical to any application. It is no different for applications running on cloud. As already discussed, the volume of data we handle these days is huge. It also comes in different formats and from different sources. Your Storage resources have to adept enough to handle this data.

Microsoft Azure has you covered here as well. It lets you store data in form of files, objects, structured and unstructured data and a lot more. This happens reliable and securely.

Talking of security Microsoft Azure ensures high level of security for your applications. It ensures all the resources in Azure cloud are guarded with firewalls and data is moved over the network with encryption. You have access to authentication and access management meaning your data and application are secure to the core.

Scheduling and Automation

Everyone hates doing repetitive tasks. What if we could automate mundane tasks or recurring tasks be it fetching some data, setting up triggers or scaling your resources when

needed? Microsoft Azure does that for you ensuring you can utilise your workforce for more productive outcomes and get rid of stagnancy or repetition of work.

Conclusion: Hence we have presented the case study