

**S.I.E.S College of Arts, Science and Commerce Sion(W),**  
**Mumbai – 400 022.**

**CERTIFICATE**

This is to certify that Mr. **CHAUHAN PANKAJ YAMUNAPRASAD**  
Roll No. **TCS2324007** Has successfully completed the necessary course of experiments in the  
subject of **Cloud Computing** during the academic year **2023 – 2024** complying with the  
requirements of **University of Mumbai**, for the course of **T.Y. BSc. Computer Science [Semester-6]**

Prof. In-Charge

**Prof. Maya Nair**

Examination Date:

Examiner's Signature & Date:

Head of the Department

**Dr. Manoj Singh**

College Seal

And

Date

## INDEX

<b>PRAC NO</b>	<b>DESCRIPTION</b>	<b>DATE</b>	<b>SIGN</b>
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02	Study and implementation of Infrastructure as a Service. (FOSS Cloud)	05/01/2024	
03	Study and implementation of Storage as a Service. (Own Cloud)	12/01/2024	
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05	Google cloud Windows VM creation.	06/02/2024	
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## Practical No 01

**Aim:** Study of Cloud Computing & Architecture.

### **The Study of Cloud Computing & Architecture**

Cloud computing has revolutionized the way businesses and individuals access and manage computing resources. This paradigm shift in computing has led to the emergence of new architectures and methodologies to design and deploy cloud-based systems effectively. In this brief study, we will delve into the fundamentals of cloud computing, explore its architecture, and discuss key considerations for designing robust cloud-based solutions.

#### **1. Introduction to Cloud Computing**

Cloud computing refers to the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scale. The key characteristics of cloud computing include on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. These characteristics enable users to access computing resources with minimal management effort and upfront costs.

#### **2. Cloud Computing Architecture**

The architecture of cloud computing encompasses various components and layers that work together to deliver cloud services. At a high level, cloud architecture can be divided into the following layers:

- a. Infrastructure as a Service (IaaS):** This layer provides virtualized computing resources over the internet. Users can rent virtual machines, storage, and networking infrastructure on a pay-as-you-go basis. Examples of IaaS providers include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).
- b. Platform as a Service (PaaS):** PaaS offers a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the underlying infrastructure. PaaS providers offer tools and services such as databases, middleware, development frameworks, and runtime environments. Popular PaaS offerings include Heroku, Microsoft Azure App Service, and Google App Engine.
- c. Software as a Service (SaaS):** SaaS delivers software applications over the internet on a subscription basis. Users can access these applications through a web browser without needing to install or maintain any software locally. Examples of SaaS applications include Salesforce, Google Workspace, and Microsoft Office 365.
- d. Cloud Deployment Models:** Cloud computing can be deployed in different models, including public cloud, private cloud, hybrid cloud, and multi-cloud. Each deployment model offers unique advantages and challenges in terms of security, scalability, and flexibility.

#### **3. Key Considerations for Cloud Architecture Design**

When designing cloud-based solutions, several factors need to be considered to ensure optimal performance, scalability, and security:

- a. Scalability:** Cloud architectures should be designed to scale dynamically to handle varying workloads and accommodate growing user demands. Techniques such as auto-scaling and load balancing can help distribute traffic evenly across multiple servers and resources.
- b. Security:** Security is a paramount concern in cloud computing. Cloud architectures should incorporate robust security measures, including encryption, identity and access management (IAM), network security, and compliance controls to protect data and applications from unauthorized access and cyber threats.
- c. Reliability and High Availability:** Cloud architectures should be designed to ensure high availability and reliability of services. Redundancy, fault tolerance, and disaster recovery mechanisms should be implemented to minimize downtime and ensure business continuity.
- d. Cost Optimization:** Cloud resources come with associated costs, so it's essential to design architectures that optimize resource utilization and minimize expenses. Techniques such as rightsizing instances, utilizing reserved instances, and leveraging serverless computing can help reduce costs without compromising performance.

#### 4. Conclusion

In conclusion, the study of cloud computing and architecture is critical for understanding how to leverage cloud technologies effectively to build scalable, secure, and cost-efficient solutions. By embracing cloud computing principles and adopting best practices in cloud architecture design, organizations can unlock new opportunities for innovation and growth in the digital era.

## Practical No 02

**Aim:** Study and implementation of Infrastructure as a Service. (FOSS Cloud)

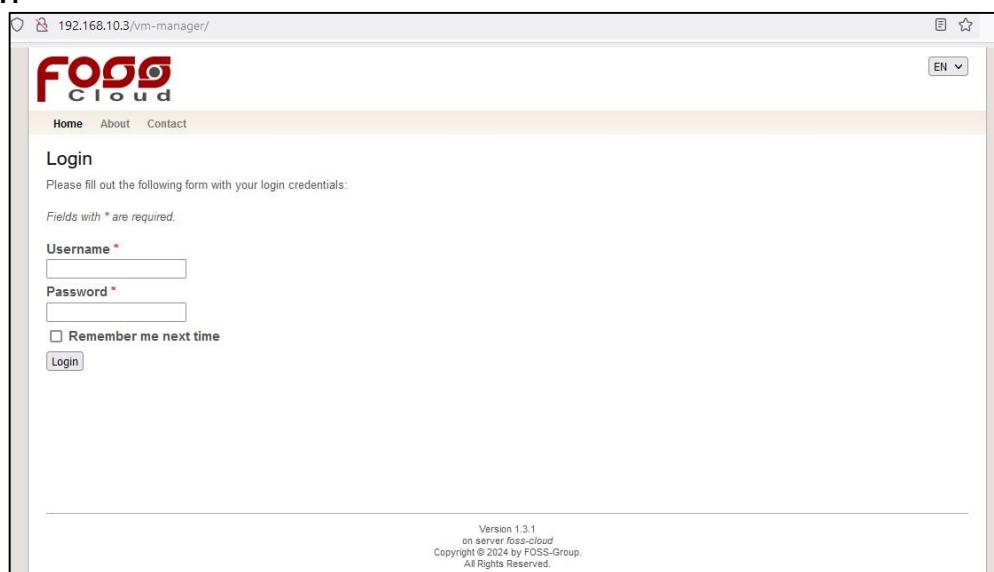
FOSS-Cloud (FOSS-Cloud software and hardware) is an integrated and redundant server infrastructure to provide virtualization- and cloud-services, Windows or Linux based SaaS-, Terminal Server-, Virtual Desktop Infrastructure (VDI) or virtual server environments.

FOSS-Cloud covers all aspects of a virtualized IT environment. FOSS-Cloud is a pure Open-Source solution, is licensed under EUPL and is available on the sourceforge.net. FOSS-Cloud is the most advanced Open-Source Cloud.

FOSS-Cloud is a cost-effective alternative to Citrix and VMware.

We can build our own private- or public-Cloud!

### **OUTPUT:**



The screenshot shows a web browser window with the URL '192.168.10.3/vm-manager/' in the address bar. The page title is 'FOSS Cloud'. The main content area is titled 'Login' and contains instructions: 'Please fill out the following form with your login credentials:' and 'Fields with \* are required.' There are two input fields: 'Username \*' and 'Password \*'. Below these is a checkbox labeled 'Remember me next time' and a 'Login' button. At the bottom of the page, there is a footer with the text: 'Version 1.3.1 on server foss-cloud Copyright © 2024 by FOSS-Group. All Rights Reserved.'

192.168.10.3/vm-manager/

# FOSS Cloud

Home About Contact

## Login

Please fill out the following form with your login credentials:

Fields with \* are required.

Username \*

Password \*

Remember me next time

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on server foss-cloud  
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192.168.10.3/vm-manager/site

# FOSS Cloud

Home About Contact Logout (admin)

Welcome to the FOSS-Cloud

The FOSS-Cloud is the foundation to build Windows or Linux based SaaS-, Terminal Server-, Virtual Desktop Infrastructure (VDI) or virtual Server-Environments.

The FOSS-Cloud solution is the most advanced Open Source Cloud in the marketplace today.

Before using, the FOSS-Cloud team would like to remind you that the primary means of sustaining the development of FOSS-Cloud is via contributions by users such as yourself. FOSS-Cloud is now and will continue to be totally free of charge; however, it takes money and resources to make FOSS-Cloud available. If you are able, please consider donating to the FOSS-Cloud Project.

[Donate](#)

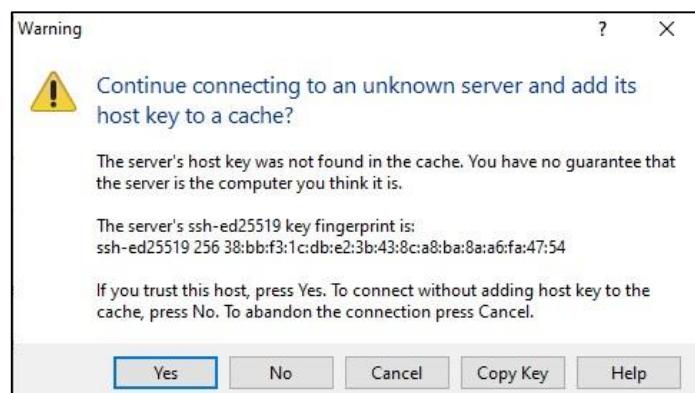
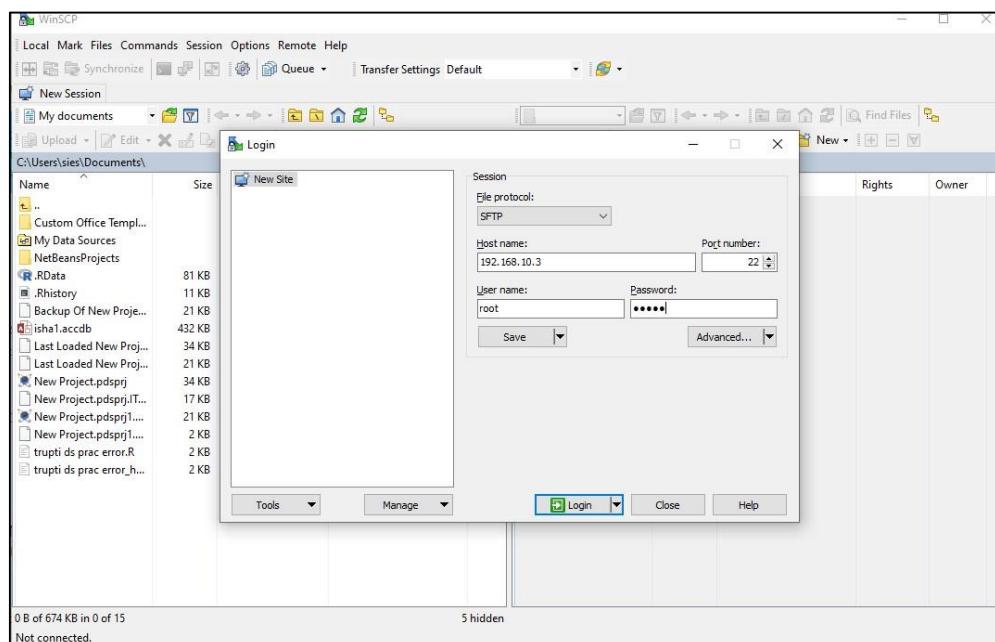
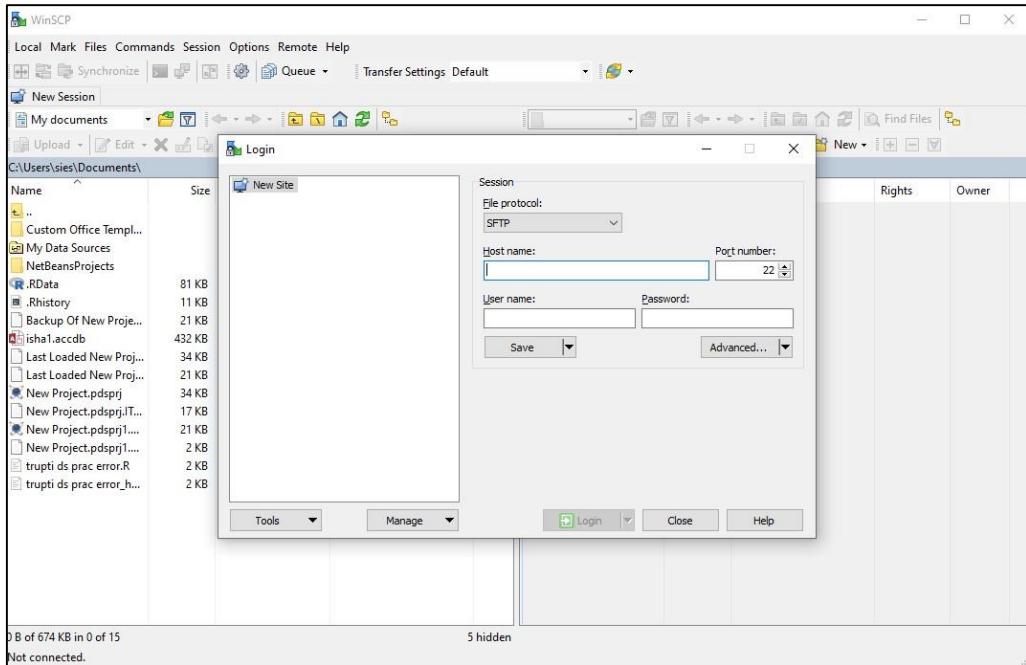
Links

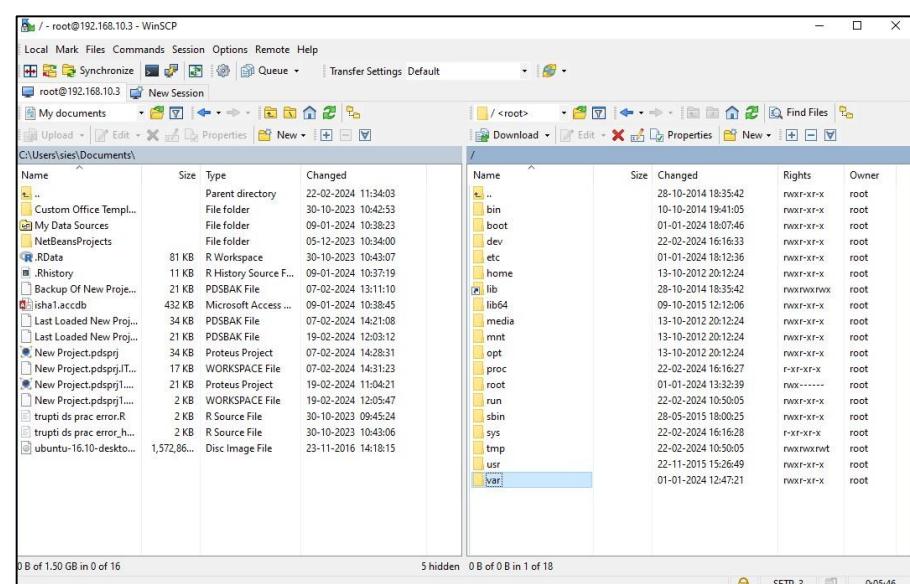
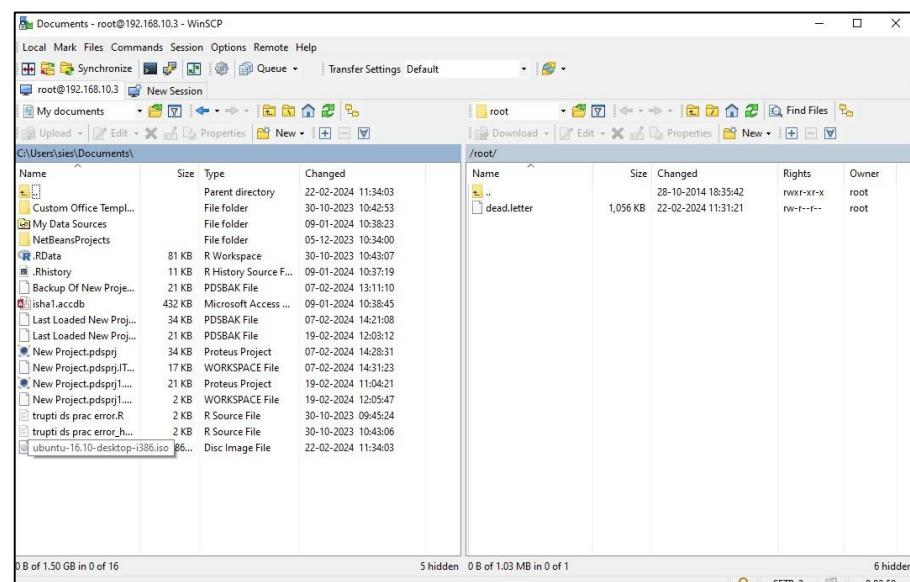
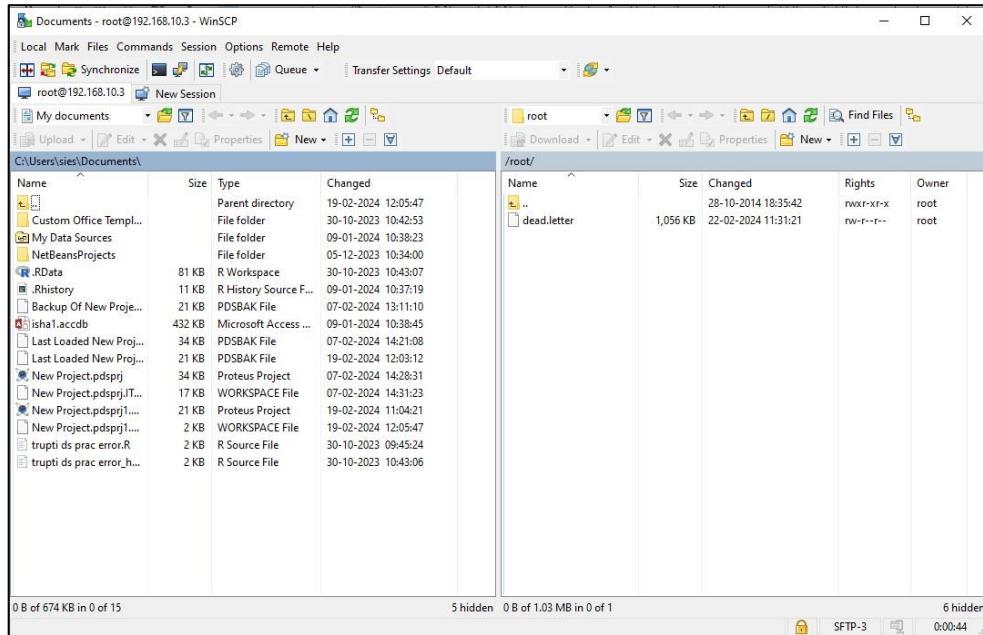
[Documentation](#)  
[Spice-Client \(with protocol handler\) download](#)

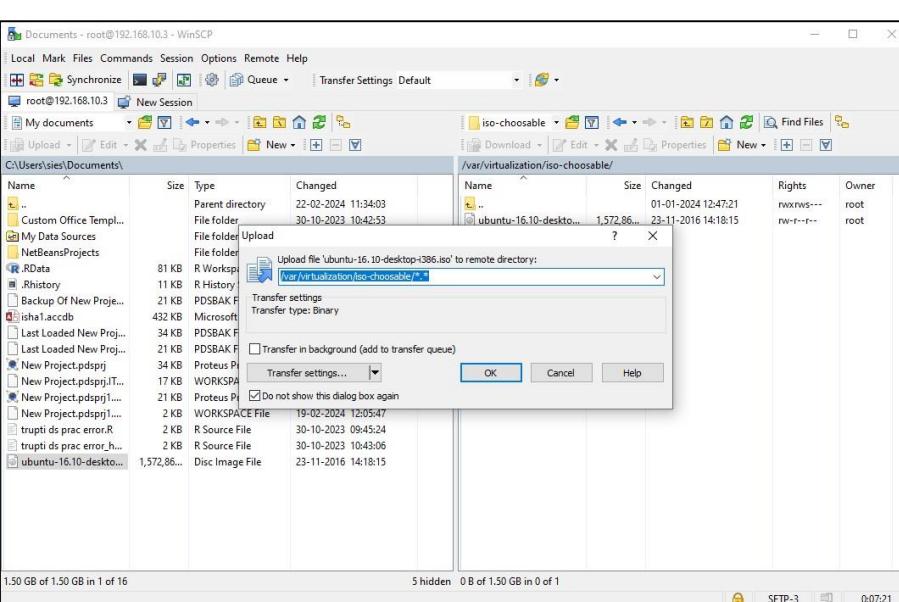
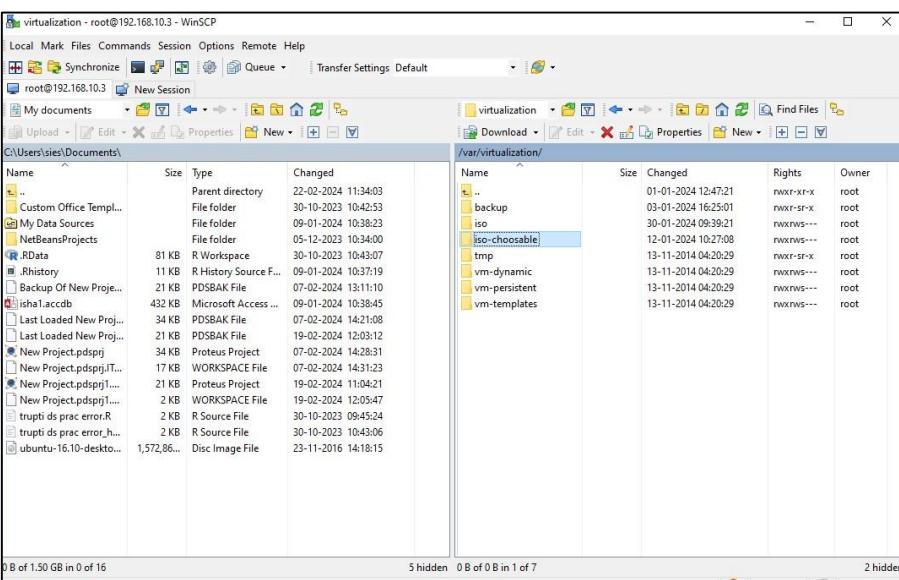
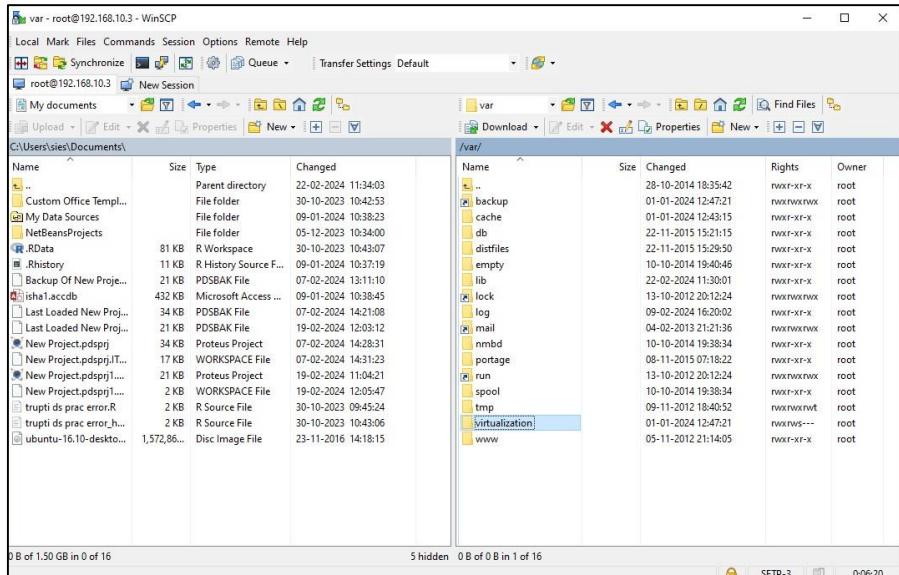
Thank you for using FOSS-Cloud

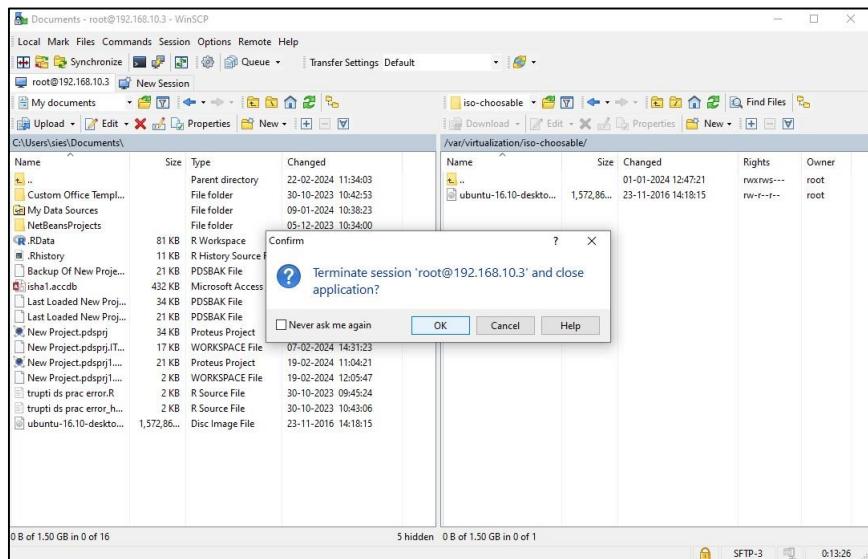
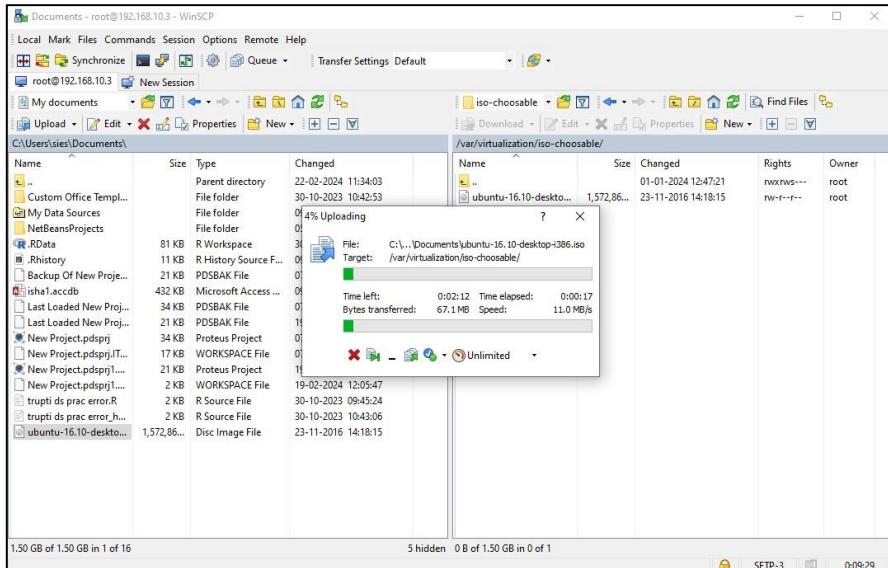
The FOSS-Cloud Team

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The screenshot shows the FOSS-Cloud VM Manager interface. The left sidebar has a navigation menu with items like 'Virtual Machine', 'VM Pool', 'Storage Pool', 'Node', 'Network', 'User', 'Configuration', 'Diagnostics', and 'Assigned VMs'. The main content area displays a welcome message: 'Welcome to the FOSS-Cloud'. It states that the FOSS-Cloud is the foundation to build Windows or Linux based SaaS-, Terminal Server-, Virtual Desktop Infrastructure (VDI) or virtual Server-Environments. It also mentions that the FOSS-Cloud solution is the most advanced Open Source Cloud in the marketplace today. A note at the bottom encourages users to contribute to the project's development. On the right side, there is a 'Links' section with links to 'Documentation' and 'Suse-Client (with protocol handler) download'. At the bottom, there is a footer with copyright information: 'Version 1.3.1 on server foss-cloud Copyright © 2024 by FOSS-Group. All Rights Reserved.'

192.168.10.3/vm-manager/vmProfile/create.html

**FOSS Cloud**

Home About Contact Logout (admin) EN

**Create VM Profile**  
Fields with \* are required.

Step 1  
Please select a profile first!

**BaseProfile**

- linux
  - default
  - Ubuntu1
  - UbuntuVM
  - Ubuntu123
  - Ubuntu 1
  - UbuntuM
  - Ubuntu2
  - ubuntu7537
  - Ubuntu7
- windows

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This screenshot shows the initial state of the VM profile creation process. The left sidebar has a 'Virtual Machine' section with 'Create' selected. The main area is titled 'Create VM Profile' and displays a message to 'Please select a profile first!'. A 'BaseProfile' section contains a flat list of available profiles: 'linux' (with sub-options like 'default', 'Ubuntu1', etc.) and 'windows'.

192.168.10.3/vm-manager/vmProfile/create.html

**FOSS Cloud**

Home About Contact Logout (admin) EN

**Create VM Profile**  
Fields with \* are required.

Step 1  
Please select a profile first!

**BaseProfile**

- linux
  - default
    - i686
      - multi
      - de-DE
      - de-AT
      - de-CH
      - en-US
      - en-GB
      - fr-CH
      - fr-FR
      - it-CH
      - it-IT
    - x86\_64
      - Ubuntu1
      - UbuntuVM
      - Ubuntu123
      - Ubuntu 1
      - UbuntuM
      - Ubuntu2
      - ubuntu7537
      - Ubuntu7
- windows

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This screenshot shows the same interface after a profile has been expanded. The 'linux' profile is now expanded, revealing its sub-profiles: 'i686' and 'x86\_64'. The 'i686' node is further expanded to show language-specific profiles like 'multi', 'de-DE', etc. The 'x86\_64' node lists several specific VM names: 'Ubuntu1', 'UbuntuVM', etc.

192.168.10.3/vm-manager/vmProfile/create.html

**Create VM Profile**

Fields with \* are required.

Step I  
Please select a profile first!

Step II  
Overwrite the default values if necessary!

**BaseProfile**

- linux
  - default
    - i386
      - multi
      - de-DE
      - de-AT
      - de-CH
      - en-US
      - en-GB
      - fr-CH
      - fr-FR
      - it-CH
      - it-IT
    - x86\_64
      - Ubuntu1
      - UbuntuVM
      - ubuntu123
      - Ubuntu1
      - UbuntuM
      - Ubuntu2
      - ubuntu7537
      - Ubuntu7
  - windows

Isofile \*

ubuntu-16.10-desktop-i386.iso

Name \*

Ubuntu2324

Description \*

VM with Ubuntu OS

Memory \*

128 MB 1.38 GB

Volume Capacity \*

10 GB 2048 GB 37 GB

CPU \*

1

Clock Offset \*

utc

**Create**

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192.168.10.3/vm-manager/vmProfile/index.html?copyaction=6177

**Manage VMProfiles**

No.	Name	Architecture	Language	Description	Action
1	Ubuntu1	linux / i386	multi	Ubuntu OS	
2	UbuntuVM	linux / i386	multi	VM with Ubuntu OS	
3	ubuntu123	linux / x86_64	multi	ubuntu	
4	Ubuntu 1	linux / x86_64	multi	This is the Ubuntu 1 VM-Profile	
5	UbuntuM	linux / i386	multi	Ubuntu OS	
6	Ubuntu2	linux / i386	multi	Ubuntu OS	
7	ubuntu7537	linux / x86_64	multi	This is the ubuntu7537 VM-Profil	
8	Ubuntu7	linux / i386	multi	Ubuntu	
9	Ubuntu2324	linux / i386	multi	VM with Ubuntu OS	

Ubuntu2324

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192.168.10.3/vm-manager/vmTemplate/create.html

**Create VmTemplate**

Fields with \* are required.

Step I  
Please select a profile first!

Step II  
Please choose a node and overwrite the default values if necessary!

Vmpool \* **vm-template-virtual-machine-pool-01**

Node \* **foss-cloud.foss-cloud.org**

Name \* **Ubuntu2324**

Description \* **VM with Ubuntu OS**

Memory \* **1.38 GB**

Volume Capacity \* **37 GB**

CPU \* **1** Clock Offset \* **utc**

Number of displays **1**

**Create**

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192.168.10.3/vm-manager/vmTemplate/index.html

**Manage VMTemplates**

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

No.	DisplayName	Status	Run Action	Memory	Node	Action
1	Ubuntu1	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
2	UbuntuVM	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
3	Ubuntu	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
4	UbuntuVM1	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
5	Ubuntu7	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
6	Ubuntu2324	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	

**start VM**

Page 1 of 1 Refresh 10

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192.168.10.3/vm-manager/vmTemplate/index.html

**Manage VMTemplates**

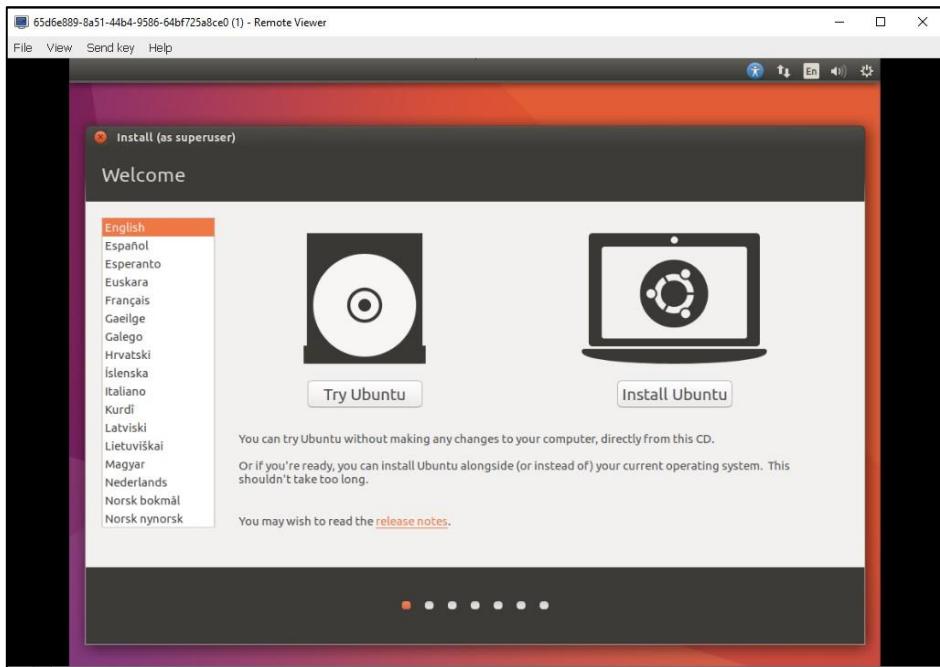
Vm Pool **vm-template-virtual-machine-pool-01**

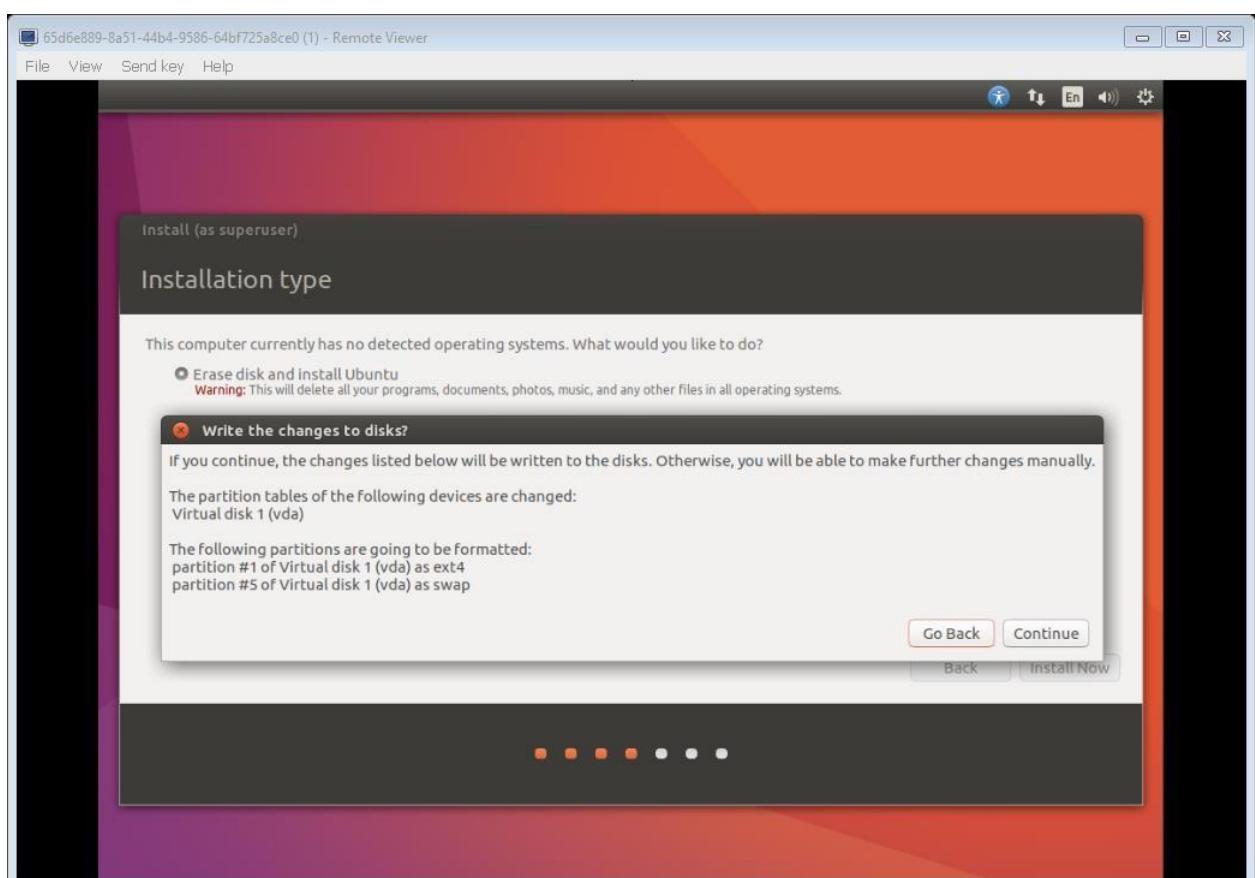
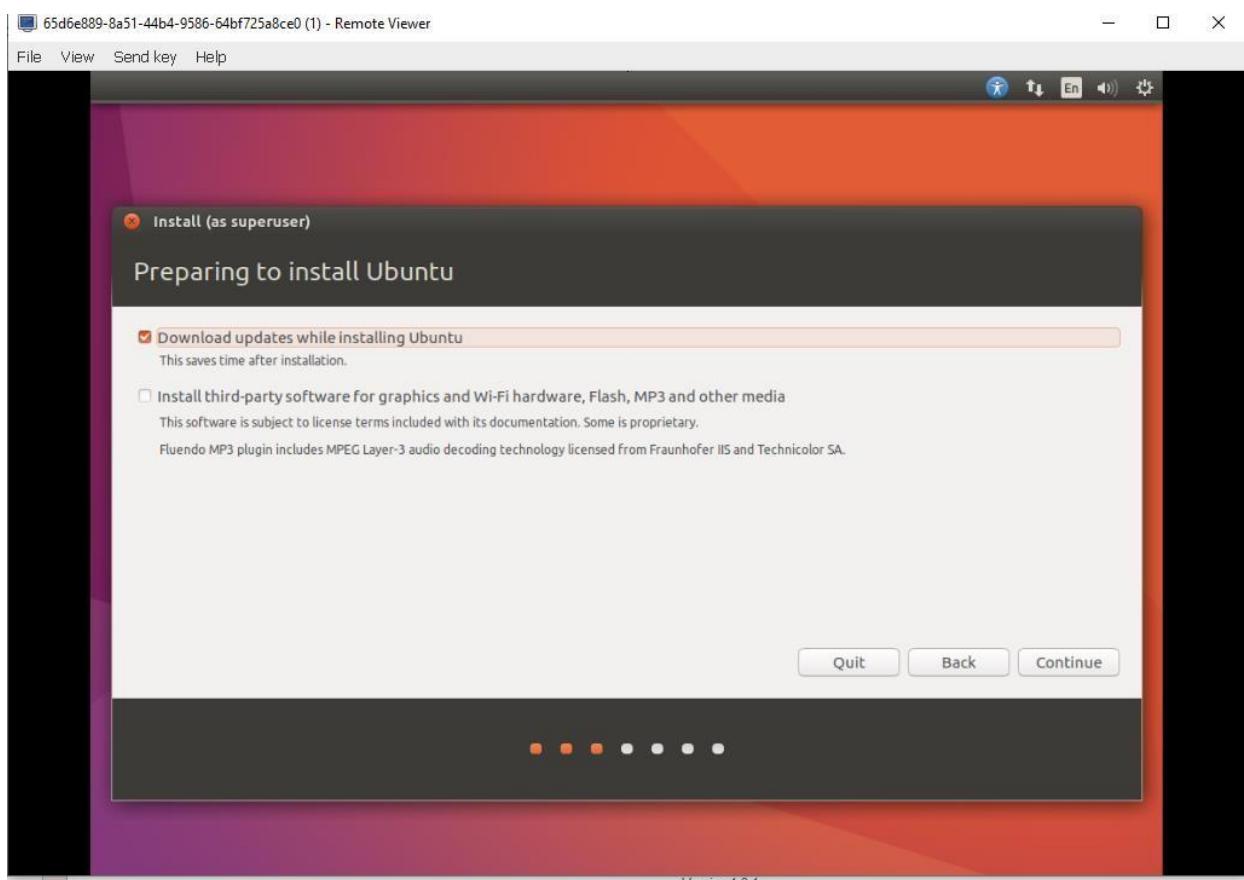
No.	DisplayName	Status	Run Action	Memory	Node	Action
1	Ubuntu1	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
2	UbuntuVM	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
3	Ubuntu	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
4	UbuntuVM1	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
5	Ubuntu7	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	
6	Ubuntu2324	stopped	→ ↳ ✎	1.38 GB	foss-cloud.foss-cloud.org	

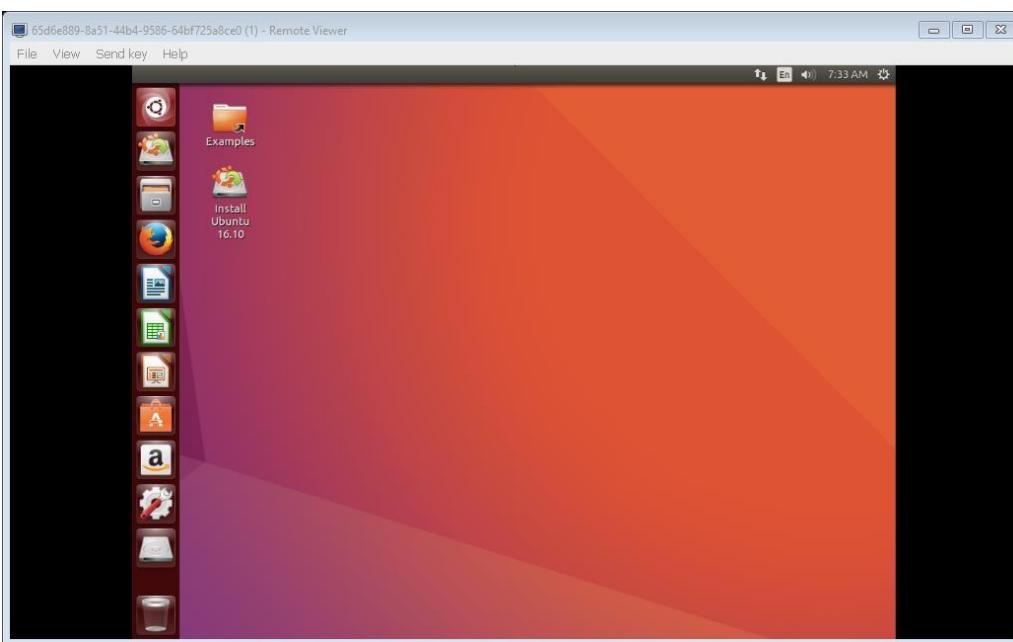
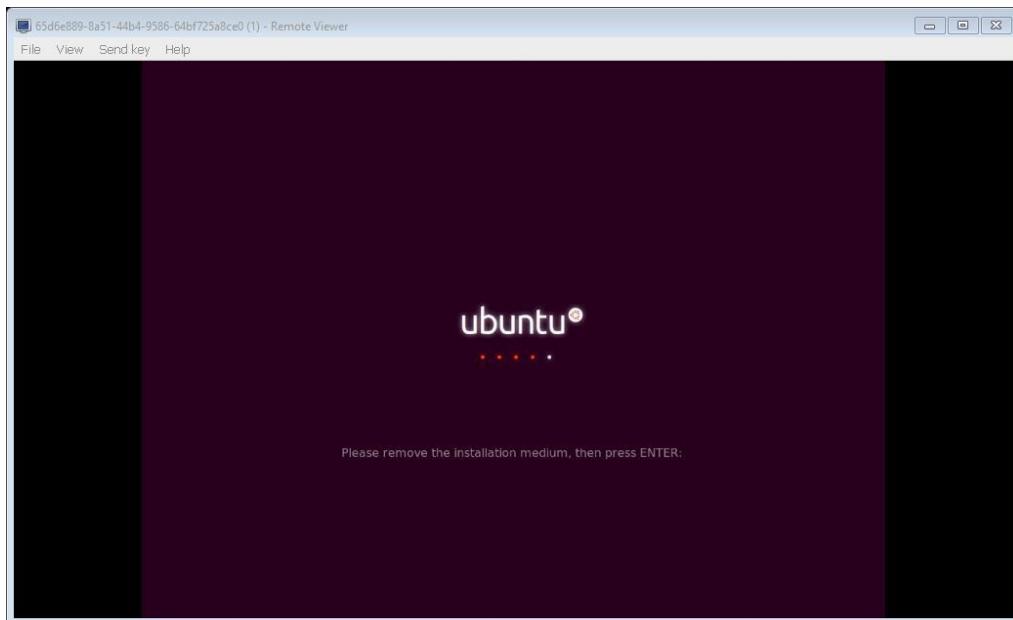
**start VM**

Page 1 of 1 Refresh 10

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on server foss-cloud  
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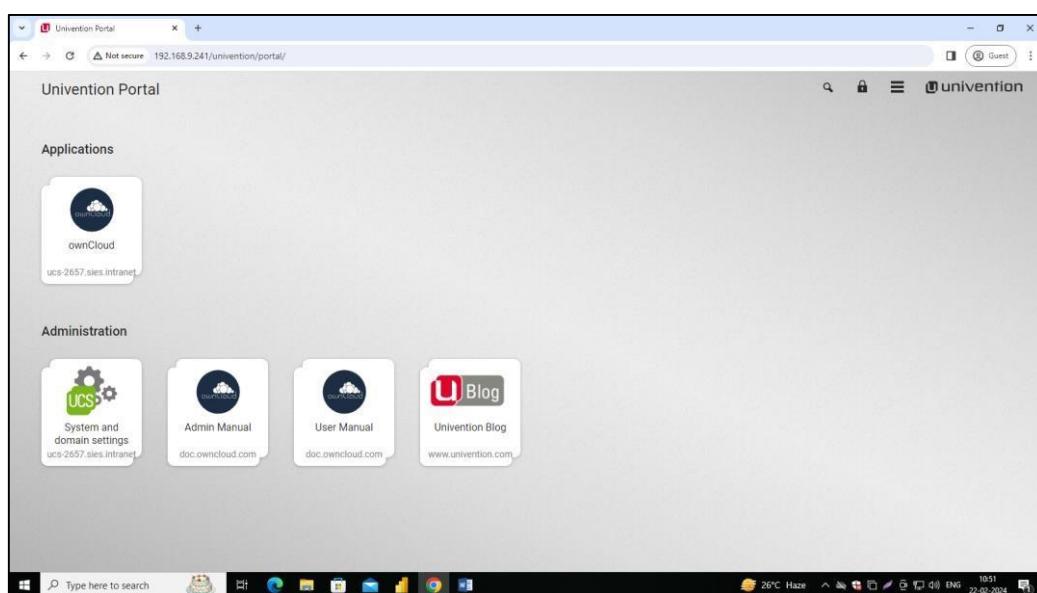
## Practical No 03

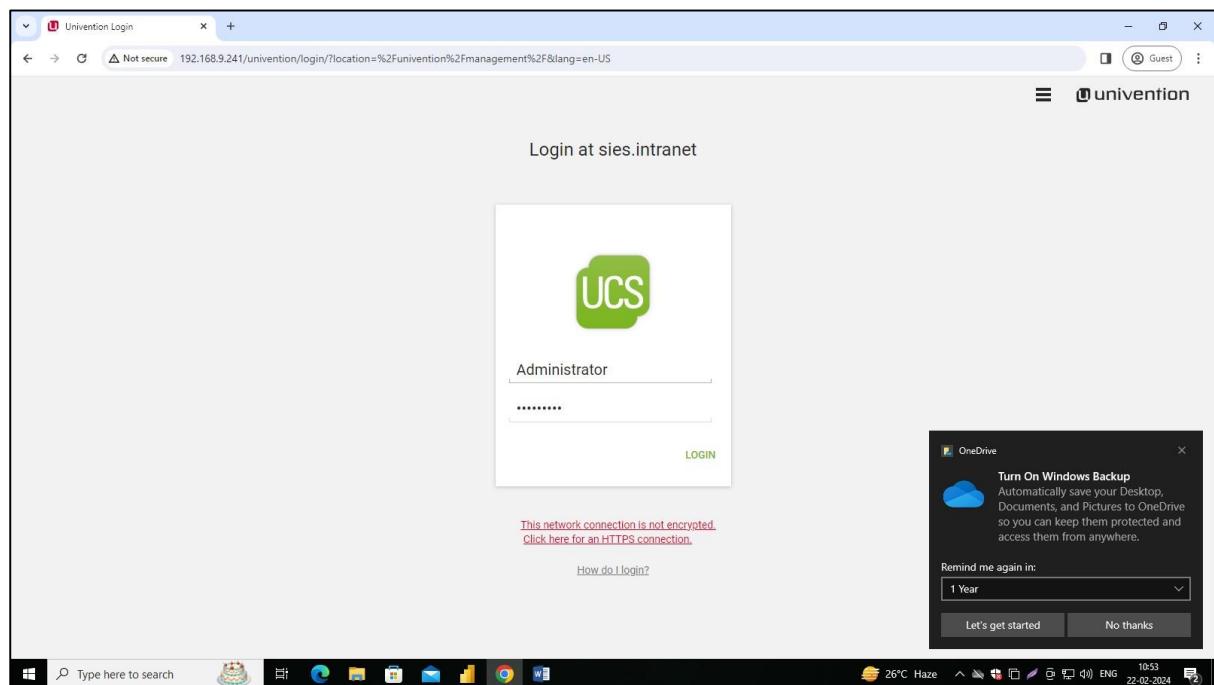
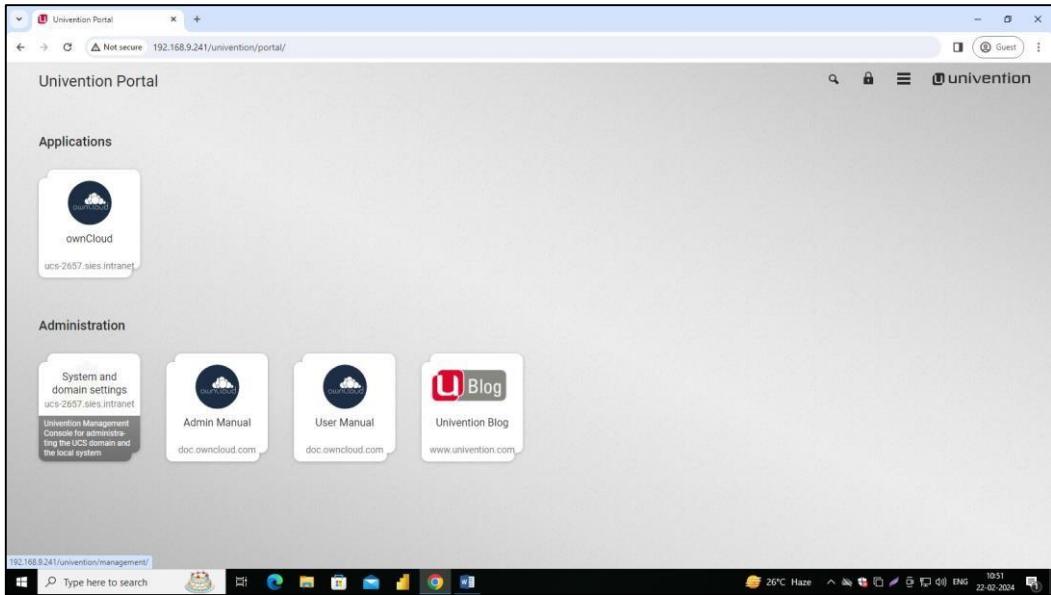
### **Aim:** Study and implementation of Storage as a Service. (Own Cloud)

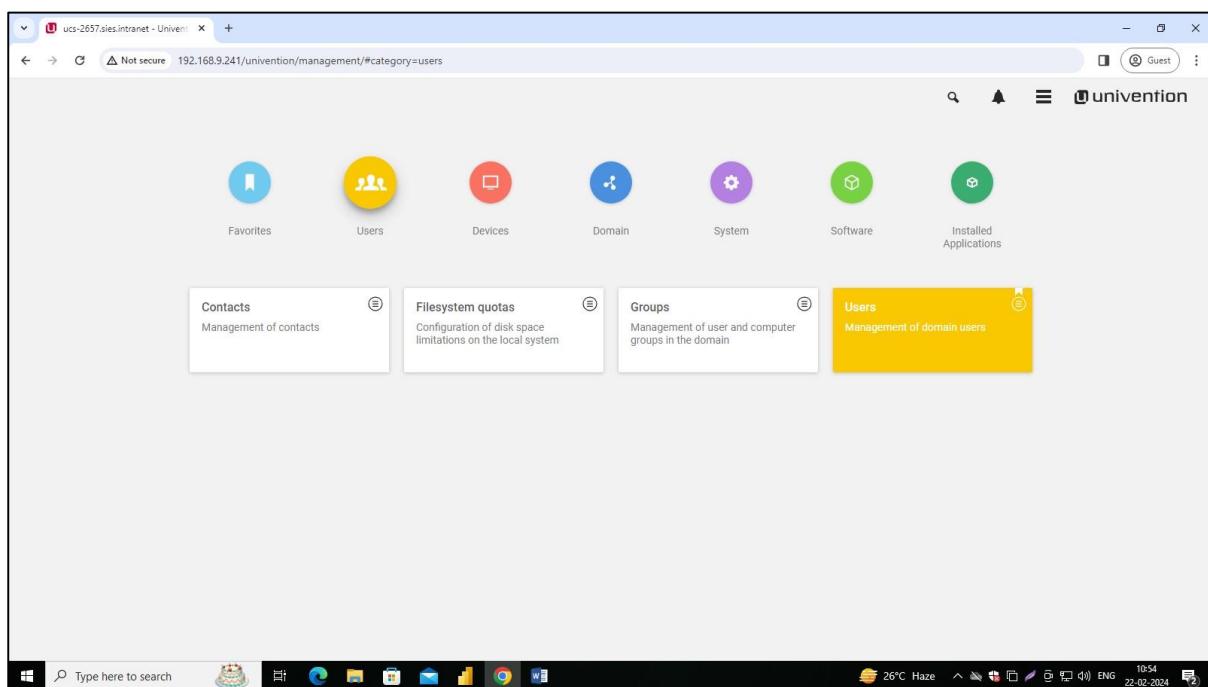
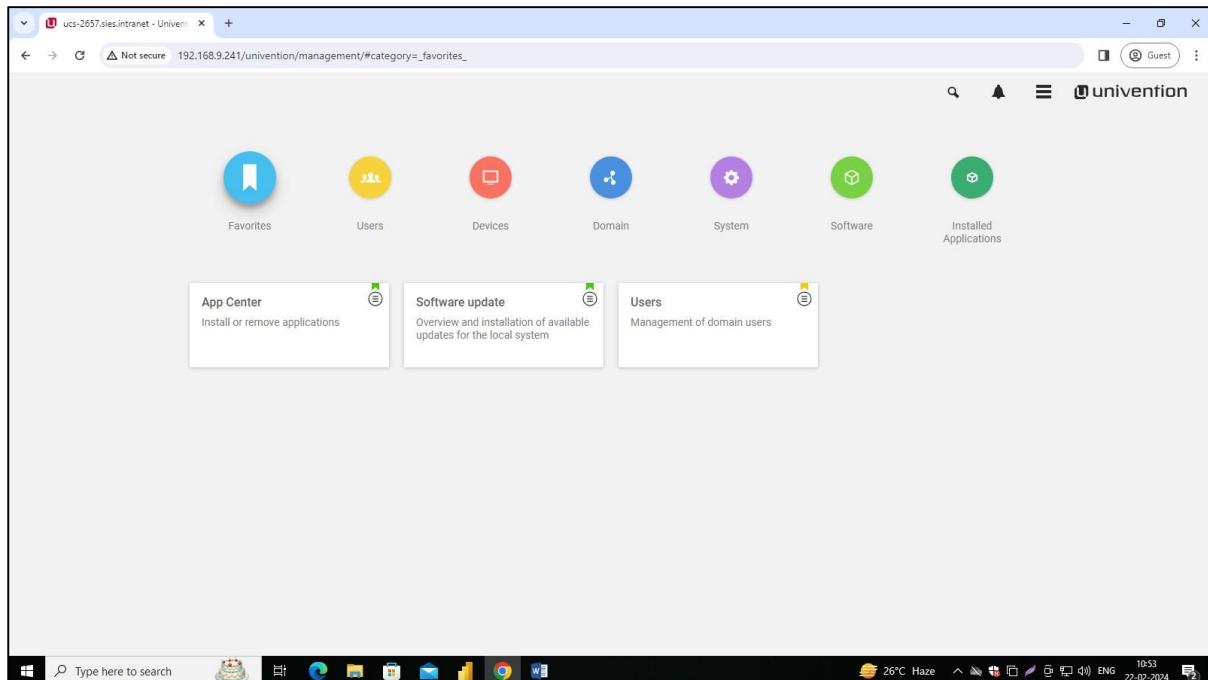
OwnCloud is an open-source software platform that provides file hosting and synchronization services. It allows users to store their files, documents, photos, and other data on a centralized server, which can be accessed from various devices such as computers, smartphones, and tablets.

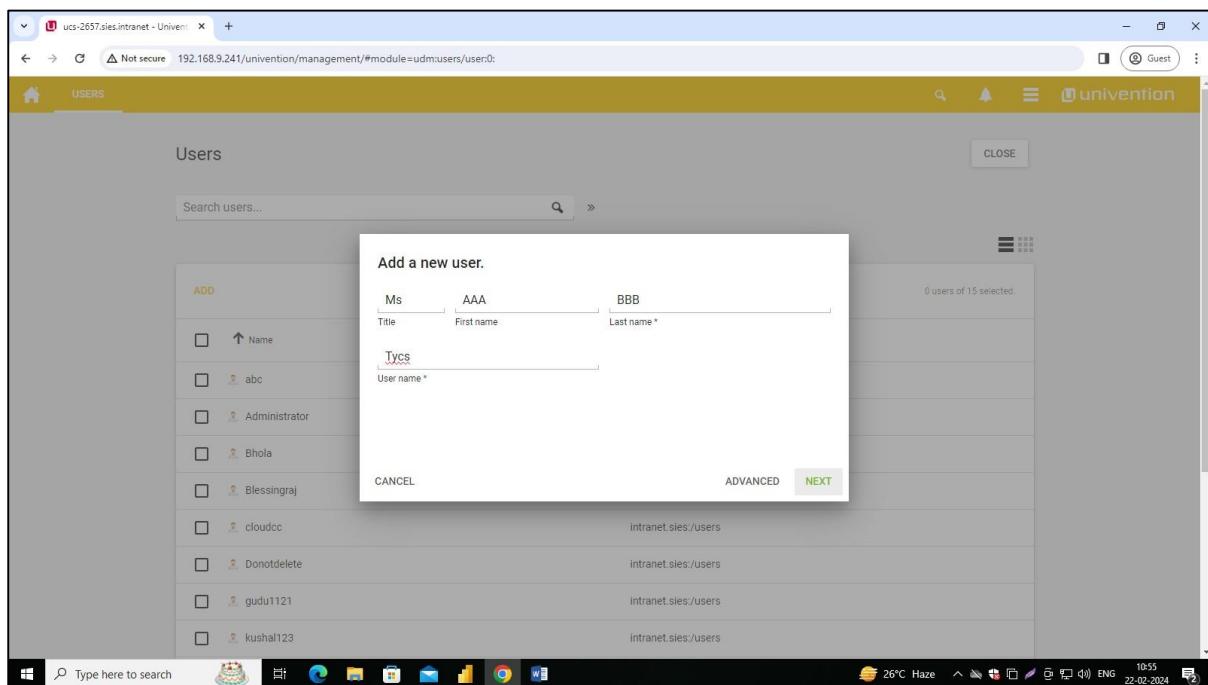
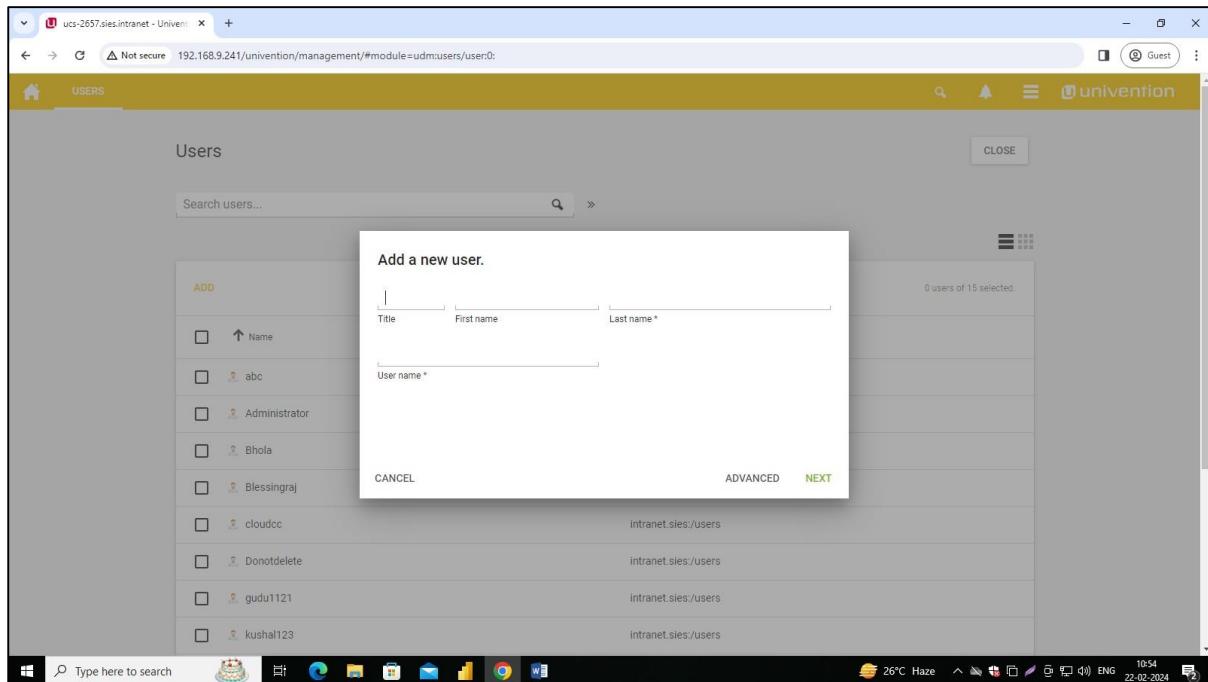
As a storage-as-a-service solution, OwnCloud offers users the ability to store their data securely in the cloud, eliminating the need for physical storage devices and providing convenient access to files from anywhere with an internet connection. Users can share files and collaborate with others by granting them access to specific folders or files. OwnCloud also provides features like versioning, encryption, and integration with other services, making it a versatile solution for storing and managing digital assets.

### **Output:**









uc-2657.sles.intranet - Univention Management

Not secure 192.168.9.241/univention/management/#module=udm:users/user:0:

Home USERS: TYCS CUSTOMIZE THIS PAGE CREATE USER BACK

Users: TYCS

General Groups Account Contact [Advanced settings] [Options] [Policies]

User account

Title	Ms	First name	AAA	Last name *	BBB
User name *	TyCS	Description			
Password *	*****	Password (retype) *			
<input type="checkbox"/> Override password history <input type="checkbox"/> Override password check					
Primary e-mail address					

Basic settings

UPLOAD NEW IMAGE

Personal information

Display name	AAA BBB
--------------	---------

Type here to search

Windows Start button, Taskbar icons (Calculator, File Explorer, Mail, etc.), Weather (26°C Haze), Date (10:56 22-02-2024)

uc-2657.sles.intranet - Univention Management

Not secure 192.168.9.241/univention/management/#module=udm:users/user:0:

Home USERS CLOSE

Users

Search users...

ADD 0 users of 16 selected.

<input type="checkbox"/>	Name	Path
<input type="checkbox"/>	abc	intranet.sles:/users
<input type="checkbox"/>	Administrator	intranet.sles:/users
<input type="checkbox"/>	Bhola	intranet.sles:/users
<input type="checkbox"/>	Blessingraj	intranet.sles:/users
<input type="checkbox"/>	cloudcc	intranet.sles:/users
<input type="checkbox"/>	Donotdelete	intranet.sles:/users
<input type="checkbox"/>	gudu1121	intranet.sles:/users
<input type="checkbox"/>	kushal123	intranet.sles:/users

Type here to search

Windows Start button, Taskbar icons (Calculator, File Explorer, Mail, etc.), Weather (26°C Haze), Date (10:59 22-02-2024)

ucs-2657.sles.intranet - Universe

Not secure 192.168.9.241/univention/management/#module=udm:users/user:0

<input type="checkbox"/>	Blessingraj	intranet.sles:/users
<input type="checkbox"/>	cloudcc	intranet.sles:/users
<input type="checkbox"/>	Donotdelete	intranet.sles:/users
<input type="checkbox"/>	gudu1121	intranet.sles:/users
<input type="checkbox"/>	kushal123	intranet.sles:/users
<input type="checkbox"/>	notdisable	intranet.sles:/users
<input type="checkbox"/>	samantha	intranet.sles:/users
<input type="checkbox"/>	Suganya_sn14	intranet.sles:/users
<input checked="" type="checkbox"/>	Tycs	intranet.sles:/users
<input type="checkbox"/>	user_an	intranet.sles:/users
<input type="checkbox"/>	User_Aneesh	intranet.sles:/users
<input type="checkbox"/>	user57	intranet.sles:/users
<input type="checkbox"/>	varun7537	intranet.sles:/users

Windows Taskbar: Type here to search, Start button, File Explorer, Control Panel, Mail, File History, Task View, Taskbar settings, Google Chrome, Microsoft Edge, File Explorer, Taskbar icons.

System tray: 26°C Haze, Volume, Network, Battery, ENG, 10:56, 22-02-2024, Taskbar icons.

ucs-2657.sles.intranet - Universe

Not secure 192.168.9.241/univention/management/#category=users

  
Favorites

  
Users

  
Devices

  
Domain

  
System

  
Software

**Contacts**  
Management of contacts

**Filesystem quotas**  
Configuration of disk space limitations on the local system

**Groups**  
Management of user and computer groups in the domain

**Users**  
Management of domain users

Administrator  
@ucs-2657

---

License 2 >

Server 2 >

User settings 1 >

Certificates 2 >

Switch language 2 >

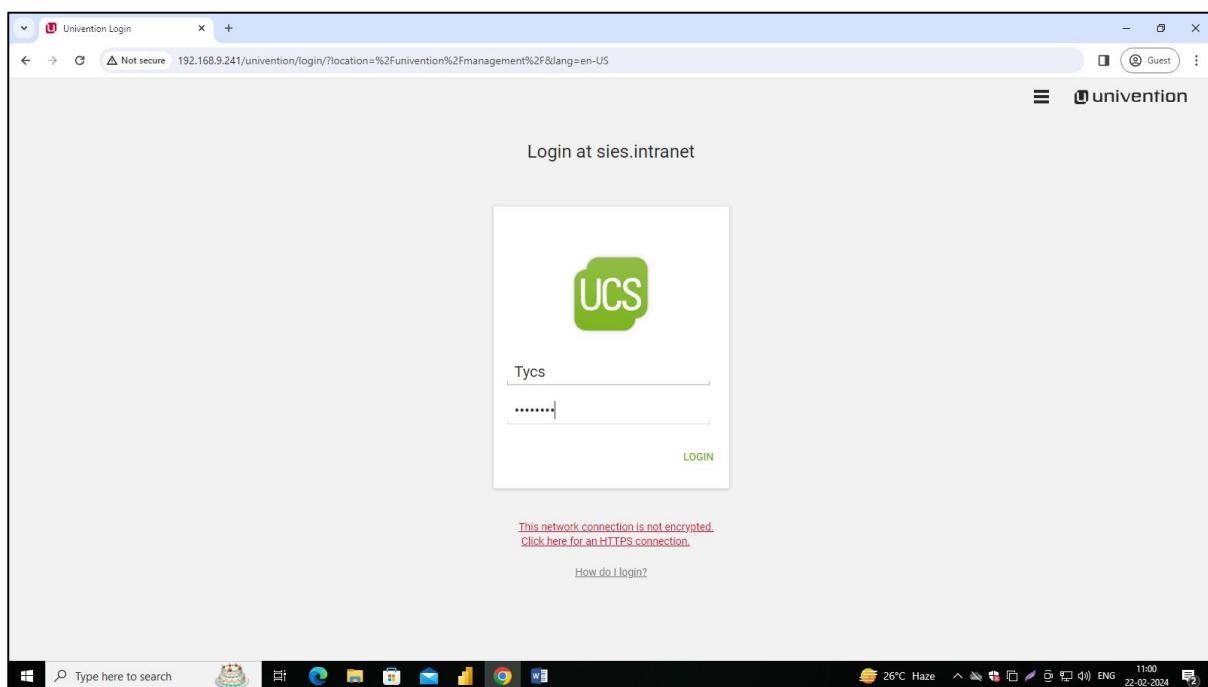
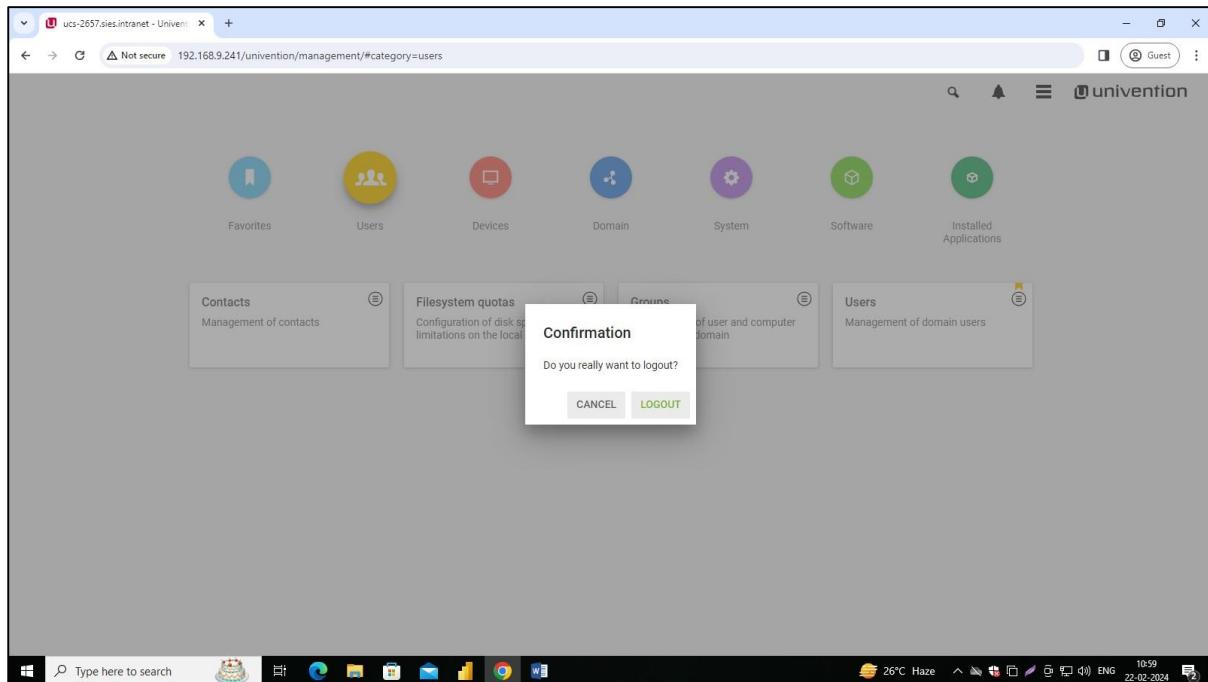
Help 7 >

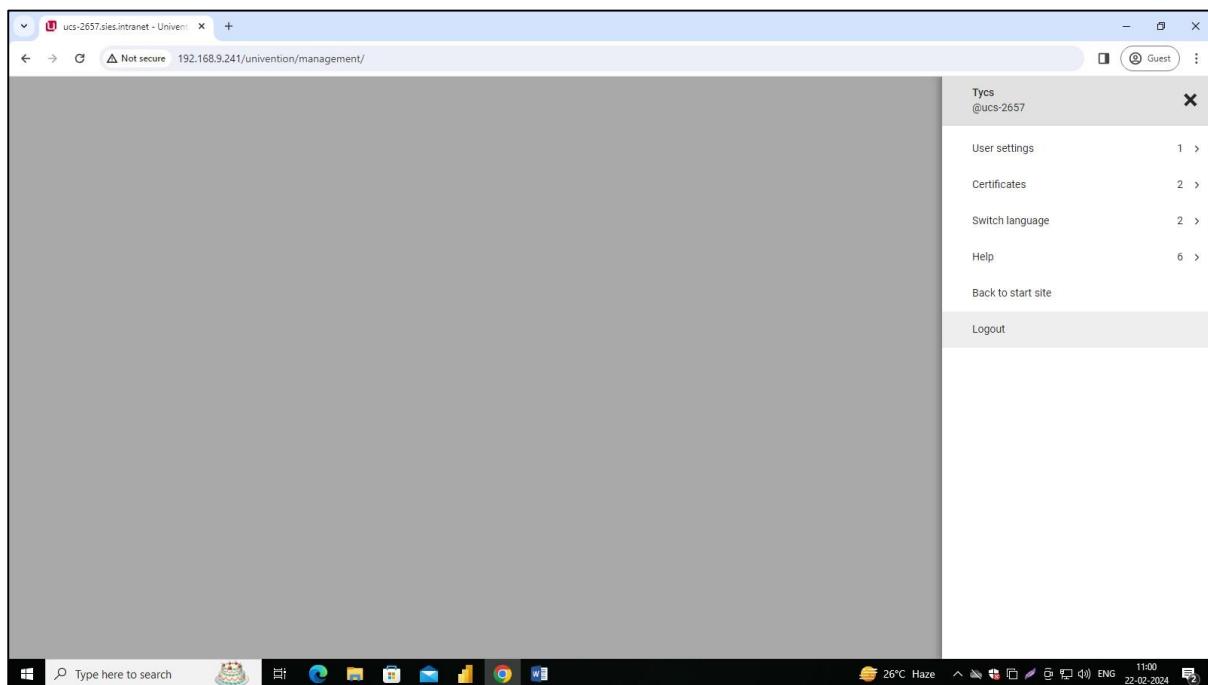
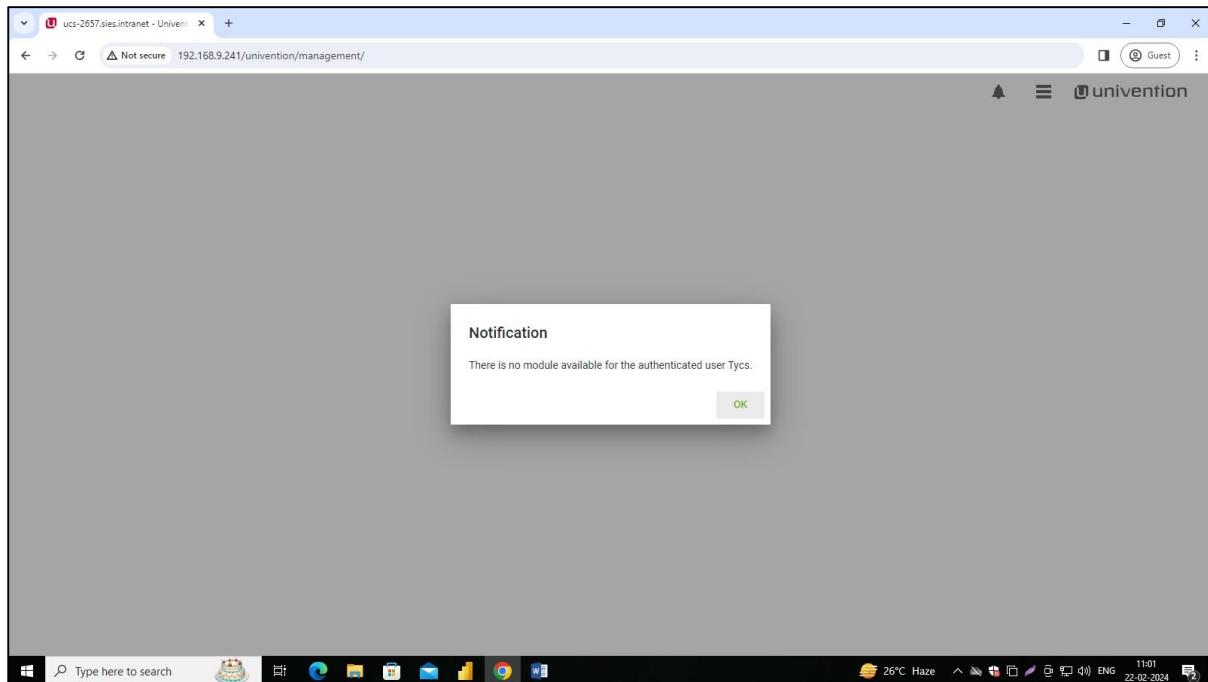
[Back to start site](#)

[Logout](#)

Windows Taskbar: Type here to search, Start button, File Explorer, Control Panel, Mail, File History, Task View, Taskbar settings, Google Chrome, Microsoft Edge, File Explorer, Taskbar icons.

System tray: 26°C Haze, Volume, Network, Battery, ENG, 10:59, 22-02-2024, Taskbar icons.





## Practical No 04

Aim: Google cloud Linux VM creation.

Output:

The screenshot shows the 'Create an instance' wizard in the Google Cloud Compute Engine interface. The left sidebar lists options: 'New VM instance', 'New VM instance from template', 'New VM instance from machine image', and 'Marketplace'. The main form is titled 'Name' with 'linux-web-server' entered. It includes sections for 'MANAGE TAGS AND LABELS' (Region: asia-south1 (Mumbai), Zone: asia-south1-c), 'Machine configuration' (N4 General-purpose machine series in Preview, 2 vCPU + 4 GB memory, 10 GB SSD persistent disk, Total \$31.42), and 'Compute Engine pricing'. A right-hand panel titled 'Install an Apache server' provides step-by-step instructions and terminal commands like 'sudo apt-get update' and 'Reading package lists... Done'.

The screenshot shows the 'VM instances' page in the Google Cloud Compute Engine interface. The left sidebar is under 'Virtual machines' and includes 'VM instances' (selected), 'Instance templates', 'Sole-tenant nodes', 'Machine images', 'TPUs', 'Committed use discounts', 'Reservations', 'Migrate to Virtual Machine...', 'Marketplace', and 'Release Notes'. The main area displays a table of VM instances with columns: Status, Name, Zone, Recommendations, In use by, Internal IP, External IP, and Connect. Two instances are listed: 'linux-web-server' (Status: green, Zone: asia-south1-c, Internal IP: 10.160.0.2, External IP: 34.100.164.56, Connect: SSH) and 'windows-server-vm' (Status: grey, Zone: us-central1-b, Internal IP: 10.128.0.2). Below the table are 'Related actions' cards for 'Explore Backup and DR', 'View billing report', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', and 'Patch management'.



SSH-in-browser

[UPLOAD FILE](#)[DOWNLOAD FILE](#)

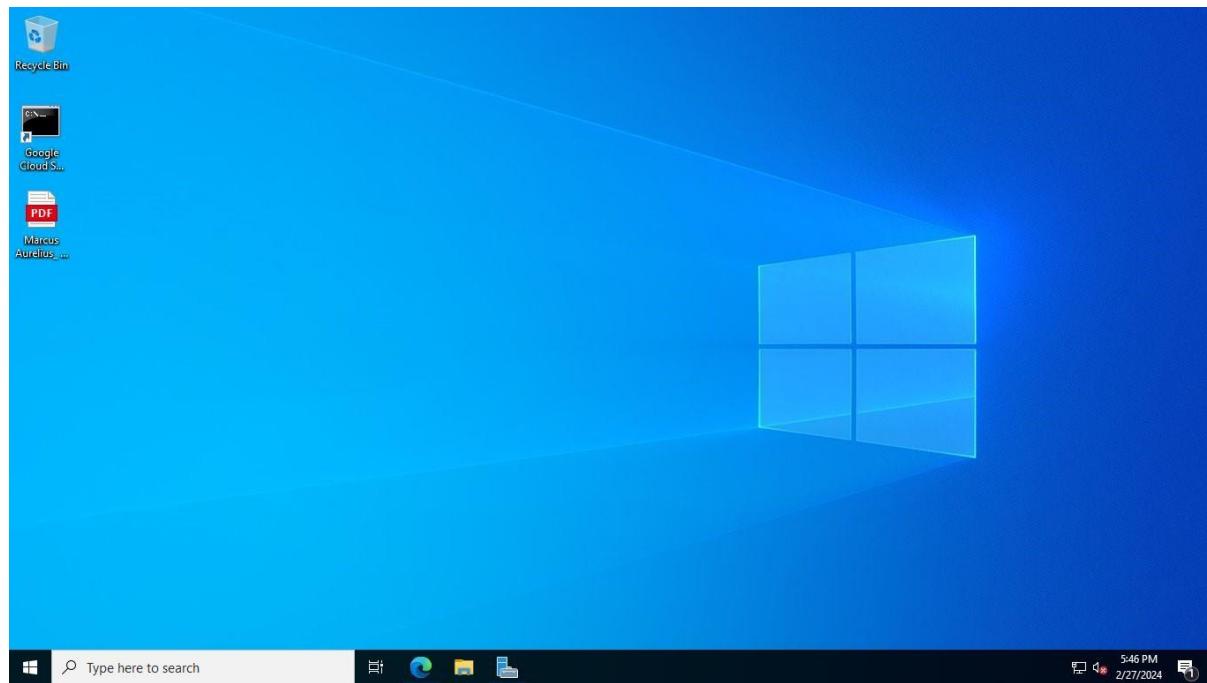
```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
rafaeroyale@linux-web-server:~$ sudo apt-get update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:5 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
Get:2 https://deb.debian.org/debian bookworm InRelease [151 kB]
Get:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease [5146 B]
Get:3 https://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease [6406 B]
Get:4 https://deb.debian.org/debian bookworm-backports InRelease [56.5 kB]
Get:6 https://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
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Get:12 https://deb.debian.org/debian bookworm-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:13 https://deb.debian.org/debian bookworm-backports/main Translation-en.diff/Index [63.3 kB]
Get:17 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-02-27-0814.13-F-2024-02-13-2006.01.
pdiff [35.2 kB]
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pdiff [35.2 kB]
Get:18 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-02-27-1409.47-F-2024-02-13-2
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Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-02-27-1409.47-F-2024-02-26-2
022.17.pdiff [10.0 kB]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-02-27-1409.47-F-2024-02-26-2
022.17.pdiff [10.0 kB]
Get:14 https://deb.debian.org/debian-security bookworm-security/main Sources [82.2 kB]
Get:15 https://deb.debian.org/debian-security bookworm-security/main amd64 Packages [143 kB]
Get:16 https://deb.debian.org/debian-security bookworm-security/main Translation-en [85.4 kB]
Fetched 1352 kB in 2s (696 kB/s)
Reading package lists... Done
rafaeroyale@linux-web-server:~$ sudo apt-get install apache2 php7.0
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'php7.0-thrift' for regex 'php7.0'
Note, selecting 'php7.0-common' for regex 'php7.0'
```

## Practical No 05

Aim: Google cloud Windows VM creation.

Output:

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar titled 'Compute Engine' has 'Virtual machines' selected. Under 'Virtual machines', 'VM instances' is also selected. The main area is titled 'VM instances' and contains a table with one row. The row details a VM named 'windows-server-vm' located in 'us-central1-b'. It has an internal IP of '10.128.0.2 (nic0)' and an external IP of '35.223.130.122 (nic0)'. The 'Connect' button shows 'RDP'. Below the table, there's a section titled 'Related actions' with links like 'Explore Backup and DR', 'View billing report', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', 'Patch management', and 'Load balance between VMs'.



## Practical No 06

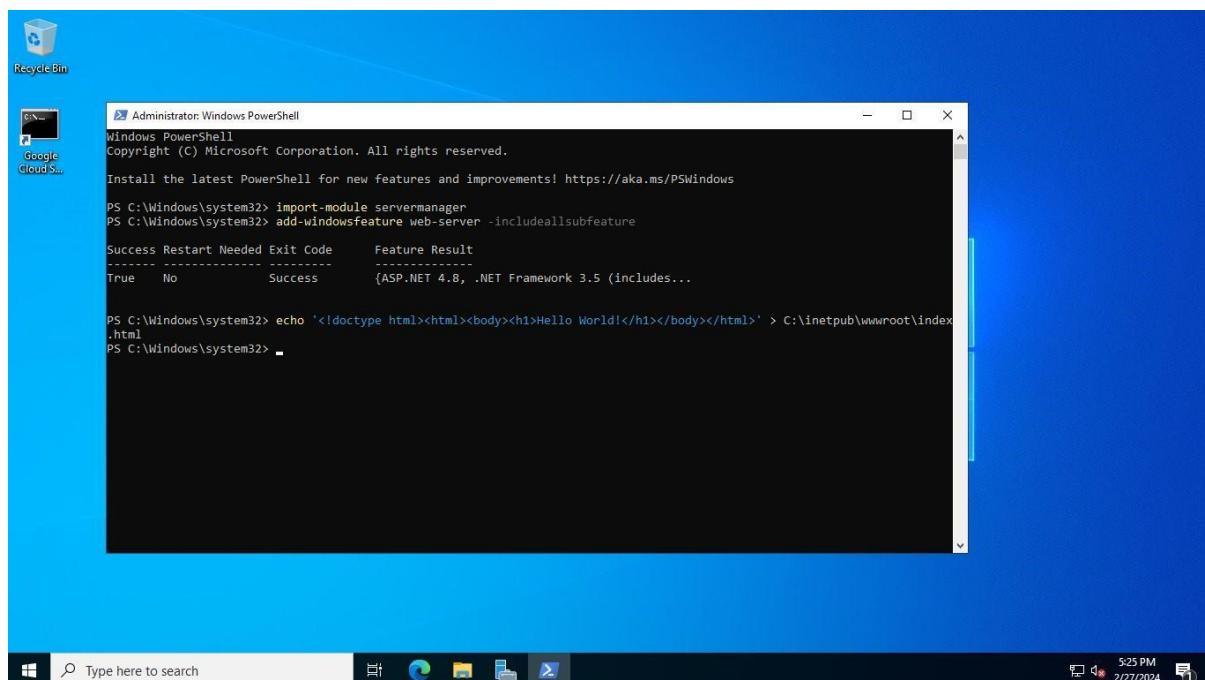
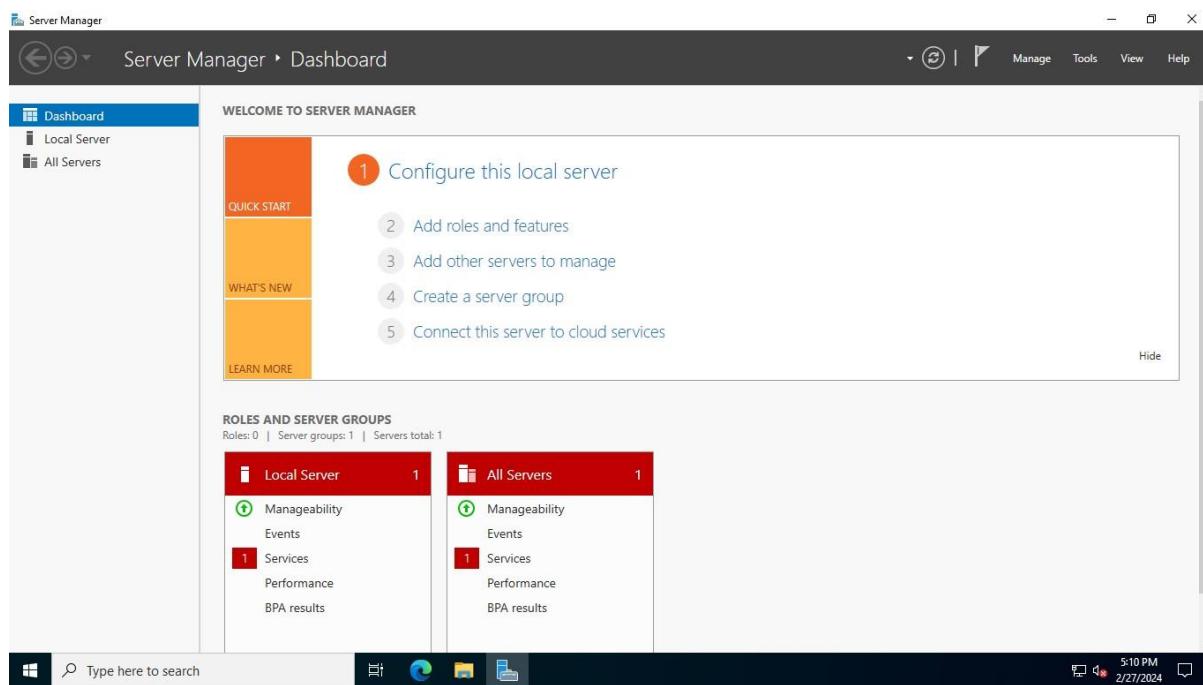
**Aim:** Perform the following in google cloud:

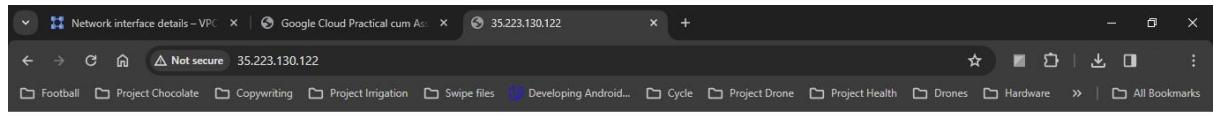
- a. A “Hello world” website on IIS-Create an IIS web server VM using Compute Engine.
- b. A “Hello World” website on Apache. Create an Apache web server on a Linux VM.
- c. Transfer files to Windows VMs.
- d. Transfer files to Linux VMs.
- e. Back up a VM's persistent disk.
- f. Configure periodic backups with a snapshot schedule.
- g. Restore a boot disk from a snapshot.
- h. Restore a persistent disk from a snapshot.

**Output:**

### 1. A “Hello world” website on IIS. Create an IIS web server VM using Compute Engine

The screenshot shows the Google Cloud Compute Engine interface. On the left, there is a sidebar with 'Virtual machines' selected, showing options like 'VM instances', 'Instance templates', 'Sole-tenant nodes', 'Machine images', 'TPUs', 'Committed use discounts', 'Reservations', 'Migrate to Virtual Machin...', 'Marketplace', and 'Release Notes'. The main area is titled 'VM instances' and has tabs for 'INSTANCES', 'OBSERVABILITY', and 'INSTANCE SCHEDULES'. Under 'INSTANCES', there is a table with one row. The row contains columns for 'Status' (green checkmark), 'Name' (windows-server-vm), 'Zone' (us-central1-b), 'Recommendations', 'In use by', 'Internal IP' (10.128.0.2 (nic0)), 'External IP' (35.223.130.122 (nic0)), and 'Connect' (RDP). Below the table, there is a section titled 'Related actions' with cards for 'Explore Backup and DR', 'View billing report', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', 'Patch management', and 'Load balance between VMs'.





Hello World!

## 2. A “Hello World” website on Apache. Create an Apache web server on a Linux VM

Name: linux-web-server

Region: asia-south1 (Mumbai)

Zone: asia-south1-c

Machine configuration:

- NEW: General-purpose machine series in Preview
- Try the new N4 series, ideal for workloads that prioritize flexibility and cost-optimization
- General purpose
- Compute optimized
- Memory optimized

Pricing:

Item	Monthly estimate
2 vCPU +	\$29.38
4 GB memory	
10 GB SSD persistent disk	\$2.04
Total	\$31.42

Terminal session (right panel):

```
sudo apt-get update
Reading package lists...
Done
Install the Apache2 HTTP Server...
```

VM instances – Compute Engine | Google Cloud Practical cum Ass... | +

console.cloud.google.com/compute/instances?onCreate=true&project=utopian-datum-380707

Football Project Chocolate Copywriting Project Irrigation Swipe files Developing Android... Cycle Project Drone Project Health Drones Hardware All Bookmarks

Google Cloud My First Project Search (/) for resources, docs, products, and more Search

**Compute Engine** VM instances CREATE INSTANCE IMPORT VM REFRESH

**Virtual machines**

**VM instances**

Filter Enter property name or value

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
Green	linux-web-server	asia-south1-c			10.160.0.2 (nic0)	34.100.164.56 (nic0)	SSH
Grey	windows-server-vm	us-central1-b			10.128.0.2 (nic0)		RDP

**Related actions**

- Explore Backup and DR NEW
- View billing report
- Monitor VMs
- Explore VM logs
- Set up firewall rules
- Patch management

ssh.cloud.google.com/v2/ssh/projects/utopian-datum-380707/zones/asia-south1-c/instances/linux-web-server?authuser=0&hl=en\_US&p... -

ssh.cloud.google.com/v2/ssh/projects/utopian-datum-380707/zones/asia-south1-c/instances/linux-web-server?authuser=0&hl=e... ▾

SSH-in-browser UPLOAD FILE DOWNLOAD FILE

Project Health Drones Hardware All Bookmarks

Search

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable law.

```
rafaeryoyal@linux-web-server: ~$ sudo apt-get update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:2 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
Get:3 https://deb.debian.org/debian bookworm InRelease [151 kB]
Get:4 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease [5146 B]
Get:5 https://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]
Get:6 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease [6406 B]
Get:7 https://deb.debian.org/debian bookworm-backports InRelease [56.5 kB]
Get:8 https://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
Get:9 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable/main amd64 Packages [1938 B]
Get:10 https://packages.cloud.google.com/apt cloud-sdk-bookworm/main amd64 Packages [459 kB]
Get:11 https://deb.debian.org/debian bookworm-backports/main Sources.diff/Index [63.3 kB]
Get:12 https://deb.debian.org/debian bookworm-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:13 https://deb.debian.org/debian bookworm-backports/main Translation-en.diff/Index [63.3 kB]
Get:14 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-02-27-0814.13-F-2024-02-13-2006.01.pdfiff [35.2 kB]
Get:15 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-02-27-0814.13-F-2024-02-13-2006.01.pdfiff [35.2 kB]
Get:16 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-02-27-1409.47-F-2024-02-13-2006.01.pdfiff [22.3 kB]
Get:17 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-02-27-1409.47-F-2024-02-13-2006.01.pdfiff [22.3 kB]
Get:18 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-02-27-1409.47-F-2024-02-13-2006.01.pdfiff [22.3 kB]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-02-27-1409.47-F-2024-02-13-2006.01.pdfiff [10.0 kB]
Get:20 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-02-27-1409.47-F-2024-02-13-2006.01.pdfiff [10.0 kB]
Get:21 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-02-27-0814.13-F-2024-02-13-2006.01.pdfiff [82.2 kB]
Get:22 https://deb.debian.org/debian bookworm-security/main amd64 Packages [143 kB]
Get:23 https://deb.debian.org/debian bookworm-security/main Translation-en [85.4 kB]
Fetched 1352 kB in 2s (696 kB/s)
Reading package lists... Done
rafaeryoyal@linux-web-server: ~$ sudo apt-get install apache2 php7.0
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'php7.0-thrift' for regex 'php7.0'
Note, selecting 'php7.0-common' for regex 'php7.0'
```

Monitor VMs

Patch management

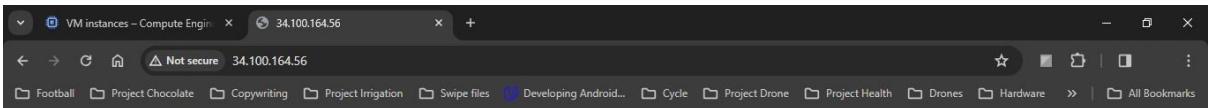
The screenshot shows a browser window with two tabs. The left tab is titled "SSH-in-browser" and contains a terminal session output:

```
Setting up libaprutil1-dbd-sqlite3:amd64 (1.6.3-1) ...
Setting up apache2-utils (2.4.57-2) ...
Setting up apache2-bin (2.4.57-2) ...
Setting up apache2 (2.4.57-2) ...
Enabling module mpm_event.
Enabling module authz_core.
Enabling module authz_host.
Enabling module authn_core.
Enabling module auth_basic.
Enabling module access_compat.
Enabling module include_file.
Enabling module authz_user.
Enabling module alias.
Enabling module dir.
Enabling module autoindex.
Enabling module env.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module reqtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /lib/systemd/system/apache2.service.
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service → /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for man-db (2.11.2-2) ...
Processing triggers for libc-bin (2.36-9+deb12u4) ...
rafaeroyle@linux-web-server:~$ echo '<!doctype html><html><body><h1>Hello World!</h1></body></html>' | sudo tee /var/www/html/index.html
<!doctype html><html><body><h1>Hello World!</h1></body></html>
rafaeroyle@linux-web-server:~$ '
```

The right tab is a cloud-based VM management interface showing a list of instances:

IP	External IP	Connect
0.2 (nic0)	34.100.164.56 (nic0)	SSH
0.2 (nic0)		RDP

Below the table are two callout boxes: "Monitor VMs" and "Patch management".



Hello World!

### 3. Transfer files to Windows VMs

#### Local Computer

bucket-of-files - Bucket details | Google Cloud Practical cum As... | 35.223.130.122

console.cloud.google.com/storage/browser/bucket-of-filestab=objects?project=utopian-datum-380707&prefix=&forceOnObjectsSortingFiltering=true&project=utopian-datum-380707

Football Project Chocolate Copywriting Project Irrigation Swipe files Developing Android... Cycle Project Drone Project Health Drones Hardware All Bookmarks

Google Cloud My First Project Search (/) for resources, docs, products, and more

Cloud Storage Bucket details

bucket-of-files

Location us (multiple regions in United States) Storage class Standard Public access Not public Protection None

OBJECTS CONFIGURATION PERMISSIONS PROTECTION LIFECYCLE OBSERVABILITY INVENTORY REPORTS

Buckets > bucket-of-files

UPLOAD FILES UPLOAD FOLDER CREATE FOLDER TRANSFER DATA MANAGE HOLDS EDIT RETENTION DOWNLOAD DELETE

Filter by name prefix only Filter objects and folders Show deleted data

Name	Size	Type	Created	Storage class	Last modified	Public ac
Marcus Aurelius_Meditations ( P...	804.9 KB	application/pdf	Feb 27, 2024, 11:08:08 PM	Standard	Feb 27, 2024, 11:08:08 PM	Not publ

Marketplace Release Notes

VM

bucket-of-files - Bucket details - Meditations | Welcome to Microsoft Edge

https://console.cloud.google.com/storage/browser/bucket-of-filestab=objects?forceOnBucketsSortingFiltering=true&project=utopian-datum-380707&prefix=&project=utopian-datum-380707

Google Cloud My First Project Search (/) for resources, docs, products, and more

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bucket-of-files

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OBJECTS CONFIGURATION PERMISSIONS PROTECTION LIFECYCLE OBSERVABILITY INVENTORY REPORTS

Buckets > bucket-of-files

UPLOAD FILES UPLOAD FOLDER CREATE FOLDER TRANSFER DATA MANAGE HOLDS EDIT RETENTION DOWNLOAD DELETE

Filter by name prefix only Filter objects and folders Show deleted data

Name	Size	Type	Created	Storage class	Last modified	Publ
Marcus Aurelius_Meditations ( P...	804.9 KB	application/pdf	Feb 27, 2024, 5:38:08 PM	Standard	Feb 27, 2024, 5:38:08 PM	No

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bucket-of-files - Bucket details - Meditations

Welcome to Microsoft Edge

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Introduction by Gregory Hays

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Book 7

Book 8

Book 9

Book 10

Book 11

Book 12

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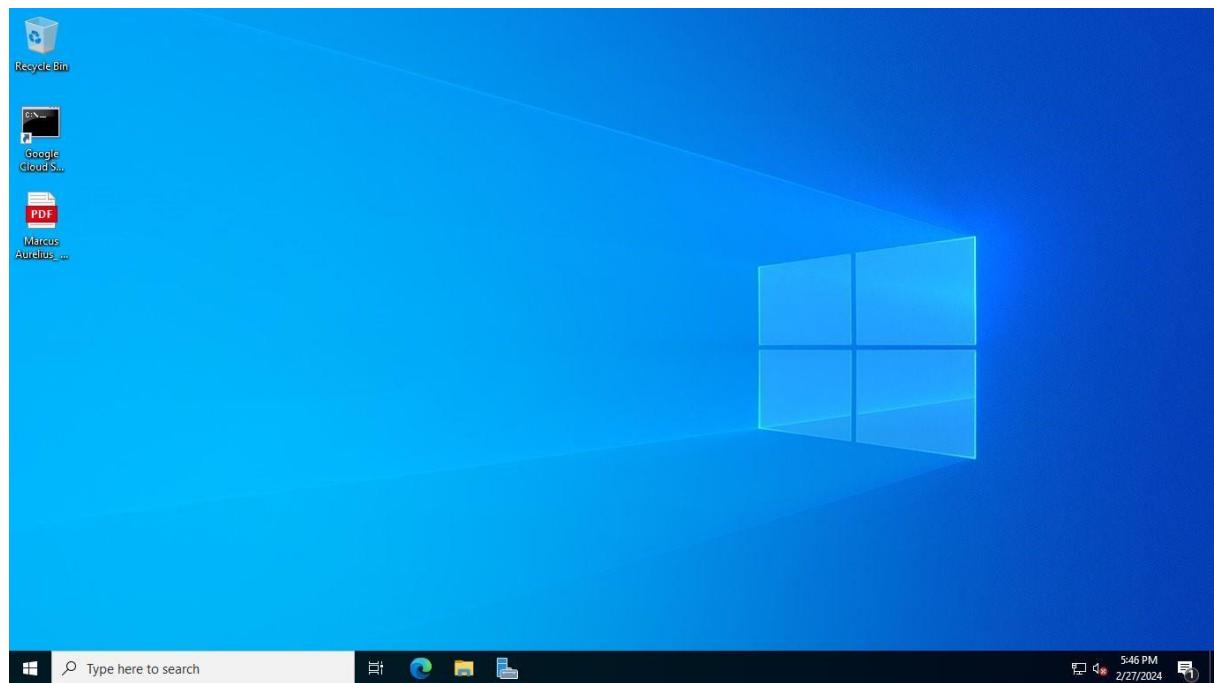
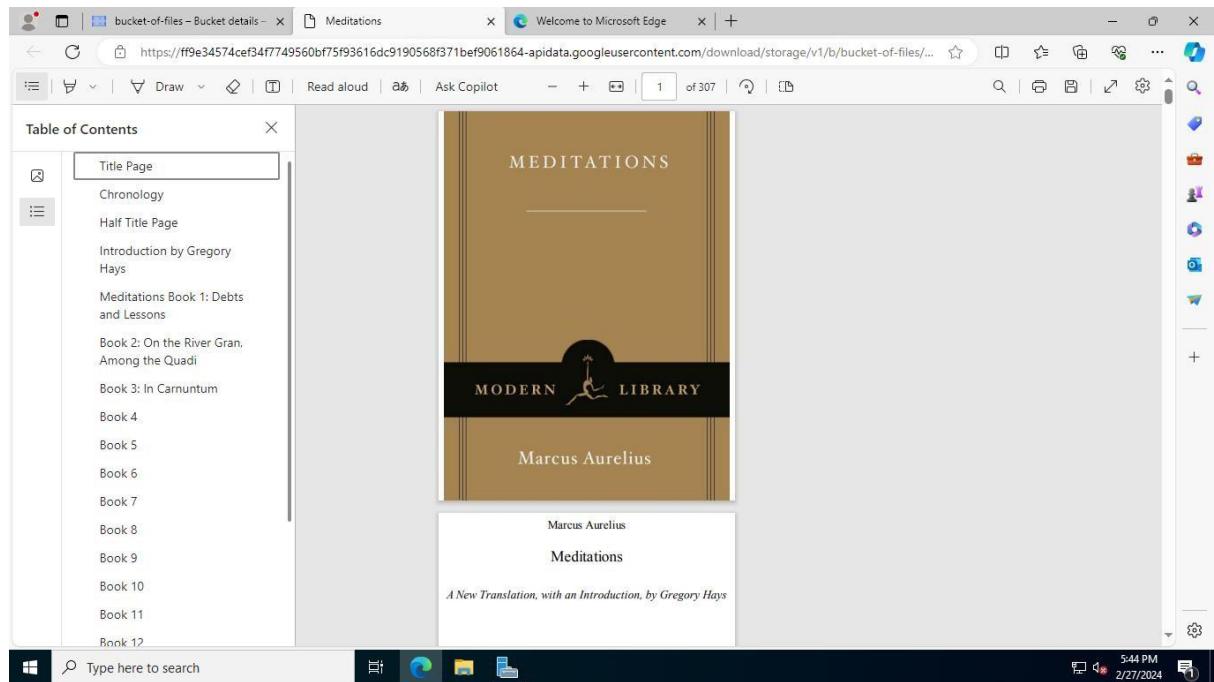
Marcus Aurelius

Meditations

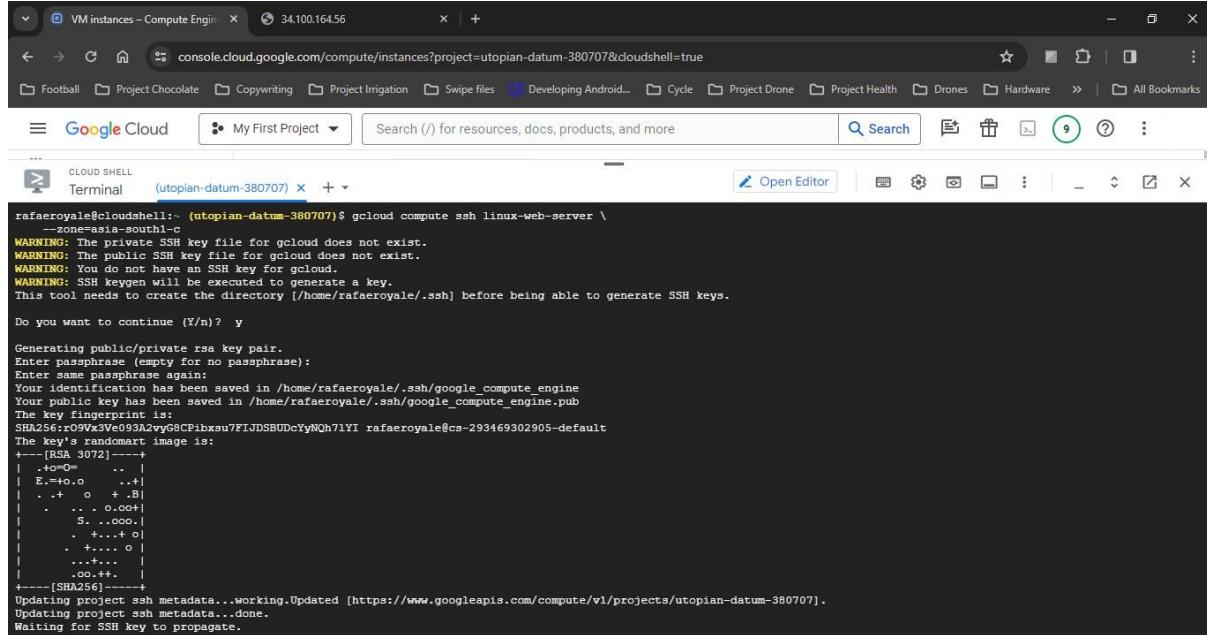
*A New Translation, with an Introduction, by Gregory Hays*

Type here to search

5:44 PM 2/27/2024

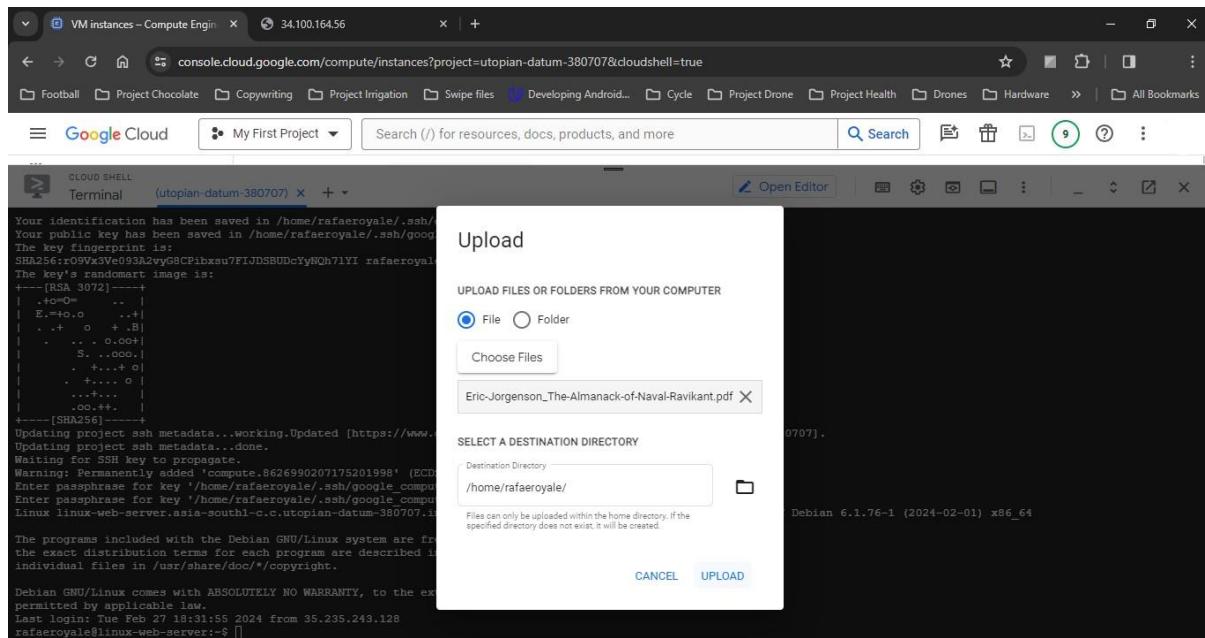


## 4. Transfer files to Linux VMs



```
rafaeroyale@cloudbashell:~ (utopian-datum-380707)$ gcloud compute ssh linux-web-server \
--zone=asia-south1-c
WARNING: The private SSH key file for gcloud does not exist.
WARNING: The public SSH key file for gcloud does not exist.
WARNING: You do not have an SSH key for gcloud.
WARNING: SSH keygen will be executed to generate a key.
This tool needs to create the directory [/home/rafaeroyale/.ssh] before being able to generate SSH keys.

Do you want to continue (Y/n)? y
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/rafaeroyale/.ssh/google_compute_engine
Your public key has been saved in /home/rafaeroyale/.ssh/google_compute_engine.pub
The key fingerprint is:
SHA256:rO9Vx3Ve093AzvvyG8CPibxsu7FIJDSBUDcYyNQh7lYI rafaeroyale@cs-293469302905-default
The key's randomart image is:
+---[RSA 3072]---+
| .+o=          .. |
| E.=+o.o      ..+ |
| .+ o + .B|     . |
| . . o.o+|     S. .ooo.|
| . . .+o|     . +...+o|
| . +.... o|     . +...+o|
| . .+... |     . .+... |
| . oo++|     . .oo++|
+---[SHA256]---+
Updating project ssh metadata...working.Updated [https://www.googleapis.com/compute/v1/projects/utopian-datum-380707].
Updating project ssh metadata...done.
Waiting for SSH key to propagate.
```



Your identification has been saved in /home/rafaeroyale/.ssh/google\_compute\_engine  
Your public key has been saved in /home/rafaeroyale/.ssh/google\_compute\_engine.pub  
The key fingerprint is:  
SHA256:rO9Vx3Ve093A2vyg8CPibxsu7FIJDSBUDcYyNQh7lYI rafaeroyale@cs-293469302905-default  
The key's randomart image is:  
[RSA 3072]-----+  
| .+o=O .. |  
| E.=to.o ..+|  
| .+. o + .B|  
| . . . o..o+|  
| S..oooo..|  
| . +...+ o|  
| . +.... o|  
| .oo++..|  
[SHA256]-----+  
Updating project ssh metadata...working.Updated [https://www.googleapis.com/compute/v1/projects/utopian-datum-380707].  
Updating project ssh metadata...done.  
Waiting for SSH key to propagate.  
Warning: Permanently added 'compute.8626990207175201998' (EDDSA)  
Enter passphrase for key '/home/rafaeroyale/.ssh/google\_compute\_engine':  
Enter passphrase for key '/home/rafaeroyale/.ssh/google\_compute\_engine':  
Linux linux-web-server.asia-south1-c.c. utopian-datum-380707.internat 6.1.0-18-cloud-amd64 #1 SMP PREEMPT\_DYNAMIC Debian 6.1.76-1 (2024-02-01) x86\_64  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/\*copyright.  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Tue Feb 27 18:31:55 2024 from 35.235.243.128  
rafaeroyale@linux-web-server:~\$

File path: /home/rafaeroyale/Eric-Jorgenson\_The-Almanack-of-Naval-Ravikant.pdf  
File paths are relative to home directory.  
-380707].

CANCEL DOWNLOAD

HIC Debian 6.1.76-1 (2024-02-01) x86\_64

Your identification has been saved in /home/rafaeroyale/.ssh/google\_compute\_engine  
Your public key has been saved in /home/rafaeroyale/.ssh/google\_compute\_engine.pub  
The key fingerprint is:  
SHA256:rO9Vx3Ve093A2vyg8CPibxsu7FIJDSBUDcYyNQh7lYI rafaeroyale@cs-293469302905-default  
The key's randomart image is:  
[RSA 3072]-----+  
| .+o=O .. |  
| E.=to.o ..+|  
| .+. o + .B|  
| . . . o..o+|  
| S..oooo..|  
| . +...+ o|  
| . +.... o|  
| .oo++..|  
[SHA256]-----+  
Updating project ssh metadata...working.Updated [https://www.googleapis.com/compute/v1/projects/utopian-datum-380707].  
Updating project ssh metadata...done.  
Waiting for SSH key to propagate.  
Warning: Permanently added 'compute.8626990207175201998' (EDDSA) to the list of known hosts.  
Enter passphrase for key '/home/rafaeroyale/.ssh/google\_compute\_engine':  
Enter passphrase for key '/home/rafaeroyale/.ssh/google\_compute\_engine':  
Linux linux-web-server.asia-south1-c.c. utopian-datum-380707.internat 6.1.0-18-cloud-amd64 #1 SMP PREEMPT\_DYNAMIC Debian 6.1.76-1 (2024-02-01) x86\_64  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/\*copyright.  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Tue Feb 27 18:31:55 2024 from 35.235.243.128  
rafaeroyale@linux-web-server:~\$

Eric-Jorgenson\_The-Almanack-of-Naval-Ravikant.pdf  
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Eric-Jorgenson\_The-Almanack-of-Naval-Ravikant.pdf /home/rafaeroyale/Eric-Jorgenson\_The-Almanack-of-Naval-Ravikant.pdf ✓

## 5. Back up a VM's persistent disk

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar lists options like Virtual machines, VM instances, Instance templates, Sole-tenant nodes, Machine images, TPUs, Committed use discounts, Reservations, Migrate to Virtual Machin..., Marketplace, and Release Notes. The main area is titled 'persistent-disk' under 'Manage disk'. It has tabs for DETAILS and MONITORING. Under DETAILS, there are sections for Properties (Type: Balanced persistent disk, Size: 100 GB, Architecture: --, Zone: us-central1-b, Labels: None, In use by: windows-server-vm, Snapshot schedule: None, Encryption type: Google-managed, Consistency group: None) and EQUIVALENT REST. At the bottom, a URL is shown: <https://console.cloud.google.com/compute/snapshotsAdd?selfLink=projects%2Futopian-datum-380707%2Fzones%2Fus-central1-b%2Fdisks%2Fpersistent-disk&project=utopian-datum-380707>.

The screenshot shows the 'Create a snapshot' dialog box. The sidebar on the left is identical to the previous screenshot. The main area is titled 'Create a snapshot'. It contains fields for Name (set to 'persistent-snapshot-1'), Description (empty), Snapshot source type (set to 'Disk'), Source disk (set to 'persistent-disk'), and Type (radio button selected for 'Snapshot'). At the bottom are buttons for CREATE, CANCEL, and EQUIVALENT CODE.

Snapshots – Compute Engine - Google Cloud Practical cum Ass... | + console.cloud.google.com/compute/snapshots?onCreateSnapshot=true&project=utopian-datum-380707

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Compute Engine Snapshots CREATE SNAPSHOT CREATE SNAPSHOT SCHEDULE REFRESH DELETE

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Snapshots are backups of persistent disks. They're commonly used to recover, transfer, or make data accessible to other resources in your project. [Learn more](#)

SNAPSHOTS ARCHIVE SNAPSHOTS INSTANT SNAPSHOTS PREVIEW SNAPSHOT SCHEDULES

Create snapshot schedules to automatically back up your data. [Learn more about creating snapshot schedules](#)

Filter Enter property name or value

Status	Name	Location	Snapshot size	Creation time	Creation type	Source disk	Source instant snapshot	Disk size
<input checked="" type="checkbox"/>	boot-snapshot-1	us	9.52 GB	Feb 27, 2024, 11:27:04 PM UTC+05:30	Manual	windows-server-vm		50 GB
<input checked="" type="checkbox"/>	persistent-snapshot-1	us	0 B	Feb 27, 2024, 11:43:21 PM UTC+05:30	Manual	persistent-disk		100 GB

## 6. Configure periodic backups with a snapshot schedule

The screenshot shows the Google Cloud Compute Engine interface for a VM instance named "linux-web-server". The "Storage" section is selected. It displays the "Boot disk" table with one entry:

Name	Image	Interface type	Size (GB)	Device name	Type	Architecture	Encryption	Mode	Wk
linux-web-server	debian-12-bookworm-v20240213	SCSI	10	linux-web-server	SSD persistent disk	x86/64	Google-managed	Boot, read/write	Del

Below the table, sections for "Local disks" and "Additional disks" both show "None".

The screenshot shows the Google Cloud Compute Engine interface for managing a disk named "linux-web-server". A modal window titled "Create a schedule" is open. In the "Name" field, "schedule-1" is entered. The "Region" dropdown is set to "asia-south1". Under "Snapshot storage location", the "Multi-regional" option is selected. At the bottom right of the modal are "CREATE" and "CANCEL" buttons.

## 7. Restore a boot disk from a snapshot

The screenshot shows the Google Cloud Compute Engine interface for a VM instance named "windows-server-vm". The instance is currently running, as indicated by the "Running" status in the "Basic information" section. The "OPERATIONS" panel on the right side of the screen includes buttons for "START / RESUME", "STOP", "SUSPEND", and "DELETE".

**Basic information**

Name	windows-server-vm
Instance Id	2366053012124755312
Description	None
Type	Instance
Status	Running
Creation time	Feb 27, 2024, 6:24:58 PM UTC+05:30
Zone	us-central1-b

The screenshot shows the same Google Cloud Compute Engine interface for the "windows-server-vm" instance. This time, the instance is listed as "Stopped" in the "Basic information" section. A prominent black message box at the bottom center of the screen displays the text "VM instance stopped" with a close button ("X").

**Basic information**

Name	windows-server-vm
Instance Id	2366053012124755312
Description	None
Type	Instance
Status	Stopped
Creation time	Feb 27, 2024, 6:24:58 PM UTC+05:30
Zone	us-central1-b

Edit windows-server-vm instance | Google Cloud Practical cum Ass... | +

console.cloud.google.com/compute/instancesEdit/zones/us-central1-b/instances/windows-server-vm?project=utopian-datum-380707

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Compute Engine

Keep disk

Delete disk

Device name

DETACH BOOT DISK

Additional disks

+ ADD NEW DISK    + ATTACH EXISTING DISK

Local disks

SAVE CANCEL

This screenshot shows the 'Edit windows-server-vm instance' page in the Google Cloud Compute Engine interface. The left sidebar lists various Compute Engine services. The main area is titled 'Edit windows-server-vm instance' and contains sections for disk management. It shows a radio button for 'Delete disk' selected, and a 'Device name' field set to 'windows-server-vm'. Below this are buttons for 'DETACH BOOT DISK', '+ ADD NEW DISK', and '+ ATTACH EXISTING DISK'. A 'Local disks' section is present but empty. At the bottom are 'SAVE' and 'CANCEL' buttons.

Edit windows-server-vm instance | Google Cloud Practical cum Ass... | +

console.cloud.google.com/compute/instancesEdit/zones/us-central1-b/instances/windows-server-vm?project=utopian-datum-380707

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Compute Engine

Allow Load Balancer

Network tags

Snapshot — boot-snapshot-1

Created on Feb 27, 2024, 11:27:04 PM, windows-server-vm

PUBLIC IMAGES CUSTOM IMAGES SNAPSHTOS ARCHIVE SNAPSHOTS EXISTING DISKS

Snapshot — boot-snapshot-1

Name \* new-boot-disk

Boot disk type \* Balanced persistent disk

Size (GB) \* 50

COMPARE DISK TYPES

Local disks

SAVE CANCEL

This screenshot shows a 'Boot disk' configuration dialog. It includes tabs for 'PUBLIC IMAGES', 'CUSTOM IMAGES', 'SNAPSHTOS' (selected), 'ARCHIVE SNAPSHOTS', and 'EXISTING DISKS'. The 'SNAPSHTOS' tab shows a dropdown for 'Snapshot' containing 'boot-snapshot-1', which was created on Feb 27, 2024. The configuration fields include 'Name' (set to 'new-boot-disk'), 'Boot disk type' (set to 'Balanced persistent disk'), and 'Size (GB)' (set to 50). At the bottom are 'SELECT' and 'CANCEL' buttons.

Edit windows-server-vm instance | Google Cloud Practical cum Ass... | +

console.cloud.google.com/compute/instancesEdit/zones/us-central1-b/instances/windows-server-vm?project=utopian-datum-380707

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Compute Engine Edit windows-server-vm instance

Network tags https-server

Storage Boot disk

Name	new-boot-disk
Type	New balanced persistent disk
Size	50 GB
License type	Free
Snapshot	boot-snapshot-1
Device name	windows-server-vm

CONFIGURE BOOT DISK

Additional disks

New disk	persistent-disk, Blank, 100 GB
----------	--------------------------------

\* SAVING CANCEL

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console.cloud.google.com/compute/instancesDetail/zones/us-central1-b/instances/windows-server-vm?project=utopian-datum-380707

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Compute Engine windows-server-vm

EDIT RESET CREATE MACHINE IMAGE CREATE SIMILAR OPERATIONS

START / RESUME STOP SUSPEND DELETE

DETAILS OBSERVABILITY OS INFO SCREENSHOT

RDP SET WINDOWS PASSWORD CONNECT TO SERIAL CONSOLE

Connecting to serial ports is disabled

Logs

Logging Serial port 1 SHOW MORE

Basic information

Name	windows-server-vm
Instance Id	2366053012124755312
Description	None
Type	Instance
Status	Stopped
Creation time	Feb 27, 2024, 6:24:58 PM UTC+05:30
Zone	us-central1-b

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Compute Engine

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## 8. Restore a persistent disk from a snapshot

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar lists options like Virtual machines, VM instances, Instance templates, Sole-tenant nodes, Machine images, TPUs, Committed use discounts, Reservations, Migrate to Virtual Machine, Marketplace, and Release Notes. The main area displays the details of a VM instance named "windows-server-vm". The instance is currently running in the "us-central1-b" zone. It has an instance ID of 2366053012124755312 and a creation time of Feb 27, 2024, 6:24:58 PM UTC+05:30. The status is Running. On the right, there are buttons for START / RESUME, STOP, SUSPEND, and DELETE.

The screenshot shows the "Edit windows-server-vm instance" page. The sidebar on the left is identical to the previous screenshot. The main area shows the instance configuration. The device name is set to "windows-server-vm". Under "Additional disks", there is one existing disk named "persistent-disk". Buttons for DETACH BOOT DISK, ADD NEW DISK, and ATTACH EXISTING DISK are available. The "Local disks" section indicates "None". Under "Security and access", the "Shielded VM" option is listed. At the bottom, there are "SAVE" and "CANCEL" buttons.

Screenshot of the Google Cloud Platform Compute Engine VM Instances page showing the 'Edit windows-server-vm instance' dialog.

**VM Instances**

- Device name: windows-server-vm
- Custom

**Additional disks**

**Local disks**  
None

**Security and access**

**Shielded VM** Turn on all settings for the most secure configuration.

**Add new disk**

Name: new-persistent-disk-1  
Name is permanent

Description:

**Source**  
Create a blank disk, apply a bootable disk image, or restore a snapshot of another disk in this project.

Disk source type: Snapshot  
Source snapshot: persistent-snapshot-1

**Disk settings**  
Disk type: Balanced persistent disk

**Compare Disk Types**

**Buttons:** SAVE, CANCEL

Screenshot of the Google Cloud Platform Compute Engine VM Instances page showing the 'Edit windows-server-vm instance' dialog after adding a new disk.

**VM Instances**

- Device name: windows-server-vm
- Custom

**Additional disks**

New disk: new-persistent-disk-1, Snapshot: persistent-snapshot-1, 100 GB

**Local disks**  
None

**Security and access**

**Shielded VM** Turn on all settings for the most secure configuration.

**Add new disk**

**Buttons:** SAVE, CANCEL

## Practical No 07

Aim: Write a program for web feed.

Code:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Web Feed</title>
</head>
<body>
    <p><b>Select category:</b></p>
    <form method="post" id="webform">
        <select required name="rssurl">
            <option value="" selected hidden>- select an option -</option>
            <option value="http://timesofindia.indiatimes.com/rssfeeds/-2128672765.cms">Science</option>
            <option value="http://timesofindia.indiatimes.com/rssfeeds/66949542.cms">Tech</option>
            <option value="http://timesofindia.indiatimes.com/rssfeeds/913168846.cms">Education</option>
        </select>
        <button type="submit">load</button>
    </form>
    <?php
        if(isset($_POST['rssurl']))
        {
            echo'<h1> Results for RSS url : '.$_POST['rssurl'].'</h1>';
            $rssurl=$_POST['rssurl'];
            $rss=new DOMDocument();
            $rss->load($rssurl);
            $feed=array();

            foreach($rss->getElementsByTagName('item') as $node)
            {
                $item=array(
                    'title'=>$node-> getElementsByTagName('title')->item(0)>nodeValue,
                    'link'=>$node-> getElementsByTagName('link')->item(0)>nodeValue,
                    'desc'=>$node-> getElementsByTagName('description')-
                >item(0)->nodeValue,
```

```

'date'=>$node-> getElementsByTagName('pubDate')->item(0)-
>nodeValue
);
array_push($feed,$item);
}

$limit=5;
for($x=0;$x<$limit;$x++)
{
$title=str_replace('&','&',$feed[$x]['title']);
$link=$feed[$x]['link'];
getDescription=$feed[$x]['desc'];
$description=$feed[$x]['desc'];
$date=date('l F d,Y',strtotime($feed[$x]['date']));

echo'<p><strong><a href='.$link.'title=' . $title .'>' . $title . '</a></strong></p>';
echo'<p>' . $description . '</p>';           echo'<small><em>Posted on ' . $date . '</em></small></p>';
}
?

```

</body>

</html>

### Output:

Web Feed    localhost/feed/

Football Project Chocolate Copywriting Project Irrigation Swipe files Developing Android... Cycle Project Drone Project Health Drones Hardware All Bookmarks

Select category:

- select an option -

Web Feed    localhost/feed/

Football Project Chocolate Copywriting Project Irrigation Swipe files Developing Android... Cycle Project Drone Project Health Drones Hardware All Bookmarks

Select category:

Science

**Results for RSS url : <http://timesofindia.indiatimes.com/rssfeeds/-2128672765.cms>**

[Mice study unravels new insights to boost treatment of liver fibrosis](#)



## Practical No 08

**Aim:** Case study on Amazon EC2/Microsoft Azure/Google Cloud Platform. (Research paper analysis)

### **INTRODUCTION**

In recent years, cloud computing has become an increasingly popular technology because it provides businesses with a method that is both flexible and scalable for managing their information technology infrastructure. The proliferation of cloud computing has led to the development of numerous cloud computing platforms, each of which possesses a set of capabilities and features that are distinct from the others. Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform are three of the cloud computing environments that are particularly well-known.

### **COMPREHENSIVE ANALYSIS**

#### **1. Amazon EC2**

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment.

Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate themselves from common failure scenarios.

Significant features: S3 Storage, Cloud Management Console, MapReduce Cloud, Amazon Machine Image (AMI).

#### **2. Microsoft Azure**

Microsoft Azure is a cloud computing platform offered by Microsoft. It was first introduced in 2010 and has since grown to become one of the main cloud computing platforms. Azure provides a comprehensive set of cloud computing services, including computation, storage, databases, networking, analytics, and more.

Azure's primary features include the following:

**Virtual Machines:** This is a cloud-based service that allows customers to construct and deploy virtual computers.

**Blob Storage:** This is a storage solution that delivers unstructured data with scalable object storage.

**Azure SQL Database** is a managed database service that supports SQL Server as well as other database engines.

**Functions:** This is a serverless computing solution that allows developers to run code without the requirement for servers to be provisioned or managed.

Azure has several pricing models, including pay-as-you-go, reserved instances, and spot instances. It also has a free tier where consumers may try out its services for free. **3. Google Cloud Platform**

Google Cloud Platform (GCP) is Google's cloud computing platform. It was first introduced in 2011 and has since grown to become one of the main cloud computing platforms. GCP provides a comprehensive set of cloud computing services, including computation, storage, databases, networking, analytics, and more.

GCP's primary characteristics include the following:

**Compute Engine** is a cloud-based service that allows customers to construct and deploy virtual computers.

**Cloud storage** is a type of storage that offers scalable object storage for unstructured data.

**Cloud SQL** is a managed database service that supports MySQL and PostgreSQL.

**Cloud Functions:** A serverless computing solution that allows developers to run code without the requirement for server provisioning or management.

GCP provides a variety of pricing options, such as pay-as-you-go, sustained usage discounts, and committed use savings. It also has a free tier where consumers may try out its services for free.

## COMPARATIVE ANALYSIS

**Pricing:** Each of the three platforms has a variety of price choices, including pay-peruse, reserved instances, and spot instances. Amazon EC2 is the costliest, whereas GCP is the least expensive. Nevertheless, price may differ based on the service or product being used.

**Performance:** All three systems provide excellent levels of scalability, dependability, and availability. Amazon EC2, on the other hand, has been the market leader in this space for many years, with a massive network of data centres and a wide choice of services.

**Features:** Each platform offers its own set of capabilities and services, with Amazon EC2 providing the greatest functionality. Microsoft Azure excels in hybrid cloud and artificial intelligence/machine learning, whereas GCP is recognised for its strength in big data and analytics.

**User Interface:** The user interface for each platform varies substantially, with Amazon EC2 being the most sophisticated and challenging for newcomers to manage. Microsoft Azure has a more user-friendly UI, but GCP provides a more contemporary and simplified user experience.

**Security:** All three platforms have strong security safeguards in place, with Amazon EC2 providing the most comprehensive security features and certifications. Microsoft Azure offers a solid security infrastructure as well, whereas GCP is recognised for using encryption and safe networking.

**Support:** Each platform provides varying levels of assistance, ranging from community forums to premium 24-hour support. Amazon EC2 offers the greatest support community, while Microsoft Azure and Google Cloud Platform provide comparable levels of assistance.

## **CONCLUSION**

In conclusion, each cloud computing platform - Amazon EC2, Microsoft Azure, and Google Cloud Platform - offers unique features and capabilities tailored to meet the diverse needs of businesses. The choice of platform depends on factors such as pricing, performance, scalability, security requirements, and ease of use.