

**Cloud Computing**

**Exploring Google Cloud Services**

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# Introduction

This assignment focuses on using key Google Cloud services, specifically virtual machines, cloud storage, and networking. Students will set up and configure virtual machines, create and manage storage solutions, and explore networking features within Google Cloud. The process will involve practical steps like launching instances, configuring storage buckets, and setting up networks. Each step will be documented to reflect the findings and configurations.

## Virtual Machines in Google Cloud

Virtual machines (VMs) in Google Cloud are scalable, customizable computing resources that run on Google's infrastructure. They allow users to deploy and manage virtualized operating systems, offering flexible configurations for processing power, storage, and networking.

Creating VM:

1. Set up authentication. Authentication is the process by which your identity is verified for access to Google Cloud services and APIs
2. Setting up VM instance in Image 1

The screenshot shows the Google Cloud console interface for creating a new VM instance. The left sidebar lists configuration steps: VM basics, Machine configuration, OS and storage, Networking, Observability, Security, and Advanced. The main panel is titled 'Identify your VM' and includes fields for Name, Region, and Zone. The 'Monthly estimate' section on the right provides a cost breakdown for the selected configuration.

Item	Monthly estimate
2 vCPU + 4 GB memory	\$24.46
10 GB balanced persistent disk	\$1.00
<b>Total</b>	<b>\$25.46</b>

Image 1: Setting up VM

3. Setting up Firewall rules in Image 2

Google Cloud assignment2 Search (/) for resources, docs, products, and more

Create an instance CREATE VM FROM...

- VM basics  
Instance: 20241013-091006, us-central1-c
- Machine configuration  
e2-medium
- OS and storage  
Debian GNU/Linux 12 (bookworm)
- Networking**  
1 firewall rule, 1 network interface
- Observability
- Security
- Advanced

### Networking

#### Firewall

Add tags and firewall rules to allow specific network traffic from the Internet

- ☒ Allow HTTP traffic
- ☐ Allow HTTPS traffic
- ☐ Allow Load Balancer Health Checks

Network tags

Hostname

Set a custom hostname for this instance or leave it default. Choice is permanent

IP forwarding

- ☐ Enable

Network performance configuration

Network interface card

Network bandwidth

- ☐ Enable per VM Tier\_1 networking performance

CREATE CANCEL EQUIVALENT CODE

#### Monthly estimate

\$25.46

That's about \$0.03 hourly

Pay for what you use: no upfront costs and per second billing

Item	Monthly estimate
2 vCPU + 4 GB memory	\$24.46
10 GB balanced persistent disk	\$1.00
<b>Total</b>	<b>\$25.46</b>

Compute Engine pricing

LESS

Image 2: Firewall rules

#### 4. Successful creation in Image 3

assignment2 Search (/) for resources, docs, products, and more

VM instances CREATE INSTANCE IMPORT VM REFRESH

INSTANCES OBSERVABILITY INSTANCE SCHEDULES

### VM instances

Filter Enter property name or value

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input checked="" type="checkbox"/>	Instance-20241013-091006	us-central1-c			10.128.0.2 (nic0)	34.31.147.81 (nic0)	SSH

Image 3: Successful creation of the VM

#### 5. Accessing VM instance via ssh in Image 4

```
balzhan.cloudcomputing@cloudshell:~ (assignment2-438508) $ gcloud compute ssh --project=assignment2-438508 --zone=us-central1-c instance-20241013-091006
Updating project ssh metadata...workingUpdated [https://www.googleapis.com/compute/v1/projects/assignment2-438508].
Updating project ssh metadata...done.
Waiting for SSH key to propagate.
Warning: Permanently added 'compute.8476967141229604325' (ED25519) to the list of known hosts.
Linux instance-20241013-091006 6.1.0-26-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.112-1 (2024-09-30) 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: Sun Oct 13 09:35:25 2024 from 35.235.244.34
balzhan.cloudcomputing@instance-20241013-091006:~$
```

Image 4: VM instance via ssh

#### 6. Updating the packages in Image 5

```

balzhan_cloudcomputing@instance-20241013-091006:~$ sudo apt-get update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:3 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
Hit:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease
Hit:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease
Get:2 https://deb.debian.org/debian bookworm InRelease [151 kB]
Get:4 https://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]
Get:5 https://deb.debian.org/debian bookworm-backports InRelease [59.0 kB]
Get:6 https://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
Get:9 https://deb.debian.org/debian bookworm-backports/main Sources.diff/Index [63.3 kB]
Get:10 https://deb.debian.org/debian bookworm-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:11 https://deb.debian.org/debian bookworm-backports/main Translation-en.diff/Index [63.3 kB]
Get:12 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-10-13-0204.45-F-2024-10-10-0222.42.pdiff [3443 B]
Get:13 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-10-13-0204.45-F-2024-10-10-0810.07.pdiff [4005 B]
Get:12 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-10-13-0204.45-F-2024-10-10-0222.42.pdiff [3443 B]
Get:13 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-10-13-0204.45-F-2024-10-10-0810.07.pdiff [4005 B]
Get:16 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-10-13-0204.45-F-2024-10-13-0204.45.pdiff [142 B]
Get:14 https://deb.debian.org/debian-security bookworm-security/main Sources [120 kB]
Get:15 https://deb.debian.org/debian-security bookworm-security/main amd64 Packages [188 kB]
Fetched 819 kB in 1s (739 kB/s)
Reading package lists... Done

```

Image 5: Updating packages

## 7. Installing apache on the VM in Image 6

```

balzhan_cloudcomputing@instance-20241013-091006:~$ sudo apt-get install apache2
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3
  libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
0 upgraded, 11 newly installed, 0 to remove and 0 not upgraded.
Need to get 2379 kB of archives.
After this operation, 8468 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
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/main amd64 libapr1 amd64 1.7.2-3 [102 kB]
Get:4 https://deb.debian.org/debian bookworm/main amd64 libaprutil1 amd64 1.6.3-1 [87.8 kB]
Get:5 https://deb.debian.org/debian bookworm/main amd64 libaprutil1-dbd-sqlite3 amd64 1.6.3-1 [13.6 kB]
Get:6 https://deb.debian.org/debian bookworm/main amd64 libaprutil1-ldap amd64 1.6.3-1 [11.8 kB]
Get:7 https://deb.debian.org/debian bookworm/main amd64 libjansson4 amd64 2.14-2 [40.8 kB]

```

Image 6: Installing apache

## 8. Deploying a web page with Hello World! In Image 7

```

balzhan_cloudcomputing@instance-20241013-091006:~$ 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>

```

Image 7: Deploying a web page

## 9. Accessing deployed page in Image 8

← → ↻ Не защищено 34.31.147.81

Hello World!

Image 8: Hello World! page

# Storage Solutions in Google Cloud

Cloud Storage in Google Cloud is really useful for a wide range of tasks, especially when dealing with large amounts of data. One of the main use cases is data backup and archiving. Companies can use it to securely store their important data without worrying about running out of space, and it's great for long-term archiving. Another use case is serving static content, like images or videos for websites or apps, which makes things like hosting media files easier and more efficient, especially with Google's global infrastructure.

For data-heavy projects, such as analytics or machine learning, Cloud Storage comes in handy too. It allows engineers and data scientists to store massive datasets and integrate them with other Google Cloud services. Plus, media companies often use it to store and deliver content, like video streaming services.

When it comes to **lifecycle management**, it adds a lot of benefits. It automates things like moving older data to cheaper storage classes (like Coldline or Archive) when you don't need to access them frequently, which saves on costs. I think this is one of the best ways to ensure you're not paying more than necessary for storage you don't need all the time. It also helps with data retention, especially when you need to delete data after a certain time to meet compliance rules. Overall, lifecycle management helps you stay organized and efficient without having to manually track your data storage.

## 1. Creating a bucket in Image 9

assignment2 Search (/) for resources, docs, products, and more Search

Create a bucket

- ☒ **Get Started**  
Name: balzhan
- ☒ **Choose where to store your data**  
Location: us-central1 (Iowa)  
Location type: Region
- ☒ **Choose a storage class for your data**  
Default storage class: Standard
- ☒ **Choose how to control access to objects**  
Public access prevention: On  
Access control: Fine-grained
- ☐ **Choose how to protect object data**  
Your data is always protected with Cloud Storage but you can also choose from these additional data protection options to add extra layers of security.

**Data protection**

- ☒ **Soft delete policy (For data recovery)**  
When enabled, this bucket and its objects will be kept for a specified period after they're deleted and can be restored during this time. [Learn more](#)

**Good to know**

- Location pricing**  
Storage rates vary depending on the storage class of your data and location of your bucket. [Pricing details](#)
- Current configuration: Region / Standard

Item	Cost
us-central1 (Iowa)	\$0.020 per GB-month

**ESTIMATE YOUR MONTHLY COST**

Image 9: Creating bucket

## 2. Successful creation of the bucket

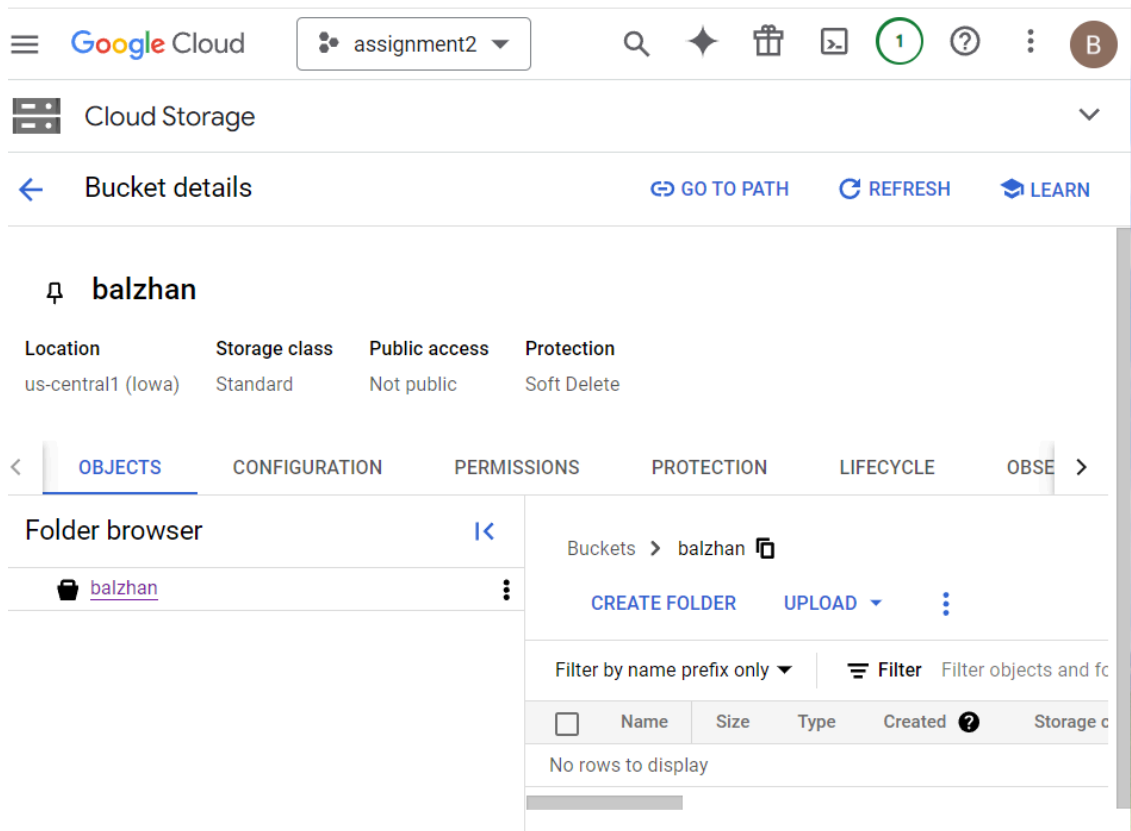


Image 10: Creation of the bucket

### 3. Setting bucket as public or private in Image 11

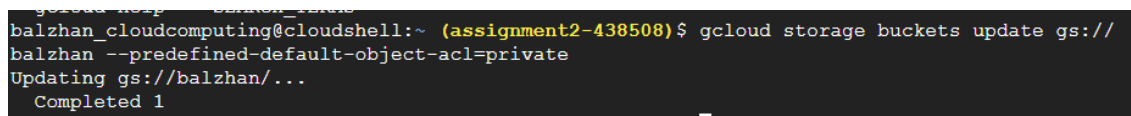


Image 11: Private bucket

### 4. Uploading object in Image 12

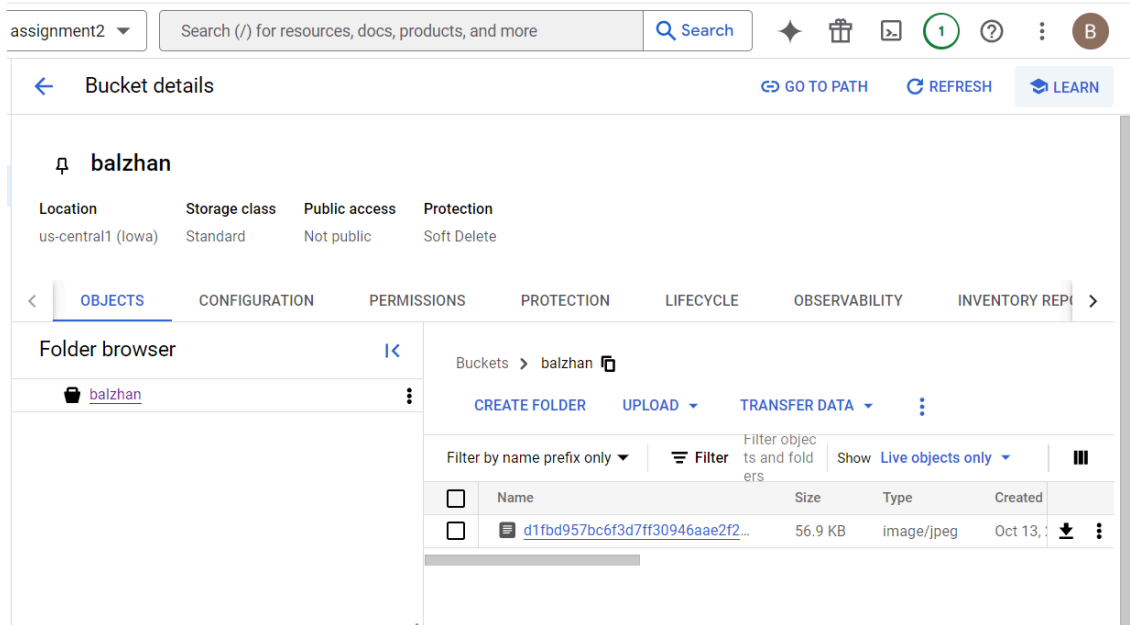


Image 12: Uploading file

## 5. Adding lifecycle rule in Image 13 to delete objects after 30 days

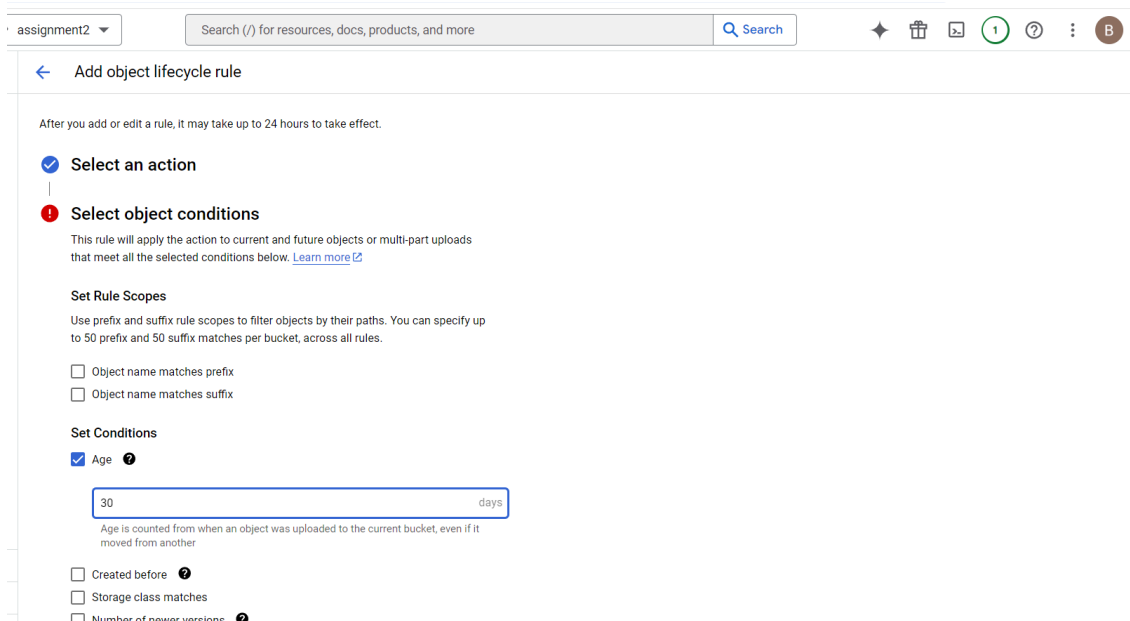


Image 13: Setting up lifecycle rules



## Networking in Google Cloud

In Google Cloud, a Virtual Private Cloud (VPC) is a scalable and flexible network that allows users to create an isolated environment for their resources. With a Google Cloud VPC, users can define their own IP ranges, subnets, and control routing rules, enabling secure communication between different Google Cloud services. It offers features like global networking, where a single VPC can span multiple regions, and built-in security through firewall rules and private access options. This ensures that users can manage and secure their workloads efficiently while maintaining flexibility for both internal and external connectivity.

### 1. Creating VPC network in Image 14

```
balzhan_cloudcomputing@cloudshell:~ (assignment2-438508)$ gcloud compute networks create balzhan-network --subnet-mode=custom --bgp-routing-mode=regional --mtu=1460
Created [https://www.googleapis.com/compute/v1/projects/assignment2-438508/global/networks/balzhan-network].
NAME: balzhan-network
SUBNET_MODE: CUSTOM
BGP_ROUTING_MODE: REGIONAL
IPV4_RANGE:
GATEWAY_IPV4:

Instances on this network will not be reachable until firewall rules
are created. As an example, you can allow all internal traffic between
instances as well as SSH, RDP, and ICMP by running:

$ gcloud compute firewall-rules create <FIREWALL_NAME> --network balzhan-network --allow tcp,udp,icmp --source-ranges <IP_RANGE>
$ gcloud compute firewall-rules create <FIREWALL_NAME> --network balzhan-network --allow tcp:22,tcp:3389,icmp
```

Image 14: Creating VPC network

### 2. Creating firewall rule in Image 15

```
balzhan_cloudcomputing@cloudshell:~ (assignment2-438508)$ gcloud compute firewall-rules create balzhan-firewall-network-rule --network balzhan-network --allow tcp:22,tcp:3389,icmp
Creating firewall...working..Created [https://www.googleapis.com/compute/v1/projects/assignment2-438508/global/firewalls/balzhan-firewall-network-rule].
Creating firewall...done.
NAME: balzhan-firewall-network-rule
NETWORK: balzhan-network
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp:22,tcp:3389,icmp
DENY:
DISABLED: False
```

Image 15: Applying firewall rule

### 3. Adding subnet in Image 16

```
balzhan_cloudcomputing@cloudshell:~ (assignment2-438508)$ gcloud compute networks subnets create balzhan-subnet \
--network=balzhan-network \
--range=10.128.0.0/20 \
--region=us-central1
Created [https://www.googleapis.com/compute/v1/projects/assignment2-438508/regions/us-central1/subnetworks/balzhan-subnet].
NAME: balzhan-subnet
REGION: us-central1
NETWORK: balzhan-network
RANGE: 10.128.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
INTERNAL_IPV6_PREFIX:
EXTERNAL_IPV6_PREFIX:
```

Image 16: Creating subnet

#### 4. Adding VM instance to the network in Image 17

```
balzhan_cloudcomputing@cloudshell:~ (assignment2-438508)$ gcloud compute instances create my-vm-instance --zone=us-central1-c --machine-type=e2-medium --network=balzhan-network --subnet=balzhan-subnet --tags=http-server,ssh-access --image=project-debian-cloud --image-family=debian-11 --scopes=https://www.googleapis.com/auth/cloud-platform
Created [https://www.googleapis.com/compute/v1/projects/assignment2-438508/zones/us-central1-c/instances/my-vm-instance].
NAME: my-vm-instance
ZONE: us-central1-c
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.128.0.2
EXTERNAL_IP: 34.122.172.43
STATUS: RUNNING
```

Image 17: Adding VM instance to the network

#### 5. Accessing the internet (pinging [www.google.com](http://www.google.com)) in Image 18

```
balzhan_cloudcomputing@cloudshell:~ (assignment2-438508)$ ping www.google.com
PING www.google.com (108.177.125.147) 56(84) bytes of data.
64 bytes from tp-in-f147.1e100.net (108.177.125.147): icmp_seq=1 ttl=114 time=2.51 ms
64 bytes from tp-in-f147.1e100.net (108.177.125.147): icmp_seq=2 ttl=114 time=0.388 ms
64 bytes from tp-in-f147.1e100.net (108.177.125.147): icmp_seq=3 ttl=114 time=0.419 ms
64 bytes from tp-in-f147.1e100.net (108.177.125.147): icmp_seq=4 ttl=114 time=0.396 ms
```

Image 18: Pinging api

Networking is a critical component of cloud infrastructure because it enables communication between cloud services, applications, and users. A well-designed cloud network ensures secure, efficient, and reliable data transmission, supporting scalability, load balancing, and global access while minimizing latency and downtime. Without robust networking, cloud environments would struggle to deliver the performance and flexibility that businesses rely on for modern, distributed applications.

## Conclusion

This assignment provided hands-on experience with key components of Google Cloud, including virtual machines, storage solutions, and networking. I successfully created a VM, installed Apache2, and hosted a simple "Hello World" webpage, demonstrating the ease of deploying applications on the Google Cloud platform. For the storage solutions, I created a bucket, experimented with access controls, uploaded files, and configured lifecycle rules for automatic deletion, giving me a better understanding of Google Cloud Storage's flexibility and management features. The most challenging part was working with networking, particularly when setting up a Virtual Private Cloud (VPC) with subnets. Despite following instructions, I encountered difficulties when attempting to connect an existing VM to the new network, although I was still able to create and configure the VPC and subnets.

## References

- [Create VMs with multiple network interfaces | VPC | Google Cloud](#)
- [Create buckets | Cloud Storage | Google Cloud](#)
- [Upload objects from a file system | Cloud Storage | Google Cloud](#)
- [Object Lifecycle Management | Cloud Storage | Google Cloud](#)
- [Object Lifecycle Management | Cloud Storage | Google Cloud](#)
- [Identity and Access Management | Cloud Storage | Google Cloud](#)