

Assignment 2, Cloud Computing

Exploring Google Cloud Services

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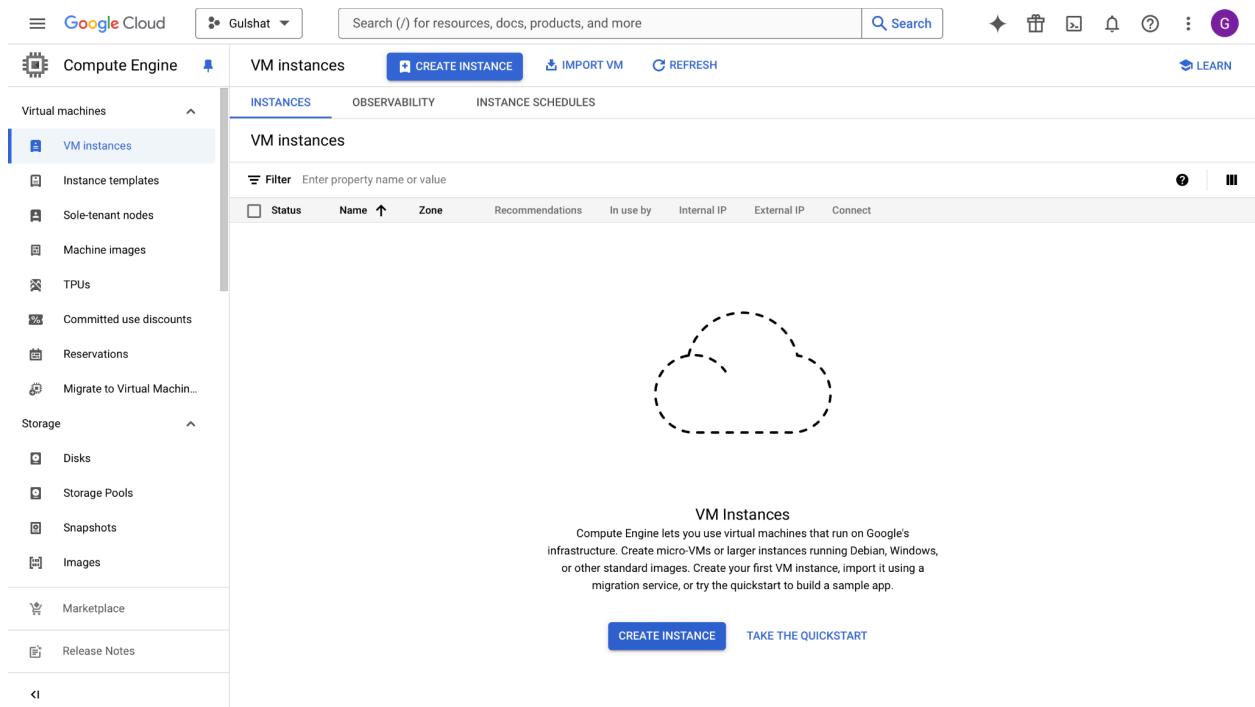
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Virtual Machines in Google Cloud

Create a Virtual Machine (VM) Instance

1. Clicked “Create instance”.



2. Created instance named “instance-gulshat” with region “asia-east1”

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

Create an instance CREATE VM FROM... EQUIVALENT CODE

- VM basics
instance-gulshat, asia-east1
- Machine configuration
e2-medium
- OS and storage
Debian GNU/Linux 12 (bookworm)
- Networking
1 network interface
- Observability
- Security
- Advanced

Identify your VM

Name *
instance-gulshat

Region *
asia-east1 (Taiwan)
Region is permanent

Zone *
Any
Google will choose a zone on your behalf, maximizing VM obtainability. Zone is permanent.

MANAGE TAGS AND LABELS

Availability policies

VM provisioning model
Standard
Choose "Spot" to get a discounted, preemptible VM. Otherwise, stick to "Standard". [Learn more](#)

VM PROVISIONING MODEL ADVANCED SETTINGS

CREATE CANCEL EQUIVALENT CODE

3. Chose e2-medium as a machine type, because it is good for development, testing, and small apps.

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Create an instance CREATE VM FROM... EQUIVALENT CODE

- VM basics
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Machine type

Choose a machine type with preset amounts of vCPUs and memory that suit most workloads. Or, you can create a custom machine for your workload's particular needs. [Learn more](#)

PRESET CUSTOM

e2-medium (2 vCPU, 1 core, 4 GB memory)

	vCPU	Memory
	1-2 vCPU (1 shared core)	4 GB

CPU platform
Automatic

vCPUs to core ratio

Visible core count

☐ Limit the VM's frequency to all-core turbo (3.1 GHz)
More consistent performance

ADVANCED CONFIGURATIONS

Display device

Enable to use screen capturing and recording tools.

☐ Enable display device

CREATE CANCEL EQUIVALENT CODE

4. Chose Debian OS, because macOS is not available as an OS for GC, then created my instance.

Google Cloud

Gulshat

Search

Create an instance

CREATE VM FROM...

- VM basics
- Machine configuration
- OS and storage
- Networking
- Observability
- Security
- Advanced

Operating system

Name

Type

Size

Snapshot schedule

License type

Image

CHANGE

Additional storage

+ ADD NEW DISK

Backup plan

PREVIEW

Secure your backups against disaster recovery. Managed by Backup and DR Service. Learn more

Backup plan

Container

Deploy a container image to this instance.

DEPLOY CONTAINER

CREATE

CANCEL

Boot disk

Select an image or snapshot to create a boot disk, or attach an existing disk. Can't find what you're looking for? Explore hundreds of VM solutions in Marketplace

PUBLIC IMAGES

CUSTOM IMAGES

SNAPSHOTS

ARCHIVE SNAPSHOTS

EXISTING DISKS

Operating system

Debian

Version

Debian GNU/Linux 12 (bookworm)

Architecture

x86_64, amd64 built on 20241009

Boot disk type

Balanced persistent disk

COMPARE DISK TYPES

Size (GB)

10

Provision between 10 and 65536 GB

SHOW ADVANCED CONFIGURATION

SELECT

CANCEL

Connect to the VM

- Clicked SSH in column Connect to open a SSH terminal.

Google Cloud

Gulshat

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

Search

Compute Engine

VM instances

CREATE INSTANCE

IMPORT VM

REFRESH

LEARN

Virtual machines

VM instances

Instance templates

Sole-tenant nodes

Machine images

TPUs

Committed use discounts

Reservations

Migrate to Virtual Machin...

Storage

Disks

Storage Pools

Snapshots

Images

Marketplace

Release Notes

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-gulshat	asia-east1-a			10.140.0.3 (nic0)	35.201.153.28 (nic0)	SSH

Related actions

Explore Backup and DR

View billing report

Monitor VMs

Explore VM logs

Set up firewall rules

Patch management

Load balance between VMs

- Run this code to install Apache.

```

gulshtat_1 kh.03@instance-gulshat:~$ sudo apt install apache2 -y
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.
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]
Get:8 https://deb.debian.org/debian bookworm/main amd64 liblua5.3-0 amd64 5.3.6-2 [123 kB]
Get:9 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2-bin amd64 2.4.62-1-deb12u2 [1386 kB]
Get:10 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2-data all 2.4.62-1-deb12u2 [160 kB]
Get:11 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2-utils amd64 2.4.62-1-deb12u2 [210 kB]
Get:12 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2 amd64 2.4.62-1-deb12u2 [223 kB]
Get:13 https://deb.debian.org/debian bookworm/main amd64 ssl-cert all 1.1.2 [21.1 kB]
Fetched 2379 KB in 1s (3572 KB/s)
Preconfiguring packages ...
Selecting previously unselected package libapr1:amd64.
(Reading database ... 70354 files and directories currently installed.)
Preparing to unpack .../00-libapr1_1.7.2-3_amd64.deb ...
Unpacking libapr1:amd64 (1.7.2-3) ...
Selecting previously unselected package libaprutil1:amd64.
Preparing to unpack .../01-libaprutil1_1.6.3-1_amd64.deb ...
Unpacking libaprutil1:amd64 (1.6.3-1) ...
Selecting previously unselected package libaprutil1-dbd-sqlite3:amd64.
Preparing to unpack .../02-libaprutil1-dbd-sqlite3_1.6.3-1_amd64.deb ...
Unpacking libaprutil1-dbd-sqlite3:amd64 (1.6.3-1) ...
Selecting previously unselected package libaprutil1-ldap:amd64.
Preparing to unpack .../03-libaprutil1-ldap_1.6.3-1_amd64.deb ...
Unpacking libaprutil1-ldap:amd64 (1.6.3-1) ...
Selecting previously unselected package libjansson4:amd64.
Preparing to unpack .../04-libjansson4_2.14-2_amd64.deb ...
Unpacking libjansson4:amd64 (2.14-2) ...
Selecting previously unselected package liblua5.3-0:amd64.
Preparing to unpack .../05-liblua5.3-0_5.3.6-2_amd64.deb ...
Unpacking liblua5.3-0:amd64 (5.3.6-2) ...
Selecting previously unselected package apache2-bin.
Preparing to unpack .../06-apache2-bin_2.4.62-1-deb12u2_amd64.deb ...
Unpacking apache2-bin (2.4.62-1-deb12u2) ...
Selecting previously unselected package apache2-data.
Preparing to unpack .../07-apache2-data_2.4.62-1-deb12u2_all.deb ...
Unpacking apache2-data (2.4.62-1-deb12u2) ...
Selecting previously unselected package apache2-utils.
Preparing to unpack .../08-apache2-utils_2.4.62-1-deb12u2_amd64.deb ...
Unpacking apache2-utils (2.4.62-1-deb12u2) ...

```


3. Run to start and enable Apache.

```

gulshtat_1 kh.03@instance-gulshat:~$ sudo systemctl start apache2
sudo systemctl enable apache2
Synchronizing state of apache2.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable apache2

```

4. Went to my instance's External IP in web browser to check if Apache is running.



Apache2 Debian Default Page

It works!

This is the default welcome page used to test the correct operation of the Apache2 server after installation on Debian systems. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should **replace this file** (located at `/var/www/html/index.html`) before continuing to operate your HTTP server.

If you are a normal user of this web site and don't know what this page is about, this probably means that the site is currently unavailable due to maintenance. If the problem persists, please contact the site's administrator.

Configuration Overview

Debian's Apache2 default configuration is different from the upstream default configuration, and split into several files optimized for interaction with Debian tools. The configuration system is **fully documented in `/usr/share/doc/apache2/README.Debian.gz`**. Refer to this for the full documentation. Documentation for the web server itself can be found by accessing the **manual** if the `apache2-doc` package was installed on this server.

The configuration layout for an Apache2 web server installation on Debian systems is as follows:

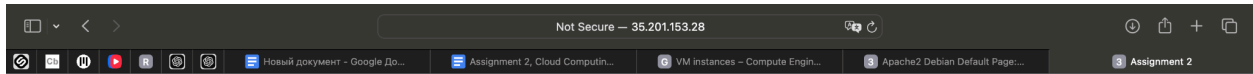
```

/etc/apache2/
|-- apache2.conf
|   |-- ports.conf
|-- mods-enabled
|   |-- *.load
|   |-- *.conf
|-- conf-enabled
|   |-- *.conf
|-- sites-enabled
|   |-- *.conf

```

- `apache2.conf` is the main configuration file. It puts the pieces together by including all remaining configuration files when starting up the web server.
- `ports.conf` is always included from the main configuration file. It is used to determine the listening ports for incoming connections, and this file can be customized anytime.
- Configuration files in the `mods-enabled/`, `conf-enabled/` and `sites-enabled/` directories contain particular configuration snippets that manage modules, global configuration fragments, or virtual host configurations, respectively.
- They are adjusted by symbolic links available configuration files from their respective `*.available/`

5. Created a simple HTML page with title “Assignment 2” (unfortunately forgot to take a screenshot of this process).



Gulshat Khamidulla

This is a simple page to test VM

Storage Solutions in Google Cloud

Create a Cloud Storage Bucket

1. Clicked “Create bucket”.

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

Cloud Storage Buckets CREATE REFRESH GO TO PATH LEARN

Overview **PREVIEW** Buckets Monitoring Settings

1 Review the soft delete settings on your buckets. Billing for soft deleted objects will begin on September 1st. LEARN MORE MANAGE SOFT DELETE POLICIES

2 A new Cloud Storage overview page has been released. It will become the Cloud Storage landing page in October 2024. TAKE A LOOK

Filter Filter buckets

Name	Created	Location type	Location	Default storage class	Last modified	Public access	Access control
No rows to display							

Store and retrieve your data
Get started by creating a bucket – a container where you can organize and control access to your data and files in Cloud Storage.

Instance deleted X CLICKSTART

2. Created an instance named “bucket-gulshat” with the region “asia”.

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

Cloud Storage Create a bucket

Overview **PREVIEW** Buckets Monitoring Settings

Get Started
Pick a globally unique, permanent name. [Naming guidelines](#)

gulshat-bucket
Tip: Don't include any sensitive information

Optimize storage for data-intensive workloads

Labels (optional)

CONTINUE

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: Multi-region / Standard

Item	Cost
asia (multiple regions in Asia)	\$0.026 per GB-month
With default replication	\$0.080 per GB written

ESTIMATE YOUR MONTHLY COST

Choose where to store your data
This choice defines the geographic placement of your data and affects cost, performance, and availability. Cannot be changed later. [Learn more](#)

Location type

☒ Multi-region
Highest availability across largest area

asia (multiple regions in Asia)

☐ Add cross-bucket replication via Storage Transfer Service
As data is added or changed, replicate it to another bucket, enabling you to store a copy that follows different bucket settings - e.g., region, storage class, etc. [Learn more](#)

☐ Dual-region
High availability and low latency across 2 regions

☐ Region

3. Set the private access.

Create a bucket

Default storage class: Standard

Choose how to control access to objects

Prevent public access
Restrict data from being publicly accessible via the internet. Will prevent this bucket from being used for web hosting. [Learn more](#)

☒ Enforce public access prevention on this bucket

Access control

☒ **Uniform**
Ensure uniform access to all objects in the bucket by using only bucket-level permissions (IAM). This option becomes permanent after 90 days. [Learn more](#)

☐ **Fine-grained**
Specify access to individual objects by using object-level permissions (ACLs) in addition to your bucket-level permissions (IAM). [Learn more](#)

CONTINUE

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](#)

☒ **Use default retention duration**
All buckets have a 7 day soft delete duration by default, unless this default has been customized by your organization administrator.

ESTIMATE YOUR MONTHLY COST

asia (multiple regions in Asia)	\$0.026 per GB-month
With default replication	\$0.080 per GB written

4. After creation a bucket uploaded an image file.

Bucket details

bucket-gulshat

Location: asia (multiple regions in Asia) | Storage class: Standard | Public access: Not public | Protection: Soft Delete

OBJECTS | CONFIGURATION | PERMISSIONS | PROTECTION | LIFECYCLE | OBSERVABILITY | INVENTORY REPORTS | OPERATIONS

Folder browser: bucket-gulshat

Objects:

Name	Size	Type	Created	Storage class
image_2024-04-24_23-39-57.png	16.6 KB	image/png	Oct 13, 2024, 5:05:18 PM	Standard

1 file successfully uploaded

Uploads and Gulshat operations

image_2024-04-24_23-39-57.png Complete

Implement Object Lifecycle Management

1. Clicked “Add a rule” and it opened a section where I found “Delete object”, then set the “Age” for 30 days.

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

Cloud Storage Add object lifecycle rule

Overview **PREVIEW** Buckets Monitoring Settings

Delete object

Objects cannot be restored after deletion, unless you have object versioning enabled. (With versioning enabled, live objects will be made noncurrent, and noncurrent versions will be permanently deleted.) You could also incur early deletion charges for objects set to Nearline, Coldline, or Archive storage classes.

☐ Delete multi-part upload
Sets a time limit and removes unfinished or idle multi-part uploads

[CONTINUE](#)

Select object conditions

This rule will apply the action to current and future objects or multi-part uploads that meet all the selected conditions below. [Learn more](#)

Set Rule Scopes

Use prefix and suffix rule scopes to filter objects by their paths. You can specify up to 50 prefix and 50 suffix matches per bucket, across all rules.

☐ Object name matches prefix
☐ Object name matches suffix

Set Conditions

☒ Age [?](#)

30 days

Age is counted from when an object was uploaded to the current bucket, even if it moved from another

2. The last step was “Create” and there is a final rule:

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

Cloud Storage Bucket details [GO TO PATH](#) [REFRESH](#) [LEARN](#)

bucket-gulshat

Location: asia (multiple regions in Asia) Storage class: Standard Public access: Not public Protection: Soft Delete

OBJECTS CONFIGURATION PERMISSIONS PROTECTION **LIFECYCLE** OBSERVABILITY INVENTORY REPORTS OPERATIONS

After you add or edit a rule, it may take up to 24 hours to take effect.

Lifecycle rules let you apply actions to a bucket's objects when certain conditions are met – for example, switching objects to colder storage classes when they reach or pass a certain age. [Learn more](#)

If an object meets the conditions for multiple rules:

- Deletion takes precedence over a change in storage class.
- Changing objects to colder storage classes takes precedence over changing to warmer ones (ex. objects will switch to the Archive storage class instead of Coldline if there are rules for both).

Rules [ADD A RULE](#) [DELETE ALL](#)

Action	Object condition	Works with
Delete object	30+ days since object was created	

3. Cloud Storage provides a virtual drive where users can keep files like documents, photos, videos, and music and can help to backup them. For projects that involve big amounts of data, CS provides the necessary space without the hardware limitations of a personal computer. Also we can use it to host simple websites or applications. If we will talk about Lifecycle management, then it helps automate the organization and deletion of files based on added rules. For example, if someone forgets to delete a file by time, he/she doesn't need to worry about it if he/she sets a rule.

By automating the management of files, users can reduce the time spent manually sorting, deleting, or moving files.

Networking in Google Cloud

Set Up a Virtual Private Cloud (VPC)

1. Created a VPC network named “instance-gulshat”.

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

VPC Network Create a VPC network

VPC networks

- IP addresses
- Internal ranges
- Bring your own IP
- Firewall
- Routes
- VPC network peering
- Shared VPC
- Serverless VPC access
- Packet mirroring
- VPC Flow Logs

Name *
network-gulshat
Lowercase letters, numbers, hyphens allowed

Description

Maximum transmission unit (MTU)
1460

Subnet creation mode
☒ Custom
☐ Automatic

Private IPv6 address settings
☐ Configure a ULA internal IPv6 range for this VPC Network
The ULA range is a /48 CIDR from which all private IPv6 subnet ranges will be taken. Google Cloud can allocate one automatically or you can allocate one manually. Allocation is permanent. You cannot deallocate or change the ULA range.

Subnets
Subnets let you create your own private cloud topology within Google Cloud. Click Automatic to create a subnet in each region, or click Custom to manually define the subnets. [Learn more](#)

New subnet

Name *
subnet-gulshat
Lowercase letters, numbers, hyphens allowed

Description

2. Created a subnet named “subnet-gulshatt”.

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

Create a VPC network

Edit subnet

Name *
subnet-gulshatt
Lowercase letters, numbers, hyphens allowed

Description

Region *
asia-east1

IP stack type
☒ IPv4 (single-stack)
☐ IPv4 and IPv6 (dual-stack)

IPv4 range *
10.0.0.0/24
E.g. 10.0.0.0/24

[CREATE SECONDARY IPV4 RANGE](#)

Private Google Access
☐ On
☒ Off

Flow logs
☐ On
☒ Off

Hybrid Subnets
☐ On
☒ Off

3. In the VPC network section, went to Firewall rules and clicked on "Add firewall rule".

ADD FIREWALL RULE

4. Created a firewall rule "allow-traffic".

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

Create a firewall rule

Firewall rules control incoming or outgoing traffic to an instance. By default, incoming traffic from outside your network is blocked. [Learn more](#)

Name *
allow-traffic
Lowercase letters, numbers, hyphens allowed

Description

Logs
Turning on firewall logs can generate a large number of logs which can increase costs in Logging [Learn more](#)
☐ On
☒ Off

Network *
network-gulshat

Priority *
1000
Priority can be 0 - 65535 [COMPARE](#)

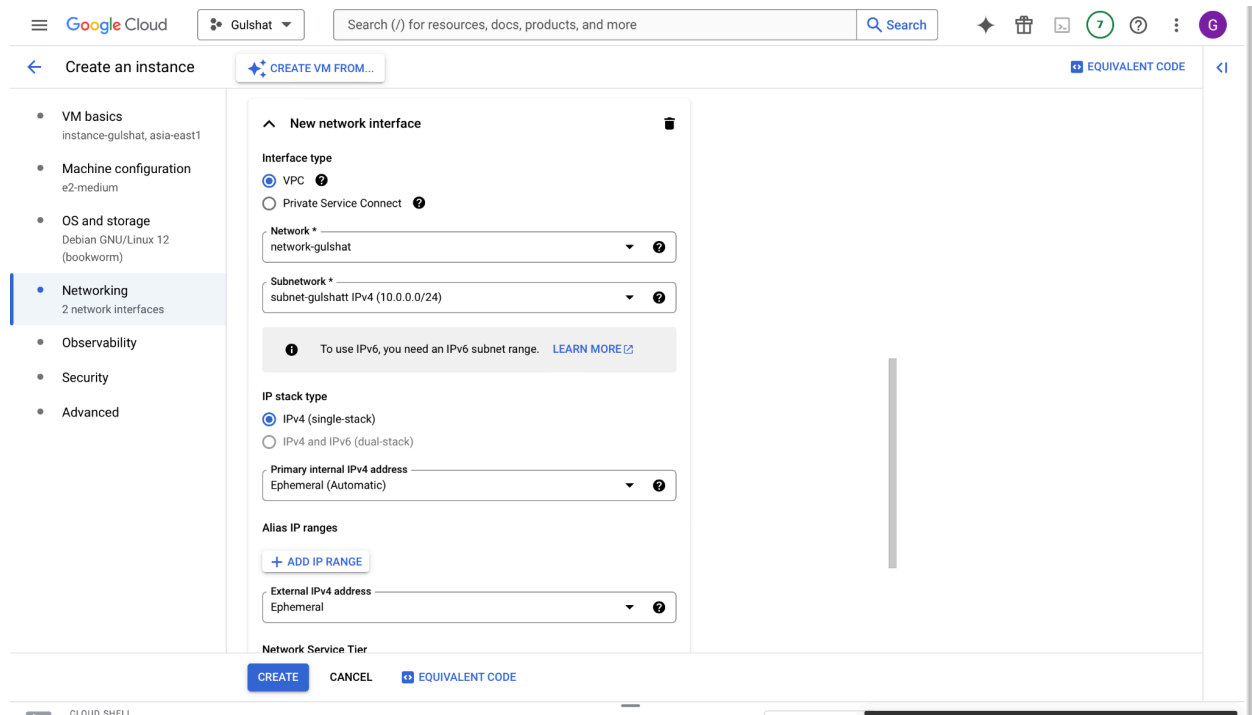
Direction of traffic
☒ Ingress
☐ Egress

Action on match
☒ Allow
☐ Deny

Targets
All instances in the network

Connect VM to VPC

1. Went to the VM instance and connected the new VM to network-gulshat while creating an instance.



2. Used the VM SSH to ping an external server to verify connectivity.

```
gulshat_j kh_03@instance-gulshat:~$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data:
```

3. In VPC we can deploy our resources. It provides complete control over the networking environment, including IP address ranges, subnets, routing, and gateways. Firewall rules in Google Cloud VPCs can help to defend, controlling the traffic allowed in and out of the network.

Conclusion

In this assignment I worked with the basics of operating virtual machines, using storage and networking features of Google Cloud products. I created a VM and configured a web server while we examined the firewall settings. Learned about Cloud Storage bucket more deeply like how to add files and perform cooldowns on files. Then, I created a VPC, added a VM into it and configured the firewall properly in order to have security policies for the network.

After these exercises, I got deep skills by using Google Cloud instruments.

References

<https://cloud.google.com/compute/docs/access/create-enable-service-accounts-for-instances#changeserviceaccountandscopes>

<https://cloud.google.com/compute/docs/tutorials/basic-webserver-apache#:~:text=This%20tutorial%20shows%20you%20how%20to>

<https://cloud.google.com/vpc/docs/create-modify-vpc-networks#gcloud>