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Azure and GCP Essentials Assignment 1

Aim: Cloud Infrastructure Setup and Access Control on GCP

Scenario: Imagine you have recently joined a startup that is working on developing an e-learning portal. Your first assignment is to set up a basic cloud infrastructure using Google Cloud Platform (GCP). You are also required to configure secure access to this infrastructure so that different team members have the appropriate level of control.

Tasks to Perform:

1. Create a new GCP project using the free tier (no actual payments should be made).
2. Setup a virtual machine(VM) using Compute Engine and run a basic web server (eg: with Python's http. Server module).
3. Set up two roles using IAM (Identity and Access Management):
 - One user with “Developer” rights (can modify and deploy)
 - Another with “Viewer” access (can only see resources)
4. Test the roles and capture screenshots showing the access permissions for each user.
5. Briefly explain how billing and resource hierarchy are handled within your project.

STEP 1: Create a New GCP Project (Free Tier)

1. Go to Google Cloud Console
2. Sign in with your Google account.
3. In the top navigation bar → Click the project dropdown → New Project.
 - Name: elearning-portal-project
 - Billing: Attach your Free Tier billing account (no payment, \$300 credit available for 90 days).
4. Click Create.

The screenshot shows the Google Cloud Dashboard for a project named "E-Learning Portal Setup". The dashboard includes sections for Project info, APIs, Resources, and a timeline chart. The sidebar on the left lists various Google Cloud products like Cloud Hub, Cloud overview, Solutions, and recently visited items.

Project info:

- Project name: E-Learning Portal Setup
- Project number: 218761856167
- Project ID: e-learning-portal-setup

API APIs

Requests (requests/sec) timeline chart (No data available for the selected time frame):

Time	Requests (requests/sec)
13:45	1.0
14:00	0.8
14:15	0.6
14:30	0.4
14:45	0.2
15:00	0

Resources:

- BigQuery: Data warehouse/analytics
- SQL: Managed MySQL, PostgreSQL, SQL Server
- Compute Engine: VMs, GPUs, TPUs, disks
- Storage: Multi-class multi-region object storage
- Cloud Run functions: Event-driven serverless functions

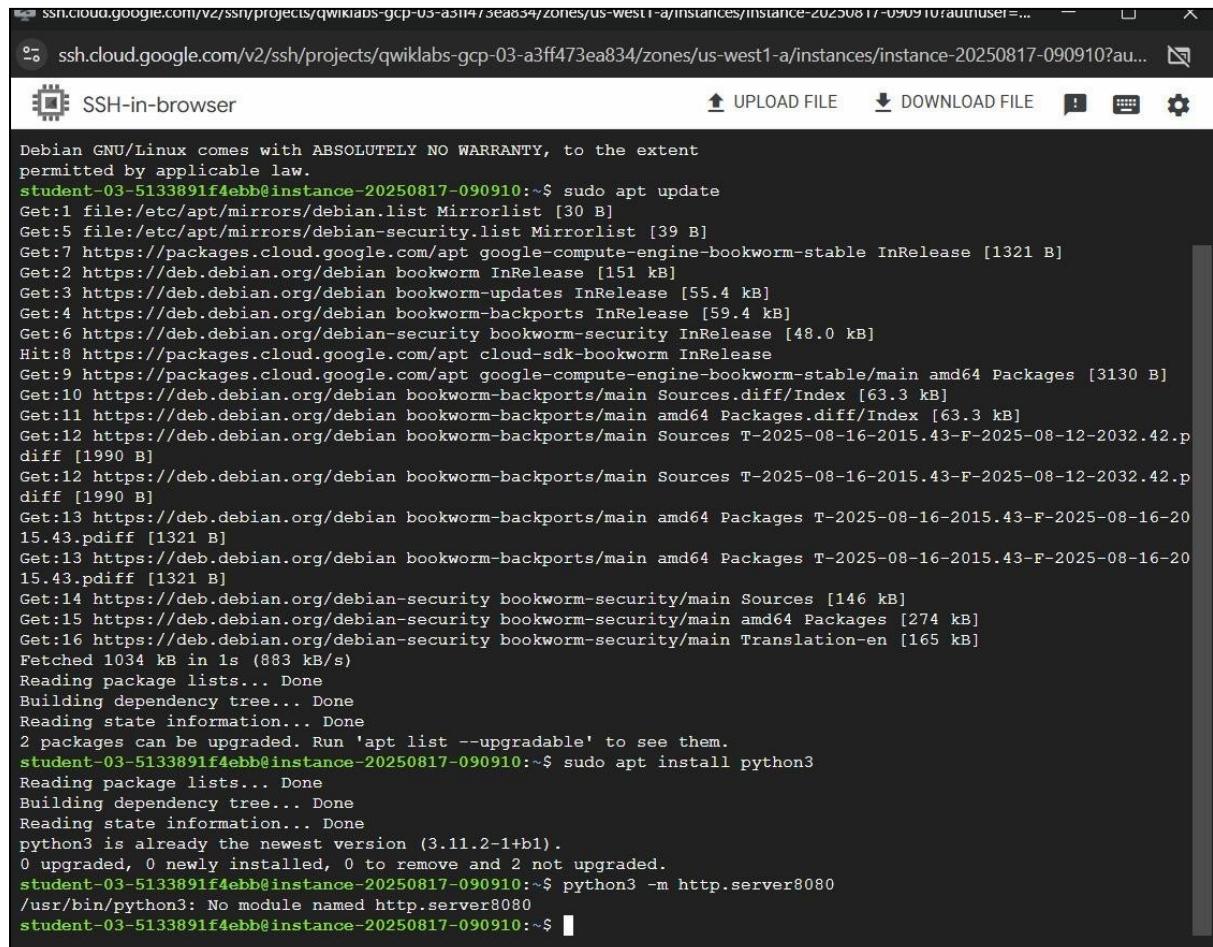
Step 2: Set up a Virtual Machine (VM) with Compute Engine

1. Navigate to Compute Engine → VM Instances → Create Instance.
2. Configure the VM:
 - Name: elearning-vm
 - Region: us-central1 (Free tier eligible)
 - Machine type: e2-micro (Free tier eligible)
 - Boot disk: Debian/Ubuntu Linux
 - Firewall: Allow HTTP traffic
3. Click Create.
4. SSH into the VM from the console.
5. Run commands to install a simple web server:

1. sudo apt update

```
sudo apt install -y python3
```

```
python3 -m http.server 8080
```



The screenshot shows an SSH session in a browser window titled "SSH-in-browser". The terminal output is as follows:

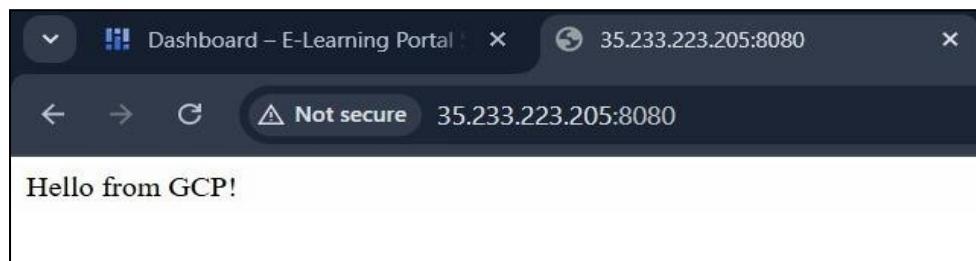
```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
student-03-5133891f4ebb@instance-20250817-090910:~$ sudo apt update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:5 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
Get:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease [1321 B]
Get:2 https://deb.debian.org/debian bookworm InRelease [151 kB]
Get:3 https://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]
Get:4 https://deb.debian.org/debian bookworm-backports InRelease [59.4 kB]
Get:6 https://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
Hit:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease
Get:9 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable/main amd64 Packages [3130 B]
Get:10 https://deb.debian.org/debian bookworm-backports/main Sources.diff/Index [63.3 kB]
Get:11 https://deb.debian.org/debian bookworm-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:12 https://deb.debian.org/debian bookworm-backports/main Sources T-2025-08-16-2015.43-F-2025-08-12-2032.42.p
diff [1990 B]
Get:12 https://deb.debian.org/debian bookworm-backports/main Sources T-2025-08-16-2015.43-F-2025-08-12-2032.42.p
diff [1990 B]
Get:13 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2025-08-16-2015.43-F-2025-08-16-20
15.43.pdiff [1321 B]
Get:13 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2025-08-16-2015.43-F-2025-08-16-20
15.43.pdiff [1321 B]
Get:14 https://deb.debian.org/debian-security bookworm-security/main Sources [146 kB]
Get:15 https://deb.debian.org/debian-security bookworm-security/main amd64 Packages [274 kB]
Get:16 https://deb.debian.org/debian-security bookworm-security/main Translation-en [165 kB]
Fetched 1034 kB in 1s (883 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
student-03-5133891f4ebb@instance-20250817-090910:~$ sudo apt install python3
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3 is already the newest version (3.11.2-1+b1).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
student-03-5133891f4ebb@instance-20250817-090910:~$ python3 -m http.server8080
/usr/bin/python3: No module named http.server8080
student-03-5133891f4ebb@instance-20250817-090910:~$
```

2. Note the **External IP** of your VM from the instance details.

3. Open a browser and visit:

http://<EXTERNAL_IP>:8080

<http://35.233.223.205:8080> (My url)



Step 3: Create IAM Roles and Add Users

1. In the Google Cloud Console, navigate to **IAM & Admin → IAM**.
2. Click **+ Grant Access** to add a new user.
3. For User 1:
 - Enter their **Gmail address**.
 - Assign **Role: Basic → Editor** (or choose “Developer” if available in custom roles).
4. For User 2 :
 - Enter their **Gmail address**.
 - Assign **Role: Basic → Viewer**.
5. Click **Save**

Output:

Creating Viewer:

The screenshot shows the 'Grant access to "qwiklabs-gcp-01-495bd322a3a7"' dialog. In the 'Resource' section, the resource ID 'qwiklabs-gcp-01-495bd322a3a7' is listed. Under 'Add principals', a principal 'student-03-75a5003696e7@qwiklabs.net' is added. In the 'Assign roles' section, a 'Role' dropdown is set to 'Viewer'. Below it, a note says 'View most Google Cloud resources.' and 'See the list of included permissions.' A 'Help me choose roles' button is also present. At the bottom, there are 'Save' and 'Cancel' buttons. To the right of the dialog, a sidebar titled 'Recommended for you' lists several links related to IAM, such as 'IAM overview', 'Grant an IAM role using the Google Cloud console', 'Choose predefined roles', 'Basic and predefined roles reference', and 'Manage access to projects, folders, and organizations'.

Creating Developer Role:

The screenshot shows the 'Create role' page in the Google Cloud IAM & Admin interface. The left sidebar lists various IAM components, and the 'Roles' section is selected. The main form is titled 'Create role' and contains fields for 'Title' (Developer role), 'Description' (Start and Stop VM), 'ID' (CustomRole), and 'Role launch stage' (Alpha). A button '+ Add permissions' is present. Below the form, a section titled '3 assigned permissions' lists four Compute Engine permissions: compute.instances.list, compute.instances.start, and compute.instances.stop, all marked as 'Supported'. A note at the bottom states 'Some permissions might be associated with and checked by third parties'.

The screenshot shows the 'instance-20250817-100206' details page in the Google Cloud Compute Engine interface. The left sidebar shows 'Virtual machines' under 'Compute Engine', with 'VM instances' selected. The main page displays basic information for the instance, including its name, ID, type, status (Running), creation time (Aug 17, 2025), location (us-east1-d), boot disk source image (debian-12-bookworm-v20250812), and architecture (X86_64). It also shows that the instance template is None and it is not in use by anyone. A 'Logs' section is visible at the bottom.

After Creating Both:

The screenshot shows the Google Cloud IAM (Identity and Access Management) interface. At the top, there are tabs for 'Allow' (which is selected), 'Deny', and 'Recommendations history'. Below these are buttons for 'Grant access' and 'Remove access', and a 'Filter' input field. A table lists users and their roles:

Type	Principal	Name	Role	Security insights
<input type="checkbox"/>	714578491368-compute@developer.gserviceaccount.com	Compute Engine default service account	Editor	
<input type="checkbox"/>	admiral@qwiklabs-services-prod.iam.gserviceaccount.com		Owner	
<input type="checkbox"/>	qwiklabs-gcp-01-495bd322a3a7@qwiklabs-gcp-01-495bd322a3a7.iam.gserviceaccount.com	Qwiklabs User Service Account	BigQuery Admin Owner Storage Admin	
<input type="checkbox"/>	student-03-75a5003696e7@qwiklabs.net		Viewer	
<input type="checkbox"/>	student-03-94f95bcb2e75@qwiklabs.net	student 34a02af1	App Engine Admin BigQuery Admin Developer role Editor Owner Viewer	

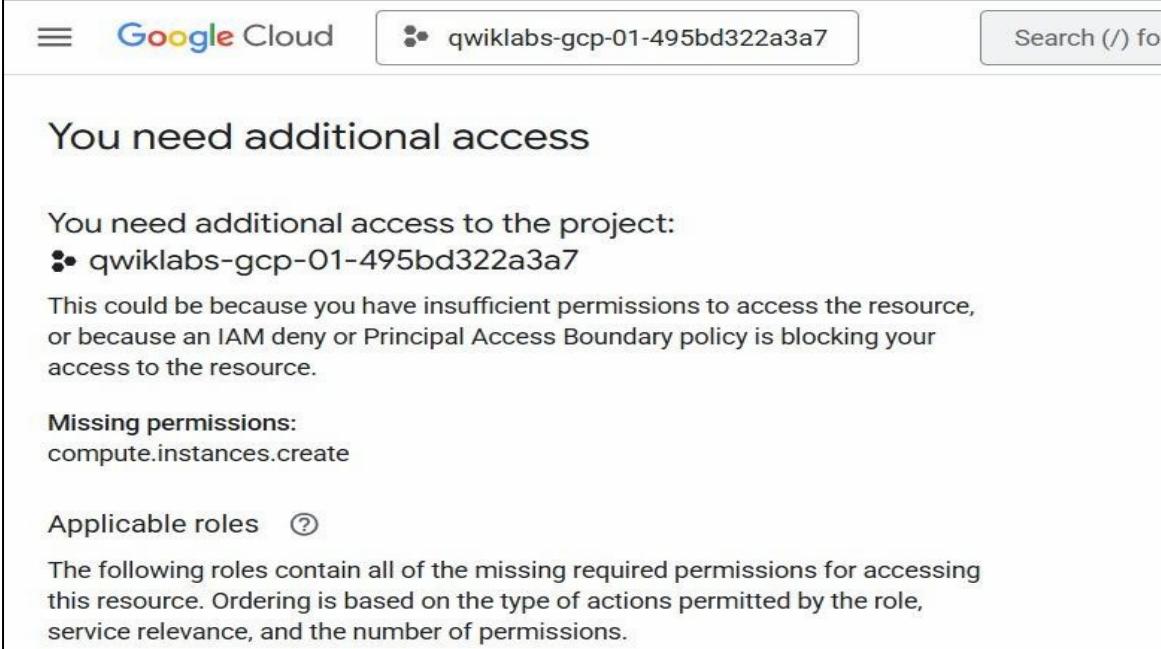
Step 4: Test Roles.

Steps:

1. **Log in as the Developer user** (with *Editor/Developer* role).
 - o Go to **Compute Engine → VM Instances**.
 - o Try creating a new VM → It should work successfully.
2. **Log in as the Viewer user** (with *Viewer* role).
 - o Go to **Compute Engine → VM Instances**.
 - o Try creating a new VM → You should receive a “**Permission Denied**” error.

Viewer:

Viewer can't create an instance.



The screenshot shows a Google Cloud error message. At the top, it says "Google Cloud" and "Search (/) for". Below that, a large heading says "You need additional access". A sub-section titled "You need additional access to the project:" lists "qwiklabs-gcp-01-495bd322a3a7". A note below explains this could be due to insufficient permissions or IAM policies. It also lists a missing permission: "compute.instances.create". A section for "Applicable roles" is shown, along with a note about roles containing required permissions. The entire message is framed by a light gray border.

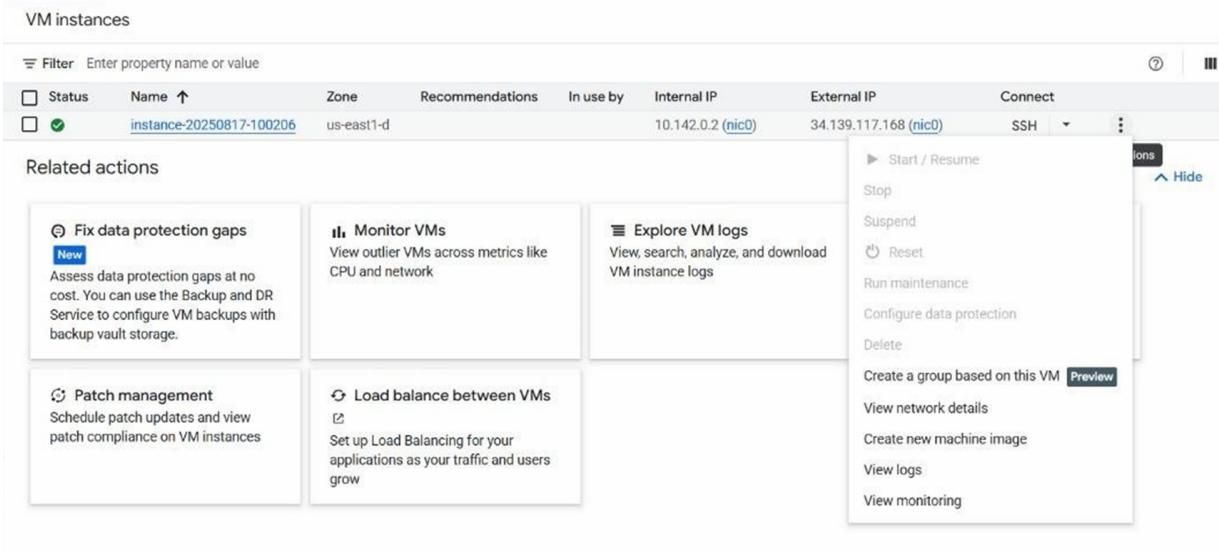
You need additional access to the project:
• [qwiklabs-gcp-01-495bd322a3a7](#)

This could be because you have insufficient permissions to access the resource, or because an IAM deny or Principal Access Boundary policy is blocking your access to the resource.

Missing permissions:
`compute.instances.create`

Applicable roles [?](#)

The following roles contain all of the missing required permissions for accessing this resource. Ordering is based on the type of actions permitted by the role, service relevance, and the number of permissions.



The screenshot shows the Google Cloud VM instances page. It displays a table with one row for an instance named "instance-20250817-100206" in the us-east1-d zone. The table columns include Status, Name, Zone, Recommendations, In use by, Internal IP, External IP, and Connect (SSH). Below the table, there's a "Related actions" section with cards for "Fix data protection gaps", "Monitor VMs", "Explore VM logs", "Patch management", and "Load balance between VMs". On the right, a context menu is open over the instance row, listing actions like Start / Resume, Stop, Suspend, Reset, Run maintenance, Configure data protection, Delete, and more. A preview link for creating a group is also visible in the menu.

Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	<input checked="" type="checkbox"/> instance-20250817-100206	us-east1-d			10.142.0.2 (nic0)	34.139.117.168 (nic0)	SSH

Related actions

- [Fix data protection gaps](#) New
Assess data protection gaps at no cost. You can use the Backup and DR Service to configure VM backups with backup vault storage.
- [Monitor VMs](#)
View outlier VMs across metrics like CPU and network
- [Explore VM logs](#)
View, search, analyze, and download VM instance logs
- [Patch management](#)
Schedule patch updates and view patch compliance on VM instances
- [Load balance between VMs](#)
Set up Load Balancing for your applications as your traffic and users grow

[Start / Resume](#)
[Stop](#)
[Suspend](#)
[Reset](#)
[Run maintenance](#)
[Configure data protection](#)
[Delete](#)
Create a group based on this VM [Preview](#)
[View network details](#)
[Create new machine image](#)
[View logs](#)
[View monitoring](#)

Developer:

VM instances

Filter Enter property name or value

Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	<input checked="" type="checkbox"/> instance-20250817-100206	us-east1-d			10.142.0.2 (nic0)	34.139.117.168 (nic0)	SSH

Related actions

 **Fix data protection gaps**
New
Assess data protection gaps at no cost. You can use the Backup and DR Service to configure VM backups with backup vault storage.

 **Monitor VMs**
View outlier VMs across metrics like CPU and network.

 **Explore VM logs**
View, search, analyze, and download VM instance logs

▶ Start / Resume
Stop
Suspend
 Reset
Run maintenance
Configure data protection
Delete
Create a group based on this VM **Preview**
View network details
Create new machine image
View logs
View monitoring

Developer can create an instance.

VM instances

Filter Enter property name or value

Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	<input checked="" type="checkbox"/> instance-20250817-100206	us-east1-d			10.142.0.2 (nic0)	34.139.117.168 (nic0)	SSH

Related actions

 **Fix data protection gaps**
New
Assess data protection gaps at no cost. You can use the Backup and DR Service to configure VM backups with backup vault storage.

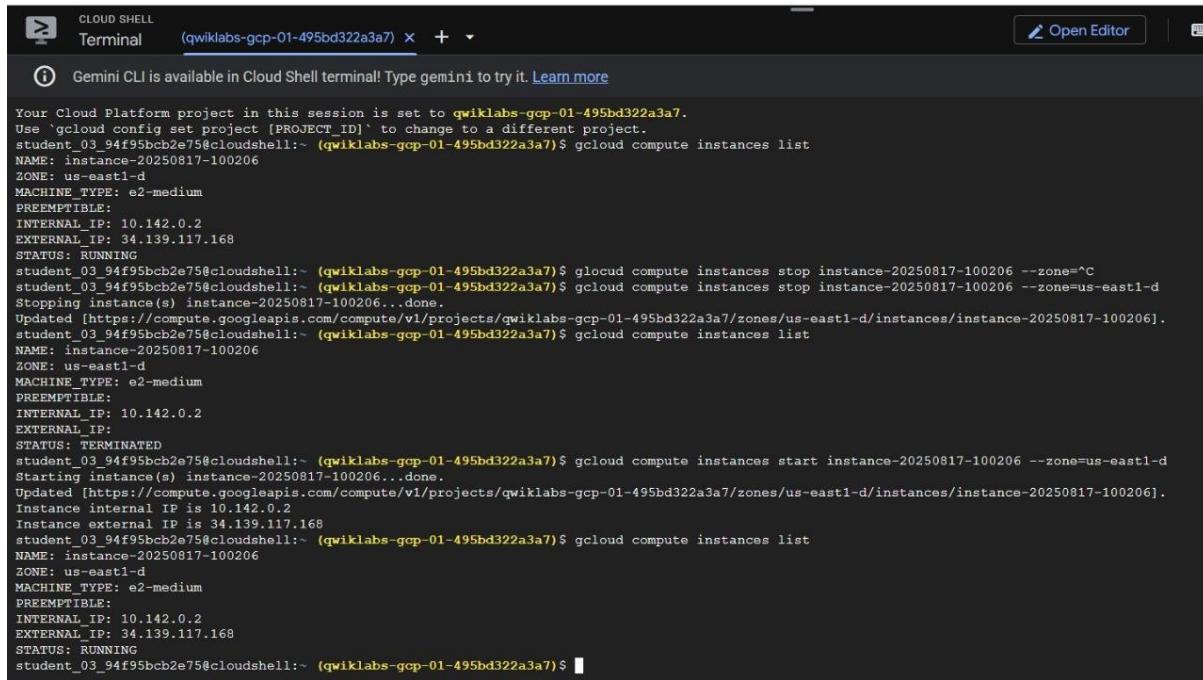
 **Monitor VMs**
View outlier VMs across metrics like CPU and network.

 **Explore VM logs**
View, search, analyze, and download VM instance logs

▶ Start / Resume
Stop
Suspend
 Reset
Run maintenance
Configure data protection
Delete
Create a group based on this VM **Preview**
View network details
Create new machine image
View logs
View monitoring

Step 5: Use of Cloud Shell and gcloud SDK

Listing all VM instances using [“gcloud compute instances list”] command



```
CLOUD SHELL
Terminal (qwiklabs-gcp-01-495bd322a3a7) X + ▾ Open Editor

Gemini CLI is available in Cloud Shell terminal! Type gemini to try it. Learn more

Your Cloud Platform project in this session is set to qwiklabs-gcp-01-495bd322a3a7.
Use `gcloud config set project [PROJECT_ID]` to change to a different project.
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$ gcloud compute instances list
NAME: instance-20250817-100206
ZONE: us-east1-d
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.142.0.2
EXTERNAL_IP: 34.139.117.168
STATUS: RUNNING
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$ gcloud compute instances stop instance-20250817-100206 --zone=^C
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$ gcloud compute instances stop instance-20250817-100206 --zone=us-east1-d
Stopping instance(s) instance-20250817-100206...done.
Updated [https://compute.googleapis.com/compute/v1/projects/qwiklabs-gcp-01-495bd322a3a7/zones/us-east1-d/instances/instance-20250817-100206].
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$ gcloud compute instances list
NAME: instance-20250817-100206
ZONE: us-east1-d
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.142.0.2
EXTERNAL_IP:
STATUS: TERMINATED
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$ gcloud compute instances start instance-20250817-100206 --zone=us-east1-d
Starting instance(s) instance-20250817-100206...done.
Updated [https://compute.googleapis.com/compute/v1/projects/qwiklabs-gcp-01-495bd322a3a7/zones/us-east1-d/instances/instance-20250817-100206].
Instance internal IP is 10.142.0.2
Instance external IP is 34.139.117.168
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$ gcloud compute instances list
NAME: instance-20250817-100206
ZONE: us-east1-d
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.142.0.2
EXTERNAL_IP: 34.139.117.168
STATUS: RUNNING
student_03_94f95bcb2e75@cloudshell:~ (qwiklabs-gcp-01-495bd322a3a7)$
```

Starting and Stopping VM Instance using gcloud commands:

1. Start: [“gcloud compute instances start --zone=”] Ex: gcloud compute instances start instance-20250817-100206 --zone=us-east1-d

2. Stop: [“gcloud compute instances stop --zone=”] Ex: gcloud compute instances stop instance-20250817-100206 --zone=us-east1-d

Step 6: Billing and Resource Hierarchy in GCP

Billing in GCP

- In Google Cloud Platform (GCP), every **project** must be linked to a **billing account**.
- The **billing account** defines how charges are paid (credit card, bank account, or promotional/free credits).
- GCP provides an **Always Free Tier**, which allows limited use of certain resources (e.g., 1 f1-micro or e2-micro VM in specific regions, 5 GB of Cloud Storage, etc.) at no cost.
- Even in the free tier, GCP **tracks usage** through the billing dashboard, so users can monitor consumption.
- If usage exceeds free tier limits, charges are calculated **per project** and billed through the connected billing account.
- In this assignment, we are using the **Free Tier**, which ensures there are no actual costs, while still demonstrating billing integration.

The screenshot shows the Google Cloud Billing Overview page. At the top, it displays "Your total cost (qwiklabs-gcp-01-495bd322a3a7, August 1 – 17, 2025)" followed by a subtraction equation: Cost (\$0.00) minus Savings (\$0.00) equals Total cost (\$0.00). Below this, a note states "Forecasted total cost Available once there is enough usage". To the right, there is a large blue star icon. Further down, a message says "Costs take a few hours to show up, and might take longer than 24 hours." with links to "Learn more" and "get an alert". At the bottom, a link points to "View details on Reports". The footer includes a weather widget (27°C, Mostly cloudy), a quick search bar, and various Google Cloud service icons.

Resource Hierarchy in GCP

Google Cloud uses a structured hierarchy to organize resources and manage permissions:

1. Organization (Top Level)

- Represents a company or institution.
- Manages all folders, projects, and resources under one umbrella.

2. Folders (Optional)

- Used to group projects (e.g., Development, Production, HR, Finance).
- Helpful in large organizations for structuring departments or environments.

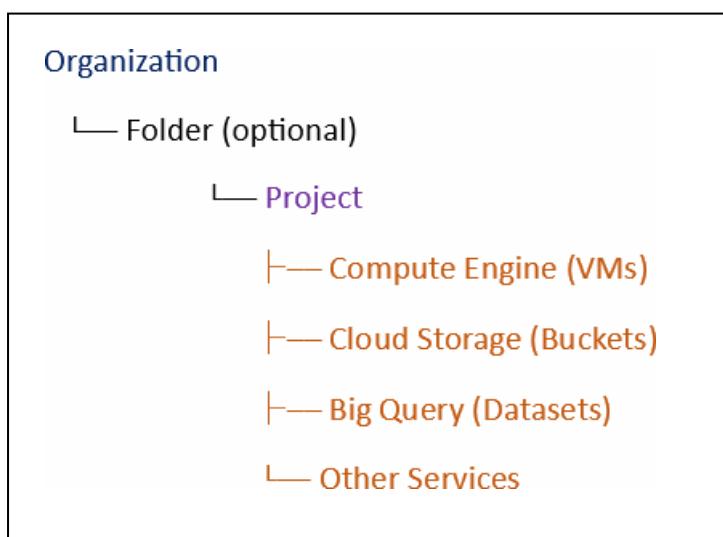
3. Projects

- The **core container** in GCP.
- Each project has its own:
 - Billing settings
 - IAM policies (who can access what)
 - Enabled services/APIs
- All resources (VMs, storage, databases, etc.) are created inside projects.

4. Resources

- The actual compute, storage, and networking services used.
- Examples: Compute Engine VM instances, Cloud Storage buckets, BigQuery datasets, etc.

Hierarchy Diagram:



Conclusion:

This assignment provided practical exposure to deploying cloud infrastructure on **Google Cloud Platform**. I successfully created a new project under the free tier, launched a VM instance, and deployed a simple Python-based web server to demonstrate functionality. By configuring IAM roles and testing access control, I understood the importance of assigning proper permissions for secure operations..