

## Assignment 1, Cloud Computing

Put all deliverables into github repository in your profile. Share link to google form 24 hours before defense. Defend by explaining deliverables and answering questions.

Deliverables: report in pdf

Google form: [https://docs.google.com/forms/d/e/1FAIpQLSe0GyNdOYIvM1tX\\_I\\_CtIPod5jBf-ACLGdHYZq1gVZbUeBzlg/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSe0GyNdOYIvM1tX_I_CtIPod5jBf-ACLGdHYZq1gVZbUeBzlg/viewform?usp=sf_link)

### Exercise 1: Understanding Cloud Computing Models

1. **Objective:** Explore different cloud computing models and understand their key differences.
2. **Steps:**
  - o Research the three primary cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
  - o Create a table comparing these models in terms of control, flexibility, and use cases.

	Control	Flexibility	Use-cases	Examples
IaaS	Need to manage computing resources (CPU, RAM, HDD)	Install different OS, choose how much storage you need and etc.	Run customized OS, hosting virtual machines and etc.	Google Compute Engine
PaaS	Need to control some configurations, but not infrastructure	Focus on building and deploying applications	develop the app using the already made instruments	Firebase, BigQuery
SaaS	No need to control	Functionalities are limited and you can not change it	Communication tools, file storage	Google Workspace

- o Identify examples of services offered by Google Cloud Platform (GCP) under each model.
3. **Questions:**
  - o What are the main differences between IaaS, PaaS, and SaaS?  
**Answer:** IaaS is the rental of computing power to launch its solutions and deploy the company's IT infrastructure. PaaS is the rental of ready-made and customized platforms for specialized tasks. SaaS is the rental of ready-made services for specific functions — sending mail, maintaining a customer base, creating a website.

- Which GCP services fall under each of these models?  
**Answer:** IaaS – Compute Engine, Cloud Storage. PaaS – BigQuery, Cloud Run, Cloud SQL. SaaS – Google Workspace, Dialogflow
- Provide a real-world example where each cloud service model might be the most appropriate choice.  
**Answer:** For IaaS – migrate the full infrastructure to Google Cloud Engine, if company want to improve scalability, reduce costs. For PaaS – create an application quickly with limited resources, for example, using Firebase as authentication service for mobile app. SaaS – use the ready-made software for company like Microsoft Teams for collaborations, Google Drive for saving files and etc.

## **Exercise 2: Exploring Google Cloud Platform's Core Services**

1. **Objective:** Get acquainted with the core services provided by Google Cloud Platform.
2. **Steps:**
  - Access the Google Cloud Console and navigate to the list of GCP services.
  - Explore and describe the purpose of the following core services:
    - Compute Engine - **create and run online VMs**
    - Google Kubernetes Engine (GKE) – **put containers on autopilot and securely run enterprise workloads at scale**
    - App Engine - **build monolithic server-side rendered websites**
    - Cloud Storage - **storing unstructured data, store any amount of data and retrieve it.**
    - BigQuery – **data platform for data analytics**
  - For each service, identify a potential use case in a business scenario.  
**Answer:** Compute Engine – migrate an infrastructure to the cloud, if company need to host the app in specific OS. GKE – company with microservices based app can use GKE for managing these services, making auto scaling for bigger users traffic and deploy new features and updates. App Engine – quickly build a backend for mobile app. It also helps to scale the app for bigger users traffic. Cloud Storage – store necessary files, images, videos, presentations and another content. BigQuery – store necessary data for future data analysis to make better marketing strategies.
3. **Questions:**
  - What is the primary use case of Compute Engine?  
**Answer:** create a virtual machine, migrate and optimize enterprise applications, backup and restore, run container-based apps.
  - How does Google Kubernetes Engine (GKE) simplify the management of containerized applications?  
**Answer:** It uses fleets to simplify management of clusters, infrastructure and workloads. Fleet is logical grouping of Kubernetes clusters and other resources that can be managed together.

- What advantages does Cloud Storage offer for data management?

**Answer:** Cloud Storage helps to develop and deploy data pipelines and storage to analyze large amounts of data. It offers high availability and performance while being strongly consistent, giving confidence and accuracy in analytics workloads.

- Why would a business choose BigQuery for their data analysis needs?

**Answer:** because it can migrate a data warehouse, provides real-time, predictive and marketing analytics by Google AI.

### **Exercise 3: Creating and Managing Virtual Machines with Compute Engine**

1. **Objective:** Learn how to create, manage, and interact with virtual machines (VMs) using Compute Engine.
2. **Steps:**
  - In the Google Cloud Console, navigate to Compute Engine and create a new VM instance.

- Configure the VM with specific parameters, such as the machine type, region, and operating system.

Name \*  ?

**▼ MANAGE TAGS AND LABELS**

Region \*  ?

Region is permanent

Zone \*  ?

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

## Machine configuration

? NEW: Google Axion virtual machines in Preview X

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<input checked="" type="checkbox"/> General purpose	Compute optimized	Memory optimized	Storage optimized	GPUs
Machine types for common workloads, optimized for cost and flexibility				
Series <span>?</span>	Description	vCPUs <span>?</span>	Memory <span>?</span>	Platform
<input type="radio"/> C4	Consistently high performance	2 - 192	4 - 1,488 GB	Intel Emerald Rapids
<input type="radio"/> N4	Flexible & cost-optimized	2 - 80	4 - 640 GB	Intel Emerald Rapids
<input type="radio"/> C3	Consistently high performance	4 - 192	8 - 1,536 GB	Intel Sapphire Rapids
<input type="radio"/> C3D	Consistently high performance	4 - 360	8 - 2,880 GB	AMD Genoa
<input type="radio"/> E2	Low cost, day-to-day computing	0.25 - 32	1 - 128 GB	Based on availability

[CREATE](#) [CANCEL](#) [EQUIVALENT CODE](#)

- Connect to the VM using SSH and install a basic web server (e.g., Apache or Nginx).

```

ssh.cloud.google.com/v2/ssh/projects/lab1-436817/zones/us-central1-c/instances/cloud-computing-lab1?authuser=0&hl=en_US&projectNumber=24049962908&useAdminProxy=True
SSH-in-browser
39 packages can be upgraded. Run 'apt list --upgradable' to see them.
dauletkd01@cloud-computing-lab1:~$ sudo apt install nginx
Reading package lists... Done
Building dependency tree...
Reading state information... Done
The following additional packages will be installed:
  fontconfig-config fonts-dejavu-core libfontconfig1 libgb3 libjpeg0 libjpeg-turbo8 libjpeg8
  libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter libnginx-mod-mail libnginx-mod-stream libtiff5
  libwebp6 libxpm4 nginx nginx-common nginx-core
Suggested packages:
  libgd-tools fcgiwrap nginx-doc ssl-cert
The following NEW packages will be installed:
  fontconfig-config fonts-dejavu-core libfontconfig1 libgb3 libjpeg0 libjpeg-turbo8 libjpeg8
  libnginx-mod-http-image-filter libnginx-mod-http-xslt-filter libnginx-mod-mail libnginx-mod-stream libtiff5
  libwebp6 libxpm4 nginx nginx-common nginx-core
0 upgraded, 17 newly installed, 0 to remove and 39 not upgraded.
Need to get 2437 kB of archives.
After this operation, 9232 kB of additional disk space will be used.
Do you want to continue [Y/n]?
Get:1 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/main amd64 fonts-dejavu-core all 2.37-1 [1041 kB]
Get:2 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/main amd64 fontconfig-config all 2.13.1-2ubuntu3 [28.8 kB]
Get:3 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/main amd64 libfontconfig1 amd64 2.13.1-2ubuntu3 [114 kB]
Get:4 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/main amd64 libgb3 amd64 2.1.3-3ubuntu0.20.04.3 [118 kB]
Get:5 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/main amd64 libjpeg8 amd64 8c2-ubuntul6 [2194 kB]
Get:6 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/main amd64 libjpeg8 amd64 2.1.3-3ubuntu0.20.04.1 [27.3 kB]
Get:7 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libwebp6 amd64 0.6.1-2ubuntu0.20.04.3 [185 kB]
Get:8 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libtiff5 amd64 4.1.0+git1917+2ubuntu0.20.04.2 [34.9 kB]
Get:9 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libxpm4 amd64 2.1.2-1ubuntu0.20.04.2 [12.8 kB]
Get:10 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libgb3 amd64 2.2.5-5ubuntu2.1 [118 kB]
Get:11 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 nginx-common all 1.18.0-0ubuntul6 [37.7 kB]
Get:12 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnginx-mod-http-image-filter amd64 1.18.0-0ubuntul6 [14.8 kB]
Get:13 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnginx-mod-mail amd64 1.18.0-0ubuntul6 [13.0 kB]
Get:14 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnginx-mod-stream amd64 1.18.0-0ubuntul6 [12.8 kB]
Get:15 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 libnginx-mod-stream amd64 1.18.0-0ubuntul6 [67.2 kB]
Get:16 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 nginx-core amd64 1.18.0-0ubuntul6 [425 kB]
Get:17 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 nginx all 1.18.0-0ubuntul6 [3616 B]
Fetched 2437 kB in 4.4 MB/s (42.9 kB/s)
Preconfiguring packages...
Selecting previously unselected package fonts-dejavu-core.
(Reading database ... 62159 files and directories currently installed.)
Preparing to unpack .../00-fonts-dejavu-core_2.37-1_all.deb ...
Unpacking fonts-dejavu-core (2.37-1) ...
Selecting previously unselected package fontconfig-config.
Preparing to unpack .../01-fontconfig-config_2.13.1-2ubuntu3_all.deb ...
Unpacking fontconfig-config (2.13.1-2ubuntu3) ...
Selecting previously unselected package libfontconfig1:amd64.
Preparing to unpack .../02-libfontconfig1_amd64_2.13.1-2ubuntu3_all.deb ...
Unpacking libfontconfig1:amd64 (2.13.1-2ubuntu3) ...
Selecting previously unselected package libjpeg-turbo8:amd64.
Preparing to unpack .../03-libjpeg-turbo8_2.0.3-0ubuntul20.04.3_amd64.deb ...
Unpacking libjpeg-turbo8:amd64 (2.0.3-0ubuntul20.04.3) ...
Selecting previously unselected package libjpeg8:amd64.
Preparing to unpack .../04-libjpeg8_8c2-ubuntul6_amd64.deb ...
Unpacking libjpeg8:amd64 (8c2-ubuntul6) ...
Selecting previously unselected package libbig0:amd64.
Preparing to unpack .../05-libbig0_2.1-3.libbuntu0.20.04.1_amd64.deb ...
Unpacking libbig0:amd64 (2.1-3.libbuntu0.20.04.1) ...

```

- Stop, start, and delete the VM through the console.

start VM - gcloud compute instances start cloud-computing-lab1

```

CLOUD SHELL Terminal (lab1-436817) x + Open Editor
dauletkd01@cloudshell:~ (lab1-436817)$ gcloud compute instances start cloud-computing-lab1
Did you mean zone [asia-east1-a] for instance: [cloud-computing-lab1] (Y/n)? Y

ERROR: (gcloud.compute.instances.start) HTTPError 404: The resource 'projects/lab1-436817/zones/asia-east1-a/instances/cloud-computing-lab1' was not found. This command is authenticated as dauletkd01@gmail.com which is the active account specified by the [core/account] property
dauletkd01@cloudshell:~ (lab1-436817)$ gcloud compute instances start cloud-computing-lab1
Did you mean zone [asia-east1-a] for instance: [cloud-computing-lab1] (Y/n)? n

No zone specified. Using zone [us-central1-c] for instance: [cloud-computing-lab1].
Starting instance(s) cloud-computing-lab1...done.
Updated [https://compute.googleapis.com/compute/v1/projects/lab1-436817/zones/us-central1-c/instances/cloud-computing-lab1].
Instance internal IP is 10.128.0.2
Instance external IP is 34.45.78.41
dauletkd01@cloudshell:~ (lab1-436817)$

```

stop VM - gcloud compute instances stop cloud-computing-lab1

```

CLOUD SHELL Terminal (lab1-436817) x + Open Editor
Did you mean zone [asia-east1-a] for instance: [cloud-computing-lab1] (Y/n)? n

No zone specified. Using zone [us-central1-c] for instance: [cloud-computing-lab1].
Starting instance(s) cloud-computing-lab1...done.
Updated [https://compute.googleapis.com/compute/v1/projects/lab1-436817/zones/us-central1-c/instances/cloud-computing-lab1].
Instance internal IP is 10.128.0.2
Instance external IP is 34.45.78.41
dauletkd01@cloudshell:~ (lab1-436817)$ gcloud compute instances stop cloud-computing-lab1
Did you mean zone [asia-east1-a] for instance: [cloud-computing-lab1] (Y/n)? n

No zone specified. Using zone [us-central1-c] for instance: [cloud-computing-lab1].
Stopping instance(s) cloud-computing-lab1...done.
Updated [https://compute.googleapis.com/compute/v1/projects/lab1-436817/zones/us-central1-c/instances/cloud-computing-lab1].
dauletkd01@cloudshell:~ (lab1-436817)$

```

## delete VM - gcloud compute instances delete cloud-computing-lab1

```
dauletkd01@cloudshell:~ (lab1-436817)$ gcloud compute instances delete cloud-computing-lab1
Did you mean zone [asia-east1-a] for instance: [cloud-computing-lab1] (Y/n)? n

No zone specified. Using zone [us-central1-c] for instance: [cloud-computing-lab1].
The following instances will be deleted. Any attached disks configured to be auto-deleted will be deleted unless they are attached to any other
instances or the `--keep-disks` flag is given and specifies them for keeping. Deleting a disk is irreversible and any data on the disk will be lost.
- [cloud-computing-lab1] in [us-central1-c]

Do you want to continue (Y/n)? Y

Deleted [https://www.googleapis.com/compute/v1/projects/lab1-436817/zones/us-central1-c/instances/cloud-computing-lab1].
dauletkd01@cloudshell:~ (lab1-436817)$
```

### 3. Questions:

- What steps did you follow to create the VM?  
create instance button

VM instances								 CREATE INSTANCE	 IMPORT VM	 REFRESH	 LEARN
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 type="checkbox"/>	 <a href="#">cloud-computing-lab1</a>	us-central1-c			10.128.0.2 (nic0)	<a href="#">34.42.132.72</a> 	 SSH				

fill necessary fields like name, region, zone and etc.

Name \*  ?

#### ▼ MANAGE TAGS AND LABELS

Region \*  ?

Region is permanent

Zone \*  ?

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

## Machine configuration

 NEW: Google Axion virtual machines in Preview X

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General purpose

Compute optimized

Memory optimized

Storage optimized

GPUs

Machine types for common workloads, optimized for cost and flexibility

Series <span>?</span>	Description	vCPUs <span>?</span>	Memory <span>?</span>	Platform
<input type="radio"/> C4	Consistently high performance	2 - 192	4 - 1,488 GB	Intel Emerald Rapids
<input type="radio"/> N4	Flexible & cost-optimized	2 - 80	4 - 640 GB	Intel Emerald Rapids
<input type="radio"/> C3	Consistently high performance	4 - 192	8 - 1,536 GB	Intel Sapphire Rapids
<input type="radio"/> C3D	Consistently high performance	4 - 360	8 - 2,880 GB	AMD Genoa
<input checked="" type="radio"/> E2	Low cost, day-to-day computing	0.25 - 32	1 - 128 GB	Based on availability

[CREATE](#)

[CANCEL](#)

[EQUIVALENT CODE](#)

Here you can change image (I choose Ubuntu)

### Boot disk ?

Name	instance-20240926-181603
Type	New balanced persistent disk
Size	10 GB
Snapshot schedule <span>?</span>	No schedule selected
License type <span>?</span>	Free
Image	 Debian GNU/Linux 12 (bookworm)

[CHANGE](#)

Click create button and get the instance in VM instances page

The screenshot shows the Google Cloud Compute Engine VM Instances page. On the left, there's a sidebar with categories like Virtual machines, Storage, Marketplace, and Release Notes. The main area has tabs for INSTANCES, OBSERVABILITY, and INSTANCE SCHEDULES. Under INSTANCES, there's a table with one row for 'cloud-computing-lab1'. The table columns include Status (green), Name (blue link), Zone (us-central1-c), Recommendations, In use by, Internal IP (10.128.0.2), External IP (34.42.132.7), Connect (SSH), and three more columns. Below the table is 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'.

- How did you connect to the VM, and what commands did you use to install the web server?

1. Generate SSH key in terminal:

```
[dauletkareneyev@MacBook-Pro-Daulet ssh-key % ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/Users/dauletkareneyev/.ssh/id_rsa):
Created directory '/Users/dauletkareneyev/.ssh'.
[Enter passphrase (empty for no passphrase):
[Enter same passphrase again:
Your identification has been saved in /Users/dauletkareneyev/.ssh/id_rsa
Your public key has been saved in /Users/dauletkareneyev/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:aH9B2PXfn9j4KhqHOpqE4EQq8k6q1R74RWYA7Mfx26E dauletkareneyev@MacBook-Pro-D
aulet.local
The key's randomart image is:
+---[RSA 3072]---+
| .. . .
| .. o . .
| o .. . o .
| o . o..... .
| +o . .* S+.. o|
| =..o.= .E o. + o|
| .=o... o... o o.|
| = o.o....o. . .
| + . oo.... .... |
+---[SHA256]---+
```

copy public ssh:

```
[dauletkareneyev@MacBook-Pro-Daulet ssh-key % cat /Users/dauletkareneyev/.ssh/id_]
rsa.pub
ssh-rsa AAAAB3NzaC1yc2EAAAQABAAQgQDEzu0IMt0yNOSIw/A6TktlNJz/gRuySiCx3P0U2n6Z
B+s2t8d1Gj2Xrk/xN4xj6WAt9FKzv/5iiMesnSWsGmgPJg0nU0tPgzo0xaRr0Ep+Nx/WVdpCmIV61SbV
n/75vYTWGZVFLj0H8f+50tbmsMeUGNH0uTLVzjexNnfRzKFPxwRDSANTVIImQXX6I7TEq3FYtM5c9has8
Mnuyg0eButq/wFQ3FelfcorkUWhhri+xzC7TyKG2fbpm1f1do0/w0/gAhIdup5eqs0q9LswWk0j/EC2
gF+sRCPUagLB2ARHxMKrX3pMX1PbY2uIykzU191303wrZf2QZS08MG00LjvV1/1srW4X0IOTId8hEdg+
B6RBdHc8la9cAx2/gcdJ0XI1F26Wz94X2Mu5iKw48QhWwkbBEPA5QzbjmI3EtJpD430luKHes1tvoF+x
rjr8E1VbqccIhK4/4b7izepIISLxVxg4OF0cR2+LghbyzDV7iihGU0vZoo4qf2VPDwqsCs= dauletk
areneyev@MacBook-Pro-Daulet.local
dauletkareneyev@MacBook-Pro-Daulet ssh-key %
```

open Metadata page and paste ssh key in the ssh keys page

The screenshot shows the Google Cloud Compute Engine Metadata page. The left sidebar shows 'Compute Engine' under 'bare Metal Solution' with various options like Servers, Networks, VRFs, and Metadata. The main area is titled 'Metadata' with tabs for 'EDIT' and 'REFRESH'. The 'SSH KEYS' tab is selected, displaying a table with one row:

Username	Key
dauletkareneyev	ssh-rsa...

A tooltip 'Equivalent REST' is visible below the table.

click button SSH

The screenshot shows the Google Cloud VM Instances page. The left sidebar shows 'VM instances' under 'Compute Engine' with various options like Zones, Network endpoint groups, Operations, Settings, Marketplace, and Release Notes. The main area shows a table of VM instances:

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input checked="" type="checkbox"/>	cloud-computing-lab1	us-central1-c			10.128.0.2 (nic0)	34.42.132.7 (nic0)	SSH

A tooltip 'Related actions' is visible at the bottom.

After that you get the terminal:

```
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1067-gcp x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

System information as of Thu Sep 26 18:12:36 UTC 2024

System load:  0.0          Processes:           102
Usage of /:   19.5% of 9.51GB  Users logged in:    0
Memory usage: 5%           IPv4 address for ens4: 10.128.0.2
Swap usage:   0%

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

dauletkd01@cloud-computing-lab1:~$ ls
dauletkd01@cloud-computing-lab1:~$ pip --version

Command 'pip' not found, but can be installed with:

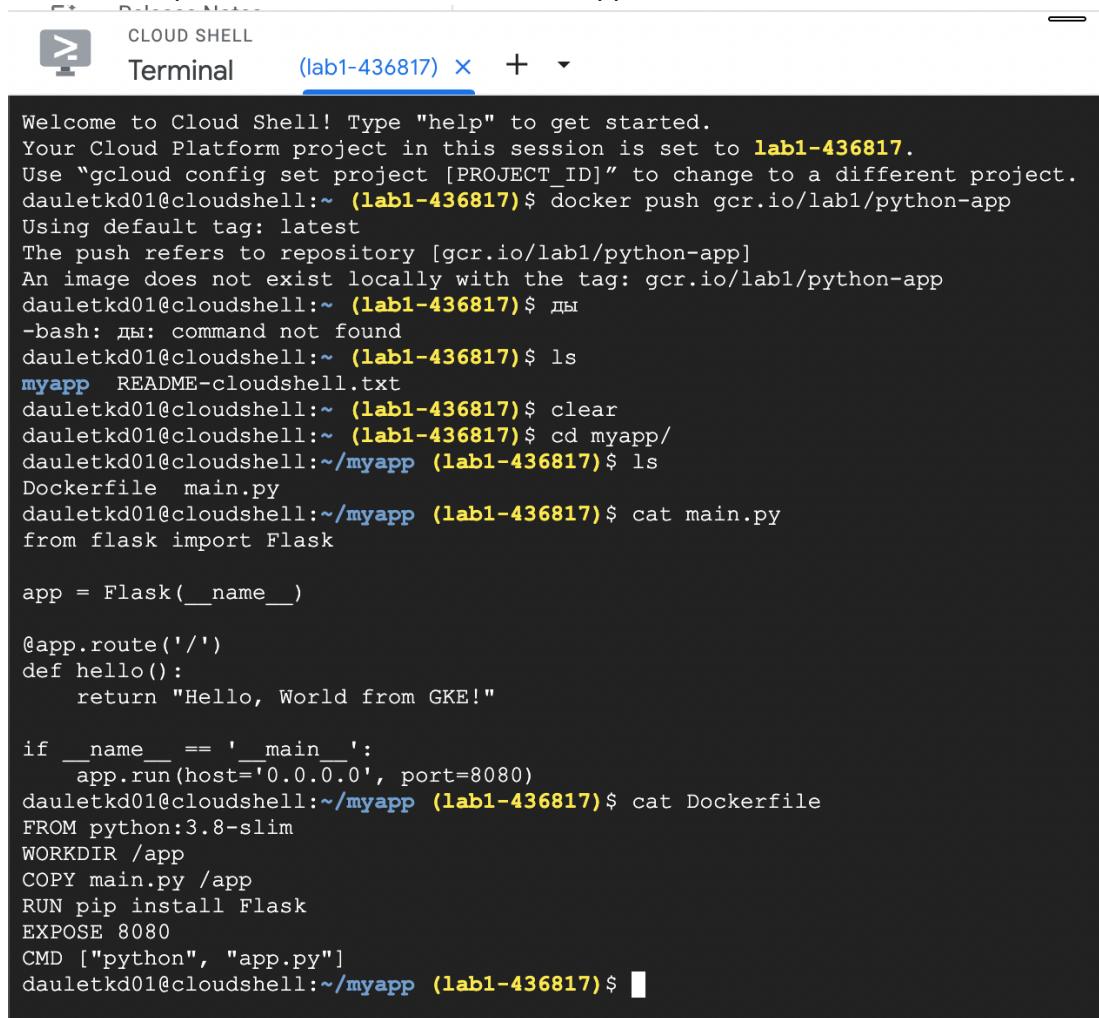
apt install python3-pip
Please ask your administrator.
```

- What happens to the VM and its data when it is stopped versus when it is deleted?  
**Answer:** when VM is stopped, OS is no longer running and instance configuration (CPU, memory, etc) no longer consumes computer resources, but save it when you restart VM. When VM is deleted, VM will be removed from Google Cloud and instance will no longer available, configurations also will be erased.

## Exercise 4: Deploying a Containerized Application on Google Kubernetes Engine (GKE)

1. **Objective:** Understand how to deploy and manage containerized applications using Google Kubernetes Engine.
2. **Steps:**

- Create a simple Docker container for a web application.



The screenshot shows a Google Cloud Shell terminal window. The title bar says "CLOUD SHELL" and "Terminal (lab1-436817)". The terminal output is as follows:

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to lab1-436817.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
dauletkd01@cloudshell:~ (lab1-436817)$ docker push gcr.io/lab1/python-app
Using default tag: latest
The push refers to repository [gcr.io/lab1/python-app]
An image does not exist locally with the tag: gcr.io/lab1/python-app
dauletkd01@cloudshell:~ (lab1-436817)$ ды
-bash: ды: command not found
dauletkd01@cloudshell:~ (lab1-436817)$ ls
myapp README-cloudshell.txt
dauletkd01@cloudshell:~ (lab1-436817)$ clear
dauletkd01@cloudshell:~ (lab1-436817)$ cd myapp/
dauletkd01@cloudshell:~/myapp (lab1-436817)$ ls
Dockerfile main.py
dauletkd01@cloudshell:~/myapp (lab1-436817)$ cat main.py
from flask import Flask

app = Flask(__name__)

@app.route('/')
def hello():
    return "Hello, World from GKE!"

if __name__ == '__main__':
    app.run(host='0.0.0.0', port=8080)
dauletkd01@cloudshell:~/myapp (lab1-436817)$ cat Dockerfile
FROM python:3.8-slim
WORKDIR /app
COPY main.py /app
RUN pip install Flask
EXPOSE 8080
CMD ["python", "app.py"]
dauletkd01@cloudshell:~/myapp (lab1-436817)$ █
```

- Push the container image to Google Container Registry (GCR).
- Create a GKE cluster in Google Cloud Console.
- Deploy the containerized application to the GKE cluster.
- Expose the application to the internet and verify its accessibility.

### 3. Questions:

- How did you create and push the Docker container to GCR?

**Answer:** docker build and push to GCR, but I could not do this and could not

solve this problem.

```
dauletkd01@cloudshell:~/myapp (lab1-436817)$ docker build -t gcr.io/lab1/python-app .
[+] Building 2.1s (9/9) FINISHED
--> [internal] load build definition from Dockerfile
--> => transferring dockerfile: 14kB
--> [internal] load metadata for docker.io/library/python:3.8-slim
--> [internal] load dockerignore
--> => transferring context: 2B
--> [1/4] FROM docker.io/library/python:3.8-slim@sha256:4dd2165f119c97c32c1d30b62bbffcd4bbb0354d6c5522c024406b5b874ac40
--> [internal] load build context
--> => transferring context: 29B
--> CACHED [2/4] WORKDIR /app
--> CACHED [3/4] COPY main.py /app
--> CACHED [4/4] RUN pip install Flask
--> exporting to image
--> => exporting layers
--> -- writing image sha256:3b59efc8d5427629a45a87daac7cf9cada4bcac0fc0af251f3eedf3604f7456
--> [internal] push to gcr.io/lab1/python-app
dauletkd01@cloudshell:~/myapp (lab1-436817)$ docker push gcr.io/lab1/python-app
Using default tag: latest
The push refers to repository [gcr.io/lab1/python-app]
47ea3bbe2986: Preparing
70520f948503: Preparing
d4f949e90408: Preparing
d6f66a04040c: Preparing
837664438a9e: Preparing
8ffef0aa5e5c: Waiting
Be2ab39afbfh: Waiting
denied: Caller does not have permission or the resource may not exist 'read'. To configure permissions, follow instructions at: https://cloud.google.com/container-registry/docs/access-control
dauletkd01@cloudshell:~/myapp (lab1-436817)$
```

- What steps were involved in setting up the GKE cluster?

**Answer:** fill name and region

[← Create an Autopilot cluster](#)

- Cluster basics  
Set up basics for your cluster
- Fleet registration  
Manage multiple clusters together
- Networking  
Define applications communication in the cluster
- Advanced settings  
Review additional options
- Review and create  
Review all settings and create your cluster

## Cluster basics

Create an Autopilot cluster by specifying a name and region. After the cluster is created, you can deploy your workload through Kubernetes and we'll take care of the rest, including:

- ✓ **Nodes:** Automated node provisioning, scaling, and maintenance
- ✓ **Networking:** VPC-native traffic routing for public or private clusters
- ✓ **Security:** Shielded GKE Nodes and Workload Identity
- ✓ **Telemetry:** Cloud Operations logging and monitoring

Name  
autopilot-cluster-1

Cluster names must start with a lowercase letter followed by up to 39 lowercase letters, numbers, or hyphens. They can't end with a hyphen. You cannot change the cluster's name once it's created.

Region  
us-central1

The regional location in which your cluster's control plane and nodes are located. You cannot change the cluster's region once it's created.

[NEXT: FLEET REGISTRATION](#)

[RESET SETTINGS](#)

choose fleet registration is will be registered on not

[Google Cloud](#)

[Lab1](#)

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

[← Create an Autopilot cluster](#)

- ✓ Cluster basics  
Set up basics for your cluster
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## Fleet registration NEW

A fleet lets you logically group and normalize Kubernetes clusters, helping you uplevel management from individual clusters to groups of clusters. To use multi-cluster capabilities and apply consistent policies across your systems, register your cluster to a fleet. [Learn about fleets](#)

Register cluster to the fleet ?

ⓘ Your cluster will be hosted in project 'lab1-436817'. To register it to a fleet in another project, skip this step and use the CLI.

[Learn how to register a GKE cluster](#)

[PREVIOUS](#)

[NEXT: NETWORKING](#)

[RESET SETTINGS](#)

fill the necessary fields in networking like network, node subnet and etc.

≡ Google Cloud Lab1 ▾

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

← Create an Autopilot cluster

Cluster basics  
Set up basics for your cluster

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**Networking**

Define how applications in this cluster communicate with each other and how clients can reach them.

Network \*  
default

Node subnet \*  
default

**IPv4 network access**

Choose the type of network you want to allow to access your cluster's workloads. [Learn more](#)

Public cluster  
Choose a public cluster to configure access from public networks to the cluster's workloads. Routes aren't created automatically. You cannot change this setting after the cluster is created.

Private cluster  
Choose a private cluster to assign internal IP addresses to Pods and nodes. This isolates the cluster's workloads from public networks. You cannot change this setting after the cluster is created.

Override control plane's default private endpoint subnet [?](#)

Cluster default Pod address range  
/17

Example: 192.168.0.0/16

Service address range

Example: 192.168.0.0/16

Enable Control plane global access [?](#)

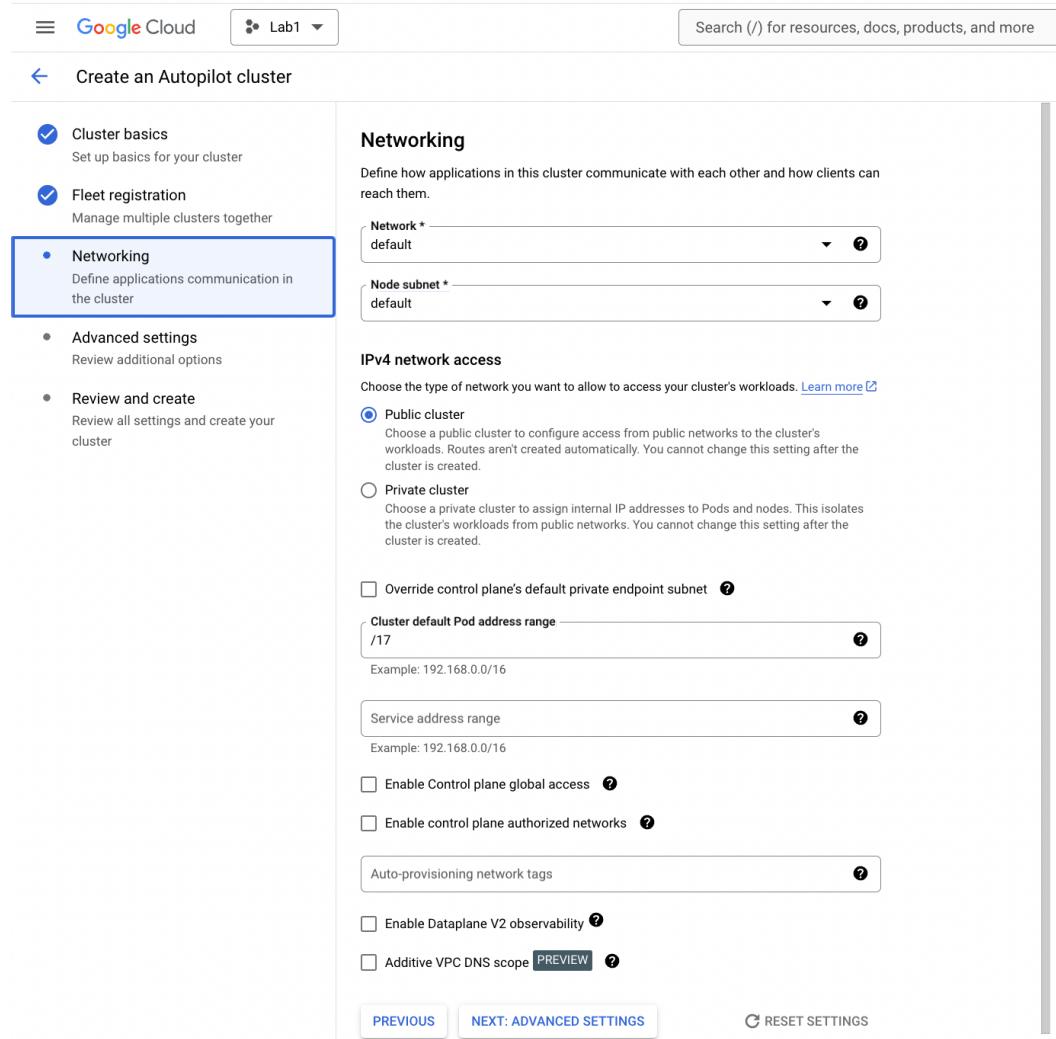
Enable control plane authorized networks [?](#)

Auto-provisioning network tags

Enable Dataplane V2 observability [?](#)

Additive VPC DNS scope [PREVIEW](#) [?](#)

[PREVIOUS](#) [NEXT: ADVANCED SETTINGS](#) [RESET SETTINGS](#)



choose target release channel in advanced settings

The screenshot shows the Google Cloud Platform interface for creating an Autopilot cluster. At the top, the navigation bar includes the Google Cloud logo, a project dropdown set to "Lab1", and a search bar. The main title is "Create an Autopilot cluster". On the left, a sidebar lists several sections: "Cluster basics" (checked), "Fleet registration" (checked), "Networking" (checked), "Advanced settings" (selected and highlighted with a blue box), and "Review and create" (disabled). The "Advanced settings" section contains a sub-section titled "Target release channel" set to "Regular (recommended)". A tooltip message states: "cAdvisor and Kubelet Metrics will be enabled by default in GKE Autopilot clusters with the version in the Rapid channel. See more details in the Advanced settings > Operations section." Below the main form, there are navigation buttons: "PREVIOUS", "NEXT: REVIEW AND CREATE", and "RESET SETTINGS".

then click create cluster button

≡ Google Cloud Lab1 ▾

← Create an Autopilot cluster

Cluster basics  
Set up basics for your cluster

Fleet registration  
Manage multiple clusters together

Networking  
Define applications communication in the cluster

Advanced settings  
Review additional options

Review and create  
Review all settings and create your cluster

**Review and create**

Double check your cluster settings. Pay extra attention to the ones that can't be changed later.

**Cluster basics**

- ✓ Cluster name: autopilot-cluster-1 🔒
- ✓ Cluster location: us-central1 🔒

**Fleet registration**

- ✓ Register to a fleet: Disabled

**Networking**

- ✓ Network: default
- ✓ Subnetwork: default
- ✓ Network access: Public cluster 🔒
- ✓ Override control plane's default private endpoint subnetwork: Disabled
- ✓ Cluster default pod address range: /17 🔒
- ✓ Control plane authorized networks: Disabled
- ✓ Dataplane V2 Observability: Disabled

**Advanced settings**

- ✓ Release channel: Regular channel
- ✓ Maintenance window: Disabled
- ✓ Service Mesh: Disabled 🔒
- ✓ Backup for GKE: Disabled
- ✓ Binary authorization: Disabled
- ✓ Secret Manager: Disabled
- ✓ Google Groups for RBAC: Disabled
- ✓ Secret encryption at the application layer: Disabled
- ✓ Security posture: Basic
- ✓ Workload vulnerability scanning: Disabled
- ✓ Boot disk encryption: Google-managed
- ✓ Service account: Default 🔒
- ✓ Access scopes: Default 🔒
- ✓ Ray Operator: Disabled
- ✓ Logging: Enabled
- ✓ Cloud Monitoring: Enabled

PREVIOUS CREATE CLUSTER

After few minutes you get the cluster in main menu

The screenshot shows the Google Cloud Kubernetes Engine interface. On the left, there's a sidebar with options like 'Learn about Enterprise', 'All Fleets', 'Resource Management', 'Clusters' (which is selected), 'Workloads', 'Teams', 'Applications', 'Secrets & ConfigMaps', 'Storage', 'Object Browser', 'Rollout Sequencing (NEW)', 'Backup for GKE', 'Marketplace', and 'Release Notes'. The main area has a banner titled 'Eight steps to set up GKE' with a 'START' button. Below it is another section titled 'Run your business critical workloads faster, safer, and easier at enterprise scale' with a 'LEARN AND ENABLE' button. At the bottom, there are tabs for 'OVERVIEW', 'OBSERVABILITY', and 'COST OPTIMIZATION'. A table lists a single cluster: 'Status' (green checkmark), 'Name' (autopilot-cluster-1), 'Location' (us-central1), 'Number of nodes' (0), 'Total vCPUs' (0), 'Total memory' (0 GB), 'Notifications' (none), and 'Labels' (empty). There are also 'Filter' and 'Edit' buttons.

- How did you verify that your application was successfully deployed and accessible?
- Answer:** I could not deploy my application, so I try to explain. Check the deployments in the cloud shell terminal by command `kubectl get pods` and you get the name of pods and current status like "Running". Also can check by command `kubectl get services` to get ip-address, copy it and paste to the browser to check that application is working. I saw it in this video - <https://youtu.be/cQeCi2hT3is>

## Exercise 5: Storing and Accessing Data in Google Cloud Storage

1. **Objective:** Learn how to store, manage, and access data using Google Cloud Storage.
2. **Steps:**

- Create a new Cloud Storage bucket in the Google Cloud Console.

The screenshot shows the Google Cloud Storage interface. On the left, there's a sidebar with options like 'Overview (PREVIEW)', 'Buckets' (which is selected), 'Monitoring', and 'Settings'. The main area shows a bucket named 'lab1-exercise5'. It displays details such as 'Location' (us-east1 (South Carolina)), 'Storage class' (Archive), 'Public access' (Not public), and 'Protection' (Soft Delete). Below this, there are tabs for 'OBJECTS', 'CONFIGURATION', 'PERMISSIONS', 'PROTECTION', 'LIFECYCLE', 'OBSERVABILITY', 'INVENTORY REPORTS', and 'OPERATIONS'. Under 'OBJECTS', there's a 'Folder browser' section showing a folder named 'lab1-exercise5'. There are buttons for 'CREATE FOLDER', 'UPLOAD', 'TRANSFER DATA', and 'OTHER SERVICES'. At the bottom, there are filters for 'Name', 'Size', 'Type', 'Created', 'Storage class', 'Last modified', 'Public access', 'Version history', and 'Encryption', along with a 'Show Live objects only' checkbox. A message at the bottom says 'No rows to display'.

- Upload various types of files (e.g., text, images, videos) to the bucket.

The screenshot shows the 'Bucket details' page for 'lab1-exercise5'. The 'OBJECTS' tab is selected, displaying a list of files: 'picture.jpeg' (181.5 KB, image/jpeg, Sep 27, 2024) and 'text.txt' (8 B, text/plain, Sep 27, 2024). A success message '1 file successfully uploaded' is visible. On the right, a sidebar titled 'Uploads and Lab1 operations' lists the uploaded files with status 'Complete'.

- Set access permissions for the bucket and test public and private access to the files.

I give to me a full access for this bucket

The screenshot shows the 'Bucket details' page for 'lab1-exercise5'. In the 'Permissions' section, under 'GRANT ACCESS', a new principal 'dauletkd01@gmail.com' is added with the role 'Storage Admin'. The 'Resource' dropdown is set to 'lab1-exercise5'. The 'Add principals' input field contains 'dauletkd01@gmail.com - Daulet Kareneyev'. The 'SAVE' button is highlighted.

make bucket a public access mode (choose confirm) by removing public

## prevention

The screenshot shows the AWS S3 Bucket Details page for a bucket named 'lab1-exercise5'. The bucket is located in 'us-east1 (South Carolina)', has 'Archive' as its storage class, and 'Not public' as its public access setting. A 'Soft Delete' protection is enabled. The 'CONFIGURATION' tab is selected, showing the 'Public access' section which is currently set to 'Not public'. A modal dialog box is open, asking 'Remove public access prevention on this bucket?'. It contains a warning message: 'You are about to remove the constraint that prevents public access to the bucket lab1-exercise5. Without public access prevention, objects in this bucket could be made accessible to anyone on the public internet.' Below the message is a note: 'By allowing public access, any permissions that had been previously granted to allUsers or allAuthenticatedUsers will be restored. [Learn more about this setting](#)'. At the bottom of the dialog are 'CANCEL' and 'CONFIRM' buttons.

## Permissions

[VIEW BY PRINCIPALS](#)

[VIEW BY ROLES](#)

- Use the Cloud Console to download, move, and delete files in the bucket.  
download

The screenshot shows the Cloud Shell terminal interface. The title bar says 'CLOUD SHELL' and 'Terminal (lab1-436817)'. The terminal window displays the following text:

```
Welcome to Cloud Shell! Type "help" to get started.  
Your Cloud Platform project in this session is set to lab1-436817.  
Use "gcloud config set project [PROJECT_ID]" to change to a different project.  
dauletkd01@cloudshell:~ (lab1-436817)$ gsutil cp gs://lab1-exercise5/text.txt .  
Copying gs://lab1-exercise5/text.txt...  
- [1 files] [ 8.0 B/ 8.0 B]  
Operation completed over 1 objects/8.0 B.  
dauletkd01@cloudshell:~ (lab1-436817)$ ls  
myapp README-cloudshell.txt text.txt  
dauletkd01@cloudshell:~ (lab1-436817)$ █
```

move to backup folder in this bucket

Bucket details for lab1-exercise5

- Buckets** (selected)
- Marketplace
- Release Notes

File list:

Name	Size	Type	Created	Storage class	Last modified
text.txt	8 B	text/plain	Sep 27, 2024, 11:22:02 AM	Archive	Sep 27, 2024

CLOUD SHELL (lab1-436817) x +

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to lab1-436817.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
dauletkd01@cloudshell: ~(lab1-436817)$ gsutil cp gs://lab1-exercise5/text.txt .
Copying gs://lab1-exercise5/text.txt...
Operation completed over 1 objects/8.0 B.
dauletkd01@cloudshell: ~(lab1-436817)$ ls
.
.
.
.
dauletkd01@cloudshell: ~(lab1-436817)$ gsutil cp gs://lab1-exercise5/text.txt gs://lab1-exercise5/backup/text.txt
Copying gs://lab1-exercise5/text.txt [Content-Type=text/plain]...
/ [1 files] 8.0 B/ 8.0 B
Operation completed over 1 objects/8.0 B.
dauletkd01@cloudshell: ~(lab1-436817)$ ls
myapp README-cloudshell.txt text.txt
dauletkd01@cloudshell: ~(lab1-436817)$
```

### delete file from bucket

Bucket details for lab1-exercise5

- Buckets** (selected)
- Marketplace
- Release Notes

File list:

Name	Size	Type	Created	Storage class	Last modified
backup/	-	Folder	-	-	-
picture.jpeg	181.5 KB	image/jpeg	Sep 27, 2024, 11:09:54 AM	Archive	Sep 27, 2024

CLOUD SHELL (lab1-436817) x +

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to lab1-436817.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
dauletkd01@cloudshell: ~(lab1-436817)$ gsutil cp gs://lab1-exercise5/text.txt .
Copying gs://lab1-exercise5/text.txt...
Operation completed over 1 objects/8.0 B.
dauletkd01@cloudshell: ~(lab1-436817)$ ls
myapp README-cloudshell.txt text.txt
dauletkd01@cloudshell: ~(lab1-436817)$ gsutil cp gs://lab1-exercise5/text.txt gs://lab1-exercise5/backup/text.txt
Copying gs://lab1-exercise5/text.txt [Content-Type=text/plain]...
/ [1 files] 8.0 B/ 8.0 B
Operation completed over 1 objects/8.0 B.
dauletkd01@cloudshell: ~(lab1-436817)$ ls
myapp README-cloudshell.txt text.txt
dauletkd01@cloudshell: ~(lab1-436817)$ gsutil rm gs://lab1-exercise5/text.txt
Removing gs://lab1-exercise5/text.txt...
/ [1 objects]
Operation completed over 1 objects.
dauletkd01@cloudshell: ~(lab1-436817)$
```

### 3. Questions:

- How do you create a Cloud Storage bucket, and what options are available during setup?

**Answer:** click Create button

Lab1

Search (/) for resources, docs,

Buckets

**CREATE**

**REFRESH**

**i** Review the soft delete settings on your buckets. Billing fo

here is options like name, location, storage class, access and options of

## data protection

The screenshot shows the 'Create a bucket' wizard in the Google Cloud Platform. The 'Get Started' step is active. In the main area, there's a text input for the bucket name ('example'), a tip about not including sensitive information, and dropdown menus for 'Optimize storage for data-intensive workloads' and 'Labels (optional)'. To the right, a 'Good to know' section includes 'Location pricing' information and a table showing monthly costs for different storage classes:

Item	Cost
us (multiple regions in United States)	\$0.026 per GB-month
With default replication	\$0.020 per GB written

Below the table is a link to 'ESTIMATE YOUR MONTHLY COST'.

- What are the differences between setting a bucket to public versus private?  
**Answer:** public mode is not require passing authentication and anyone can access the bucket. Private mode gives permissions only specific users and give them a role.
- How can you manage access permissions for individual files in a bucket?  
**Answer:** **access control lists** provide a manage permissions for individual files. There are 3 roles – reader, writer, owner. To give permission use the command in terminal: `gsutil acl ch -u dauletkd01@gmail.com:O gs://lab1-exercise5/picture.jpeg` where dauletkd01@gmail.com is my mail, O means Owner, gs://lab1-exercise5/picture.jpeg – path to file

## Exercise 6: Analyzing Data with BigQuery

1. **Objective:** Perform data analysis tasks using BigQuery.
2. **Steps:**

- Access BigQuery in the Google Cloud Console.

- Create a dataset and table by importing a sample dataset provided by Google.

- Write and execute SQL queries to perform basic data analysis, such as filtering, aggregation, and sorting.

filter

The screenshot shows the Google BigQuery interface. On the left, the 'Explorer' sidebar lists various datasets and tables, including 'country\_codes'. In the main area, a query titled 'Untitled query' is displayed:

```
1 SELECT * FROM `bigquery-public-data.country_codes.country_codes`
2 where country_name like '%stan';
```

The 'Query results' section shows a table with the following data:

Row	country_name	alpha_2_code	alpha_3_code
1	Afghanistan	AF	AFG
2	Kazakhstan	KZ	KAZ
3	Kyrgyzstan	KG	KGZ
4	Pakistan	PK	PAK
5	Tajikistan	TJ	TKJ
6	Turkmenistan	TM	TKM
7	Uzbekistan	UZ	UZB

## aggregation and sorting

The screenshot shows the Google BigQuery interface. On the left, the 'Explorer' sidebar lists various datasets and tables, including 'bbc\_news'. In the main area, a query titled 'Untitled query' is displayed:

```
1 SELECT title, count(category) as counter FROM `bigquery-public-data.bbc_news.fulltext`
2 where category = 'tech'
3 group by title
4 order by counter desc;
```

The 'Query results' section shows a table with the following data:

Row	title	counter
1	DVD copy protection strength...	2
2	Intel unveils laser breakthrough	2
3	Looks and music to drive mobil...	2
4	Millions to miss out on the net	2
5	Virus poses as Christmas e-mail	2
6	Sony PSP tipped as a 'must-hav...	2
7	IBM puts cash behind Linux pu...	2
8	What high-definition will do to...	2
9	Freeze on anti-spam campaign	2
10	Games win for Blu-ray DVD for...	2
11	Blind student hears in colour'	2
12	Commodore finds new lease of...	2

- Visualize the results using Google Data Studio or another visualization tool.  
I choose first query to get all countries with "stan"

The screenshot shows a Google Data Studio report titled 'Отчет без названия'. It contains a pie chart visual with the following data:

Country	Percentage
Turkmenistan	14.3%
Pakistan	14.3%
Kazakhstan	14.3%
Afghanistan	14.3%
Uzbekistan	14.3%
Tajikistan	14.3%
Kyrgyzstan	14.3%

The data pane on the right shows the following parameters and filters:

- Источник данных: countries
- Параметр: country\_name
- Показатель: Record Count

## 3. Questions:

- What steps did you take to create a dataset and table in BigQuery?

**Answer:** after creating a query, need to save it as BigQuery table, then give a

name to the dataset and give name to the table. Then save it

Save to BigQuery Table

### Destination

Project \* lab1-436817 [BROWSE](#)

Dataset \* stan

Table \* countries

⚠ Table already exists

### Advanced options

▼

[SAVE](#) [CANCEL](#)

then you see a new dataset with table

The screenshot shows the BigQuery web interface. On the left, the Explorer sidebar displays a project named 'lab1-436817' with various resources like Queries, Notebooks, Data canvases, Workflows, and External connections. A new dataset named 'stan' has been created under this project, and its 'countries' table is selected. The main pane shows the SQL query used to create the table:

```
1 SELECT * FROM `bigquery-public-data.country_codes.country_codes`;  
2 WHERE country_name like '%stan';
```

The 'Query results' section displays the data from the 'countries' table:

Row	country_name	alpha_2_code	alpha_3_code
1	Afghanistan	AF	AFG
2	Kazakhstan	KZ	KAZ
3	Kyrgyzstan	KG	KGZ
4	Pakistan	PK	PAK
5	Tajikistan	TJ	TJK
6	Turkmenistan	TM	TKM
7	Uzbekistan	UZ	UZB

- How did you write and execute SQL queries in BigQuery?

**Answer:** click to button with 3 points, choose Query and you get the menu where

you can write queries to this table

The screenshot shows the BigQuery web interface. In the top navigation bar, there are several tabs: 'country\_des', 'stan\_countries', 'countries', and an 'Untitled query' tab which is currently active. Below the tabs, there are buttons for 'RUN', 'SAVE', 'DOWNLOAD', 'SHARE', 'SCHEDULE', 'OPEN IN', and 'MORE'. The main area is titled 'Untitled query' and contains the following SQL code:

```
1 SELECT * FROM `lab1-436817.stan.countries`;
```

To the left, the 'Explorer' sidebar is visible, showing a tree structure of projects, datasets, and tables. A context menu is open over the 'countries' table in the 'stan' dataset, with the 'Open' option highlighted.

- What insights were you able to derive from the data analysis?

**Answer:** in the country\_codes table, there are 7 countries with ending "stan".

Query results					
JOB INFORMATION		RESULTS	CHART	JSON	EXECUTION DETAILS
Row	country_name	alpha_2_code		alpha_3_code	
1	Afghanistan	AF		AFG	
2	Kazakhstan	KZ		KAZ	
3	Kyrgyzstan	KG		KGZ	
4	Pakistan	PK		PAK	
5	Tajikistan	TJ		TJK	
6	Turkmenistan	TM		TKM	
7	Uzbekistan	UZ		UZB	