

Assignment 1

Cloud Computing

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Github link for this Assignment:<https://github.com/piiiiiiiiiiiipp/Cloud-Coputing-ASS>

Exercise 1: Understanding Cloud Computing Models

- Research the three primary cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

There are 3 main most popular cloud service models: IaaS, PaaS, SaaS. Of course there exists more types, but this are the base.

IaaS is Infrastructure as a Service, it is a cloud-hosted servers, virtual storage, networking in simple words - hardware in cloud.

PaaS is Platform as a Service, it is not only Infrastructure meaning computing, storage, networking, but also a software deployment, DB tools, development tools and etc.

SaaS is Software as a Service, it is a whole software through Internet, meaning ready to use system.

- Create a table comparing these models in terms of control, flexibility, and use cases.

Model	Control	Flexibility	Use cases
IaaS	High control of infrastructure	Able to adjust services	Storage and backup, hosting websites...
PaaS	Infrastructure is managed by provider , but able to control apps and tools.	Customizable, but infrastructure isn't.	App dev and deploy, Testing, Dev environments, Builds and launching applications...
SaaS	Provider handles everything	Low management of the infrastructure	CRM, ERP, collaboration tools....

- Identify examples of services offered by Google Cloud Platform (GCP) under each model.

IaaS	Compute Engine, Cloud Storage, Cloud File Store, Load Balancer.
PaaS	App Engine, Cloud Functions, Firebase, GKE
SaaS	Workspace, BigQuery, Cloud Identity

Questions:

- What are the main differences between IaaS, PaaS, and SaaS?

Answer:

Main difference of the level of control and flexibility you have, each model refers to the needs of a client, for a more customized or exact services as storage use IaaS, for a software for development, deploy, build and testing use PaaS, for a ready to use software apps use SaaS,

- Which GCP services fall under each of these models?

Answer:

IaaS	Compute Engine, Cloud Storage, Cloud File Store, Load Balancer.
PaaS	App Engine, Cloud Functions, Firebase, GKE
SaaS	Workspace, BigQuery, Cloud Identity

- Provide a real-world example where each cloud service model might be the most appropriate choice.

Answer:

For only storage, computing and networking (website needs) IaaS if you choose to develop your own service and infrastructure, applications use PaaS, and for ready software use SaaS.

Exercise 2: Exploring Google Cloud Platform's Core Services

- 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
 - Google Kubernetes Engine (GKE)
 - App Engine
 - Cloud Storage
 - BigQuery
- For each service, identify a potential use case in a business scenario.

Compute Engine -	VMs for any code to run.	- Platform Hosting
GKE -	Managing Kubernetes for containerized apps.	- Deploy microservice.
App Engine -	For build and deploy of apps.	- Forum development.
Cloud Storage -	Any type storage.	- Backup.
BigQuery -	Data warehouse for big data analysis.	Retail Chain Analytics

Questions:

- What is the primary use case of Compute Engine?

Delivering on-demand **VMs** for handling tasks of wide range of workloads, data computing and etc.

- How does Google Kubernetes Engine (GKE) simplify the management of containerized applications?

GKE **simplifies** it by automating deploy, scaling, monitoring and etc. It help in Kubernetes clusters management.

- What advantages does Cloud Storage offer for data management?

Advantages of CS is **security, accessibility, scalability, durability**. Of course, **effectiveness**.

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

It's a fast serverless scalable data warehouse for query. It's easy to use, fast, seamlessly integrated.

Exercise 3: Creating and Managing Virtual Machines with Compute Engine

Steps:

- In the Google Cloud Console, navigate to Compute Engine and create a new VM instance.

The screenshot shows the Google Cloud Compute Engine Instances page. At the top, there is a navigation bar with the Google Cloud logo, a dropdown for 'My Project 39531', and various icons for search, notifications, and user profile. Below the navigation bar, the title 'Compute Engine' is displayed next to a cloud icon. The main area is titled 'VM instances' and features a 'CREATE INSTANCE' button. There are three tabs at the top: 'INSTANCES' (which is selected), 'OBSERVABILITY', and 'INSTANCE SCHEDULES'. The 'INSTANCES' tab shows a table with columns for Status, Name, Zone, Recommendations, In use by, Internal IP, External IP, and Connect. A large dashed cloud icon is overlaid on the left side of the table. At the bottom, there is a section titled 'VM Instances' with a sub-section about Compute Engine.

VM Instances
Compute Engine lets you use virtual machines that run on Google's

The screenshot shows the 'Create an instance' wizard in the Google Cloud Platform. The 'Name' field is set to 'instance-20240926-131940'. The 'Region' is 'europe-west2 (London)' and the 'Zone' is 'europe-west2-a'. Under 'Machine configuration', the 'General purpose' tab is selected, showing various machine types like C4, N4, C3, C3D, E2, and N2. The 'E2' machine type is selected. On the right, a 'Monthly estimate' table shows costs for 2 vCPU + 1 GB memory (\$7.88), 10 GB balanced persistent disk (\$1.20), and a total monthly estimate of \$9.08. A 'Compute Engine pricing' link is also present.

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

The screenshot shows the 'VM instances' page in the Google Cloud Platform Compute Engine section. A new VM instance named 'instance-20240926-131940' is listed in the table, located in the 'europe-west2-a' zone. The 'SSH' button is visible next to the instance details. Below the table, there's a 'Related actions' section with links to 'Explore Backup and DR', 'View billing report', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', and 'Patch management'.

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

```

Linux instance-20240926-131940 6.1.0-25-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.106-3 (2024-08-26) 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.

kime1im85@instance-20240926-131940:~$ sudo apt update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:3 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
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:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease [1321 B]
Get:6 https://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease [1650 B]
Get:9 https://deb.debian.org/debian bookworm-updates/main Sources.diff/Index [11.7 kB]
Get:10 https://deb.debian.org/debian bookworm-updates/main amd64 Packages.diff/Index [11.7 kB]
Get:11 https://deb.debian.org/debian bookworm-updates/main Translation-en.diff/Index [11.7 kB]
Get:12 https://deb.debian.org/debian bookworm-updates/main Sources T-2024-09-10-2011.55-F-2024-09-10-2011.55.pdiff [562 B]
Get:13 https://deb.debian.org/debian bookworm-updates/main amd64 Packages T-2024-09-10-2011.55-F-2024-09-10-2011.55.pdiff [1116 B]
Get:12 https://deb.debian.org/debian bookworm-updates/main Sources T-2024-09-10-2011.55-F-2024-09-10-2011.55.pdiff [562 B]
Get:13 https://deb.debian.org/debian bookworm-updates/main amd64 Packages T-2024-09-10-2011.55-F-2024-09-10-2011.55.pdiff [1116 B]
Get:14 https://deb.debian.org/debian bookworm-updates/main Translation-en T-2024-09-10-2011.55-F-2024-09-10-2011.55.pdiff [538 B]
Get:14 https://deb.debian.org/debian bookworm-updates/main Translation-en T-2024-09-10-2011.55-F-2024-09-10-2011.55.pdiff [538 B]
Get:15 https://deb.debian.org/debian bookworm-backports/main Sources.diff/Index [63.3 kB]
Get:16 https://deb.debian.org/debian bookworm-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:17 https://deb.debian.org/debian bookworm-backports/main Translation-en.diff/Index [63.3 kB]
Get:18 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-09-25-2006.54-F-2024-09-10-2011.55.pdiff [29.5 kB]
Get:18 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-09-25-2006.54-F-2024-09-10-2011.55.pdiff [29.5 kB]

```

Debian OS

```

sudo apt update
sudo apt install apache2 -y ((yes))

```

```
What's New Dashboard VM instances rfrjkmpk + ssh.cloud.google.com/v2/ssh/projects/gold-courage-436813-j9/zones/europe-west2-a/instances/instance-20240926-131940?authuser=0... ssh.cloud.google.com/v2/ssh/projects/gold-courage-436813-j9/zones/europe-west2-a/instances/instance-20240926-131940?authuser=0... SSH in-browser UPLOAD FILE DOWNLOAD FILE Setting up apache2-data (2.4.62-1-deb12u1) ... Setting up libaprutil1:amd64 (1.6.3-1) ... Setting up libaprutil1-dbd-pgsql:amd64 (1.6.3-1) ... Setting up libaprutil1-dbd-sqlite3:amd64 (1.6.3-1) ... Setting up apache2-utils (2.4.62-1-deb12u1) ... Setting up apache2-bin (2.4.62-1-deb12u1) ... Setting up apache2 (2.4.62-1-deb12u1) ... Enabling module authn_core. Enabling module authn_host. Enabling module authn_core. Enabling module authn_file. Enabling module access_compat. Enabling module authn_file. Enabling module authn_user. Enabling module alias. Enabling module headers. Enabling module autoindex. Enabling module env. Enabling module mime. Enabling module negotiation. Enabling module setenvif. Enabling module filter. Enabling module deflate. Enabling module status. Enabling module timeout. Enabling conf charset. Enabling conf localized-error-pages. Enabling conf otherlanguages-access-log. Enabling conf security. Enabling conf serve-cgi-bin. Enabling site 000-default. Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /lib/systemd/system/apache2.service Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /lib/systemd/system/apache-htcacheclean.service. Processing triggers for man-db (2.11.2-2) ...
```

SSH-in-browser

```
Setting up libaprutil1-ldap:amd64 (1.6.3-1) ...
Setting up libaprutil1-dbd-sqlite3:amd64 (1.6.3-1) ...
Setting up apache2-utils (2.4.62-1~deb12u1) ...
Setting up apache2-bin (2.4.62-1~deb12u1) ...
Setting up apache2 (2.4.62-1~deb12u1) ...
Enabling module mpm_event.
Enabling module authz_core.
Enabling module authz_host.
Enabling module authn_core.
Enabling module auth_basic.
Enabling module access_compat.
Enabling module authn_file.
Enabling module authz_user.
Enabling module alias.
Enabling module dir.
Enabling module autoindex.
Enabling module env.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module reqtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /lib/systemd/system/apache2.service

Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service → /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for man-db (2.11.2-2) ...
Processing triggers for libc-bin (2.36-9+deb12u8) ...
kimelim85@instance-20240926-131940:~$ sudo systemctl start apache2
```

Starting the server

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

The screenshot shows the Google Cloud Compute Engine interface for an instance named "instance-2024...". The "OBSERVABILITY" tab is selected, displaying two charts: "New Connections with VMs/Ex..." and "Sent to VMs/External/Google". The top navigation bar includes links for "What's New", "Dashboard", "instance-2024...", "rfr gjkmpj...", and "Error". The left sidebar lists "Compute Engine" services: Metrics, Logs, Overview, CPU, Processes, Memory, Network (Summary, Packet Mirroring), and Disk (Performance, Capacity). A "MONITOR VM INSTANCES" section is also present.

The screenshot shows the Google Cloud Compute Engine "VM instances" page. It displays a single instance named "Instance-20240926-131940" with status "Running", name "Instance-20240926-131940", zone "europe-west2-a", internal IP "10.154.0.2 (nic0)", and external IP "34.105.221.121 (nic0)". The "INSTANCE SCHEDULES" tab is selected. The left sidebar shows "Virtual machines" with options like VM instances, Instance templates, Sole-tenant nodes, Machine Images, TPUs, Committed use discounts, Reservations, and Migrate to Virtual Machine. Other sections include Storage (Disks, Marketplace, Release Notes) and Compute Engine (Explore Backup and DR, View billing report, Monitor VMs, Explore VM logs, Set up firewall rules, Patch management, Load balance between VMs).

Let's see if it's on.

The screenshot shows the Google Cloud Compute Engine interface. On the left, there's a sidebar with 'Compute Engine' selected under 'Virtual machines'. The main area shows a table of VM instances. A modal dialog is open over the table, asking 'Stop instance-20240926-131940?'. It says 'You'll be billed only for these preserved resources:' and lists 'Persistent disks' and 'Static IP addresses'. Below that, it says 'The VM will gracefully shut down in 90 seconds. If processes are still running, the VM will be forced to stop and files may get corrupted.' At the bottom of the modal are 'CANCEL' and 'STOP' buttons. To the right of the modal, there's a 'Related' section with links like 'Explore Backup and DR', 'View billing report', 'Monitor VMs', 'Patch management', and 'Load balance between VMs'. A 'LEARN' button is also present. On the far right, there's a sidebar titled 'Recommended for you' with links to 'List applicable routes for a VM network interface', 'View and understand Firewall Insights', 'Review and optimize firewall rules', and 'Create and run Connectivity Tests'.

Stopping the VM.

This screenshot shows the same Google Cloud Compute Engine interface after the VM has been stopped. The modal dialog from the previous screenshot is now closed, and a black banner at the bottom of the screen says 'VM instance stopped' with a close button. The table of VM instances shows one row for 'instance-20240926-131940' which is now listed as 'Stopped'. The rest of the interface remains the same, with the 'Related' section and 'LEARN' button visible on the right.

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
Running	instance-20240926-131940	europe-west2-a			10.154.0.2 (nic0)		SSH

Related actions

Explore Backup and DR View billing report Monitor VMs

Start / Resume Stop Screenshot

What's New My Billing Account – Reports – VM instances – Compute Engine +

console.cloud.google.com/compute/instances?project=gold-courage-436813-j9&tab=monitoring

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Compute Engine VM instances CREATE INSTANCE IMPORT VM REFRESH

Virtual machines VM instances

Instance templates Sole-tenant nodes Machine Images TPUs Committed use discounts Reservations Migrate to Virtual Machine Storage Disks Marketplace Release Notes

Start instance-20240926-131940?

You'll be charged for running this VM according to its configuration.

CANCEL START

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

VM instance stopped

11°C Cloudy 6:31 PM 9/26/24 ENG US

Start Instance.

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
Running	instance-20240926-131940	europe-west2-a			10.154.0.2 (nic0)		SSH

Related actions

Explore Backup and DR View billing report Monitor VMs

Start / Resume Stop Screenshot

Start instance-20240926-131940?

You'll be charged for running this VM according to its configuration.

CANCEL START

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

Delete instance-20240926-131940?

Are you sure you want to delete instance instance-20240926-131940?

This will delete boot disk instance-20240926-131940

CANCEL DELETE

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

Starting instance-20240926-131940...

What's New My Billing Account – Reports – VM instances – Compute Engine +

console.cloud.google.com/compute/instances?project=gold-courage-436813-j9&tab=monitoring

Gmail YouTube Dashboard VK reg Board Projects - Jira D Курбанисмайлова... Angular-Movies/src... Basic Git Command... Threadboard All Bookmarks

Google Cloud My Project 39531 Search (/) for resources, docs, products, and more Search

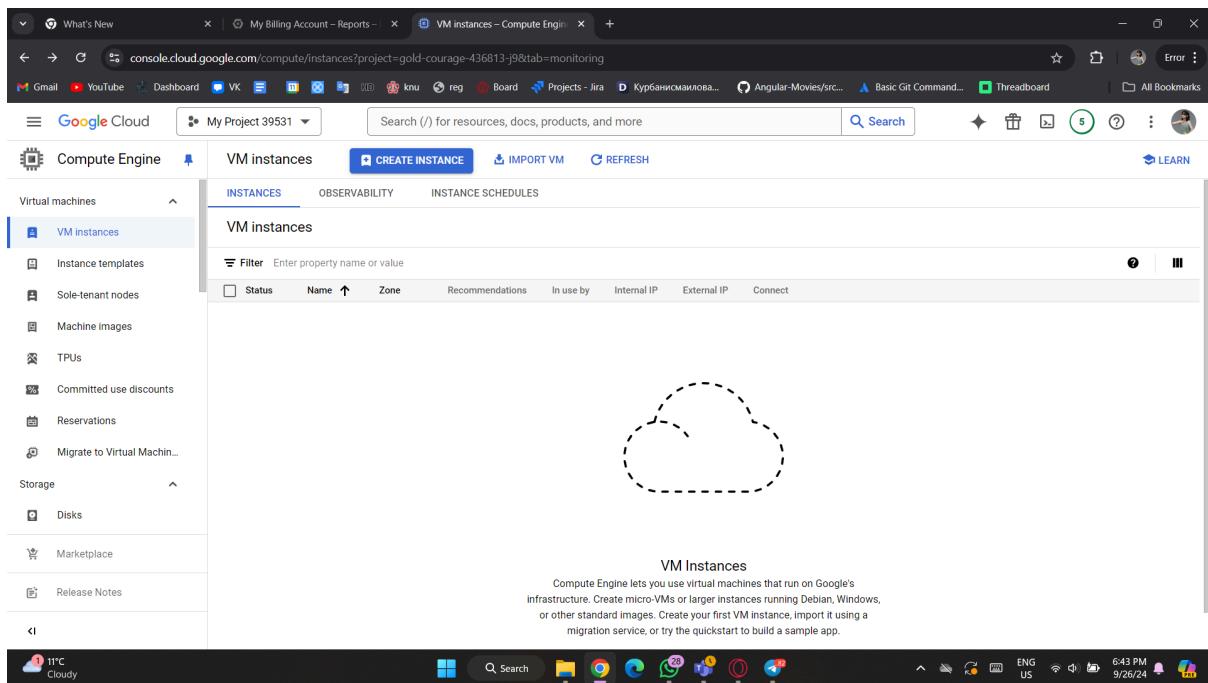
Compute Engine VM instances CREATE INSTANCE IMPORT VM REFRESH

Virtual machines VM instances

Instance templates Sole-tenant nodes Machine Images TPUs Committed use discounts Reservations Migrate to Virtual Machine Storage Disks Marketplace Release Notes

Starting instance-20240926-131940...

11°C Cloudy 6:32 PM 9/26/24 ENG US



Questions:

- What steps did you follow to create the VM?

Go to the Google cloud Console, open a Compute engine, enabling the API first. Then move to the Compute Engine main pane and click “create” under the VM instances. Then configure the VM, and it's done.

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

I connected through SSH, there is a button in Google Console.

My VM was Linux based, so I used `sudo apt update`

```
sudo apt install apache2 -y
```

- What happens to the VM and its data when it is stopped versus when it is deleted?

Stopping the VM turns off the machine, but so called **disk** is alive and session data is not lost, on the other hand **deleting** the instance **loses** everything and frees the hardware.

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

Steps:

- Create a simple Docker container for a web application

```
MINGW64:/c/Users/elnus/myapp
'ang_threadboard (3).zip'
angular_threadboard/
ansi1/
dotTraceSnapshots/
knu2023software-design/
npm-cache/
ntuser.dat.LOG1
ntuser.dat.LOG2
ntuser.ini
source/
threadboard/
threadboard.zip
Документы/
Изображения/
'Рабочий стол'/
elnus@tetris MINGW64 ~
$ mkdir myapp
aselnus@tetris MINGW64 ~
cre
abelelnus@tetris MINGW64 ~/myapp
$
```

Dismiss Enable Gemini API

[View your billing reports and cost trends](#)

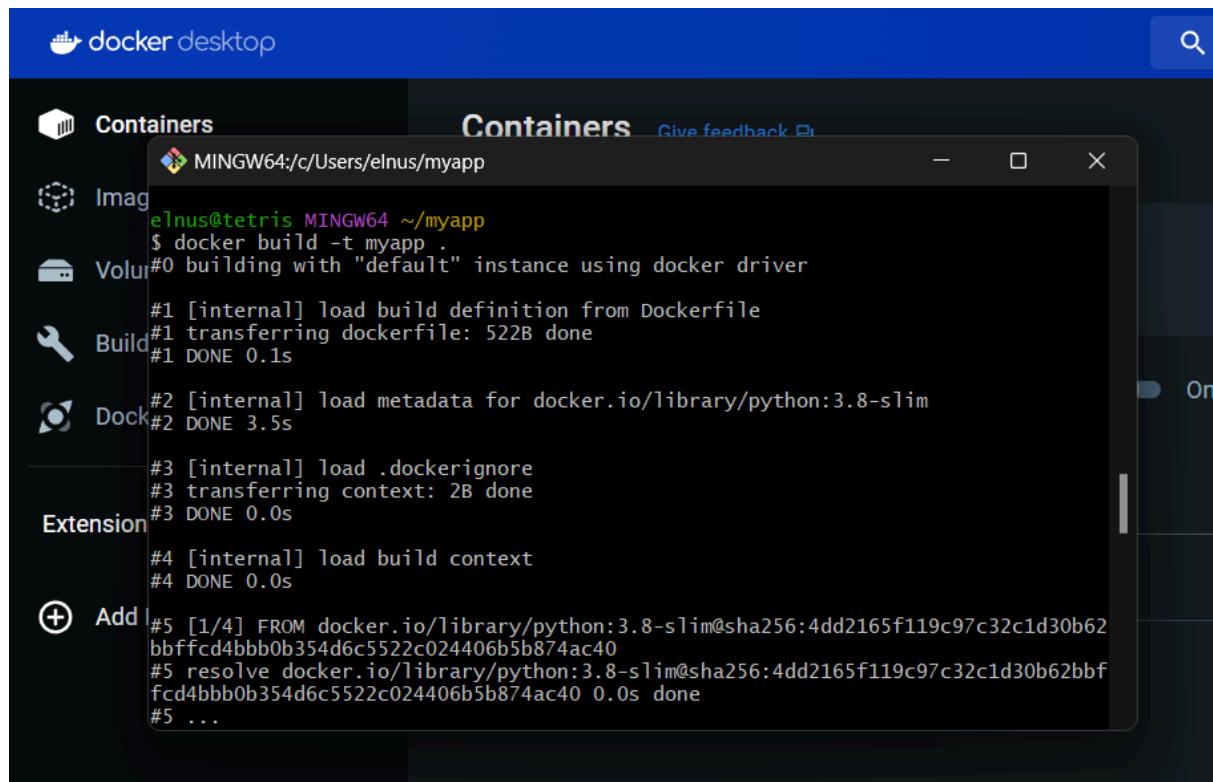
```
Изображения/
'Рабочий стол'/
elnus@tetris MINGW64 ~
$ mkdir myapp
elelnus@tetris MINGW64 ~
$ cd myapp
Reports:elnus@tetris MINGW64 ~/myapp
$ nano app.py
elnus@tetris MINGW64 ~/myapp
$ nano app.py
elnus@tetris MINGW64 ~/myapp
$ nano requirements.txt
elnus@tetris MINGW64 ~/myapp
$ nano Dockerfile
elnus@tetris MINGW64 ~/myapp
$ docker build -t my-flask-app .
abelelnus@tetris MINGW64 ~/myapp
$
```

Dismiss Enable Gemini API

[View your billing reports and cost trends](#)

[Help document](#)

I made flask app(PY), and the Docker file, then Docker image, also there is a app.py, requirements.txt with app reqs.



The screenshot shows the Docker Desktop interface. At the top, there's a header bar with the word "Containers" and a "Give feedback" button. Below the header, a terminal window displays the following text:

```
Containers Containers Give feedback ▾
MINGW64:/c/Users/elnus/myapp
mag#9 DONE 0.2s
View build details: docker-desktop://dashboard/build/default/default/qu6helz8wn6d09dkehb2kxggy
what's Next?
  1. Sign in to your Docker account → docker login
  2. View a summary of image vulnerabilities and recommendations → docker scout quickview
elnus@tetris MINGW64 ~/myapp
$ docker run -p 8080:8080 myapp
 * Serving Flask app 'app' (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
     Use a production WSGI server instead.
 * Debug mode: off
 * Running on all addresses (0.0.0.0)
   WARNING: This is a development server. Do not use it in a production deployment.
     * Running on http://127.0.0.1:8080
     * Running on http://172.17.0.2:8080 (Press CTRL+C to quit)
```

Below the terminal, a browser window is open to `localhost:8080`. The page title is "Khanafiyeva_E_ASS1...". The content of the page is "Hello i'm alive".

```
MINGW64:/c/Users/elnus
elnus@tetris MINGW64 ~
$ ^[[200~docker ps
bash: $'\E[200~docker': command not found

elnus@tetris MINGW64 ~
$ docker ps
CONTAINER ID   IMAGE      COMMAND       CREATED          STATUS
              PORTS     NAMES
7c151f26e092   myapp      "python app.py"   About a minute ago   Up About a minut
e   0.0.0.0:8080->8080/tcp   flamboyant_cerf

elnus@tetris MINGW64 ~
$ docker tag myapp gcr.io/gold-courage-436813-j9/myapp:v1
elnus@tetris MINGW64 ~
$
```

I connect the Docker image with my Google Container Registry project.

- Push the container image to Google Container Registry (GCR).

```
ChatGPT
MINGW64:/c/Users/elnus
$ AC

elnus@tetris MINGW64 ~
$ docker push myapp gcr.io/gold-courage-436813-j9/myapp:v1
"docker push" requires exactly 1 argument.
See 'docker push --help'.

Usage: docker push [OPTIONS] NAME[:TAG]

To upload an image to a registry

elnus@tetris MINGW64 ~
$ docker push gcr.io/gold-courage-436813-j9/myapp:v1
The push refers to repository [gcr.io/gold-courage-436813-j9/myapp]
9fb1910a8b1e: Preparing
f19428f1474a: Preparing
H0eed00098b43: Preparing
de06647e8a8c: Preparing
837964438a9e: Preparing
8ffef0ea5e5c: Preparing
8e2ab394fabf: Preparing
8ffef0ea5e5c: Waiting
8e2ab394fabf: Waiting
This will upload y
```

```
C:\Users\elnus\AppData\Local\Google\Cloud SDK>docker push gcr.io/gold-courage-436813-j9/myapp:v1
The push refers to repository [gcr.io/gold-courage-436813-j9/myapp]
9fb1910a8b1e: Pushing [=====] 12.06MB
f19428f1474a: Pushing [=====] 4.608kB
0eed00098b43: Pushing 1.536kB
de06647e8a8c: Layer already exists
837964438a9e: Layer already exists
8ffef0ea5e5c: Layer already exists
8e2ab394fabf: Layer already exists
```

```
Docker configuration file updated.

osag: C:\Users\elnus\AppData\Local\Google\Cloud SDK>docker push gcr.io/gold-courage-436813-j9/myapp:v1
The push refers to repository [gcr.io/gold-courage-436813-j9/myapp]
9fb1910a8b1e: Pushed
f19428f1474a: Pushed
0eed00098b43: Pushed
de06647e8a8c: Layer already exists
837964438a9e: Layer already exists
8ffef0ea5e5c: Layer already exists
8e2ab394fabf: Layer already exists
```

- Create a GKE cluster in Google Cloud Console.

```
C:\Users\elnus\AppData\Local\Google\Cloud SDK>gcloud components install kubectl
Restarting command:
$ gcloud components install kubectl

C:\Users\elnus\AppData\Local\Google\Cloud SDK>gcloud container clusters get-credentials autopilot-cluster-1 --zone us-central1
C:\Users\elnus\AppData\Local\Google\Cloud SDK>gcloud container clusters get-credentials autopilot-cluster-1 --zone us-central1 --project gold-courage-436813-j9
Fetching cluster endpoint and auth data.
kubeconfig entry generated for autopilot-cluster-1.

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl create deployment myapp --image=gcr.io/gold-courage-436813-j9/myapp:v1
```

The screenshot shows a Windows desktop environment. At the top, there is a taskbar with various icons including Search, File Explorer, Google Chrome, and others. The system tray shows the date and time as 7:43 PM 9/26/24.

In the center, a terminal window displays the following command history:

```
C:\Users\elnus\AppData\Local\Google\Cloud SDK>gcloud components install kubectl
Restarting command:
$ gcloud components install kubectl

C:\Users\elnus\AppData\Local\Google\Cloud SDK>gcloud container clusters get-credentials autopilot-cluster-1 --zone us-central1
C:\Users\elnus\AppData\Local\Google\Cloud SDK>gcloud container clusters get-credentials autopilot-cluster-1 --zone us-central1 --project gold-courage-436813-j9
Fetching cluster endpoint and auth data.
kubeconfig entry generated for autopilot-cluster-1.

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl create deployment myapp --image=gcr.io/gold-courage-436813-j9/myapp:v1
```

Below the terminal, a browser window is open to the Google Cloud Kubernetes Engine dashboard. The URL is console.cloud.google.com/kubernetes/list/overview?project=gold-courage-436813-j9. The dashboard shows the "Kubernetes Engine" section with options to "CREATE", "DEPLOY", "REFRESH", "ONBOARDING", and "LEARN". A large callout box highlights "easier at enterprise scale" with text about GKE Enterprise's features. Below this, there are tabs for "OVERVIEW", "OBSERVABILITY", and "COST OPTIMIZATION". The "OVERVIEW" tab shows a table with one row for the "autopilot-cluster-1" cluster, located in "us-central1" with 0 nodes, 0 vCPUs, and 0 memory. A "LEARN AND ENABLE" button is visible. The bottom of the browser window also has a taskbar with the same set of icons as the main desktop.

- Deploy the containerized application to the GKE cluster.

```
C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl create deployment myapp --image=gcr.io/gold-courage-436813-j9/myapp:v1
Warning: autopilot-default-resources-mutator:Autopilot updated Deployment default/myapp: defaulted unspecified 'cpu' resource for containers [myapp] (see https://g.co/gke/autopilot-defaults).
deployment.apps/myapp created

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl expose deployment myapp --type=LoadBalancer --port 8080
service/myapp exposed

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl get deployments
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
myapp     0/1       1           0           31s

C:\Users\elnus\AppData\Local\Google\Cloud SDK>
```

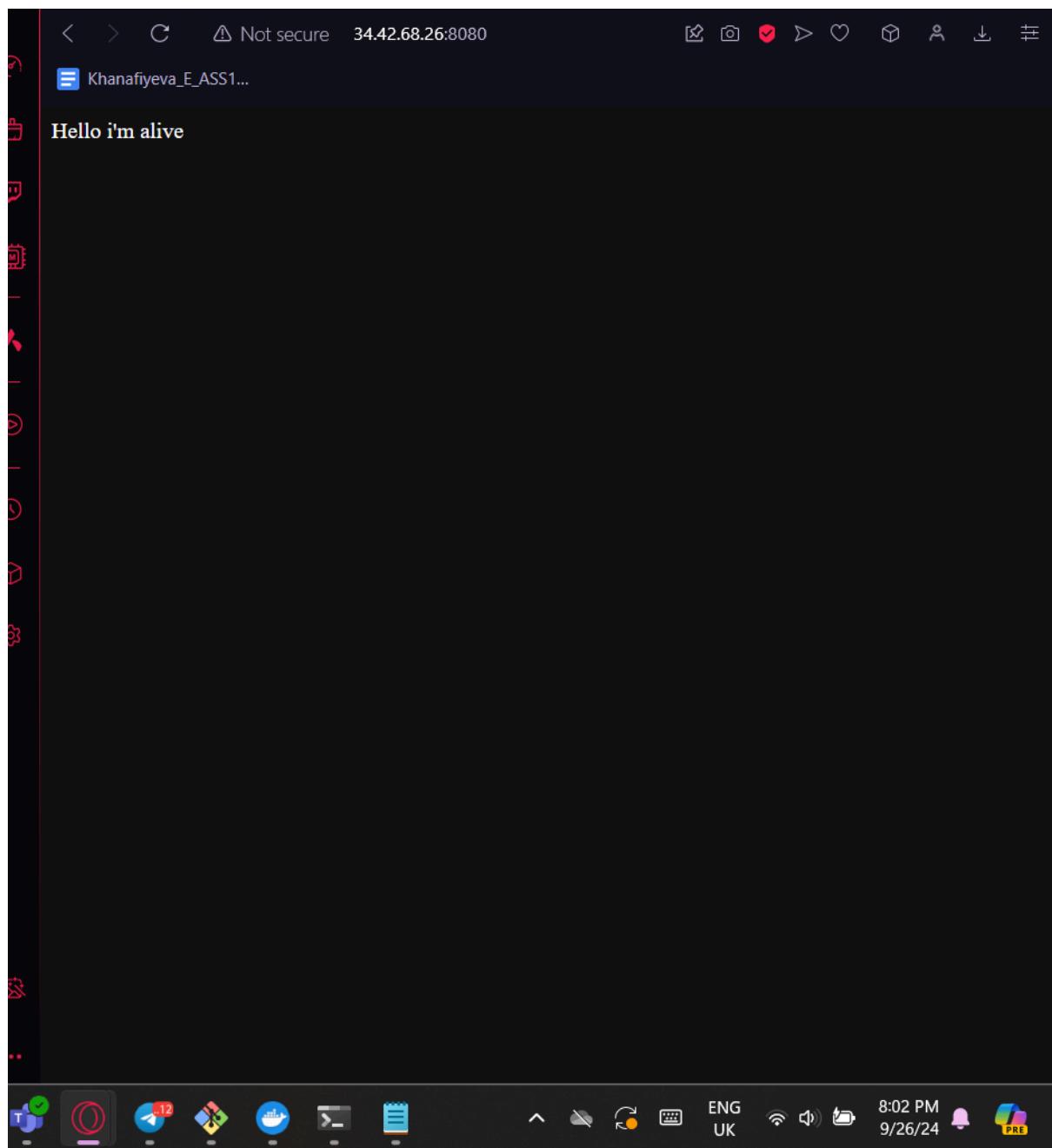
- Expose the application to the internet and verify its accessibility.

```
C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl get services
NAME      TYPE      CLUSTER-IP      EXTERNAL-IP      PORT(S)      AGE
kubernetes  ClusterIP  34.118.224.1  <none>        443/TCP      12m
myapp     LoadBalancer  34.118.237.122  34.42.68.26  8080:32354/TCP  4m22s

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl get deployments
NAME      READY  UP-TO-DATE  AVAILABLE  AGE
myapp    1/1      1          1          6m13s

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl get pods
NAME          READY  STATUS      RESTARTS  AGE
myapp-66b764c85-2hx26  1/1    Running   0          6m14s

C:\Users\elnus\AppData\Local\Google\Cloud SDK>kubectl logs myapp-66b764c85-2hx26
 * Serving Flask app 'app' (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on all addresses (0.0.0.0)
   WARNING: This is a development server. Do not use it in a production deployment.
 * Running on http://127.0.0.1:8080
 * Running on http://10.8.0.6:8080 (Press CTRL+C to quit)
```



Questions:

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

I wrote python app, then a Docker file, build the Docker image.

Authenticate Docker with GCP.

Pushed the image to Google.

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

Go to the console, create a cluster, then configure the cluster by name location and nodes.

- How did you verify that your application was successfully deployed and accessible?

I used kubectl to deploy my containerized application to the GKE cluster Then exposed the deployment tot the internet, then connected to that IP.

Exercise 5: Storing and Accessing Data in Google Cloud Storage

Steps:

- Create a new Cloud Storage bucket in the Google Cloud Console.
- Upload various types of files (e.g., text, images, videos) to the bucket.
- Set access permissions for the bucket and test public and private access to the files.
- Use the Cloud Console to download, move, and delete files in the bucket.

Questions:

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

The screenshot shows the Google Cloud Storage console interface. At the top, the URL is `console.cloud.google.com/storage/browser/elnbucket;tab=o...`. The main navigation bar includes 'Google Cloud' and 'My Project 39531'. Below this, the 'Cloud Storage' section is selected. The 'Bucket details' page for 'elnbucket' is displayed, showing the following information:

Location	Storage class	Public access	Protection
us (multiple regions in United States)	Standard	Not public	Soft Delete

Below the table, there are tabs for 'OBJECTS' (which is selected), 'CONFIGURATION', 'PERMISSIONS', 'PROTECTION', 'LIFECYCLE', and 'OBSE'. The 'OBJECTS' tab shows a 'Folder browser' with a single entry 'elnbucket'. To the right of the browser, there are buttons for 'CREATE FOLDER', 'UPLOAD', and a filter dropdown. A message box at the bottom left says 'Created bucket elnbucket'.

There were options of name of the bucket, location and storage class.Also the access control which is private by default.

The screenshot shows the 'Bucket details' page for 'elnbucket' in the Google Cloud Storage section. The left sidebar has 'Cloud Storage' selected under 'Buckets'. The main area is titled 'Permissions' with tabs 'VIEW BY PRINCIPALS' and 'VIEW BY ROLES'. Under 'VIEW BY PRINCIPALS', there's a table with columns 'Type', 'Principal', and 'Action'. It lists several entries: 'Editors of project: gold-courage-436813-j9', 'Owners of project: gold-courage-436813-j9', 'service-278608458653@compute-system.iam.gserviceaccount.com', 'service-278608458653@containerregistry.iam.gserviceaccount.com', and 'Viewers of project: gold-courage-436813-j9'. Below this is a 'Filter' input field. To the right, there's a 'Resource' section for 'elnbucket' and a 'Add principals' section with a red box highlighting the 'New principals' input field which contains 'Enter at least one principal'. A 'Assign roles' section follows, with a table for 'Role' and 'IAM condition (optional)'. A note says 'Grants permission to view objects and their metadata, excluding ACLs.' At the bottom are 'SAVE' and 'CANCEL' buttons.

- What are the differences between setting a bucket to public versus private?

The screenshot shows the same 'Bucket details' page for 'elnbucket'. A modal dialog is open in the center, titled '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 elnbucket. 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.' At the bottom of the dialog are 'CANCEL' and 'CONFIRM' buttons. The background of the page shows the 'Public access' section with 'Not public' selected, and a note: 'This bucket is not publicly accessible because its public access prevention is enabled. Because of this restriction, objects in this bucket cannot be shared over the internet.' There are also sections for 'OBJECTS' and 'CONFIGURATION'.

The screenshot shows the Google Cloud Storage console for project 'My Project 39531'. A single bucket named 'elnbucket' is selected. The right-hand panel displays the 'Permissions for elnbucket' interface. It includes sections for 'Public access' (disabled), 'Access control' (fine-grained, object-level ACLs enabled), and a table for inherited roles. The table lists two entries: 'Compute Engine Service Agent (1)' and 'Container Registry Service Agent (1)'. The status bar at the bottom indicates '8:12 PM 9/26/24'.

Difference is that public access allows any user that has a link to access the bucket and can be **access** from the internet.

While private is limited access, only for permitted auth users.

- How can you manage access permissions for individual files in a bucket?

You can click on 3 dots on each file and select the users or user groups.

Exercise 6: Analyzing Data with BigQuery

Questions:

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

The screenshot shows the Google Cloud BigQuery Studio interface. On the left, there's a sidebar with sections like Analysis, Migration, and Administration. The main area has tabs for Explorer, Untitled query, and Untitled query. In the Explorer tab, a tree view shows a project named 'gold-courage-436813-j9' with various resources like Queries, Notebooks, Data canvases, etc. A modal window titled 'Create dataset' is open on the right. It has fields for 'Project ID' (set to 'gold-courage-436813-j9') and 'Dataset ID' (set to 'ds1'). Under 'Location type', 'Multi-region' is selected with 'US (multiple regions in United States)' chosen. There are sections for 'Default table expiration' (checkbox for 'Enable table expiration' and a dropdown for 'Default maximum table age'), 'Tags', and 'Advanced options'. At the bottom of the modal are 'CREATE DATASET' and 'CANCEL' buttons. A small notification at the bottom left says 'Deleted 1 bucket'.

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

The screenshot shows the Google Cloud BigQuery interface. On the left, the Explorer sidebar displays resources under the project 'gold-courage-436813-j9'. A query editor window titled 'Untitled query' contains the following SQL code:

```
1 SELECT
2   DATE(date) AS strike_date,
3   SUM(number_of_strikes) AS total_strikes
4 FROM
5   `your_project.your_dataset.lightning_strikes`
6 GROUP BY
7   strike_date
8 ORDER BY
9   strike_date;
10
```

An error message at the top right states: 'Invalid project ID 'your_project'. Project ID must be a valid project ID or a valid dataset ID.'

The screenshot shows the Google Cloud BigQuery interface after the query has been executed. The status bar indicates 'Query completed.' The results table displays the following data:

strike_date	total_strikes
1990-01-01	330444
1990-01-02	2412
1990-01-03	1101681
1990-01-04	3723625
1990-01-05	176679

The status bar also shows '8:37 PM 9/26/24'.

The screenshot shows two separate sessions of the Google Cloud BigQuery web interface.

Session 1 (Top):

- Explorer:** The sidebar shows a project named "gold-courage-436813-j9". Under "ds1", there is a dataset named "lightning_strikes".
- Untitled query:**

```

1 SELECT
2   AVG(number_of_strikes) AS avg_strikes_per_day
3   FROM
4   | gold-courage-436813-j9.ds1.lightning_strikes;
      
```
- Query results:**

Row	avg_strikes_per_day
1	9.758325082970...

Session 2 (Bottom):

- Explorer:** The sidebar shows a project named "gold-courage-436813-j9". Under "ds1", there is a dataset named "lightning_strikes".
- Untitled query:**

```

1 SELECT
2   date,
3   SUM(number_of_strikes) AS total_strikes
4   FROM
5   | gold-courage-436813-j9.ds1.lightning_strikes
6   GROUP BY
7   date;
      
```
- Query results:**

Row	date	total_strikes
1	1992-01-14 00:00:00 UTC	4960480
2	2000-02-25 00:00:00 UTC	15715364
3	1999-11-05 00:00:00 UTC	6589
4	2007-11-20 00:00:00 UTC	159728
5	2014-03-18 00:00:00 UTC	5742198

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

The screenshot displays two open tabs in a web browser:

- BigQuery Пользовательская инструкция SQL** (Looker Studio): This tab shows a bar chart titled "BigQuery Пользовательская инструкция SQL". The chart tracks "total_strikes" from January 1990 to August 2022. The y-axis represents "total_strikes" from 0 to 800. The x-axis lists dates from "29 янв. 1990, 00:00:00" to "20 янв. 2022, 00:00:00". The data shows a general decline over time, starting around 650 strikes and ending around 400 strikes. A tooltip for the first bar indicates 635 851 458.
- Untitled query** (Google Cloud BigQuery): This tab displays an SQL query titled "Untitled query" with the following code:

```
1 SELECT
2   EXTRACT(YEAR FROM date) AS year,
3   SUM(number_of_strikes) AS total_strikes
4 FROM
5   `gold-course-436813-j9.ds1.lightning_strikes`
6 GROUP BY
7   year
8 ORDER BY
9   year;
```

The results section shows the following data:

year	total_strikes
1990	9550948356
1991	10191263202
1992	985869352
1993	14572571258
1994	15106594020
1995	13702651000

The browser interface includes standard navigation controls, a search bar, and various extension icons. The status bar at the bottom right shows the date as 9/26/24 and the time as 8:48 PM.

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

Untitled query (Query completed)

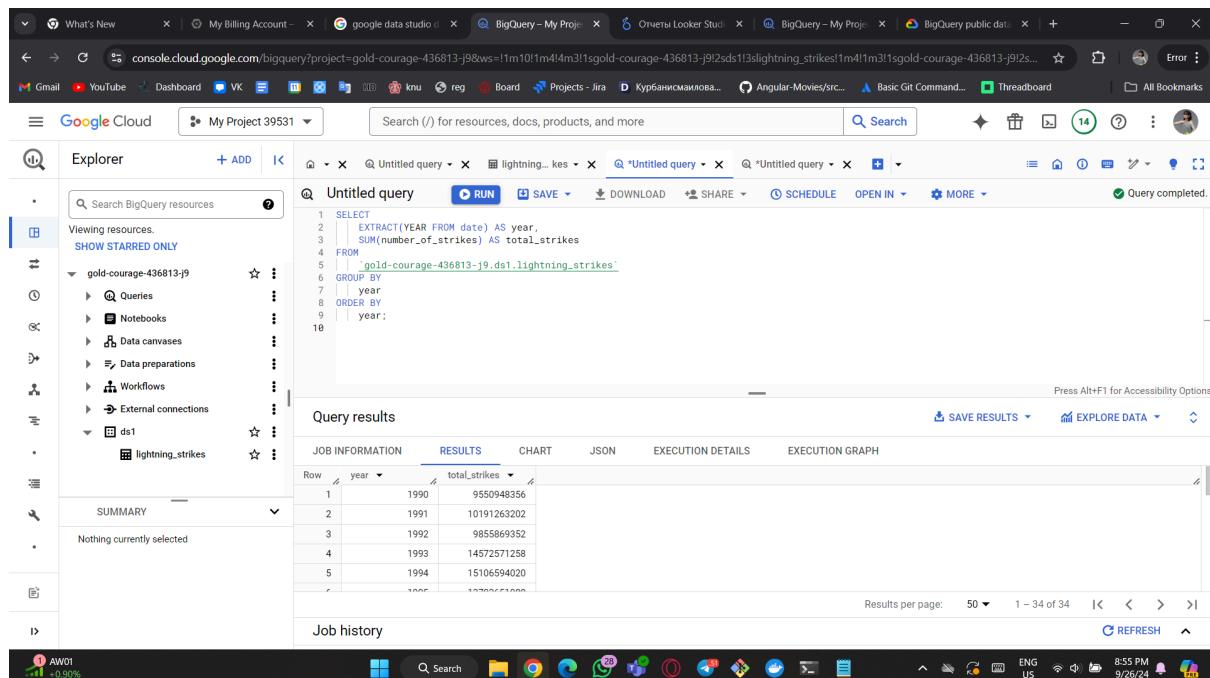
```
1 SELECT
2   EXTRACT(YEAR FROM date) AS year,
3   SUM(number_of_strikes) AS total_strikes
4 FROM
5   `gold-courage-436813-j9.ds1.lightning_strikes`
6 GROUP BY
7   year
8 ORDER BY
9   year;
10
```

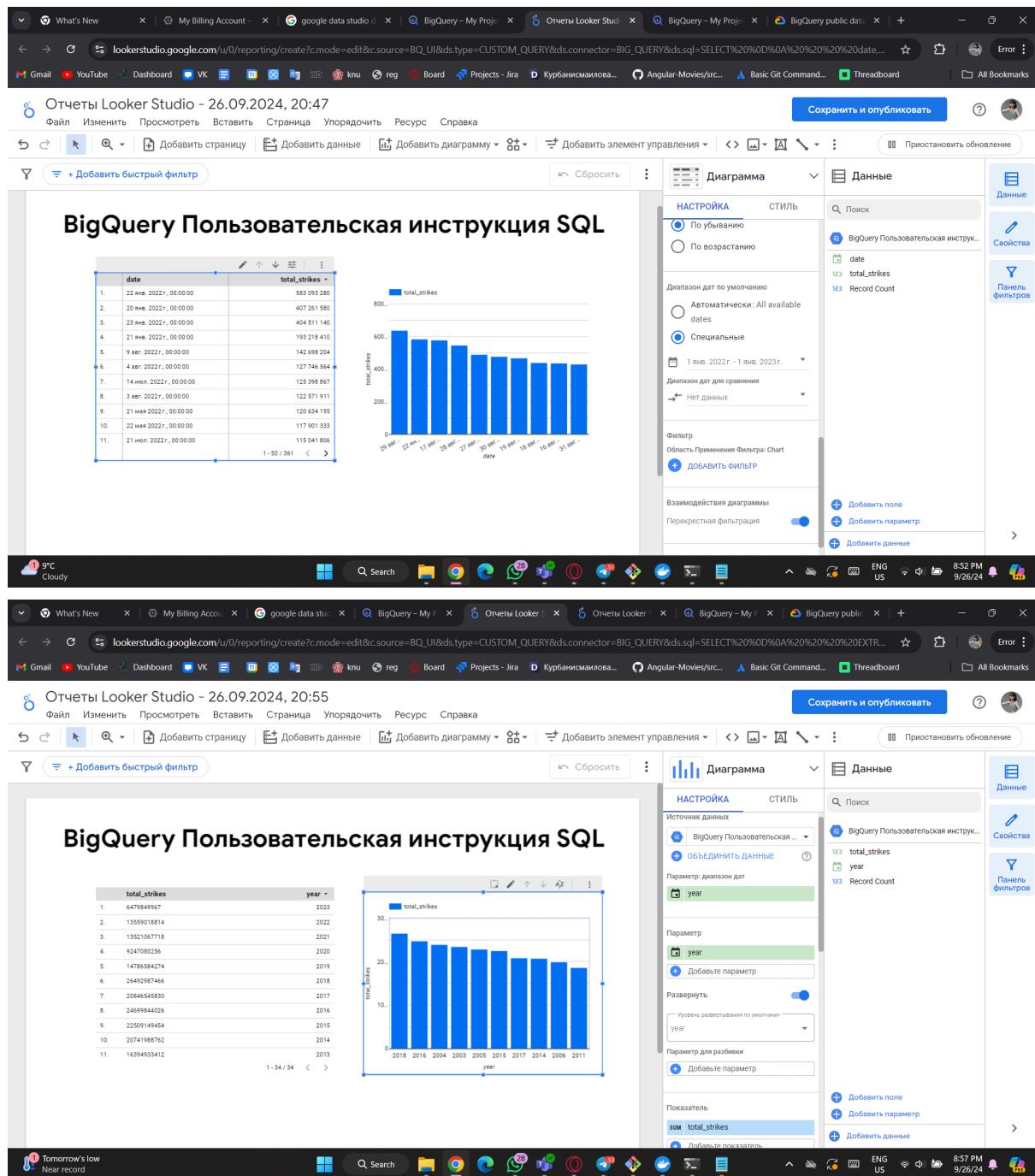
Query results

Row	year	total_strikes
1	1990	9550948356
2	1991	10191263202
3	1992	985569352
4	1993	14572571258
5	1994	15106594020
...

Job history

REFRESH





I used a dataset from public sources that shows amount of strikes in time of period,

I queried the times for each year, and I could analyze that 2022 was the most striked year since 1980.