Assignment 1, Cloud Computing

24MD0470 - Akhmetkan Azhar

Exercise 1: Understanding Cloud Computing Models

- **Objective**: Explore different cloud computing models and understand their key differences.
- **Steps**:
  - Research the three primary cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
  - Create a table comparing these models in terms of control, flexibility, and use cases.
  - Identify examples of services offered by Google Cloud Platform (GCP) under each model.
- **Questions**:
  - What are the main differences between IaaS, PaaS, and SaaS?

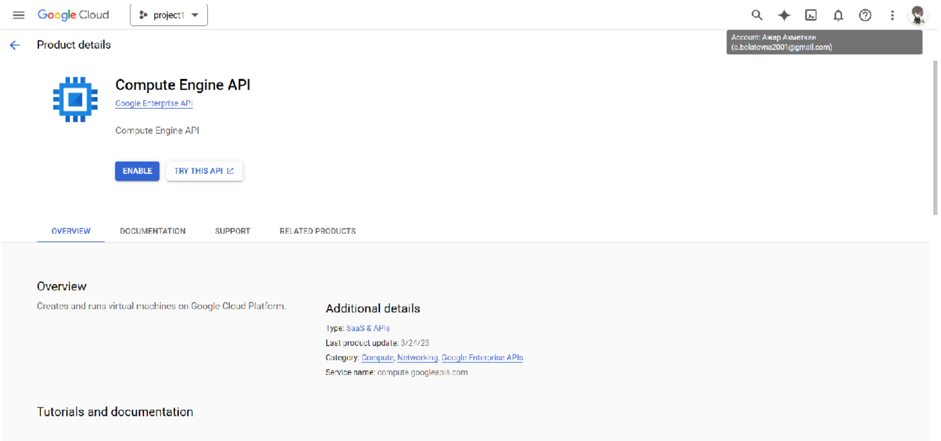
    IaaS or Infrastructure as a Service provides virtualized computing resources over the internet and is particularly useful for custom hardware setups. Meanwhile, **PaaS or Platform as a Service** allows users to manage applications without having to address the underlying infrastructure. PaaS is perfect for quickly building and deploying apps. On the other hand, **SaaS or Software as a Service** requires a subscription to access software features over the internet. SaaS offers the least control, as the provider manages everything, making it ideal for collaboration tools.
  - Which GCP services fall under each of these models?

    In the context of Google Cloud Platform, these models are well represented. For **IaaS**, services such as Google Compute Engine and Google Cloud Storage are prominent. In the **PaaS** category, Google App Engine and Google Cloud Functions cater to application development needs. In the **SaaS** realm, Google Workspace—including tools like Gmail and Google Docs—provides convenient solutions for everyday tasks.
  - Provide a real-world example where each cloud service model might be the most appropriate choice.

    Lets illustrate these concepts with real-world examples. If someone starts a new company and needed a custom server for an application then they would likely choose Google Compute Engine. Google App Engine would be the best option for working on a web app who want to focus on coding instead of server management. And for daily tasks like managing emails and collaborating with a team, subscribing to Google Workspace would be a best choice, as it requires no maintenance from the user.

Exercise 2: Exploring Google Cloud Platform's Core Services

- **Objective**: Get acquainted with the core services provided by Google Cloud Platform.
- **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
        - Google Kubernetes Engine (GKE)
        - App Engine
        - Cloud Storage
        - BigQuery
    - For each service, identify a potential use case in a business scenario.
- **Questions**:
    - What is the primary use case of Compute Engine?



Google Cloud | project1

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Product details

Compute Engine API

Google Enterprise API

Compute Engine API

ENABLE | TRY THIS API

OVERVIEW | DOCUMENTATION | SUPPORT | RELATED PRODUCTS

Overview

Creates and runs virtual machines on Google Cloud Platform.

Additional details

Type: SaaS & APIs

Last product update: 3/24/23

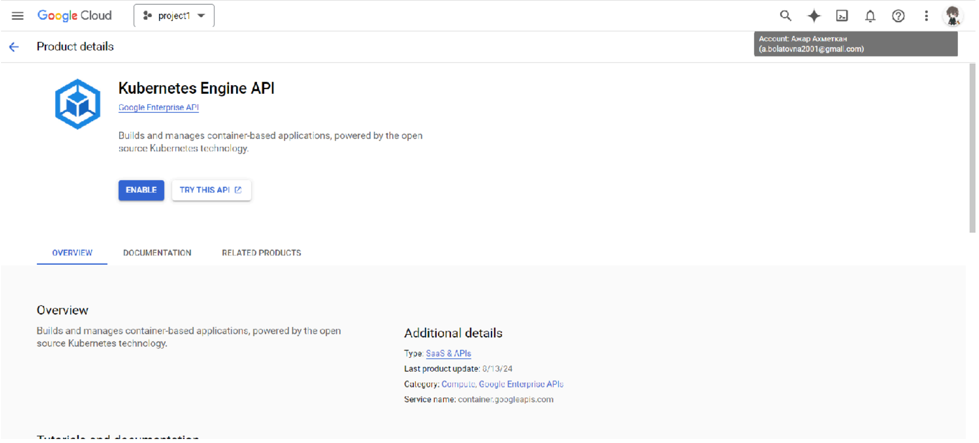
Category: Compute, Networking, Google Enterprise APIs

Service name: compute.googleapis.com

Tutorials and documentation

the primary use case of Compute Engine is to offer scalable and customizable virtual machines for different tasks. Businesses can use it to run applications, host websites, or handle batch processing. It’s especially helpful for companies that want the flexibility to adjust their virtual machines according to specific needs, like CPU, memory, and storage options.

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



Google Cloud | project1

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Product details

Kubernetes Engine API

Google Enterprise API

Builds and manages container-based applications, powered by the open source Kubernetes technology.

ENABLE | TRY THIS API

OVERVIEW | DOCUMENTATION | RELATED PRODUCTS

Overview

Builds and manages container-based applications, powered by the open source Kubernetes technology.

Additional details

Type: SaaS & APIs

Last product update: 8/13/24

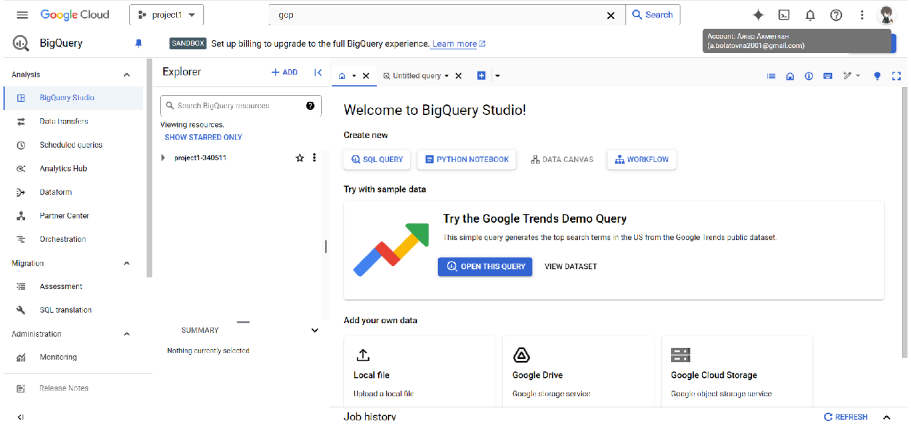
Category: Compute, Google Enterprise APIs

Service name: container.googleapis.com

Tutorials and documentation

Google Kubernetes Engine simplifies the management of containerized applications by automating many tasks related to deployment and scaling. It handles load balancing, scaling, and monitoring, allowing developers to focus more on building their apps instead of worrying about the infrastructure. Also, it automates updates and health checks, making the entire process more efficient.

- What advantages does Cloud Storage offer for data management?
  Cloud Storage offers several benefits for managing data. It is highly scalable - allowing users to store and access almost unlimited amounts of data without the fear of running out of space. It also provides high durability and availability, which automatically copying data across multiple locations. Another advantage is accessibility - users can reach their data from anywhere on the internet, making sharing and collaboration easy. Also it is cost-effective, with different pricing options that help businesses find what fits their budget and needs best.
- Why would a business choose BigQuery for their data analysis needs?



Set up billing to upgrade to the full BigQuery experience. Learn more

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Viewing resources.

Nothing currently selected

Welcome to BigQuery Studio!

Try the Google Trends Demo Query

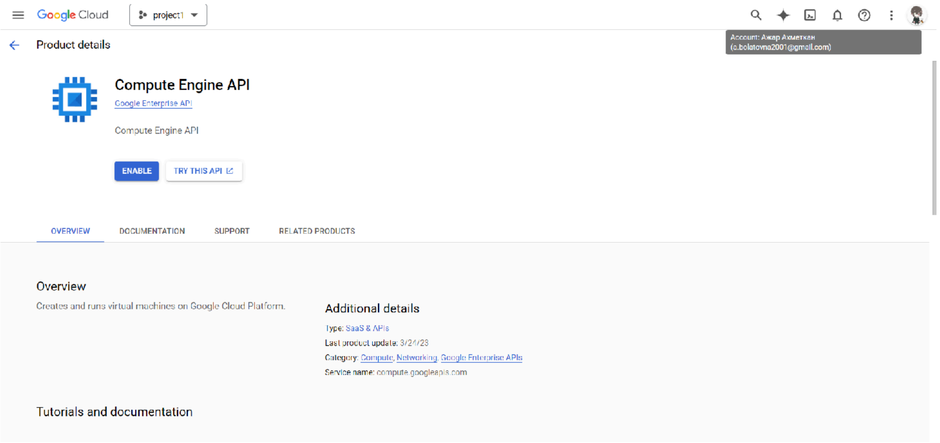
This simple query generates the top search terms in the US from the Google Trends public dataset.

A business choose BigQuery for data analysis because it can quickly and efficiently manage large datasets. As a fully managed data warehouse, it enables real-time analytics and fast SQL queries, allowing companies to gain insights without handling complex infrastructure. Its integration with other Google Cloud services and support for machine learning make it an excellent option for businesses that want to use data for better decision making.

Exercise 3: Creating and Managing Virtual Machines with Compute Engine

- **Objective**: Learn how to create, manage, and interact with virtual machines (VMs) using Compute Engine.
- **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.
  - Connect to the VM using SSH and install a basic web server (e.g., Apache or Nginx).
  - Stop, start, and delete the VM through the console.
- **Questions**:
  What steps did you follow to create the VM?
  To create a VM instance in Google Cloud Console, I navigated to the Compute Engine

section and clicked button "enable" and add billing account.



Compute Engine API

Compute Engine API

Overview

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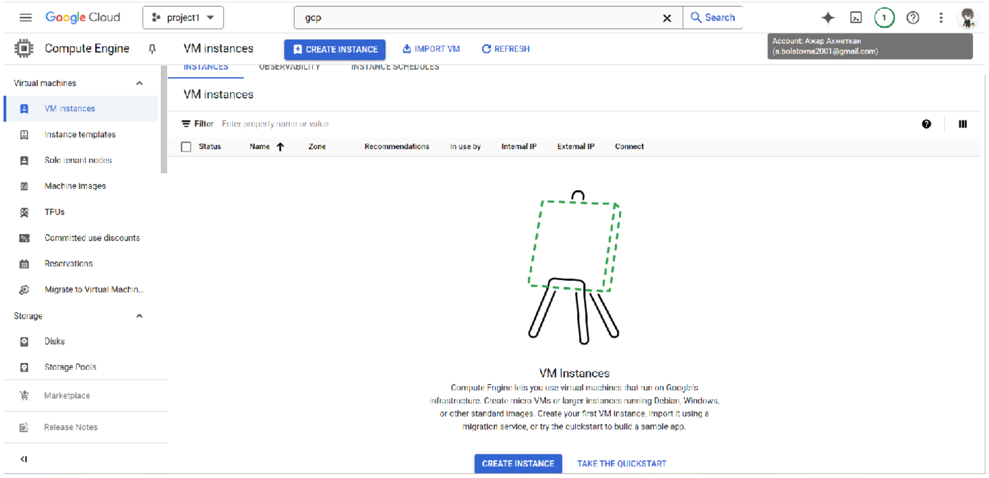
Tutorials and documentation

Next,clicked on “Create Instance.”

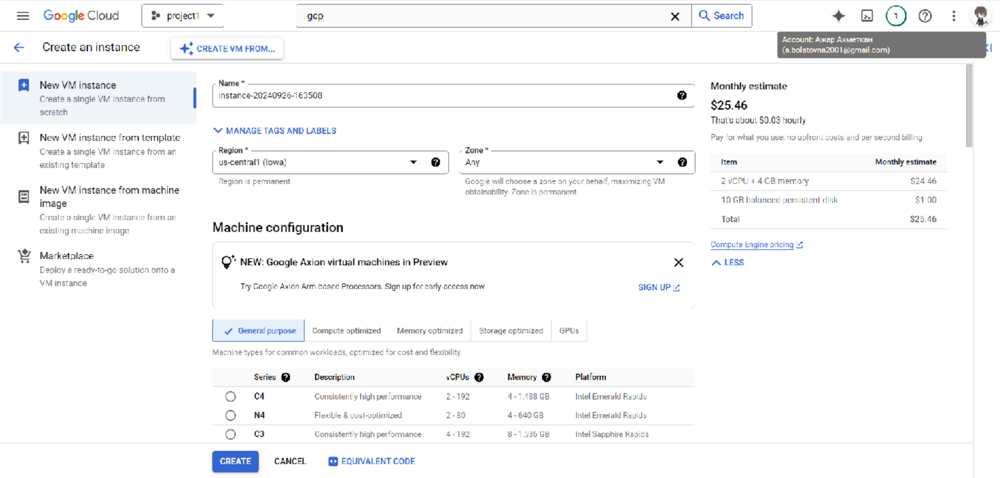


VM instances

VM Instances

Compute Engine lets you use virtual machines that run on Google's infrastructure. Create micro VMs or larger instances running Debian, Windows, or other standard images. Create your first VM instance, import it using a migration service, or try the quickstart to build a sample app.

I then configured the VM by selecting the machine type, choosing the region, and picking the operating system I wanted to use. After confirming the settings, I clicked on the “Create” button to launch the VM.



New VM instance
Create a single VM instance from scratch

New VM instance from template
Create a single VM instance from an existing template

New VM instance from machine image
Create a single VM instance from an existing machine image

Marketplace
Deploy a ready-to-go solution onto a VM instance

Name * instance-20240926-163508

Region * us-central1 (Iowa)
Region is permanent

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

Machine configuration

NEW: Google Axion virtual machines in Preview

Try Google Axion Arm based Processors. Sign up for early access now

Machine types for common workloads, optimized for cost and flexibility

	Series	Description	vCPUs	Memory	Platform
○	C4	Consistently high performance	2 - 192	4 - 1,488 GB	Intel Emerald Rapids
○	N4	Flexible & cost-optimized	2 - 80	4 - 640 GB	Intel Emerald Rapids
○	C3	Consistently high performance	4 - 192	8 - 1,536 GB	Intel Sapphire Rapids

Monthly estimate

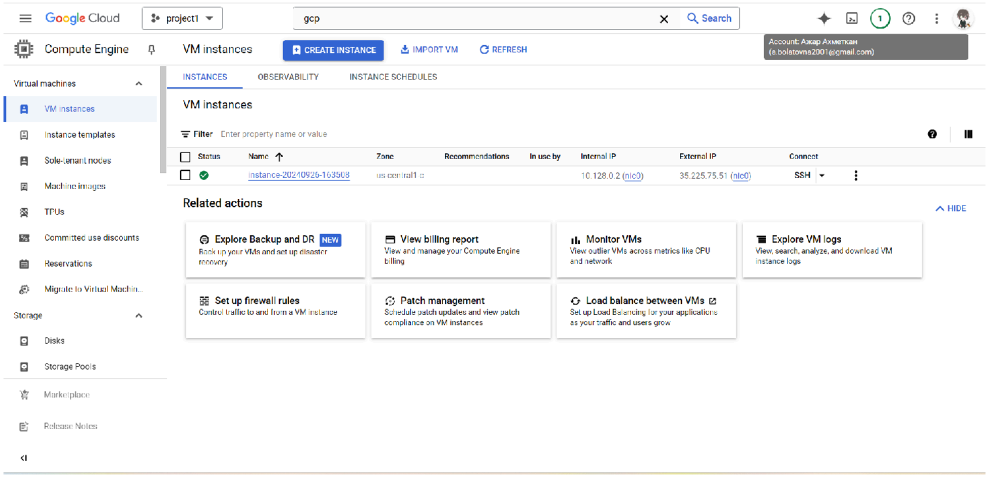
$25.46

That's about $0.03 hourly

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

Item	Monthly estimate
2 vCPU + 4 GB memory	$24.46
10 GB balanced persistent disk	$1.00
Total	$25.46

Finally, below is my new VM instance



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VM instances

Filter Enter property name or value

□	Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
□	✓	instance-20240926-163508	us-central1-c			10.128.0.2 (nic0)	35.225.75.51 (nic0)	SSH

Related actions

Explore Backup and DR NEW
Back up your VMs and set up disaster recovery

View billing report
View and manage your Compute Engine billing

Monitor VMs
View outlier VMs across metrics like CPU and network

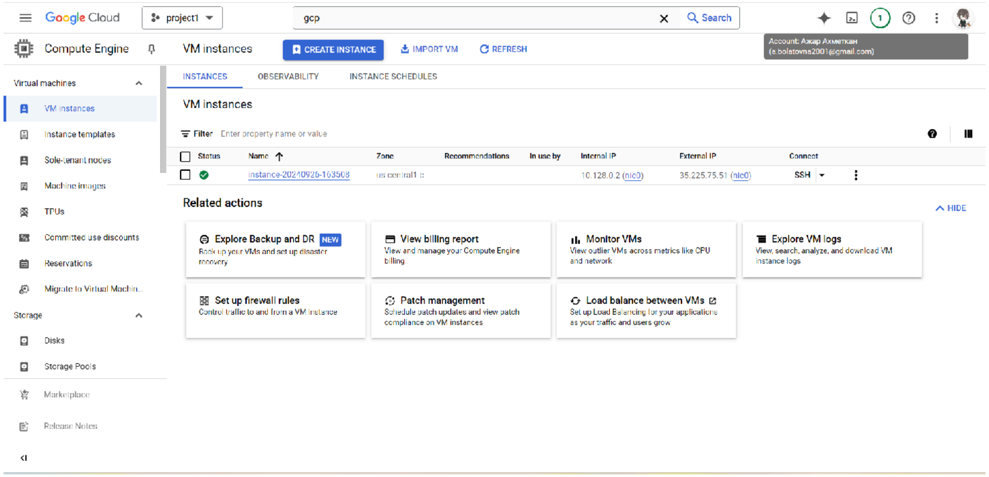
Explore VM logs
View, search, analyze, and download VM instance logs

Set up firewall rules
Control traffic to and from a VM instance

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

- How did you connect to the VM, and what commands did you use to install the web server?
  To connect to the VM, I used SSH. In the Google Cloud Console, I found the VM instance I created and clicked on the “SSH” button next to it.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VM instances

Filter Enter property name or value

□	Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
□	✓	instance-20240926-163508	us-central1-c			10.128.0.2 (nic0)	35.225.75.51 (nic0)	SSH

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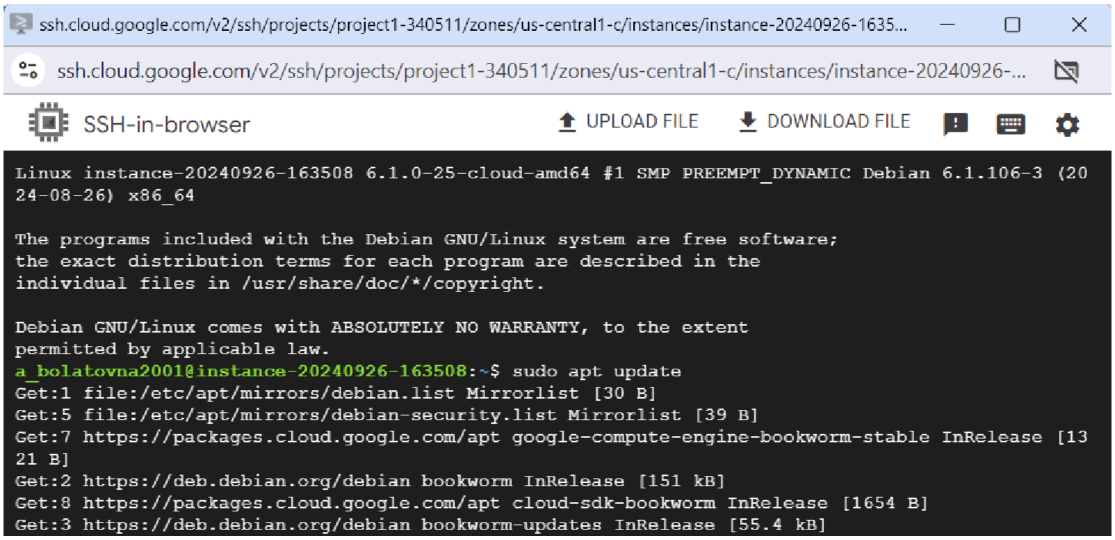
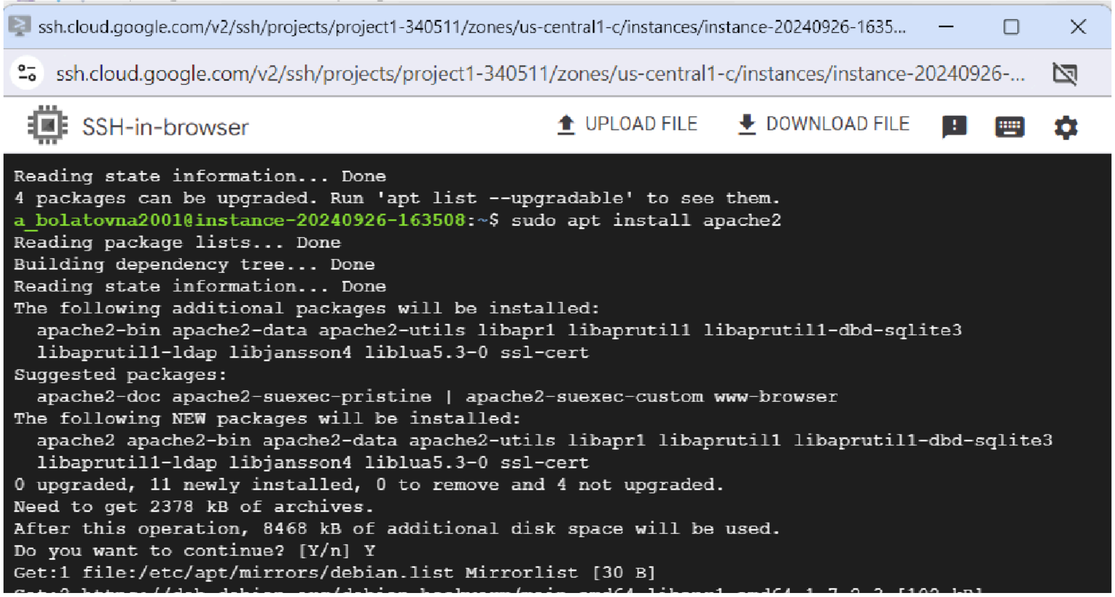
This opened a terminal window where I could run commands. To install a basic web server Apache, i used

--sudo apt update

--sudo apt install apache2

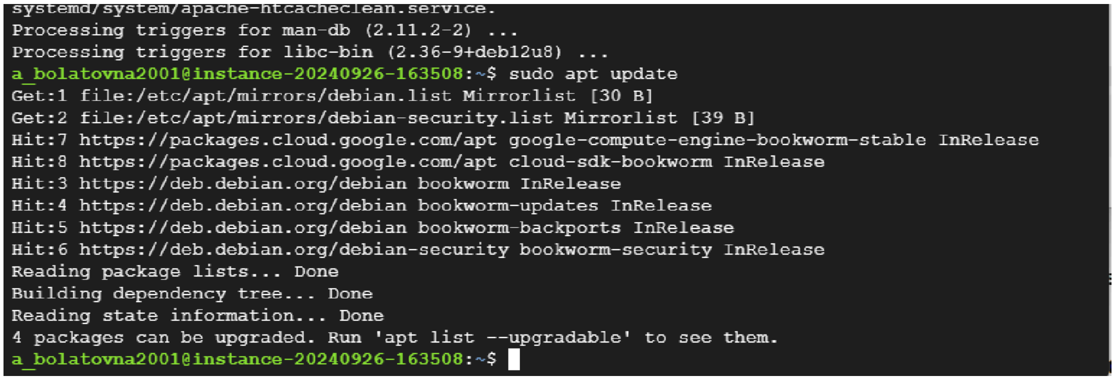

ssh.cloud.google.com/v2/ssh/projects/project1-340511/zones/us-central1-c/instances/instance-20240926-1635...
ssh.cloud.google.com/v2/ssh/projects/project1-340511/zones/us-central1-c/instances/instance-20240926-...
SSH-in-browser
UPLOAD FILE
DOWNLOAD FILE

```
Linux instance-20240926-163508 6.1.0-25-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.106-3 (20
24-08-26) 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.
a_bolatovna2001@instance-20240926-163508:~$ 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 [13
21 B]
Get:2 https://deb.debian.org/debian bookworm InRelease [151 kB]
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease [1654 B]
Get:3 https://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]
```

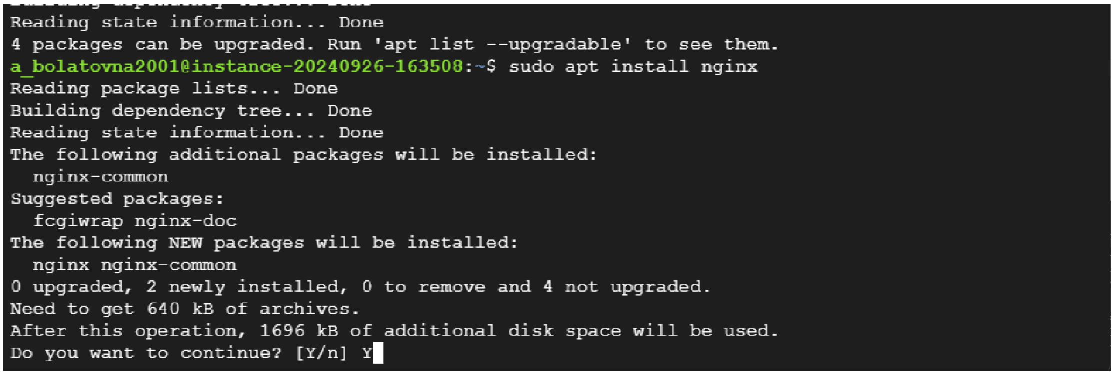

ssh.cloud.google.com/v2/ssh/projects/project1-340511/zones/us-central1-c/instances/instance-20240926-1635...
ssh.cloud.google.com/v2/ssh/projects/project1-340511/zones/us-central1-c/instances/instance-20240926-...
SSH-in-browser
UPLOAD FILE
DOWNLOAD FILE

```
Reading state information... Done
4 packages can be upgraded. Run 'apt list --upgradable' to see them.
a_bolatovna2001@instance-20240926-163508:~$ sudo apt install apache2
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3
  libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3
  libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
0 upgraded, 11 newly installed, 0 to remove and 4 not upgraded.
Need to get 2378 kB of archives.
After this operation, 8468 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
```

To install a basic web server Nginx, i used
--sudo apt update
--sudo apt install nginx

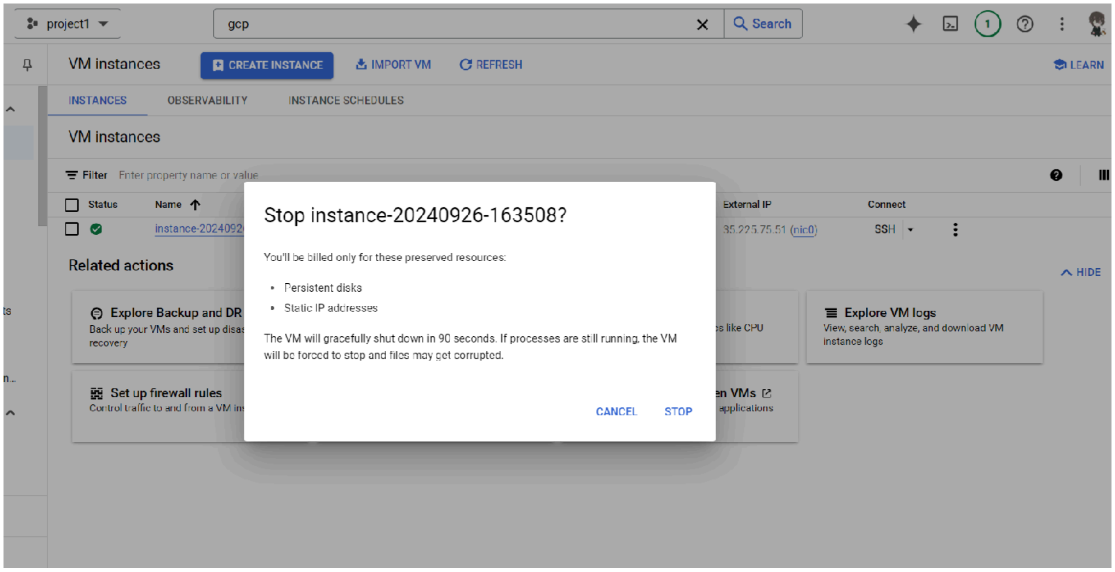


```
systemd/system/apache-htcacheclean.service.
Processing triggers for man-db (2.11.2-2) ...
Processing triggers for libc-bin (2.36-9+deb12u8) ...
a_bolatovna2001@instance-20240926-163508:~$ sudo apt update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:2 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
Hit:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease
Hit:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease
Hit:3 https://deb.debian.org/debian bookworm InRelease
Hit:4 https://deb.debian.org/debian bookworm-updates InRelease
Hit:5 https://deb.debian.org/debian bookworm-backports InRelease
Hit:6 https://deb.debian.org/debian-security bookworm-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
4 packages can be upgraded. Run 'apt list --upgradable' to see them.
a_bolatovna2001@instance-20240926-163508:~$
```



```
Building dependency tree... Done
Reading state information... Done
4 packages can be upgraded. Run 'apt list --upgradable' to see them.
a_bolatovna2001@instance-20240926-163508:~$ sudo apt install nginx
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  nginx-common
Suggested packages:
  fcgiwrap nginx-doc
The following NEW packages will be installed:
  nginx nginx-common
0 upgraded, 2 newly installed, 0 to remove and 4 not upgraded.
Need to get 640 kB of archives.
After this operation, 1696 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
```

- What happens to the VM and its data when it is stopped versus when it is deleted?
  When the VM is stopped, it keeps all its data and settings, so it can be started again later. While the VM is stopped, You won't be charged for the resources while the VM is stopped, but you may still have charges for the persistent disk and any static IP addresses.

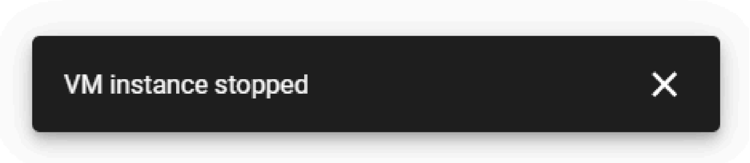


Stop instance-20240926-163508?

You'll be billed only for these preserved resources:

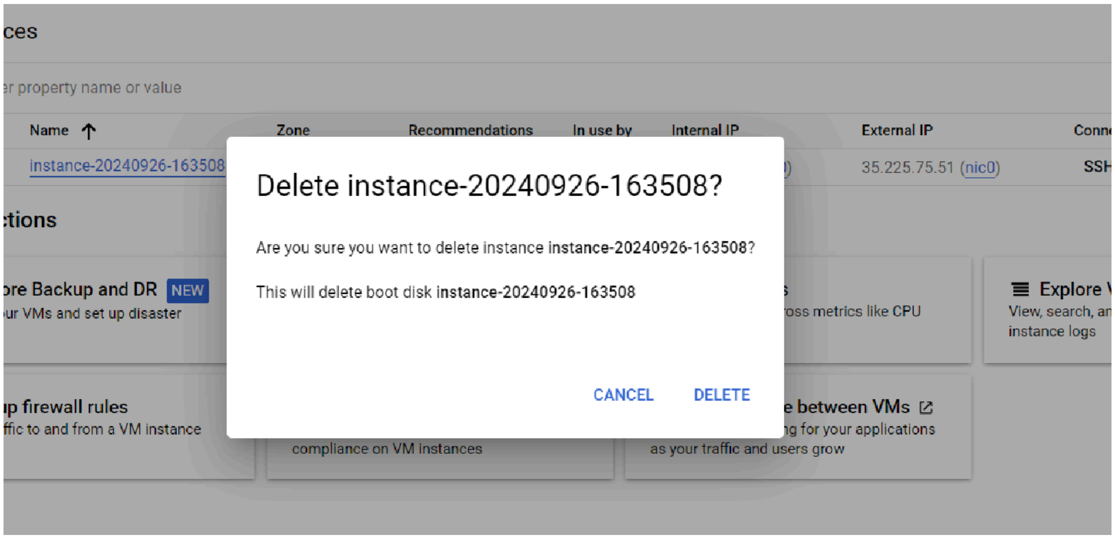
- Persistent disks
- Static IP addresses

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.



VM instance stopped ✕

If the VM is deleted, all data on it is permanently lost, including any installed software and settings. However, if the data was saved on a separate persistent disk, that disk can be kept for future use.



ces

r property name or value

Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Conn
instance-20240926-163508				)	35.225.75.51 (nic0)	SSH

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ip firewall rules
ffic to and from a VM instance

compliance on VM instances

s
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e between VMs
ng for your applications
as your traffic and users grow

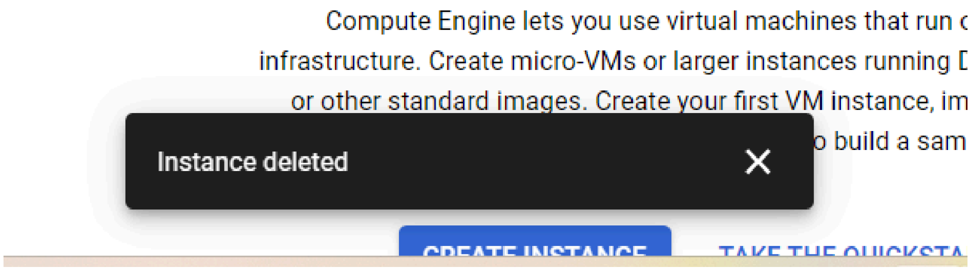
Explore V
View, search, ar
instance logs

Delete instance-20240926-163508?

Are you sure you want to delete instance **instance-20240926-163508**?

This will delete boot disk **instance-20240926-163508**

CANCEL DELETE



Compute Engine lets you use virtual machines that run c
infrastructure. Create micro-VMs or larger instances running D
or other standard images. Create your first VM instance, im
o build a sam

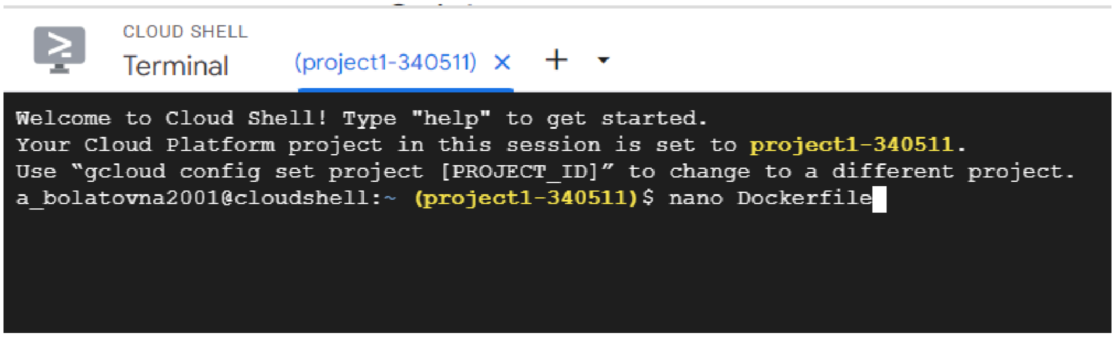
Instance deleted ✕

CREATE INSTANCE TAKE THE QUICKSTA

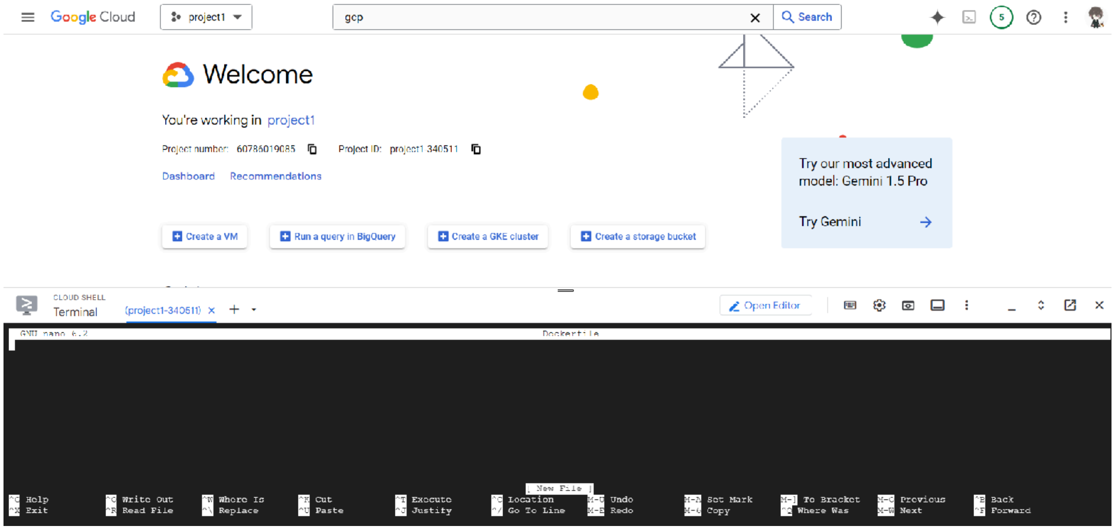
Exercise 4: Deploying a Containerized Application on Google Kubernetes Engine (GKE)

- **Objective**: Understand how to deploy and manage containerized applications using Google Kubernetes Engine.
- **Steps**:
  - Create a simple Docker container for a web application.
  - 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.

- **Questions**:
    - How did you create and push the Docker container to GCR?
      I opened the Terminal, using Google Cloud Shell, open it from the Google Cloud Console and use a text editor nano in the terminal to create a Dockerfile.



```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to project1-340511.
Use “gcloud config set project [PROJECT_ID]” to change to a different project.
a_bolatovna2001@cloudshell:~ (project1-340511)$ nano Dockerfile
```

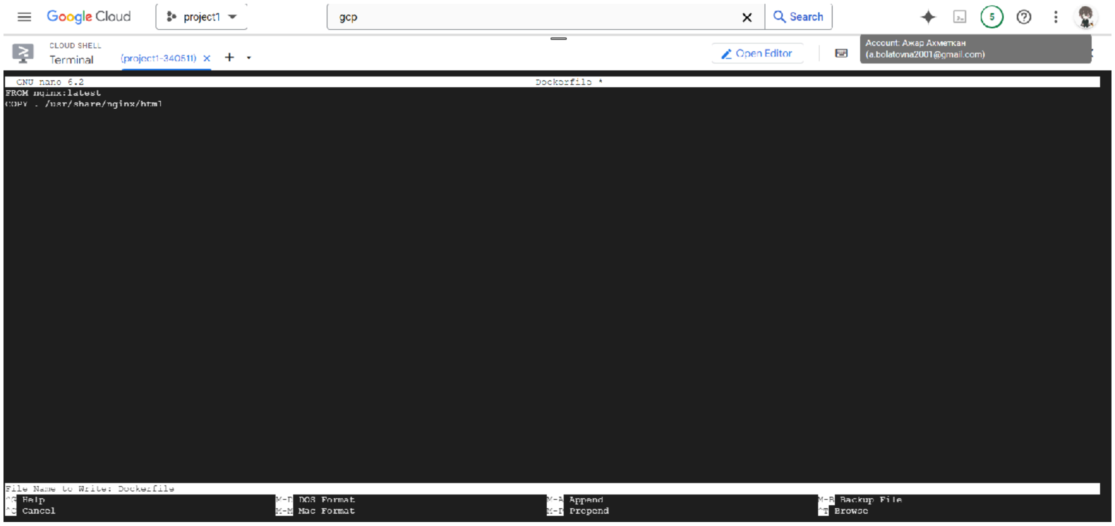


You're working in project1

Project number: 60786019085 Project ID: project1-340511

```
  GNU nano 6.2                          Dockerfile




                                      [ New File ]
^G Help      ^O Write Out  ^W Where Is  ^K Cut      ^T Execute  ^C Location  M-U Undo   M-A Set Mark  M-] To Bracket  M-Q Previous  ^B Back
^X Exit      ^R Read File  ^\ Replace   ^U Paste    ^J Justify  ^/ Go To Line M-E Redo  M-6 Copy      ^Q Where Was    M-W Next      ^F Forward
```

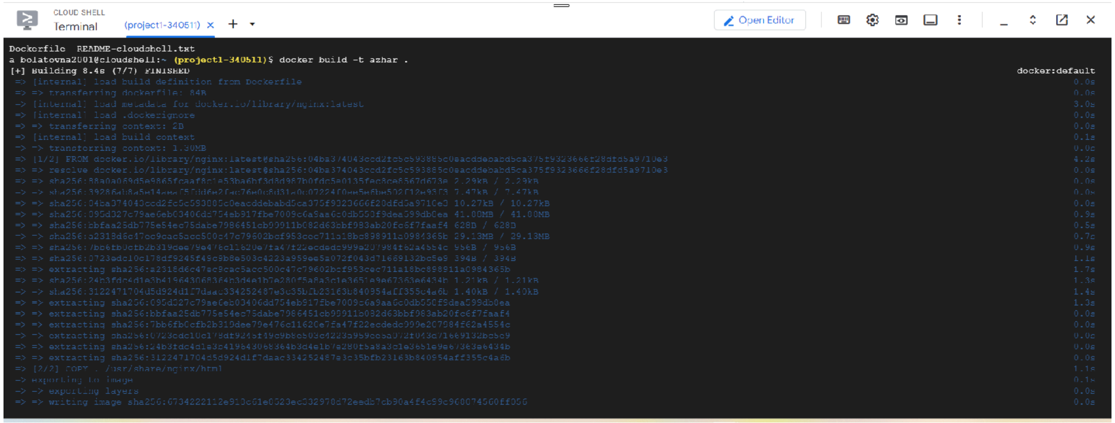
Write the necessary instructions simple web application using Nginx in the Dockerfile and save it with pressing Ctrl + O



```
  GNU nano 6.2                          Dockerfile *
FROM nginx:latest
COPY . /usr/share/nginx/html




File Name to Write: Dockerfile
^G Help          M-D DOS Format      M-A Append       M-B Backup File
^C Cancel        M-M Mac Format      M-P Prepend      ^T Browse
```

After saving, pressed Ctrl + X to exit the Nano editor and proceeded to build Docker image "azhar" by running the following command in the terminal:

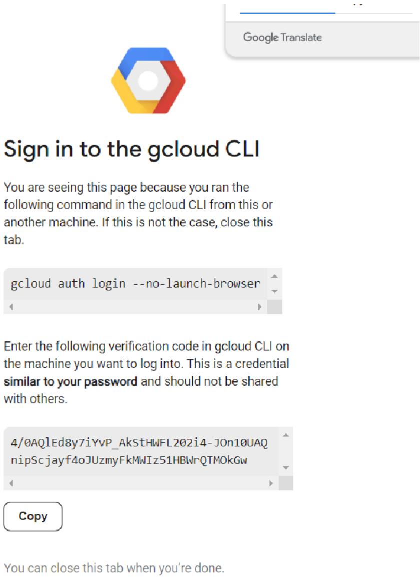
--docker build -t azhar .



```
Dockerfile  README-cloudshell.txt
a_bolatovna2001@cloudshell:~ (project1-340511)$ docker build -t azhar .
[+] Building 8.4s (7/7) FINISHED                                                                                          docker:default
 => [internal] load build definition from Dockerfile                                                                                 0.0s
 => => transferring dockerfile: 84B                                                                                                  0.0s
 => [internal] load metadata for docker.io/library/nginx:latest                                                                      3.0s
 => [internal] load .dockerignore                                                                                                    0.0s
 => => transferring context: 2B                                                                                                      0.0s
 => [internal] load build context                                                                                                    0.1s
 => => transferring context: 1.30MB                                                                                                  0.0s
 => [1/2] FROM docker.io/library/nginx:latest@sha256:04ba374043ccd2fc5c593885c0eacddebabd5ca375f9323666f28dfd5a9710e3                4.2s
 => => resolve docker.io/library/nginx:latest@sha256:04ba374043ccd2fc5c593885c0eacddebabd5ca375f9323666f28dfd5a9710e3                0.0s
 => => sha256:88a0a069d5e9865fcaaf8c1e53ba6bf3d8d987b0fdc5e0135fec8ce8567d673e 2.29kB / 2.29kB                                       0.0s
 => => sha256:39286ab8a5e14dea f5 f0d6e2fac76e0c8d31a0c0722 4f0ee5e6be502f12e93f3 7.47kB / 7.47kB                                    0.0s
 => => sha256:04ba374043ccd2fc5c593885c0eacddebabd5ca375f9323666f28dfd5a9710e3 10.27kB / 10.27kB                                     0.0s
 => => sha256:095d327c79ae6eb03406dd754eb917fbe7009c6a9aa6c0db550f9dea599db0ea 41.00MB / 41.00MB                                     0.9s
 => => sha256:bbfaa25db775e54ec75dabe7986451cb99911b082d63bbf983ab20fc6f7faaf4 628B / 628B                                           0.5s
 => => sha256:a2318d6c47ec9cac5acc500c47c79602bcf953cec711a18bc898911a0984365b 29.13MB / 29.13MB                                     0.7s
 => => sha256:7bb6fb0cfb2b319dee79e476c11620e7fa47f22ecdedc999e207984f62a4554c 956B / 956B                                           0.9s
 => => sha256:0723edc10c178df9245f49c9b8e503c4223a959ee5a072f043d71669132bc5e9 394B / 394B                                           1.1s
 => => extracting sha256:a2318d6c47ec9cac5acc500c47c79602bcf953cec711a18bc898911a0984365b                                            1.7s
 => => sha256:24b3fdc4d1e3b419643068364b3d4e1b7e280f5a8a3c1e3651e9e67363e6434b 1.21kB / 1.21kB                                       1.3s
 => => sha256:3122471704d5d924d1f7daac334252487e3c35bfb23163b840954aff355c4a6b 1.40kB / 1.40kB                                       1.4s
 => => extracting sha256:095d327c79ae6eb03406dd754eb917fbe7009c6a9aa6c0db550f9dea599db0ea                                            1.3s
 => => extracting sha256:bbfaa25db775e54ec75dabe7986451cb99911b082d63bbf983ab20fc6f7faaf4                                            0.0s
 => => extracting sha256:7bb6fb0cfb2b319dee79e476c11620e7fa47f22ecdedc999e207984f62a4554c                                            0.0s
 => => extracting sha256:0723edc10c178df9245f49c9b8e503c4223a959ee5a072f043d71669132bc5e9                                            0.0s
 => => extracting sha256:24b3fdc4d1e3b419643068364b3d4e1b7e280f5a8a3c1e3651e9e67363e6434b                                            0.0s
 => => extracting sha256:3122471704d5d924d1f7daac334252487e3c35bfb23163b840954aff355c4a6b                                            0.0s
 => [2/2] COPY . /usr/share/nginx/html                                                                                               1.1s
 => exporting to image                                                                                                               0.1s
 => => exporting layers                                                                                                              0.0s
 => => writing image sha256:6734222112e918c61e8523ec332978d72eedb7cb90a4f4c99c968074560ff056                                         0.0s
```

Next step was authenticate with Google Cloud, still in the terminal, I logged in to Google Cloud account and get window with password:

--gcloud auth login



Sign in to the gcloud CLI

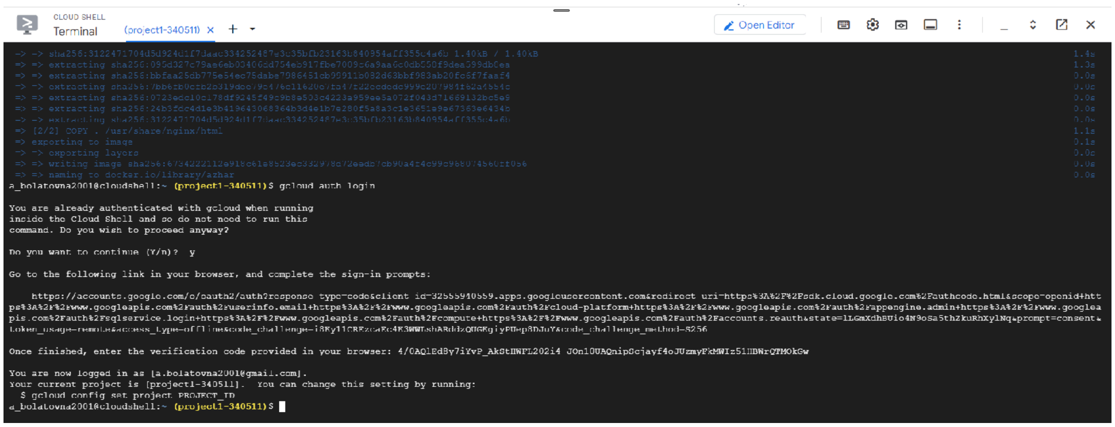
You are seeing this page because you ran the following command in the gcloud CLI from this or another machine. If this is not the case, close this tab.

```
gcloud auth login --no-launch-browser
```

Enter the following verification code in gcloud CLI on the machine you want to log into. This is a credential **similar to your password** and should not be shared with others.

```
4/0AQlEd8y7iYvP_AkStHWFL202i4-JOn10UAQ
nipScjayf4oJUzmyFkMWIz51HBWrQTMOkGw
```

You can close this tab when you're done.

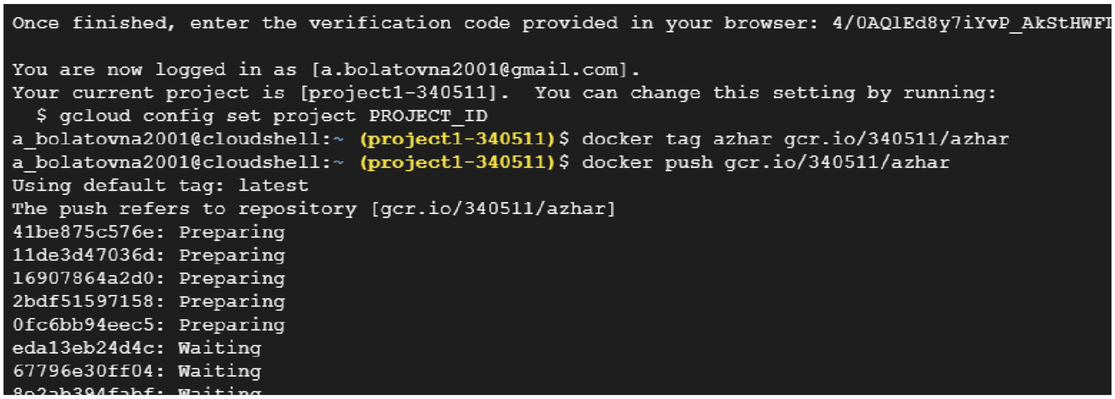


```
 => => sha256:3122471704d5d924d1f7daac334252487e3c35bfb23163b840954aff355c4a6b 1.40kB / 1.40kB                                       1.4s
 => => extracting sha256:095d327c79ae6eb03406dd754eb917fbe7009c6a9aa6c0db550f9dea599db0ea                                            1.3s
 => => extracting sha256:bbfaa25db775e54ec75dabe7986451cb99911b082d63bbf983ab20fc6f7faaf4                                            0.0s
 => => extracting sha256:7bb6fb0cfb2b319dee79e476c11620e7fa47f22ecdedc999e207984f62a4554c                                            0.0s
 => => extracting sha256:0723edc10c178df9245f49c9b8e503c4223a959ee5a072f043d71669132bc5e9                                            0.0s
 => => extracting sha256:24b3fdc4d1e3b419643068364b3d4e1b7e280f5a8a3c1e3651e9e67363e6434b                                            0.0s
 => => extracting sha256:3122471704d5d924d1f7daac334252487e3c35bfb23163b840954aff355c4a6b                                            0.0s
 => [2/2] COPY . /usr/share/nginx/html                                                                                               1.1s
 => exporting to image                                                                                                               0.1s
 => => exporting layers                                                                                                              0.0s
 => => writing image sha256:6734222112e918c61e8523ec332978d72eedb7cb90a4f4c99c968074560ff056                                         0.0s
 => => naming to docker.io/library/azhar                                                                                             0.0s
a_bolatovna2001@cloudshell:~ (project1-340511)$ gcloud auth login

You are already authenticated with gcloud when running
inside the Cloud Shell and so do not need to run this
command. Do you wish to proceed anyway?

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

Go to the following link in your browser, and complete the sign-in prompts:

    https://accounts.google.com/o/oauth2/auth?response_type=code&client_id=32555940559.apps.googleusercontent.com&redirect_uri=https%3A%2F%2Fsdk.cloud.google.com%2Fauthcode.html&scope=openid+htt
ps%3A%2F%2Fwww.googleapis.com%2Fauth%2Fuserinfo.email+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcloud-platform+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fappengine.admin+https%3A%2F%2Fwww.googlea
pis.com%2Fauth%2Fsqlservice.login+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcompute+https%3A%2F%2Fwww.googleapis.com%2Fauth%2Faccounts.reauth&state=1LGmXdhBUio4N9oSa5thZkuRhXylNq&prompt=consent&
token_usage=remote&access_type=offline&code_challenge=i8Ky11CREzcaEc4K3WWTshARddzQUGKgiyPUep8DJuY&code_challenge_method=S256

Once finished, enter the verification code provided in your browser: 4/0AQlEdBy7iYvP_AkStHWFL202i4 JOn10UAQnipScjayf4oJUzmyFkMWIz51HBWrQTMOkGw

You are now logged in as [a.bolatovna2001@gmail.com].
Your current project is [project1-340511].  You can change this setting by running:
  $ gcloud config set project PROJECT_ID
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

Using the terminal I tagged image for Google Container Registry and finally, pushed tagged image to Google Container Registry by commands below:

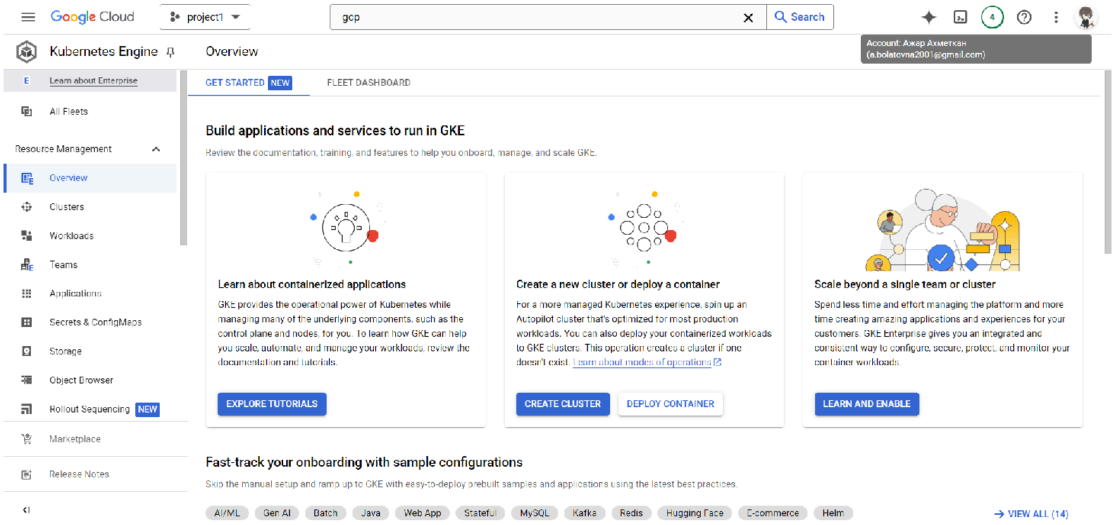
--docker tag azhar gcr.io/340511/azhar

--docker push gcr.io/340511/azhar



```
Once finished, enter the verification code provided in your browser: 4/0AQlEd8y7iYvP_AkStHWFI

You are now logged in as [a.bolatovna2001@gmail.com].
Your current project is [project1-340511].  You can change this setting by running:
  $ gcloud config set project PROJECT_ID
a_bolatovna2001@cloudshell:~ (project1-340511)$ docker tag azhar gcr.io/340511/azhar
a_bolatovna2001@cloudshell:~ (project1-340511)$ docker push gcr.io/340511/azhar
Using default tag: latest
The push refers to repository [gcr.io/340511/azhar]
41be875c576e: Preparing
11de3d47036d: Preparing
16907864a2d0: Preparing
2bdf51597158: Preparing
0fc6bb94eec5: Preparing
eda13eb24d4c: Waiting
67796e30ff04: Waiting
8e2ab394fabf: Waiting
```

- What steps were involved in setting up the GKE cluster?
  To set up the GKE cluster, I navigated to the Google Cloud Console and selected Kubernetes Engine. I clicked on “Create Cluster” configured the settings, such as choosing the cluster type, specifying the number of nodes, and selecting the region.



Build applications and services to run in GKE

Review the documentation, training, and features to help you onboard, manage, and scale GKE.

Learn about containerized applications

GKE provides the operational power of Kubernetes while managing many of the underlying components, such as the control plane and nodes, for you. To learn how GKE can help you scale, automate, and manage your workloads, review the documentation and tutorials.

Create a new cluster or deploy a container

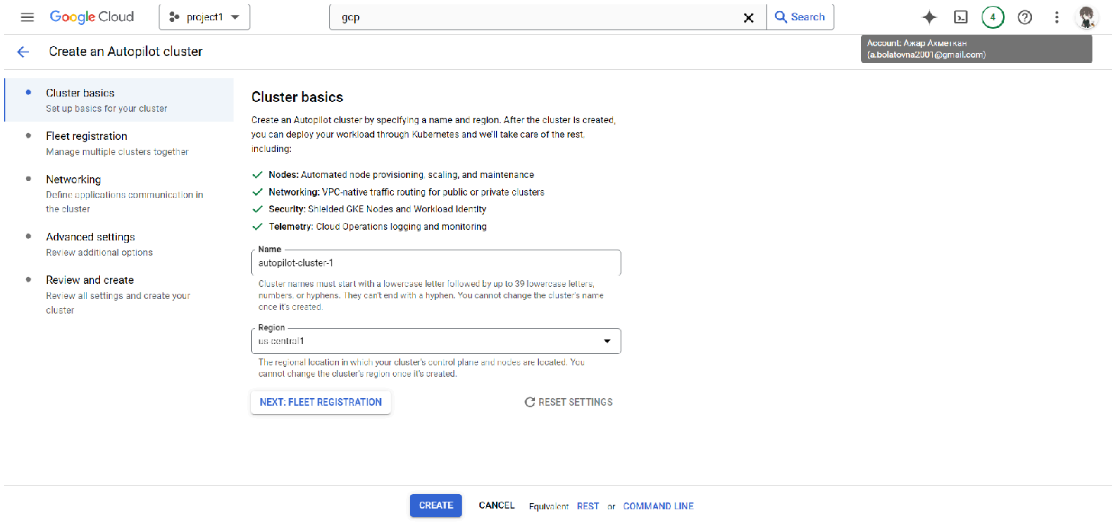
For a more managed Kubernetes experience, spin up an Autopilot cluster that's optimized for most production workloads. You can also deploy your containerized workloads to GKE clusters. This operation creates a cluster if one doesn't exist. Learn about modes of operations

Scale beyond a single team or cluster

Spend less time and effort managing the platform and more time creating amazing applications and experiences for your customers. GKE Enterprise gives you an integrated and consistent way to configure, secure, protect, and monitor your container workloads.

Fast-track your onboarding with sample configurations

Skip the manual setup and ramp up to GKE with easy-to-deploy prebuilt samples and applications using the latest best practices.


Google Cloud
project1
gcp
Search
Account: Ажар Ахметкан
(a.bolatovna2001@gmail.com)
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
NEXT: FLEET REGISTRATION
RESET SETTINGS
CREATE
CANCEL
Equivalent REST or COMMAND LINE

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

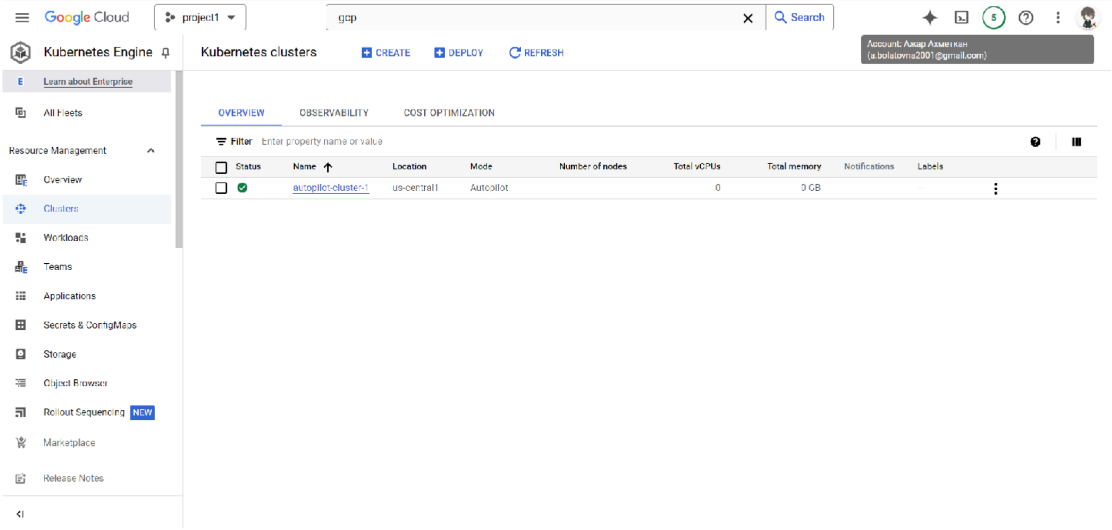
Name: autopilot-cluster-1

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.

After reviewing the settings, I clicked “Create” to launch the cluster.

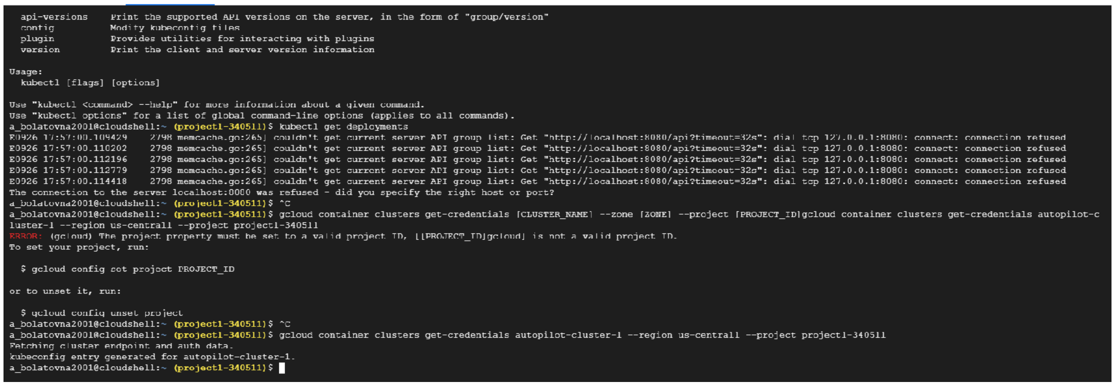


Kubernetes clusters

□	Status	Name ↑	Location	Mode	Number of nodes	Total vCPUs	Total memory	Notifications	Labels
□	✓	autopilot-cluster-1	us-central1	Autopilot		0	0 GB		—

- How did you verify that your application was successfully deployed and accessible?
  Open terminal Google Cloud Shell and I connected to GKE cluster

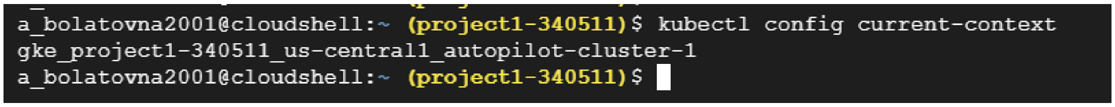
gcloud container clusters get-credentials autopilot-cluster-1 --region us-central1 --project project1-340511



```
  api-versions    Print the supported API versions on the server, in the form of "group/version"
  config          Modify kubeconfig files
  plugin          Provides utilities for interacting with plugins
  version         Print the client and server version information

Usage:
  kubectl [flags] [options]

Use "kubectl <command> --help" for more information about a given command.
Use "kubectl options" for a list of global command-line options (applies to all commands).
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl get deployments
E0926 17:57:00.109429    2798 memcache.go:265] couldn't get current server API group list: Get "http://localhost:8080/api?timeout=32s": dial tcp 127.0.0.1:8080: connect: connection refused
E0926 17:57:00.110202    2798 memcache.go:265] couldn't get current server API group list: Get "http://localhost:8080/api?timeout=32s": dial tcp 127.0.0.1:8080: connect: connection refused
E0926 17:57:00.112196    2798 memcache.go:265] couldn't get current server API group list: Get "http://localhost:8080/api?timeout=32s": dial tcp 127.0.0.1:8080: connect: connection refused
E0926 17:57:00.112779    2798 memcache.go:265] couldn't get current server API group list: Get "http://localhost:8080/api?timeout=32s": dial tcp 127.0.0.1:8080: connect: connection refused
E0926 17:57:00.114418    2798 memcache.go:265] couldn't get current server API group list: Get "http://localhost:8080/api?timeout=32s": dial tcp 127.0.0.1:8080: connect: connection refused
The connection to the server localhost:8080 was refused - did you specify the right host or port?
a_bolatovna2001@cloudshell:~ (project1-340511)$ ^C
a_bolatovna2001@cloudshell:~ (project1-340511)$ gcloud container clusters get-credentials [CLUSTER_NAME] --zone [ZONE] --project [PROJECT_ID]gcloud container clusters get-credentials autopilot-c
luster-1 --region us-central1 --project project1-340511
ERROR: (gcloud) The project property must be set to a valid project ID, [[PROJECT_ID]gcloud] is not a valid project ID.
To set your project, run:

  $ gcloud config set project PROJECT_ID

or to unset it, run:

  $ gcloud config unset project
a_bolatovna2001@cloudshell:~ (project1-340511)$ ^C
a_bolatovna2001@cloudshell:~ (project1-340511)$ gcloud container clusters get-credentials autopilot-cluster-1 --region us-central1 --project project1-340511
Fetching cluster endpoint and auth data.
kubeconfig entry generated for autopilot-cluster-1.
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

After running the command, I checked the current context

kubectl config current-context:

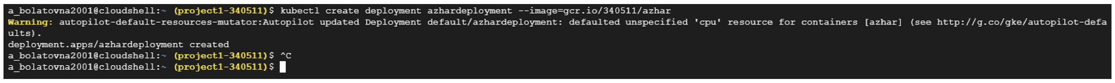


```
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl config current-context
gke_project1-340511_us-central1_autopilot-cluster-1
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

Used the command

kubectl create deployment azhardeployment --image=gcr.io/340511/azhar

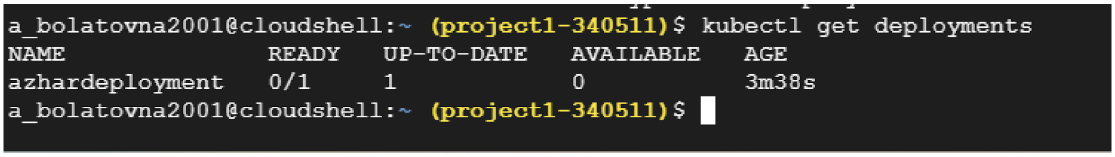
to create a new deployment



```
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl create deployment azhardeployment --image=gcr.io/340511/azhar
Warning: autopilot-default-resources-mutator:Autopilot updated Deployment default/azhardeployment: defaulted unspecified 'cpu' resource for containers [azhar] (see http://g.co/gke/autopilot-defa
ults).
deployment.apps/azhardeployment created
a_bolatovna2001@cloudshell:~ (project1-340511)$ ^C
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

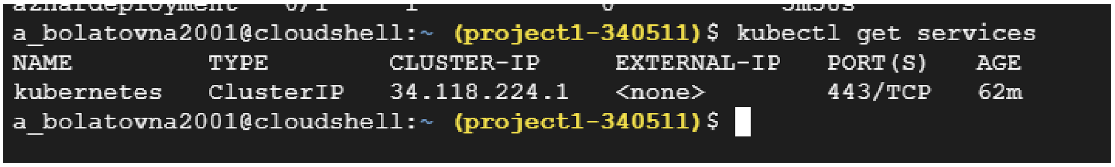
To see the status of your deployments,I runned:

kubectl get deployments



```
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl get deployments
NAME              READY   UP-TO-DATE   AVAILABLE   AGE
azhardeployment   0/1     1            0           3m38s
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

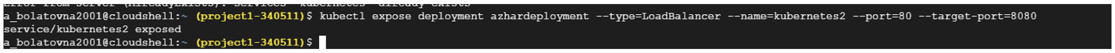
Next, I checked the service associated with application to see how it's exposed to the internet.



```
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl get services
NAME         TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   34.118.224.1   <none>        443/TCP   62m
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

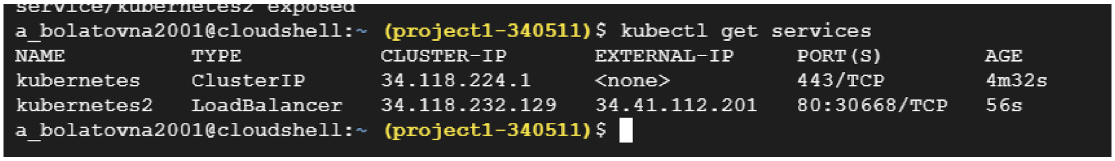
I identified that it is ClusterIP: This type is only accessible within the cluster and won't work for external access. So i decided create new service with LoadBalancer.

kubectl expose deployment azhardeployment --type=LoadBalancer --name=kubernetes2 --port=80 --target-port=8080



```
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl expose deployment azhardeployment --type=LoadBalancer --name=kubernetes2 --port=80 --target-port=8080
service/kubernetes2 exposed
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

Check again services and get kubernetes2



```
a_bolatovna2001@cloudshell:~ (project1-340511)$ kubectl get services
NAME          TYPE           CLUSTER-IP       EXTERNAL-IP     PORT(S)        AGE
kubernetes    ClusterIP      34.118.224.1     <none>          443/TCP        4m32s
kubernetes2   LoadBalancer   34.118.232.129   34.41.112.201   80:30668/TCP   56s
a_bolatovna2001@cloudshell:~ (project1-340511)$
```

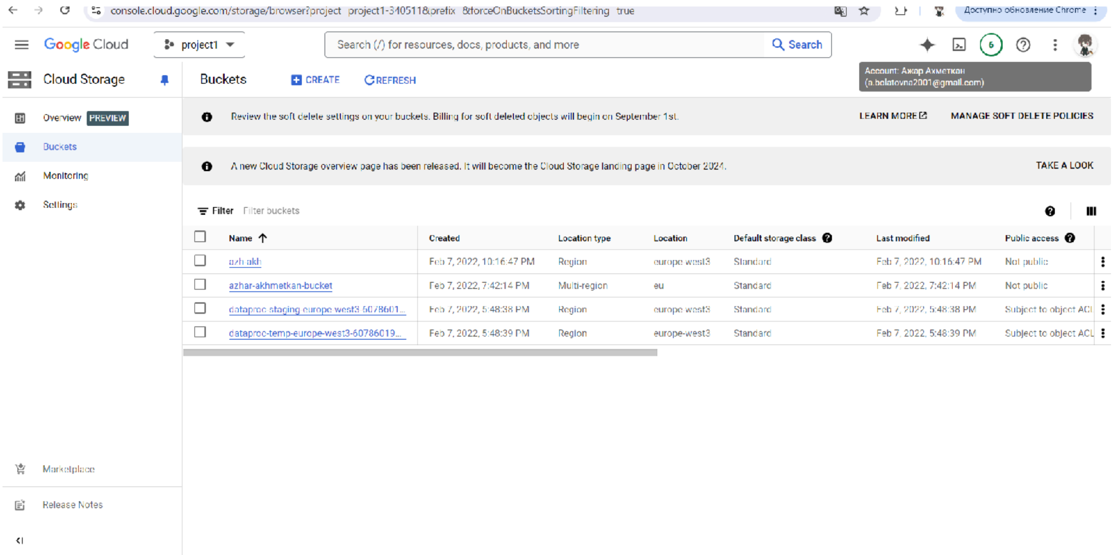
So my external IP is 34.41.112.201 and can use to access application.

Exercise 5: Storing and Accessing Data in Google Cloud Storage

- **Objective**: Learn how to store, manage, and access data using 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?

To create a Cloud Storage bucket, I go to the Google Cloud Console and navigate to the Cloud Storage section. Then, I click on "Create" near buckets.

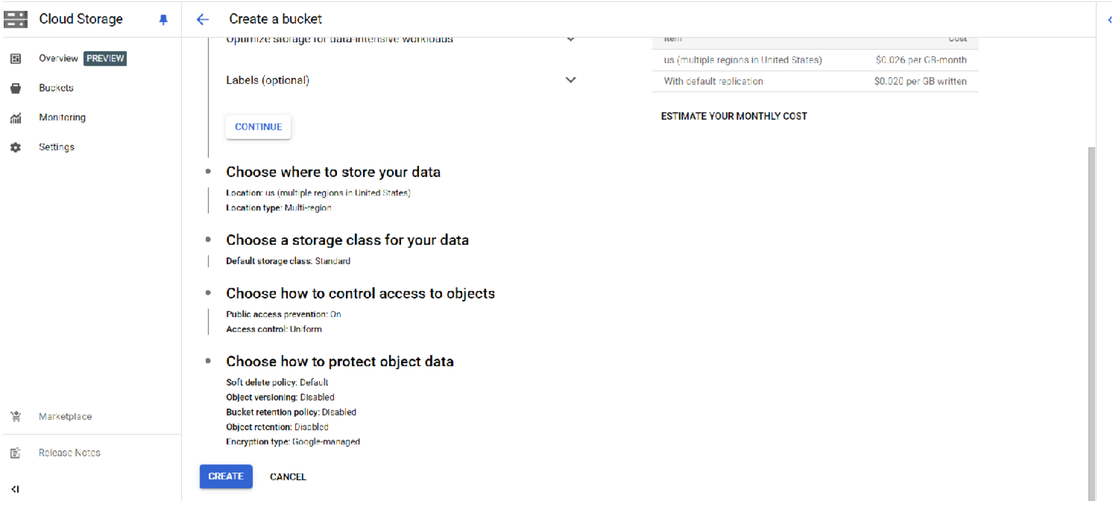

console.cloud.google.com/storage/browser?project project1-340511&prefix &forceOnBucketsSortingFiltering true
Доступно обновление Chrome
Google Cloud
project1
Search (/) for resources, docs, products, and more
Search
Account: Ажар Ахметкан
(a.bolatovna2001@gmail.com)
Cloud Storage
Buckets
CREATE
REFRESH
Overview PREVIEW
Buckets
Monitoring
Settings
Marketplace
Release Notes
LEARN MORE
MANAGE SOFT DELETE POLICIES
TAKE A LOOK
Filter
Filter buckets

Review the soft delete settings on your buckets. Billing for soft deleted objects will begin on September 1st.

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

Name	Created	Location type	Location	Default storage class	Last modified	Public access
azh akh	Feb 7, 2022, 10:16:47 PM	Region	europe west3	Standard	Feb 7, 2022, 10:16:47 PM	Not public
azhar-akhmetkan-bucket	Feb 7, 2022, 7:42:14 PM	Multi-region	eu	Standard	Feb 7, 2022, 7:42:14 PM	Not public
dataproc staging europe west3 6078601...	Feb 7, 2022, 5:48:38 PM	Region	europe west3	Standard	Feb 7, 2022, 5:48:38 PM	Subject to object ACL
dataproc-temp-europe-west3-60786019...	Feb 7, 2022, 5:48:39 PM	Region	europe-west3	Standard	Feb 7, 2022, 5:48:39 PM	Subject to object ACL

Set upped my bucket, choosing a unique name for my bucket, select a location and pick a storage class and decide on the access control method. Clicked create.



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

Choose where to store your data

Location: us (multiple regions in United States)
Location type: Multi-region

Choose a storage class for your data

Default storage class: Standard

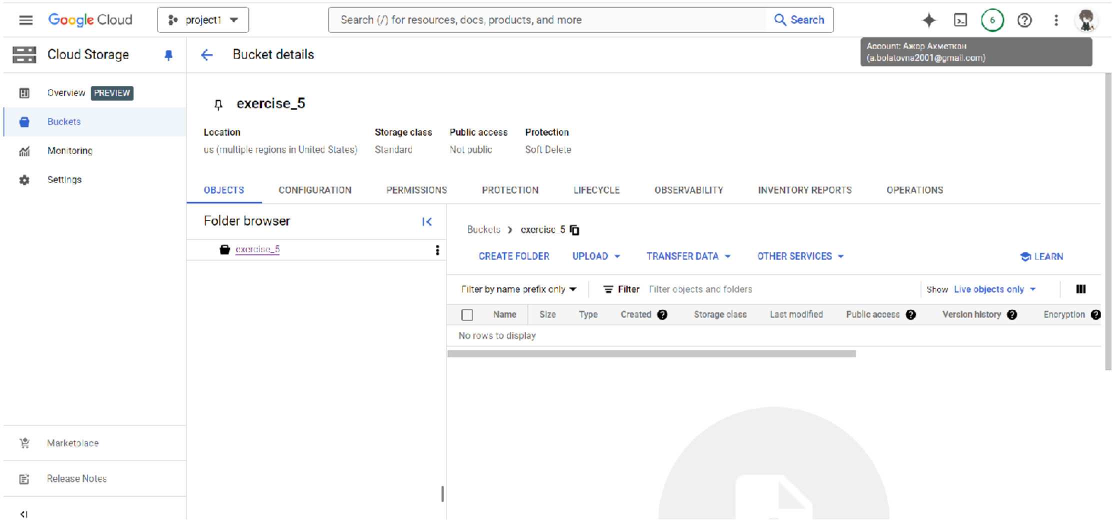
Choose how to control access to objects

Public access prevention: On
Access control: Uniform

Choose how to protect object data

Soft delete policy: Default
Object versioning: Disabled
Bucket retention policy: Disabled
Object retention: Disabled
Encryption type: Google-managed

And got exercise_5 bucket:



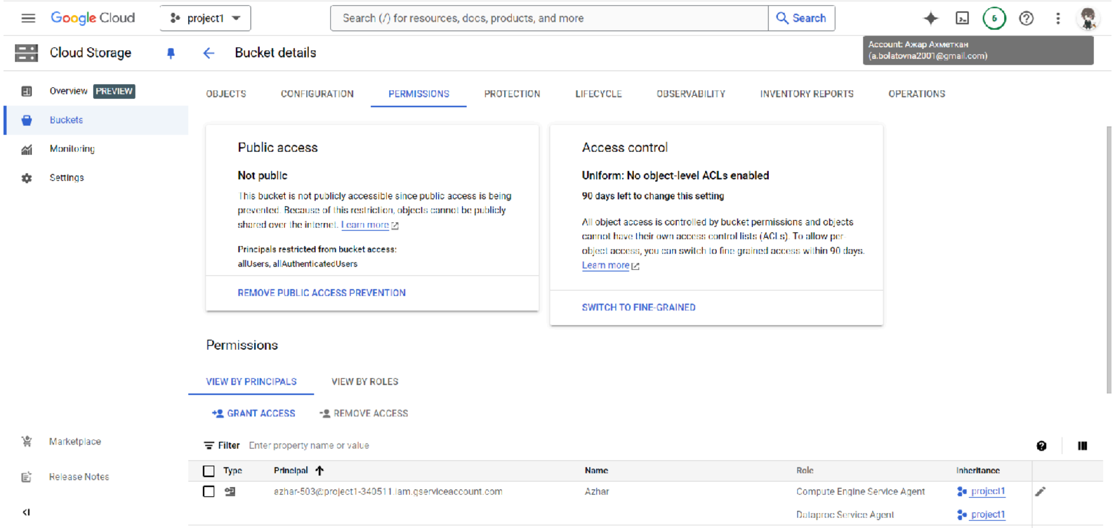
exercise_5

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

☐	Name	Size	Type	Created	Storage class	Last modified	Public access	Version history	Encryption

No rows to display

- What are the differences between setting a bucket to public versus private? Setting a bucket to public means anyone on the internet can access its files without needing authentication, which is great for sharing things widely. But a private bucket restricts access, so only people with the right permissions can view or download the files. This is important if I have sensitive data that shouldn't be accessible to everyone.
- How can you manage access permissions for individual files in a bucket? To manage access for individual files, I can select the file in the Cloud Console and go to the Permissions tab. From there, I can add or remove users, groups, or service accounts, and specify what roles they have, like Viewer or Editor. This way, I can control who can see or modify each file separately.



Public access

Not public

This bucket is not publicly accessible since public access is being prevented. Because of this restriction, objects cannot be publicly shared over the internet. Learn more

Principals restricted from bucket access: allUsers, allAuthenticatedUsers

Access control

Uniform: No object-level ACLs enabled

90 days left to change this setting

All object access is controlled by bucket permissions and objects cannot have their own access control lists (ACLs). To allow per-object access, you can switch to fine-grained access within 90 days. Learn more

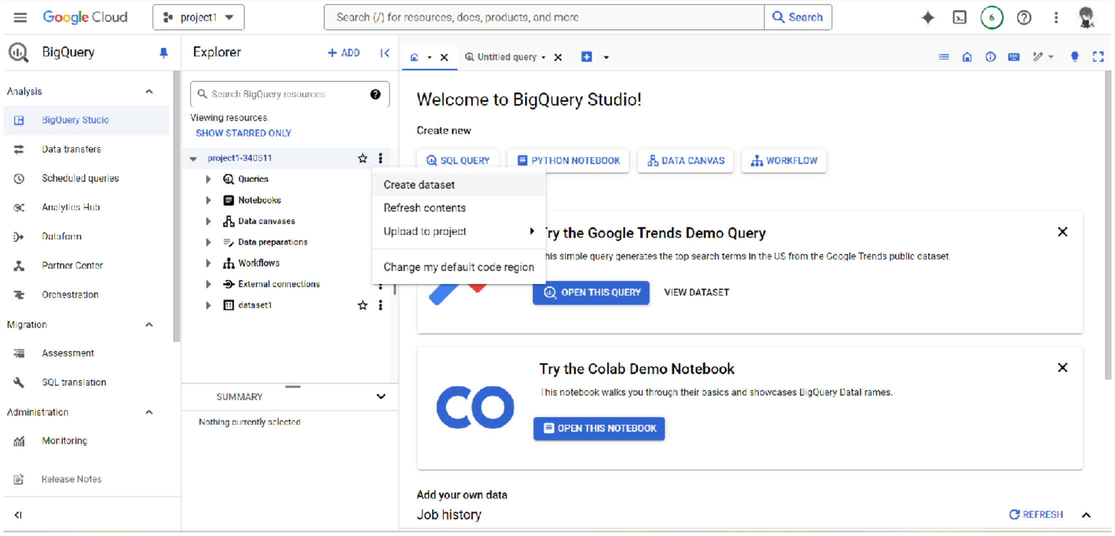
Permissions

□	Type	Principal	Name	Role	Inheritance
□		azhar-503@project1-340511.iam.gserviceaccount.com	Azhar	Compute Engine Service Agent Dataproc Service Agent	project1 project1

Exercise 6: Analyzing Data with BigQuery

- **Objective**: Perform data analysis tasks using BigQuery.
- **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.
  - Visualize the results using Google Data Studio or another visualization tool.
- **Questions**:
  - What steps did you take to create a dataset and table in BigQuery?

To create a dataset in BigQuery, I first logged into the Google Cloud Console and went to the BigQuery section. I clicked on my project, then hit "Create Dataset."



Welcome to BigQuery Studio!

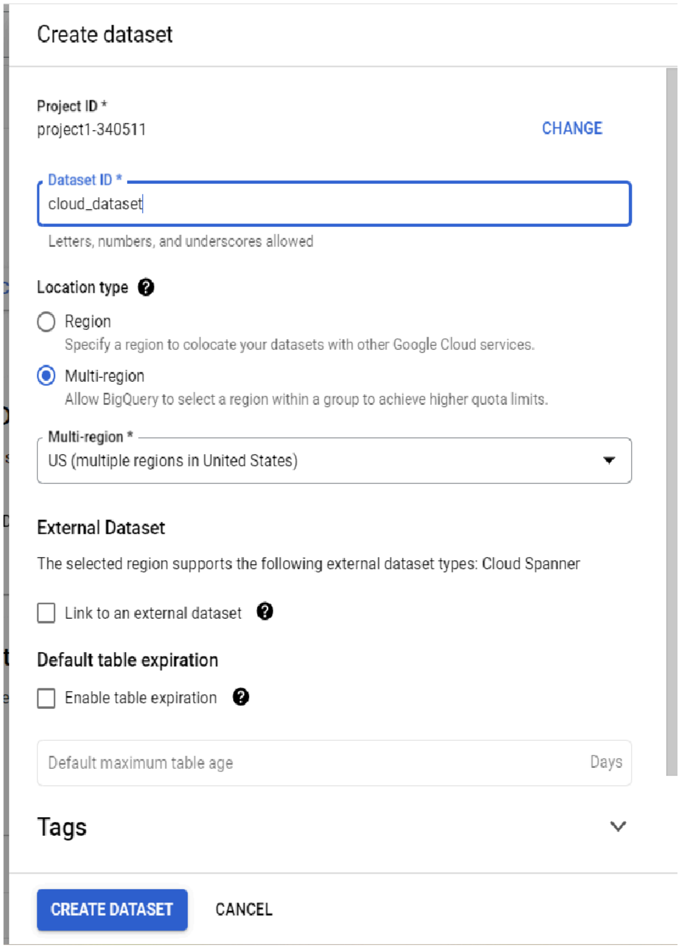
Try the Google Trends Demo Query

This simple query generates the top search terms in the US from the Google Trends public dataset.

Try the Colab Demo Notebook

This notebook walks you through their basics and showcases BigQuery DataFrames.

I picked a name "cloud_dataset" for the dataset and set up the necessary options.



Create dataset

Project ID *
project1-340511

Dataset ID *
cloud_dataset

Letters, numbers, and underscores allowed

Location type

○ Region
Specify a region to colocate your datasets with other Google Cloud services.

● Multi-region
Allow BigQuery to select a region within a group to achieve higher quota limits.

Multi-region *
US (multiple regions in United States)

External Dataset

The selected region supports the following external dataset types: Cloud Spanner

□ Link to an external dataset

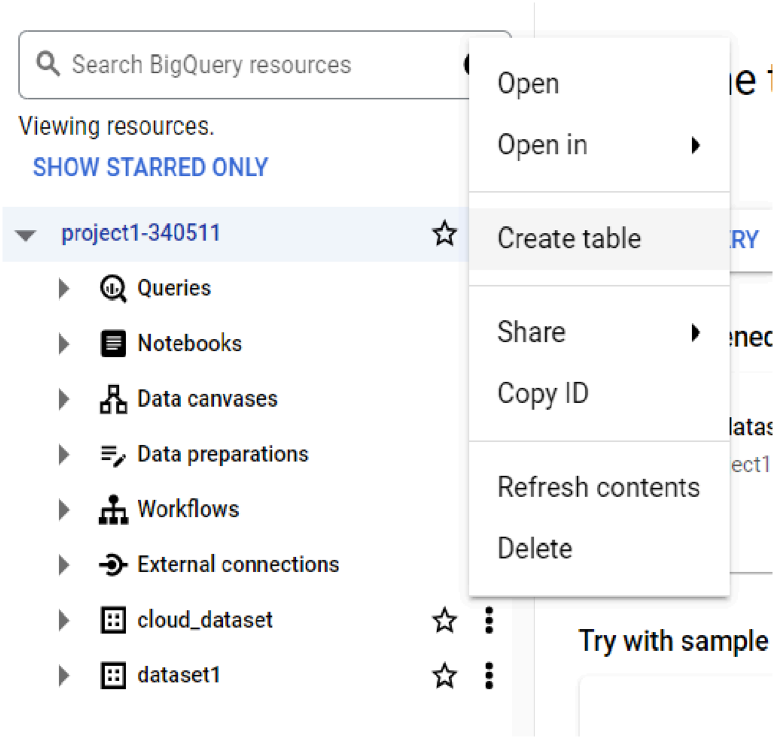
Default table expiration

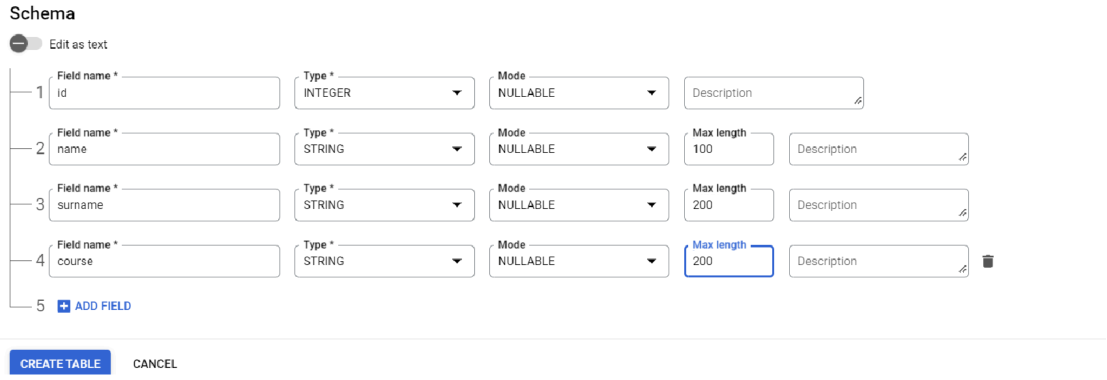
□ Enable table expiration

Default maximum table age Days

Tags

After that, I created a table "forexercise6" by clicking "Create Table,"




Schema

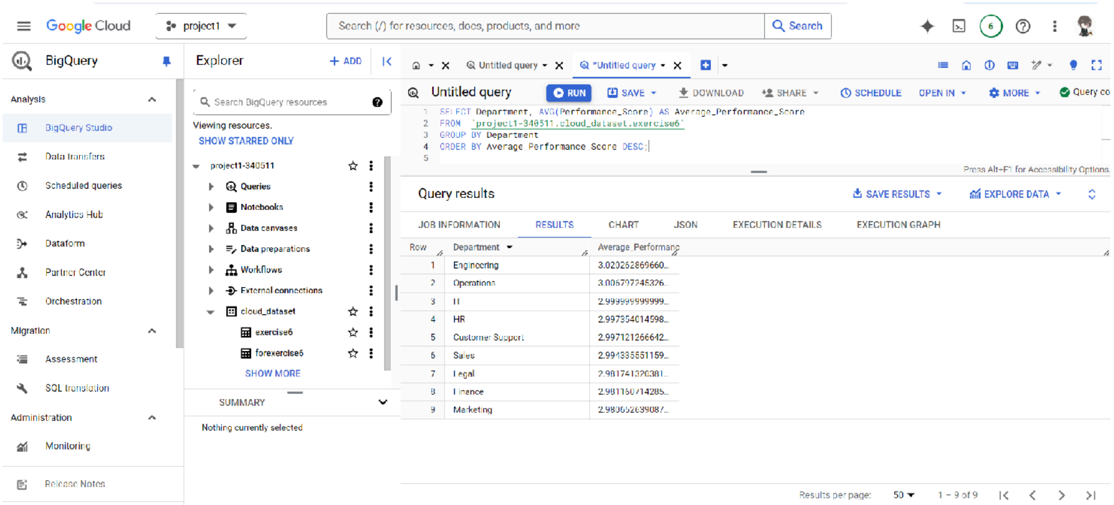
Edit as text

	Field name *	Type *	Mode	Max length	Description
1	id	INTEGER	NULLABLE		Description
2	name	STRING	NULLABLE	100	Description
3	surname	STRING	NULLABLE	200	Description
4	course	STRING	NULLABLE	200	Description
5	ADD FIELD				

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

I wrote SQL queries in the BigQuery editor. After selecting my dataset and table, I typed out the queries I wanted to run and clicked the "Run" button. I used commands to filter the data, do some aggregations, and sort the results based on what I needed to analyze.

average performance score for each department:

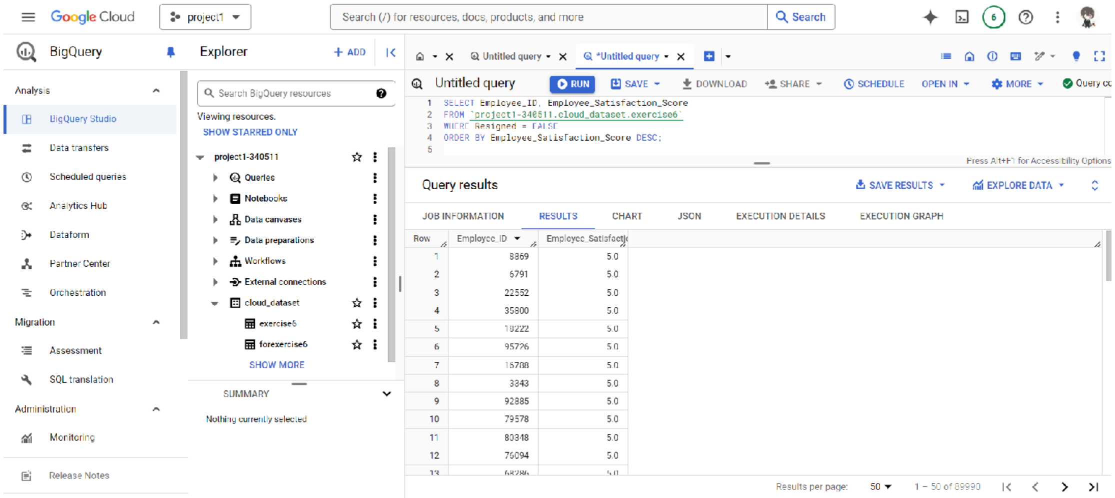


```sql
SELECT Department, AVG(Performance_Score) AS Average_Performance_Score
FROM `project1-340511.cloud_dataset.exercise6`
GROUP BY Department
ORDER BY Average_Performance_Score DESC;
```

Row	Department	Average_Performanc
1	Engineering	3.020262869660...
2	Operations	3.006797245326...
3	IT	2.999999999999...
4	HR	2.997354014598...
5	Customer Support	2.997121266642...
6	Sales	2.994335551159...
7	Legal	2.981741320381...
8	Finance	2.981160714285...
9	Marketing	2.980652639087...

Results per page: 50 1 – 9 of 9

the employee satisfaction scores for employees who have not resigned:



```sql
SELECT Employee_ID, Employee_Satisfaction_Score
FROM `project1-340511.cloud_dataset.exercise6`
WHERE Resigned = FALSE
ORDER BY Employee_Satisfaction_Score DESC;
```

Row	Employee_ID	Employee_Satisfactio
1	8869	5.0
2	6791	5.0
3	22552	5.0
4	35800	5.0
5	18222	5.0
6	95726	5.0
7	16788	5.0
8	3343	5.0
9	92885	5.0
10	79578	5.0
11	80348	5.0
12	76094	5.0
13	68286	5.0

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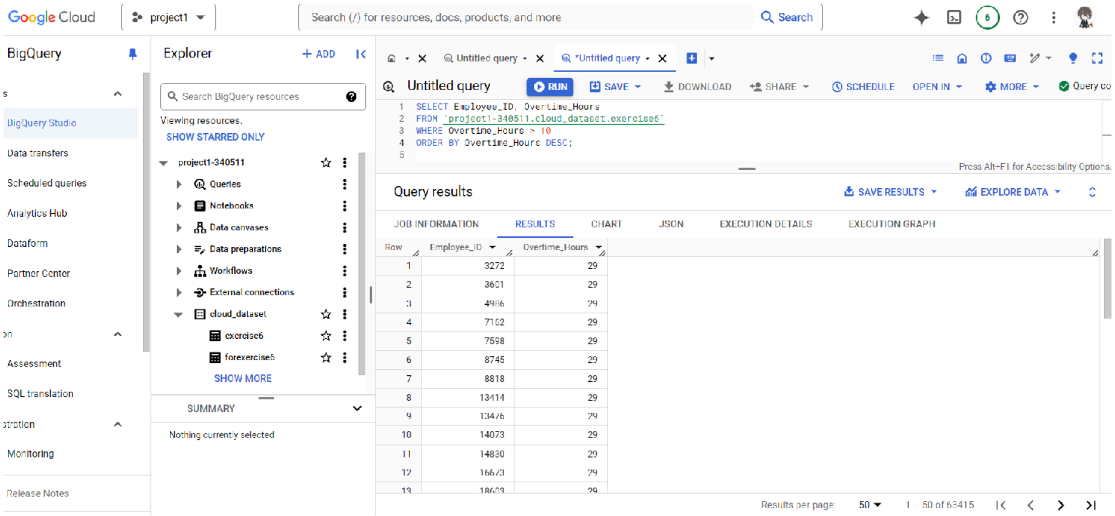
Employees with Overtime Hours:



```sql
SELECT Employee_ID, Overtime_Hours
FROM `project1-340511.cloud_dataset.exercise6`
WHERE Overtime_Hours > 10
ORDER BY Overtime_Hours DESC;
```

Row	Employee_ID	Overtime_Hours
1	3272	29
2	3601	29
3	4986	29
4	7162	29
5	7598	29
6	8745	29
7	8818	29
8	13414	29
9	13476	29
10	14073	29
11	14830	29
12	16673	29
13	18603	29

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

From my analysis, I found a few key insights. First, the average performance score was highest in the IT department, suggesting they might have better support or engagement. Second, employees with more training hours had higher satisfaction scores, showing that training is important for keeping employees happy. Finally, many employees working significant overtime were in high-demand roles, which might indicate they are overloaded. This suggests that the company should consider balancing workloads to prevent burnout.