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Cloud Computing
Assignment №2

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Introduction

Google Cloud services is a tool that has been developed to address various company needs. These services allow you to run a virtual machine under the properties that are required for certain tasks, store and analyze data, and even integrate cloud systems with each other. Together, these services represent a variety of opportunities, depending on the needs of the company.

Virtual Machines In Google Cloud

Virtual machines in Google services, as the name itself describes, are virtual machines with certain characteristics. Users can edit characteristics such as settings, operating systems, machine type, size, and so on. It is also a flexible solution to the various needs of such simple solutions as web project hosting and even complex integrated systems like complex data analytics.

Storage Solutions in Google Cloud

Google services provide a huge range of options for storing data in cloud systems. From storing simple file types such as word, excel, folders and so on, even with the ability to integrate data with analytical tools. Also, in these services, you can always adjust the settings for expanding cloud storage, delimit access and integrate with other services. Nowadays, cloud storage is used by almost many users from all over the world. For example, entrepreneurs of small businesses in Kazakhstan use Google cloud services to store corporate documents and resources for transfer to third parties.

Networking in Google Cloud

Creating a real-time network in Google Cloud allows users to set up networks. The user can access the secure network infrastructure from a trusted source. With features such as a virtual private cloud, Google Cloud allows users to create an isolated network and configure routing to improve security and performance. This service allows companies to create sustainable and scalable applications in the cloud.

Google Cloud Platform offers a powerful combination of services that help businesses thrive in the cloud. With Virtual Machines, you can easily deploy scalable compute resources for any workload. For data storage, GCP provides flexible options to securely store everything from files to big data. And its robust networking features ensure that your applications communicate seamlessly and securely. Together, these tools make it easier for organizations to innovate and grow in a cloud environment.

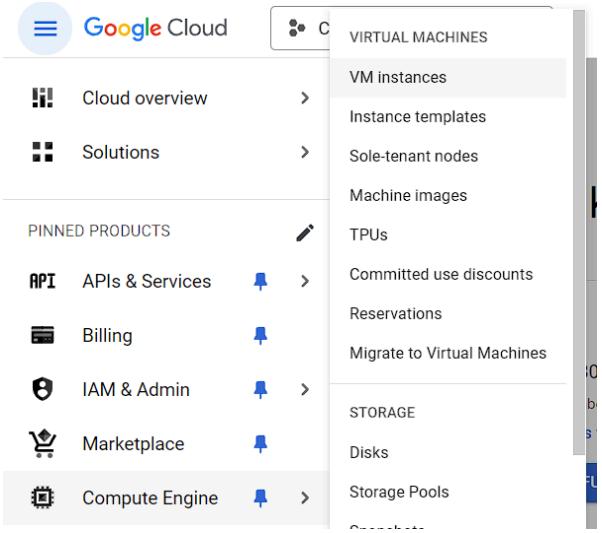
Virtual Machines In Google Cloud

VM Creation

Create a Virtual Machine (VM) Instance:

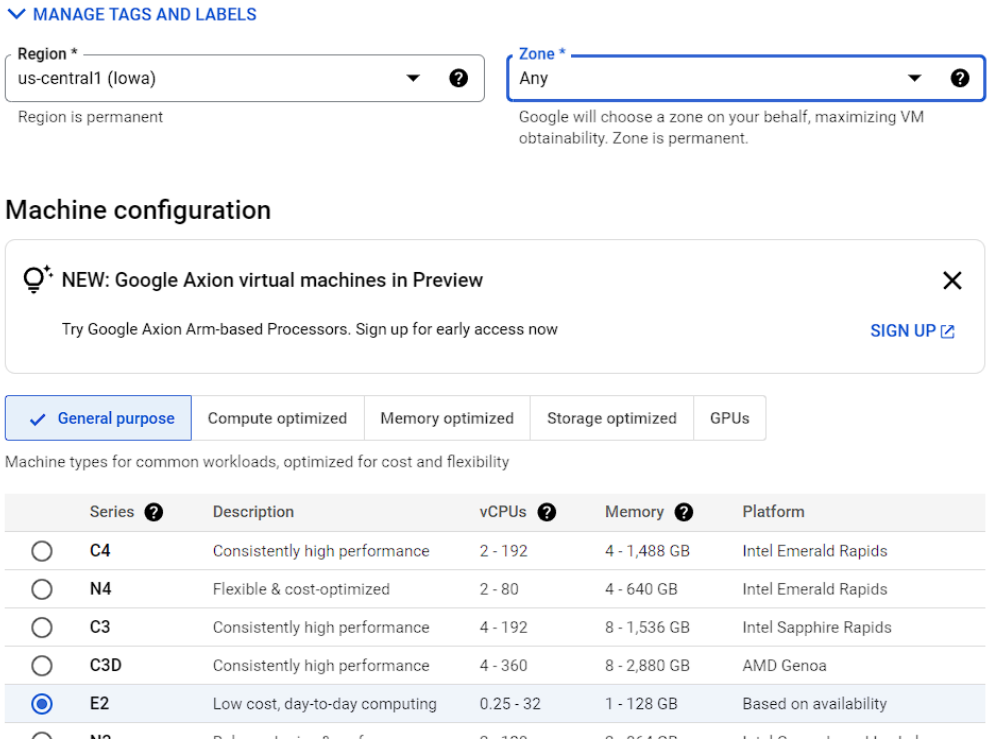
Step 1: First, we log in to the Google console website. Since we have already created a project during the previous assignment 1*, this time we can skip this step by referring to the previous project. After that, we go to "compute engine/VM" instances as it is shown in **Picture-1.1**.

Picture-1.1



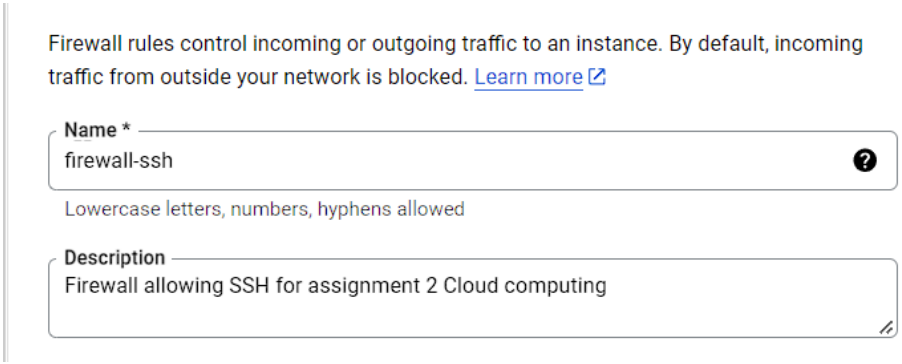
Step 2: In the page of VM, we navigate to "Create new VM instance" where we can create new instance. Then we set settings like machine type, operating system and region. As it displayed at **Picture-1.2**, we setted Region to "us-central1 (Iowa)", zone to "Any" and machine configuration to E2. E2 stands for Low cost, day-to-day computing which has 1-128 GB of memory.

Picture-1.2



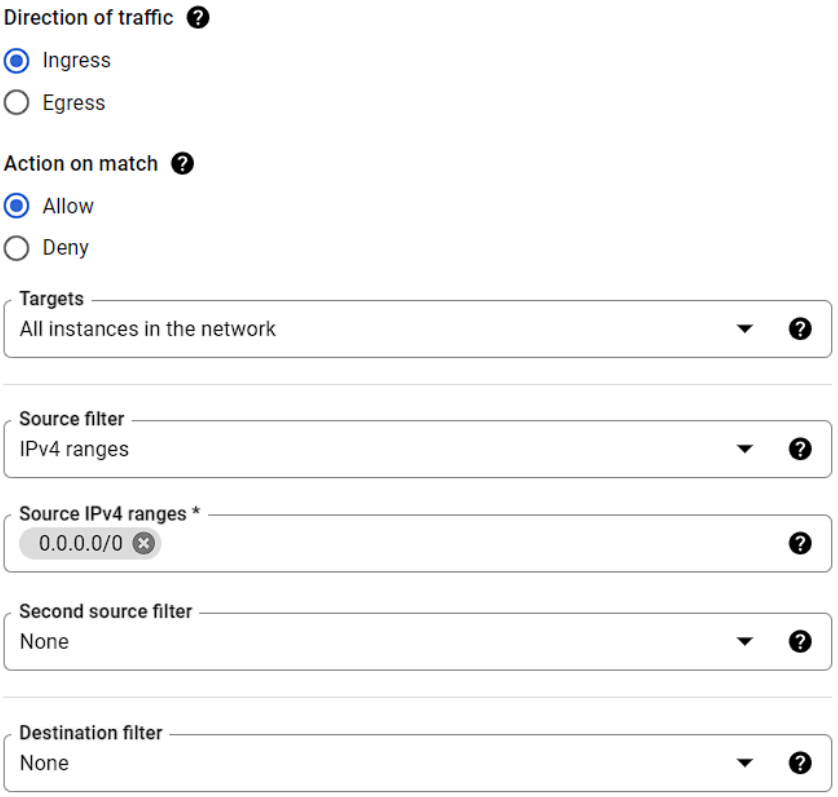
Step 3: Now we will configure the firewall to allow SSH traffic. First we go to the main page where we can choose VPC Network where we will set Firewall rules. Navigate to Firewall/New Firewall rules. There we can create a Firewall rule where we will set options for SSH options. Now in the setting of Firewall we name it “firewall-ssh”, description “Firewall allowing SSH for assignment #2 Cloud Computing” as shown in **Picture-1.3**.

Picture-1.3



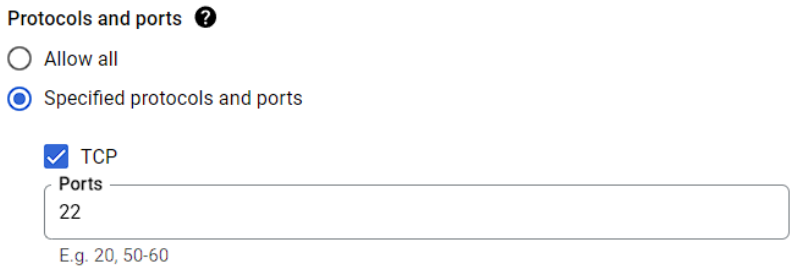
Then we set directions of traffic, action on match and define source filter and range of IPv4 as it displayed at **Picture-1.4**

Picture-1.4



Then we set last configurations like Protocols and ports for SSH options like in **Picture-1.5**.

Picture-1.5



Connection

Connect to the VM:

Step 1: Now we can use the SSH option from the VM instance. In SSH we use commands to install Apache to our VM as shown in **Picture-1.6** and **Picture-1.7**. Code snippets which I used:

-sudo apt update (To update package index)
-sudo apt install apache2 -y (install apache)
-sudo systemctl start apache2 (start apache)
-sudo systemctl enable apache2 (enable apache)
-sudo ufw allow 'Apache Full' (adjust firewall)
-sudo systemctl status apache2 (For checking Apache's status)

Picture-1.6

```
kalen_meiirzhan@instance-20241015-171414:~$ 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]
Hit:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease
Get:8 https://packages.cloud.google.com/apt cloud-sdk-bookworm InRelease [1654 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:6 https://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
Get:9 https://packages.cloud.google.com/apt cloud-sdk-bookworm/main all Packages [1573 kB]
Get:10 https://packages.cloud.google.com/apt cloud-sdk-bookworm/main amd64 Packages [3391 kB]
Get:11 https://deb.debian.org/debian bookworm-backports/main Sources.diff/Index [63.3 kB]
Get:12 https://deb.debian.org/debian bookworm-backports/main amd64 Packages.diff/Index [63.3 kB]
Get:13 https://deb.debian.org/debian bookworm-backports/main Translation-en.diff/Index [63.3 kB]
Get:17 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-10-15-1411.47-F-2024-10-10-0222.42.pdiff [7733 B]
Get:18 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-10-15-0300.55-F-2024-10-10-0810.07.pdiff [6091 B]
Get:17 https://deb.debian.org/debian bookworm-backports/main Sources T-2024-10-15-1411.47-F-2024-10-10-0222.42.pdiff [7733 B]
Get:18 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2024-10-15-0300.55-F-2024-10-10-0810.07.pdiff [6091 B]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-10-14-2004.38-F-2024-10-13-0204.45.pdiff [925 B]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2024-10-14-2004.38-F-2024-10-13-0204.45.pdiff [925 B]
Get:14 https://deb.debian.org/debian-security bookworm-security/main Sources [121 kB]
Get:15 https://deb.debian.org/debian-security bookworm-security/main amd64 Packages [188 kB]
Get:16 https://deb.debian.org/debian-security bookworm-security/main Translation-en [115 kB]
Fetched 5908 kB in 1s (4514 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

Picture-1.7

```
kalen_meiirzhan@instance-20241015-171414:~$ sudo apt install apache2 -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3 libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-dbd-sqlite3 libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
0 upgraded, 11 newly installed, 0 to remove and 2 not upgraded.
Need to get 2379 kB of archives.
After this operation, 8468 kB of additional disk space will be used.
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:2 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]
Get:3 https://deb.debian.org/debian bookworm/main amd64 libapr1 amd64 1.7.2-3 [102 kB]
Get:4 https://deb.debian.org/debian bookworm/main amd64 libaprutil1 amd64 1.6.3-1 [87.8 kB]
Get:5 https://deb.debian.org/debian bookworm/main amd64 libaprutil1-dbd-sqlite3 amd64 1.6.3-1 [13.6 kB]
Get:6 https://deb.debian.org/debian bookworm/main amd64 libaprutil1-ldap amd64 1.6.3-1 [11.8 kB]
Get:7 https://deb.debian.org/debian bookworm/main amd64 libjansson4 amd64 2.14-2 [40.8 kB]
Get:8 https://deb.debian.org/debian bookworm/main amd64 liblua5.3-0 amd64 5.3.6-2 [123 kB]
Get:9 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2-bin amd64 2.4.62-1~deb12u2 [1386 kB]
Get:10 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2-data all 2.4.62-1~deb12u2 [160 kB]
Get:11 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2-utils amd64 2.4.62-1~deb12u2 [210 kB]
Get:12 https://deb.debian.org/debian-security bookworm-security/main amd64 apache2 amd64 2.4.62-1~deb12u2 [223 kB]
Get:13 https://deb.debian.org/debian bookworm/main amd64 ssl-cert all 1.1.2 [21.1 kB]
Fetched 2379 kB in 0s (13.1 MB/s)
Preconfiguring packages ...
Selecting previously unselected package libapr1:amd64.
(Reading database ... 70354 files and directories currently installed.)
Preparing to unpack .../00-libapr1_1.7.2-3_amd64.deb ...
Unpacking libapr1:amd64 (1.7.2-3) ...
Selecting previously unselected package libaprutil1:amd64.
Preparing to unpack .../01-libaprutil1_1.6.3-1_amd64.deb ...
Unpacking libaprutil1:amd64 (1.6.3-1) ...
Selecting previously unselected package libaprutil1-dbd-sqlite3:amd64.
Preparing to unpack .../02-libaprutil1-dbd-sqlite3_1.6.3-1_amd64.deb ...
Unpacking libaprutil1-dbd-sqlite3:amd64 (1.6.3-1) ...
Selecting previously unselected package libaprutil1-ldap:amd64.
Preparing to unpack .../03-libaprutil1-ldap_1.6.3-1_amd64.deb ...
Unpacking libaprutil1-ldap:amd64 (1.6.3-1) ...
Selecting previously unselected package libjansson4:amd64.
Preparing to unpack .../04-libjansson4_2.14-2_amd64.deb ...
Unpacking libjansson4:amd64 (2.14-2) ...
Selecting previously unselected package liblua5.3-0:amd64.
Preparing to unpack .../05-liblua5.3-0_5.3.6-2_amd64.deb ...
```

In **Picture-1.7** we can see that Apache server was installed successfully and now running in our VM linux based environment.

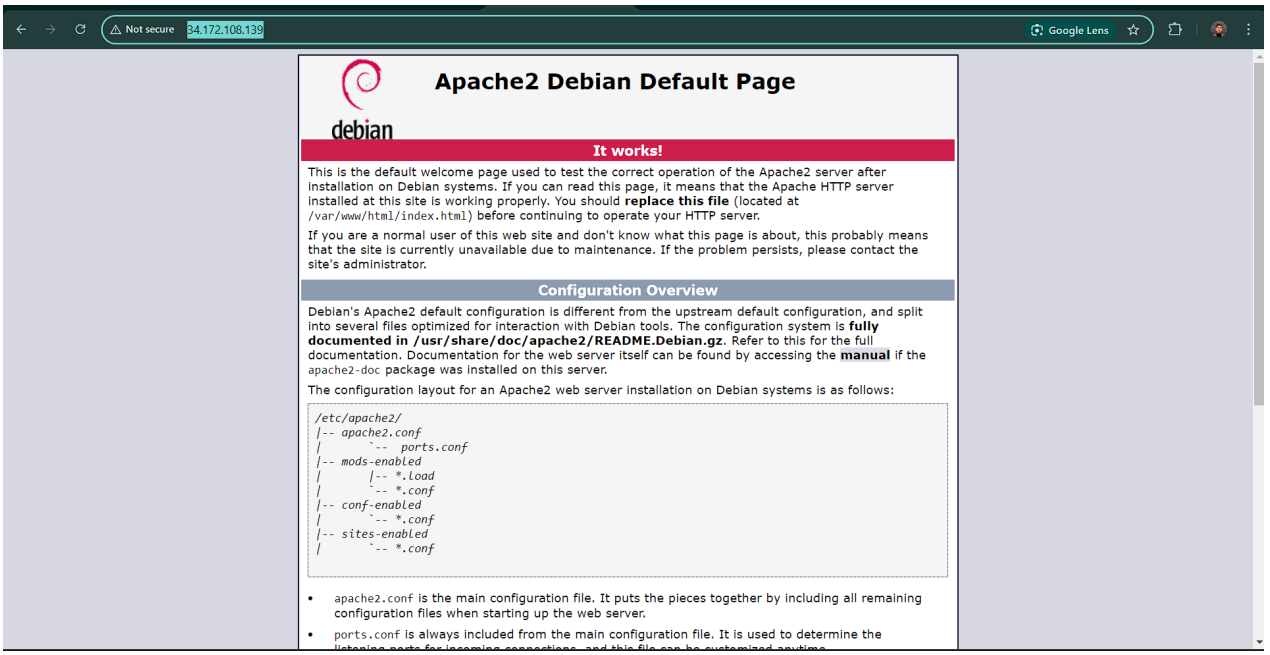
Picture-1.7

```
kalen_meiirzhan@instance-20241015-171414:~$ sudo systemctl start apache2
kalen_meiirzhan@instance-20241015-171414:~$ sudo systemctl enable apache2
Synchronizing state of apache2.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable apache2
kalen_meiirzhan@instance-20241015-171414:~$ sudo ufw allow 'Apache Full'
sudo: ufw: command not found
kalen_meiirzhan@instance-20241015-171414:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; preset: enabled)
     Active: active (running) since Tue 2024-10-15 17:46:35 UTC; 4min 24s ago
       Docs: https://httpd.apache.org/docs/2.4/
   Main PID: 1932 (apache2)
      Tasks: 55 (limit: 4682)
     Memory: 10.9M
        CPU: 70ms
     CGroup: /system.slice/apache2.service
             ├─1932 /usr/sbin/apache2 -k start
             ├─1933 /usr/sbin/apache2 -k start
             └─1934 /usr/sbin/apache2 -k start

Oct 15 17:46:35 instance-20241015-171414 systemd[1]: Starting apache2.service - The Apache HTTP Server...
Oct 15 17:46:35 instance-20241015-171414 systemd[1]: Started apache2.service - The Apache HTTP Server.
kalen_meiirzhan@instance-20241015-171414:~$
```

Let's check our Apache server for running from the external Ip address of the VM Address link-"http://34.172.108.139/". In the **Picture-1.8** below we can see that our server Apache is running successfully by this external IP Address.

Picture-1.8



Findings

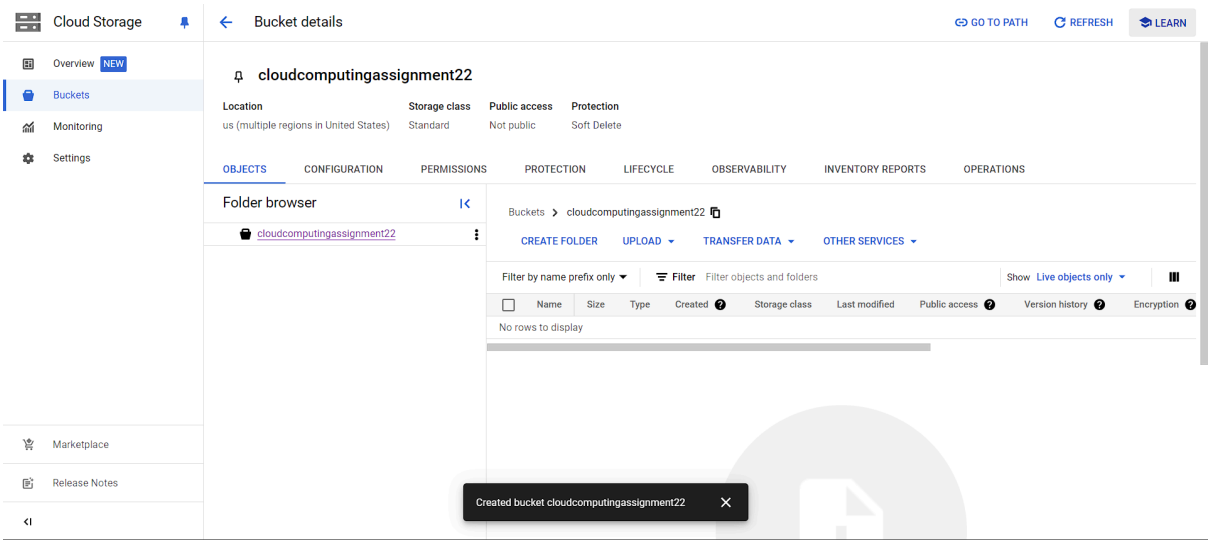
It was a good experience running Apache server from a VM instance served by Google Console. I chose Apache server, because it's more familiar to me(I usually work with Apache server). I understand that it's not mandatory to add new Firewall rules for instances, because it was already offered by Google in the VM instance settings page. I get that all networking issues could be done by just editing VM instance settings by providing clarified options. It's very cool and convenient, respect to Google.

Storage Solution in Google Cloud

Bucket Creation

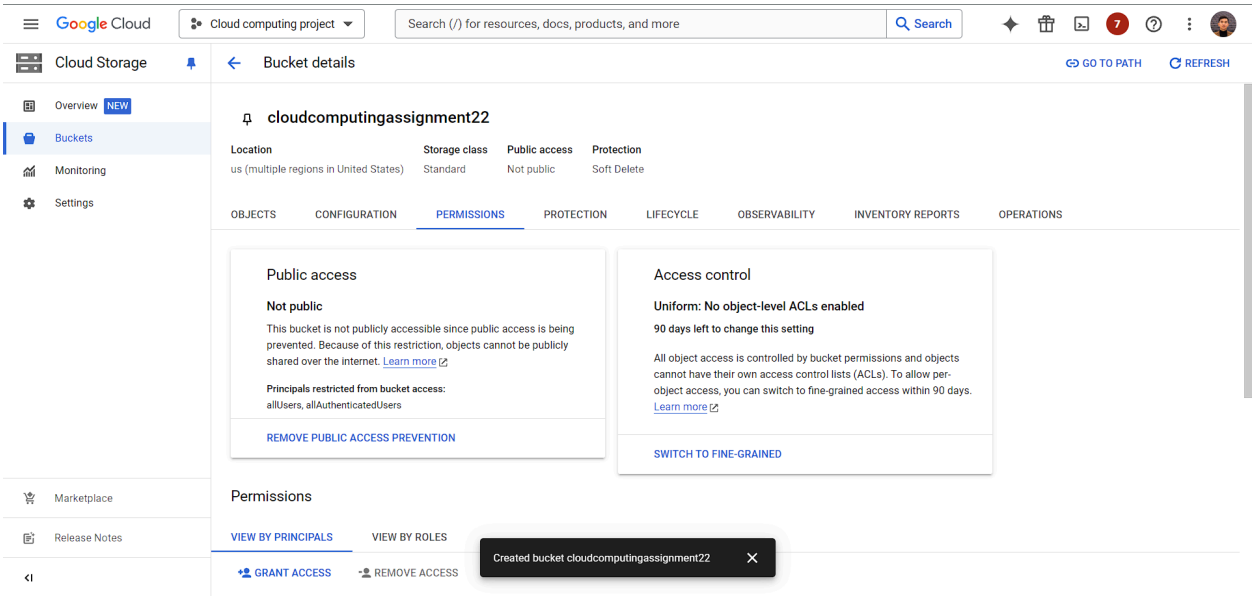
Step 1: Use the Google Cloud Console to create a Cloud Storage bucket. First we go to the path Cloud storage/Buckets where we create a bucket for storage with the name "cloudcomputingassignment22" as it displayed at **Picture-2.1** below.

Picture-2.1



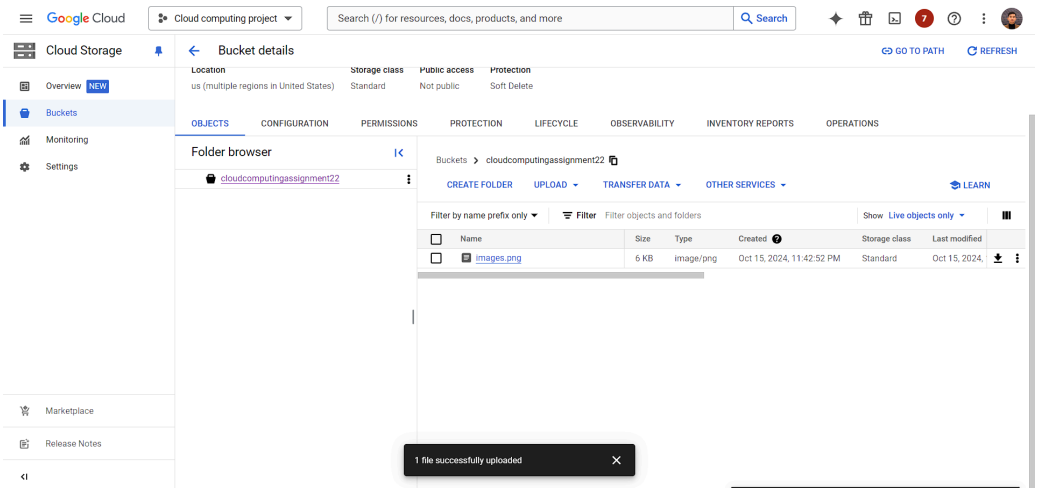
Step 2: We can set permissions to our Bucket. In **Picture-2.2** below it is shown that our bucket is Not public.

Picture-2.2



Step 3: Now we can upload files to our bucket. In **Picture-2.3** below, images.png was uploaded to our bucket.

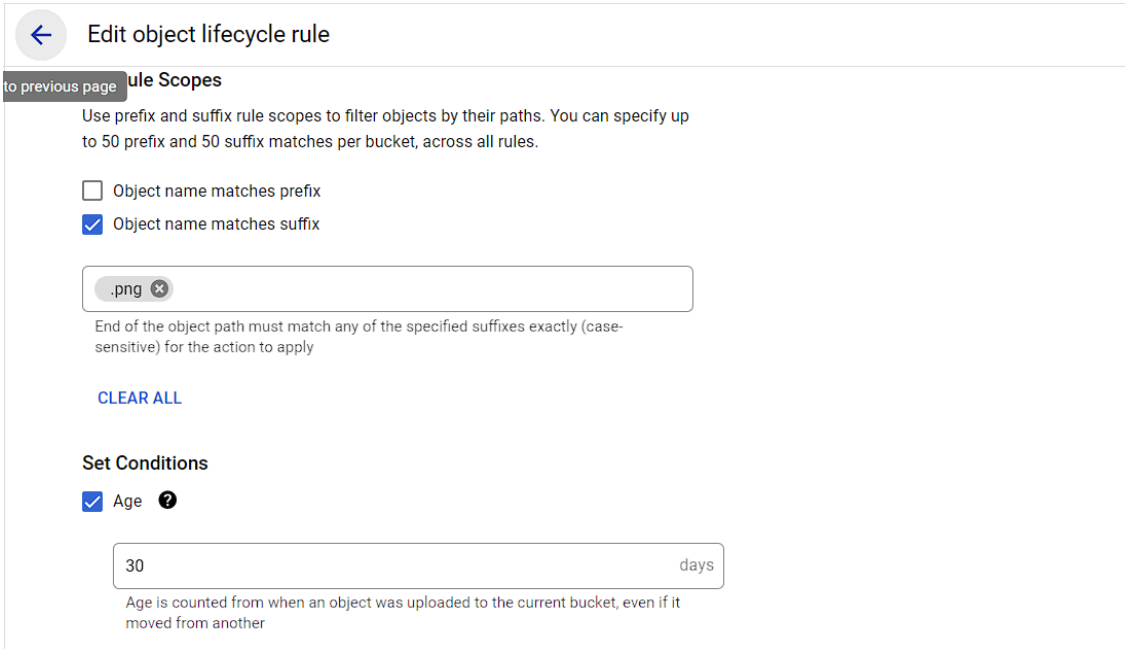
Picture-2.3



Lifecycle Management

Now we will set the lifecycle to our files which ends with the suffix ".png" where age is 30 days as it displayed at **Picture-2.4** below. It means that files with the suffix ".png" will be deleted automatically after 30 days. Our uploaded file "images.png", will be deleted after 30 days.

Picture-2.4



Findings

Google cloud storage is a good solution for storing files of different types. It also gives the opportunity to manage permissions and to set the lifecycle to files with different options which you would prefer to set. This storage is very convenient for usage. For example it could be used by photo studios, where they will upload images of consumers. Consumers could take photos by bucket storage, where images will be deleted after 30 days. Opportunity to delete files makes storage more organized and less memory consuming. Also it's convenient to store in hierarchy files, which will make it more structured. In conclusion I want to say buckets are a good solution to store data.

Networking in Google Cloud

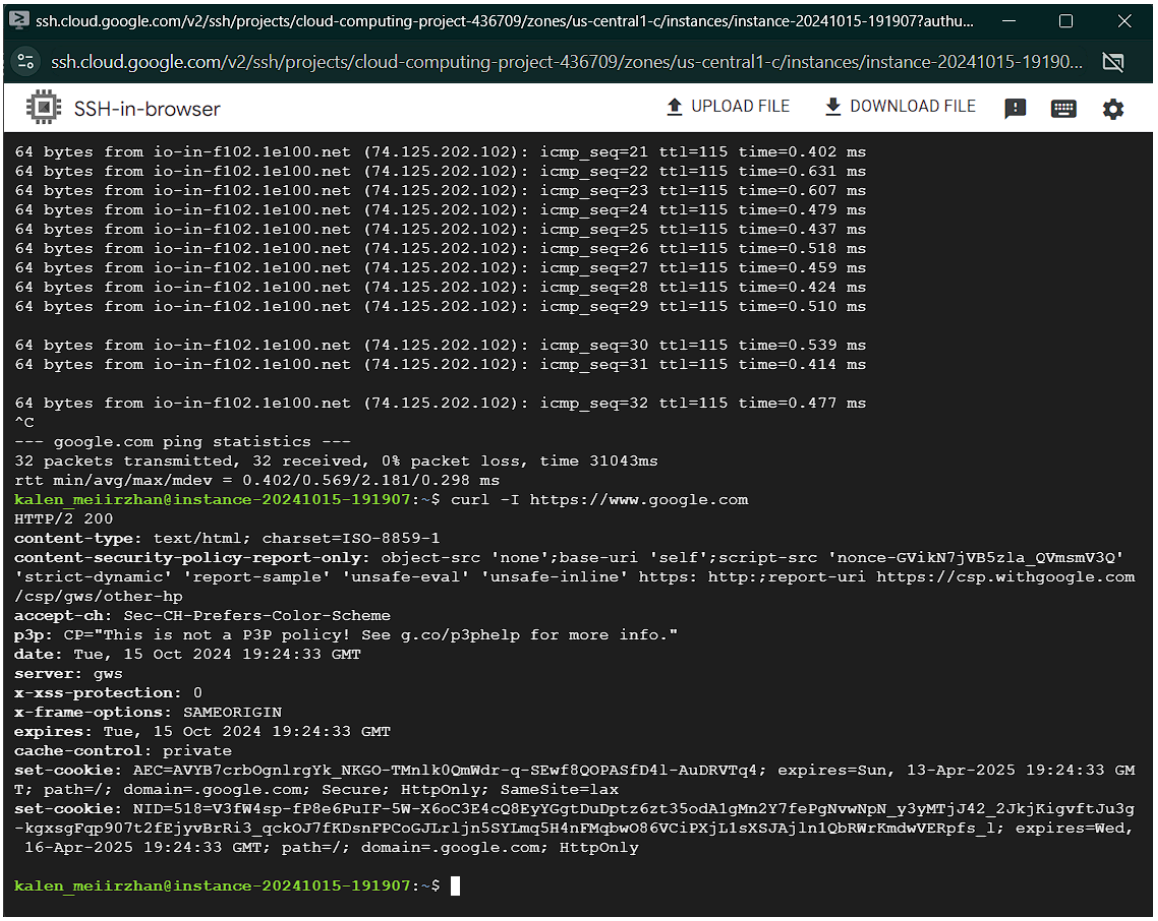
VPC Setup

VPC Setup: In section **VM Creation** in this assignment, we created and setted rules for Firewall with SSH option. As it was displayed at **step 3** in the VM Creation section, first we went to the VPC Set up/Firewall/Create Firewall rule. There we can set rules for our firewall. It means that we can define our own network and control the traffic in Google Cloud services. We already created a VPC Network in step 3, like this way we can set VPC.

Connectivity

To ensure that our VM communicate with internet it's enough to run our VM, then run commands:
-ping google.com (returns pings and bytes from google.com)
or
-curl -I https://www.google.com (it will return more information about connection status)
as it was displayed at **Picture-3.1** below. By this we can easily ensure that our VM communicates with the Internet.

Picture-3.1



Findings

For a number of reasons, networking is crucial to cloud architecture. It makes it possible for resources like databases, storage, and virtual machines to communicate with one another and work together more easily. By lowering latency and guaranteeing that apps operate well, good networking also enhances performance. Because of its support for scalability, businesses may readily add resources as their demands increase. Additionally, networking is essential for disaster recovery since it offers high availability and facilitates speedy data recovery. All things considered, the efficiency, security, and functionality of cloud infrastructure depend heavily on efficient networking.

Conclusion

In conclusion, Google Cloud provides a robust suite of services that significantly enhance how businesses operate in a digital landscape. *Virtual Machines* offer the flexibility and scalability needed to run diverse applications efficiently, allowing organizations to adapt to changing demands while optimizing costs. With features like custom machine types and preemptible VMs, businesses can tailor their infrastructure to meet specific needs.

Google Cloud's Storage Solutions ensure data is stored reliably and is readily accessible, catering to various storage needs through options like Cloud Storage, Persistent Disks, and Filestore. The ability to implement Object Lifecycle Management further streamlines data handling by automating processes such as archiving and deletion, which helps organizations manage costs and comply with data retention policies.

Networking in Google Cloud plays a critical role in maintaining seamless communication between resources, ensuring that applications run smoothly while prioritizing security. With capabilities like Virtual Private Clouds (VPCs), firewall rules, and private Google access, organizations can build secure and efficient network architectures that support both public and hybrid cloud environments.

Together, these services create a comprehensive and integrated cloud environment, empowering businesses to innovate, scale, and thrive in an ever-evolving technological landscape. Google Cloud's commitment to providing flexible, secure, and efficient solutions positions it as a leader in the cloud services industry.

References

1. Google cloud services documentation (2024) Available at: https://cloud.google.com/storage (Accessed: 16 october 2024).
2. Google cloud services documentation (2024) Available at: https://cloud.google.com/network-connectivity-center?gad_source=1&gclid=CjwKCAjwpbi4BhByEiwAMC8JnbVPOou_1Ox1_sxAGDKeAtx2XIhE_l6K89F28-j4XzMeuET2Abx-BxoCK38QAvD_BwE&gclsrc=aw.ds (Accessed: 16 october 2024).