

Assignment 2, Cloud Computing

Assignment: Exploring Google Cloud Services

Performed by: Aisha Ait

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Introduction

The goal of this assignment is to gain hands-on experience with Google Cloud services, specifically focusing on virtual machines, storage solutions, and networking. Students will set up and configure different services within Google Cloud and document their findings.

Disclaimer

I did not create VM instances since I did not want to create an account. Instead, I described steps needed to perform the task, that is why no screenshots were taken.

1. Virtual Machines in Google Cloud

VM Creation:

Step 1: In the Google Cloud Console site from the dashboard, on the left-hand menu, I click “Compute Engine” and select “VM instances”.

Step 2: I click the “Create Instance” button at the top of the VM instances page.

Step 3: Configured the VM Instance

- **Name:** I give the instance a name - “aisha-vm-instance”.
- **Region and Zone:** I choose a region “Asia-Northeast3” since it is the nearest to Kazakhstan.

Google Cloud Compute Engine – My First Project – Google Cloud co... 13 А ⚡ перевести

Create an instance

Identify your VM

Name * aisha-vm-instance

Region * asia-northeast3 (Seoul) Zone * asia-northeast3-a

Labels [MANAGE LABELS](#)

Tags [+ ADD TAGS](#)

[SHOW LESS](#)

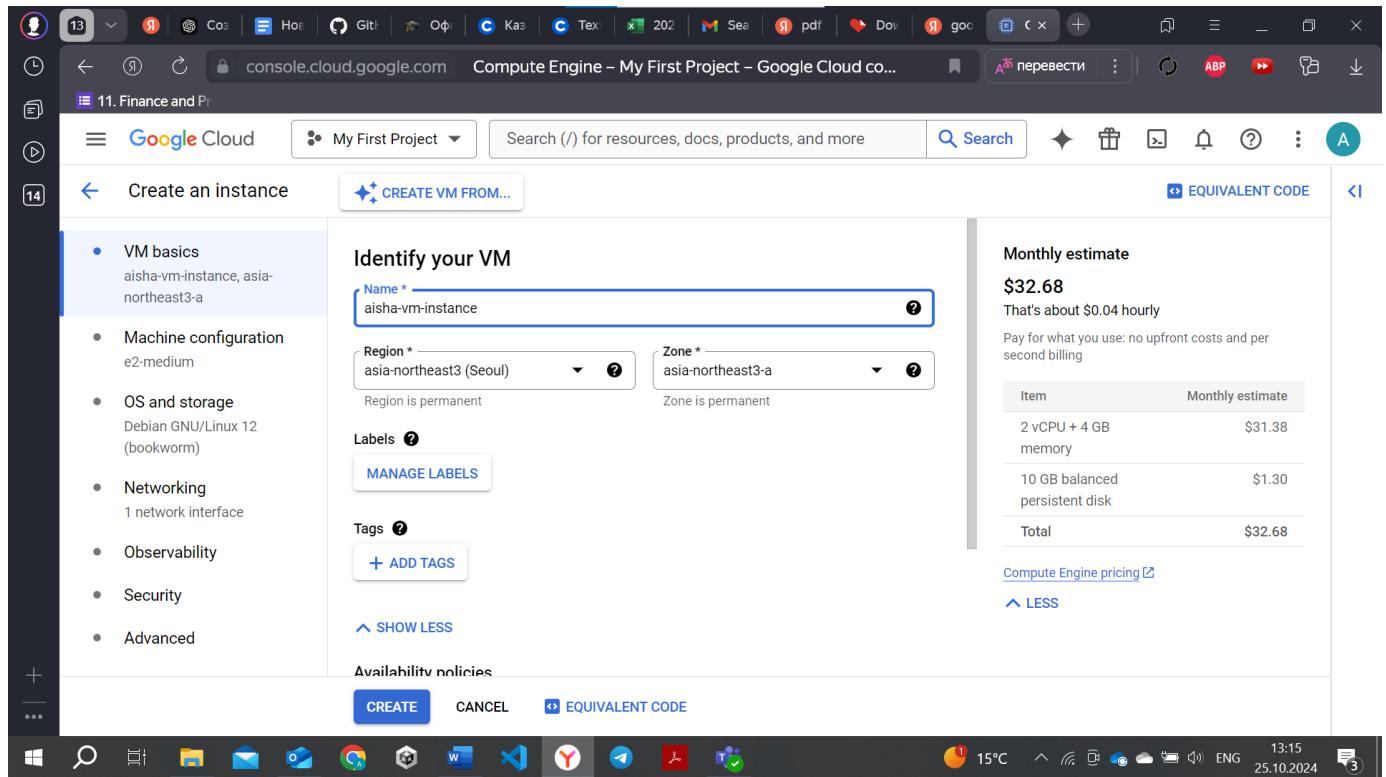
Availability policies

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

Monthly estimate
\$32.68
That's about \$0.04 hourly
Pay for what you use: no upfront costs and per second billing

Item	Monthly estimate
2 vCPU + 4 GB memory	\$31.38
10 GB balanced persistent disk	\$1.30
Total	\$32.68

[Compute Engine pricing](#) [LESS](#)



Google Cloud VM instances – Compute Engine – My First Project – ... 13 А ⚡ перевести

VM instances

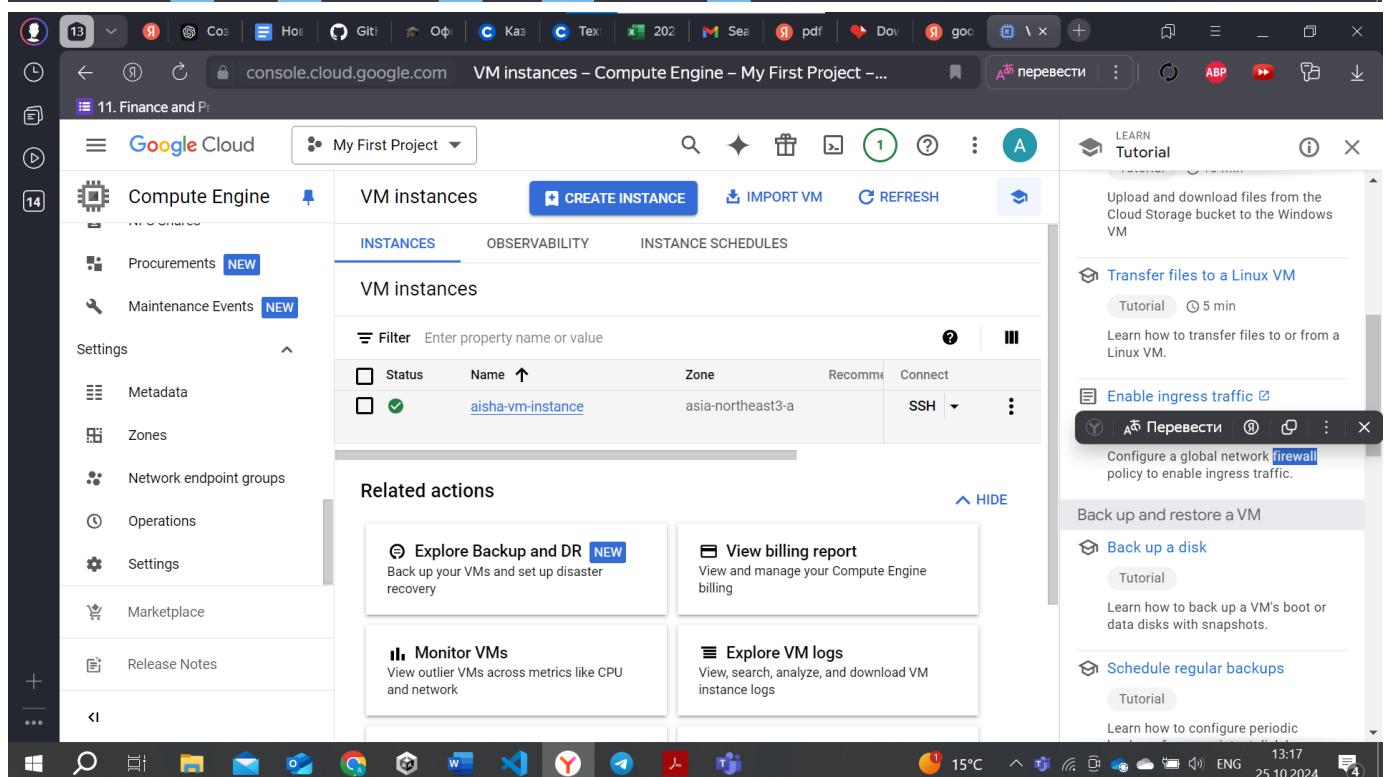
[CREATE INSTANCE](#) [IMPORT VM](#) [REFRESH](#)

Status	Name	Zone	Recommendations	Connect
<input type="checkbox"/>	aisha-vm-instance	asia-northeast3-a	SSH	⋮

Related actions

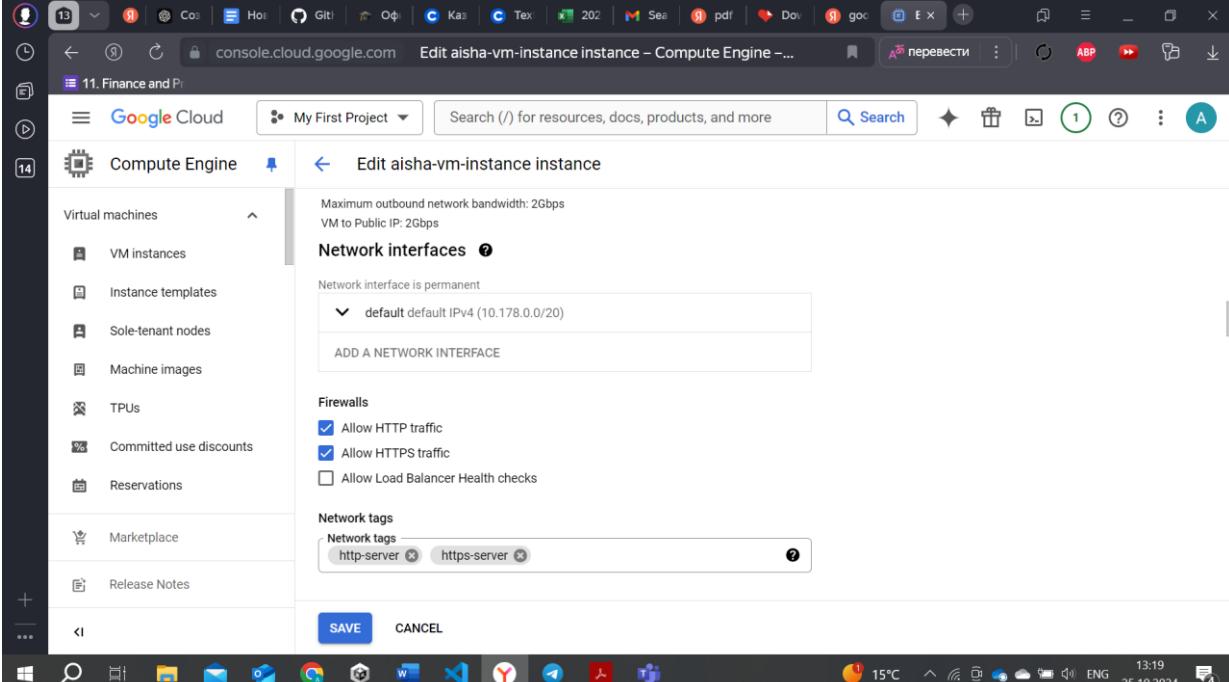
[Explore Backup and DR](#) [View billing report](#)

[Monitor VMs](#) [Explore VM logs](#)

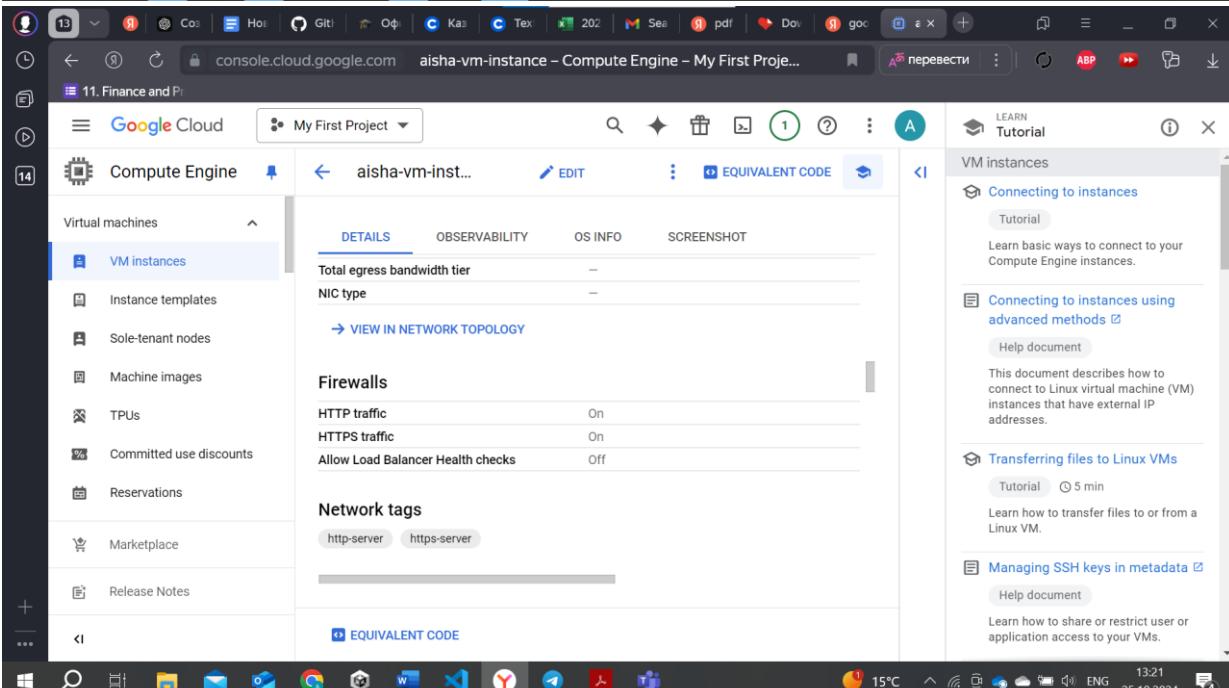


Step 4: Configured Firewall to Allow SSH Traffic

- Under the **Firewall** section, I:
 - Checked the box for **Allow HTTP traffic**.
 - Checked the box for **Allow HTTPS traffic** (for secure web traffic).
 - This will allow external users to access your web server via HTTP/HTTPS.
 - I click “Save”.



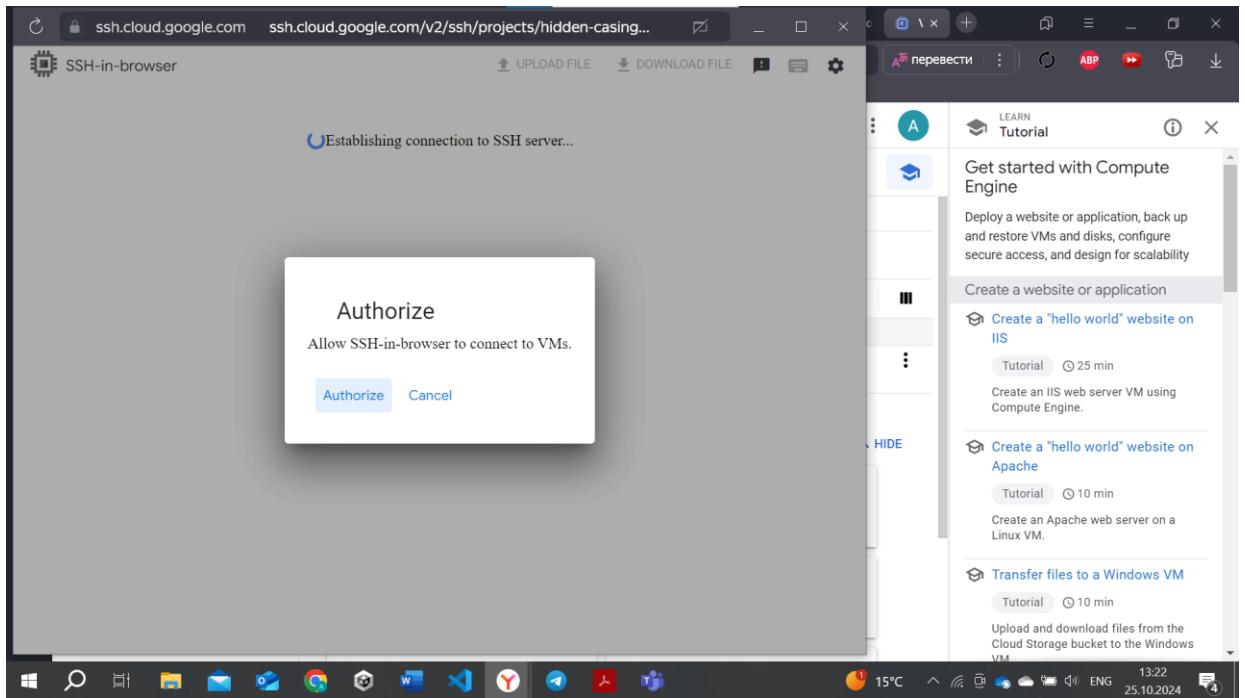
The screenshot shows the "Edit aisha-vm-instance instance" page in the Google Cloud Compute Engine interface. In the "Network interfaces" section, under "Firewalls", the checkboxes for "Allow HTTP traffic" and "Allow HTTPS traffic" are checked. Below this, under "Network tags", there are two tags: "http-server" and "https-server". At the bottom of the page, there are "SAVE" and "CANCEL" buttons.



The screenshot shows the "aisha-vm-inst..." page in the Google Cloud Compute Engine interface. Under the "Firewalls" section, it shows that "HTTP traffic" is On and "HTTPS traffic" is On. To the right of the main content, there is a sidebar titled "LEARN" with several documentation links related to connecting to instances, transferring files, and managing SSH keys.

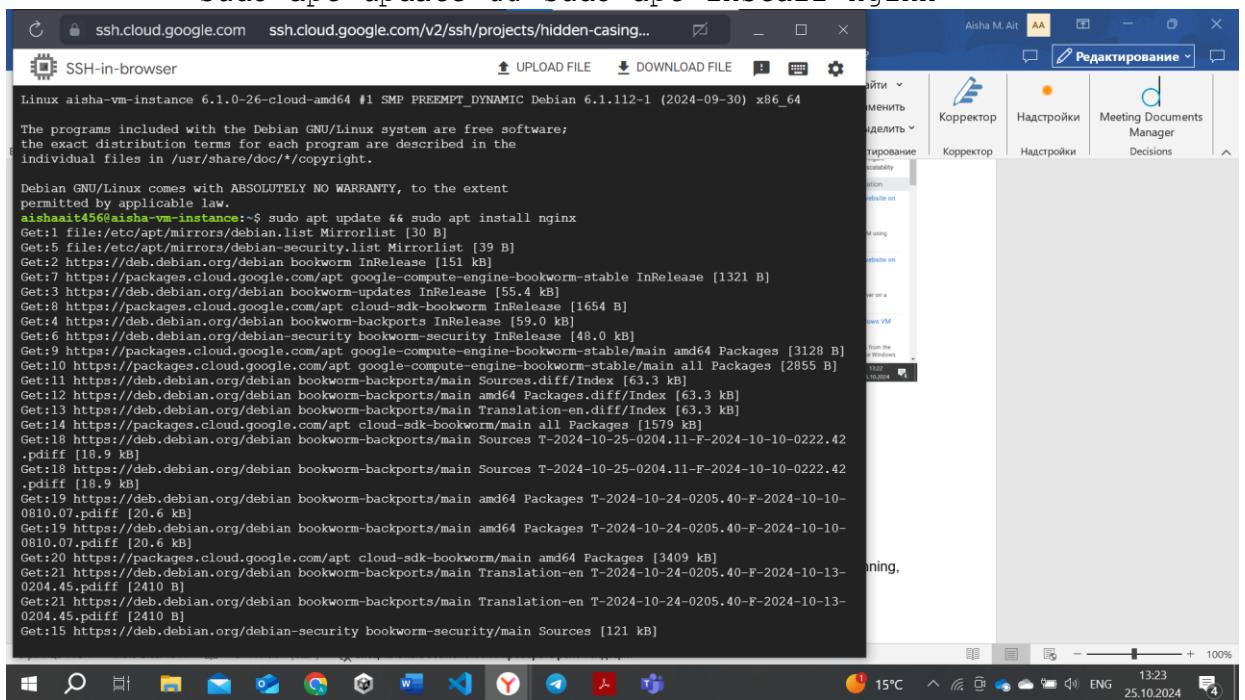
Connection to the VM:

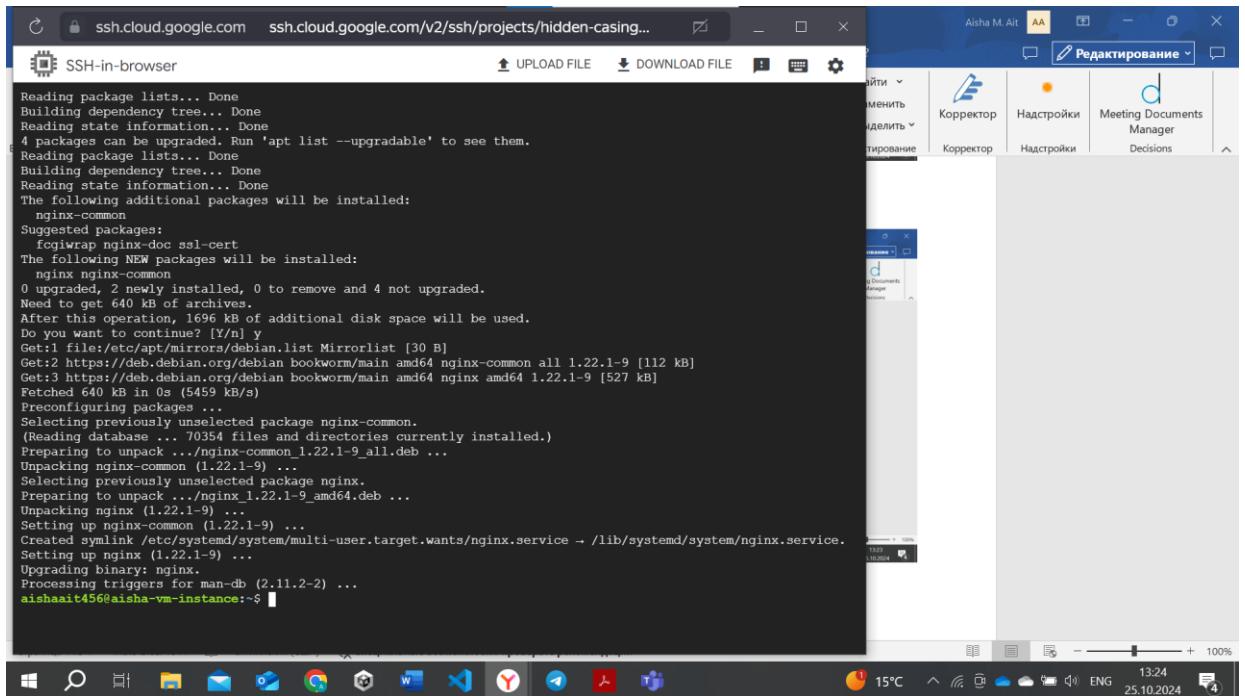
Step 1: Used the SSH option from the Google Cloud Console to connect to the VM.



Step 2: On the VM, I installed a web server by using command for Nginx:

```
sudo apt update && sudo apt install nginx
```

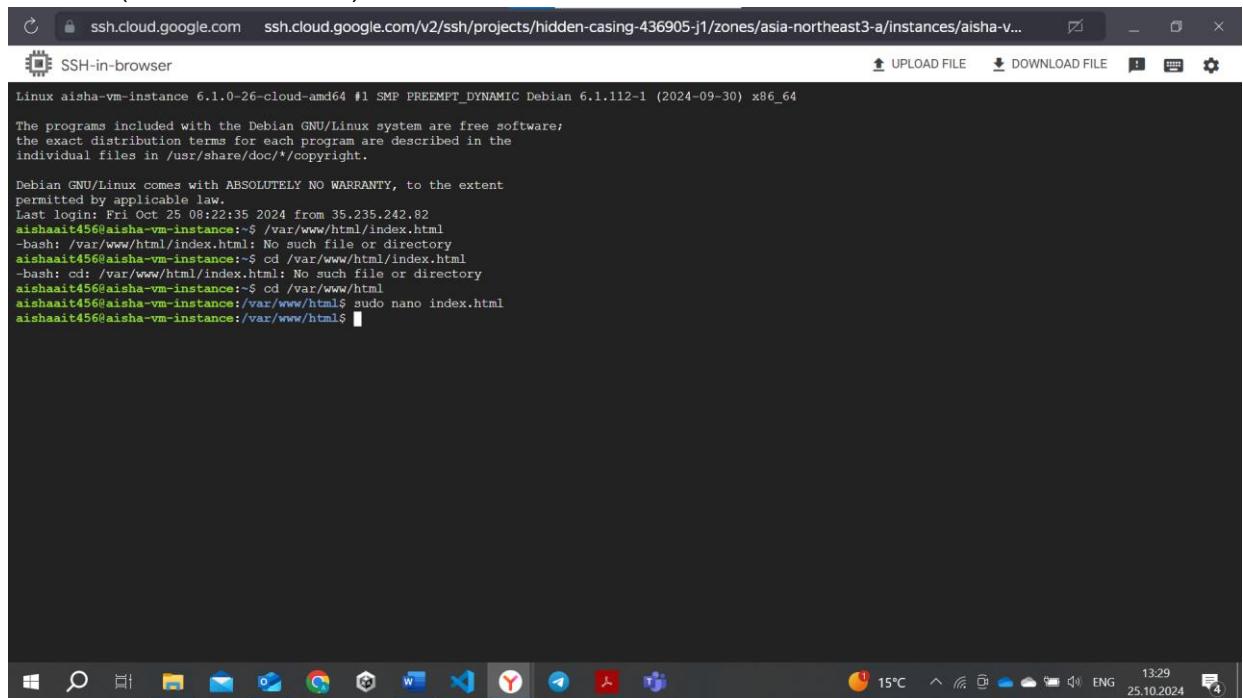




```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
4 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
nginx-common
Suggested packages:
fcgiwrap nginx-doc ssl-cert
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
Get:1 file:/etc/apt/mirrors.debian.list Mirrorlist [30 B]
Get:2 https://deb.debian.org/debian bookworm/main amd64 nginx-common all 1.22.1-9 [112 kB]
Get:3 https://deb.debian.org/debian bookworm/main amd64 nginx amd64 1.22.1-9 [527 kB]
Fetched 640 kB in 0s (5459 kB/s)
Preconfiguring packages ...
Selecting previously unselected package nginx-common.
(Reading database ... 70356 files and directories currently installed.)
Preparing to unpack .../nginx-common 1.22.1-9_all.deb ...
Unpacking nginx-common (1.22.1-9) ...
Selecting previously unselected package nginx.
Preparing to unpack .../nginx 1.22.1-9_amd64.deb ...
Unpacking nginx (1.22.1-9) ...
Setting up nginx-common (1.22.1-9) ...
Created symlink /etc/systemd/system/multi-user.target.wants/nginx.service → /lib/systemd/system/nginx.service.
Setting up nginx (1.22.1-9) ...
Upgrading binary: nginx.
Processing triggers for man-db (2.11.2-2) ...
aishaait456@aisha-vm-instance:~$
```

Step 3: Created a Test HTML Page:

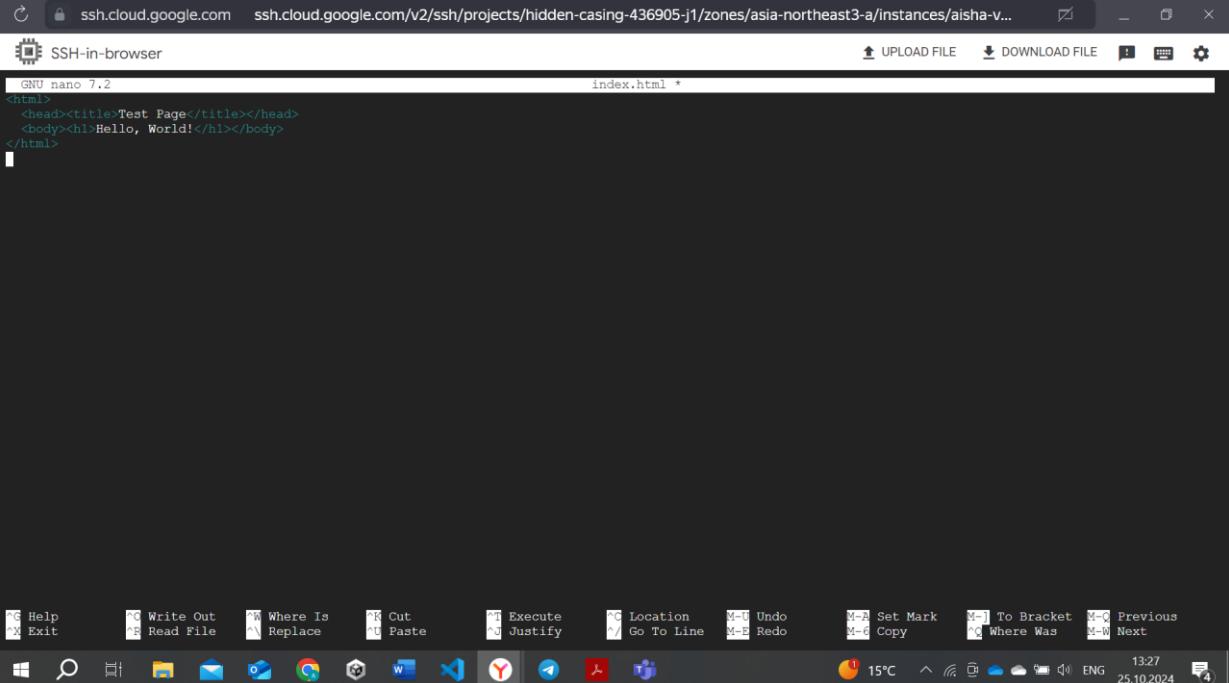
- Created a simple HTML file in the web server's root directory
(cd /var/www/html).



```
Linux aisha-vm-instance 6.1.0-26-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.112-1 (2024-09-30) 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.
Last login: Fri Oct 25 08:22:35 2024 from 35.235.242.82
aishaait456@aisha-vm-instance:~$ cd /var/www/html
-a bash: /var/www/html/index.html: No such file or directory
aishaait456@aisha-vm-instance:~$ cd /var/www/html/index.html
-a bash: cd: /var/www/html/index.html: No such file or directory
aishaait456@aisha-vm-instance:~$ sudo nano index.html
aishaait456@aisha-vm-instance:~$
```

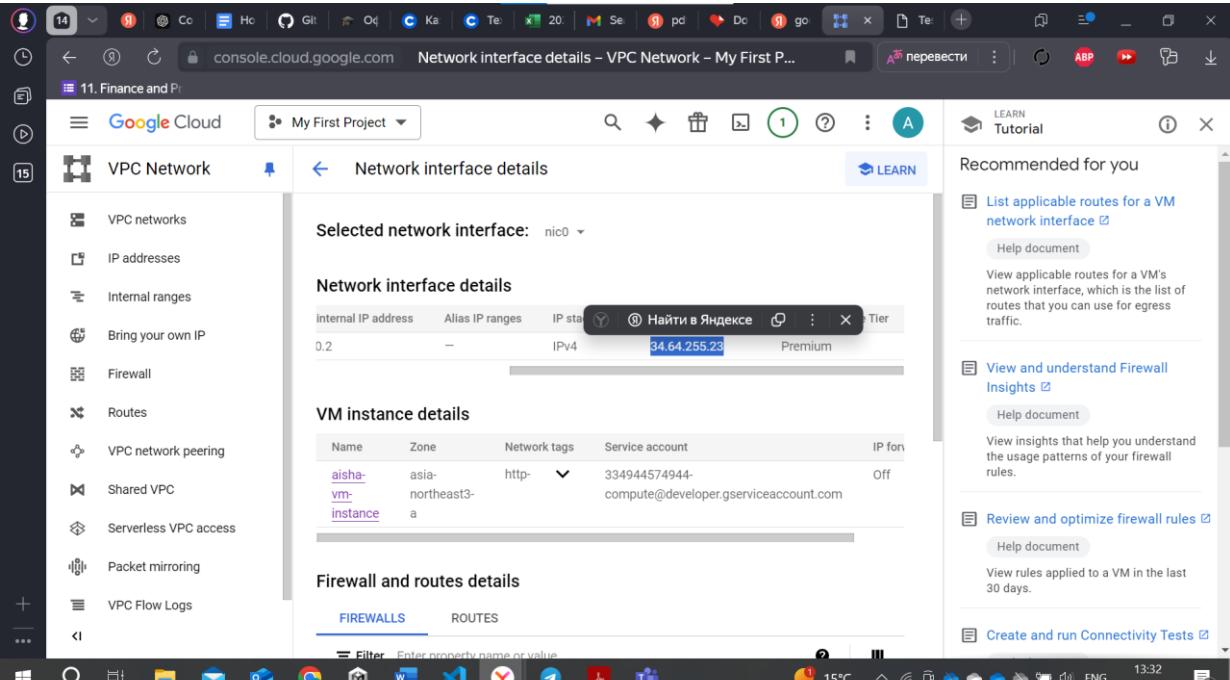
- Use a text editor like nano or vim to create an HTML file:
sudo nano index.html



```
GNU nano 7.2 index.html *
<html>
<head><title>Test Page</title></head>
<body><h1>Hello, World!</h1></body>
</html>
```

The screenshot shows a terminal window titled "SSH-in-browser" running on "ssh.cloud.google.com". The command "nano index.html" was run, creating a file with the content of a simple HTML page. The terminal has a dark background with white text. At the bottom, there's a standard Windows-style menu bar with options like Help, Exit, Write Out, Read File, Where Is, Replace, Cut, Paste, Execute, Location, Undo, Redo, Set Mark, To Bracket, Copy, Where Was, Previous, and Next. Below the menu is a toolbar with icons for various functions. The status bar at the bottom right shows the date and time: 15°C, ENG, 25.10.2024.

- Opened the VM's public IP address in a browser to confirm the web server is running, and the test page is displayed correctly.



The screenshot shows the Google Cloud Console interface. The left sidebar is collapsed, and the main area displays "Network interface details - VPC Network - My First Project".

Selected network interface: nic0

Network interface details

Internal IP address	Alias IP ranges	IP state	Tier
0.2	—	IPv4 34.64.255.23	Premium

VM instance details

Name	Zone	Network tags	Service account	IP forwarding
aisha-vm-instance	asia-northeast3-a	http-	334944574944-compute@developer.gserviceaccount.com	Off

Firewall and routes details

FIREWALLS ROUTES

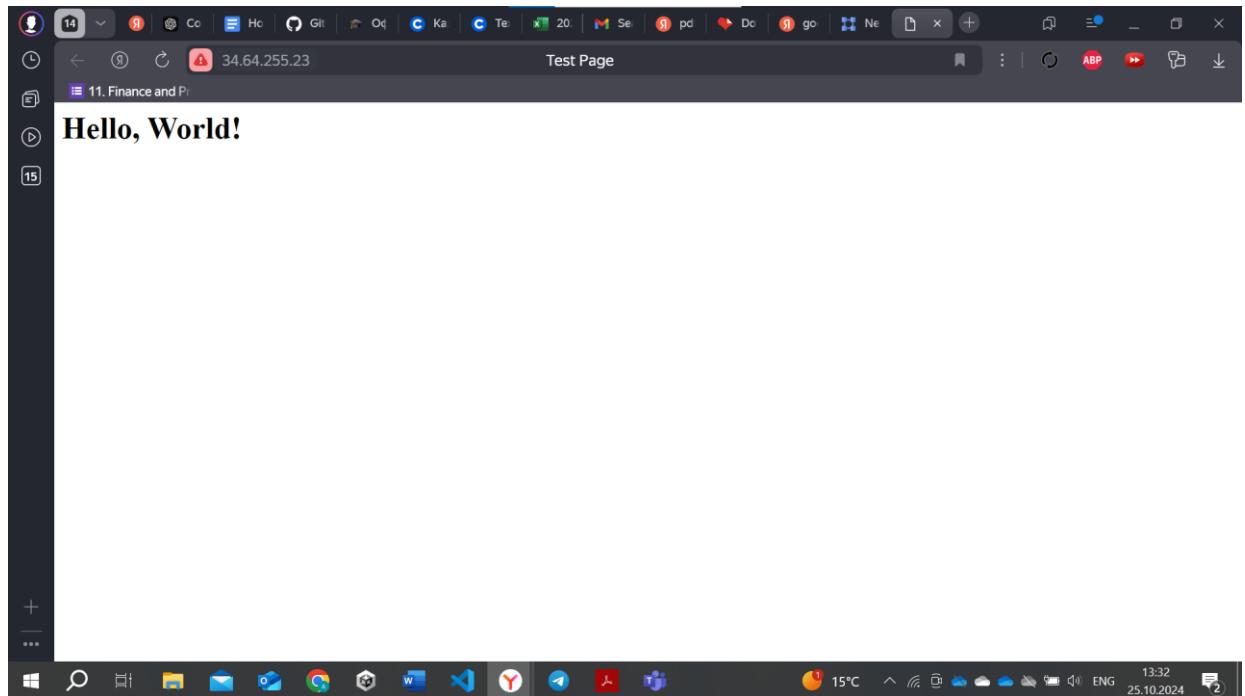
Help document View applicable routes for a VM's network interface, which is the list of routes that you can use for egress traffic.

View and understand Firewall Insights Help document View insights that help you understand the usage patterns of your firewall rules.

Review and optimize firewall rules Help document View rules applied to a VM in the last 30 days.

Create and run Connectivity Tests

The status bar at the bottom right shows the date and time: 15°C, ENG, 25.10.2024.



2. Storage Solutions in Google Cloud

Bucket creation:

Step 1:

- I went to the Google Cloud Console and navigated to the **Cloud Storage** section.
- I clicked **Create Bucket** and named it `aisha-bucket-tst`.
- During the setup, I chose the storage location, selected “Standard” storage class, and set the access control to private, ensuring that only I have access to the files.
- Saved the bucket settings.

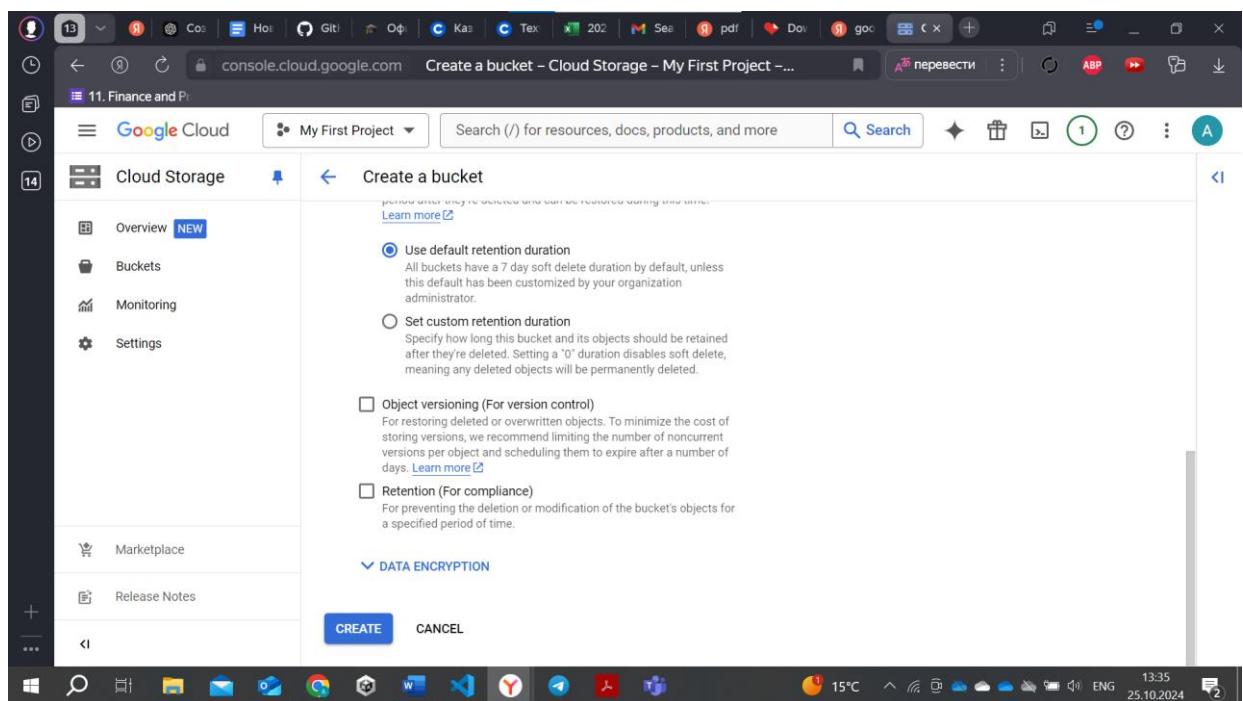
A screenshot of the Google Cloud Storage 'Create a bucket' wizard. The left sidebar shows 'My First Project' and 'Cloud Storage' with sub-options like Overview, Buckets, Monitoring, and Settings. The main panel is titled 'Create a bucket' and contains several steps:

- Get Started**: Name: aisha-bucket-tst
- 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**: Your data is always protected with Cloud Storage but you can also choose from these additional data protection options to add extra layers of security.

On the right, there's a 'Good to know' section with 'Location pricing' information and a table showing estimated monthly costs for different storage items. The table includes:

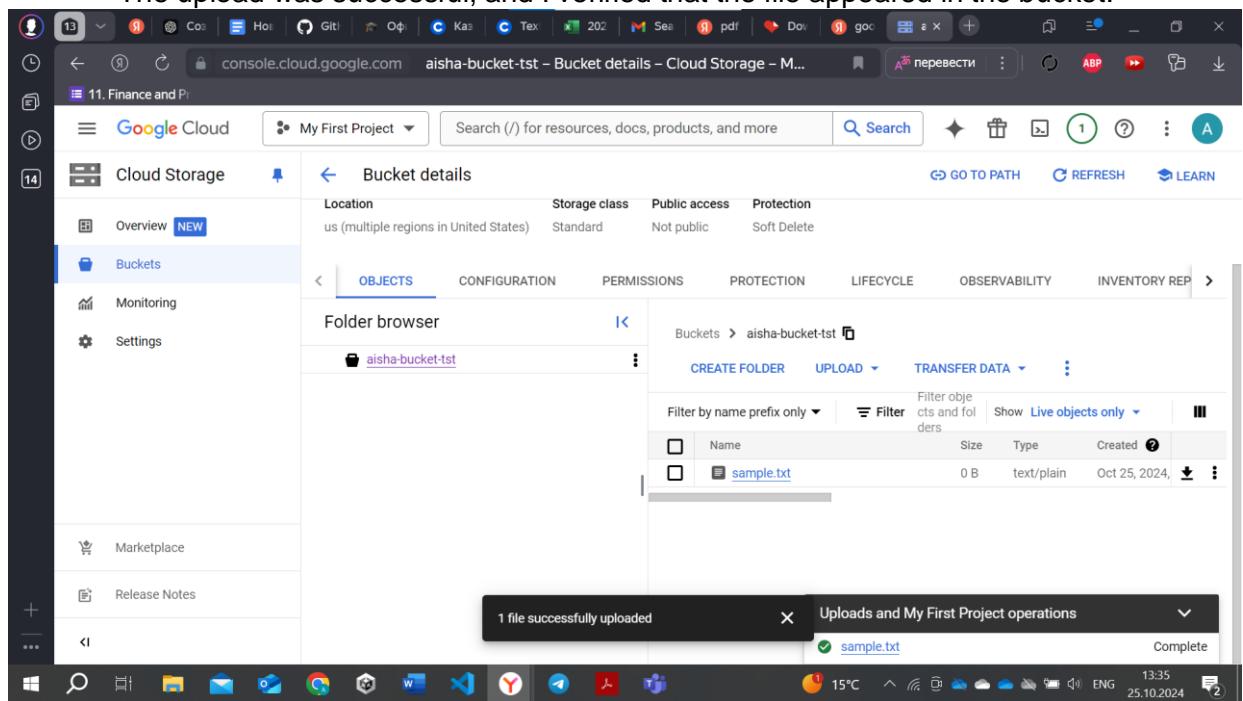
Item	Cost
us (multiple regions in United States)	\$0.026 per GB-month
With default replication	\$0.020 per GB written

The system tray at the bottom shows the date as 25.10.2024 and the time as 13:34.



Step 2. Uploaded a Sample File:

- After the bucket was created, I uploaded a sample txt file by clicking the "Upload files" button in the bucket's dashboard.
- The upload was successful, and I verified that the file appeared in the bucket.



Step 3. Set Up Object Lifecycle Management:

- I went to the **Lifecycle section** of the bucket settings.

- I added a new lifecycle rule that automatically deletes objects older than 30 days.
- I applied the rule, ensuring my files are managed efficiently over time.

The screenshot shows the Google Cloud Storage Bucket details page for the 'aisha-bucket-tst' bucket. The left sidebar shows 'Cloud Storage' with 'Overview NEW' selected. The main content area has tabs for 'OBJECTS', 'CONFIGURATION', 'PERMISSIONS', 'PROTECTION', 'LIFECYCLE' (which is selected), 'OBSERVABILITY', and 'INVENTORY REP'. Below the tabs, a note says 'After you add or edit a rule, it may take up to 24 hours to take effect.' A section titled 'Lifecycle rules let you apply actions to a bucket's objects when certain conditions are met – for example, switching objects to colder storage classes when they reach or pass a certain age.' includes a 'Learn more' link. A 'Rules' section with 'ADD A RULE' and 'DELETE ALL' buttons shows a message: 'You haven't added any lifecycle rules to this bucket.' The URL in the address bar is <https://console.cloud.google.com/storage/lifecycle/aisha-bucket-tst/edit?>

The screenshot shows the 'Add object lifecycle rule' configuration page. The left sidebar shows 'Cloud Storage' with 'Overview NEW' selected. The main content area has a heading 'Select object conditions' with a note: 'This rule will apply the action to current and future objects or multi-part uploads that meet all the selected conditions below.' It includes a 'Set Rule Scopes' section for prefix and suffix rule scopes. Under 'Set Conditions', 'Age' is checked with a value of '30' days. A note explains: 'Age is counted from when an object was uploaded to the current bucket, even if it moved from another.' Other condition options include 'Created before' and 'Storage class matches'. The URL in the address bar is <https://console.cloud.google.com/storage/lifecycle/aisha-bucket-tst/edit?>

The screenshots illustrate the process of creating a lifecycle rule in Google Cloud Storage. The top window shows the configuration dialog where actions and conditions are selected. The bottom window shows the resulting rule defined in the bucket's lifecycle settings.

Action	Object condition	Works with
Delete object	30+ days since object was created	trash pencil

Lifecycle Management: Lifecycle rules in Google Cloud Storage (GCS) are automated policies that help manage the storage and lifecycle of objects within a bucket. These rules define actions that should be taken on objects based on their age, storage class, or other criteria.

Findings: I learned enhanced navigation in Google Cloud Console, understood the importance of automated file management, valued documentation for future reference.

3. Networking in Google Cloud

VPC Setup:

Step 1. Created a New VPC Network with Subnets:

- I went to the **VPC Network** section in **Google Cloud Console** and clicked **Create VPC network**.
- I named the network like `aisha-vpc`.
- I created a few subnets in different regions, setting up the IP ranges.
- After configuring the subnets, I saved the VPC.

The screenshots show the 'Create a VPC network' wizard in the Google Cloud Console. The left sidebar lists various VPC-related options: VPC networks, IP addresses, Internal ranges, Bring your own IP, Firewall, Routes, VPC network peering, Shared VPC, Serverless VPC access, Packet mirroring, and VPC Flow Logs. The main pane shows the configuration for a new VPC network named 'aisha-vpc'. It includes fields for 'Name' (aisha-vpc), 'Description', 'Maximum transmission unit (MTU)' (1460), 'Subnet creation mode' (Custom selected), and 'Private IPv6 address settings' (checkbox unchecked). Below these are sections for 'Subnets' (with a note about creating a private cloud topology) and 'Firewall rules' (with a note to select rules for the VPC network). The bottom screenshot shows the completed configuration with three subnets ('subnet-1', 'subnet-2', 'subnet-3') listed under the 'Subnets' section.

Step 2. Configured Firewall Rules:

- In the **VPC settings**, I created a new firewall rule to allow traffic between my VM and the internet.
- I allowed SSH, HTTP, and ICMP traffic to ensure external access and monitoring capabilities.

The screenshot shows the Google Cloud Network Security interface. On the left sidebar, under 'Cloud Armor', 'Cloud IDS', and 'Cloud NGFW', there are various options like Secure Web Proxy, DDoS Dashboard, Cloud Armor policies, Adaptive Protection, Cloud Armor Service Tier, IDS Dashboard, IDS Endpoints, and IDS Threats. The main panel is titled 'Create a firewall rule' and shows the configuration for a new rule named 'rule-1'. The 'Protocols and ports' section is set to 'Specified protocols and ports'. Under 'TCP', ports 22 and 80 are selected. Under 'Other', 'Protocol' is set to 'icmp'. A note at the bottom says 'Separate multiple protocols by commas, e.g. ah; icmp'.

The screenshot shows the Google Cloud VPC Network details interface for the 'aisha-vpc' network. The left sidebar lists VPC networks, IP addresses, Internal ranges, Bring your own IP, Firewall, Routes, VPC network peering, Shared VPC, Serverless VPC access, Packet mirroring, and VPC Flow Logs. The main panel is titled 'VPC network details' for 'aisha-vpc'. It shows the 'FIREWALLS' tab selected. A table lists the existing firewall rule: Name: 'rule-1', Enforcement order: 1, Type: 'VPC firewall rules', Deployment scope: 'Global'. Below the table, a message box says 'Successfully created firewall rule "rule-1"'.

- The rule was applied to all the VMs connected to the VPC.

Step 3. I went to the VM instance settings and verified that it was connected to the new VPC ('aisha-vpc') under the network interface. Ensured everything was connected correctly.

Connectivity: I logged into the VM via SSH and used the following commands:

ping google.com – the ping was successful, confirming that the VM was connected to the internet through the VPC.

```
Linux aisha-vm-instance 6.1.0-26-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.112-1 (2024-09-30) 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.

Last login: Fri Oct 25 08:25:07 2024 from 35.235.242.81
aisha@t456:aisha-vm-instance:~$ ping google.com
PING google.com (142.250.206.238) 56(84) bytes of data.
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=1 ttl=117 time=35.2 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=2 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=3 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=4 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=5 ttl=117 time=33.5 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=6 ttl=117 time=33.7 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=7 ttl=117 time=33.7 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=8 ttl=117 time=33.7 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=9 ttl=117 time=33.5 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=10 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=11 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=12 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=13 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=14 ttl=117 time=33.5 ms
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64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=19 ttl=117 time=33.7 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=20 ttl=117 time=33.5 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=21 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=22 ttl=117 time=33.7 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=23 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=24 ttl=117 time=33.5 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=25 ttl=117 time=33.5 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=26 ttl=117 time=33.6 ms
64 bytes from kix06s10-in-f14.le100.net (142.250.206.238): icmp_seq=27 ttl=117 time=33.6 ms
```

Findings: Networking is essential in cloud infrastructure as it enables seamless connectivity and communication between services while ensuring security through access controls and isolation. It supports scalability and performance optimization by allowing dynamic resource allocation and load balancing. Additionally, effective networking enhances disaster recovery and cost management, making it crucial for building reliable cloud environments.

Conclusion:

In this assignment, I learned how to create and manage key components of Google Cloud services, including Virtual Machines, Cloud Storage buckets, and Virtual Private Cloud (VPC) networks. I gained hands-on experience in configuring firewall rules, implementing object lifecycle management, and ensuring network connectivity for VMs. These skills are vital for building scalable, secure, and high-performing cloud environments.

The potential applications of these Google Cloud services are vast, ranging from hosting web applications and managing data storage to enabling robust disaster recovery solutions. Organizations can leverage these services to enhance their operational efficiency, improve security, and optimize costs while meeting their specific business needs. Overall, this experience has equipped me with valuable insights into the practical aspects of cloud infrastructure and its role in modern IT solutions.

References:

Google Cloud Documentation:

- Compute Engine Documentation
- Cloud Storage Documentation
- VPC Documentation

Google Cloud Training and Tutorials:

- Google Cloud Training
- [Qwiklabs: Hands-On Cloud Training](#)