



National University of Sciences and Technology (NUST)
School of Electrical Engineering and Computer Science

Faculty of Computing

SE-315: Cloud Computing

Lab 03: Cloud Shell and GCP essentials

CLO1: Explain the core concepts of the cloud computing paradigm

Date: 25.09.24



Lab 03: Cloud Shell and GCP essentials

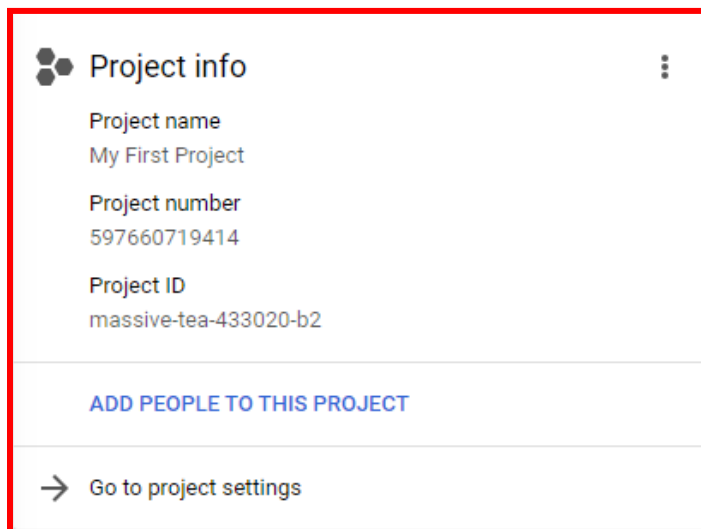
Lab Task

Task 1. Configuring your environment

In the below screenshot, I am setting the region and zone as **us-central1** and **us-central1-c**

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud config set compute/region us-central1
WARNING: Property validation for compute/region was skipped.
Updated property [compute/region].
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud config get-value compute/region
Your active configuration is: [cloudshell-16703]
us-central1
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud config set compute/zone us-central1-c
WARNING: Property validation for compute/zone was skipped.
Updated property [compute/zone].
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud config get-value compute/zone
Your active configuration is: [cloudshell-16703]
us-central1-c
```

Finding project information



we can see that project-id is: massive-tea-433020-b2



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similarly, we can get the project-id from terminal as well:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud config get-value project
Your active configuration is: [cloudshell-16703]
massive-tea-433020-b2
```

view details about the project using “gcloud compute project-info describe --project \$(gcloud config get-value project)”

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute project-info describe --project $(gcloud config get-value project)
Your active configuration is: [cloudshell-16703]
cloudArmorTier: CA_STANDARD
commonInstanceMetadata:
  fingerprint: -ciGDMTaydw=
  kind: compute#metadata
creationTimestamp: '2024-09-17T22:39:21.003-07:00'
defaultNetworkTier: PREMIUM
defaultServiceAccount: 597660719414-compute@developer.gserviceaccount.com
id: '5212495394395117927'
kind: compute#project
name: massive-tea-433020-b2
quotas:
- limit: 1000.0
  metric: SNAPSHOTS
  usage: 0.0
- limit: 5.0
  metric: NETWORKS
  usage: 1.0
- limit: 100.0
  metric: FIREWALLS
  usage: 8.0
- limit: 100.0
  metric: IMAGES
  usage: 0.0
- limit: 8.0
  metric: STATIC_ADDRESSES
  usage: 0.0
- limit: 200.0
  metric: ROUTES
  usage: 0.0
- limit: 15.0
  metric: FORWARDING_RULES
```

Setting environment variables to store project ID and zone:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ export PROJECT_ID=$(gcloud config get-value project)
Your active configuration is: [cloudshell-16703]
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ export ZONE=$(gcloud config get-value compute/zone)
Your active configuration is: [cloudshell-16703]
```

verifying that my variables are set properly:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ echo -e "PROJECT ID: massive-tea-433020-b2\nZONE: us-central1-c"
PROJECT ID: massive-tea-433020-b2
ZONE: us-central1-c
```

echo command outputs the Project ID and Zone correctly:

```
PROJECT ID: massive-tea-433020-b2
ZONE: us-central1-c
```



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Creating a **virtual machine** with the gcloud tool using **create** command:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute instances create gcelab2 --machine-type e2-medium --zone us-central1-c
Created [https://www.googleapis.com/compute/v1/projects/massive-tea-433020-b2/zones/us-central1-c/instances/gcelab2].
NAME: gcelab2
ZONE: us-central1-c
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.128.0.8
EXTERNAL_IP: 35.188.50.212
STATUS: RUNNING
```

following are the details of the vm (gcelab2) created:

```
Created [https://www.googleapis.com/compute/v1/projects/massive-tea-433020-b2/zones/us-central1-c/instances/gcelab2]
NAME: gcelab2
ZONE: us-central1-c
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.128.0.8
EXTERNAL_IP: 35.188.50.212
STATUS: RUNNING
```

Viewing the list of configurations in my environment:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud config list
[accessibility]
screen_reader = True
[component_manager]
disable_update_check = True
[compute]
gce_metadata_read_timeout_sec = 30
region = us-central1
zone = us-central1-c
[core]
account = sfatima.bese22seecs@seecs.edu.pk
disable_usage_reporting = False
project = massive-tea-433020-b2
[metrics]
environment = devshell
```



Task 2. Filtering command-line output

Listing the compute instance available in the project:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute instances list
NAME: gcelab2
ZONE: us-central1-c
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.128.0.8
EXTERNAL_IP: 35.188.50.212
STATUS: RUNNING
```

Listing the gcelab2 virtual machine:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute instances list --filter="name=('gcelab2')"
NAME: gcelab2
ZONE: us-central1-c
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.128.0.8
EXTERNAL_IP: 35.188.50.212
STATUS: RUNNING
```

Listing the firewall rules in the project:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute firewall-rules list
NAME: default-allow-health-check
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp
DENY:
DISABLED: False

NAME: default-allow-health-check-ipv6
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp
DENY:
DISABLED: False

NAME: default-allow-http
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp:80
DENY:
DISABLED: False

NAME: default-allow-https
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp:443
DENY:
DISABLED: False
```



Listing the firewall rules for the default network:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute firewall-rules list --filter="network='default'"
NAME: default-allow-health-check
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp
DENY:
DISABLED: False

NAME: default-allow-health-check-ipv6
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp
DENY:
DISABLED: False

NAME: default-allow-http
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp:80
DENY:
DISABLED: False

NAME: default-allow-https
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp:443
DENY:
DISABLED: False
```

Listing the firewall rules for the default network where the allow rule matches an ICMP rule:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute firewall-rules list --filter="NETWORK:'default' AND ALLOW:'icmp'"
NAME: default-allow-icmp
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 65534
ALLOW: icmp
DENY:
DISABLED: False

NAME: default-allow-internal
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 65534
ALLOW: tcp:0-65535,udp:0-65535,icmp
DENY:
DISABLED: False
```



Task 3. Connecting to your VM instance

Connecting **VM with SSH**, run the following command:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute ssh gcelab2 --zone us-central1-c
WARNING: The private SSH key file for gcloud does not exist.
WARNING: The public SSH key file for gcloud does not exist.
WARNING: You do not have an SSH key for gcloud.
WARNING: SSH keygen will be executed to generate a key.
This tool needs to create the directory [/home/sfatima_bese22seecs/.ssh] before being able to generate SSH keys.

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

Installing **nginx web server** on virtual machine:

```
sfatima_bese22seecs@gcelab2:~$ sudo apt install -y nginx
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
```

checking if nginx is enabled using **status** command:

```
sfatima_bese22seecs@gcelab2:~$ sudo systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
   Loaded: loaded (/lib/systemd/system/nginx.service; enabled; vendor preset: enabled)
   Active: active (running) since Wed 2024-09-25 04:54:36 UTC; 2min 26s ago
     Docs: man:nginx(8)
```

disconnecting from SSH using **exit** command:

```
sfatima_bese22seecs@gcelab2:~$ exit
logout
Connection to 35.188.50.212 closed.
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$
```



Task 4. Updating the firewall

Listing the firewall rules for the project:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute firewall-rules list
NAME: default-allow-health-check
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp
DENY:
DISABLED: False

NAME: default-allow-health-check-ipv6
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp
DENY:
DISABLED: False
```

Adding a tag to the virtual machine:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute instances add-tags gcelab2 --tags http-server,https-server
Updated [https://www.googleapis.com/compute/v1/projects/massive-tea-433020-b2/zones/us-central1-c/instances/gcelab2].
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$
```

Listing the firewall rules for the project after updating:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ gcloud compute firewall-rules list --filter=ALLOW:'80'
NAME: default-allow-http
NETWORK: default
DIRECTION: INGRESS
PRIORITY: 1000
ALLOW: tcp:80
DENY:
DISABLED: False
```

Verifying communication is possible for http to the virtual machine:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2)$ curl http://$(gcloud compute instances list --filter=name:gcelab2 --format='value(EXTERNAL_IP)')
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
  body {
    width: 35em;
    margin: 0 auto;
    font-family: Tahoma, Verdana, Arial, sans-serif;
  }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
```




Task 5. Viewing the system logs

Viewing the available logs on the system:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2) $ gcloud logging logs list
```

```
Enabling service [logging.googleapis.com] on project [massive-tea-433020-b2]...
Operation "operations/acat.p2-597660719414-4756a5f6-661d-4da0-b272-81a36652007b" finished successfully.
NAME: projects/massive-tea-433020-b2/logs/cloudaudit.googleapis.com%2Factivity
NAME: projects/massive-tea-433020-b2/logs/cloudaudit.googleapis.com%2Fsystem_event
NAME: projects/massive-tea-433020-b2/logs/compute.googleapis.com%2Fshielded_vm_integrity
NAME: projects/massive-tea-433020-b2/logs/sensitiveaction.googleapis.com%2Faction
```

Viewing the logs that relate to compute resources using **compute** filter:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2) $ gcloud logging logs list --filter="compute"
NAME: projects/massive-tea-433020-b2/logs/compute.googleapis.com%2Fshielded_vm_integrity
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2) $
```

Reading the logs related to the resource type of gce_instance:

```
sfatima_bese22seecs@cloudshell:~ (massive-tea-433020-b2) $ gcloud logging read "resource.type=gce_instance" --limit 3
---
insertId: kubmzwdv0x8
labels:
  compute.googleapis.com/root_trigger_id: 506b2dfe-5a9c-406d-ab27-b08bc646028e
logName: projects/massive-tea-433020-b2/logs/cloudaudit.googleapis.com%2Factivity
operation:
  id: operation-1727240633439-622ea8c65d48c-15927084-1fba26cb
  last: true
  producer: compute.googleapis.com
protoPayload:
  '@type': type.googleapis.com/google.cloud.audit.AuditLog
  authenticationInfo:
    principalEmail: sfatima.bese22seecs@seecs.edu.pk
    principalSubject: user:sfatima.bese22seecs@seecs.edu.pk
  methodName: v1.compute.instances.setTags
  request:
    '@type': type.googleapis.com/compute.instances.setTags
  requestMetadata:
    callerIp: 35.201.173.29
    callerSuppliedUserAgent: google-cloud-sdk gcloud/489.0.0 command/gcloud.compute.instances.add-tags
    invocation-id/a01d9e066ed04a0fbf70adce4dd93231 environment/devshell environment-version/None
    client-os/LINUX client-os-ver/6.1.100 client-pltf-arch/x86_64 interactive/True
    from-script/False python/3.11.9 term/screen (Linux 6.1.100+),gzip(gfe)
  destinationAttributes: {}
  requestAttributes: {}
  resourceName: projects/massive-tea-433020-b2/zones/us-central1-c/instances/gcelab2
  serviceName: compute.googleapis.com
receiveTimestamp: '2024-09-25T05:03:57.080445676Z'
resource:
  labels:
    instance_id: '9047304902235007985'
    project_id: massive-tea-433020-b2
    zone: us-central1-c
```



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Reading the logs for a specific virtual machine (gcelab2):

```
(massive-tea-433020-b2)$ gcloud logging read "resource.type=gce_instance AND labels.instance_name='gcelab2'" --limit=10
```

following is the logs explorer for the specific VM as he console did not display any output:

The screenshot shows the Google Cloud Logs Explorer interface. The query bar contains the query: `resource.type=gce_instance AND labels.instance_name='gcelab2'`. The left sidebar shows the log fields, including Resource Type (VM Instance), Log Name, Project ID, Instance ID, and Zone. The main panel displays a timeline of logs for the VM gcelab2, showing events such as `v1.compute.instances.insert` and `v1.compute.instances.setTags`. The logs are filtered for the last 1 hour, from 9/25/24, 9:19 AM to 9/25/24, 10:19 AM.

logs for gcelab2:

The screenshot shows the Google Cloud Logs Explorer interface, displaying logs for the VM gcelab2. The logs are filtered for the last 1 hour, from 9/25/24, 9:19 AM to 9/25/24, 10:19 AM. The logs show events such as `v1.compute.instances.insert` and `v1.compute.instances.setTags` for the VM gcelab2.



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Billing details:

Credits

ALL CREDITS

View and download credit details here. Active committed use discounts are not included here and can be viewed on the [Commitments page](#).

Filter Filter credits

Credit name	Status ↑	Percent remaining	Remaining value	Original value	Type	Credit ID	Scope ⓘ	Start date
SE315: Cloud Computing	✓ Available	100%	\$49.79	\$50.00	One-time	4BPQ3JFU...	Any service on this billing account.	September 10, 2024

Billing

Billing account
Billing Account for Education

Overview

Cost management

Reports

Cost table

Cost breakdown

Budgets & alerts

Billing export

Cost optimization

FinOps hub

Committed use discounts...

CUD analysis

Pricing

Cost estimation

Release Notes

Overview

Paid account

Manage billing account

Learn

Billing account overview

Your total cost
(September 1 – 25, 2024)

Cost
\$0.23

Credits used
\$0.23

Total cost
\$0.00

Forecasted total cost
\$0.00

0% vs. August

FinOps Hub with carbon tracking

Save up to
\$0.00

0% of last month's total cost

FinOps score
2.2 / 5.0

FinOps maturity: Medium

Create a budget alert

Set a monthly budget for your billing account. You'll get email notifications as your costs approach and exceed the budget amount.

\$100

\$

Create

Recommended for you

Cloud Billing overview

Help document

Understand how resources, billing accounts, and projects work together.

Google Cloud Billing Tour

Tutorial 10 min

Introduces the billing section of the console and some of the reports available to you.

Billing Reports Tutorial

Tutorial 30 min

Familiarize yourself with billing reports and learn how to answer cost management questions.

Analyze Cloud Billing data with BigQuery

Tutorial 20 min

Learn how to export Cloud Billing data to BigQuery and query it.

View your billing reports and cost trends

Help document

Learn how to use billing reports to gain visibility into your costs.

Type here to search

11:10 am
25/09/2024

as seen in the last screenshot, lab ended at **11:10 AM on 25/09/2024**