Topic: Report on GCP VM with Auto-Scaling and Security Implementation

Contributor:

Reda Fatima Ali (Indian Institute of Technology, Jodhpur)

Roll: M23AID008

Department: Data and Computational Sciences

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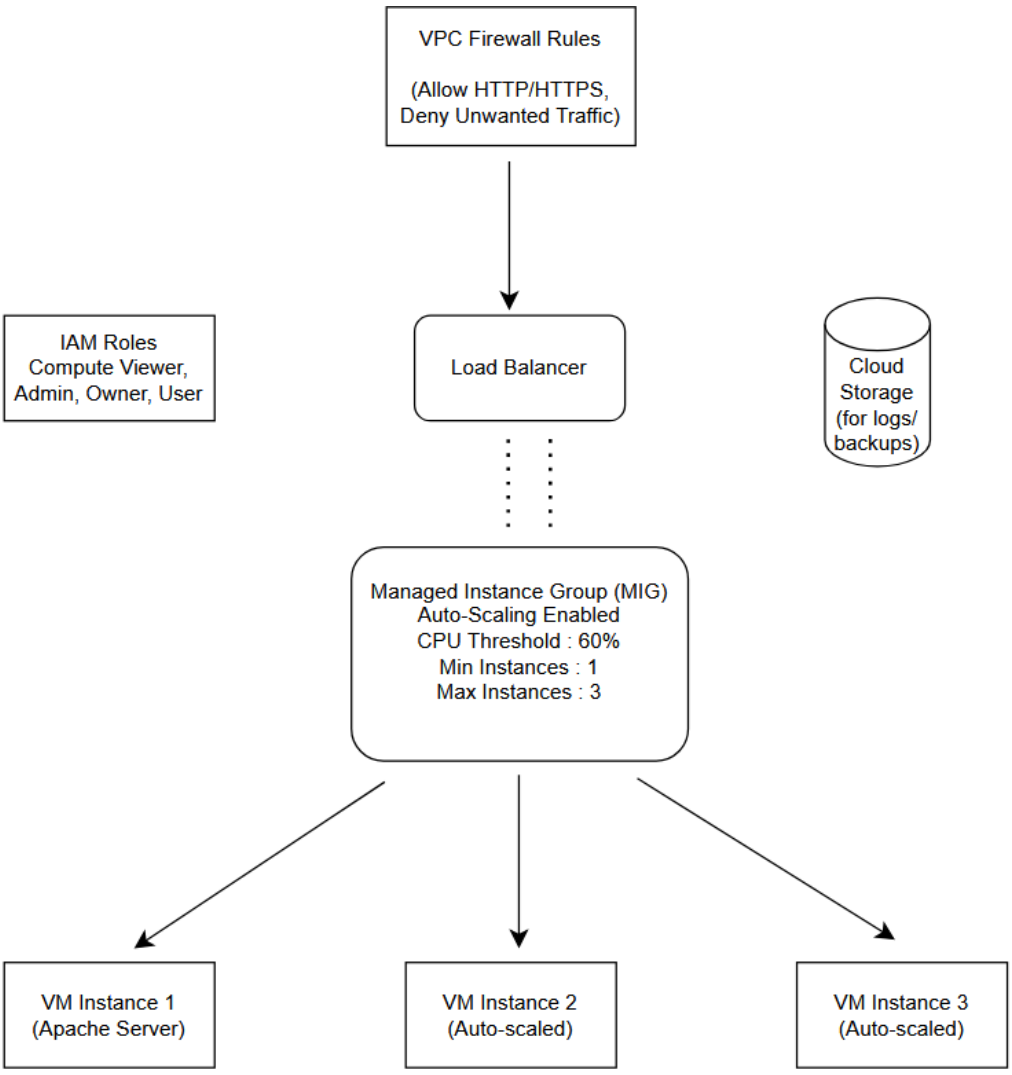

Architecture Design

Creation of VM instance on GCP

- Go to Google Cloud Console: https://console.cloud.google.com/
- Navigate to Compute Engine > VM Instances.
- Click 'Create Instance'.
- Enter the instance name ("*vm-instance*").
- Choose a region (e.g., us-central1) and zone.
- Select the machine type (e2-micro for free tier).
- Select the boot disk (Debian/Ubuntu).
- Under Firewall, check 'Allow HTTP traffic' and 'Allow HTTPS traffic' if needed.
- Click 'Create' to launch the VM.

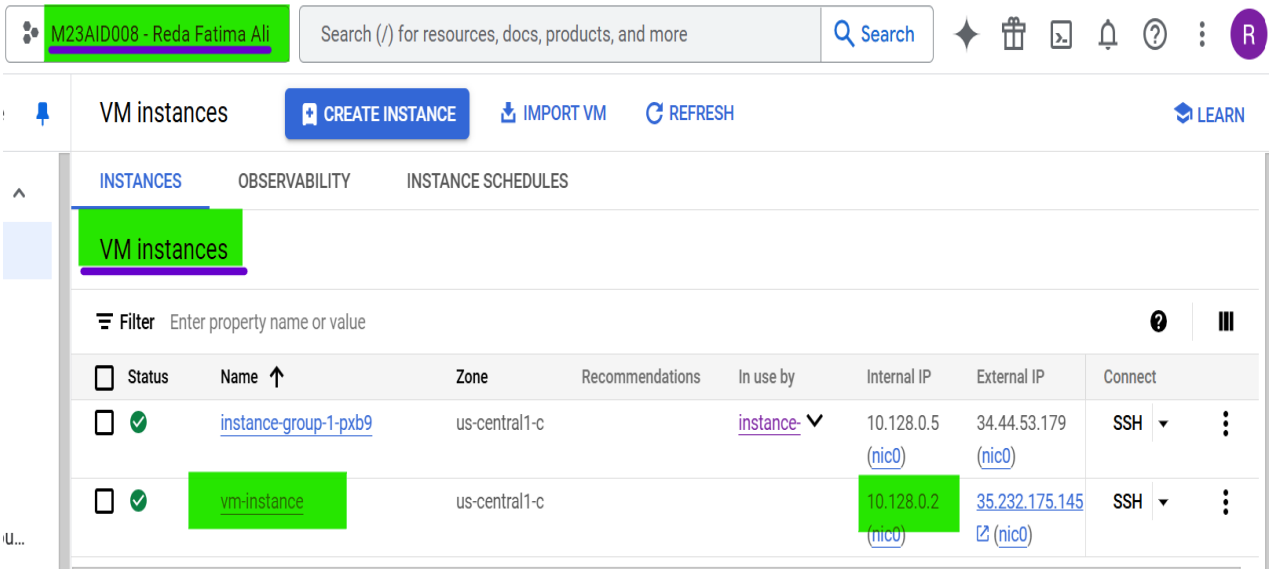

Fig. 1: VM Instance Created ("*vm-instance*")

Reasons to go for the above steps w.r.t creation of VM instance on GCP

- We start by creating a VM as the base compute resource needed to run applications and simulate workloads.
- Creating a VM in GCP provides a scalable, secure, and highly available compute environment with minimal setup.
- Choosing the free-tier eligible machine type (e2-micro) helps manage costs effectively while testing.

Configuration of Auto-Scaling Policies on GCP

- Navigate to Compute Engine > Instance Groups.
- Click 'Create Instance Group'.
- Name your group (e.g., my-instance-group).
- Choose the location (same as the VM region).
- Select an Instance Template (create one if needed with your VM configuration).
- Enable Autoscaling (with below configurations):
  - ✓ Mode: On
  - ✓ Metric: CPU Utilization
  - ✓ Target CPU Utilization: 60%
  - ✓ Minimum Instances: 1
  - ✓ Maximum Instances: 3
- Click 'Create' to set up the instance group with auto-scaling enabled.

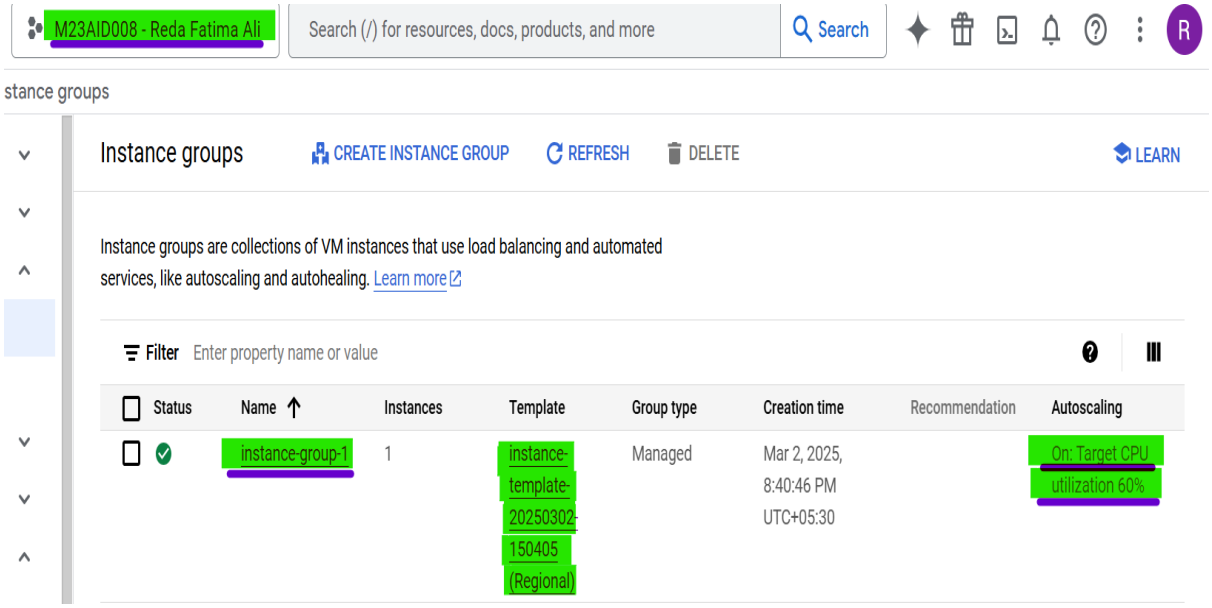

Fig. 2: Instance Group Created & Configuration of auto scaling (“*instance-group-1*”)

Reasons to go for the configuration of auto scaling policy on GCP

- Auto-scaling is configured to handle unpredictable traffic spikes, ensuring the application remains responsive.
- Auto-scaling automatically adjusts the number of VM instances based on workload, ensuring optimal performance.
- Helps control costs by scaling down resources during low usage periods.

Implementation of Security Measures

Setting up IAM Roles for Restricted Access

- Navigate to IAM & Admin > IAM.
- Click 'Grant Access' or 'Add'
- Enter the email address of the user.
- Assign the roles.
- Click 'Save' to apply the roles.

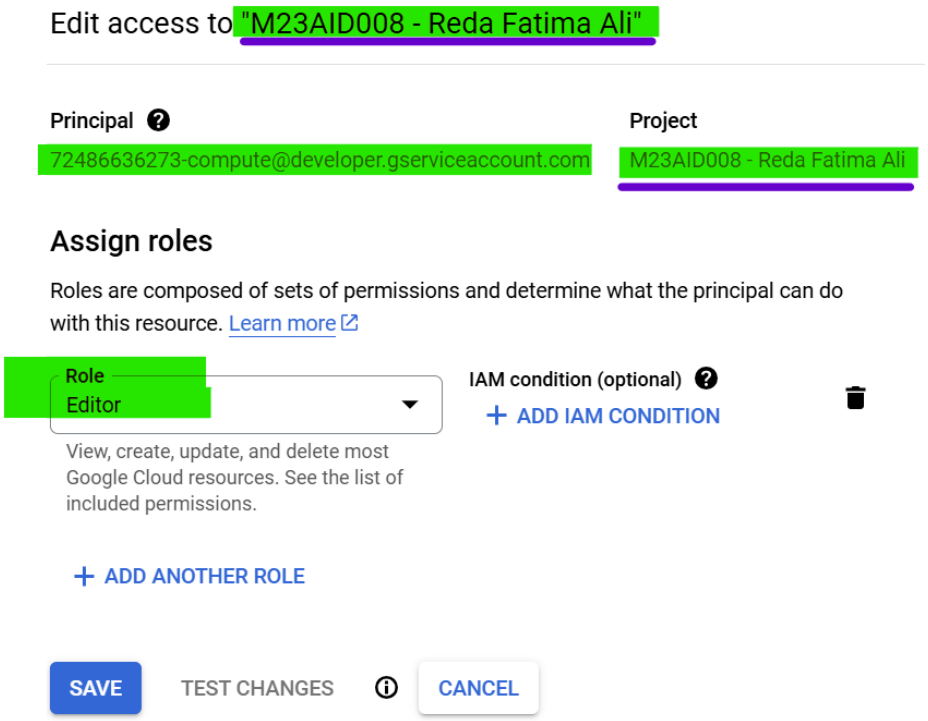

Fig. 3: IAM Roles

Reasons to have IAM Roles Implemented

- Securing the environment is critical; setting up IAM prevents unauthorized access to sensitive resources.
- IAM ensures only authorized users have access, reducing the risk of accidental or malicious actions.
- Roles provide fine-grained access control, adhering to the principle of least privilege.

Configuration of firewall rules to allow/deny traffic

- Navigate to VPC Network > Firewall Rules.
- Click **'Create Firewall Rule'**.
- Enter a name (e.g., allow-http).
- Direction: Ingress.
- Targets: All instances in the network or specific tags.
- Source IP ranges: 0.0.0.0/0 (for public access).
- Protocols and ports: TCP: 80 (HTTP), TCP: 443 (HTTPS).
- Click 'Create' to apply the rule.

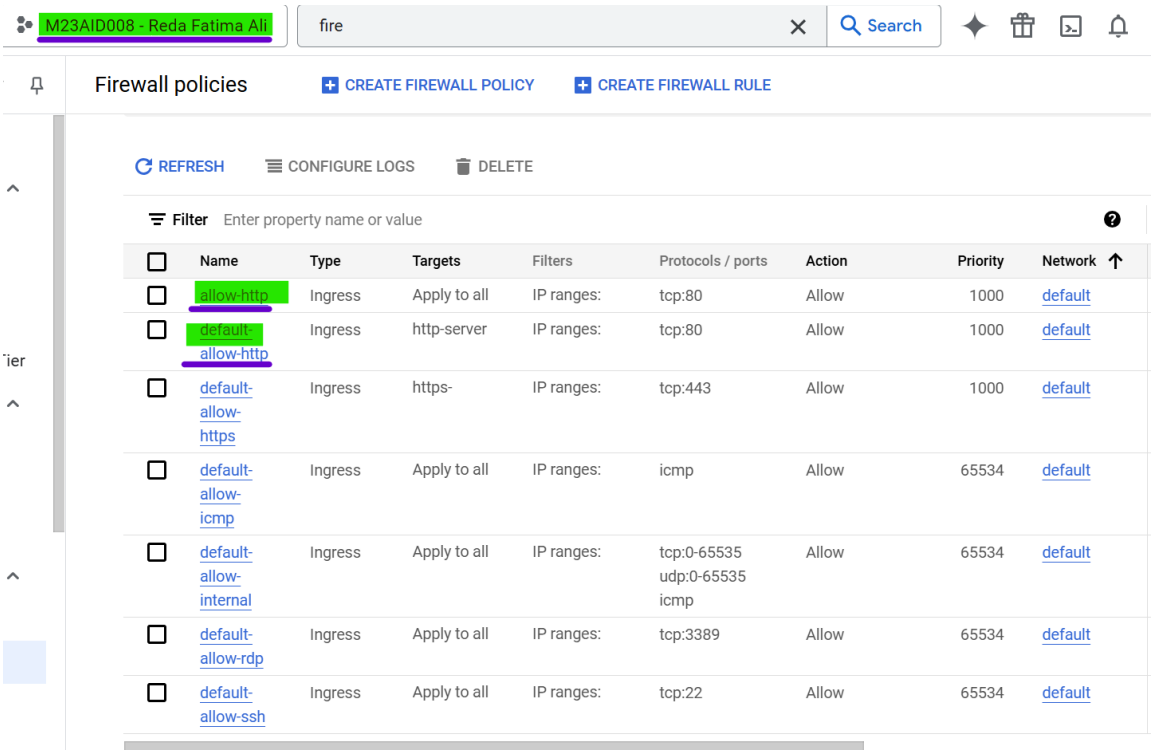

Fig. 4: Firewall Rules

Load Testing (Stress)- To verify the Autoscaling

- Step 1: **SSH into the instance group**, created above

- Step 2: **sudo apt update**

```
m23aid008@instance-group-1-pxb9:~$ 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]
Hit:7 https://packages.cloud.google.com/apt google-compute-engine-bookworm-stable InRelease
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]
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6.27.pdiff [54.3 kB]
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0.32.pdiff [8657 B]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2025-03-03-0216.08-F-2025-02-14-201
0.32.pdiff [8657 B]
Get:16 https://deb.debian.org/debian-security bookworm-security/main Sources [145 kB]
Get:17 https://deb.debian.org/debian-security bookworm-security/main amd64 Packages [246 kB]
Get:18 https://deb.debian.org/debian-security bookworm-security/main Translation-en [147 kB]
Fetched 6501 kB in 2s (4288 kB/s)
Reading package lists... Done
Building dependency tree... Done
```

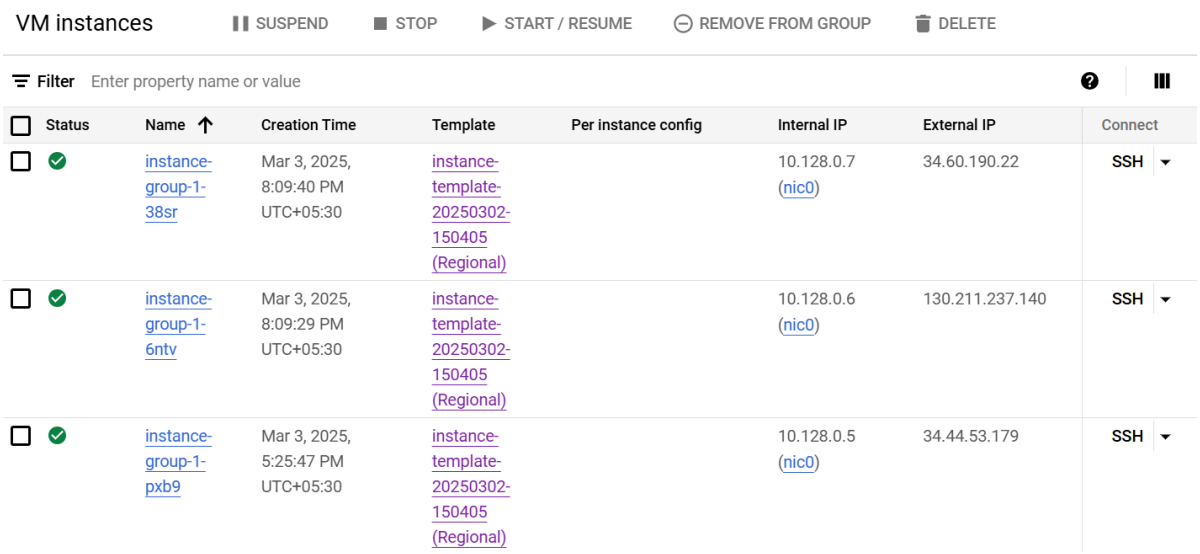
- Step 3: **Install Stress – sudo apt install stress -y**

```
m23aid008@instance-group-1-pxb9:~$ sudo apt install stress -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  stress
0 upgraded, 1 newly installed, 0 to remove and 7 not upgraded.
Need to get 21.9 kB of archives.
After this operation, 57.3 kB of additional disk space will be used.
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:2 https://deb.debian.org/debian bookworm/main amd64 stress amd64 1.0.7-1 [21.9 kB]
Fetched 21.9 kB in 0s (205 kB/s)
Selecting previously unselected package stress.
(Reading database ... 69641 files and directories currently installed.)
Preparing to unpack .../stress_1.0.7-1_amd64.deb ...
Unpacking stress (1.0.7-1) ...
Setting up stress (1.0.7-1) ...
Processing triggers for man-db (2.11.2-2) ...
```

- Step 4: **Run stress to max CPU – stress –cpu 4 –timeout 600**

```
m23aid008@instance-group-1-pxb9:~$ stress --cpu 4 --timeout 600
stress: info: [1734] dispatching hogs: 4 cpu, 0 io, 0 vm, 0 hdd
```

- While Load is running, **watch for new instances getting created automatically as CPU usage exceeds the auto-scaling threshold**.



GitHub Link :

https://github.com/RedaFA7/M23AID008_CSL7510/tree/main