

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

Contributor:



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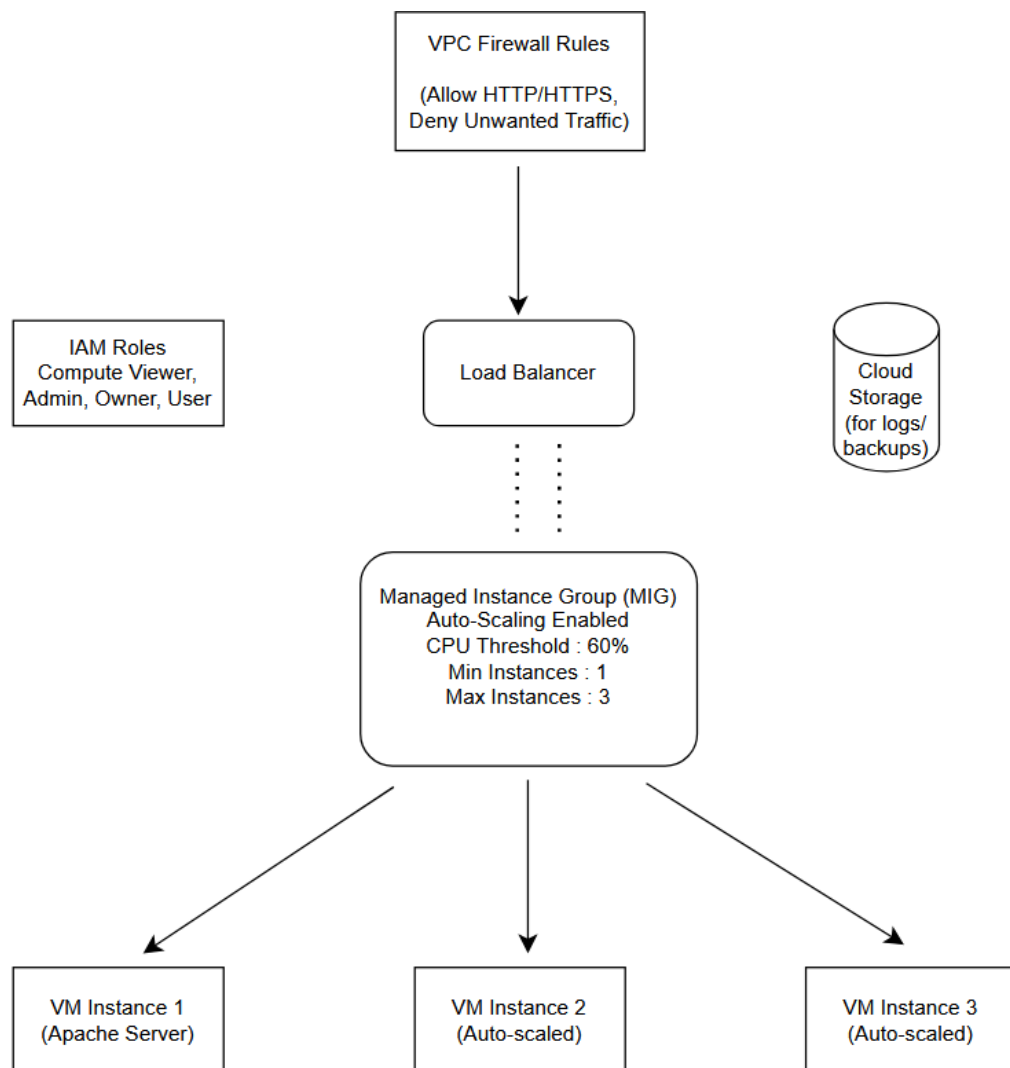
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Architecture Design



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.

The screenshot shows the Google Cloud Console interface for VM instances. At the top, there's a search bar and navigation icons. Below, the 'VM instances' section is active, with buttons for 'CREATE INSTANCE', 'IMPORT VM', and 'REFRESH'. A table lists the instances:

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
✓	instance-group-1-pxb9	us-central1-c		instance-	10.128.0.5 (nic0)	34.44.53.179 (nic0)	SSH
✓	vm-instance	us-central1-c			10.128.0.2 (nic0)	35.232.175.145 (nic0)	SSH

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.

The screenshot shows the Google Cloud Platform console interface. At the top, there's a user profile 'M23AID008 - Reda Fatima Ali' and a search bar. Below the header, the 'Instance groups' page is displayed. It includes a 'CREATE INSTANCE GROUP' button, a 'REFRESH' button, and a 'DELETE' button. A description states: 'Instance groups are collections of VM instances that use load balancing and automated services, like autoscaling and autohealing. [Learn more](#)'. Below this, there's a filter bar and a table listing instance groups.

Status	Name	Instances	Template	Group type	Creation time	Recommendation	Autoscaling
<input checked="" type="checkbox"/>	instance-group-1	1	instance-template-20250302-150405 (Regional)	Managed	Mar 2, 2025, 8:40:46 PM UTC+05:30		On Target CPU utilization 60%

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.

Edit access to **"M23AID008 - Reda Fatima Ali"**

Principal ?	Project
72486636273-compute@developer.gserviceaccount.com	M23AID008 - Reda Fatima Ali

Assign roles

Roles are composed of sets of permissions and determine what the principal can do with this resource. [Learn more](#)

Role	IAM condition (optional) ?	
Editor	+ ADD IAM CONDITION	
View, create, update, and delete most Google Cloud resources. See the list of included permissions.		
+ ADD ANOTHER ROLE		

SAVE

TEST CHANGES

?

CANCEL

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.

Firewall policies [+ CREATE FIREWALL POLICY](#) [+ CREATE FIREWALL RULE](#)

[REFRESH](#) [CONFIGURE LOGS](#) [DELETE](#)

[Filter](#) Enter property name or value

<input type="checkbox"/>	Name	Type	Targets	Filters	Protocols / ports	Action	Priority	Network	↑
<input type="checkbox"/>	allow-http	Ingress	Apply to all	IP ranges:	tcp:80	Allow	1000	default	
<input type="checkbox"/>	default-allow-http	Ingress	http-server	IP ranges:	tcp:80	Allow	1000	default	
<input type="checkbox"/>	default-allow-https	Ingress	https-	IP ranges:	tcp:443	Allow	1000	default	
<input type="checkbox"/>	default-allow-icmp	Ingress	Apply to all	IP ranges:	icmp	Allow	65534	default	
<input type="checkbox"/>	default-allow-internal	Ingress	Apply to all	IP ranges:	tcp:0-65535 udp:0-65535 icmp	Allow	65534	default	
<input type="checkbox"/>	default-allow-rdp	Ingress	Apply to all	IP ranges:	tcp:3389	Allow	65534	default	
<input type="checkbox"/>	default-allow-ssh	Ingress	Apply to all	IP ranges:	tcp:22	Allow	65534	default	

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 [39 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]
Get:4 https://deb.debian.org/debian bookworm-backports InRelease [59.1 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 amd64 Packages [3680 kB]
Get:10 https://packages.cloud.google.com/apt/cloud-sdk-bookworm/main all Packages [1670 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:14 https://deb.debian.org/debian bookworm-backports/main Sources T-2025-03-03-0811.53-F-2025-02-12-1406.49.pdiff [44.9 kB]
Get:15 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2025-03-03-0811.53-F-2025-02-12-2016.27.pdiff [54.3 kB]
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Get:15 https://deb.debian.org/debian bookworm-backports/main amd64 Packages T-2025-03-03-0811.53-F-2025-02-12-2016.27.pdiff [54.3 kB]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2025-03-03-0216.08-F-2025-02-14-2010.32.pdiff [8657 B]
Get:19 https://deb.debian.org/debian bookworm-backports/main Translation-en T-2025-03-03-0216.08-F-2025-02-14-2010.32.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.**

VM instances SUSPEND STOP START / RESUME REMOVE FROM GROUP DELETE

Filter Enter property name or value

<input type="checkbox"/>	Status	Name ↑	Creation Time	Template	Per instance config	Internal IP	External IP	Connect
<input type="checkbox"/>	✓	instance-group-1-38sr	Mar 3, 2025, 8:09:40 PM UTC+05:30	instance-template-20250302-150405 (Regional)		10.128.0.7 (nic0)	34.60.190.22	SSH ▾
<input type="checkbox"/>	✓	instance-group-1-6ntv	Mar 3, 2025, 8:09:29 PM UTC+05:30	instance-template-20250302-150405 (Regional)		10.128.0.6 (nic0)	130.211.237.140	SSH ▾
<input type="checkbox"/>	✓	instance-group-1-pxb9	Mar 3, 2025, 5:25:47 PM UTC+05:30	instance-template-20250302-150405 (Regional)		10.128.0.5 (nic0)	34.44.53.179	SSH ▾

GitHub Link :

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