

# Virtualization and Cloud Computing

## Assignment 2

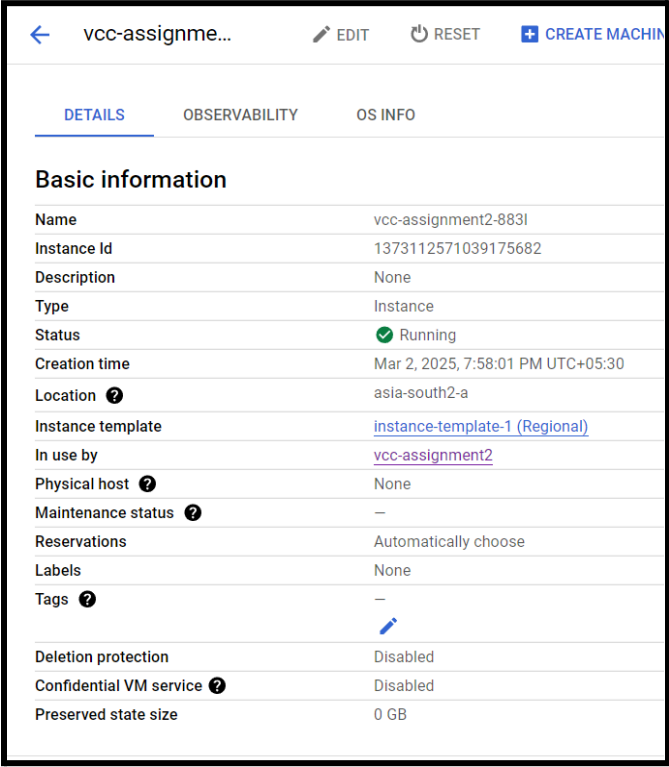
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Demonstration Link: <https://youtu.be/35KmzM-rgyk>

### Steps to create a VM instance

- Go to compute engine > VM instances.
- Click create instance.
- Configure the instance:
  - **Name:** Providing a name of my choice
  - **Region and Zone:** I chose **asia-south2 (Delhi)**.
- Machine type: Select an appropriate machine type. I chose **e2-medium** since it said “good for everyday usage”.
- Finally, create the instance.



The screenshot shows the 'DETAILS' tab of a VM instance named 'vcc-assignment2-8831'. The instance is in a 'Running' state, created on March 2, 2025, at 7:58:01 PM UTC+05:30, in the 'asia-south2-a' region. It uses the 'instance-template-1 (Regional)' template and is associated with the 'vcc-assignment2' project. The physical host is 'None', and the maintenance status is also 'None'. The instance has no reservations, labels, or tags. Deletion protection and confidential VM service are both disabled, and the preserved state size is 0 GB.

vcc-assignme...		EDIT	RESET	CREATE MACHIN
DETAILS    OBSERVABILITY    OS INFO				
Basic information				
Name	vcc-assignment2-8831			
Instance Id	1373112571039175682			
Description	None			
Type	Instance			
Status	Running			
Creation time	Mar 2, 2025, 7:58:01 PM UTC+05:30			
Location ?	asia-south2-a			
Instance template	<a href="#">instance-template-1 (Regional)</a>			
In use by	<a href="#">vcc-assignment2</a>			
Physical host ?	None			
Maintenance status ?	—			
Reservations	Automatically choose			
Labels	None			
Tags ?	—			
Deletion protection	Disabled			
Confidential VM service ?	Disabled			
Preserved state size	0 GB			

←
vcc-assignme...
EDIT
RESET
CREATE MACHINE IMAGE

DETAILS
OBSERVABILITY
OS INFO

### Machine configuration

Machine type	e2-medium (2 vCPUs, 4 GB Memory)
CPU platform	AMD Rome
Minimum CPU platform	None
Architecture	x86/64
vCPUs to core ratio ?	—
Custom visible cores ?	—
All-core turbo-only mode ?	—
Display device	Disabled Enable to use screen capturing and recording tools
GPUs	None
Resource policies	

### Networking

Public DNS PTR Record	None
Total egress bandwidth tier	—
NIC type	—

### Steps to configure auto-scaling policies

- Create an instance template: Go to compute engine > instance templates.
- Provide a name of choice.
- Enable autoscaling mode.
- Set minimum and maximum number of instances. I have set them as **1 and 7** respectively.
- Set autoscaling signals, ie, when to autoscale. I have set CPU utilization to **45%.**
- Set initialization period. I have set it to **60 seconds.**
- Keep the rest as default settings.
- Finally, save.

[←](#)
vcc-assignment2
[EDIT](#)
[UPDATE VMS](#)

### Autoscaling

Autoscaling mode	On
Minimum # of instances	1
Maximum # of instances	7
Initialization period	60 seconds
Autoscaling signal	
CPU utilization	45%
Predictive autoscaling	Off
Scale in controls	Off
Scaling schedules	<a href="#">MANAGE SCHEDULES</a>

- After creation, one instance will be shown like this:

VM instances							
<a href="#">CREATE INSTANCE</a> <a href="#">IMPORT VM</a> <a href="#">REFRESH</a>							
<a href="#">INSTANCES</a> <a href="#">OBSERVABILITY</a> <a href="#">INSTANCE SCHEDULES</a>							
VM instances							
<a href="#">Filter</a> Enter property name or value							
<input type="checkbox"/> Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	<a href="#">vcc-assignment2-883l</a>	asia-south2-a		<a href="#">vcc-assignment2</a>	10.190.0.4 ( <a href="#">nic0</a> )	34.131.203.160 ( <a href="#">nic0</a> )	SSH

## Steps to see creation of multiple instances

- The idea is to stress test the virtual machine so that CPU utilization spikes up and multiple instances are created when utilization goes above the threshold **(45% in my case)**.
- For this, I am going to use '**stress**'. It is a **command-line utility tool** used to generate CPU, memory, I/O, and disk stress on a system. It is primarily used for performance testing, benchmarking, and validating auto-scaling configurations in cloud environments like GCP.
- Firstly, run '**sudo apt update && sudo apt install -y stress**' on SSH to install the '**stress**' CLI tool.
- Then, select the number of cores to stress and the timeout period. I am using **10 cores** and a timeout period of **30 seconds**.
- Each machine has **2 cores on the E2-medium machine**. Hence, multiple instances are bound to be created.
- Run '**stress --cpu 10 --timeout 30s**'.
- Before stress test:

VM instances						
<div>SUSPEND</div> <div>STOP</div> <div>START / RESUME</div> <div>REMOVE FROM GROUP</div> <div>DELETE</div>						
<div>Filter</div> Enter property name or value						
<input type="checkbox"/> Status	Name <span>↑</span>	Creation Time	Template	Per instance config	Internal IP	External IP
<input type="checkbox"/>	<a href="#">vcc-assignment2-883l</a>	Mar 2, 2025, 7:58:01 PM UTC+05:30	<a href="#">instance-template-1 (Regional)</a>		10.190.0.4 <a href="#">(nic0)</a>	34.131.203.160

- After stress test (4 instances created):

The screenshot shows the Google Cloud Platform console with a list of VM instances and an SSH terminal window.

**VM instances table:**

Status	Name	Creation Time	Template
✓	vcc-assignment2-2379	Mar 2, 2025, 11:12:21 PM UTC+05:30	instance-template-1 (Regional)
✓	vcc-assignment2-8831	Mar 2, 2025, 7:58:01 PM UTC+05:30	instance-template-1 (Regional)
✓	vcc-assignment2-m013	Mar 2, 2025, 11:12:32 PM UTC+05:30	instance-template-1 (Regional)
✓	vcc-assignment2-xk4j	Mar 2, 2025, 11:12:32 PM UTC+05:30	instance-template-1 (Regional)

**SSH terminal window:**

```
Linux vcc-assignment2-8831 6.1.0-31-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.128-1 (2025-02-07)
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: Sun Mar  2 16:34:08 2025 from 35.235.245.18
b22cs090@vcc-assignment2-8831:~$ stress --cpu 10 --timeout 30s
stress: info: [2809] dispatching hogs: 10 cpu, 0 io, 0 vm, 0 hdd
stress: info: [2809] successful run completed in 30s
b22cs090@vcc-assignment2-8831:~$
```

## Setting up IAM roles for restricted access

- Go to IAM & Admin > IAM.
- Click on grant access.
- Email ID can be added and appropriate roles can be assigned to the ID.
- Roles can be editor / owner / viewer or other custom / specific roles.

The screenshot shows the Google Cloud IAM console with the 'Grant access to "vcc-assignment2"' dialog open.

**Grant access to "vcc-assignment2"**

Grant principals access to this resource and add roles to specify what actions the principals can take. Optionally, add conditions to grant access to principals only when a specific criteria is met. [Learn more about IAM conditions](#)

**Resource**

- vcc-assignment2

**Add principals**

Principals are users, groups, domains, or service accounts. [Learn more about principals in IAM](#)

New principals \*

**Assign roles**

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

Select a role \*

**IAM condition (optional)**

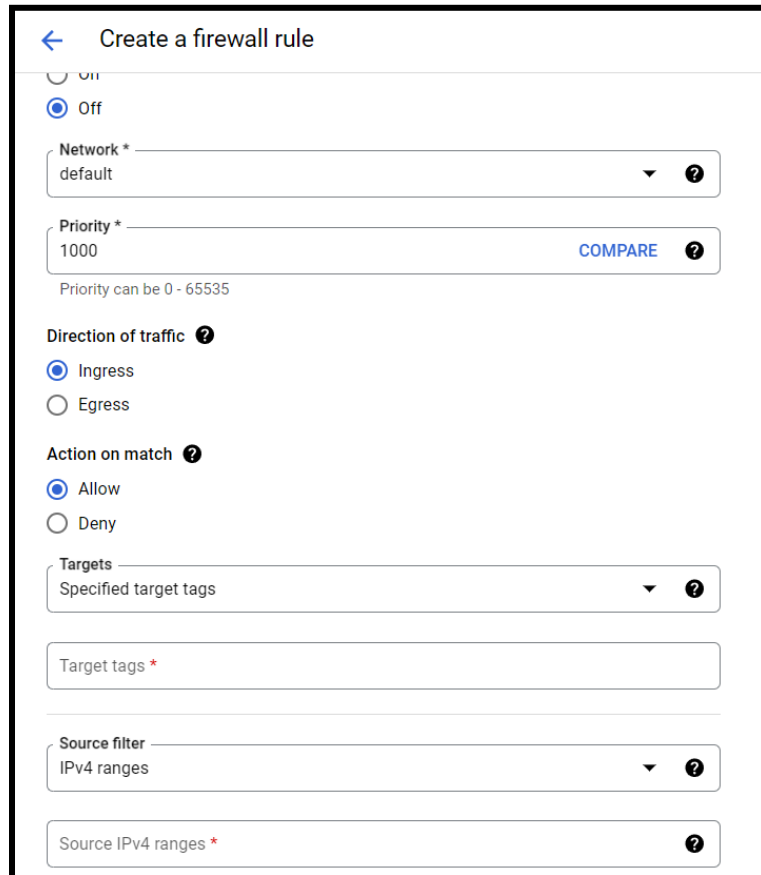
+ ADD IAM CONDITION

+ ADD ANOTHER ROLE

SAVE CANCEL

## Configuring firewall rules

- Go to VPC Network > Firewall.
- Click create firewall rule.
- Here, we can create custom firewall rules based on priority, direction of traffic, action on match, source filter, source IP ranges, protocols and ports, and many more.



The screenshot shows the 'Create a firewall rule' interface. At the top, there is a back arrow and the title 'Create a firewall rule'. Below this, there are several sections for configuring the rule:

- On/Off:** Two radio buttons are present. The 'Off' button is selected.
- Network \*:** A dropdown menu showing 'default' with a question mark icon.
- Priority \*:** A text input field containing '1000'. To the right of the field is a 'COMPARE' button and a question mark icon. Below the field, a note states 'Priority can be 0 - 65535'.
- Direction of traffic ?**: Two radio buttons are present. The 'Ingress' button is selected.
- Action on match ?**: Two radio buttons are present. The 'Allow' button is selected.
- Targets:** A dropdown menu showing 'Specified target tags' with a question mark icon.
- Target tags \*:** A text input field.
- Source filter:** A dropdown menu showing 'IPv4 ranges' with a question mark icon.
- Source IPv4 ranges \*:** A text input field with a question mark icon.

← Create a firewall rule

Name

Destination filter

None

Protocols and ports ?

☐ Allow all

☒ Specified protocols and ports

☐ TCP

Ports

E.g. 20, 50-60

☐ UDP

Ports

E.g. all

☐ SCTP

Ports

E.g. 20, 50-60

☐ Other

Protocols

Separate multiple protocols by commas, e.g. ah, icmp

### **Architecture Design:**

- A VM Instance is managed by an instance group.
- Auto-scaling policy adjusts instances based on CPU usage.
- Firewall rules control inbound and outbound traffic.
- IAM roles manage access.
- Diagram is shown below.

