Virtual Cloud Computing
(CSL7510)

Submitted by
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Assignment 3:
Create a Local VM and Auto-Scale It to GCP or Any Other Public Cloud When Resource Usage Exceeds 75%

Indian Institute of Technology Jodhpur
Department of Artificial Intelligence and Data Science
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OBJECTIVE

Create and configure multiple Virtual Machines (VMs) using VirtualBox, establish a network between them, and deploy a microservice-based application across the connected VMs.

1. Introduction

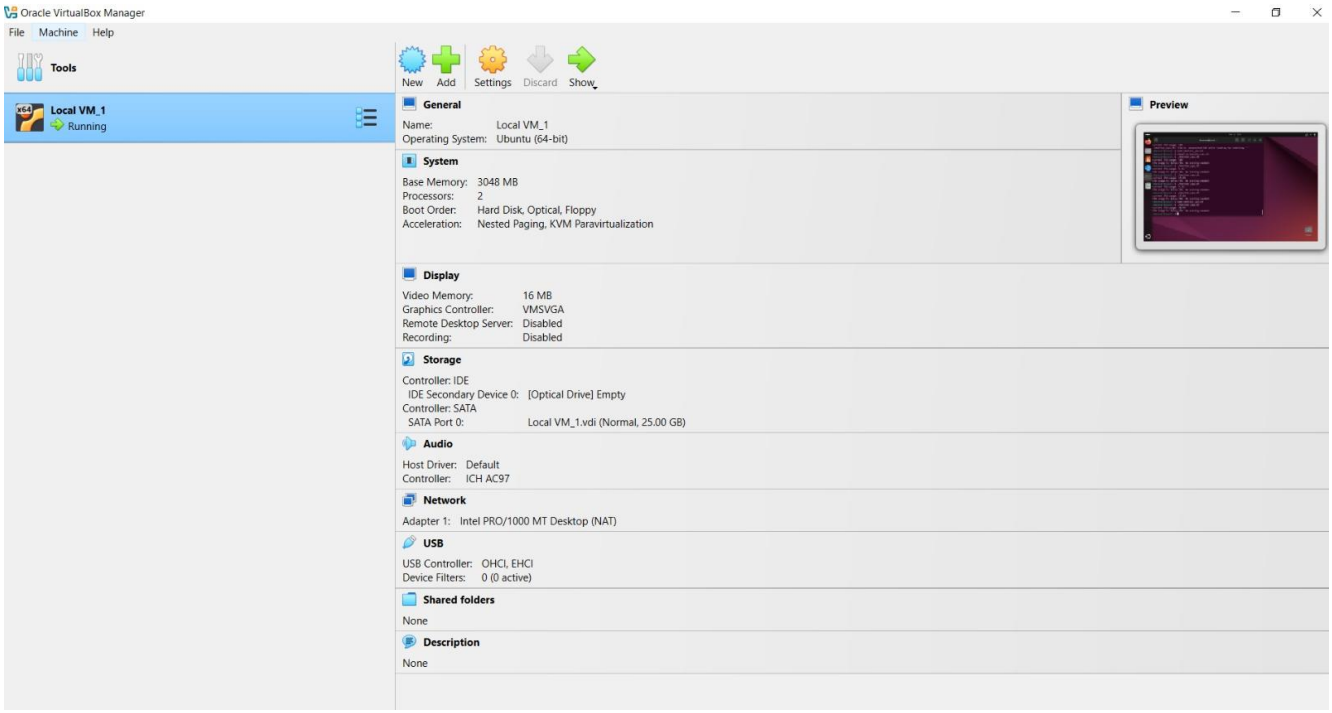
The objective of this project is to create a local virtual machine (VM), implement resource monitoring, and configure auto-scaling to a public cloud (GCP, AWS, or Azure) when resource usage exceeds 75%. This implementation demonstrates the process of monitoring system resources, triggering auto-scaling, and migrating to the cloud when needed.

2. VM Creation and Configuration

1. **Local VM Creation**

VM Setup:

1. **Install Virtual Box or VMware:**
   - Download and install Virtual Box or VMware Workstation Player on your system.
2. **Create a New Virtual Machine:**
   - Set up a new virtual machine (VM) by selecting a suitable operating system (e.g., Ubuntu or another Linux distribution).
3. **Allocate Resources:**
   - Assign sufficient resources (such as CPU, RAM, and Storage) to your VM based on your specific requirements.



1.Initial configuration and setup of the VM in VirtualBox.

2. Install Google Cloud SDK on the VM

Steps to install Google Cloud SDK:

Update Package Lists:

- Begin by updating the package lists for upgrades and new package installations:

  sudo apt-get update

Install Required Dependencies:

- Install the necessary dependencies for the Google Cloud SDK:

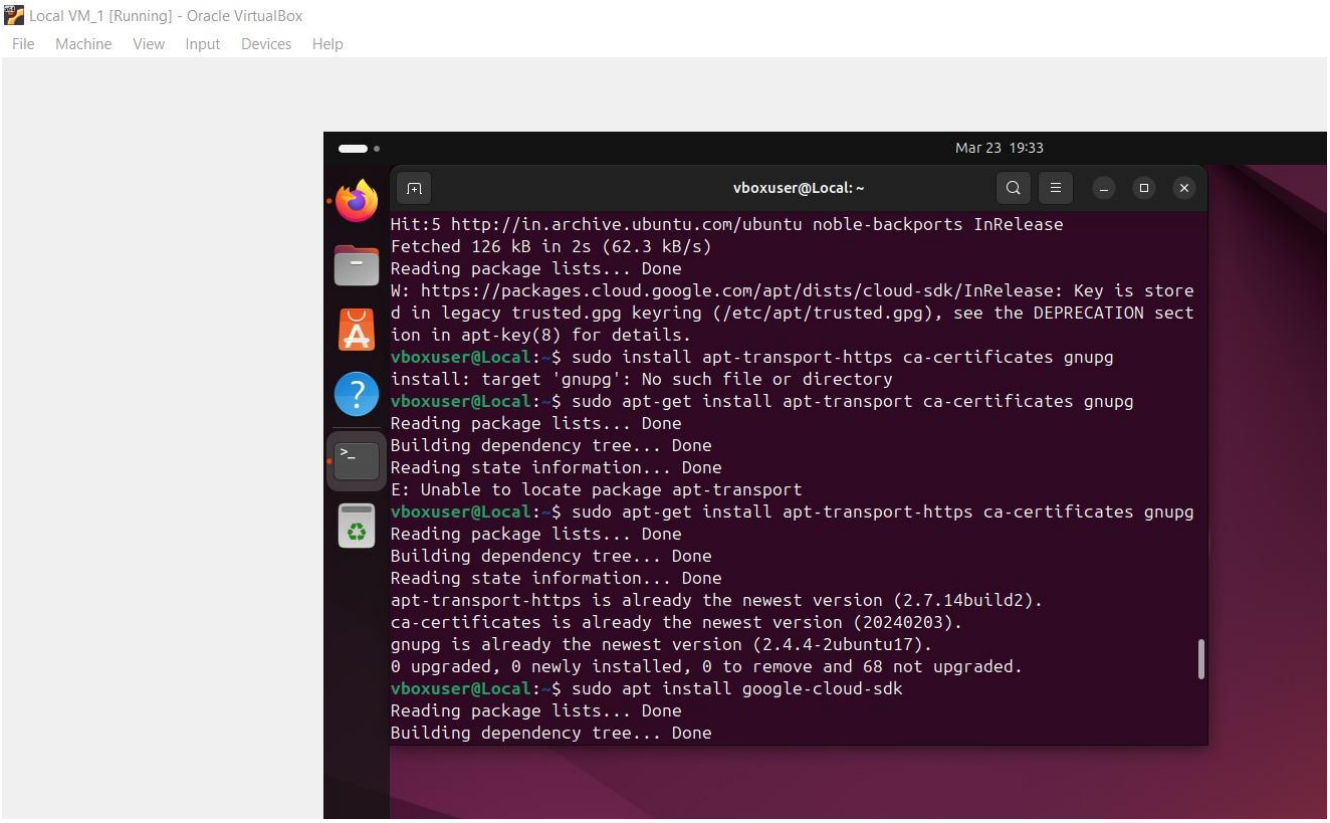
sudo apt-get install apt-transport-https ca-certificates gnupg

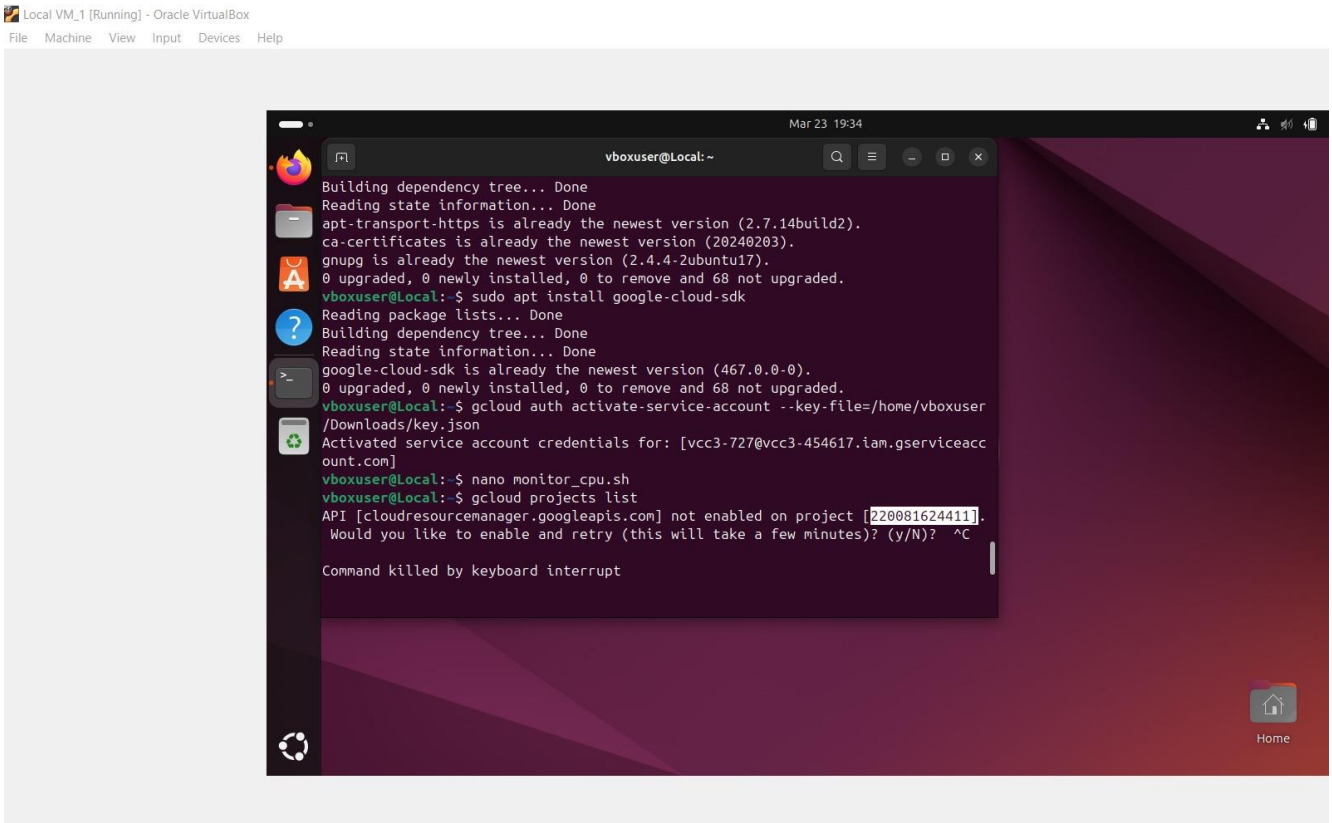
Verify the Project ID:

- After installing the SDK, use the following command to check the available projects:

gcloud project list

- This step confirms that the SDK installation was successful and allows you to view the project ID.





For checking the project id (it will applicable if only success)

3. Create a Service Account on Google Cloud Platform (GCP)

Steps to create a Service Account:

Access Google Cloud Console:

- Navigate to the Google Cloud Console (console.cloud.google.com).

Go to IAM & Admin Section:

- In the left-hand menu, find and select IAM & Admin.

Select Service Accounts:

- Under IAM & Admin, choose Service Accounts.

Create a New Service Account:

- Click on the Create Service Account button.

Provide a Name:

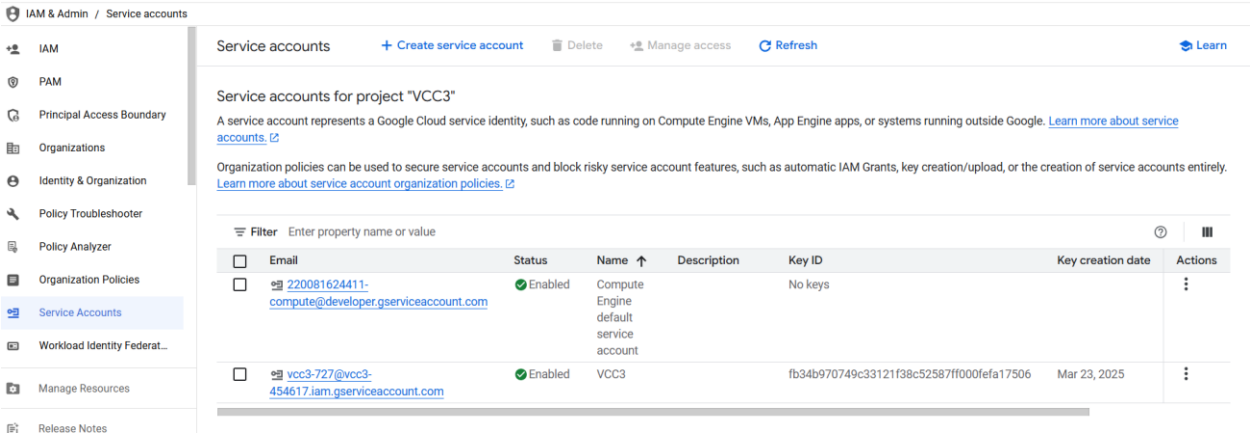
- Enter a name for the service account, then click Create.

Assign Roles to the Service Account:

- Select roles such as Editor, Viewer, or custom roles based on the permissions you need.

Finish the Creation Process:

- Once roles are assigned, click Done to complete the creation of the service account.



4. Download the Service Account Key

Select the Service Account:

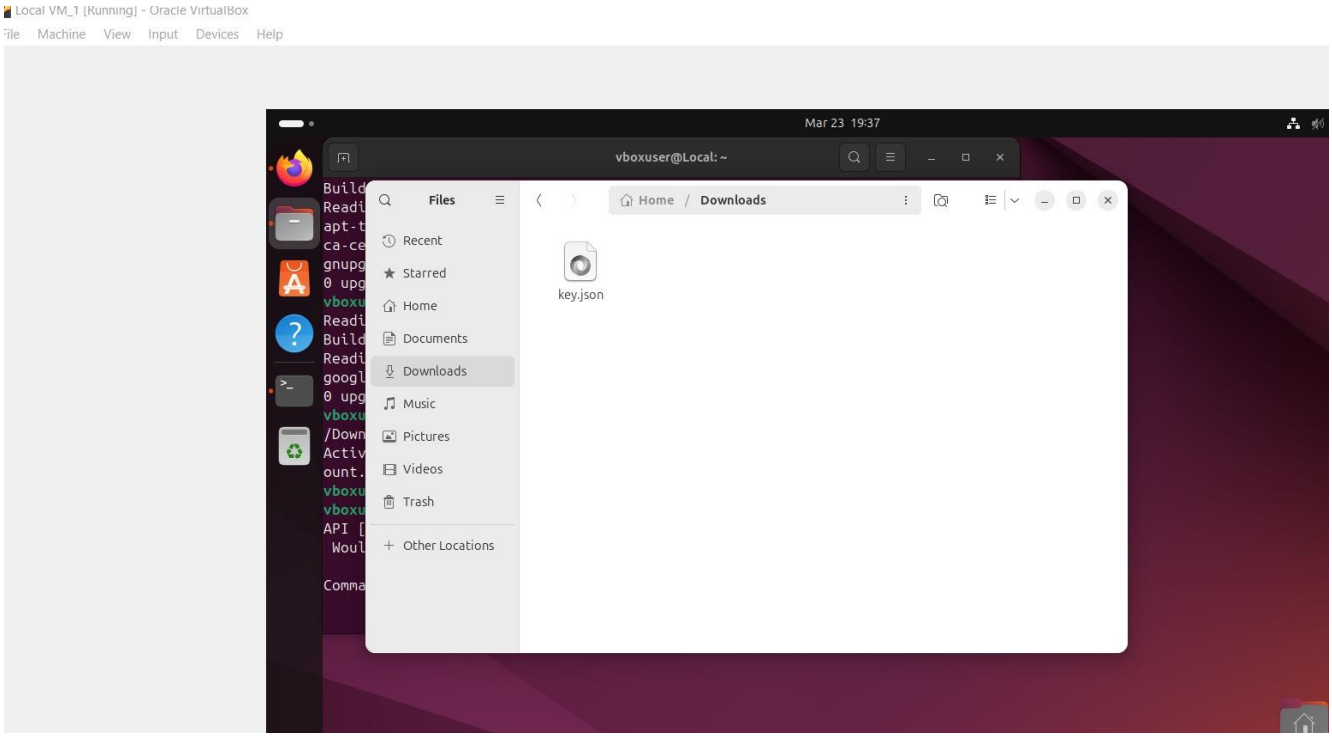
- In the Service Accounts section, find and select the newly created service account.

Add a Key:

- Click on Add Key and choose JSON from the options.

Download the Key:

- The key file in JSON format will be downloaded to your local machine.



5. Activate the Service Account on VM

Open the Terminal:

- On your VM, open the terminal.

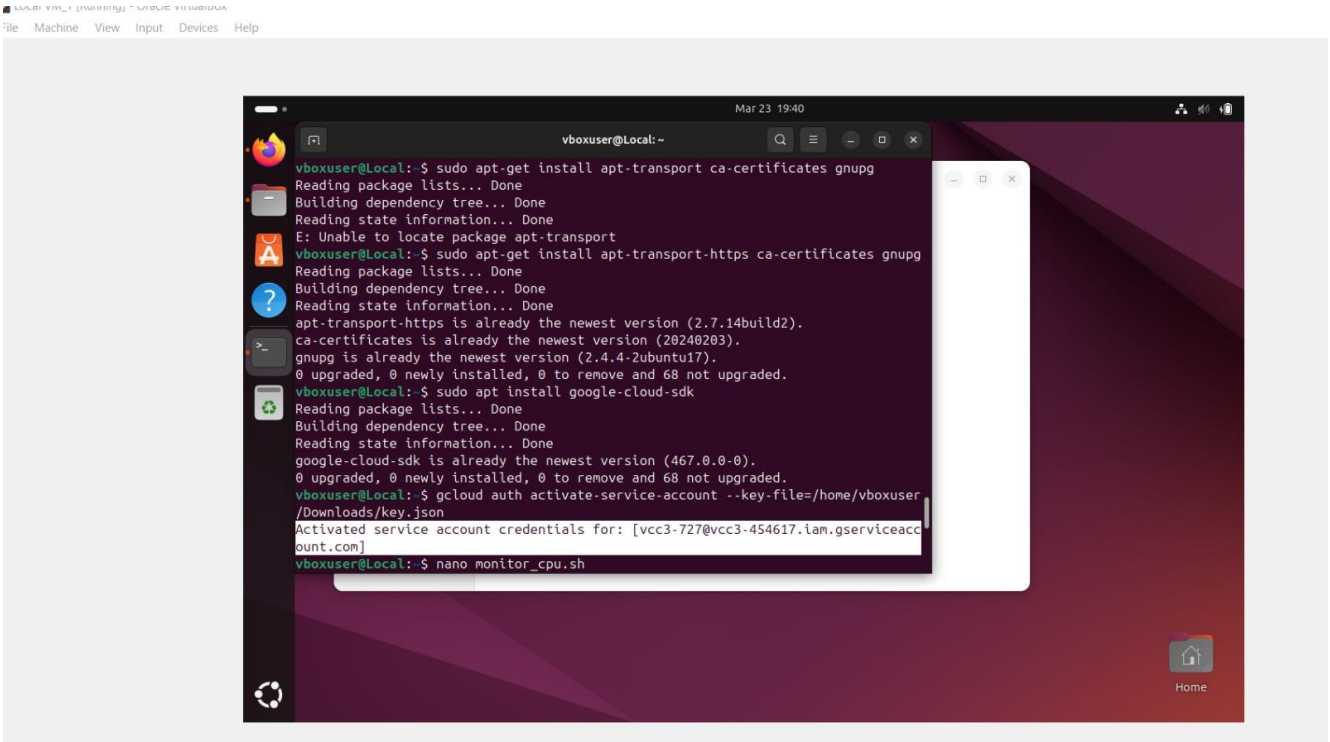
Navigate to the Directory:

- Change to the directory where the service account key file (JSON) is stored.

Authenticate with the Service Account Key:

- Run the following command to authenticate using the service account key:

gcloud auth activate-service-account --key-file=/path/to/your/key.json



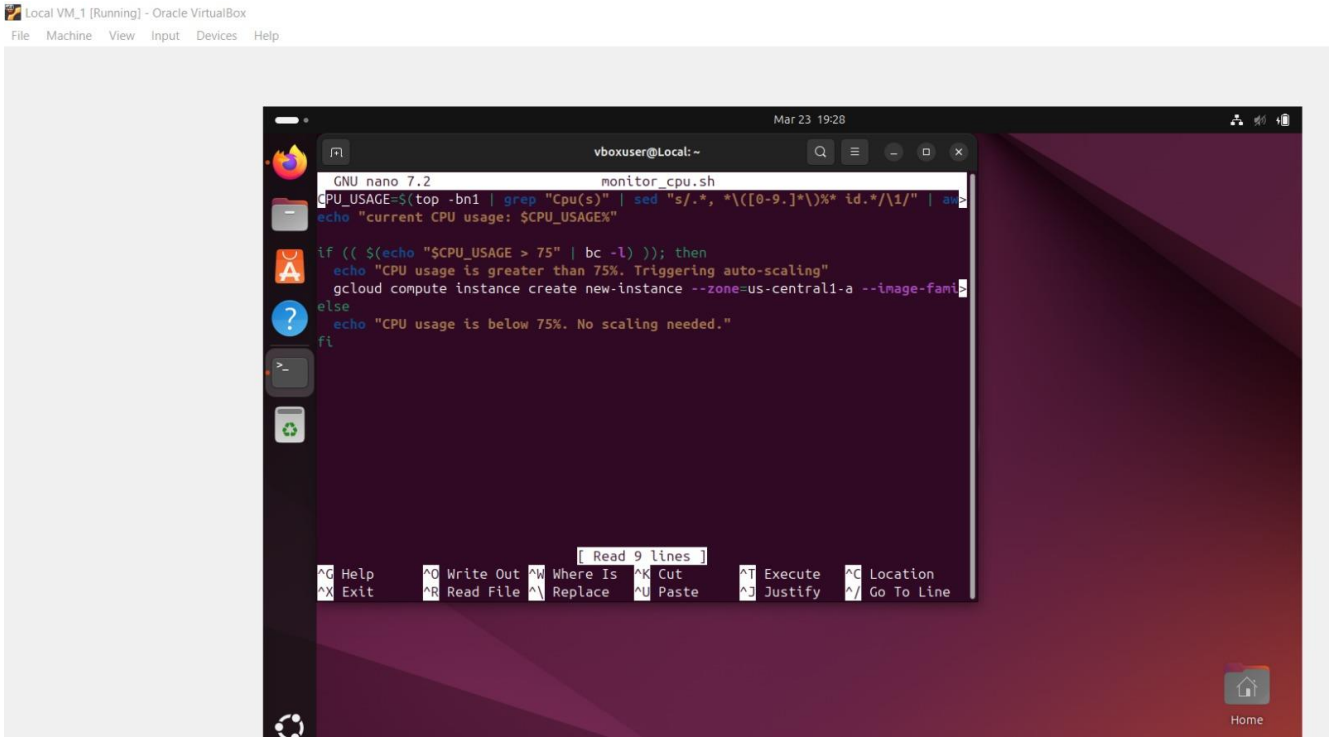
6. Run the Script for Auto-scaling and Monitoring

1. **Create or Find a Script:**
   - You can either create or find an existing script that monitors system resources, such as CPU and memory usage, on your VM. Tools like Prometheus and Grafana can be used for advanced monitoring, or you can write a custom shell script for simpler needs.
2. **Monitor Resource Usage:**
   - The script should continuously check the system's resource usage (e.g., CPU, memory).
3. **Trigger Auto-scaling:**
   - If the script detects that resource usage exceeds 75%, it should trigger the auto-scaling process to a public cloud (e.g., Google Cloud Platform). This could involve actions like spinning up additional VM instances on the cloud to handle the increased load.

Write below script:

```
# Check CPU usage and scale if > 75%
CPU_USAGE=$(top -bn1 | grep "Cpu(s)" | sed "s/., *\([0-9.]\)%* id.*/\1/" | awk '{print 100 - $1}')
echo "Current CPU usage: $CPU_USAGE%"

if (( $(echo "$CPU_USAGE > 75" | bc -l) )); then
  echo "CPU usage is greater than 75%. Triggering auto-scaling."
  # Trigger auto-scaling (e.g., create a new instance in GCP)
  gcloud compute instances create new-instance --zone=us-central1-a --image-family=debian-9 --image-
project=debian-cloud
else
  echo "CPU usage is below 75%. No scaling needed."
Fi
```



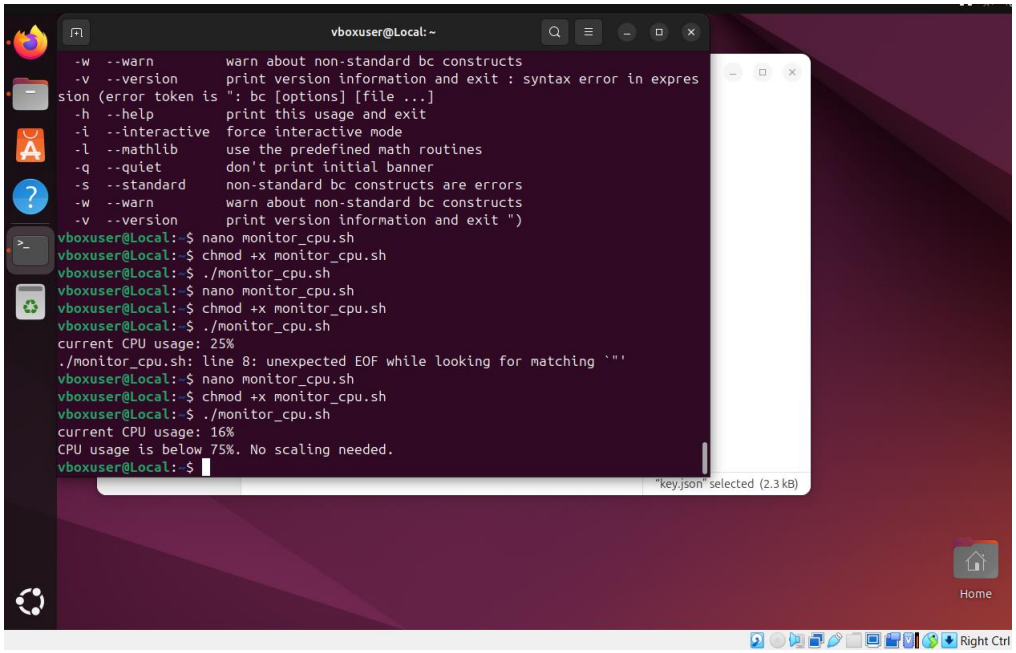
Save and close the file (CTRL + X, Y, Enter).

Running the Script in GCP (Auto-scaling to GCP)

We will run the following commands:

chmod +x monitor_cpu.sh

./monitor_cpu.sh --This command will show CPU utilization.



File Machine View Input Devices Help

Mar 23 18:26

vboxuser@Local: ~

```
vboxuser@Local:~$ ./monitor_cpu.sh
vboxuser@Local:~$ nano monitor_cpu.sh
vboxuser@Local:~$ chmod +x monitor_cpu.sh
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 25%
./monitor_cpu.sh: line 8: unexpected EOF while looking for matching `"'
vboxuser@Local:~$ nano monitor_cpu.sh
vboxuser@Local:~$ chmod +x monitor_cpu.sh
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 16%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 9.1%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 17.4%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 9.1%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 17.4%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$
```

Home

Local VM_1 [Running] - Oracle VirtualBox

File Machine View Input Devices Help

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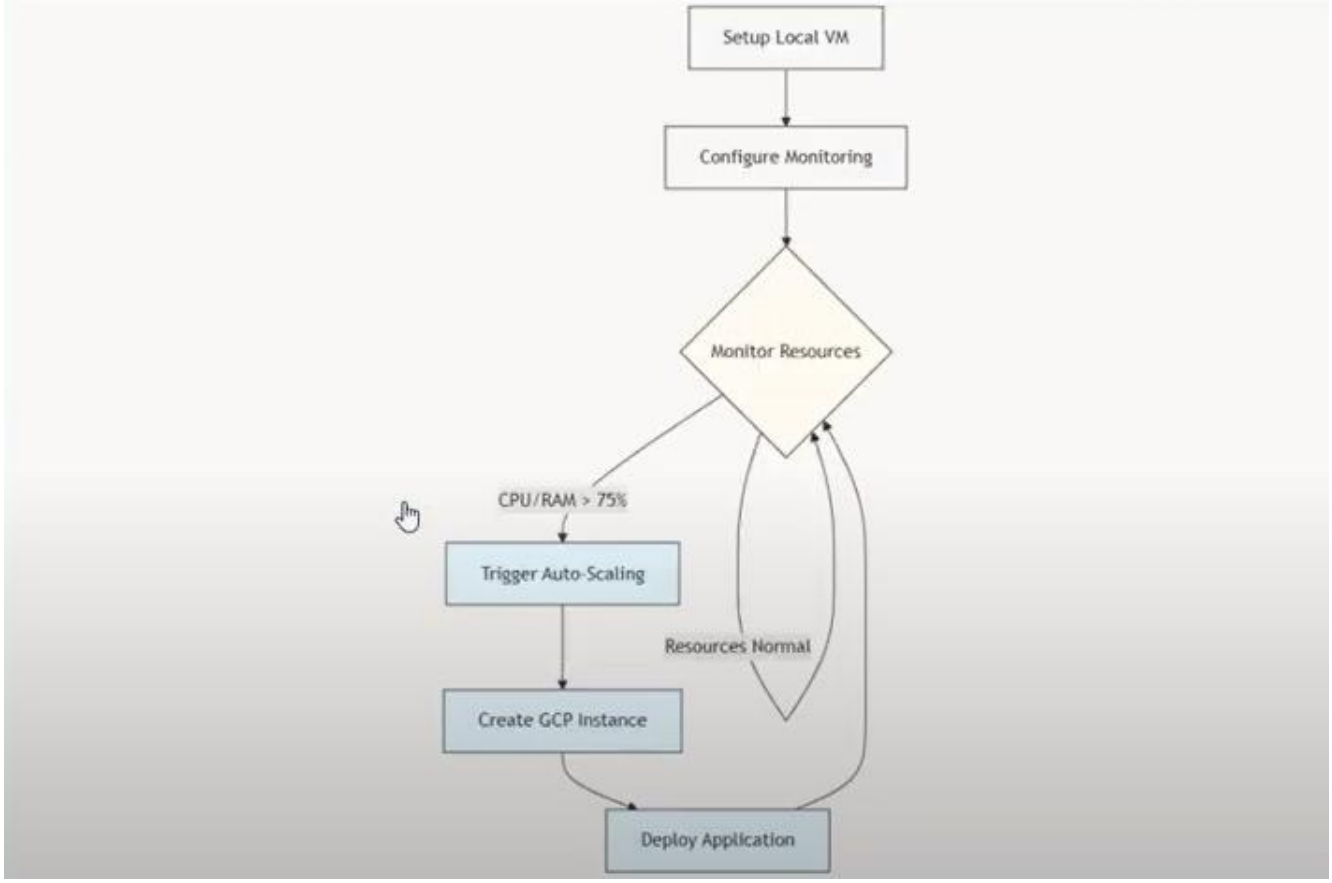
vboxuser@Local: ~

```
vboxuser@Local:~$ chmod +x monitor_cpu.sh
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 16%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 9.1%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 17.4%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 9.1%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 17.4%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ nano monitor_cpu.sh
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 30.4%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$ ./monitor_cpu.sh
current CPU usage: 13%
CPU usage is below 75%. No scaling needed.
vboxuser@Local:~$
```

Home

Architectural Diagram



Conclusion

You have now successfully set up a local Ubuntu VM to monitor its CPU usage and trigger auto-scaling on GCP when necessary. This script can be expanded to monitor additional resources like memory, disk usage, etc., and scale other cloud resources as needed.

Resources

Link to Source Code Repo :
https://github.com/Sg714274/Assignment3_VCC

Link to Recorded Video Demo :

https://drive.google.com/file/d/1itYBLzTO5P2A6dYerQTD7VoaPTRpr0aG/view