

Problem Statement Overview

You need to:

- Scale VMs based on CPU utilization.
- Ensure fault tolerance by deploying in a way that minimizes the impact of potential failures.
- Use a custom VM image for consistency across your deployments.
- Deploy all VMs in the same availability zone to enhance reliability.

Step-by-Step Implementation

Step 1: Create a Virtual Machine in Azure

1. Log in to the Azure Portal:

- Go to the [Azure Portal](#) and sign in with your account.

2. Create a New Virtual Machine:

- In the Azure Portal, click on "**Create a resource**" from the left-hand menu.

3. Configure the VM Basics:

- **Subscription:** Choose your subscription.
- **Resource Group:** You can either create a new resource group or select an existing one.
- **Virtual Machine Name:** Give your VM a name.
- **Region:** Select "**West US**" from the dropdown menu.
- **Availability Options:** Choose according to your needs (No infrastructure redundancy, Availability zone, etc.).
- **Image:** Select "**Ubuntu**" from the list of available images (choose the specific version you need, e.g., Ubuntu 20.04 LTS).
- **Size:** Choose the VM size based on your requirements.

4. Configure Administrator Account:

- Choose the **Authentication type** (SSH public key or password). If using SSH, you'll need to generate an SSH key pair if you haven't already.
- Enter the **Username** and **SSH public key** (if applicable).

5. Configure Networking:

- Under the **Networking** tab, ensure a new virtual network and subnet are created or select an existing one.
- Make sure to allow **Public IP** to connect to your VM.

6. Open SSH Port:

- In the **Networking** section, add an inbound port rule to allow **SSH (port 22)** and **HTTPS (port 80)**

7. Review + Create:

- Review your settings and click **"Create"** to provision the VM. This may take a few minutes.

Home >

CreateVm-canonical.ubuntu-24_04-lts-server-20240926084259 | Overview ⚙ ...

Deployment

Search × << Delete Cancel Redeploy Download Refresh

Overview

Inputs

Outputs

Template

Deployment is in progress

Deployment name: CreateVm-canonical.ubuntu-24_04-lts-server-2... Start time: 9/26/2024, 8:45:40 AM
Subscription: Free Trial Correlation ID: 4c869783-43dd-4407-b845-7e3cdc151231
Resource group: ubuntu_group

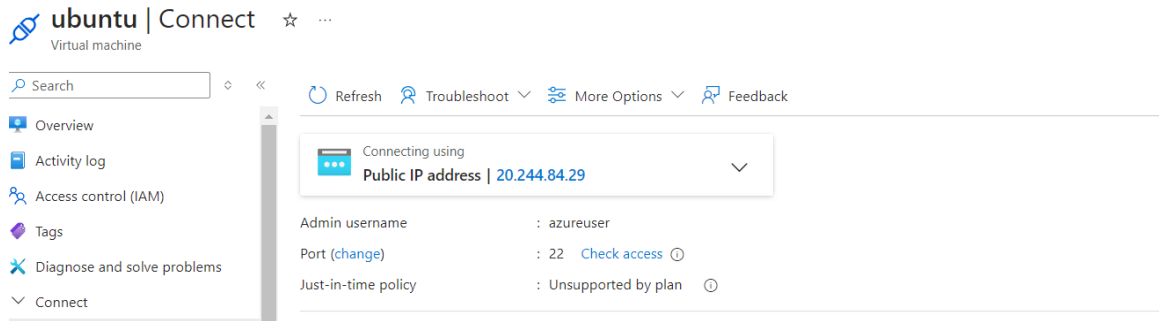
Deployment details

Resource	Type	Status	Operation details
ubuntu	Microsoft.Compute/virtualMachines	Created	Operation details
ubuntu979_z1	Microsoft.Network/networkInterfa...	Created	Operation details
ubuntu-ip	Microsoft.Network/publicIpAddre...	OK	Operation details
ubuntu-nsg	Microsoft.Network/networkSecuri...	OK	Operation details
ubuntu-vnet	Microsoft.Network/virtualNetworks	OK	Operation details

Step 2: Connect to the Linux VM using Terminal

1. Get the Public IP Address:

- Once the VM is created, go to the **"Overview"** page of your VM in the Azure Portal.
- Note the **Public IP address** of the VM.



2. Open Terminal:

- On your local machine, open a terminal (Linux, macOS, or Windows with WSL).

3. Connect to the VM:

- Use the following command to connect via SSH:

Native SSH



Connect from your local machine (Windows)

A public IP address is required to connect via this connection method.

Configured

2 Open a local shell (on Windows)

Open Terminal (Windows 11), PowerShell (Windows 10 or less), or a shell of your choice. Or switch the local machine OS above to view more instructions.

3 Copy and execute SSH command

Provide a path to your SSH private key file on your local machine.

ubuntu_key.pem

Can't find your private key? [Reset your SSH private key](#)

SSH to VM with specified private key.

```
ssh -i ubuntu_key.pem azureuser@20.244.84.29
```



Copied

Other Information

Using a Linux subsystem like WSL or Ubuntu on Terminal?

Copy your private key path to the Linux subsystem and ensure it has the correct read-only access.

Move your private key to the Linux subsystem. Use chmod to assign read-only access, then SSH.

```
mv /mnt/c/<your-private-key> ~/.ssh/
```



```
chmod 400 ~/.ssh/<your-private-key>
```



```
ssh -i ~/.ssh/<your-private-key> azureuser@20.244.84.29
```



4. Accept the SSH Key:

- The first time you connect, you'll be asked to confirm the authenticity of the host. Type **"yes"** and hit **Enter**.

```
Microsoft Windows [Version 10.0.22631.4169]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Mohd Shahid\Downloads>ssh -i ubuntu_key.pem azureuser@20.244.84.29
The authenticity of host '20.244.84.29 (20.244.84.29)' can't be established.
ED25519 key fingerprint is SHA256:4fA3F09zmhQZqMWLJteU0fML/9dm04iFCuVxz7LxbzE.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

- If you used a password for authentication, enter it when prompted.

```
System information as of Thu Sep 26 03:20:44 UTC 2024

System load:  0.09          Processes:            112
Usage of /:   5.0% of 28.02GB Users logged in:        0
Memory usage: 28%          IPv4 address for eth0: 10.0.0.4
Swap usage:   0%

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

azureuser@ubuntu:~$
```

Step 2: Install Apache 2 Software

1. Update the Package Index:

- Run the following command to update the package index:

sudo apt update

```
root@ubuntu:/home/azureuser# apt update
Hit:1 http://azure.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://azure.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Hit:3 http://azure.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Hit:4 http://azure.archive.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:5 http://azure.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:6 http://azure.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:7 http://azure.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:8 http://azure.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:9 http://azure.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:10 http://azure.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:11 http://azure.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
Get:12 http://azure.archive.ubuntu.com/ubuntu noble/multiverse amd64 c-n-f Metadata [8328 B]
Get:13 http://azure.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [531 kB]
Get:14 http://azure.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [129 kB]
```

2. Install Apache 2:

- Install the Apache 2 software with the following command:

sudo apt install apache2 -y

```
root@ubuntu:/home/azureuser# sudo apt install apache2 -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1t64 libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.4-0
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1t64 libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.4-0
0 upgraded, 10 newly installed, 0 to remove and 29 not upgraded.
Need to get 2083 kB of archives.
After this operation, 8094 kB of additional disk space will be used.
Get:1 http://azure.archive.ubuntu.com/ubuntu noble/main amd64 libapr1t64 amd64 1.7.2-3.1build2
Get:2 http://azure.archive.ubuntu.com/ubuntu noble/main amd64 libaprutil1t64 amd64 1.6.3-1.1ubuntu1
Get:3 http://azure.archive.ubuntu.com/ubuntu noble/main amd64 libaprutil1-dbd-sqlite3 amd64 1.6.3-1.1ubuntu1
Get:4 http://azure.archive.ubuntu.com/ubuntu noble/main amd64 libaprutil1-ldap amd64 1.6.3-1.1ubuntu1
Get:5 http://azure.archive.ubuntu.com/ubuntu noble/main amd64 liblua5.4-0 amd64 5.4.6-3build2
```

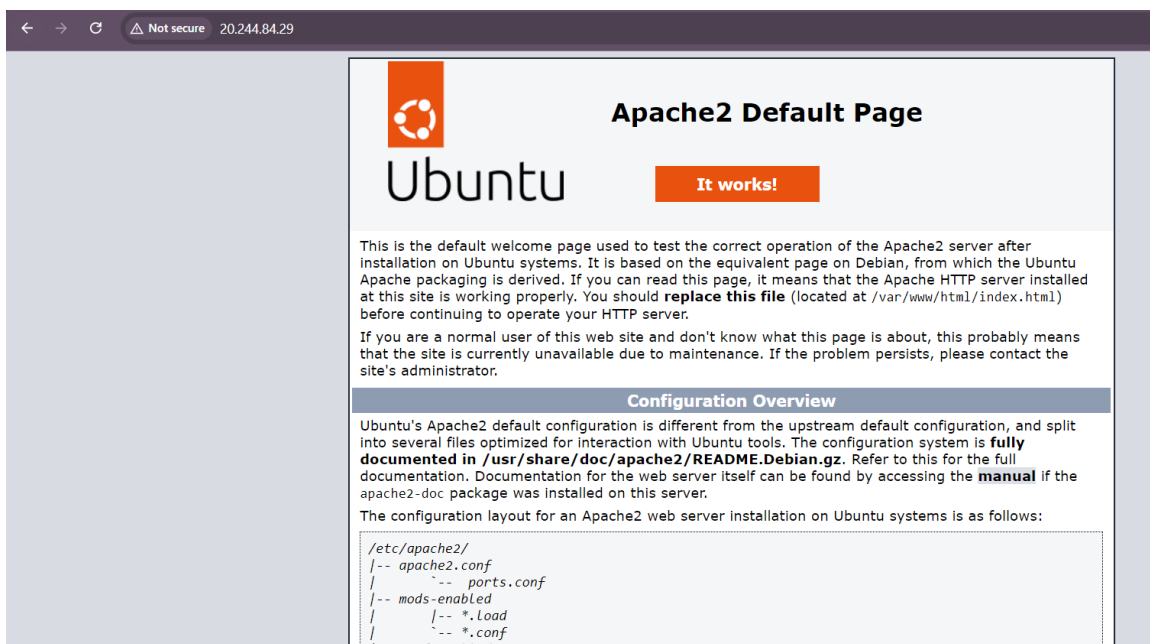
3. Start Apache Service:

- Start the Apache service and enable it to start on boot:

```
sudo systemctl start apache2
```

```
sudo systemctl enable apache2
```

4. Verify Apache Installation:



Step 3: Create an Image Out of the VM

- Go to the Azure portal and select your VM from the list.
- On the page for the VM, on the upper menu, select **Capture**.

Create an image ...

✓ Validation passed

Basics Tags Review + create

Basics

Subscription	Free Trial
Resource group	ubuntu_group
Region	Central India
Share image to Azure compute gallery	Yes
Automatically delete this virtual machine after creating the image	No
Azure compute gallery	(new) Myimage
Operating system state	Generalized
Target VM image definition	(new) ubuntu
Version number	1.0.1
Source virtual machine	ubuntu
Exclude from latest	No
End of life date	None
Lock deleting Replicated Locations	Yes
Shallow replication	No

Step 3: Create a Virtual Machine Scale Set

1. Create a Scale Set:

- In the Azure Portal, select **Create a resource > Compute > Virtual Machine Scale Set**.
- Fill in the basics:
 - **Subscription:** Select your subscription.
 - **Resource Group:** Choose the resource group created earlier.



- **Name:** Provide a name for your scale set.
- **Region:** Choose the same region as your resource group.
- **Image:** Select the custom image you created earlier.
- **Instance count:** Set the initial count (e.g., 1).

Scaling configuration *

Scaling configuration
 Scaling condition count: 1
 Predictive autoscaling: Disabled
 Diagnostic logs: Disabled
 Scale-in policy: Default
 Force delete: Disabled
[Configure](#)

Instance details

Image * ⓘ

 Myimage/ubuntu/latest - x64 Gen2 

[See all images](#) | [Configure VM generation](#)

2. Configure Scaling Settings:

- **Autoscale:**
 - Enable autoscaling.
 - Set minimum instances to 1 and maximum to 5.
- **Scale Out Rule:**
 - Condition: CPU utilization exceeds 70% over a 10-minute period.
 - Action: Increase the instance count by 20%.
- **Scale In Rule:**
 - Condition: CPU utilization drops below 40% over a 10-minute period.
 - Action: Decrease the instance count by 10%.

Default *
Default condition

Delete warning

The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

Scale mode

☒ Scale based on a metric
☐ Scale to a specific instance count

Rules

Scale out

When	Ubuntu	(Average) Percentage CPU > 70	Increase percent by 20
------	--------	-------------------------------	------------------------

Scale in

When	Ubuntu	(Average) Percentage CPU < 40	Decrease percent by 10
------	--------	-------------------------------	------------------------

+ Add a rule

Instance limits

Minimum * ⓘ
 ✓

Maximum * ⓘ
 ✓

Default * ⓘ
 ✓

Schedule

This scale condition is executed when none of the other scale condition(s) match

Step 4: Networking Configuration

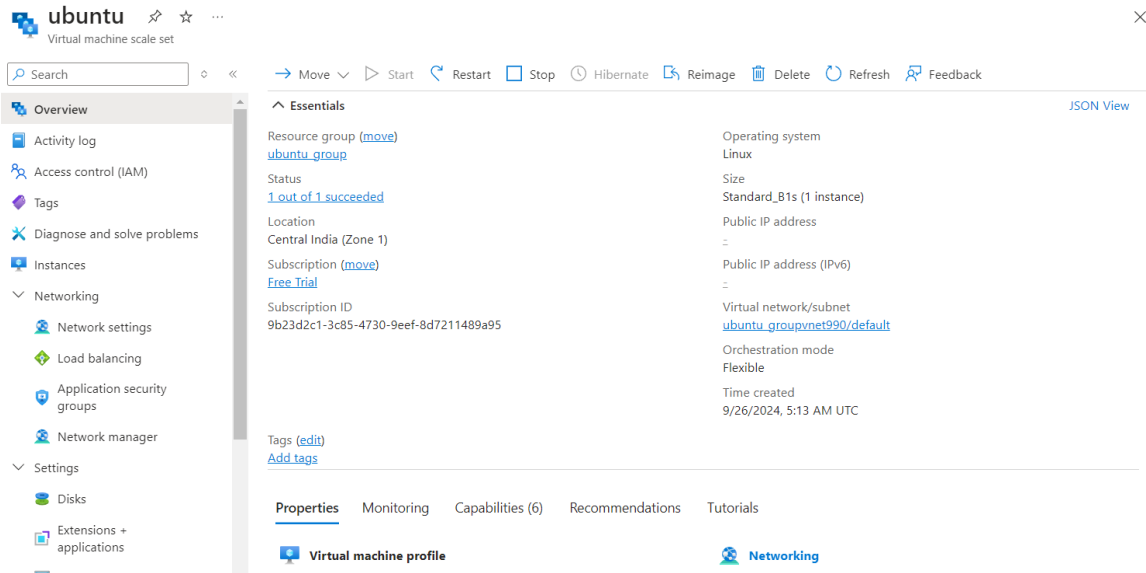
1. Availability Zones:

- During scale set creation, specify **Availability zones** to ensure that all VMs are deployed within the same zone.
- This can be found in the **Availability options** section.

Step 5: Verify Configuration

1. Review and Create:

- Go through all the configurations.
- Click **Create** to deploy the scale set.



2. Monitor and Test:

- After deployment, monitor the CPU utilization through the Azure Monitor or Insights to ensure scaling works as expected.
- Simulate load testing to verify that the scale-out and scale-in rules are functioning correctly.

Step 6: Ongoing Management

1. Regular Monitoring:

- Utilize Azure Monitor to set alerts based on scaling conditions.
- Review the performance regularly to adjust scaling thresholds if necessary.

2. Failure Management:

- Set up Azure Backup or Azure Site Recovery to ensure that your application is resilient to failures.
- Ensure that other fault tolerance mechanisms are in place.