❖ Multi-Cloud DR Project Using (AWS & AZURE Cloud)

Google Drive Link :

https://drive.google.com/drive/folders/1UG6wh9vMlngzJObVn-CCHhmcVBnrm0SW?usp=sharing

GitHub Link :

https://github.com/sagarpatilbox/Multi-Cloud-DR-UpGrad-Project

❖ On your **local machine** Install

- Install:
  - Terraform
  - AWS CLI
  - Azure CLI

1. Install Terraform on Windows

Step 1 — Download Terraform

1. Go to: https://developer.hashicorp.com/terraform/downloads
2. Under **Windows**, download:
   64-bit Terraform ZIP

Step 2 — Extract Terraform

1. Extract the ZIP file.
2. Move `terraform.exe` to a folder such as:

   C:\terraform

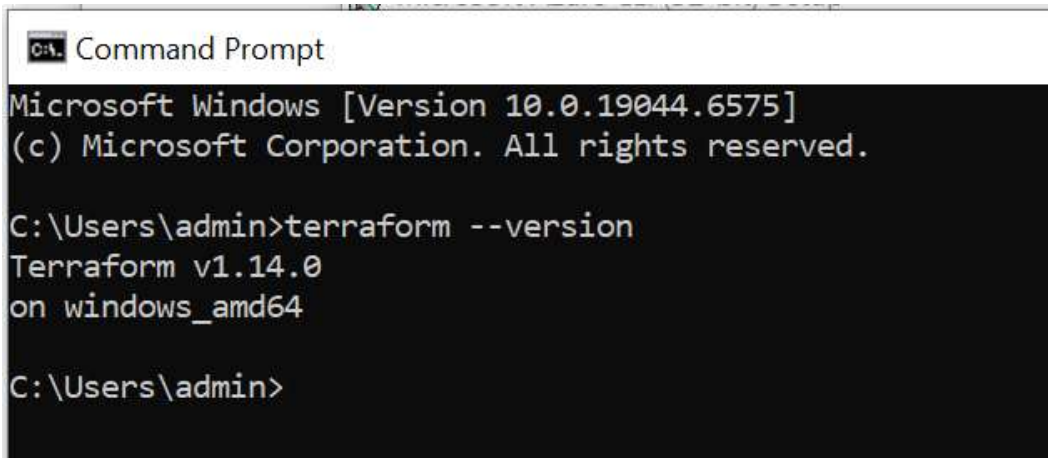
Step 3 — Test installation

- Open PowerShell and run:

  ```
  terraform -version
  ```

- You should see output like:

  ```
  Terraform v1.x.x
  ```



2. Install AWS CLI on Windows

Step 1 — Download AWS CLI

Download 64-bit Windows installer: https://awscli.amazonaws.com/AWSCLIV2.msi

Step 2 — Run Installer

1. Double-click `AWSCLIV2.msi`
2. Follow prompts → Finish

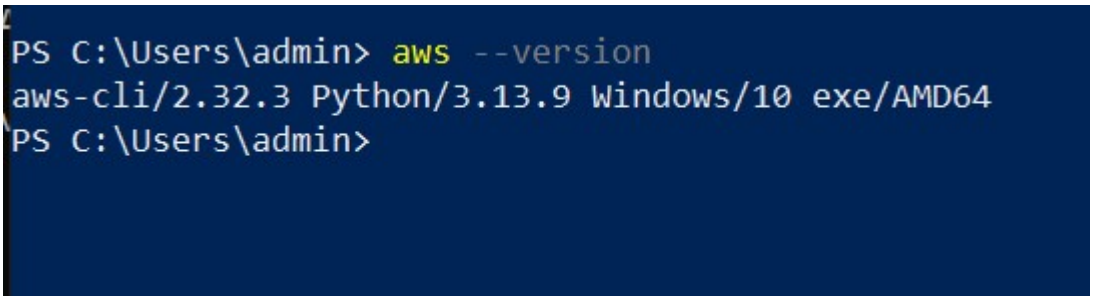
Step 3 — Verify installation

- Open PowerShell:

```
aws --version
```

- Expected output:

```
aws-cli/2.x.x Python/3.x
```



3. Install Azure CLI on Windows

Step 1 — Download Azure CLI

Go to: https://aka.ms/installazurecliwindows

This downloads **`AzureCLI.msi`**.

Step 2 — Run installer

Follow wizard → Install

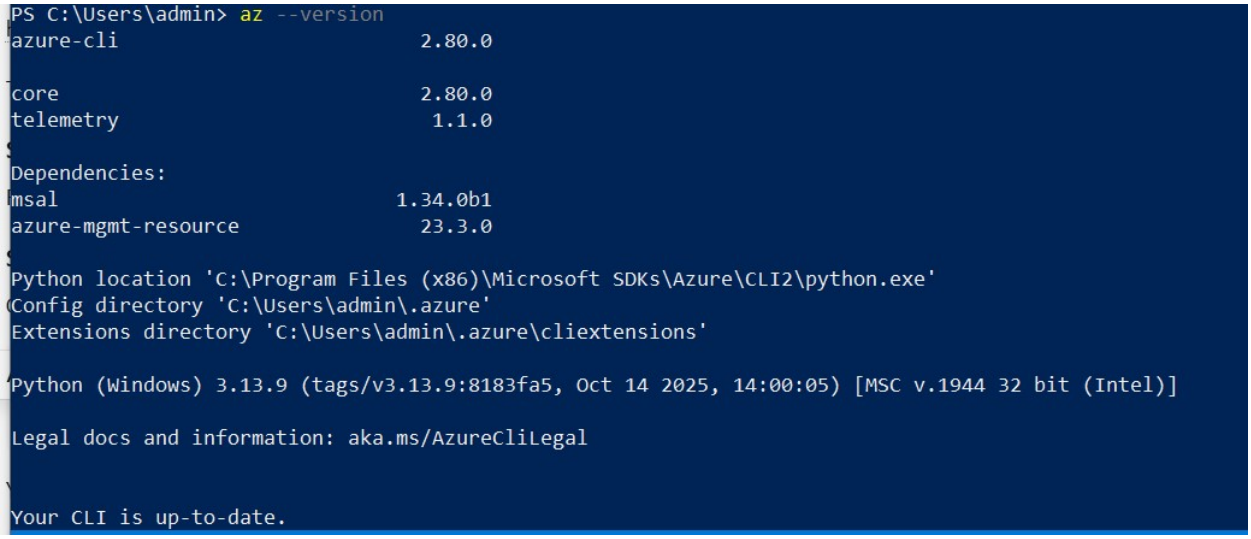
Step 3 — Verify installation

- Open PowerShell:

```
az --version
```

- You should see:

```
azure-cli 2.x.x
```



❖ On your **local machine** Install

Using Git Bash (Recommended for Terraform & SSH)

Step 1 — Open Git Bash

- Install Git for Windows: https://git-scm.com/download/win

- Then open **Git Bash**.

Step 2 — Run the same SSH keygen command

```
ssh-keygen -t rsa -b 4096 -C "multi-cloud-dr" -f ~/.ssh/mcdr_key
```

Your key files will be created at:

```
C:\Users\<YourUsername>\.ssh\mcdr_key
C:\Users\<YourUsername>\.ssh\mcdr_key.pub
```

- `mcdr_key` → private key
- `mcdr_key.pub` → public key

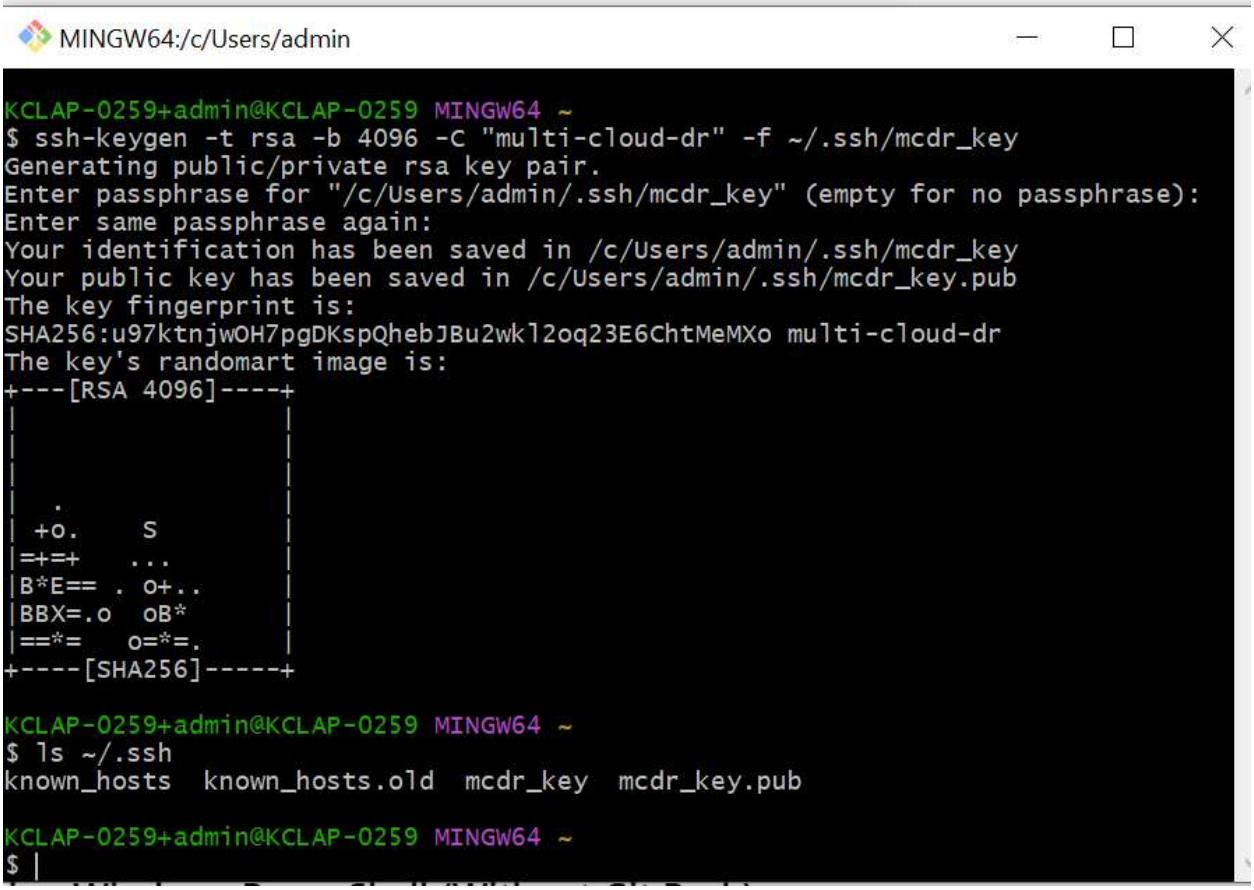
Step 3 — Verify keys

- In Git Bash:

```
ls ~/.ssh
```

- You should see:

```
mcdr_key  mcdr_key.pub
```



Task 1 – Infrastructure Provisioning (AWS & Azure)

1.1 AWS – VPC, Subnets, EC2 (App + Tools)

1.1.1 Create folder & files

```
mkdir -p project/aws
cd project/aws
```

Create **`variables.tf`**:

```
variable "aws_region" {
  description = "AWS region"
  type        = string
  default     = "us-east-1"
}

variable "project_name" {
  description = "Project name prefix"
  type        = string
  default     = "multi-cloud-dr"
}

variable "public_key_path" {
  description = "Path to your SSH public key"
  type        = string
}
```

Create **`main.tf`**:

```
terraform {
  required_version = ">= 1.3.0"

  required_providers {
    aws = {
      source  = "hashicorp/aws"
      version = "~> 5.0"
    }
  }
}

provider "aws" {
  region = var.aws_region
}

# VPC
resource "aws_vpc" "main" {
  cidr_block           = "10.0.0.0/16"
  enable_dns_support   = true
  enable_dns_hostnames = true
```

```
  tags = {
    Name = "${var.project_name}-vpc"
  }
}

# Internet Gateway
resource "aws_internet_gateway" "igw" {
  vpc_id = aws_vpc.main.id

  tags = {
    Name = "${var.project_name}-igw"
  }
}

# Public subnets
resource "aws_subnet" "public_1" {
  vpc_id                  = aws_vpc.main.id
  cidr_block              = "10.0.1.0/24"
  availability_zone       = "${var.aws_region}a"
  map_public_ip_on_launch = true
  tags = {
    Name = "${var.project_name}-public-1"
  }
}

resource "aws_subnet" "public_2" {
  vpc_id                  = aws_vpc.main.id
  cidr_block              = "10.0.2.0/24"
  availability_zone       = "${var.aws_region}b"
  map_public_ip_on_launch = true
  tags = {
    Name = "${var.project_name}-public-2"
  }
}

# Private subnets
resource "aws_subnet" "private_1" {
  vpc_id            = aws_vpc.main.id
  cidr_block        = "10.0.11.0/24"
  availability_zone = "${var.aws_region}a"
  tags = {
    Name = "${var.project_name}-private-1"
  }
}

resource "aws_subnet" "private_2" {
  vpc_id            = aws_vpc.main.id
  cidr_block        = "10.0.12.0/24"
  availability_zone = "${var.aws_region}b"
  tags = {
    Name = "${var.project_name}-private-2"
  }
}

# NAT
resource "aws_eip" "nat_eip" {
  domain = "vpc"
```

```
  tags = { Name = "${var.project_name}-nat-eip" }
}

resource "aws_nat_gateway" "nat" {
  allocation_id = aws_eip.nat_eip.id
  subnet_id     = aws_subnet.public_1.id
  depends_on    = [aws_internet_gateway.igw]

  tags = {
    Name = "${var.project_name}-nat"
  }
}

# Public route table
resource "aws_route_table" "public" {
  vpc_id = aws_vpc.main.id

  route {
    cidr_block = "0.0.0.0/0"
    gateway_id = aws_internet_gateway.igw.id
  }

  tags = {
    Name = "${var.project_name}-public-rt"
  }
}

resource "aws_route_table_association" "public_1" {
  subnet_id      = aws_subnet.public_1.id
  route_table_id = aws_route_table.public.id
}

resource "aws_route_table_association" "public_2" {
  subnet_id      = aws_subnet.public_2.id
  route_table_id = aws_route_table.public.id
}

# Private route table
resource "aws_route_table" "private" {
  vpc_id = aws_vpc.main.id

  route {
    cidr_block     = "0.0.0.0/0"
    nat_gateway_id = aws_nat_gateway.nat.id
  }

  tags = {
    Name = "${var.project_name}-private-rt"
  }
}

resource "aws_route_table_association" "private_1" {
  subnet_id      = aws_subnet.private_1.id
  route_table_id = aws_route_table.private.id
}

resource "aws_route_table_association" "private_2" {
```

```
  subnet_id      = aws_subnet.private_2.id
  route_table_id = aws_route_table.private.id
}

# Security group
resource "aws_security_group" "web_sg" {
  name        = "${var.project_name}-web-sg"
  description = "Allow SSH and HTTP"
  vpc_id      = aws_vpc.main.id

  ingress {
    description = "SSH"
    from_port   = 22
    to_port     = 22
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  ingress {
    description = "HTTP"
    from_port   = 80
    to_port     = 80
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  egress {
    from_port   = 0
    to_port     = 0
    protocol    = "-1"
    cidr_blocks = ["0.0.0.0/0"]
  }

  tags = {
    Name = "${var.project_name}-web-sg"
  }
}

# Key pair using your public key
resource "aws_key_pair" "default" {
  key_name   = "${var.project_name}-key"
  public_key = file(var.public_key_path)
}


# App instance
resource "aws_instance" "app" {
  ami                         = "ami-0ecb62995f68bb549"
  instance_type               = "t3.micro"
  subnet_id                   = aws_subnet.public_1.id
  vpc_security_group_ids      = [aws_security_group.web_sg.id]
  key_name                    = aws_key_pair.default.key_name
  associate_public_ip_address = true

  tags = {
    Name = "${var.project_name}-app"
    Role = "app"
```

```
  }
}

# Tools instance
resource "aws_instance" "tools" {
  ami                         = "ami-0ecb62995f68bb549"
  instance_type               = "t3.micro"
  subnet_id                   = aws_subnet.public_2.id
  vpc_security_group_ids      = [aws_security_group.web_sg.id]
  key_name                    = aws_key_pair.default.key_name
  associate_public_ip_address = true

  tags = {
    Name = "${var.project_name}-tools"
    Role = "tools"
  }
}
```

Create **`outputs.tf`**:

```
output "app_public_ip" {
  value       = aws_instance.app.public_ip
  description = "Public IP of the App Machine"
}

output "tools_public_ip" {
  value       = aws_instance.tools.public_ip
  description = "Public IP of the Tools Machine"
}
```

1.1.2 Configure & Run Terraform

First Configure aws Login :

```
aws configure
```

Give Below Information :

```
AWS Access Key ID: <from CSV>
AWS Secret Access Key: <from CSV>
Default region name: us-east-1
Default output format: json
```

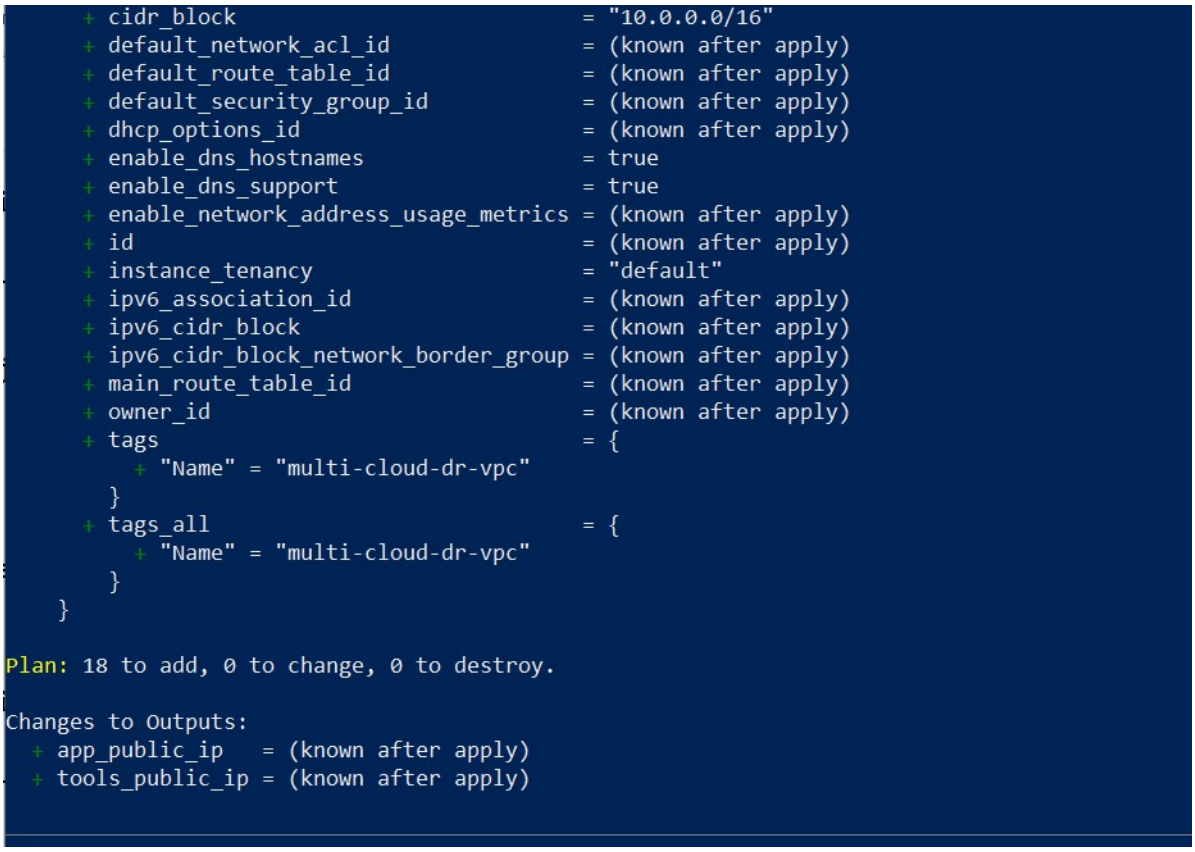
Run Terraform

```
cd project/aws
terraform init
terraform plan -var="public_key_path=$HOME/.ssh/mcdr_key.pub"
terraform apply -var="public_key_path=$HOME/.ssh/mcdr_key.pub"
```

```
PS C:\Users\admin\project\aws> terraform init
Initializing the backend...
Initializing provider plugins...
- Reusing previous version of hashicorp/aws from the dependency lock file
- Using previously-installed hashicorp/aws v5.100.0

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
PS C:\Users\admin\project\aws>
```

❖ Screenshots to capture:

- Terminal with **`terraform plan`** summary (AWS).

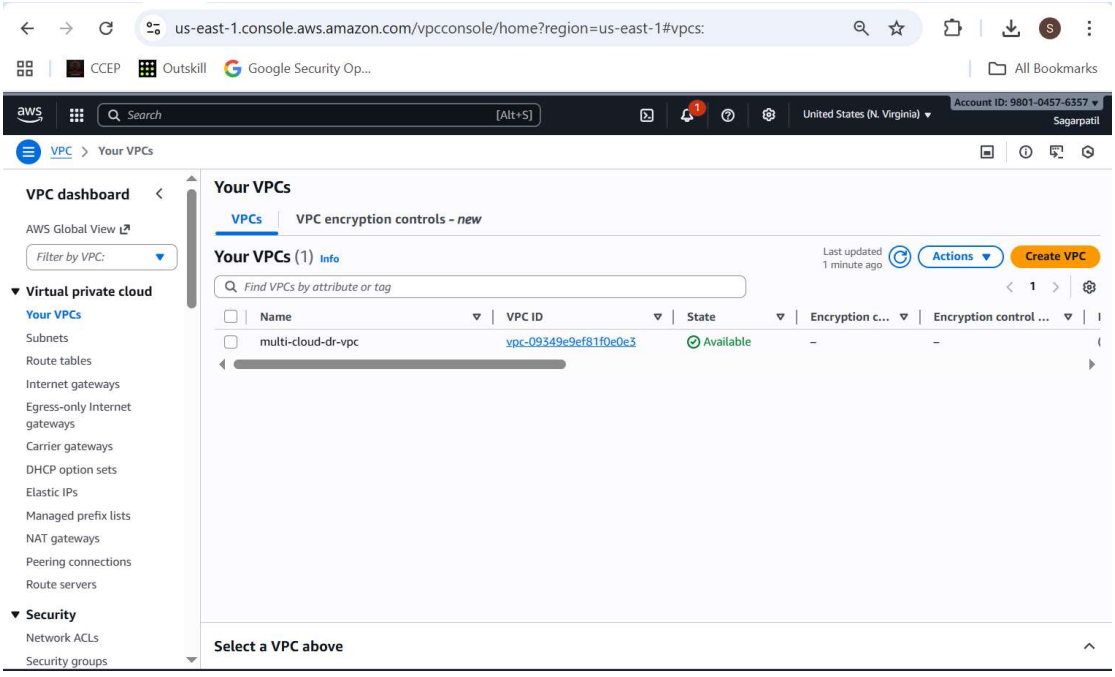


```
      + cidr_block                          = "10.0.0.0/16"
      + default_network_acl_id              = (known after apply)
      + default_route_table_id              = (known after apply)
      + default_security_group_id           = (known after apply)
      + dhcp_options_id                     = (known after apply)
      + enable_dns_hostnames                = true
      + enable_dns_support                  = true
      + enable_network_address_usage_metrics = (known after apply)
      + id                                  = (known after apply)
      + instance_tenancy                    = "default"
      + ipv6_association_id                 = (known after apply)
      + ipv6_cidr_block                     = (known after apply)
      + ipv6_cidr_block_network_border_group = (known after apply)
      + main_route_table_id                 = (known after apply)
      + owner_id                            = (known after apply)
      + tags                                = {
          + "Name" = "multi-cloud-dr-vpc"
        }
      + tags_all                            = {
          + "Name" = "multi-cloud-dr-vpc"
        }
    }

Plan: 18 to add, 0 to change, 0 to destroy.

Changes to Outputs:
  + app_public_ip   = (known after apply)
  + tools_public_ip = (known after apply)
```

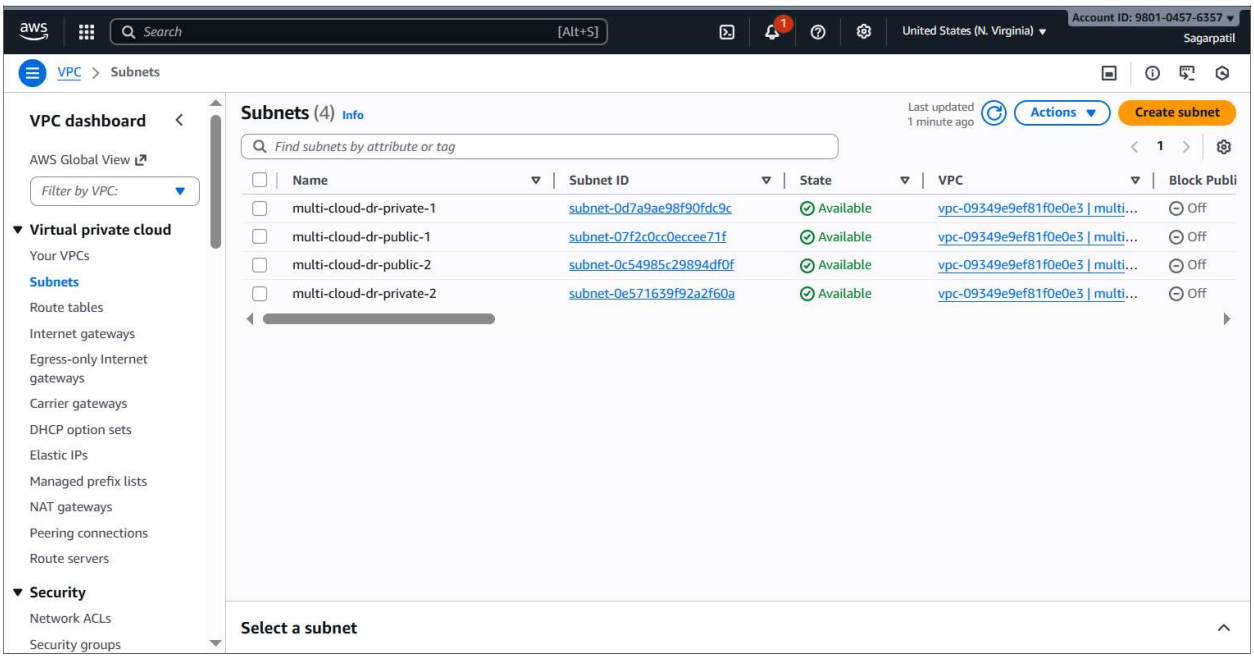
- Terminal with `terraform apply` success.

```
aws_route_table_association.public_2: Creation complete after 1s [id=rtbassoc-00d5857dbe291c9f7]
aws_route_table_association.public_1: Creation complete after 1s [id=rtbassoc-0e962ca424dbf3c3d]
aws_instance.tools: Still creating... [00m10s elapsed]
aws_nat_gateway.nat: Still creating... [00m10s elapsed]
aws_instance.app: Still creating... [00m10s elapsed]
aws_instance.tools: Creation complete after 16s [id=i-06057e17c07065325]
aws_instance.app: Creation complete after 16s [id=i-08552db2f4b74d714]
aws_nat_gateway.nat: Still creating... [00m20s elapsed]
aws_nat_gateway.nat: Still creating... [00m30s elapsed]
aws_nat_gateway.nat: Still creating... [00m40s elapsed]
aws_nat_gateway.nat: Still creating... [00m50s elapsed]
aws_nat_gateway.nat: Still creating... [01m00s elapsed]
aws_nat_gateway.nat: Still creating... [01m10s elapsed]
aws_nat_gateway.nat: Still creating... [01m20s elapsed]
aws_nat_gateway.nat: Still creating... [01m30s elapsed]
aws_nat_gateway.nat: Creation complete after 1m39s [id=nat-07e03dc3f9feb978f]
aws_route_table.private: Creating...
aws_route_table.private: Creation complete after 3s [id=rtb-08f15f4aa6a2d9d40]
aws_route_table_association.private_2: Creating...
aws_route_table_association.private_1: Creating...
aws_route_table_association.private_2: Creation complete after 1s [id=rtbassoc-0b9bd517e6e6d2fa6]
aws_route_table_association.private_1: Creation complete after 2s [id=rtbassoc-02bc13545f92ec502]

Apply complete! Resources: 18 added, 0 changed, 0 destroyed.

Outputs:

app_public_ip = "35.171.158.150"
tools_public_ip = "54.144.200.231"
PS C:\Users\admin\project\aws>
```

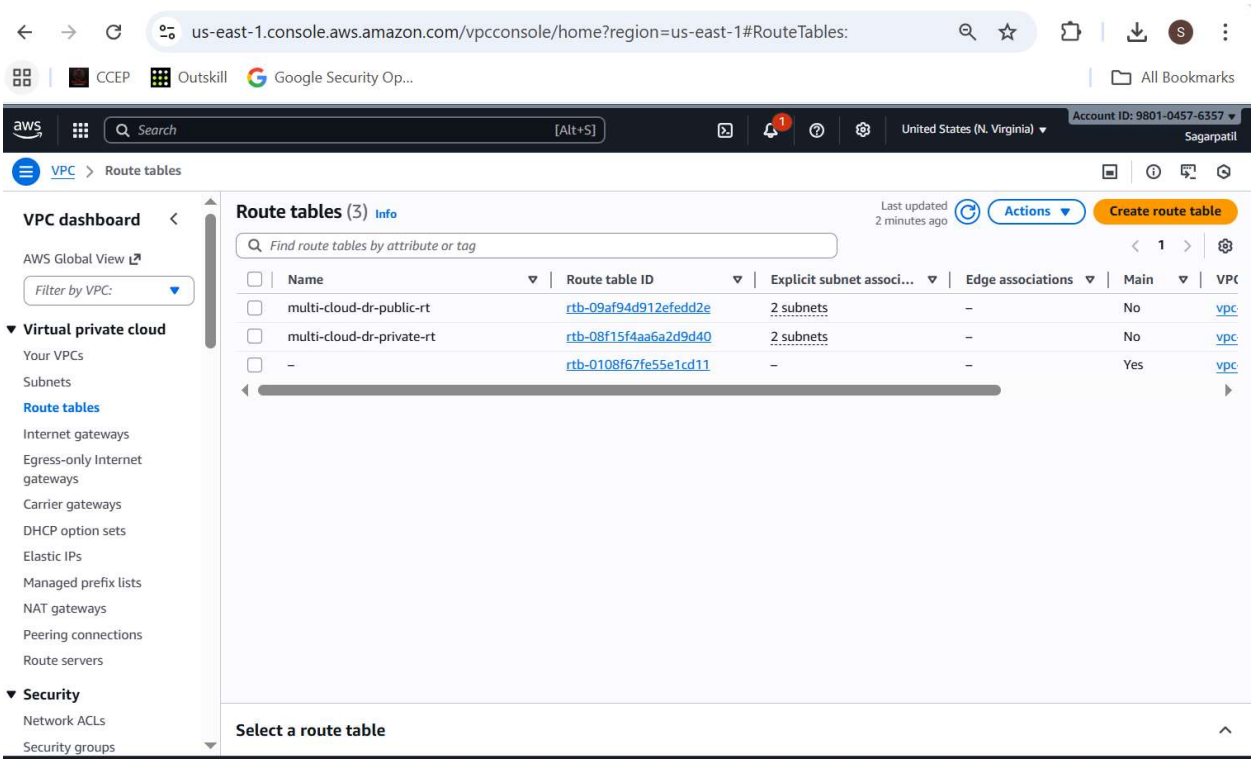
- AWS Console:
  - VPC details



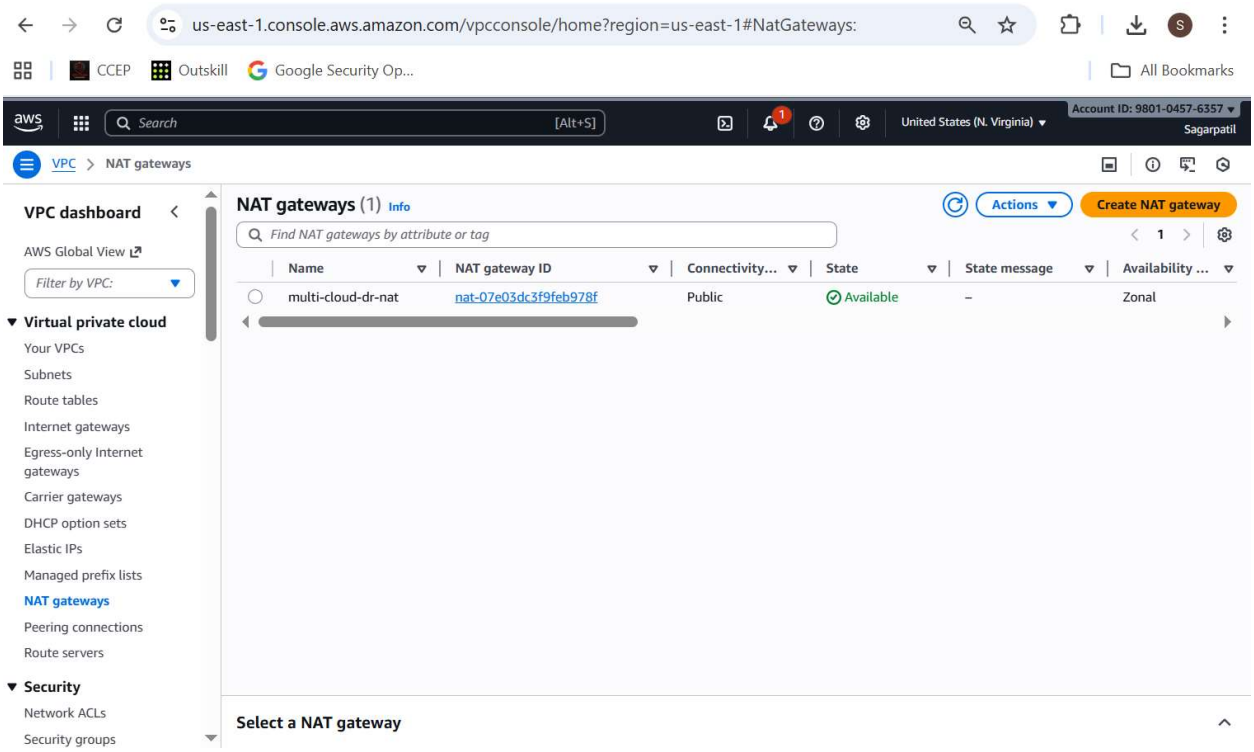
- Subnets listing (2 public, 2 private)



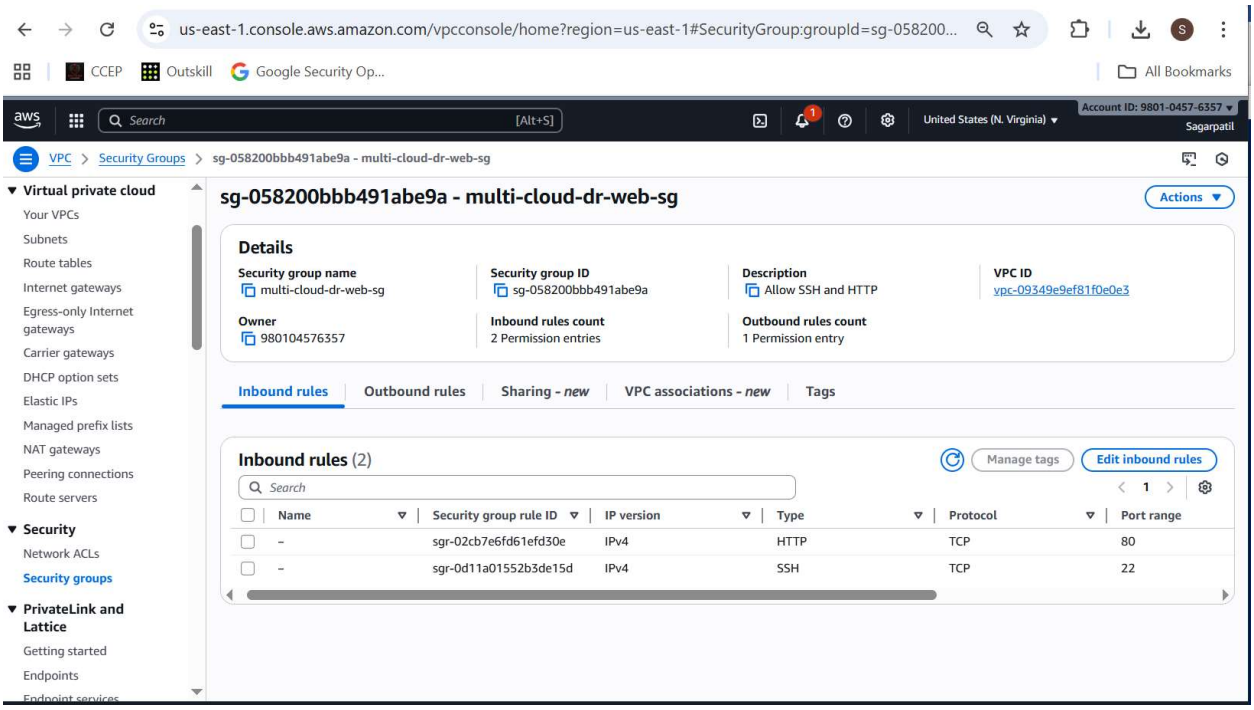
- Route tables (public + private)



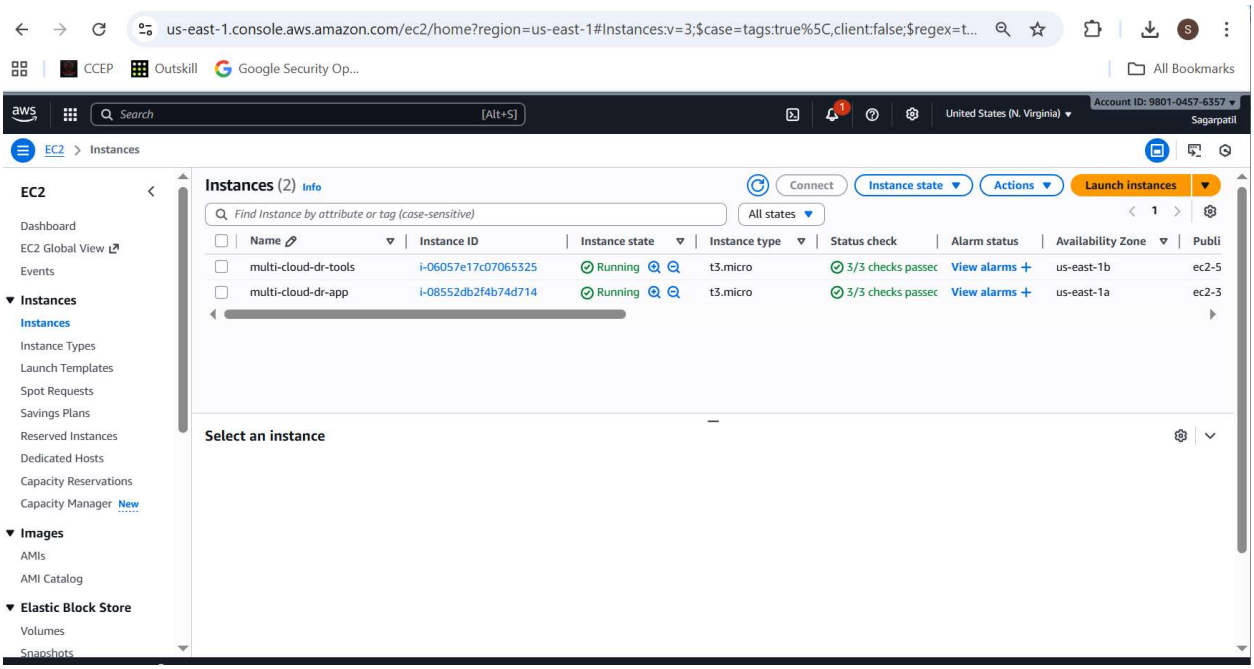
- NAT gateway



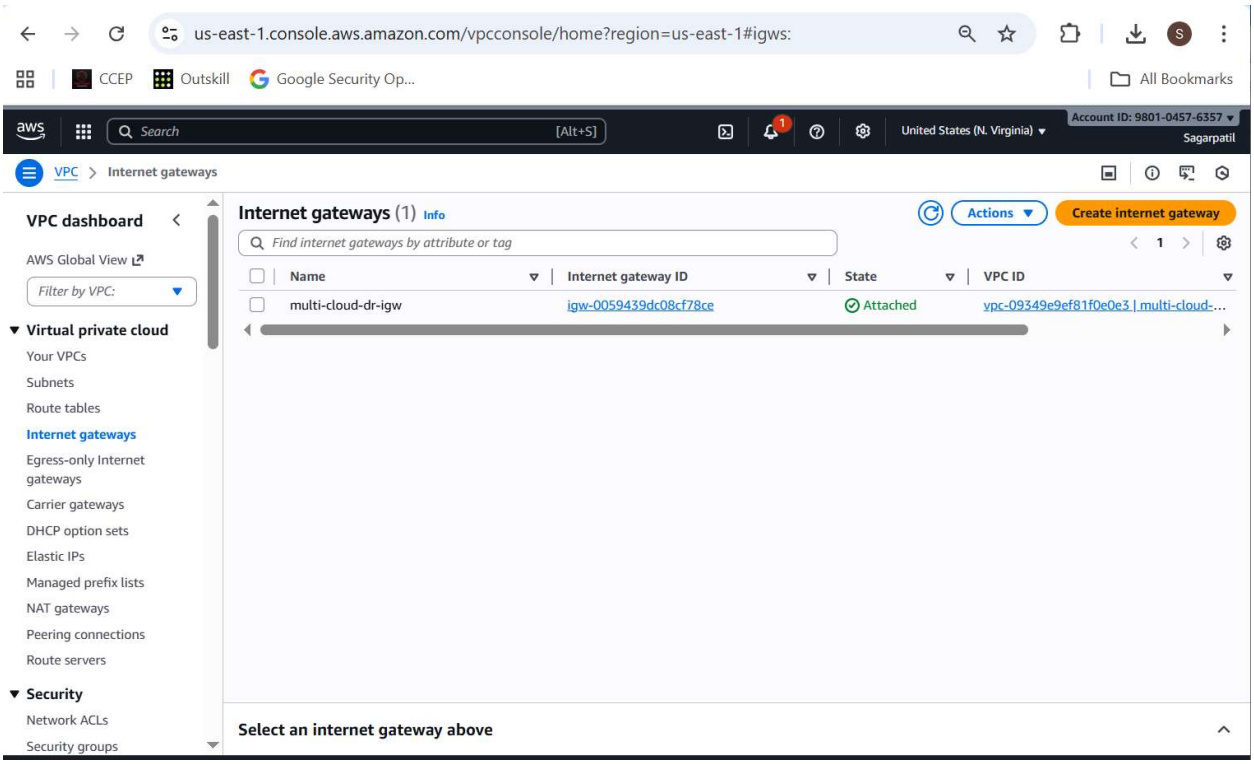
- Security group inbound rules (22, 80)



- EC2 instances list showing App + Tools machines



- Internet Gateway



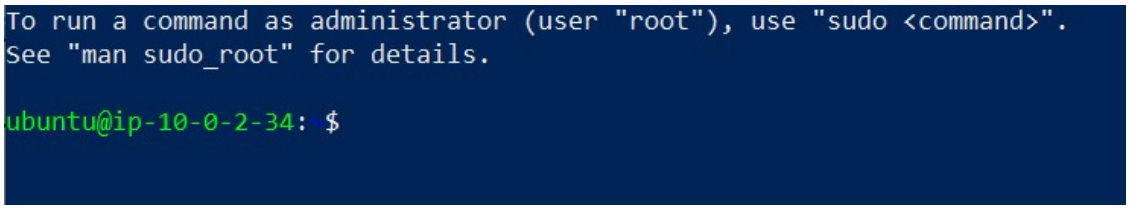
1.1.3 SSH test to EC2s

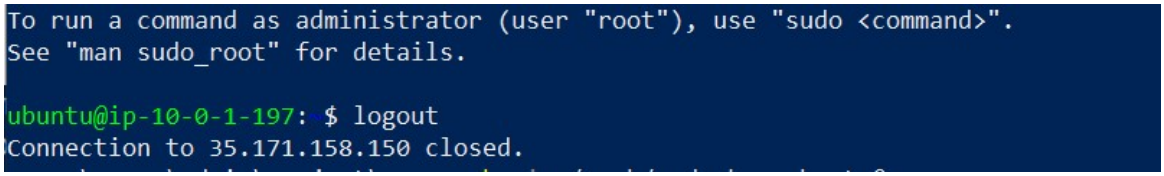
From local:

```
ssh -i ~/.ssh/mcdr_key ubuntu@<AWS_APP_PUBLIC_IP>
ssh -i ~/.ssh/mcdr_key ubuntu@<AWS_TOOLS_PUBLIC_IP>
```

Screenshot:

- Terminal showing successful SSH into both EC2s.





1.2 Azure – VNet, Subnet, NSG, VM

1.2.1 Create folder & files

```
cd project
mkdir -p azure
cd azure
```

variables.tf:

```
variable "azure_location" {
  description = "Azure location"
  type        = string
  default     = "eastus"
}

variable "project_name" {
  description = "Project name"
  type        = string
  default     = "multi-cloud-dr"
}

variable "admin_username" {
  description = "Admin username for VM"
```

```
  type        = string
  default     = "azureuser"
}

variable "public_key_path" {
  description = "Path to SSH public key"
  type        = string
}
```

main.tf:

```
terraform {
  required_version = ">= 1.3.0"

  required_providers {
    azurerm = {
      source  = "hashicorp/azurerm"
      version = "~> 4.0"
    }
  }
}

provider "azurerm" {
  features {}
}

resource "azurerm_resource_group" "rg" {
  name     = "${var.project_name}-rg"
  location = var.azure_location
}

resource "azurerm_virtual_network" "vnet" {
  name                = "${var.project_name}-vnet"
  location            = azurerm_resource_group.rg.location
  resource_group_name = azurerm_resource_group.rg.name
  address_space       = ["10.10.0.0/16"]
}

resource "azurerm_subnet" "subnet_app" {
  name                 = "${var.project_name}-subnet-app"
  resource_group_name  = azurerm_resource_group.rg.name
  virtual_network_name = azurerm_virtual_network.vnet.name
  address_prefixes     = ["10.10.1.0/24"]
}

resource "azurerm_network_security_group" "nsg" {
  name                = "${var.project_name}-nsg"
  location            = azurerm_resource_group.rg.location
  resource_group_name = azurerm_resource_group.rg.name

  security_rule {
    name                       = "SSH"
    priority                   = 100
    direction                  = "Inbound"
    access                     = "Allow"
    protocol                   = "Tcp"
```

```
    source_port_range          = "*"
    destination_port_range     = "22"
    source_address_prefix      = "*"
    destination_address_prefix = "*"
  }

  security_rule {
    name                       = "HTTP"
    priority                   = 110
    direction                  = "Inbound"
    access                     = "Allow"
    protocol                   = "Tcp"
    source_port_range          = "*"
    destination_port_range     = "80"
    source_address_prefix      = "*"
    destination_address_prefix = "*"
  }
}

resource "azurerm_subnet_network_security_group_association"
"subnet_nsg_assoc" {
  subnet_id                 = azurerm_subnet.subnet_app.id
  network_security_group_id = azurerm_network_security_group.nsg.id
}

resource "azurerm_public_ip" "app_pip" {
  name                = "${var.project_name}-app-pip"
  location            = azurerm_resource_group.rg.location
  resource_group_name = azurerm_resource_group.rg.name
  allocation_method   = "Static"
  sku                 = "Basic"
}

resource "azurerm_network_interface" "app_nic" {
  name                = "${var.project_name}-app-nic"
  location            = azurerm_resource_group.rg.location
  resource_group_name = azurerm_resource_group.rg.name

  ip_configuration {
    name                          = "internal"
    subnet_id                     = azurerm_subnet.subnet_app.id
    private_ip_address_allocation = "Dynamic"
    public_ip_address_id          = azurerm_public_ip.app_pip.id
  }
}

resource "azurerm_linux_virtual_machine" "app_vm" {
  name                = "${var.project_name}-app-vm"
  location            = azurerm_resource_group.rg.location
  resource_group_name = azurerm_resource_group.rg.name
  size                = "Standard_B1s"

  admin_username                  = var.admin_username
  disable_password_authentication = true

  network_interface_ids = [azurerm_network_interface.app_nic.id]
```

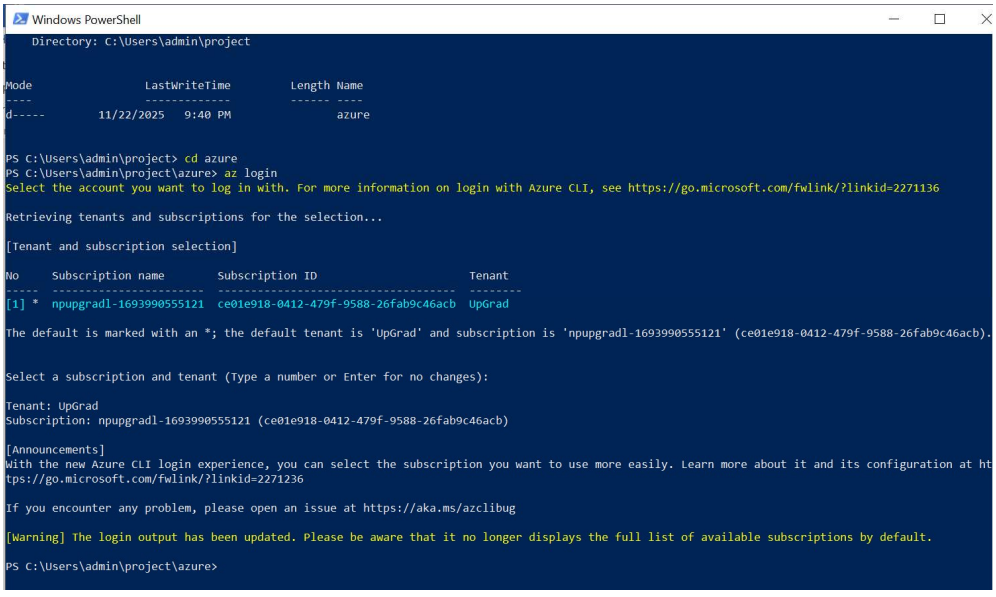
```
  admin_ssh_key {
    username   = var.admin_username
    public_key = file(var.public_key_path)
  }

  os_disk {
    name                 = "${var.project_name}-app-osdisk"
    caching              = "ReadWrite"
    storage_account_type = "Standard_LRS"
  }

  source_image_reference {
    publisher = "Canonical"
    offer     = "0001-com-ubuntu-server-jammy"
    sku       = "22_04-lts"
    version   = "latest"
  }

  computer_name = "appvm"

  tags = {
    Role = "app"
  }
}
```

outputs.tf:

```
output "app_vm_public_ip" {
  value       = azurerm_public_ip.app_pip.ip_address
  description = "Public IP of Azure App VM"
}
```

1.2.2 Run Terraform

```
az login      # if not already logged in
```



```
cd project/azure
terraform init
```

```
PS C:\Users\admin\project\azure> terraform init
Initializing the backend...
Initializing provider plugins...
- Finding hashicorp/azurerm versions matching "~> 4.0"...
- Installing hashicorp/azurerm v4.54.0...
- Installed hashicorp/azurerm v4.54.0 (signed by HashiCorp)
Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
PS C:\Users\admin\project\azure>
```

```
terraform plan -var="public_key_path=$HOME/.ssh/mcdr_key.pub"
terraform apply -var="public_key_path=$HOME/.ssh/mcdr_key.pub"
```

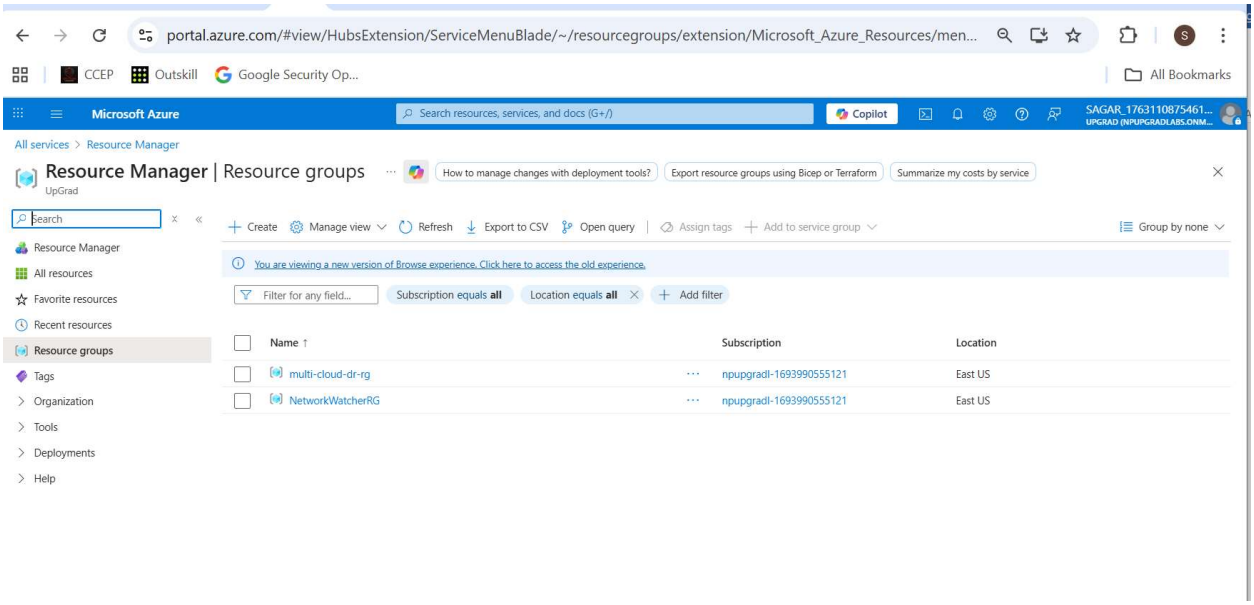
Screenshots:

- Terminal with `plan` and `apply` (Azure).

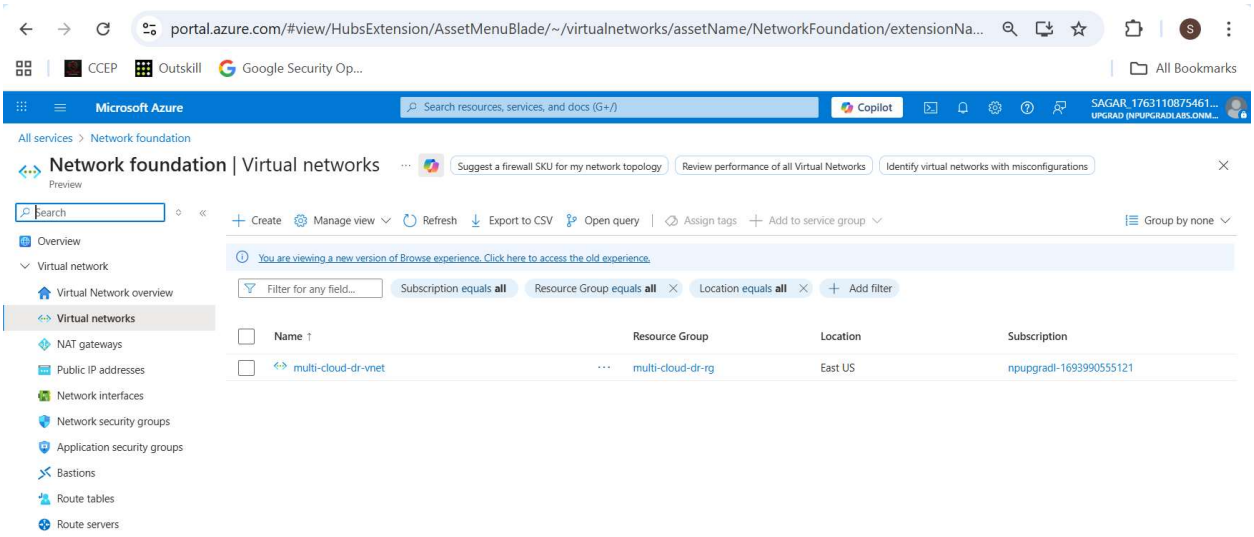
```
      + address_prefixes                              = [
          + "10.10.1.0/24",
        ]
      + default_outbound_access_enabled               = true
      + id                                            = (known after apply)
      + name                                          = "multi-cloud-dr-subnet-app"
      + private_endpoint_network_policies             = "Disabled"
      + private_link_service_network_policies_enabled = true
      + resource_group_name                           = "multi-cloud-dr-rg"
      + virtual_network_name                          = "multi-cloud-dr-vnet"
    }

  # azurerm_subnet_network_security_group_association.subnet_nsg_assoc will be created
  + resource "azurerm_subnet_network_security_group_association" "subnet_nsg_assoc" {
      + id                        = (known after apply)
      + network_security_group_id = (known after apply)
      + subnet_id                 = (known after apply)
    }

  # azurerm_virtual_network.vnet will be created
  + resource "azurerm_virtual_network" "vnet" {
      + address_space                = [
          + "10.10.0.0/16",
        ]
      + dns_servers                  = (known after apply)
      + guid                         = (known after apply)
      + id                           = (known after apply)
      + location                     = "eastus"
      + name                         = "multi-cloud-dr-vnet"
      + private_endpoint_vnet_policies = "Disabled"
      + resource_group_name          = "multi-cloud-dr-rg"
      + subnet                       = (known after apply)
    }

Plan: 8 to add, 0 to change, 0 to destroy.

Changes to Outputs:
  + app_vm_public_ip = (known after apply)
```

```
azurerm_linux_virtual_machine.app_vm: Creating...
azurerm_linux_virtual_machine.app_vm: Still creating... [00m10s elapsed]
azurerm_linux_virtual_machine.app_vm: Still creating... [00m20s elapsed]
azurerm_linux_virtual_machine.app_vm: Still creating... [00m30s elapsed]
azurerm_linux_virtual_machine.app_vm: Still creating... [00m40s elapsed]
azurerm_linux_virtual_machine.app_vm: Still creating... [00m50s elapsed]
azurerm_linux_virtual_machine.app_vm: Creation complete after 54s [id=/subscriptions/ce01e918-0412-479f-9588-26fab9c46acb/resourceGroups/multi-cloud-
dr-rg/providers/Microsoft.Compute/virtualMachines/multi-cloud-dr-app-vm]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.

Outputs:

app_vm_public_ip = "172.173.149.211"
PS C:\Users\admin\project\azure>
```

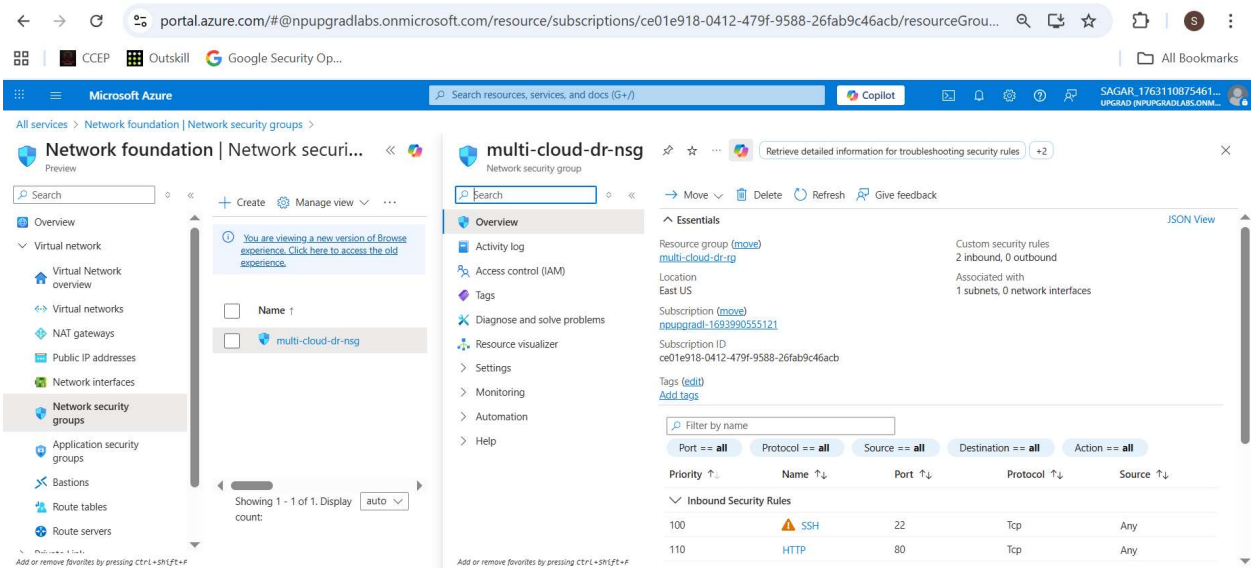
- Azure portal:
  - Resource group



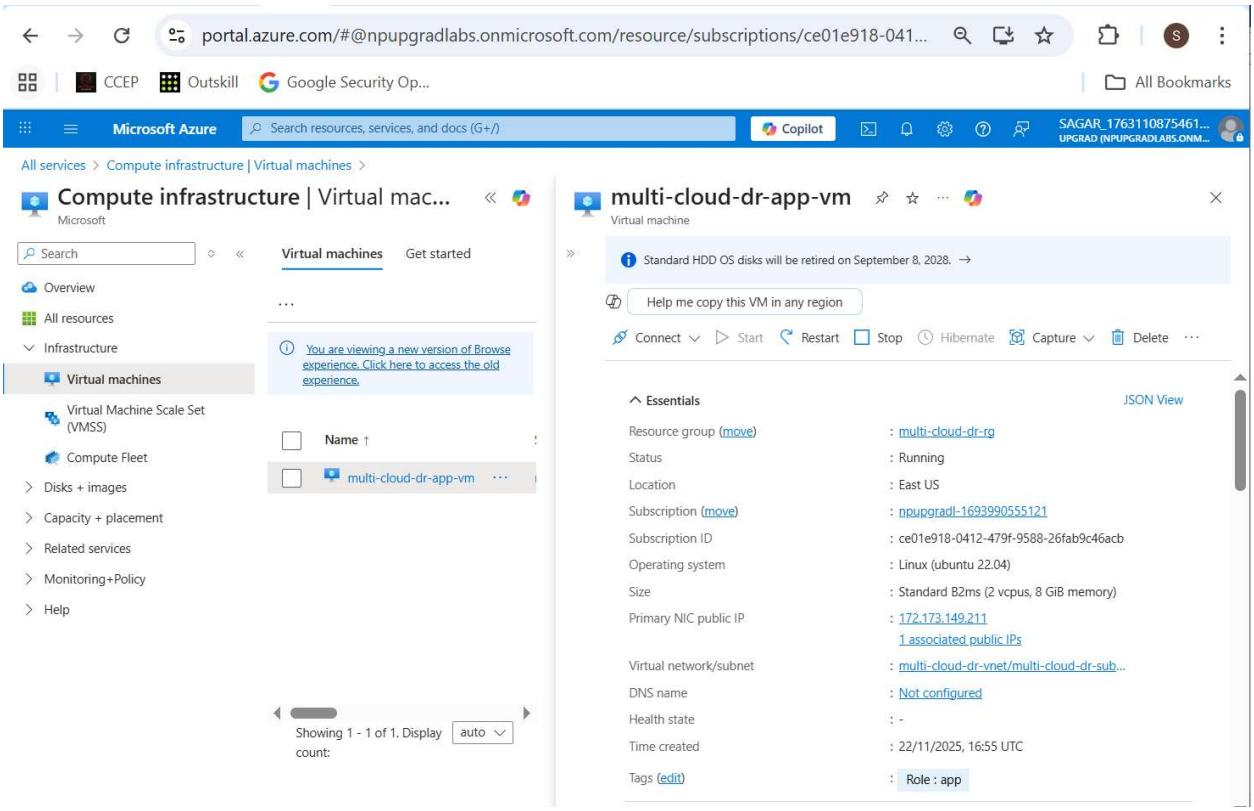
  - VNet + subnet



- NSG inbound rules (22, 80)



- VM overview (running, public IP).

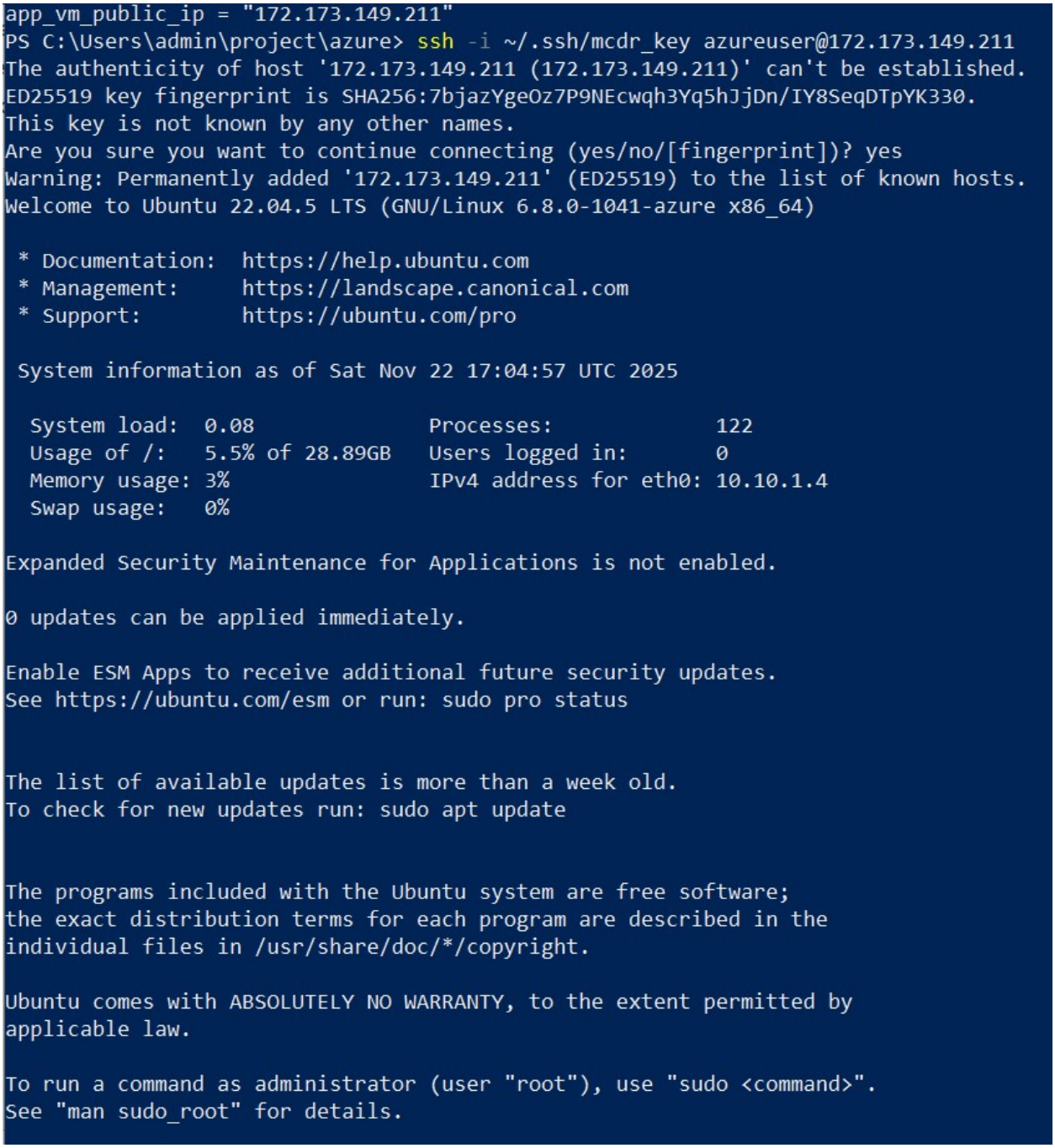


1.2.3 SSH test to Azure VM

```
ssh -i ~/.ssh/mcdr_key azureuser@<AZURE_APP_PUBLIC_IP>
```

Screenshot:

Terminal showing successful SSH login.



Task 2 – Configuration Management (Ansible)

All Ansible work happens on the **AWS Tools Machine**.

2.1 Install Ansible on Tools Machine

- SSH to Tools Machine:

```
ssh -i ~/.ssh/mcdr_key ubuntu@<AWS_TOOLS_PUBLIC_IP>
```

- Install Ansible:

```
sudo apt update
sudo apt install -y ansible git
ansible --version
```

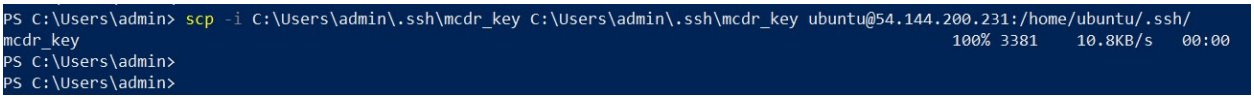
Screenshot:

ansible --version output.

2.2 Copy SSH key to Tools Machine

On **local machine**:

```
scp -i C:\Users\admin\.ssh\mcdr_key C:\Users\admin\.ssh\mcdr_key
ubuntu@<AWS_TOOLS_PUBLIC_IP>:/home/ubuntu/.ssh/
```



On **Tools Machine**:

```
chmod 600 ~/.ssh/mcdr_key
```

2.3 Create Ansible inventory

On Tools Machine:

```
mkdir -p ~/multi-cloud-ansible
cd ~/multi-cloud-ansible

vim inventory.ini
```

inventory.ini:

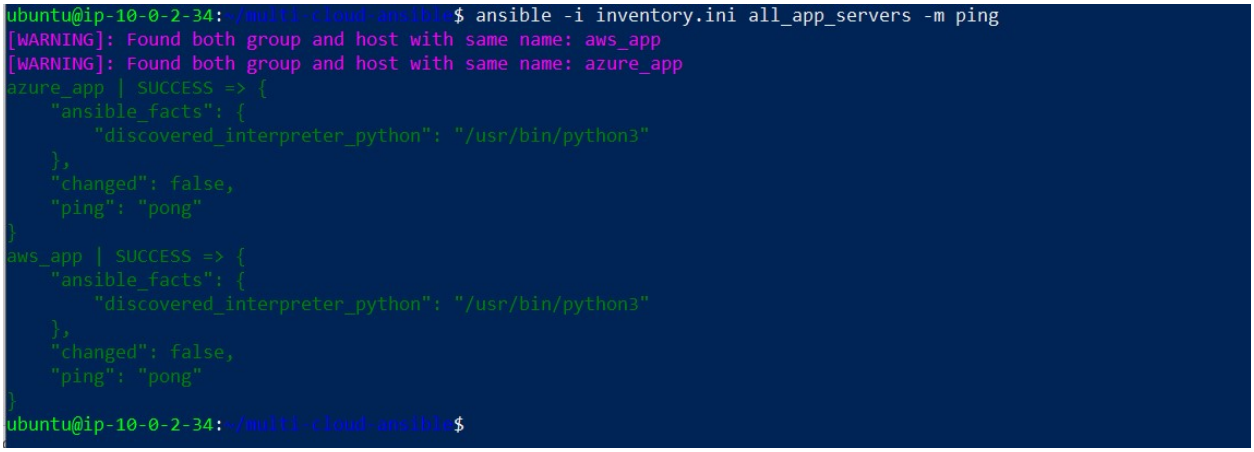
```
[aws_app]
aws_app ansible_host=<AWS_APP_PUBLIC_IP> ansible_user=ubuntu
ansible_ssh_private_key_file=/home/ubuntu/.ssh/mcdr_key

[azure_app]
azure_app ansible_host=<AZURE_APP_PUBLIC_IP> ansible_user=azureuser
ansible_ssh_private_key_file=/home/ubuntu/.ssh/mcdr_key

[all_app_servers:children]
aws_app
azure_app
```

Test connectivity:

```
ansible -i inventory.ini all_app_servers -m ping
```

Screenshot:

Ping output showing `pong` from both hosts.



2.4 Ansible playbook to install & start Nginx

Create **nginx_setup.yml**:

```
---
- name: Install and configure Nginx on AWS and Azure app servers
  hosts: all_app_servers
  become: yes
  vars:
    nginx_pkg_name: nginx
```

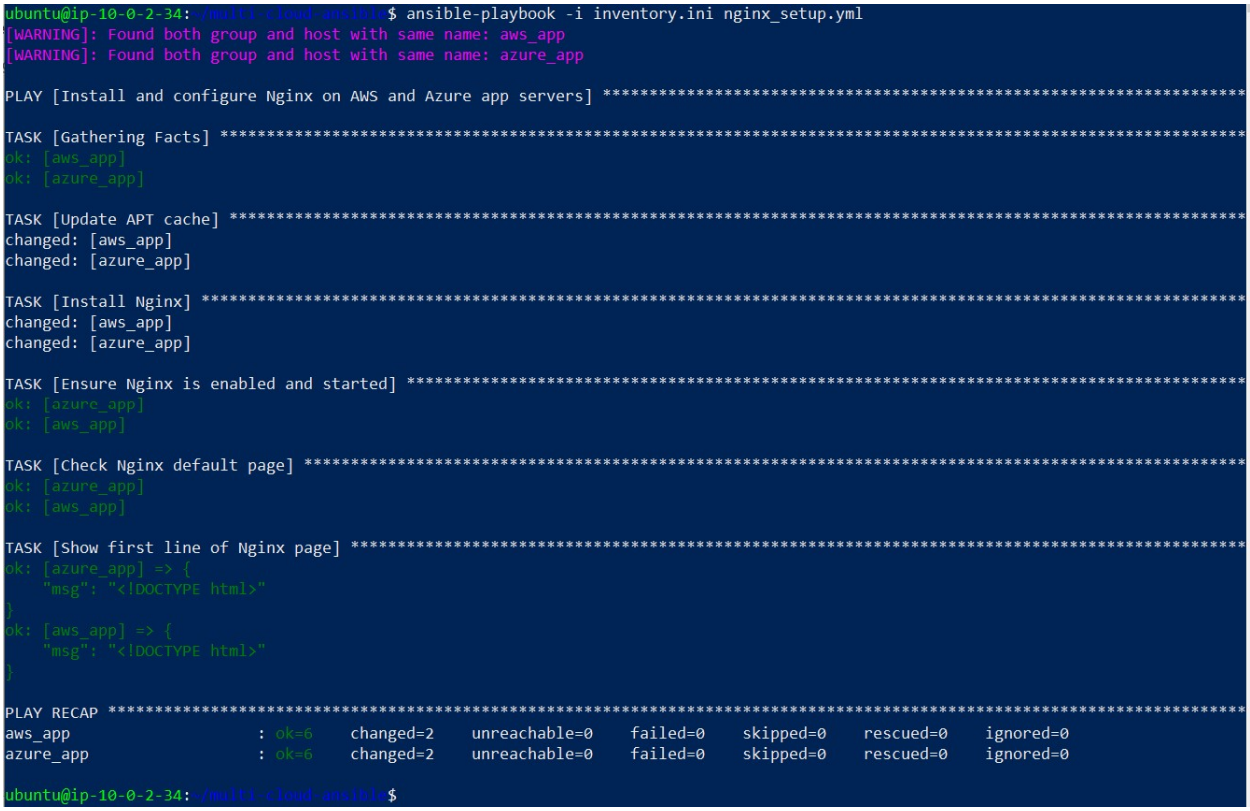
```
  tasks:
    - name: Update APT cache
      ansible.builtin.apt:
        update_cache: yes
        cache_valid_time: 3600

    - name: Install Nginx
      ansible.builtin.apt:
        name: "{{ nginx_pkg_name }}"
        state: present

    - name: Ensure Nginx is enabled and started
      ansible.builtin.service:
        name: nginx
        state: started
        enabled: yes

    - name: Check Nginx default page
      ansible.builtin.command: curl -s http://localhost
      register: nginx_page
      changed_when: false

    - name: Show first line of Nginx page
      ansible.builtin.debug:
        msg: "{{ nginx_page.stdout_lines | default([]) | first | default('no
output') }}"
```

Run it:

```
ansible-playbook -i inventory.ini nginx_setup.yml
```

Screenshots:

- Playbook run showing success.

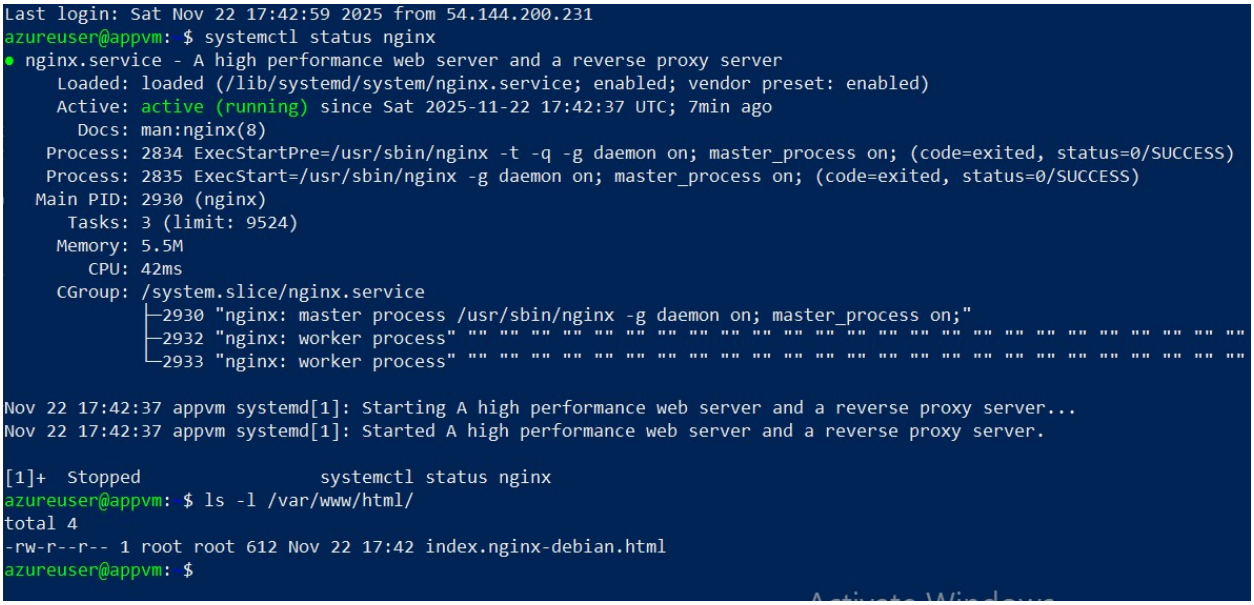


On **each app** server:

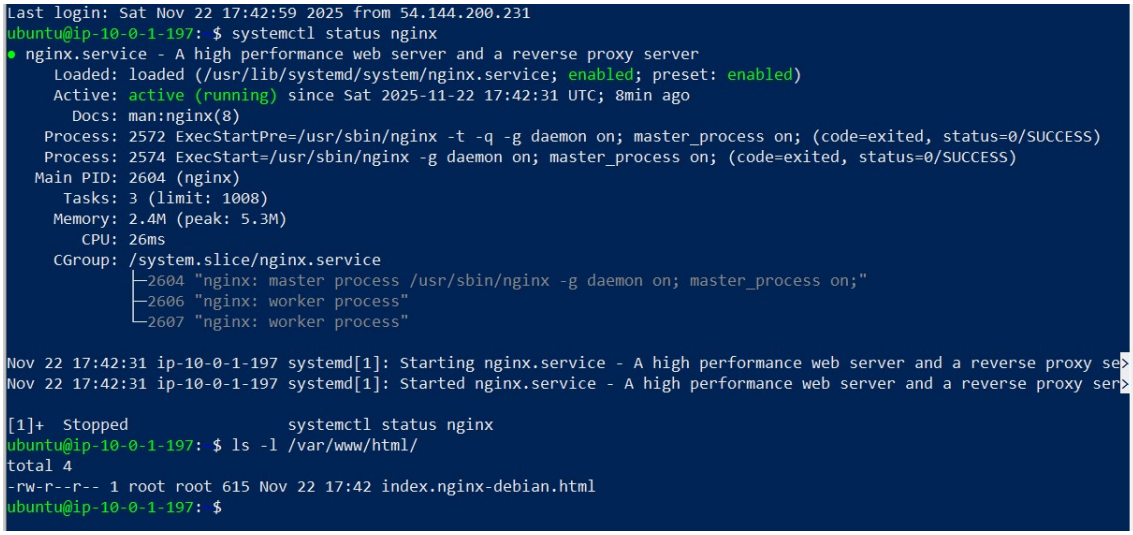
```
# On AWS app
systemctl status nginx
ls -l /var/www/html/


# On Azure app
systemctl status nginx
ls -l /var/www/html/
```

Screenshots:

- `systemctl status nginx` on AWS & Azure = active.



- `/var/www/html` listing.



Task 3 – Application Deployment (Custom Nginx Pages)

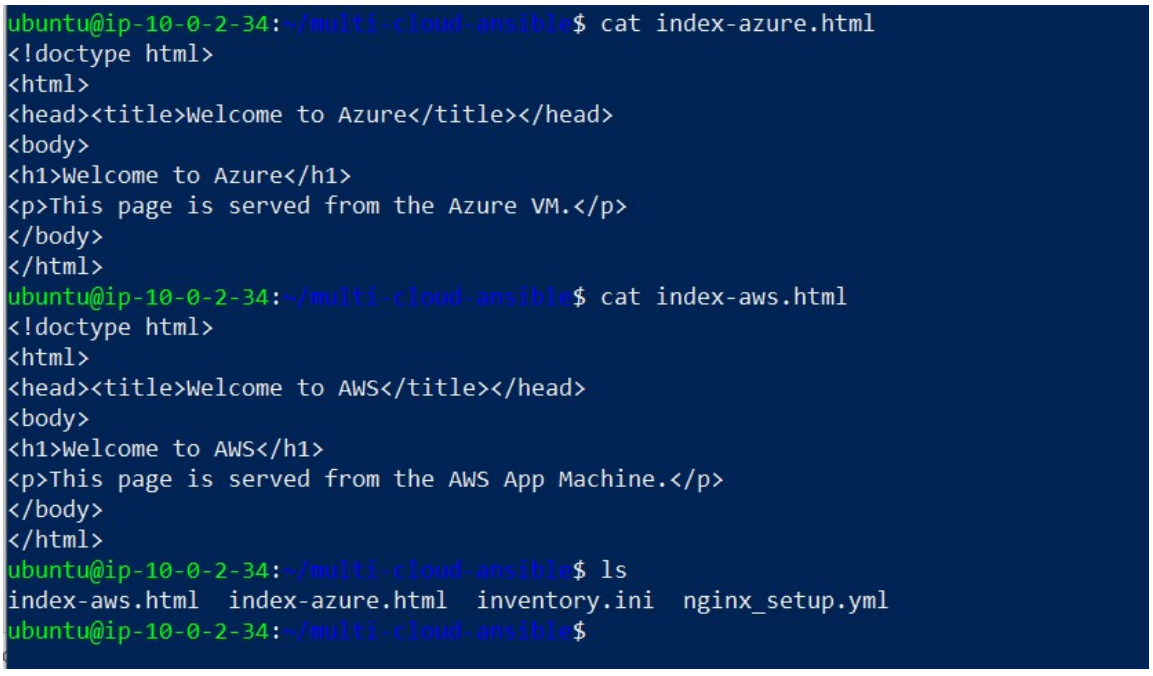
3.1 Create custom html files on Tools Machine

From `~/multi-cloud-ansible`:

```
cat > index-aws.html << 'EOF'
<!doctype html>
<html>
<head><title>Welcome to AWS</title></head>
<body>
<h1>Welcome to AWS</h1>
<p>This page is served from the AWS App Machine.</p>
</body>
</html>
EOF

cat > index-azure.html << 'EOF'
<!doctype html>
<html>
<head><title>Welcome to Azure</title></head>
<body>
<h1>Welcome to Azure</h1>
<p>This page is served from the Azure VM.</p>
</body>
</html>
EOF
```

Screenshot:

`ls` showing **`index-aws.html`** and **`index-azure.html`**.



3.2 Add cloud flag to inventory

Edit **`inventory.ini`**:

```
[aws_app]
aws_app ansible_host=<AWS_APP_PUBLIC_IP> ansible_user=ubuntu
ansible_ssh_private_key_file=/home/ubuntu/.ssh/mcdr_key cloud=aws

[azure_app]
azure_app ansible_host=<AZURE_APP_PUBLIC_IP> ansible_user=azureuser
ansible_ssh_private_key_file=/home/ubuntu/.ssh/mcdr_key cloud=azure

[all_app_servers:children]
aws_app
azure_app
```

3.3 Deployment playbook

Create **`nginx_deploy.yml`**:

```
---
- name: Deploy custom index pages to AWS and Azure
  hosts: all_app_servers
  become: yes

  tasks:
    - name: Set index source based on cloud
      ansible.builtin.set_fact:
        custom_index_src: "index-{{ cloud }}.html"

    - name: Copy custom index.html to web root
      ansible.builtin.copy:
        src: "{{ custom_index_src }}"
        dest: /var/www/html/index.html
        owner: www-data
        group: www-data
        mode: '0644'
      notify: Restart nginx

    - name: Ensure Nginx default site uses index.html
      ansible.builtin.lineinfile:
        path: /etc/nginx/sites-available/default
        regexp: '^\s*index '
        line: "\tindex index.html;"
        backup: yes
      notify: Restart nginx

    - name: Check Nginx page from localhost
      ansible.builtin.command: curl -s http://localhost
      register: nginx_page
      changed_when: false

    - name: Assert correct welcome text
      ansible.builtin.assert:
```

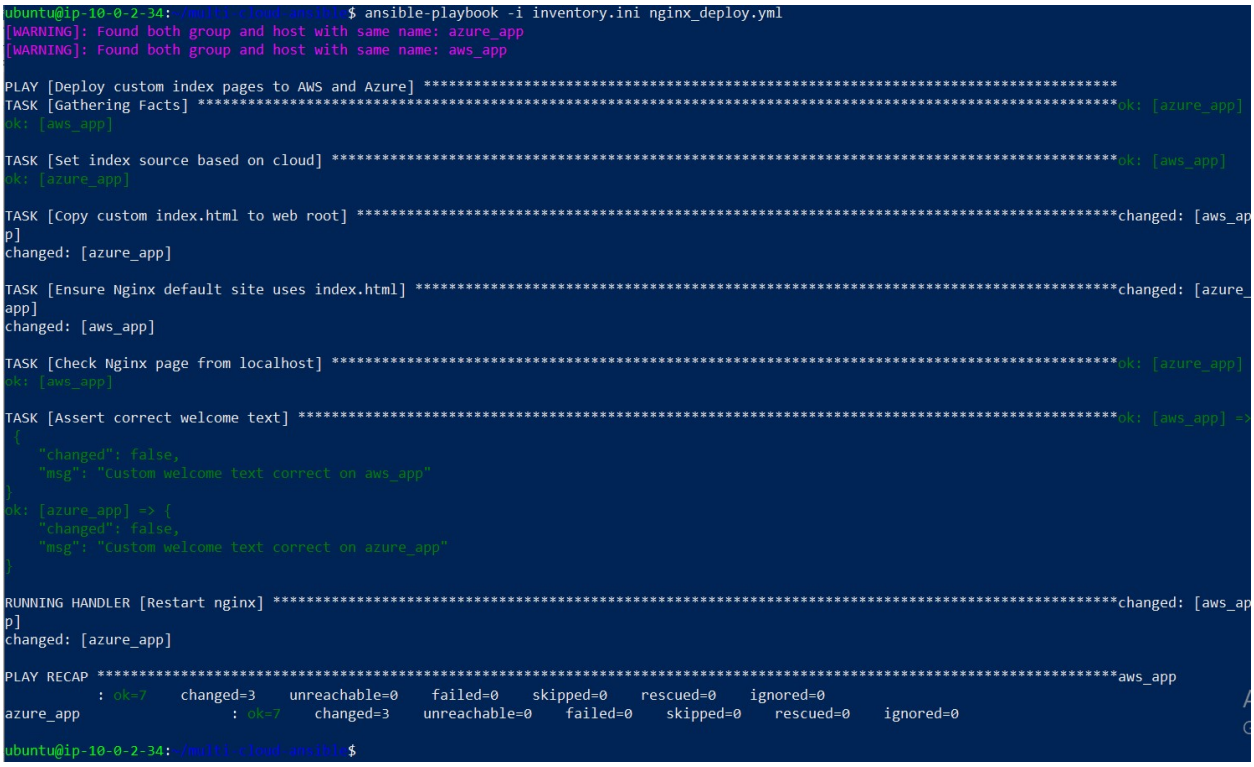
```
        that:
          - >
            (cloud == 'aws' and 'Welcome to AWS' in nginx_page.stdout)
            or
            (cloud == 'azure' and 'Welcome to Azure' in nginx_page.stdout)
        fail_msg: "Custom welcome text not correct on {{ inventory_hostname
}}"
        success_msg: "Custom welcome text correct on {{ inventory_hostname
}}"

  handlers:
    - name: Restart nginx
      ansible.builtin.service:
        name: nginx
        state: restarted
```

Run:

```
ansible-playbook -i inventory.ini nginx_deploy.yml
```

Screenshots:

- Playbook run showing copy + assert tasks success.



On **AWS app**:

```
cat /var/www/html/index.html
```

```
ubuntu@ip-10-0-1-197: $ cat /var/www/html/index.html
<!doctype html>
<html>
<head><title>Welcome to AWS</title></head>
<body>
<h1>Welcome to AWS</h1>
<p>This page is served from the AWS App Machine.</p>
</body>
</html>
ubuntu@ip-10-0-1-197: $
```

On **Azure app**: `cat /var/www/html/index.html`

```
azureuser@appvm:~$ cat /var/www/html/index.html
<!doctype html>
<html>
<head><title>Welcome to Azure</title></head>
<body>
<h1>Welcome to Azure</h1>
<p>This page is served from the Azure VM.</p>
</body>
</html>
azureuser@appvm:~$
```

Nginx config:

```
sudo cat /etc/nginx/sites-available/default | grep -i "index"
```

Screenshot:
Line showing **`index index.html;`**.

```
ubuntu@ip-10-0-1-197: $ sudo cat /etc/nginx/sites-available/default | grep -i "index"
        # Add index.php to the list if you are using PHP
        index index.html;
#       index index.html;
ubuntu@ip-10-0-1-197: $
```

```
azureuser@appvm: $ sudo cat /etc/nginx/sites-available/default | grep -i "index"
        # Add index.php to the list if you are using PHP
        index index.html;
#       index index.html;
azureuser@appvm: $
```

3.4 Browser verification

From your local machine:

- Open `http://<AWS_APP_PUBLIC_IP>` → **Welcome to AWS**

Welcome to AWS

This page is served from the AWS App Machine.

- Open `http://<AZURE_APP_PUBLIC_IP>` → **Welcome to Azure**

Welcome to Azure

This page is served from the Azure VM.

Screenshots: Browser for AWS page.

Welcome to AWS

This page is served from the AWS App Machine.

- Browser for Azure page.

Welcome to Azure

This page is served from the Azure VM.

Task 4 – Jenkins Setup for Continuous Deployment

4.1 Install Jenkins on Tools Machine

On Tools Machine:

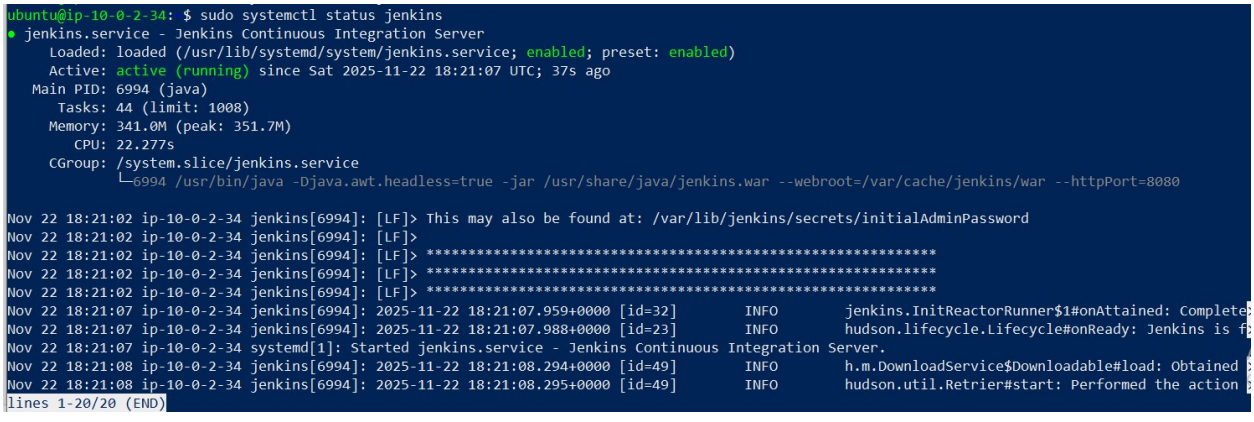
```
sudo apt update
sudo apt install -y openjdk-17-jdk
java -version
```

Add Jenkins repo & install:

```
curl -fsSL https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key | sudo
tee \
  /usr/share/keyrings/jenkins-keyring.asc > /dev/null

echo deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc] \
  https://pkg.jenkins.io/debian-stable binary/ | sudo tee \
  /etc/apt/sources.list.d/jenkins.list > /dev/null

sudo apt update
sudo apt install -y jenkins
sudo systemctl enable jenkins
sudo systemctl start jenkins
sudo systemctl status jenkins
```

Screenshot:

`systemctl status jenkins` = active.



Update security group for Tools Machine to allow **TCP 8080** from your IP.

Open from browser:

`http://<AWS_TOOLS_PUBLIC_IP>:8080`

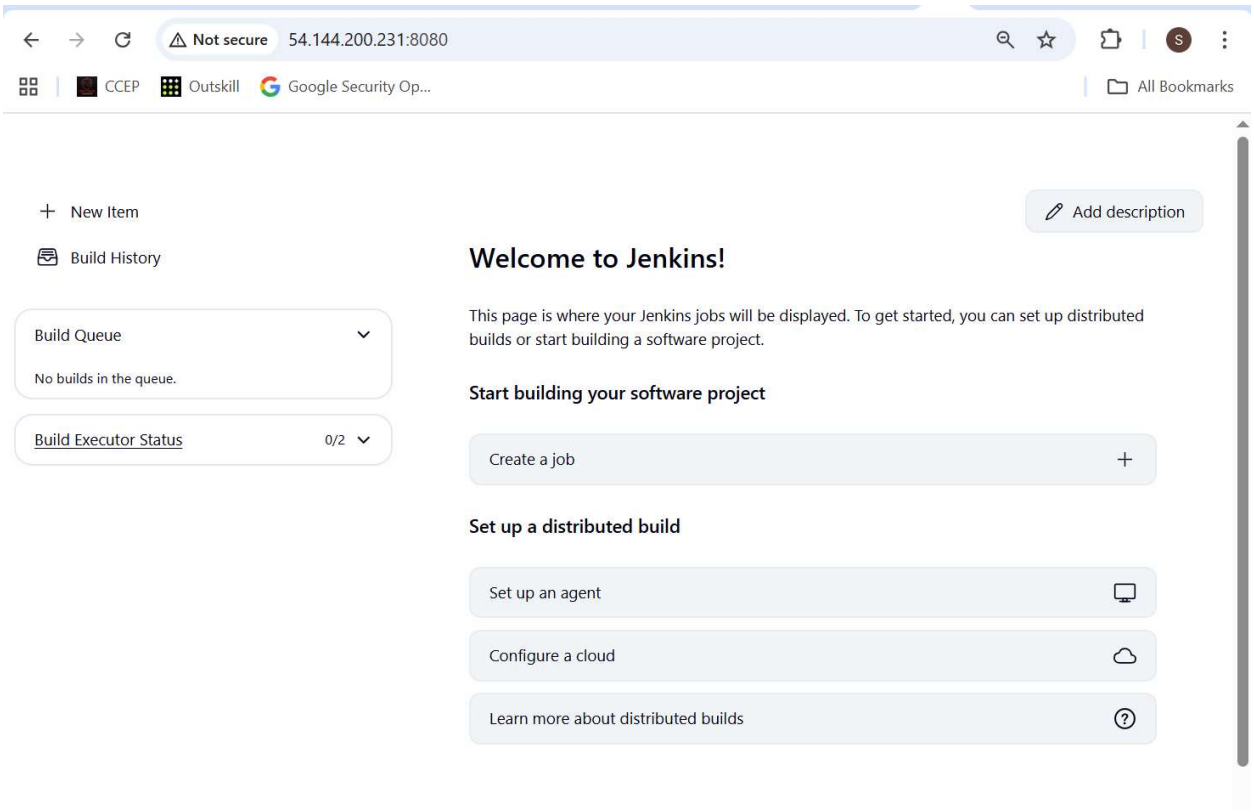
Get initial password:

```
sudo cat /var/lib/jenkins/secrets/initialAdminPassword
```

Finish Jenkins setup and create admin user.

Screenshots:

- Jenkins first dashboard after setup.



4.2 Prepare GitHub repo

Create a GitHub repo, e.g. **`multi-cloud-dr-cd`** containing:

- `inventory.ini` (same content but key path **`/var/lib/jenkins/.ssh/mcdr_key`**)
- `nginx_deploy.yml`
- `index-aws.html`
- `index-azure.html`
- `Jenkinsfile`

On Tools Machine, copy key for Jenkins:

```
sudo mkdir -p ~jenkins/.ssh
sudo cp /home/ubuntu/.ssh/mcdr_key ~jenkins/.ssh/
```

```
sudo chown -R jenkins:jenkins ~jenkins/.ssh
sudo chmod 700 ~jenkins/.ssh
sudo chmod 600 ~jenkins/.ssh/mcdr_key
```

In repo's **`inventory.ini`**:

```
[aws_app]
aws_app ansible_host=<AWS_APP_PUBLIC_IP> ansible_user=ubuntu
ansible_ssh_private_key_file=/var/lib/jenkins/.ssh/mcdr_key cloud=aws

[azure_app]
azure_app ansible_host=<AZURE_APP_PUBLIC_IP> ansible_user=azureuser
ansible_ssh_private_key_file=/var/lib/jenkins/.ssh/mcdr_key cloud=azure

[all_app_servers:children]
aws_app
azure_app
```

4.3 Jenkinsfile

Create **`Jenkinsfile`** in repo:

```
pipeline {
    agent any

    environment {
        ANSIBLE_FORCE_COLOR = 'true'
    }

    stages {
        stage('Checkout') {
            steps {
                checkout scm
            }
        }

        stage('Deploy via Ansible') {
            steps {
                sh '''
                  ansible-playbook -i inventory.ini nginx_deploy.yml
                '''
            }
        }
    }

    post {
        success {
            echo 'Deployment successful.'
        }
        failure {
            echo 'Deployment failed. Check logs.'
        }
    }
}
```

Push everything to GitHub.

4.4 Configure Jenkins job

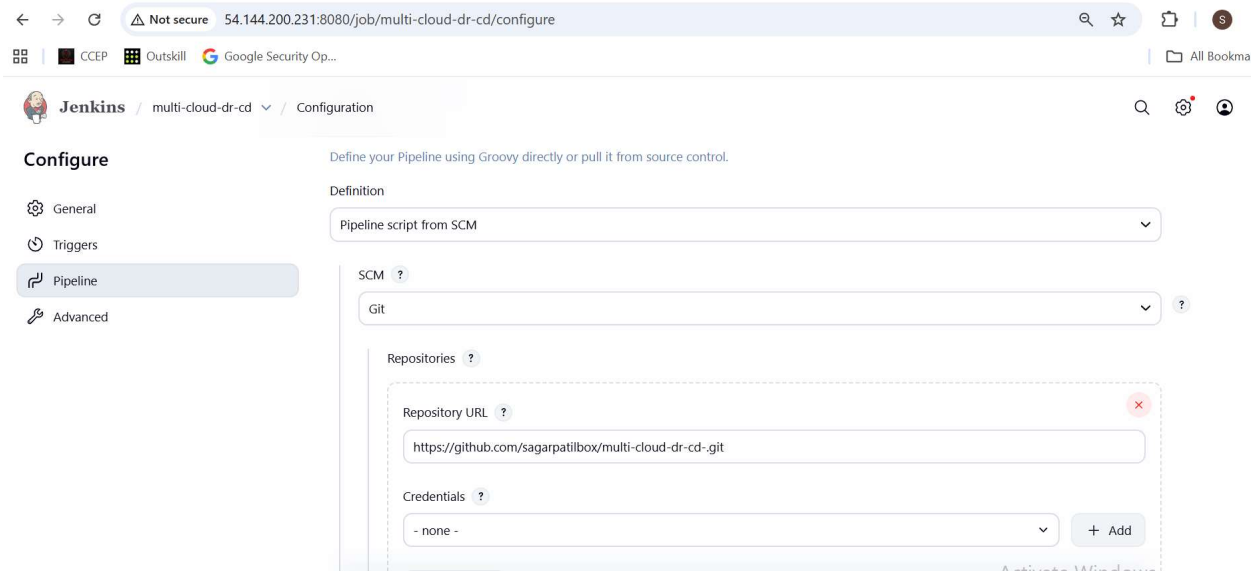
In Jenkins UI:

1. **New Item** → choose **Pipeline**.
2. Name: `multi-cloud-dr-cd`.
3. Under **Pipeline**:
    - Definition: **Pipeline script from SCM**
    - SCM: **Git**
    - Repo URL: `https://github.com/sagarpatilbox/multi-cloud-dr-cd.git`
    - Credentials: add if private
    - Script Path: **`Jenkinsfile`**

Save.

Screenshot:

Jenkins job config page.



4.5 Run pipeline

Click **Build Now**.

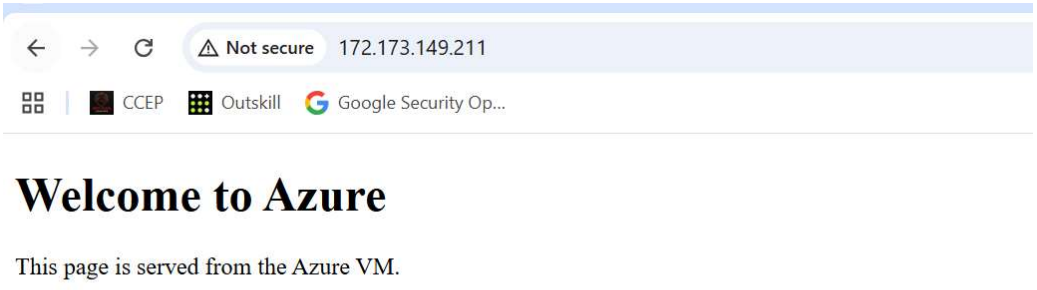
Screenshots:

- Console output showing:

Now edit HTML in GitHub (e.g. add `v2`) → run/build again → check pages updated.

Screenshots:

- Before/after browser pages.



Welcome to Azure Sagar

This page is served from the Azure VM.

Welcome to AWS

This page is served from the AWS App Machine.

Welcome to AWS Sagar

This page is served from the AWS App Machine.

Task 5 – Traffic Management Using AWS Route 53

I am Using My domain **`app.sagardevsecops.online`**

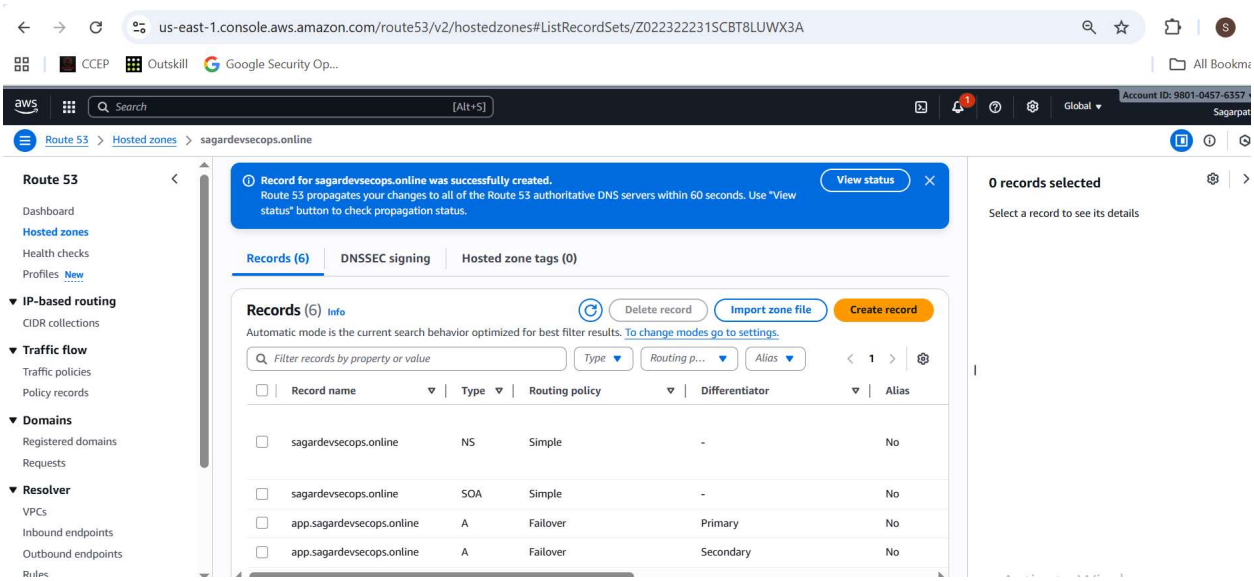
5.1 Create hosted zone

In AWS Console → **Route 53** → **Hosted zones** → **Create hosted zone**:

- Domain name: `sagardevsecops.online`
- Type: Public hosted zone

Screenshot:

Hosted zone overview.



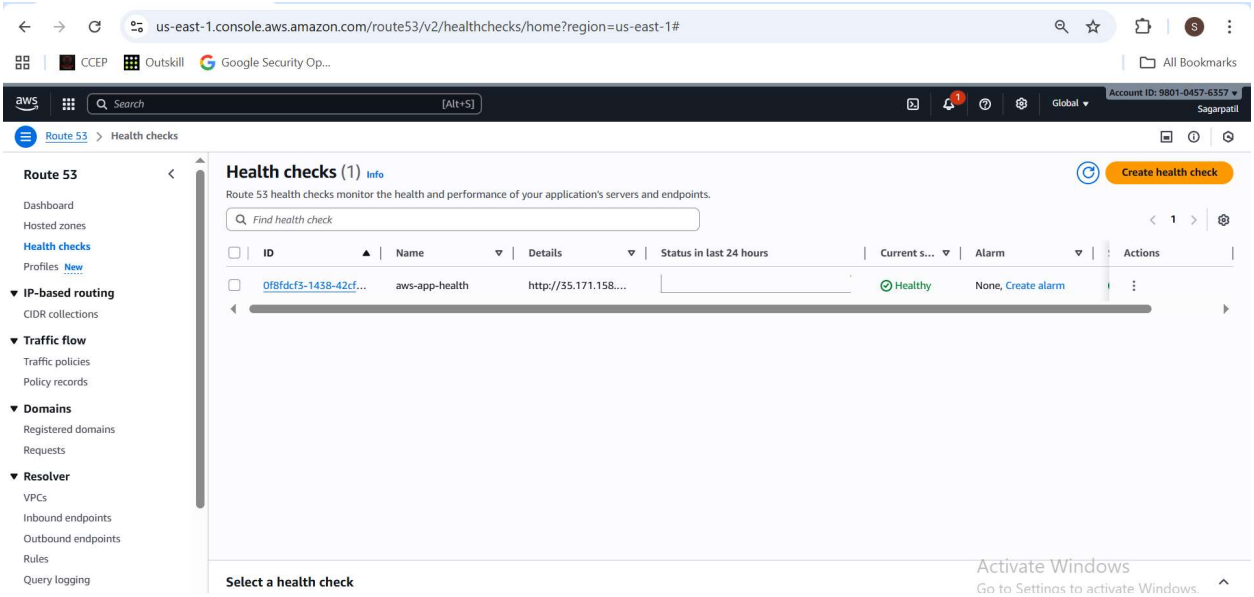
5.2 Create health check for AWS app

Route 53 → **Health checks** → **Create health check**:

- Name: **`aws-app-health`**
- Endpoint → IP address = `<AWS_APP_PUBLIC_IP>`
- Protocol: HTTP
- Port: 80
- Path: `/`

Screenshot:

Health check details (status OK when app running).



5.3 Create failover records

In hosted zone → **Create record**:

Primary record (AWS)

- Record name: `app.sagardevsecops.online`
- Type: A
- Routing policy: **Failover**
- Failover record type: **Primary**
- Value: `<AWS_APP_PUBLIC_IP>`
- Health check: `aws-app-health`
- Record ID: `aws-primary`

Secondary record (Azure)

- Record name: `app.sagardevsecops.online`
- Type: A
- Routing policy: **Failover**
- Failover record type: **Secondary**
- Value: `<AZURE_APP_PUBLIC_IP>`
- No health check
- Record ID: `azure-secondary`

Screenshots:

`app.sagardevsecops.online`

Welcome to AWS

This page is served from the AWS App Machine.

5.4 Test failover

1. With AWS app **running**:
2. `curl http://app.sagardevsecops.online`

Screenshot: Browser output.

Welcome to AWS

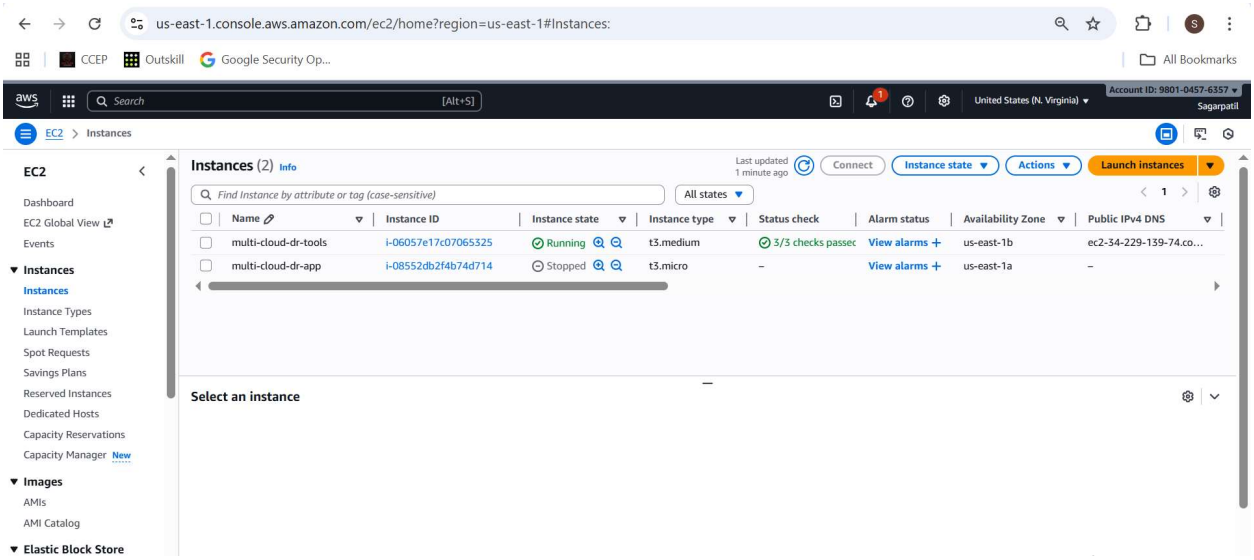
This page is served from the AWS App Machine.

3. Stop AWS App instance in EC2 console.
    - Wait for health check to show **Unhealthy**.

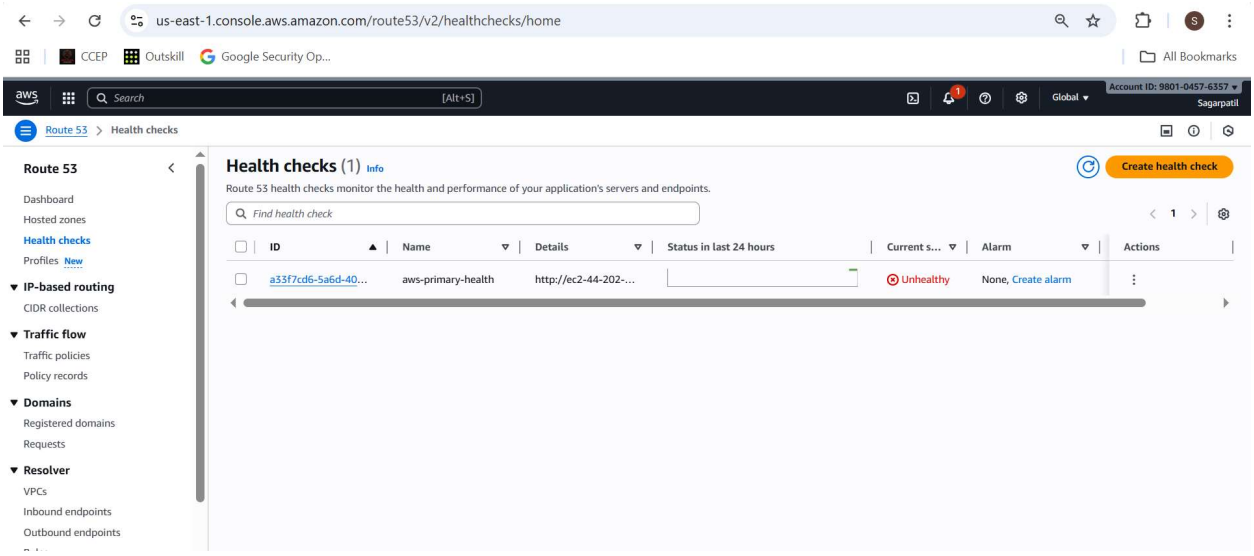
      Now you should see **Welcome to Azure**.

Screenshots:

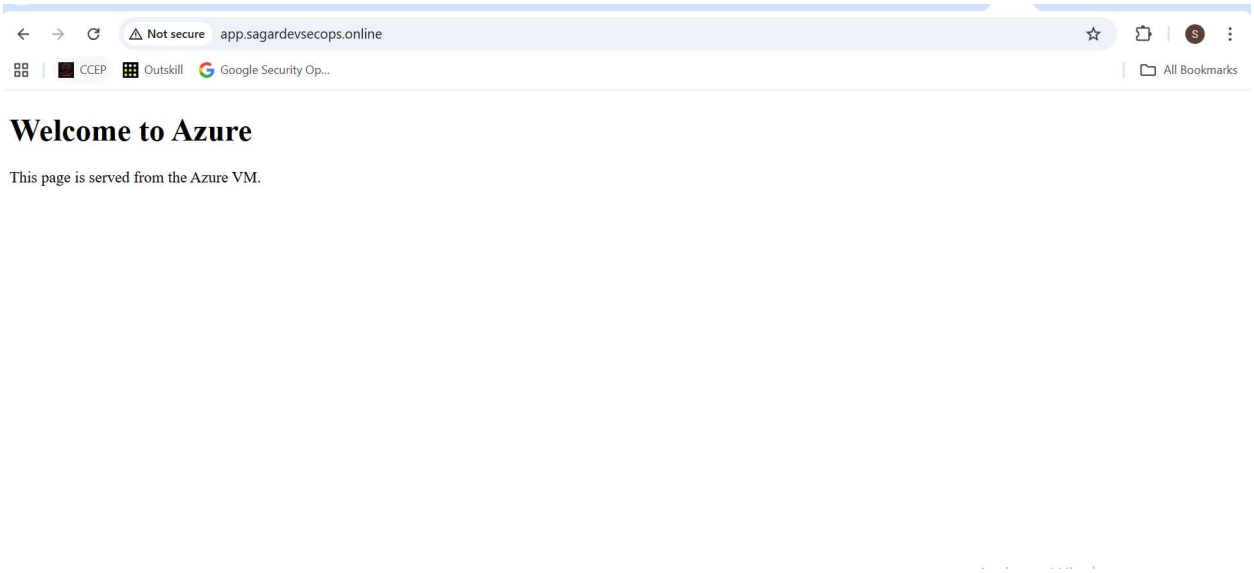
- EC2 instance state = stopped.



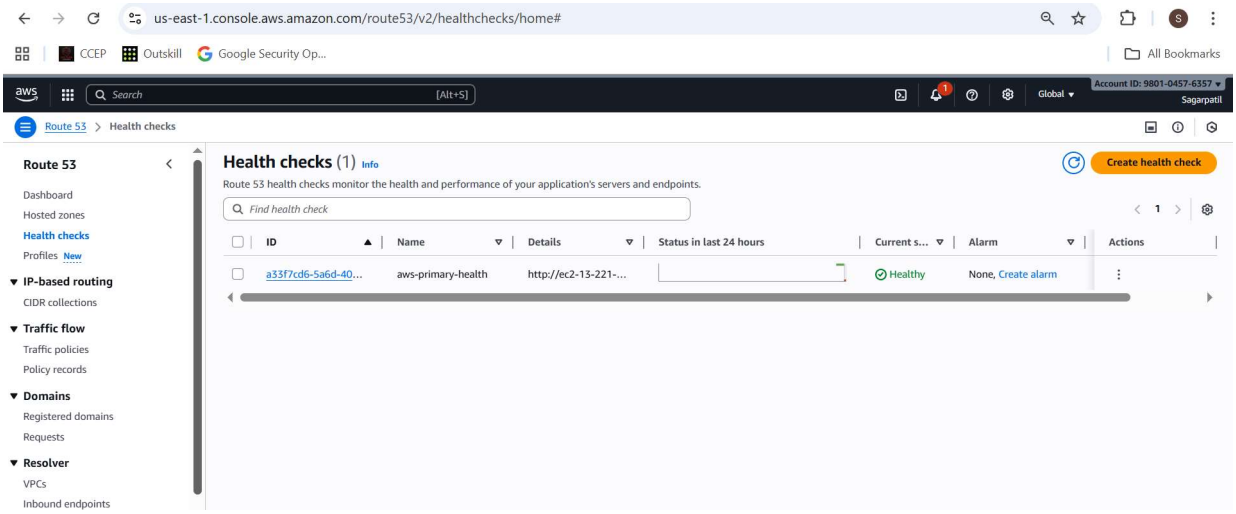
- Health check status = Unhealthy.



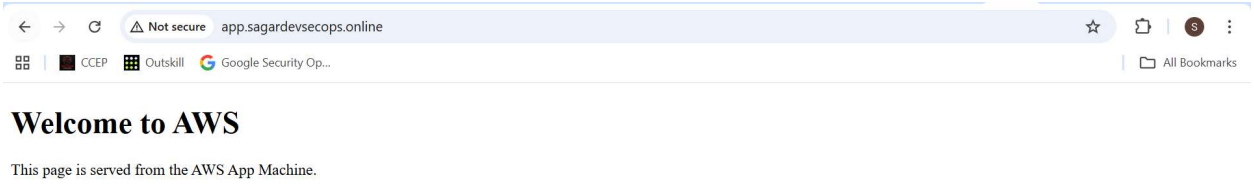
- Browser showing Azure page via `app.sagardevsecops.online`.



4. Start AWS instance again, wait until health check is healthy, and re-test.



- Browser showing AWS page again.



⭐ Bonus Task – Kubernetes (EKS + AKS + Nginx + Failover)

This is optional but nice.

B.1 EKS via Terraform (high-level)

In `project/k8s/aws-eks/main.tf` you can use:

```
terraform {
  required_version = ">= 1.3.0"

  required_providers {
    aws = {
      source  = "hashicorp/aws"
      version = "~> 5.0"
    }
  }
}

provider "aws" {
  region = "us-east-1"
}

# 1) VPC module
module "vpc" {
  source  = "terraform-aws-modules/vpc/aws"
  version = "~> 5.0"

  name = "eks-dr-vpc"
  cidr = "10.20.0.0/16"

  azs             = ["us-east-1a", "us-east-1b"]
  private_subnets = ["10.20.1.0/24", "10.20.2.0/24"]
  public_subnets  = ["10.20.11.0/24", "10.20.12.0/24"]

  enable_nat_gateway = true
}

# 2) EKS module
module "eks" {
  source  = "terraform-aws-modules/eks/aws"
  version = "~> 20.0"

  cluster_name    = "eks-dr-cluster"
  cluster_version = "1.30"

  vpc_id     = module.vpc.vpc_id
  subnet_ids = module.vpc.private_subnets

  # EKS API endpoint - public everywhere (lab only!)
  cluster_endpoint_private_access        = true
  cluster_endpoint_public_access         = true
```

```
  cluster_endpoint_public_access_cidrs    = ["0.0.0.0/0"]

  # Let the Terraform caller (your admin user) be cluster admin
  authentication_mode                         = "API_AND_CONFIG_MAP"
  enable_cluster_creator_admin_permissions = true

  eks_managed_node_groups = {
    default = {
      min_size       = 1
      max_size       = 2
      desired_size   = 1
      instance_types = ["t3.small"]
    }
  }
}
```

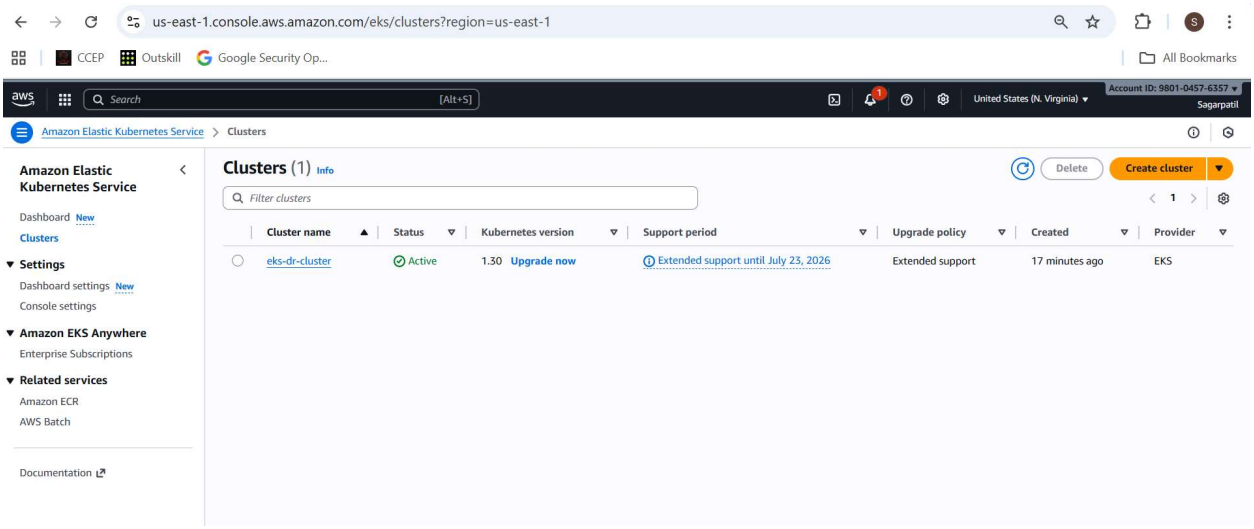
Run:

```
terraform init
terraform apply
aws eks update-kubeconfig --name eks-dr-cluster --region us-east-1
kubectl get nodes
```

Screenshots:

`kubectl get nodes` , EKS console.

```
PS C:\Users\admin\project\k8s\aws-eks> kubectl get pods
No resources found in default namespace.
PS C:\Users\admin\project\k8s\aws-eks>
```



```
    }

  # module.eks.module.eks_managed_node_group["default"].module.user_data.null_resource.validate_cluster_service_cidr will be created
  + resource "null_resource" "validate_cluster_service_cidr" {
      + id = (known after apply)
    }

Plan: 56 to add, 0 to change, 0 to destroy.

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value: yes

module.eks.module.eks_managed_node_group["default"].aws_iam_role.this[0]: Creating
```

```
module.eks.aws_eks_cluster.this[0]: Still creating... [09m10s elapsed]
module.eks.aws_eks_cluster.this[0]: Still creating... [09m20s elapsed]
module.eks.aws_eks_cluster.this[0]: Still creating... [09m30s elapsed]
module.eks.aws_eks_cluster.this[0]: Creation complete after 9m32s [id=eks-dr-cluster]
module.eks.data.tls_certificate.this[0]: Reading...
module.eks.time_sleep.this[0]: Creating...
module.eks.data.tls_certificate.this[0]: Read complete after 2s [id=0c37bb608751c2a14704338d4b14c14e6dbe88ac]
module.eks.aws_iam_openid_connect_provider.oidc_provider[0]: Creating...
module.eks.aws_iam_openid_connect_provider.oidc_provider[0]: Creation complete after 2s [id=arn:aws:iam::980104576357:oi
dc-provider/oidc.eks.us-east-1.amazonaws.com/id/417D59DA8BC2B0E6656A8348C81517B2]
module.eks.time_sleep.this[0]: Still creating... [00m10s elapsed]
module.eks.time_sleep.this[0]: Still creating... [00m20s elapsed]
module.eks.time_sleep.this[0]: Still creating... [00m30s elapsed]
module.eks.time_sleep.this[0]: Creation complete after 30s [id=2025-11-23T13:10:45Z]
module.eks.module.eks_managed_node_group["default"].module.user_data.null_resource.validate_cluster_service_cidr: Creati
ng...
module.eks.module.eks_managed_node_group["default"].module.user_data.null_resource.validate_cluster_service_cidr: Creati
on complete after 0s [id=5786262614895386475]
module.eks.module.eks_managed_node_group["default"].aws_launch_template.this[0]: Creating...
module.eks.module.eks_managed_node_group["default"].aws_launch_template.this[0]: Creation complete after 9s [id=lt-0e21f
1df7dd79b976]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Creating...
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [00m10s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [00m20s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [00m30s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [00m40s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [00m50s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [01m00s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [01m10s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [01m20s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [01m30s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Still creating... [01m40s elapsed]
module.eks.module.eks_managed_node_group["default"].aws_eks_node_group.this[0]: Creation complete after 1m42s [id=eks-dr
-cluster:default-20251123131054085200000015]

Apply complete! Resources: 56 added, 0 changed, 0 destroyed.
PS C:\Users\admin\project\k8s\aws-eks>
```

B.2 AKS via Terraform

`project/k8s/azure-aks/main.tf` similar to earlier AKS config:

```
provider "azurerm" {
  features {}
  subscription_id = "4c419c18-22ee-4dfa-8014-71f05d545136"
}

resource "azurerm_resource_group" "rg" {
  name     = "aks-dr-rg"
  location = "West US3"
}
```

```
resource "azurerm_kubernetes_cluster" "aks" {
  name                = "aks-dr-cluster"
  location            = azurerm_resource_group.rg.location
  resource_group_name = azurerm_resource_group.rg.name
  dns_prefix          = "aksdr"

  default_node_pool {
    name       = "default"
    node_count = 1
    vm_size    = "Standard_B2s"
  }

  identity {
    type = "SystemAssigned"
  }
}
```

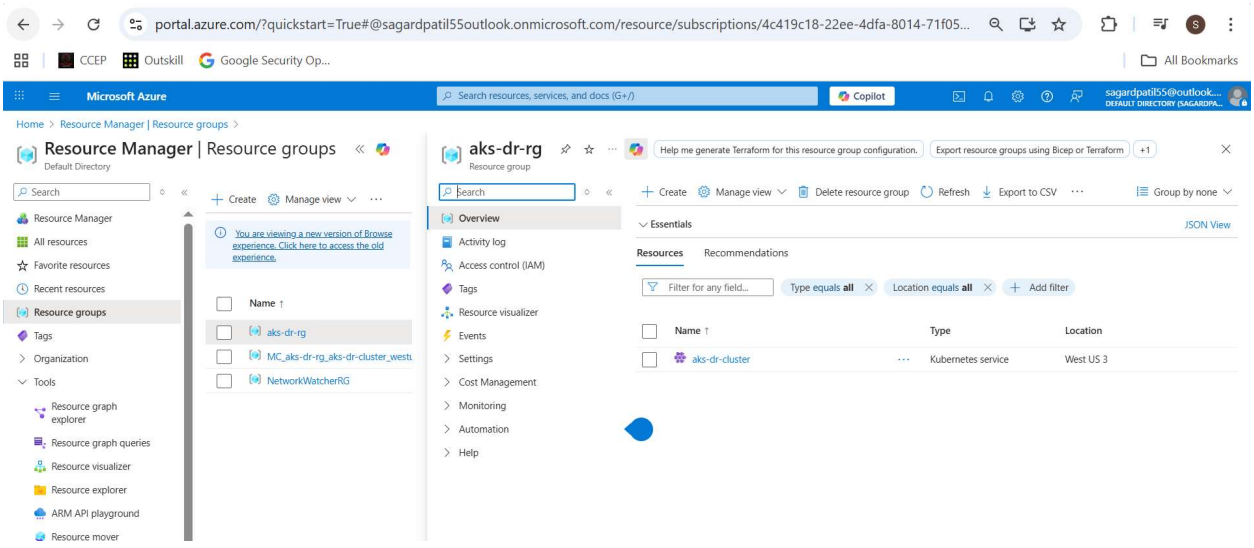
Then: **az login** # for login

```
terraform init
terraform apply
terraform output -raw kube_config > aks.kubeconfig
KUBECONFIG=aks.kubeconfig kubectl get nodes
```

Screenshots:

AKS cluster, `kubectl get nodes`.

```
PS C:\Users\admin\project\k8s\azure-aks> kubectl get nodes
NAME                                STATUS   ROLES    AGE   VERSION
aks-default-24710189-vmss000000   Ready    <none>   15m   v1.32.9
PS C:\Users\admin\project\k8s\azure-aks>
```



```
      + default_node_pool {
          + kubelet_disk_type    = (known after apply)
          + max_pods             = (known after apply)
          + name                 = "default"
          + node_count           = 1
          + node_labels          = (known after apply)
          + orchestrator_version = (known after apply)
          + os_disk_size_gb      = (known after apply)
          + os_disk_type         = "Managed"
          + os_sku               = (known after apply)
          + scale_down_mode      = "Delete"
          + type                 = "VirtualMachineScaleSets"
          + ultra_ssd_enabled    = false
          + vm_size              = "Standard_B2s"
          + workload_runtime     = (known after apply)
        }

      + identity {
          + principal_id = (known after apply)
          + tenant_id    = (known after apply)
          + type         = "SystemAssigned"
        }

      + kubelet_identity (known after apply)

      + network_profile (known after apply)

      + windows_profile (known after apply)
    }

  # azurerm_resource_group.rg will be created
  + resource "azurerm_resource_group" "rg" {
      + id       = (known after apply)
      + location = "eastus"
      + name     = "rg-aks-dr"
    }

Plan: 2 to add, 0 to change, 0 to destroy.

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value:
```

B.3 Nginx manifests (same for both clusters)

`configmap-aws.yaml` (apply to EKS):

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: nginx-index
data:
  index.html: |
    <html><body><h1>Welcome to AWS - Kubernetes</h1></body></html>
```

`configmap-azure.yaml` (apply to AKS):

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: nginx-index
data:
  index.html: |
    <html><body><h1>Welcome to Azure - Kubernetes</h1></body></html>
```

`nginx-deployment.yaml`:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-k8s
spec:
  replicas: 2
  selector:
    matchLabels:
      app: nginx-k8s
  template:
    metadata:
      labels:
        app: nginx-k8s
    spec:
      containers:
        - name: nginx
          image: nginx:stable
          ports:
            - containerPort: 80
          volumeMounts:
            - name: index-html
              mountPath: /usr/share/nginx/html/index.html
              subPath: index.html
      volumes:
        - name: index-html
          configMap:
            name: nginx-index
            items:
              - key: index.html
                path: index.html
```

nginx-service.yaml:

```
apiVersion: v1
kind: Service
metadata:
  name: nginx-lb
spec:
  type: LoadBalancer
  selector:
    app: nginx-k8s
  ports:
    - port: 80
      targetPort: 80
```

Apply to **EKS**:

```
kubectl apply -f configmap-aws.yaml
kubectl apply -f nginx-deployment.yaml
kubectl apply -f nginx-service.yaml
kubectl get svc nginx-lb
```

Apply to **AKS**:

For powershell :

```
$Env:KUBECONFIG = "aks.kubeconfig"

az aks get-credentials `

  --resource-group aks-dr-rg `

  --name aks-dr-cluster
```

```
KUBECONFIG=aks.kubeconfig kubectl apply -f configmap-azure.yaml
KUBECONFIG=aks.kubeconfig kubectl apply -f nginx-deployment.yaml
KUBECONFIG=aks.kubeconfig kubectl apply -f nginx-service.yaml
KUBECONFIG=aks.kubeconfig kubectl get svc nginx-lb
```

Use the **EXTERNAL-IP** values as endpoints.

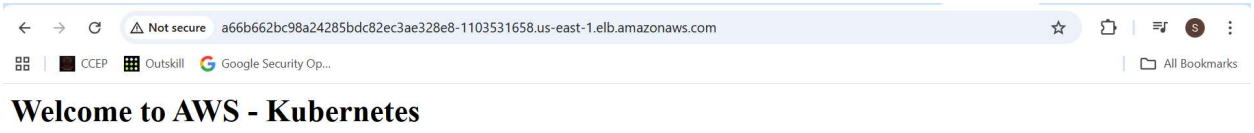
Screenshots:

- `kubectl get svc nginx-lb` for both clusters.

```
PS C:\Users\admin\project\k8s\aws-eks> kubectl get pods
No resources found in default namespace.
PS C:\Users\admin\project\k8s\aws-eks> kubectl apply -f configmap-aws.yaml
configmap/nginx-index created
PS C:\Users\admin\project\k8s\aws-eks> kubectl apply -f nginx-deployment.yaml
deployment.apps/nginx-k8s created
PS C:\Users\admin\project\k8s\aws-eks> kubectl apply -f nginx-service.yaml
service/nginx-lb created
PS C:\Users\admin\project\k8s\aws-eks> kubectl get svc nginx-lb
NAME       TYPE           CLUSTER-IP       EXTERNAL-IP                                                              PORT(S)        AGE
nginx-lb   LoadBalancer   172.20.161.185   a66b662bc98a24285bdc82ec3ae328e8-1103531658.us-east-1.elb.amazonaws.com   80:32056/TCP   28s
PS C:\Users\admin\project\k8s\aws-eks>
```

```
PS C:\Users\admin\project\k8s\azure-aks> kubectl apply -f configmap-azure.yaml
configmap/nginx-index unchanged
PS C:\Users\admin\project\k8s\azure-aks> kubectl apply -f nginx-deployment.yaml
deployment.apps/nginx-k8s created
PS C:\Users\admin\project\k8s\azure-aks> kubectl apply -f nginx-service.yaml
service/nginx-lb created
PS C:\Users\admin\project\k8s\azure-aks> kubectl get svc nginx-lb
NAME       TYPE           CLUSTER-IP    EXTERNAL-IP   PORT(S)        AGE
nginx-lb   LoadBalancer   10.0.176.11   <pending>     80:32395/TCP   13s
PS C:\Users\admin\project\k8s\azure-aks> kubectl get svc nginx-lb
NAME       TYPE           CLUSTER-IP    EXTERNAL-IP     PORT(S)        AGE
nginx-lb   LoadBalancer   10.0.176.11   20.171.172.54   80:32395/TCP   63s
PS C:\Users\admin\project\k8s\azure-aks>
```

- Browser showing AWS K8s page and Azure K8s page.



Welcome to AWS - Kubernetes

B.4 Route 53 failover with LB IPs

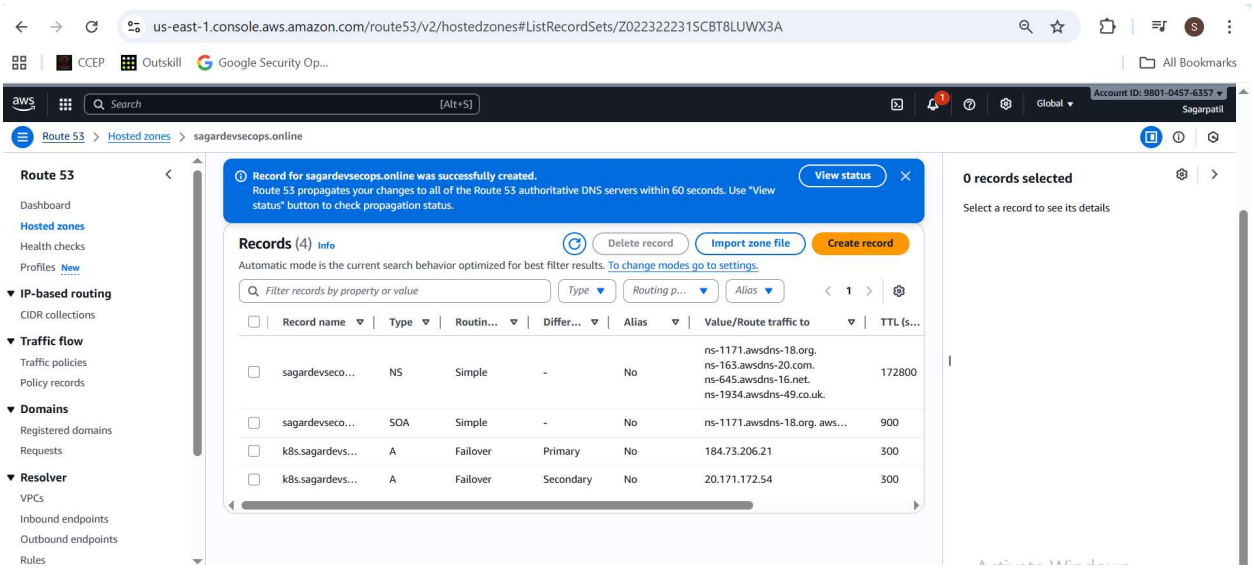
Update `k8s.sagardevsecops.online` failover records:

- Primary A → EKS LB IP
- Secondary A → AKS LB IP

(**Health check on EKS LB**.)

Screenshots:

- Route 53 records with LB IPs.



B.5 Simulate EKS failure

On **EKS:**

```
kubectl scale deploy nginx-k8s --replicas=0
kubectl get pods
```

When health check fails, `k8s.sagardevsecops.online` should serve Azure K8s page.

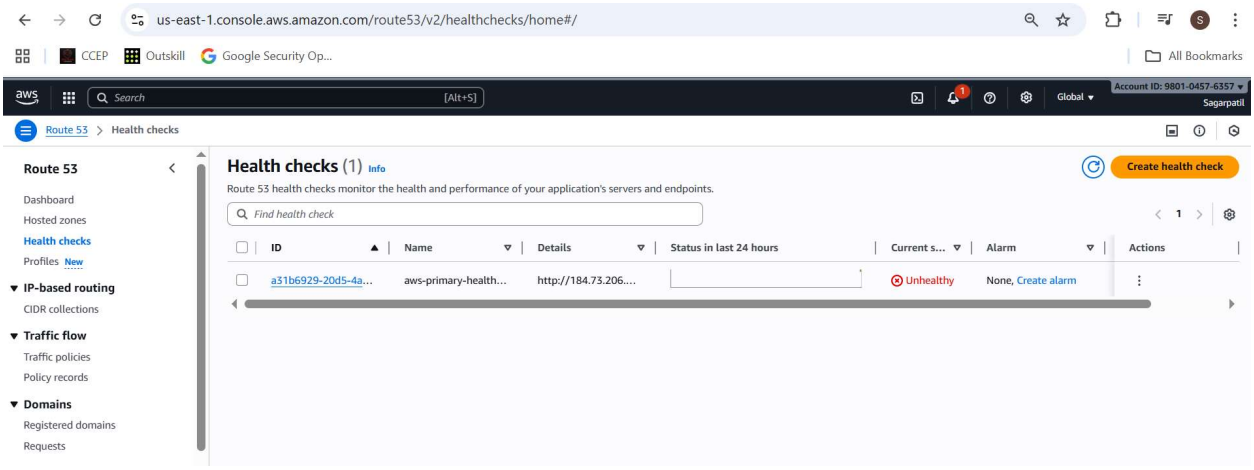
Screenshots:

- **`kubectl get pods`** showing 0 pods.

```
PS C:\Users\admin\project\k8s\aws-eks> kubectl get pods
No resources found in default namespace.
PS C:\Users\admin\project\k8s\aws-eks>
```

```
PS C:\Users\admin\project\k8s\azure-aks> kubectl get pods
NAME                         READY   STATUS    RESTARTS   AGE
nginx-k8s-5688d7b88c-ccsk4   1/1     Running   0          37m
nginx-k8s-5688d7b88c-h5dx7   1/1     Running   0          37m
PS C:\Users\admin\project\k8s\azure-aks> kubectl scale deploy nginx-k8s --replicas=0
deployment.apps/nginx-k8s scaled
PS C:\Users\admin\project\k8s\azure-aks> kubectl get pods
No resources found in default namespace.
PS C:\Users\admin\project\k8s\azure-aks>
```

- Health check unhealthy.



- Browser showing Azure K8s page via `app.sagardevsecops.online`.

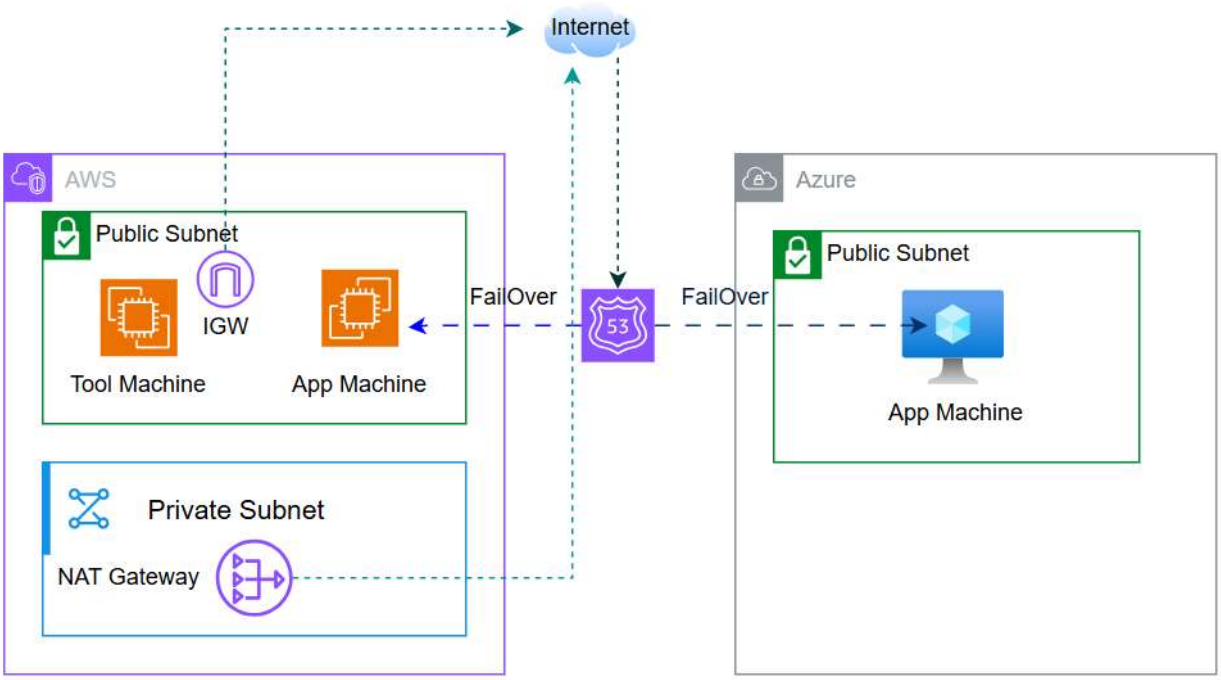
Welcome to Azure - Kubernetes

Scale back:

```
kubectl scale deploy nginx-k8s --replicas=2
```

Welcome to AWS - Kubernetes

Multi-Cloud DR Project Architecture Diagram :



❖ Multi-Cloud DR Project – Total Cost to Company (TCO) Report :

Cloud Provider	Resource	Qty	Estimate (US$/mo)	Estimate (INR/mo)
AWS	App EC2 t3.micro	1	8.5	680
AWS	Tools EC2 t3.micro	1	8.5	680
AWS	NAT Gateway	1	32	2,560
AWS	Route 53 hosted zone + health check	1	1	80
AWS Total			**≈ 50**	**≈ 3,998**
Azure	VM Standard_B2ms	1	70	5,600
Azure	Public IP (Standard SKU)	1	3	240
Azure	OS disk + storage	1	5	400
Azure Total			**≈ 78**	**≈ 6,240**
Grand Total	Combined AWS + Azure		**≈ US$ 128**	**≈ ₹10,250**