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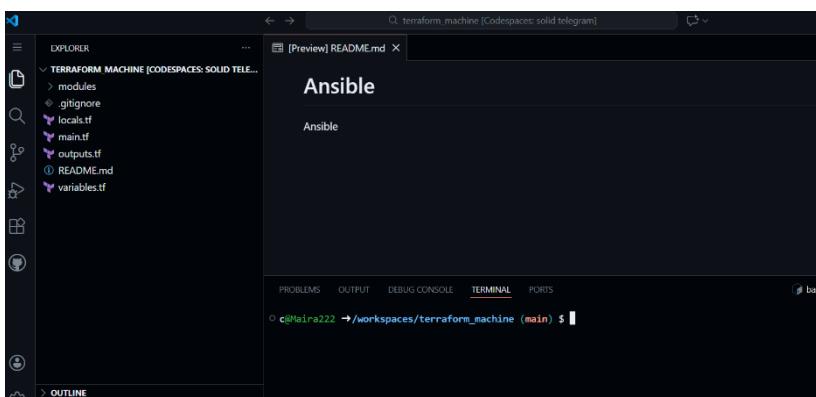
Reg.no: 2023-BSE-040

Subject: Cloud Computing

LAB # 14

TASK 0:

1.



A screenshot of the Visual Studio Code interface. The left sidebar shows a tree view with a node expanded to 'modules' containing 'main.tf', 'outputs.tf', and 'variables.tf'. The main editor area has the title 'Ansible' and contains the word 'Ansible'. Below the editor is a 'PROBLEMS' tab. The bottom right corner shows a terminal window with the prompt 'c@maira222 ~\$'.

2.

```
c@maira222 ~$ aws --version
aws --version
ansible --version || echo "ansible not yet installed"
bash: aws: command not found
bash: terraform: command not found
bash: ansible: command not found
ansible not yet installed
c@maira222 ~$
```

3.

```
@Maira222 ~$ aws sts get-caller-identity
{
    "UserId": "AIDA2XJTBOLBFMNNVP4L",
    "Account": "737230811842",
    "Arn": "arn:aws:iam::737230811842:user/Admin"
}
@Maira222 ~$
```

TASK 1:

1.

```
@Maira222 ~$ ls ~/.ssh
ssh-keygen -t ed25519 -f ~/.ssh/id_ed25519 -N ""
ls -la ~/.ssh
Generating public/private ed25519 key pair.
Created directory '/home/codespace/.ssh'.
Your identification has been saved in /home/codespace/.ssh/id_ed25519
Your public key has been saved in /home/codespace/.ssh/id_ed25519.pub
The key fingerprint is:
SHA256:SSC5ABIKK4krXO8wa3E12VTS1P5TD7mRkwEZ1IFAn0 codespace@codespaces-832527
The key's randomart image is:
++[ED25519 256]++
|=. . . o++.0Bb+
|=o. . . + ...=Eo.|
| * o . +.. ..+..|
|o.. o .... =+|
|o. + o S + .|
| . B o |
| o . . |
| . |
+---[SHA256]----+
total 20
drwx----- 2 codespace codespace 4096 Jan 10 12:11 .
drwxr-x--- 1 codespace codespace 4096 Jan 10 12:11 ..
-rw----- 1 codespace codespace 419 Jan 10 12:11 id_ed25519
-rw-r--r-- 1 codespace codespace 109 Jan 10 12:11 id_ed25519.pub
```

2.

```
@Maira222 → /workspaces/terraform_machine (main) $ touch terraform.tfvars
@Maira222 → /workspaces/terraform_machine (main) $ ls -la terraform.tfvars
-rw-rw-rw- 1 codespace codespace 0 Jan 10 12:12 terraform.tfvars
@Maira222 → /workspaces/terraform_machine (main) $
```

3.

```
@Maira222 → /workspaces/terraform_machine (main) $ cat terraform.tfvars
vpc_cidr_block = "10.0.0.0/16"
subnet_cidr_block = "10.0.10.0/24"
availability_zone = "me-central-1a"
env_prefix = "dev"
instance_type = "t3.micro"
public_key = "~/.ssh/id_ed25519.pub"
private_key = "~/.ssh/id_ed25519"
@Maira222 → /workspaces/terraform_machine (main) $
```

4.

```
@Maira222 → /workspaces/terraform_machine (main) $ terraform init
Initializing modules...
- myapp-subnet in modules/subnet
- myapp-webserver in modules/webserver
Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Finding latest version of hashicorp/http...
- Installing hashicorp/aws v6.28.0...
- Installed hashicorp/aws v6.28.0 (signed by HashiCorp)
- Installing hashicorp/http v3.5.0...
- Installed hashicorp/http v3.5.0 (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.
@Maira222 → /workspaces/terraform_machine (main) $
```

5.

```
@Maira222 → /workspaces/terraform_machine (main) $ terraform apply -auto-approve
module.myapp-webserver[0].aws_security_group.web_sg: Creating...
module.myapp-subnet.aws_subnet.myapp_subnet_1: Creating...
module.myapp-subnet.aws_internet_gateway.myapp_igw: Creation complete after 0s [id=igw-063f3eb310a99d398]
module.myapp-subnet.aws_default_route_table.main_rt: Creating...
module.myapp-subnet.aws_default_route_table.main_rt: Creation complete after 0s [id=rtb-077da1838d5d5ce25]
module.myapp-webserver[0].aws_security_group.web_sg: Creation complete after 3s [id=sg-0c0bd7de878d3dabb]
module.myapp-webserver[1].aws_security_group.web_sg: Creation complete after 3s [id=sg-0e69178733d9902f0]
module.myapp-subnet.aws_subnet.myapp_subnet_1: Still creating... [00m10s elapsed]
module.myapp-subnet.aws_subnet.myapp_subnet_1: Creation complete after 11s [id=subnet-0bb0a5eeaf35bfd53]
module.myapp-webserver[1].aws_instance.myapp-server: Creating...
module.myapp-webserver[0].aws_instance.myapp-server: Creating...
module.myapp-webserver[1].aws_instance.myapp-server: Still creating... [00m10s elapsed]
module.myapp-webserver[0].aws_instance.myapp-server: Still creating... [00m10s elapsed]
module.myapp-webserver[1].aws_instance.myapp-server: Creation complete after 13s [id=i-0101ae54d4817ba9c]
module.myapp-webserver[0].aws_instance.myapp-server: Creation complete after 13s [id=i-07188878400f18d84]

Apply complete! Resources: 10 added, 0 changed, 0 destroyed.

Outputs:

webserver_public_ips = [
  "3.29.231.258",
  "40.172.234.39",
]
@Maira222 → /workspaces/terraform_machine (main) $
```

6.

```
@Maira222 → /workspaces/terraform_machine (main) $ terraform output
webserver_public_ips = [
  "3.29.231.258",
  "40.172.234.39",
]
@Maira222 → /workspaces/terraform_machine (main) $
```

TASK 2:

1.

```
@Maira222 → /workspaces/terraform_machine (main) $ pipx install ansible-core
ansible --version
  installed package ansible-core 2.20.1, installed using Python 3.12.1
These apps are now globally available
- ansible
- ansible-config
- ansible-console
- ansible-doc
- ansible-galaxy
- ansible-inventory
- ansible-playbook
- ansible-pull
- ansible-test
- ansible-vault
done! ✨ ✨ ✨
ansible [core 2.20.1]
  config file = None
  configured module search path = ['~/home/codespace/.ansible/plugins/modules', '/usr/share/ansible/plugins/modules']
  ansible python module location = /usr/local/py-utils/venvs/ansible-core/lib/python3.12/site-packages/ansible
  ansible collection location = /home/codespace/.ansible/collections:/usr/share/ansible/collections
  executable location = /usr/local/py-utils/bin/ansible
  python version = 3.12.1 (main, Nov 27 2025, 10:47:52) [GCC 13.3.0] (/usr/local/py-utils/venvs/ansible-core/bin/python)
  jinja version = 3.1.6
  pyyaml version = 6.0.3 (with libyaml v0.2.5)
@Maira222 → /workspaces/terraform_machine (main) $
```

2.

```
PyYAML: VERSION == 6.0.3 (WITH LIBYAML == 0.8.2-1)
@Maira222 → /workspaces/terraform_machine (main) $ terraform output
  webserver_public_ips = [
    "3.29.231.250",
    "40.172.234.39",
  ]
@Maira222 → /workspaces/terraform_machine (main) $
```

3.

```
@Maira222 → /workspaces/terraform_machine (main) $ touch hosts
ls -la hosts
-rw-rw-rw- 1 codespace codespace 0 Jan 10 12:21 hosts
@Maira222 → /workspaces/terraform_machine (main) $
```

4.

```
@Maira222 → /workspaces/terraform_machine (main) $ cat hosts
3.29.231.250  ansible_user=ec2-user  ansible_ssh_private_key_file=~/ssh/id_ed25519
40.172.234.39  ansible_user=ec2-user  ansible_ssh_private_key_file=~/ssh/id_ed25519
@Maira222 → /workspaces/terraform_machine (main) $
```

5.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible all -i hosts -m ping
[ERROR]: Task failed: Failed to connect to the host via ssh: Host key verification failed.
Origin: <adhoc 'ping' task>

{'action': 'ping', 'args': {}, 'timeout': 0, 'async_val': 0, 'poll': 15}

3.29.231.250 | UNREACHABLE! => {
    "changed": false,
    "msg": "Task failed: Failed to connect to the host via ssh: Host key verification failed.",
    "unreachable": true
}
40.172.234.39 | UNREACHABLE! => {
    "changed": false,
    "msg": "Task failed: Failed to connect to the host via ssh: Host key verification failed.",
    "unreachable": true
}
@Maira222 → /workspaces/terraform_machine (main) $
```

6.

```
@Maira222 → /workspaces/terraform_machine (main) $ cat hosts
3.29.231.250  ansible_user=ec2-user  ansible_ssh_private_key_file=~/ssh/id_ed25519  ansible_ssh_common_args=' -o StrictHostKeyChecking=no'
40.172.234.39  ansible_user=ec2-user  ansible_ssh_private_key_file=~/ssh/id_ed25519  ansible_ssh_common_args=' -o StrictHostKeyChecking=no'
@Maira222 → /workspaces/terraform_machine (main) $
```

7.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible all -i hosts -m ping
[WARNING]: Host '3.29.231.250' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible-core/2.20/reference_appendices/interpreter_discovery.html for more information.
3.29.231.250 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
[WARNING]: Host '40.172.234.39' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible-core/2.20/reference_appendices/interpreter_discovery.html for more information.
40.172.234.39 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
@Maira222 → /workspaces/terraform_machine (main) $
```

TASK 3:

1.

```
GNU nano 7.2                                     main.tf
availability_zone = var.availability_zone
env_prefix = var.env_prefix
default_route_table_id = aws_vpc.myapp_vpc.default_route_table_id
}

module "myapp-webserver" {
  source = "./modules/webserver"
  env_prefix = var.env_prefix
  instance_type = var.instance_type
  availability_zone = var.availability_zone
  public_key = var.public_key
  my_ip = local.my_ip
  vpc_id = aws_vpc.myapp_vpc.id
  subnet_id = module.myapp-subnet.subnet.id

  # Loop count
  count          = 3
  # Use count.index to differentiate instances
  instance_suffix = count.index

}
```

2.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform apply -auto-approve

Changes to Outputs:
  ~ webserver_public_ips = [
      # (1 unchanged element hidden)
      "40.172.234.39",
    + (known after apply),
  ]
module.myapp-webserver[2].aws_key_pair.ssh-key: Creating...
module.myapp-webserver[2].aws_security_group.web_sg: Creating...
module.myapp-webserver[2].aws_key_pair.ssh-key: Creation complete after 1s [id=dev-serverkey-2]
module.myapp-webserver[2].aws_security_group.web_sg: Creation complete after 3s [id=sg-022ce461735735f44]
module.myapp-webserver[2].aws_instance.myapp-server: Creating...
module.myapp-webserver[2].aws_instance.myapp-server: Still creating... [0m10s elapsed]
module.myapp-webserver[2].aws_instance.myapp-server: Creation complete after 13s [id=i-0035d6b12c9da3a04]

Apply complete! Resources: 3 added, 0 changed, 0 destroyed.

Outputs:

webserver_public_ips = [
  "3.29.231.250",
  "40.172.234.39",
  "3.29.123.105",
]
```

3.

```
[@Maira222 →/workspaces/terraform_machine (main) $ terraform output
webserver_public_ips = [
  "3.29.231.250",
  "40.172.234.39",
  "3.29.123.105",
]
○ @Maira222 →/workspaces/terraform_machine (main) $ ]
```

4.

```
[@Maira222 →/workspaces/terraform_machine (main) $ cat hosts
[ec2]
3.29.231.250
40.172.234.39

[ec2:vars]
ansible_user=ec2-user
ansible_ssh_private_key_file=~/ssh/id_ed25519
ansible_ssh_common_args='-o StrictHostKeyChecking=no'

[droplet]
3.29.123.105

[droplet:vars]
ansible_user=ec2-user
ansible_ssh_private_key_file=~/ssh/id_ed25519
ansible_ssh_common_args='-o StrictHostKeyChecking=no'
○ @Maira222 →/workspaces/terraform_machine (main) $ ]
```

5.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible ec2 -i hosts -m ping
[WARNING]: Host '3.29.231.250' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/latest/reference_appendices/interpreter_discovery.html for more information.
3.29.231.250 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
[WARNING]: Host '40.172.234.39' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/latest/reference_appendices/interpreter_discovery.html for more information.
40.172.234.39 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
@Maira222 → /workspaces/terraform_machine (main) $
```

6.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible 40.172.234.39 -i hosts -m ping
[WARNING]: Host '40.172.234.39' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/latest/reference_appendices/interpreter_discovery.html for more information.
40.172.234.39 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
@Maira222 → /workspaces/terraform_machine (main) $
```

7.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible droplet -i hosts -m ping
[WARNING]: Host '3.29.123.105' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/latest/reference_appendices/interpreter_discovery.html for more information.
3.29.123.105 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
@Maira222 → /workspaces/terraform_machine (main) $
```

8.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible all -i hosts -m ping
},
"changed": false,
"ping": "pong"
}
[WARNING]: Host '3.29.231.250' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/latest/reference_appendices/interpreter_discovery.html for more information.
3.29.231.250 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
[WARNING]: Host '3.29.123.105' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/latest/reference_appendices/interpreter_discovery.html for more information.
3.29.123.105 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3.9"
    },
    "changed": false,
    "ping": "pong"
}
@Maira222 → /workspaces/terraform_machine (main) $
```

TASK 4:

1.

```
@Maira222 → /workspaces/terraform_machine (main) $ cat ~/.ansible.cfg
[default]
host_key_checking = False
interpreter_python = /usr/bin/python3
@Maira222 → /workspaces/terraform_machine (main) $
```

2.

```
GNU nano 7.2
[ec2]
3.29.231.250
40.172.234.39

[ec2:vars]
ansible_user=ec2-user
ansible_ssh_private_key_file=~/ssh/id_ed25519

[droplet]
3.29.123.105

[droplet:vars]
ansible_user=ec2-user
ansible_ssh_private_key_file=~/ssh/id_ed25519
```

3.

```
@Maira222 →/workspaces/terraform_machine (main) $ ansible all -i hosts -m ping
  },
  "changed": false,
  "ping": "pong"
}
[WARNING]: Host '3.29.123.105' is using the discovered Python interpreter at '/usr/bin/python3.9'. Another Python interpreter could cause a different interpreter to be discovered. See https://core/2.20/reference_appendices/interpreter_discovery.html for more information.
3.29.123.105 | SUCCESS => {
  "ansible_facts": {
    "discovered_interpreter_python": "/usr/bin/python3.9"
  },
  "changed": false,
  "ping": "pong"
}
[WARNING]: Host '40.172.234.39' is using the discovered Python interpreter at '/usr/bin/python3.9'. Another Python interpreter could cause a different interpreter to be discovered. See https://core/2.20/reference_appendices/interpreter_discovery.html for more information.
40.172.234.39 | SUCCESS => {
  "ansible_facts": {
    "discovered_interpreter_python": "/usr/bin/python3.9"
  },
  "changed": false,
  "ping": "pong"
}
@Maira222 →/workspaces/terraform_machine (main) $
```

4.

```
● @Maira222 →/workspaces/terraform_machine (main) $ touch my-playbook.yaml
ls -la my-playbook.yaml
-rw-rw-rw- 1 codespace codespace 0 Jan 10 12:49 my-playbook.yaml
○ @Maira222 →/workspaces/terraform_machine (main) $
```

5.

```
● @Maira222 →/workspaces/terraform_machine (main) $ cat my-playbook.yaml
---
- name: Configure nginx web server
  hosts: ec2
  become: true
  tasks:
    - name: install nginx and update cache
      yum:
        name: nginx
        state: present
        update_cache: yes

    - name: start nginx server
      service:
        name: nginx
        state: started
○ @Maira222 →/workspaces/terraform_machine (main) $
```

```

@Maira222 → /workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
PLAY [Configure nginx web server] ****
TASK [Gathering Facts] ****
[WARNING]: Host '3.29.231.250' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/core/2.20/reference_appendices/interpreter_discovery.html for more information.
ok: [3.29.231.250]
[WARNING]: Host '40.172.234.39' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible-core/2.20/reference_appendices/interpreter_discovery.html for more information.
ok: [40.172.234.39]

TASK [install nginx and update cache] ****
changed: [3.29.231.250]
changed: [40.172.234.39]

TASK [start nginx server] ****
changed: [40.172.234.39]
changed: [3.29.231.250]

PLAY RECAP ****
3.29.231.250 : ok=3    changed=2    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
40.172.234.39 : ok=3    changed=2    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0

```

7.

```

GNU nano 7.2                                my-playbook.yaml
---
- name: Configure nginx web server
  hosts: droplet
  become: true
  tasks:
    - name: install nginx and update cache
      yum:
        name: nginx
        state: present
        update_cache: yes

    - name: start nginx server
      service:
        name: nginx
        state: started

```

8.

```

@Maira222 → /workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
PLAY RECAP ****
3.29.231.250 : ok=3    changed=2    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
40.172.234.39 : ok=3    changed=2    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0

@Maira222 → /workspaces/terraform_machine (main) $ nano my-playbook.yaml
@Maira222 → /workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml

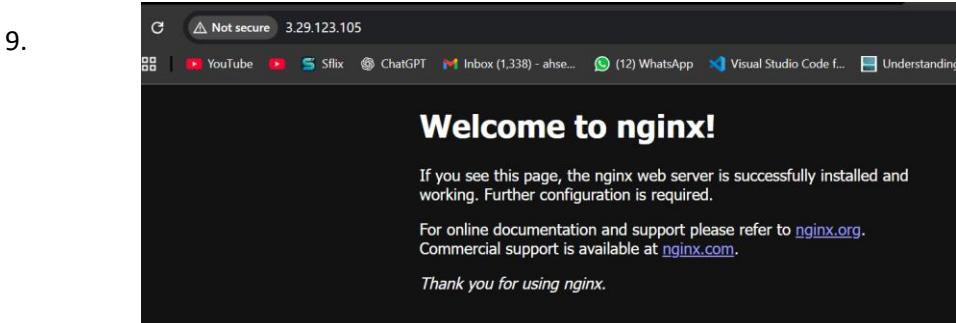
PLAY [Configure nginx web server] ****
TASK [Gathering Facts] ****
[WARNING]: Host '3.29.123.105' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installation of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible/core/2.20/reference_appendices/interpreter_discovery.html for more information.
ok: [3.29.123.105]

TASK [install nginx and update cache] ****
changed: [3.29.123.105]

TASK [start nginx server] ****
changed: [3.29.123.105]

PLAY RECAP ****
3.29.123.105 : ok=3    changed=2    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0

```



TASK 5:

1.

```
@Maira222 →/workspaces/terraform_machine (main) $ touch ansible.cfg
ls -la ansible.cfg
-rw-rw-rw- 1 codespace codespace 0 Jan 10 13:06 ansible.cfg
```

2.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat ansible.cfg
[defaults]
host_key_checking=False
interpreter_python = /usr/bin/python3
@Maira222 →/workspaces/terraform_machine (main) $
```

3.

```
GNU nano 7.2
main.tf
subnet_cidr_block = var.subnet_cidr_block
availability_zone = var.availability_zone
env_prefix = var.env_prefix
default_route_table_id = aws_vpc.myapp_vpc.default_route_table_id
}

module "myapp-webserver" {
  source = "./modules/webserver"
  env_prefix = var.env_prefix
  instance_type = var.instance_type
  availability_zone = var.availability_zone
  public_key = var.public_key
  my_ip = local.my_ip
  vpc_id = aws_vpc.myapp_vpc.id
  subnet_id = module.myapp-subnet.subnet.id

  # Loop count
  count          = 1
  # Use count.index to differentiate instances
  instance_suffix = count.index
}


```

4.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform apply -auto-approve
module.myapp-webserver[2].aws_instance.myapp-server: Still destroying... [id=i-0035d6b12c9da3a04, 00
module.myapp-webserver[1].aws_instance.myapp-server: Still destroying... [id=i-0101ae54d4817ba9c, 00
module.myapp-webserver[1].aws_instance.myapp-server: Still destroying... [id=i-0101ae54d4817ba9c, 00
module.myapp-webserver[2].aws_instance.myapp-server: Still destroying... [id=i-0035d6b12c9da3a04, 00
module.myapp-webserver[2].aws_instance.myapp-server: Destruction complete after 50s
module.myapp-webserver[2].aws_key_pair.ssh-key: Destroying... [id=dev-serverkey-2]
module.myapp-webserver[2].aws_security_group.web_sg: Destroying... [id=sg-022ce461735735f44]
module.myapp-webserver[2].aws_key_pair.ssh-key: Destruction complete after 0s
module.myapp-webserver[2].aws_security_group.web_sg: Destruction complete after 1s
module.myapp-webserver[1].aws_instance.myapp-server: Still destroying... [id=i-0101ae54d4817ba9c, 01
module.myapp-webserver[1].aws_instance.myapp-server: Still destroying... [id=i-0101ae54d4817ba9c, 01
module.myapp-webserver[1].aws_instance.myapp-server: Destruction complete after 1m10s
module.myapp-webserver[1].aws_key_pair.ssh-key: Destroying... [id=dev-serverkey-1]
module.myapp-webserver[1].aws_security_group.web_sg: Destroying... [id=sg-0e69178733d9902f0]
module.myapp-webserver[1].aws_key_pair.ssh-key: Destruction complete after 0s
module.myapp-webserver[1].aws_security_group.web_sg: Destruction complete after 1s

Apply complete! Resources: 0 added, 0 changed, 6 destroyed.

Outputs:

webserver_public_ips = [
  "3.29.231.250",
]
```

5.

```
● @Maira222 →/workspaces/terraform_machine (main) $ terraform output
webserver_public_ips = [
  "3.29.231.250",
]
```

6.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat hosts

[nginx]
3.29.231.250

[nginx:vars]
ansible_ssh_private_key_file=~/ssh/id_ed25519
ansible_user=ec2-user
```

7.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat my-playbook.yaml
---
- name: Configure nginx web server
  hosts: nginx
  become: true
  tasks:
    - name: install nginx and update cache
      yum:
        name: nginx
        state: present
        update_cache: yes

    - name: install openssl
      yum:
        name: openssl
        state: present

    - name: start nginx server
      service:
        name: nginx
        state: started
        enabled: true
```

8.

```
@Maira222 →/workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
[WARNING]: Ansible is being run in a world writable directory (/workspaces/terraform_machine), ignoring it as an ansible source. For more information see https://docs.ansible.com/ansible-devel/reference_appendices/config.html#cfg-in-world-writable-dir

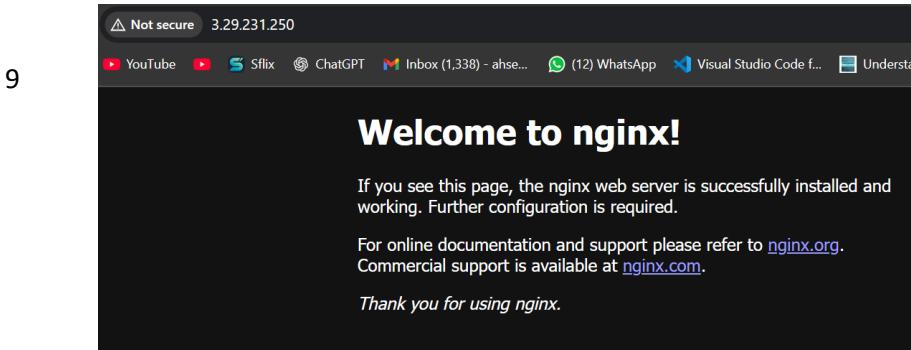
PLAY [Configure nginx web server] ****
TASK [Gathering Facts] ****
[WARNING]: Host '3.29.231.250' is using the discovered Python interpreter at '/usr/bin/python3.9', but future installs of another Python interpreter could cause a different interpreter to be discovered. See https://docs.ansible.com/ansible-core/2.20/reference_appendices/interpreter_discovery.html for more information.
ok: [3.29.231.250]

TASK [install nginx and update cache] ****
ok: [3.29.231.250]

TASK [install openssl] ****
ok: [3.29.231.250]

TASK [start nginx server] ****
changed: [3.29.231.250]

PLAY RECAP ****
3.29.231.250 : ok=4    changed=1    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```



TASK 6:

1.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat my-playbook.yaml
uri:
  url: "http://169.254.169.254/latest/meta-data/public-ipv4"
  headers:
    X-aws-ec2-metadata-token: "{{ imdsv2_token.content }}"
  return_content: yes
  register: public_ip

- name: Show current public IP
  debug:
    msg: "Public IP: {{ public_ip.content }}"

- name: Generate self-signed SSL certificate
  command: >
    openssl req -x509 -nodes -days 365
    -newkey rsa:2048
    -keyout /etc/ssl/private/selfsigned.key
    -out /etc/ssl/certs/selfsigned.crt
    -subj "/CN={{ public_ip.content }}"
    -addext "subjectAltName=IP:{{ public_ip.content }}"
    -addext "basicConstraints=CA:FALSE"
    -addext "keyUsage=digitalSignature,keyEncipherment"
    -addext "extendedKeyUsage=serverAuth"
  args:
    creates: /etc/ssl/certs/selfsigned.crt
```

2.

```
@Maira222 →/workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
TASK [Create SSL private directory] *****
changed: [3.29.231.250]

TASK [Create SSL certs directory] *****
changed: [3.29.231.250]

TASK [Get INDSV2 token] *****
ok: [3.29.231.250]

TASK [Get current public IP] *****
ok: [3.29.231.250]

TASK [Show current public IP] *****
ok: [3.29.231.250] => {
    "msg": "Public IP: 3.29.231.250"
}

TASK [Generate self-signed SSL certificate] *****
changed: [3.29.231.250]

PLAY RECAP *****
3.29.231.250 : ok=11   changed=3    unreachable=0   failed=0   skipped=0   rescued=0   ignored=0
```

3.

```
@Maira222 →/workspaces/terraform_machine (main) $ ssh ec2-user@3.29.231.250 -i ~/.ssh/id_ed25519
, _#
~\ #####
~ \#####
~ \
~ \#/
~ \v' '-->
~ /
~ \_/
~ \_/
~ \m'/

Last login: Sat Jan 10 13:24:46 2026 from 4.240.18.229
[ec2-user@ip-10-0-10-64 ~]$ sudo cat /etc/ssl/certs/selfsigned.crt
-----BEGIN CERTIFICATE-----
MIIDPTCCAiWgAwIBAgUBT1ihihC9n9r5Bc6gSzn1s8mKmDQYJKoZIhvvcNAQEL
BQAwTzEVMBMGAlUEAwMMy4yOS4yMzEuMjUwMB4XTI2MDFxMDEzjhjQ8NlxDtI3
MDExNDzjQ9NlJzEzVMBMGA1UEAwMMy4yOS4yMzEuMjUwMB4XTI2MDFxMDEzjhjQ8NlxDtI3
9wBAQFEAAOCQA8AMIIBCgKCAQEAtW5RtF11/WQb5cd1kbv1l0e07OG4vb+k1/N
MqrpbFHggaqQwujBb90fChM43MuFd3jYEG9CBM52absGtJEj7yfQC1xq/8xokfLPe
UhEUwv8i1/jqeBtqKefdzPgyr/P6/gUL4Bd0X16w9MMSoC00wLtq/6uLoQ
J1HSFJ3DS3G6FBcwzzgjYxp4Mf3NVR4f6w1l5z8fTbVldP/8G8z52o60G/I3cE
c2fADQdzkEut2UXrUAOhhvr5rSKhNxQDHtqLnAr7RKUNL6fcoiHv5jyMOuuxFz
9AyJchB1SkjukAk+Uzx3nIC/D8AH/RVehm4ugIINKVSUbmkwIDAQAB04GAW4w
HQYDVRF0BBYEF1fnytEvCwbuup3d0/RSaDf/051XMBGA1UdIwQYMBAfI1fnytEv
Cwbuup3d0/RSaDf/051XMBGA1UdEQQIMAhBA4d5/owCQyDVR0TBAlwADALBgNV
HQ8EBAMCBAoWEyDVR0OwCgYIKwYBBQUHawEwDQYJKozIhvcNAQELBQADggEB
AI88DrmlD3h15DT8D0u8z+x1KIzzjneJbyGbQhpQx5aLq+jcy9KO+TT601
tJSO+u7K6k6jRSCLPBwqZJQl.yggnYVLYkbz5qBizi/14h/V6m2E3mE6fkic8g
PuqBwzIMDJe9v4P6Gsm08CY5V8Bq4dCtWztLDlawqEwVptgJYJvDSF9
JDsnt37RLrtfUEZAFOavmg2HzUp/y5ChgMbF7chxwhbUDsqjYGr4wak9XpOrk
fcBeo2mSpikerQttewnclk0fNvojfNfN8+PZYCnok7/8YYXSVUO92F3L1WdVT/4/0
330varDL/N2bohDpm/PBdg=
-----END CERTIFICATE-----
[ec2-user@ip-10-0-10-64 ~]$
```

TASK 7:

1.

```
jaraco
./aws/dist/setuptools/_vendor/jaraco:
text

./aws/dist/setuptools/_vendor/jaraco/text:
'Lorem ipsum.txt'

./aws/dist/wheel-0.45.1.dist-info:
INSTALLER LICENSE.txt METADATA RECORD REQUESTED WHEEL direct_url.json entry_points.txt

./files:
index.php

./modules:
subnet webserver

./modules/subnet:
main.tf outputs.tf variables.tf

./modules/webserver:
main.tf outputs.tf variables.tf

./templates:
nginx.conf.j2
```

2.

```
@Maira222 → /workspaces/terraform_machine/files (main) $ cat index.php

.info a:hover {
    text-decoration: underline; /* optional: underline on hover */
}
</style>
</head>
<body>
<div class="container">
<h1> Nginx Front End Web Server </h1>

<div class="info"><span class="label">Hostname:</span> <?= htmlspecialchars($hostname) ?></div>
<div class="info"><span class="label">Instance ID:</span> <?= htmlspecialchars($instance_id) ?></div>
<div class="info"><span class="label">Private IP:</span> <?= htmlspecialchars($private_ip) ?></div>
<div class="info"><span class="label">Public IP:</span> <?= htmlspecialchars($public_ip) ?></div>
<div class="info"><span class="label">Public DNS:</span>
    <a href="https://<?= htmlspecialchars($public_dns) ?>" target="_blank">
        https://<?= htmlspecialchars($public_dns) ?></a>
    </div>
<div class="info"><span class="label">Deployed:</span> <?= $deployed_date ?></div>
<div class="info"><span class="label">Status:</span>  Active and Running</div>
<div class="info"><span class="label">Managed By:</span> Terraform + Ansible</div>
</div>
</body>
</html>
```

3.

```
@Maira222 → /workspaces/terraform_machine/templates (main) $ cat nginx.conf.j2
ssl_certificate_key /etc/ssl/private/selfsigned.key;

location / {
    root /usr/share/nginx/html;
    index index.php index.html index.htm;
    # proxy_pass http://158.252.94.241:80;
    # proxy_pass http://backend_servers;

    # ● This block is necessary for Php Website
    location ~ \.php$ {
        include fastcgi_params;
        fastcgi_pass unix:/run/php-fpm/www.sock;
        fastcgi_index index.php;
        fastcgi_param SCRIPT_FILENAME $document_root$fastcgi_script_name;
    }
}

server {
    listen 80;
    server_name _;
    return 301 https://$host$request_uri;
}
```

4.

```
GNU nano 7.2                                my-playbook.yaml *
      -addext "subjectAltName=IP:{{ public_ip.content }}"
      -addext "basicConstraints=CA:FALSE"
      -addext "keyUsage=digitalSignature,keyEncipherment"
      -addext "extendedKeyUsage=serverAuth"
  args:
    creates: /etc/ssl/certs/selfsigned.crt
- name: Deploy Nginx website and configuration files
  hosts: nginx
  become: true
  tasks:
    - name: install php-fpm and php-curl
      yum:
        name:
          - php-fpm
          - php-curl
        state: present

    - name: Copy website files
      copy:
        src: files/index.php
        dest: /usr/share/nginx/html/index.php
        owner: nginx
```

5.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
PLAY [Deploy Nginx website and configuration files] ****
TASK [Gathering Facts] ****
ok: [3.29.231.250]

TASK [install php-fpm and php-curl] ****
ok: [3.29.231.250]

TASK [Copy website files] ****
ok: [3.29.231.250]

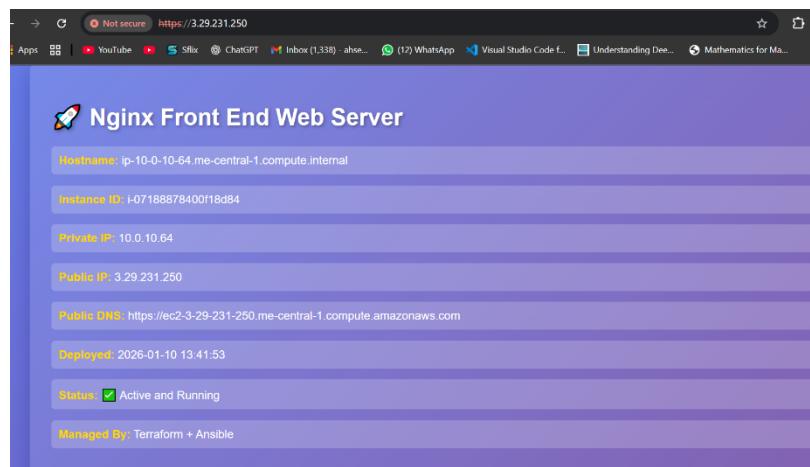
TASK [Copy nginx.conf template] ****
changed: [3.29.231.250]

TASK [Restart nginx] ****
changed: [3.29.231.250]

TASK [Start and enable php-fpm] ****
changed: [3.29.231.250]

PLAY RECAP ****
3.29.231.250 : ok=17    changed=3    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

6.



TASK 8:

1.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform destroy -auto-approve
module.myapp_subnet.aws_default_route_table.main_rt: Destruction complete after 0s
module.myapp_webserver[0].aws_instance.myapp_server: Destroying... [id=i-07188878400f18d84]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Destroying... [id=igw-063f3eb310a99d398]
module.myapp_webserver[0].aws_instance.myapp_server: Still destroying... [id=i-07188878400f18d84, 00m10s elapsed]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-063f3eb310a99d398, 00m10s elapsed]
module.myapp_webserver[0].aws_instance.myapp_server: Still destroying... [id=i-07188878400f18d84, 00m20s elapsed]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-063f3eb310a99d398, 00m20s elapsed]
module.myapp_webserver[0].aws_instance.myapp_server: Still destroying... [id=i-07188878400f18d84, 00m30s elapsed]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-063f3eb310a99d398, 00m30s elapsed]
module.myapp_webserver[0].aws_instance.myapp_server: Still destroying... [id=i-07188878400f18d84, 00m40s elapsed]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-063f3eb310a99d398, 00m40s elapsed]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Destruction complete after 48s
module.myapp_webserver[0].aws_instance.myapp_server: Still destroying... [id=i-07188878400f18d84, 00m50s elapsed]
module.myapp_webserver[0].aws_instance.myapp_server: Still destroying... [id=i-07188878400f18d84, 00m50s elapsed]
module.myapp_subnet.myapp_subnet_1: Destruction complete after 5s
module.myapp_webserver[0].aws_subnet.myapp_subnet_1: Destroying... [id=subnet-0bb0a5eeaf35bfd53]
module.myapp_webserver[0].aws_key_pair.ssh-key: Destroying... [id=dev-serverkey-0]
module.myapp_webserver[0].aws_security_group.web_sg: Destroying... [id=sg-0c0bd7de878d3dabb]
module.myapp_webserver[0].aws_key_pair.ssh-key: Destruction complete after 0s
module.myapp_subnet.aws_subnet.myapp_subnet_1: Destruction complete after 0s
module.myapp_webserver[0].aws_security_group.web_sg: Destruction complete after 0s
aws_vpc.myapp_vpc: Destroying... [id=vpc-0411dd68d7ff43dc5]
aws_vpc.myapp_vpc: Destruction complete after 1s

Destroy complete! Resources: 7 destroyed.
```

2.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform apply -auto-approve
aws_vpc.myapp_vpc: Creating...
module.myapp_webserver[0].aws_key_pair.ssh-key: Creation complete after 0s [id=dev-serverkey-0]
aws_vpc.myapp_vpc: Still creating... [00m10s elapsed]
aws_vpc.myapp_vpc: Creation complete after 12s [id=vpc-02557685bfbad8ac3]
module.myapp_subnet.aws_internet_gateway.myapp_igw: Creating...
module.myapp_subnet.aws_subnet.myapp_subnet_1: Creating...
module.myapp_webserver[0].aws_security_group.web_sg: Creating...
module.myapp_subnet.aws_internet_gateway.myapp_igw: Creation complete after 1s [id=igw-0d0c4402e37a56ccc]
module.myapp_subnet.aws_default_route_table.main_rt: Creating...
module.myapp_subnet.aws_default_route_table.main_rt: Creation complete after 0s [id=rtb-07c37f92890f3df0]
module.myapp_webserver[0].aws_security_group.web_sg: Creation complete after 3s [id=sg-090a0badced64903c]
module.myapp_subnet.aws_subnet.myapp_subnet_1: Still creating... [00m05s elapsed]
module.myapp_subnet.aws_subnet.myapp_subnet_1: Creation complete after 11s [id=subnet-04ee2b905d58d82b6]
module.myapp_webserver[0].aws_instance.myapp_server: Creating...
module.myapp_webserver[0].aws_instance.myapp_server: Still creating... [00m10s elapsed]
module.myapp_webserver[0].aws_instance.myapp_server: Creation complete after 12s [id=i-006fd97f884f19909]

Apply complete! Resources: 7 added, 0 changed, 0 destroyed.

Outputs:
```

3.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform output
webserver_public_ips = [
  "40.172.100.181",
]
```

4.

```
GNU nano 7.2
[docker_servers]
40.172.100.181

[docker_servers:vars]
ansible_ssh_private_key_file=~/ssh/id_ed25519
ansible_user=ec2-user
```

5.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat my-playbook.yaml
file:
  path: /usr/local/lib/docker/cli-plugins
  state: directory
  mode: '0755'

- name: install docker-compose
  get_url:
    url: https://github.com/docker/compose/releases/latest/download/docker-compose-linux-{{ lookup('
  )}}
  dest: /usr/local/lib/docker/cli-plugins/docker-compose
  mode: '+x'

- name: View architecture of the system
  debug:
    msg: "System architecture of {{ inventory_hostname }} is {{ ansible_facts['architecture'] }}"

- name: Alternate method to view architecture of the system
  debug:
    msg: "System architecture of {{inventory_hostname}} is {{ lookup('pipe', 'uname -m') }}"

- name: restart docker service
  service:
    name: docker
    state: restarted
@Maira222 →/workspaces/terraform_machine (main) $
```

6.

```
@Maira222 ~/workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
ok: [40.172.100.181]

TASK [create docker cli-plugins directory] ****
changed: [40.172.100.181]

TASK [install docker-compose] ****
changed: [40.172.100.181]

TASK [View architecture of the system] ****
ok: [40.172.100.181] => {
    "msg": "System architecture of 40.172.100.181 is x86_64"
}

TASK [Alternate method to view architecture of the system] ****
ok: [40.172.100.181] => {
    "msg": "System architecture of 40.172.100.181 is x86_64"
}

TASK [restart docker service] ****
changed: [40.172.100.181]

PLAY RECAP ****
40.172.100.181 : ok=8    changed=4    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

7.

```
@Maira222 ~/workspaces/terraform_machine (main) $ ssh ec2-user@40.172.100.181 -i ~/.ssh/id_ed25519
,
  _#
  ~\_#####
  ~~ \#####
  ~~ \##|
  ~~ \#/  -- https://aws.amazon.com/linux/amazon-linux-2023
  ~~ V~' '-->
  ~~~ /
  ~~~ /_
  ~m/'
```

Last login: Sat Jan 10 13:57:03 2026 from 4.240.18.229
[ec2-user@ip-10-0-10-175 ~]\$

8.

```
Last login: Sat Jan 10 13:57:03 2026 from 4.240.18.229
[ec2-user@ip-10-0-10-175 ~]$ sudo docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS          NAMES
[ec2-user@ip-10-0-10-175 ~]$
```

TASK 9:

1.

```
GNU nano 7.2                                     my-playbook.yaml *
vars_files:
  - project-vars.yaml
tasks:
  - name: add user to docker group
    user:
      name: "{{ normal_user }}"
      groups: docker
      append: yes

  - name: reconnect to apply group changes
    meta: reset_connection

  - name: verify docker access
    command: docker ps
    register: docker_ps
    changed_when: false

  - name: display docker ps output
    debug:
      var: docker_ps.stdout

  - name: fail if docker is not accessible
```

2.

```
@Maira222 ~/workspaces/terraform_machine (main) $ cat project-vars.yaml
normal_user: ec2-user
docker_compose_file_location: <location-of-file>
@Maira222 ~/workspaces/terraform_machine (main) $
```

3.

```
GNU nano 7.2                                my-playbook.yaml *
- name: copy docker-compose file
  copy:
    src: "{{ docker_compose_file_location }}/compose.yaml"
    dest: /home/{{ normal_user }}/compose.yaml
    mode: '0644'
  when: not compose_file.stat.exists

- name: deploy containers using docker-compose
  command: docker compose up -d
  register: compose_result
  changed_when: "'Creating' in compose_result.stdout or 'Recreating' in compose_result.s
```

4.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat compose.yaml
db:
  image: postgres:alpine
  container_name: gitea_db
  environment:
    - POSTGRES_USER=gitea
    - POSTGRES_PASSWORD=gitea
    - POSTGRES_DB=gitea
  restart: always
  volumes:
    - gitea_postgres:/var/lib/postgresql/data
  expose:
    - 5432
  networks:
    - webnet

volumes:
  gitea_postgres:
    name: gitea_postgres
  gitea:
    name: gitea

networks:
  webnet:
    name: webnet
```

5.

```
@Maira222 →/workspaces/terraform_machine (main) $ ansible-playbook -i hosts my-playbook.yaml
ok: [40.172.100.181] => {
    "docker_ps.stdout": "CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES"
}

TASK [fail if docker is not accessible] *****
skipping: [40.172.100.181]

PLAY [Deploy Docker Containers] *****

TASK [Gathering Facts] *****
ok: [40.172.100.181]

TASK [check if docker-compose file exists] *****
ok: [40.172.100.181]

TASK [copy docker-compose file] *****
changed: [40.172.100.181]

TASK [deploy containers using docker-compose] *****
ok: [40.172.100.181]

PLAY RECAP *****
40.172.100.181 : ok=16    changed=2    unreachable=0    failed=0    skipped=1    rescued=0    ignored=0
```

6.

```
resource "aws_security_group" "web_sg" {
  vpc_id      = var.vpc_id
  name        = "${var.env_prefix}-web-sg-${var.instance_suffix}"
  description = "Security group for web server allowing HTTP, HTTPS
  ingress {
    from_port   = 3000
    to_port     = 3000
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
  ingress {
    from_port   = 22
    to_port     = 22
    protocol    = "tcp"
```

7.

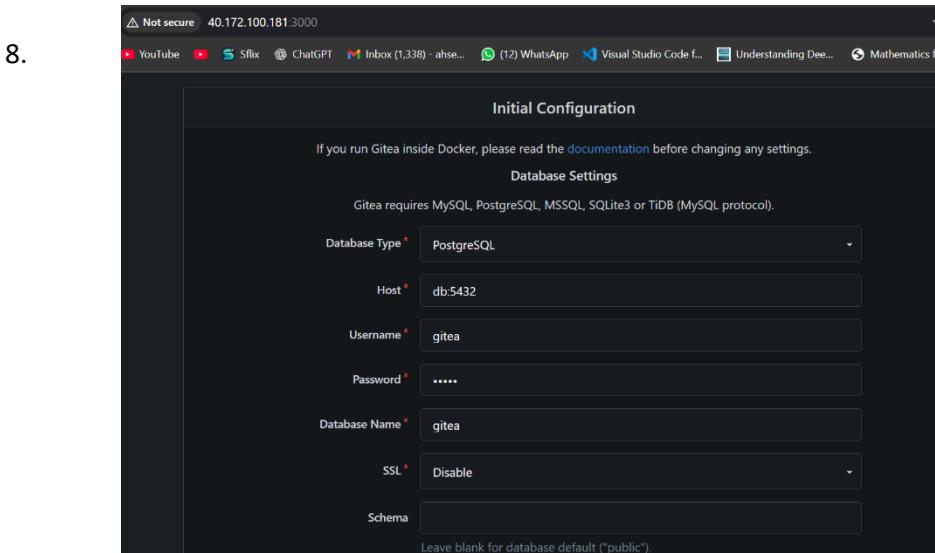
```
@Maire222 → /workspaces/terraform_machine (main) $ terraform apply -auto-approve
}

Plan: 0 to add, 1 to change, 0 to destroy.
module.myapp-webserver[0].aws_security_group.web_sg: Modifying... [id=sg-090a0badced64903c]
module.myapp-webserver[0].aws_security_group.web_sg: Modifications complete after 1s [id=sg-090a0badced64903c]

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

Outputs:

webserver_public_ips = [
  "40.172.100.181",
]
@Maire222 → /workspaces/terraform_machine (main) $
```



TASK 10:

1.

```
GNU nano 7.2                                     main.tf *
count          = 1
# Use count.index to differentiate instances
instance_suffix = count.index

}
resource "null_resource" "configure_server" {
  triggers = {
    webserver_public_ips_for_ansible = join(",", [for i in module.myapp-webserver : i.ansible_ip])
  }

  depends_on = [module.myapp-webserver]

  provisioner "local-exec" {
    command = <<-EOT
      ansible-playbook -i ${self.triggers.webserver_public_ips_for_ansible}, \
        --private-key "${var.private_key}" --user ec2-user \
        my-playbook.yaml
    EOT
  }
}
```

@Maire222 → /workspaces/terraform_machine (main) \$ terraform destroy -auto-approve

```
[ ] -> null
module.myapp-subnet.aws_default_route_table.main_rt: Destroying... [id=tb-07c37fa92890f3df0]
module.myapp-subnet.aws_default_route_table.main_rt: Destruction complete after 0s
module.myapp-webserver[0].aws_instance.myapp-server: Destroying... [id=i-006fd7f97f884f19909]
module.myapp-subnet.aws_internet_gateway.myapp_igw: Destroying... [id=igw-0dc4402e37a56ccc]
module.myapp-webserver[0].aws_instance.myapp-server: Still destroying... [id=i-006fd7f884f19909, 0m10s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-0dc4402e37a56ccc, 0m10s elapsed]
module.myapp-subnet.aws_instance.myapp-server: Still destroying... [id=i-006fd7f884f19909, 0m20s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-0dc4402e37a56ccc, 0m20s elapsed]
module.myapp-webserver[0].aws_instance.myapp-server: Still destroying... [id=i-006fd7f884f19909, 0m30s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp_igw: Still destroying... [id=igw-0dc4402e37a56ccc, 0m30s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp_igw: Destruction complete after 37s
module.myapp-webserver[0].aws_instance.myapp-server: Still destroying... [id=i-006fd7f884f19909, 0m40s elapsed]
module.myapp-webserver[0].aws_instance.myapp-server: Destruction complete after 40s
module.myapp-webserver[0].aws_key_pair.ssh-key: Destroying... [id=dev-serverkey-0]
module.myapp-webserver[0].aws_security_group.web_sg: Destroying... [id=sg-090a0badced64903c]
module.myapp-subnet.aws_subnet.myapp_subnet_1: Destroying... [id=subnet-04ee2b905d58d82b6]
module.myapp-webserver[0].aws_key_pair.ssh-key: Destruction complete after 0s
module.myapp-subnet.aws_subnet.myapp_subnet_1: Destruction complete after 0s
module.myapp-webserver[0].aws_security_group.web_sg: Destruction complete after 1s
aws_vpc.myapp_vpc: Destroying... [id=vpc-02557685bfbad8ac3]
aws_vpc.myapp_vpc: Destruction complete after 0s

Destroy complete! Resources: 7 destroyed.
@Maire222 → /workspaces/terraform_machine (main) $
```

3.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform apply -auto-approve
null_resource.configure_server (local-exec): TASK [copy docker-compose file] ****
*** null_resource.configure_server (local-exec): changed: [3.28.39.6]
null_resource.configure_server (local-exec): TASK [deploy containers using docker-compose] ****
*** null_resource.configure_server: Still creating... [01m20s elapsed]
null_resource.configure_server (local-exec): ok: [3.28.39.6]

null_resource.configure_server (local-exec): PLAY RECAP ****
*** null_resource.configure_server (local-exec): 3.28.39.6 : ok=16    changed=6    unreachable=0    failed=0
    skipped=1   rescued=0   ignored=0

null_resource.configure_server: Creation complete after 1m28s [id=1240548288126280200]

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

Outputs:
```

4.

```
GNU nano 7.2                                         my-playbook.yaml
---
- name: Wait for some time to ensure system readiness
  hosts: all
  tasks:
    - name: Wait 300 seconds for port 22 to become open and contain "OpenSSH"
      wait_for:
        port: 22
        host: "{{ inventory_hostname }}"
        delay: 10
        timeout: 300
      delegate_to: localhost
- name: Configure Docker
```

5.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform apply -auto-approve
null_resource.configure_server (local-exec): TASK [copy docker-compose file] ****
*** null_resource.configure_server (local-exec): changed: [158.252.78.37]

null_resource.configure_server (local-exec): TASK [deploy containers using docker-compose] ****
*** null_resource.configure_server: Still creating... [01m40s elapsed]
null_resource.configure_server: Still creating... [01m50s elapsed]
null_resource.configure_server (local-exec): ok: [158.252.78.37]

null_resource.configure_server (local-exec): PLAY RECAP ****
*** null_resource.configure_server (local-exec): 158.252.78.37 : ok=18    changed=6    unreachable=0
    skipped=1   rescued=0   ignored=0

null_resource.configure_server: Creation complete after 1m50s [id=6852706823798556676]

Apply complete! Resources: 8 added, 0 changed, 0 destroyed.

Outputs:

webserver_public_ips = [
  "158.252.78.37",
]
```

TASK 11:

1.

```
GNU nano 7.2                                         ansible.cfg
[defaults]
host_key_checking=False
interpreter_python = /usr/bin/python3
deprecation_warnings = False

enable_plugins = aws_ec2
private_key_file = ~/.ssh/id_ed25519
```

2.

```
● @Maira222 →/workspaces/terraform_machine (main) $ touch inventory_aws_ec2.yaml
ls -la inventory_aws_ec2.yaml
-rw-rw-rw- 1 codespace codespace 0 Jan 10 14:42 inventory_aws_ec2.yaml
@Maira222 →/workspaces/terraform_machine (main) $
```

3.

```
@Maira222 →/workspaces/terraform_machine (main) $ cat inventory_aws_ec2.yaml
---
plugin: aws_ec2
regions:
  - me-central-1
```

4.

```
}
```

```
module "myapp-webserver-prod" {
  source = "./modules/webserver"
  env_prefix = "prod"
  instance_type = "t3.nano"
  availability_zone = var.availability_zone
  public_key = var.public_key
  my_ip = local.my_ip
  vpc_id = aws_vpc.myapp_vpc.id
  subnet_id = module.myapp-subnet.subnet.id

  # Loop count
  count          = 1
  # Use count.index to differentiate instances
  instance_suffix = count.index
}
```

[W
^G Help ^O Write Out ^W Where Is ^K Cut

5.

```
GNU nano 7.2                               outputs.tf
output "webserver_public_ips" {
  value = [for i in module.myapp-webserver : i.aws_instance.public_ip]
}

output "prod-webserver_public_ips" {
  value = [for i in module.myapp-webserver-prod : i.aws_instance.public_ip]
}
```

6.

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform init
Initializing the backend...
Initializing modules...
- myapp-webserver-prod in modules/webserver
Initializing provider plugins...
- Reusing previous version of hashicorp/aws from the dependency lock file
- Reusing previous version of hashicorp/null from the dependency lock file
- Reusing previous version of hashicorp/http from the dependency lock file
- Using previously-installed hashicorp/aws v6.28.0
- Using previously-installed hashicorp/null v3.2.4
- Using previously-installed hashicorp/http v3.5.0

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.
@Maira222 →/workspaces/terraform_machine (main) $
```

```
@Maira222 →/workspaces/terraform_machine (main) $ terraform apply -auto-approve
Plan: 3 to add, 0 to change, 0 to destroy.

Changes to Outputs:
  + prod-webserver_public_ips = [
      + (known after apply),
    ]
module.myapp-webserver-prod[0].aws_key_pair.ssh-key: Creating...
module.myapp-webserver-prod[0].aws_security_group.web_sg: Creating...
module.myapp-webserver-prod[0].aws_key_pair.ssh-key: Creation complete after 0s [id=prod-serverkey-0]
module.myapp-webserver-prod[0].aws_security_group.web_sg: Creation complete after 3s [id=sg-0063d04dc60f]
module.myapp-webserver-prod[0].aws_instance.myapp-server: Creating...
module.myapp-webserver-prod[0].aws_instance.myapp-server: Still creating... [00m10s elapsed]
module.myapp-webserver-prod[0].aws_instance.myapp-server: Creation complete after 12s [id=i-007b10bb2f6b]

Apply complete! Resources: 3 added, 0 changed, 0 destroyed.
```

Outputs:

```
prod-webserver_public_ips = [
    "3.28.132.47",
]
webserver_public_ips = [
    "158.252.78.37",
]
```

7.

```
[Success@Maira222 ~] /workspaces/terraform_machine (main) $ $(which python) -c "import boto3, botocore; print(boto3._1.42.25)
```

5.

```
@Maira222 → /workspaces/terraform_machine (main) $ ansible-inventory -i inventory_aws_ec2.yaml --graph

[WARNING]: Failed to parse inventory with 'yaml' plugin: Plugin configuration YAML file, not YAML inventory

Failed to parse inventory with 'yaml' plugin.

<<< caused by >>>

Plugin configuration YAML file, not YAML inventory
Origin: <inventory plugin 'yaml' with source '/workspaces/terraform_machine/inventory_aws_ec2.yaml'>

[WARNING]: Failed to parse inventory with 'ini' plugin: Failed to parse inventory: Invalid host pattern '----' supplied, '----' is normally a sign this is a YAML file.

Failed to parse inventory with 'ini' plugin.

<<< caused by >>>

Failed to parse inventory: Invalid host pattern '----' supplied, '----' is normally a sign this is a YAML file.
Origin: /workspaces/terraform_machine/inventory_aws_ec2.yaml

[WARNING]: Unable to parse /workspaces/terraform_machine/inventory_aws_ec2.yaml as an inventory source
[WARNING]: No inventory was parsed, only implicit localhost is available
@all:
  |--@ungrouped:
@Maira222 → /workspaces/terraform_machine (main) <
```

TASK 12:

1

```
@Maira222 → /workspaces/terraform_machine (main) $ cat inventory_aws_ec2.yaml
---
plugin: aws_ec2
regions:
  - me-central-1
keyed_groups:
  - key: tags
    prefix: tag
    separator: "_"
```

2.

```
re version 2.23.
@all:
  [-@ungrouped:
   |-@aws_ec2:
    | |--public-ip-address
    |--@tag_Name_prod_ec2_instance_0:
     | |--public-ip-address
     |--@instance_type_t3.nano:
      | |--public-ip-address
      |--@tag_Name_dev_ec2_instance_0:
       | |--public-ip-address
       |--@instance_type_t3.micro:
        | |--public-ip-address
        |--@tag_Environment_prod:
         | |--public-ip-address
         |--@tag_Owner_DevOps_Team:
          | |--public-ip-address
          |--@tag_Name_prod_web_2:
           | |--public-ip-address
           |--@tag_Purpose_Multi_Tier_Web_Infrastructure:
            | |--public-ip-address
            |--@tag_Project_Assignment_2:
             | |--public-ip-address
             |--@tag_ManagedBy_Terraform:
```

3.

```
(ansible-core) @Maira222 → /workspaces/terraform_machine (main) $ cat my-playbook.yaml
  mode: '0644'

  - name: Restart nginx
    service:
      name: nginx
      state: restarted

  - name: Start and enable php-fpm
    service:
      name: php-fpm
      state: started
      enabled: true
```