
LAB 15

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REGISTRATION #: 2023-BSE-061

DEPARTMENT: BSE(5B)

LAB TASK

Lab Project – Terraform + Ansible Roles: Nginx Frontend with 3 Backend HTTPD Servers (HA + Auto-Config)

Final repo name (on GitHub):

CC_<YourName>_<YourRollNumber>/LabProject_FrontendBackend

1

General

Owner *



23-22411-061-rgb ▾

Repository name *

CC_ShumailZahra_2023-BSE-061/LabProject_FrontendBackend

✓ Your new repository will be created as CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend.

The repository name can only contain ASCII letters, digits, and the characters ., -, and _.

Great repository names are short and memorable. How about [effective-octo-fortnight?](#)

Description

0 / 350 characters

2

Configuration

Choose visibility *

Choose who can see and commit to this repository



Public ▾

Add README

READMEs can be used as longer descriptions. [About READMEs](#)

Off



Add .gitignore

.gitignore tells git which files not to track. [About ignoring files](#)

No .gitignore ▾

Add license

Licenses explain how others can use your code. [About licenses](#)

No license ▾

Create repository

Terraform – Networking & Common Settings (Architecture Definition)

```
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim variables.tf
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

variable "vpc_cidr_block" {}
variable "subnet_cidr_block" {}
variable "availability_zone" {}
variable "env_prefix" {}
variable "instance_type" {}

variable "public_key" {}
variable "private_key" {}
variable "region" {
  default = "us-east-1"
}
~
~
~
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~
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~
~

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim locals.tf
```

Frontend Nginx with 3 Backend HTTPD Servers (HA)

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

data "http" "my_ip" {
  url = "https://icanhazip.com"
}

locals {
  my_ip = "${chomp(data.http.my_ip.response_body)}/32"
}
~
~

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim main.tf
```

```
provider "aws" {
  region = var.region
}
resource "aws_vpc" "main" {
  cidr_block = var.vpc_cidr_block
  tags = {
    Name = "${var.env_prefix}-vpc"
  }
}

resource "aws_internet_gateway" "igw" {
  vpc_id = aws_vpc.main.id
}

resource "aws_subnet" "public" {
  vpc_id            = aws_vpc.main.id
  cidr_block        = var.subnet_cidr_block
  availability_zone  = var.availability_zone
  map_public_ip_on_launch = true
}

resource "aws_route_table" "rt" {
  vpc_id = aws_vpc.main.id

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

resource "aws_route_table_association" "rta" {
  subnet_id      = aws_subnet.public.id
  route_table_id = aws_route_table.rt.id
}
```

0 0 0

```

}

resource "aws_security_group" "web_sg" {
  vpc_id = aws_vpc.main.id

  ingress {
    from_port = 22
    to_port   = 22
    protocol  = "tcp"
    cidr_blocks = [local.my_ip]
  }

  ingress {
    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"]
  }
}

```

2. Terraform – Frontend & Backend EC2 Instances

```

cidr_blocks = [ 0.0.0.0/0 ]
}

resource "aws_key_pair" "key" {
  key_name    = "${var.env_prefix}-key"
  public_key = file(var.public_key)
}

data "aws_ami" "amazon_linux" {
  most_recent = true
  owners      = ["amazon"]

  filter {
    name   = "name"
    values = ["amzn2-ami-hvm-*"]
  }
}

resource "aws_instance" "frontend" {
  ami                = data.aws_ami.amazon_linux.id
  instance_type      = var.instance_type
  subnet_id          = aws_subnet.public.id
  vpc_security_group_ids = [aws_security_group.web_sg.id]
  key_name           = aws_key_pair.key.key_name

  tags = {
    Name = "${var.env_prefix}-frontend"
  }
}

```

```

tags = {
  Name = "${var.env_prefix}-frontend"
}
}

resource "aws_instance" "backend" {
  count          = 3
  ami            = data.aws_ami.amazon_linux.id
  instance_type = var.instance_type
  subnet_id      = aws_subnet.public.id
  vpc_security_group_ids = [aws_security_group.web_sg.id]
  key_name       = aws_key_pair.key.key_name

  tags = {
    Name = "${var.env_prefix}-backend-${count.index}"
  }
}

```

INSERT

```

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim main.tf
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim outputs.tf
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $

```

```

output "frontend_public_ip" {
  value = aws_instance.frontend.public_ip
}

output "backend_public_ips" {
  value = [for b in aws_instance.backend : b.public_ip]
}

output "backend_private_ips" {
  value = [for b in aws_instance.backend : b.private_ip]
}

```

```

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim terraform.tfvars
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $

```

```
vpc_cidr_block      = "10.0.0.0/16"
subnet_cidr_block  = "10.0.1.0/24"
availability_zone   = "us-east-1a"
env_prefix          = "lab"
instance_type       = "t2.micro"
public_key          = "~/.ssh/id_ed25519.pub"
private_key         = "~/.ssh/id_ed25519"
```

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```

3. Ansible – Global Config & Inventory

```
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/ansible.cfg
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/ansible.cfg
```

```
[defaults]
host_key_checking = False
interpreter_python = /usr/bin/python3
~
~
~
```

```
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/inventory/hosts
```



```
[frontend]
```

```
35.170.52.171
```

```
[backends]
```

```
34.200.244.32
```

```
44.201.6.74
```

```
3.238.9.253
```

```
[all:vars]
```

```
ansible_user=ec2-user
```

```
ansible_ssh_private_key_file=~/.ssh/id_ed25519
```

```
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```

```
- name: Install httpd
  yum:
    name: httpd
    state: present
    update_cache: yes

- name: Enable and start httpd
  service:
    name: httpd
    state: started
    enabled: true

- name: Deploy backend index page
  template:
    src: backend_index.html.j2
    dest: /var/www/html/index.html
    owner: apache
    group: apache
    mode: '0644'
```

```
~
~
```

4. Ansible Roles – Backend HTTPD Role (backend/)

```
@23-22411-061-rgb →/workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/roles/backend/tasks/main.yml
```

```

- name: Install httpd
  yum:
    name: httpd
    state: present
    update_cache: yes

- name: Enable and start httpd
  service:
    name: httpd
    state: started
    enabled: true

- name: Deploy backend index page
  template:
    src: backend_index.html.j2
    dest: /var/www/html/index.html
    owner: apache
    group: apache
    mode: '0644'

```

```

uf/tasks/main.yml
● @23-22411-061-rgb →/workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/roles/backe
d/templates/backend_index.html.j2
○ @23-22411-061-rgb →/workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $

```

```

<!DOCTYPE html>
<html>
<head>
  <title>Backend {{ inventory_hostname }}</title>
</head>
<body>
  <h1>Backend server: {{ inventory_hostname }}</h1>
  <p>Private IP: {{ ansible_default_ipv4.address | default('unknown') }}</p>
</body>
</html>

```

5. Ansible Roles – Frontend Nginx Role (frontend/)

```

@23-22411-061-rgb →/workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/roles/fronte
nd/tasks/main.yml
@23-22411-061-rgb →/workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $

```

```
- name: Install nginx
  yum:
    name: nginx
    state: present
    update_cache: yes

- name: Enable and start nginx
  service:
    name: nginx
    state: started
    enabled: true

- name: Deploy nginx frontend config
  template:
    src: nginx_frontend.conf.j2
    dest: /etc/nginx/nginx.conf
  notify: Restart nginx
```

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) \$ vim ansible/roles/frontend/handlers/main.yml

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

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) \$ vim ansible/roles/frontend/templates/nginx_frontend.conf.j2

```

user nginx;
worker_processes auto;
error_log /var/log/nginx/error.log notice;
pid /run/nginx.pid;

events {
    worker_connections 1024;
}

http {
    log_format main '$remote_addr - $remote_user [$time_local] "$request"
                    '$status $body_bytes_sent "$http_referer"
                    "$http_user_agent" "$http_x_forwarded_for"';

    access_log /var/log/nginx/access.log main;

    sendfile        on;
    tcp_nopush      on;
    keepalive_timeout 65;
    types_hash_max_size 4096;

    include         /etc/nginx/mime.types;
    default_type    application/octet-stream;

    upstream backend_servers {
        server {{ backend1_private_ip }}:80;
        server {{ backend2_private_ip }}:80;
        server {{ backup_backend_private_ip }}:80 backup;
    }

    server {
        listen 80;
        server_name _;

        location / {
            default_type application/octet-stream;

            upstream backend_servers {
                server {{ backend1_private_ip }}:80;
                server {{ backend2_private_ip }}:80;
                server {{ backup_backend_private_ip }}:80 backup;
            }

            server {
                listen 80;
                server_name _;

                location / {
                    proxy_pass http://backend_servers;
                    proxy_set_header Host $host;
                    proxy_set_header X-Real-IP $remote_addr;
                    proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
                }
            }
        }
    }
}

```

6. Ansible Main Playbook Using Roles

```

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim ansible/playbooks/site.yml
---
- name: Configure backend HTTPD servers
  hosts: backends
  become: true
  roles:
    - backend

- name: Configure frontend Nginx load balancer
  hosts: frontend
  become: true
  vars:
    backend1_private_ip: "{{ hostvars[groups['backends'][0]].ansible_default_ipv4.address }}"
    backend2_private_ip: "{{ hostvars[groups['backends'][1]].ansible_default_ipv4.address }}"
    backup_backend_private_ip: "{{ hostvars[groups['backends'][2]].ansible_default_ipv4.address }}"
  roles:
    - frontend
~
~
~
~
~
~
~
~

```

7. Terraform–Ansible Integration (Automation)

```

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $ vim main.tf
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) $

```

```

    }
  }
  resource "null_resource" "ansible_config" {
    triggers = {
      frontend_ip = aws_instance.frontend.public_ip
      backend_ips = join(",", [for b in aws_instance.backend : b.public_ip])
    }

    depends_on = [
      aws_instance.frontend,
      aws_instance.backend
    ]

    provisioner "local-exec" {
      command = <<EOT
        ANSIBLE_HOST_KEY_CHECKING=False ansible-playbook \
          -i ansible/inventory/hosts \
          ansible/playbooks/site.yaml
      EOT
    }
  }
}

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS bash - LabProject_FrontendBackend

@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) \$ terraform apply -auto-ap
prove

null_resource.ansible_config (local-exec): changed: [35.170.52.171]

```

null_resource.ansible_config (local-exec): PLAY RECAP *****
null_resource.ansible_config (local-exec): 3.238.9.253           : ok=5   changed=1   unreachable=0   failed=0   skipped=0   rescued=0
ignored=0
null_resource.ansible_config (local-exec): 34.200.244.32        : ok=5   changed=1   unreachable=0   failed=0   skipped=0   rescued=0
ignored=0
null_resource.ansible_config (local-exec): 35.170.52.171        : ok=6   changed=3   unreachable=0   failed=0   skipped=0   rescued=0
ignored=0
null_resource.ansible_config (local-exec): 44.201.6.74          : ok=5   changed=1   unreachable=0   failed=0   skipped=0   rescued=0
ignored=0

```

null_resource.ansible_config: Creation complete after 1m21s [id=108150615940078604]

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

Outputs:

```

backend_private_ips = [
  "10.0.1.233",
  "10.0.1.72",
  "10.0.1.156",
]
backend_public_ips = [
  "34.200.244.32",
  "44.201.6.74",
  "3.238.9.253",
]
frontend_public_ip = "35.170.52.171"

```

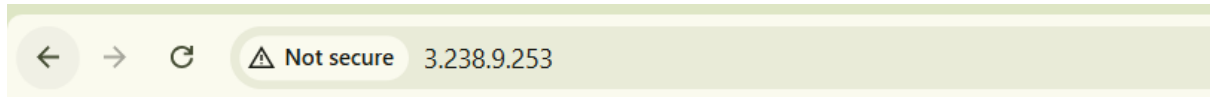
@23-22411-061-rgb → /workspaces/CC_ShumailZahra_2023-BSE-061-LabProject_FrontendBackend/LabProject_FrontendBackend (main) \$

← → ↻ ⚠ Not secure 34.200.244.32

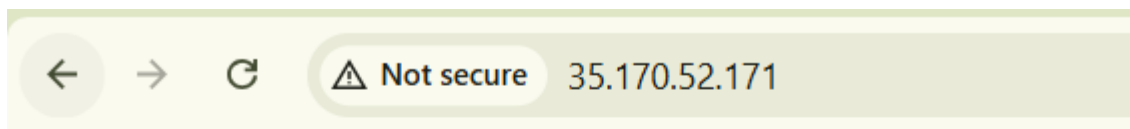
Hello from backend 34.200.244.32



Hello from backend 44.201.6.74



Hello from backend 3.238.9.253



Hello from backend 34.200.244.32



Hello from backend 44.201.6.74



Hello from backend 3.238.9.253
