CLOUD COMPUTING LAB

BSE (V-B)

LAB 15: Lab Project

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Roll No: **2023-BSE-068**

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- **Structure (tree)**

```
├── ansible
│   ├── ansible.cfg
│   ├── inventory
│   │   └── hosts
│   ├── inventory.tpl
│   ├── playbooks
│   │   └── site.yaml
│   └── roles
│       ├── backend
│       │   ├── handlers
│       │   │   └── main.yml
│       │   ├── tasks
│       │   │   └── main.yml
│       │   └── templates
│       │       └── backend_index.html.j2
│       └── frontend
│           ├── handlers
│           │   └── main.yml
│           ├── tasks
│           │   └── main.yml
│           └── templates
│               └── nginx_frontend.conf.j2
├── locals.tf
├── main.tf
├── modules
│   ├── subnet
│   │   ├── main.tf
│   │   ├── outputs.tf
│   │   └── variables.tf
│   └── webserver
│       ├── main.tf
│       ├── outputs.tf
│       └── variables.tf
├── outputs.tf
├── terraform.tfstate
├── terraform.tfstate.backup
├── terraform.tfvars
├── terraform.tfvars.example
└── variables.tf

16 directories, 26 files
```

- **Initialization (terraform init):**

```
@Urwa012 ➜/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $ terraform init
Initializing the backend...
Initializing modules...
Initializing provider plugins...
- Reusing previous version of hashicorp/http from the dependency lock file
- Reusing previous version of hashicorp/aws from the dependency lock file
- Reusing previous version of hashicorp/local from the dependency lock file
- Reusing previous version of hashicorp/null from the dependency lock file
- Using previously-installed hashicorp/local v2.6.1
- Using previously-installed hashicorp/null v3.2.4
- Using previously-installed hashicorp/http v3.5.0
- Using previously-installed hashicorp/aws v6.28.0

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.
@Urwa012 ➜/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $
```

- **Deployment (terraform apply -auto-approve)**

```
@Urwa012 →/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $ terraform apply -auto-approve

null_resource.run_ansible (local-exec): TASK [frontend : Start and Enable Nginx] ************************************
null_resource.run_ansible (local-exec): changed: [51.112.180.161]

null_resource.run_ansible (local-exec): TASK [frontend : Deploy Nginx Reverse Proxy Config] ***************************
null_resource.run_ansible (local-exec): [DEPRECATION WARNING]: INJECT_FACTS_AS_VARS default to `True` is deprecated, top-level facts will not be auto injecte
ore version 2.24.
null_resource.run_ansible (local-exec): Origin: /workspaces/cc-urwazahra-2023-BSE-068/lab_project/ansible/playbooks/site.yaml:13:18

null_resource.run_ansible (local-exec): 11   vars:
null_resource.run_ansible (local-exec): 12
null_resource.run_ansible (local-exec): 13     backend1_ip: "{{ hostvars[groups['backends'][0]].ansible_default_ipv4.address }}"
null_resource.run_ansible (local-exec):                     ^ column 18

null_resource.run_ansible (local-exec): Use `ansible_facts["fact_name"]` (no `ansible_` prefix) instead.

null_resource.run_ansible (local-exec): changed: [51.112.180.161]

null_resource.run_ansible (local-exec): RUNNING HANDLER [frontend : Restart nginx] ************************************
null_resource.run_ansible: Still creating... [01m50s elapsed]
null_resource.run_ansible (local-exec): changed: [51.112.180.161]

null_resource.run_ansible (local-exec): PLAY RECAP *********************************************************************
null_resource.run_ansible (local-exec): 3.28.45.202              : ok=5    changed=4    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
null_resource.run_ansible (local-exec): 3.29.139.95              : ok=5    changed=4    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
null_resource.run_ansible (local-exec): 3.29.30.142              : ok=5    changed=4    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
null_resource.run_ansible (local-exec): 51.112.180.161           : ok=5    changed=4    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0

null_resource.run_ansible: Creation complete after 1m51s [id=145186093514031318]

Apply complete! Resources: 2 added, 0 changed, 2 destroyed.

Outputs:

backend_private_ips = [
  "10.0.1.23",
  "10.0.1.218",
  "10.0.1.48",
]
backend_public_ips = [
  "3.29.139.95",
  "3.28.45.202",
  "3.29.30.142",
]
frontend_public_ip = "51.112.180.161"
@Urwa012 →/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $
```

- **Verifying Load Balancing (Active Nodes)**

- ***Backend Server 1:***

Response from Backend: 3.28.45.202

My Private IP is: **10.0.1.218**

Status: Active

- ***Backend Server 2:***

Response from Backend: 3.29.139.95

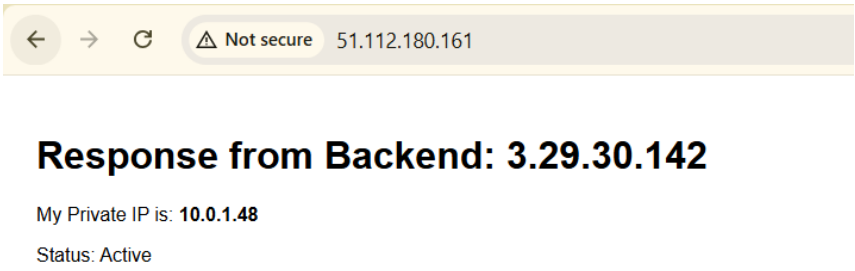
My Private IP is: **10.0.1.23**

Status: Active

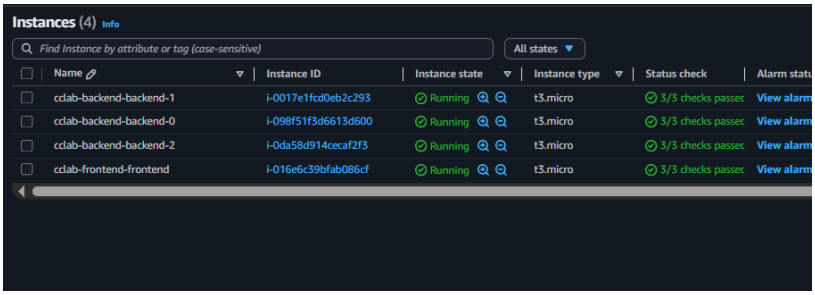
- **Stop httpd service on both Primary Backend Servers:**

```
@Urwa012 →/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $ ssh -iMyLabKey.pem ec2-user@3.29.139.95
     #_
     ~\_  ####_        Amazon Linux 2023
    ~~  \_#####\
    ~~     \###|
    ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
     ~~       V~' '->
      ~~~         /
        ~~._.   _/
           _/ _/
         _/m/'
Last login: Wed Jan 21 20:44:40 2026 from 20.192.21.49
[ec2-user@ip-10-0-1-23 ~]$ sudo systemctl stop httpd
[ec2-user@ip-10-0-1-23 ~]$ exit
logout
Connection to 3.29.139.95 closed.
@Urwa012 →/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $ ssh -iMyLabKey.pem ec2-user@3.28.45.202
     #_
     ~\_  ####_        Amazon Linux 2023
    ~~  \_#####\
    ~~     \###|
    ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
     ~~       V~' '->
      ~~~         /
        ~~._.   _/
           _/ _/
         _/m/'
Last login: Wed Jan 21 20:44:40 2026 from 20.192.21.49
[ec2-user@ip-10-0-1-218 ~]$ sudo systemctl stop httpd
[ec2-user@ip-10-0-1-218 ~]$ exit
logout
Connection to 3.28.45.202 closed.
@Urwa012 →/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $
```

- **Verifying the Backup Server:**



- **EC2 Instances:**



- **Cleanup:**

```
@Urwa012 ➜/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $ terraform destroy -auto-approve
aws_instance.backend[1]: Destroying... [id=i-015f5ea829fac18ef]
aws_instance.backend[0]: Destroying... [id=i-0c05447abd7ddb51d]
module.myapp-subnet.aws_route_table_association.a-rtb-subnet: Destruction complete after 1s
module.myapp-subnet.aws_route_table.myapp-route-table: Destroying... [id=rtb-092bca99cf5b5ef45]
module.myapp-subnet.aws_route_table.myapp-route-table: Destruction complete after 0s
module.myapp-subnet.aws_internet_gateway.myapp-igw: Destroying... [id=igw-0ad881d3b8e65173a]
aws_instance.backend[2]: Still destroying... [id=i-0f6dd3be65868e758, 00m10s elapsed]
aws_instance.frontend: Still destroying... [id=i-052a1c560ede05931, 00m10s elapsed]
aws_instance.backend[1]: Still destroying... [id=i-015f5ea829fac18ef, 00m10s elapsed]
aws_instance.backend[0]: Still destroying... [id=i-0c05447abd7ddb51d, 00m10s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp-igw: Still destroying... [id=igw-0ad881d3b8e65173a, 00m10s elapsed]
aws_instance.backend[2]: Still destroying... [id=i-0f6dd3be65868e758, 00m20s elapsed]
aws_instance.frontend: Still destroying... [id=i-052a1c560ede05931, 00m20s elapsed]
aws_instance.backend[1]: Still destroying... [id=i-015f5ea829fac18ef, 00m20s elapsed]
aws_instance.backend[0]: Still destroying... [id=i-0c05447abd7ddb51d, 00m20s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp-igw: Still destroying... [id=igw-0ad881d3b8e65173a, 00m20s elapsed]
aws_instance.backend[2]: Still destroying... [id=i-0f6dd3be65868e758, 00m30s elapsed]
aws_instance.backend[1]: Still destroying... [id=i-015f5ea829fac18ef, 00m30s elapsed]
aws_instance.backend[0]: Still destroying... [id=i-0c05447abd7ddb51d, 00m30s elapsed]
aws_instance.frontend: Still destroying... [id=i-052a1c560ede05931, 00m30s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp-igw: Still destroying... [id=igw-0ad881d3b8e65173a, 00m30s elapsed]
aws_instance.backend[2]: Still destroying... [id=i-0f6dd3be65868e758, 00m40s elapsed]
aws_instance.frontend: Still destroying... [id=i-052a1c560ede05931, 00m40s elapsed]
aws_instance.backend[0]: Still destroying... [id=i-0c05447abd7ddb51d, 00m40s elapsed]
aws_instance.backend[1]: Still destroying... [id=i-015f5ea829fac18ef, 00m40s elapsed]
aws_instance.frontend: Destruction complete after 40s
aws_instance.backend[1]: Destruction complete after 40s
module.myapp-subnet.aws_internet_gateway.myapp-igw: Still destroying... [id=igw-0ad881d3b8e65173a, 00m40s elapsed]
aws_instance.backend[2]: Still destroying... [id=i-0f6dd3be65868e758, 00m50s elapsed]
aws_instance.backend[0]: Still destroying... [id=i-0c05447abd7ddb51d, 00m50s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp-igw: Still destroying... [id=igw-0ad881d3b8e65173a, 00m50s elapsed]
module.myapp-subnet.aws_internet_gateway.myapp-igw: Destruction complete after 58s
aws_instance.backend[2]: Still destroying... [id=i-0f6dd3be65868e758, 01m00s elapsed]
aws_instance.backend[0]: Still destroying... [id=i-0c05447abd7ddb51d, 01m00s elapsed]
aws_instance.backend[0]: Destruction complete after 1m1s
aws_instance.backend[2]: Destruction complete after 1m1s
aws_key_pair.ssh-key: Destroying... [id=server-key]
module.myapp-subnet.aws_subnet.myapp-subnet-1: Destroying... [id=subnet-04557c38af7bbca43]
aws_security_group.myapp-sg: Destroying... [id=sg-0d9d0cace6512b197]
aws_key_pair.ssh-key: Destruction complete after 0s
module.myapp-subnet.aws_subnet.myapp-subnet-1: Destruction complete after 0s
aws_security_group.myapp-sg: Destruction complete after 0s
module.myapp-subnet.aws_vpc.myapp-vpc: Destroying... [id=vpc-08b134a832fba08cc]
module.myapp-subnet.aws_vpc.myapp-vpc: Destruction complete after 1s

Destroy complete! Resources: 13 destroyed.
@Urwa012 ➜/workspaces/cc-urwazahra-2023-BSE-068/lab_project (main) $
```