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| Semester | T.E. Semester V – Information Technology |
| Subject | Advance DevOps Lab |
| Subject Professor In-charge | Prof. Indu Anoop |
| Laboratory | (Leave blank for now) |

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| Student Name | Khot Mohammed Siddique | |
| Roll Number | 20101A0048 | |
| Grade and Subject Teacher's Signature | | |

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| Experiment | 6 | |
| Problem Statement | To build, change, destroy AWS/GCP/ Microsoft Azure/DigitalOcean infrastructure using terraform | |
| Resources / Apparatus Required | Hardware: Computer System | Software: Web Browser |
| Details | **Terraform**<br><br>Terraform is an infrastructure as code (IaC) tool that allows you to build, change, and version infrastructure safely and efficiently. This includes low-level components such as compute instances, storage, and networking, as well as high-level components such as DNS entries, SaaS features, etc. Terraform can manage both existing service providers and custom in-house solutions.<br><br>**Key Features**<br><br>**Infrastructure as Code**:<br><br>You describe your infrastructure using Terraform's high-level configuration language in human-readable, declarative configuration files. This allows you to create a blueprint that you can version, share, and reuse. | |

**Resource Graph**

Terraform builds a resource graph and creates or modifies non-dependent resources in parallel. This allows Terraform to build resources as efficiently as possible and gives you greater insight into your infrastructure.

**Change Automation**

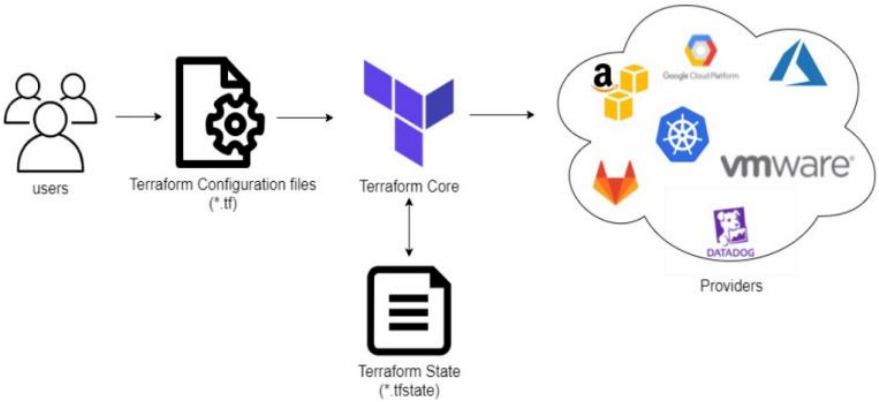
Terraform can apply complex changesets to your infrastructure with minimal human interaction. When you update configuration files, Terraform determines what changed and creates incremental execution plans that respect dependencies.

**How does Terraform work?**

Terraform works with two major components:

one is the **terraform core**: it takes the terraform configuration which is being provided by the user and then takes the terraform state which is managed by terraform itself. As such, this gets fed into the core that is responsible for figuring out what is that graph of our different resources for example how these different pieces relate to each other or what needs to be created/updated/destroyed, it does all the essential lifecycle management.

On the backside, terraform supports many different **providers**, such as: cloud providers (AWS,GCP,AZURE) and they also could be on-premise infrastructure (VMware, OpenStack.) But this support is not restricted or limited only to Infrastructure As A Service , terraform can also manage higher level like Platform As A Service(Kubernetes, Lambdas..)or even Software As A Service (DataDog, GitHub..)




All of these are important pieces of the infrastructure, they are all part of the logical end-to-end delivery.

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| | Terraform has over a hundred providers for different technologies, and each provider gives terraform users access to their resources. It also gives you the ability to create infrastructure at different levels.<br><br>**Terraform Workflow:**<br><br>These are the list of steps we are going to perform<br>**1.** Create a file and save it as **main.tf**<br>2. Execute the command **terraform init** to initialize<br>3. Execute the command **terraform plan** to check what change would be made. (Should always do it)<br>4. If you are happy with the changes it is claiming to make, then execute **terraform apply** to commit and start the build |
| Code | **Pre-requisite:** An AMI of ubuntu 20 system with terraform installed.<br><br>Steps to build, change, destroy AWS infrastructure using Terraform<br><br>**Step: 1 : To BUILD an AWS infrastructure**<br><br>1.1 Write your **main.tf** file<br><br>terraform -help or<br>terraform --help<br>terraform validate se syntax validate hota hai<br><br>Use command to create a file and edit it<br>**touch main.tf**<br>**nano main.tf**<br>Edit to following contents<br><br>Ek iam user bana aur usko administrator access de but yaha usko custom password mat de credential type me access key select kar add user me ..password select mat kar..to ek baar user ko add karega na to waha tujhe us user ka access key id aur secret access key milega..ab is detail ko main.tf file me daalde<br><br>Ami id ubuntu 20 ec2 ke side me dikh jaegi<br><br>Ctrl + s se save aur ctrl X se exit |

Terraform ek state file banata hai aur agar usko dekhna hai to ls use kar
but uska syntax samjhne jaisa nhi hota to terraform show ka use kar sakta hai

```
provider "aws" {
  region     = "us-east-1"
  access_key = "AKIAZ4QG6PDPWA5P3BSA"
  secret_key = "1iJIVyIP+B4geRZL0q3BCfRKqd2yzb+pg4zZfXpe"
}


resource "aws_instance" "terraform-VIT"{
      ami="ami-0149b2da6ceec4bb0"
      instance_type="t2.micro"
}
```

Replace the access key and secret key values of the new IAM user which needs to be created in the region mentioned. Also replace the ami value to the virtual system's ami value [ From launch instances portal]

1.2 Initialize the terraform

terraform fmt se indentation ko theek kar sakta hai
terraform fmt main.tf

Write the command
**terraform init**

```
Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v4.33.0...
- Installed hashicorp/aws v4.33.0 (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.
root@ip-172-31-81-193:/home/ubuntu# terraform plan -lock=false

Terraform used the selected providers to generate the following execution plan.
Resource actions are indicated with the following symbols:
```

1.3 Execute plan phase to understand what changes to be done.

**terraform plan -lock=false**

```
root@ip-172-31-28-218:/opt# terraform plan -lock=false

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # aws_instance.terraform-VIT will be created
  + resource "aws_instance" "terraform-VIT" {
      + ami                                  = "ami-0149b2da6ceec4bb0"
```

```
Plan: 1 to add, 0 to change, 0 to destroy.
```

1.4 Apply the actions which were planned in apply phase

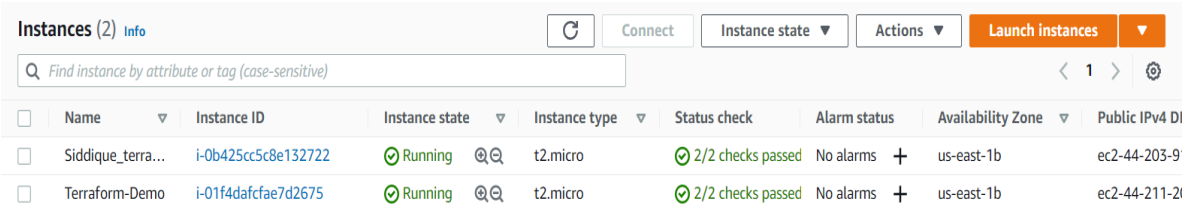
**terraform apply -lock=false**

```
root@ip-172-31-28-218:/opt# terraform apply -lock=false

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # aws_instance.terraform-VIT will be created
  + resource "aws_instance" "terraform-VIT" {
      + ami                                  = "ami-0149b2da6ceec4bb0"
      }

Plan: 1 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

aws_instance.terraform-VIT: Creating...
aws_instance.terraform-VIT: Still creating... [10s elapsed]
aws_instance.terraform-VIT: Creation complete after 12s [id=i-0b425cc5c8e132722]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
root@ip-172-31-81-193:/home/ubuntu#
```

Type 'yes' to confirm to apply.

**Step 2: Confirm the infrastructure created**

Go to EC2 console to check if a new instance is created as per the code written in main.tf file.




**Step 3: CHANGE the infrastructure created using terraform**

Modify main.tf to include instance name.

**Main.tf modify kar change demonstrate karne ke liye**
**Ek baar main.tf me changes kiya na uske baad phir se sab steps kar Init,apply,plan who sab**

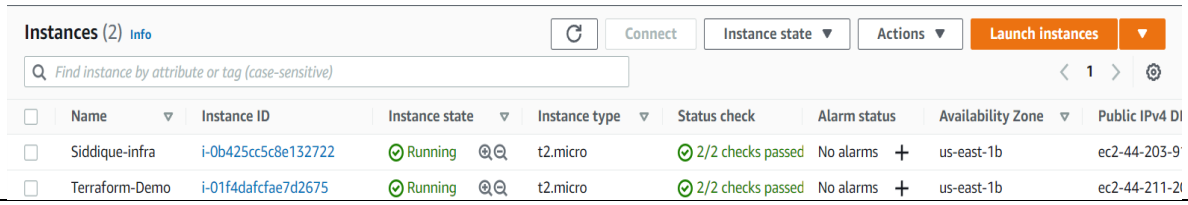
**Uske baad is code ke hisaab se automatic instance me name ajaega jo tu tags me daalega**

```
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
root@ip-172-31-81-193:/home/ubuntu# cat >main.tf
provider "aws" {
  region     = "us-east-1"
  access_key = "AKIAZ4QG6PDPWA5P3BSA"
  secret_key = "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"
}


resource "aws_instance" "terraform-VIT"{
        ami="ami-0149b2da6ceec4bb0"
        instance_type="t2.micro"
        tags={
                Name="Siddique-infra"
        }
}
^C
root@ip-172-31-81-193:/home/ubuntu#
```

Repeat steps from 1.2.

```
Terraform will perform the following actions:

  # aws_instance.terraform-VIT will be updated in-place
  ~ resource "aws_instance" "terraform-VIT" {
        id                                   = "i-0b425cc5c8e132722"
      ~ tags                                 = {
          ~ "Name" = "Siddique_terraform" -> "Siddique-infra"
        }
      ~ tags_all                             = {
          ~ "Name" = "Siddique_terraform" -> "Siddique-infra"
        }
        # (29 unchanged attributes hidden)

        # (7 unchanged blocks hidden)
    }

Plan: 0 to add, 1 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

aws_instance.terraform-VIT: Modifying... [id=i-0b425cc5c8e132722]
aws_instance.terraform-VIT: Modifications complete after 1s [id=i-0b425cc5c8e132722]

Apply complete! Resources: 0 added, 1 changed, 0 destroyed.
root@ip-172-31-81-193:/home/ubuntu#
```

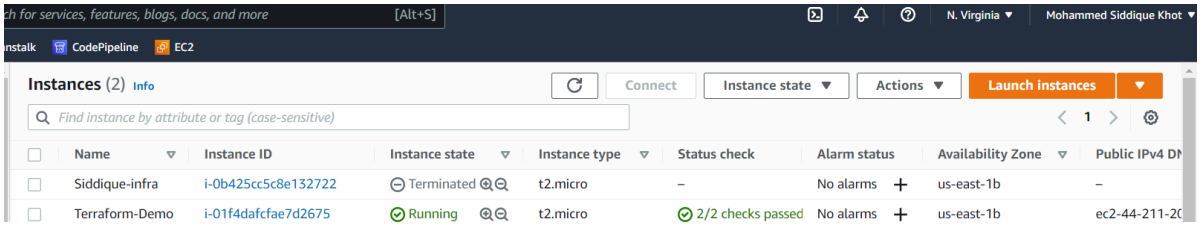


Resource successfully changed to include instance name.

**Step 4: DESTROY the built infrastructure**

**terraform destroy**

```
Plan: 0 to add, 0 to change, 1 to destroy.

Do you really want to destroy all resources?
  Terraform will destroy all your managed infrastructure, as shown above.
  There is no undo. Only 'yes' will be accepted to confirm.

  Enter a value: yes

aws_instance.terraform-VIT: Destroying... [id=i-0b425cc5c8e132722]
aws_instance.terraform-VIT: Still destroying... [id=i-0b425cc5c8e132722, 10s elapsed]
aws_instance.terraform-VIT: Still destroying... [id=i-0b425cc5c8e132722, 20s elapsed]
aws_instance.terraform-VIT: Destruction complete after 29s

Destroy complete! Resources: 1 destroyed.
root@ip-172-31-81-193:/home/ubuntu#
```

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| Conclusion | Successfully implemented through code how to build, change, destroy AWS infrastructure using terraform |