



HashiCorp

Terraform

How Terraform Works:

- Written in Golang
- Interfaces with the API of the “provider”
- Create
- Read
- Update
- Delete

```
resource "docker_image" "nodered_image" {  
  name = "nodered/node-red:latest"  
}
```

= *docker pull nodered/node-red:latest*

Core Terraform Workflow:

```
resource "docker_image" "image_id" {  
  name = "nginx"  
}  
  
resource "docker_container" "container_id" {  
  name = "nginx"  
  image = docker_image.image_id.latest  
  ports {  
    internal = "80"  
    external = "8080"  
  }  
}
```

Write



```
# docker_image.image_id will be created  
+ resource "docker_image" "image_id" {  
  + id      = (known after apply)  
  + latest  = (known after apply)  
  + name    = "nginx"  
}
```

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

Plan



```
docker_image.image_id: Creating...  
docker_image.image_id: Creation complete after 5s [id=sha256:f3  
docker_container.container_id: Creating...  
docker_container.container_id: Creation complete after 1s [id=0  
  
Apply complete! Resources: 2 added, 0 changed, 0 destroyed.
```

Apply

Terraform State

- Stores information about the current environment
- Is created based on the configuration files and any changes are committed to the infrastructure via the API
- Only knows about resources created by it. If those resources are missing, it can replace, but cannot see other resources.

```
1  {
2    "version": 4,
3    "terraform_version": "0.14.7",
4    "serial": 1,
5    "lineage": "a23576b6-f870-e0e5-31d1-b41736e86628",
6    "outputs": {},
7    "resources": [
8      {
9        "mode": "managed",
10       "type": "docker_image",
11       "name": "nodered_image",
12       "provider": "provider[\"registry.terraform.io/terraform-providers/docker\"]",
13       "instances": [
14         {
15           "schema_version": 0,
16           "attributes": {
17             "id": "sha256:c060f9cb7fd5a4375549f954c0bfac42107094f879a33ab27118749206c42bb0nodered/node-red:latest",
18             "keep_locally": null,
19             "latest": "sha256:c060f9cb7fd5a4375549f954c0bfac42107094f879a33ab27118749206c42bb0",
20             "name": "nodered/node-red:latest",
21             "pull_trigger": null,
22             "pull_triggers": null
23           },
24           "sensitive_attributes": [],
25           "private": "bnVsbA=="
26         }
27       ]
28     }
29   ]
30 }
31
```

IaC Workflow:

```
resource "docker_image" "image_id" {  
  name = "nginx"  
}  
  
resource "docker_container" "container_id" {  
  name = "nginx"  
  image = docker_image.image_id.latest  
  ports {  
    internal = "80"  
    external = "8080"  
  }  
}
```

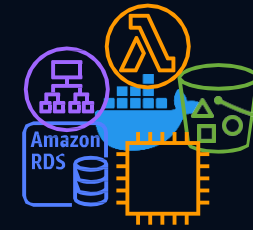
Terraform Code



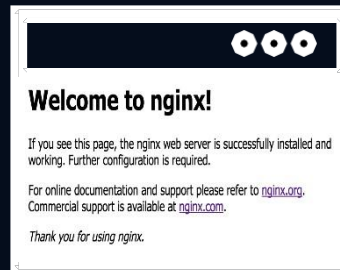
Git Repository



CI/CD Tools



Infrastructure



Application

Idempotence

- Can run code as many times as you like while still maintaining the resources specified.
- One reason the “local-exec” provisioner isn’t recommended.
- Isn’t always true. You should ALWAYS verify your plan before applying infrastructure in production.



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Declarative vs. Procedural

Declarative

- WHAT do you want the final deployment to look like?
- "I want a VPC and 2 EC2 Instances that are connected to an IGW for internet access"
- Requires "state"
- Process is more abstracted
- "Idempotent"
- Primary Terraform operation

Procedural (Imperative)

- HOW do you want to deploy resources?
- "Create the VPC first, then create the IGW, then create the EC2 instances"
- Not dependent on state
- More control over the process
- Running an operation twice will still perform the operation, regardless of its previous execution or the damage it can cause
- Terraform can perform Imperative tasks, but it is best practice to keep the code as declarative as possible

Terraform vs. Azure Tooling



- Open source
- HCL Syntax
- Vendor Neutral
- Requires state management and storage
- Requires resources to run
- Requires logging infrastructure
- Breaking changes are generally more likely

CloudFormation

- Closed source
- JSON/YAML Syntax
- Only useful with Azure resources
- State is managed by Azure

The Docker Provider

Do Lab 6

<https://registry.terraform.io/providers/kreuzwerker/docker/latest/docs>

Terraform Init Deeper Dive

<https://developer.hashicorp.com/terraform/cli/commands/init>

Terraform Dependency Lock

<https://developer.hashicorp.com/terraform/language/files/dependency-lock>

Terraform Apply

<https://registry.terraform.io/providers/kreuzwerker/docker/latest/docs/resources/image.html>

Plan and Apply Deeper Dive

<https://developer.hashicorp.com/terraform/cli/commands/apply>

Referencing other Resources

<https://developer.hashicorp.com/terraform/language/expressions#references-to-resource-attributes>