
KODEKLOUD

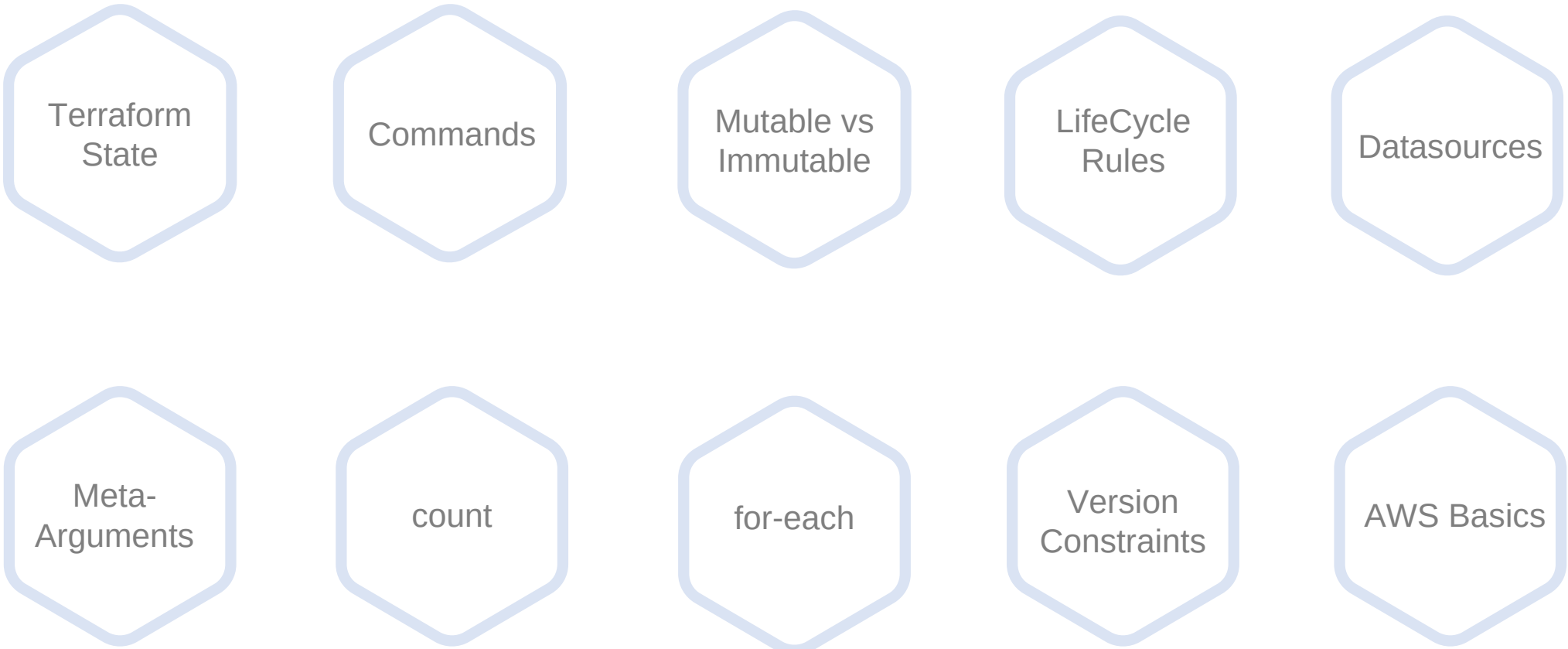
Vijin Palazhi

@vijinpalazhi

Objectives

- Introduction to IaC
- Types of IaC Tools
- Why Terraform?
- HCL Basics
- Provision, Update and Destory
- Providers
- Input Variables
- Output Variables
- Resource Attributes
- Resource Dependencies

Objectives



Objectives

- Programmatic Access
- IAM Basics
- IAM with Terraform
- Introduction to S3
- S3 with Terraform
- Introduction to DynanoDB
- DynamoDB with Terraform

Objectives

- Remote State
- State Locking
- Remote Backend with S3
- State Commands
- Introduction to EC2
- AWS EC2 With Terraform
- Provisioners

Objectives

- Terraform Taints
- Debugging
- Terraform Import
- Modules
- Functions
- Conditional Expressions
- Workspaces
- Terraform Cloud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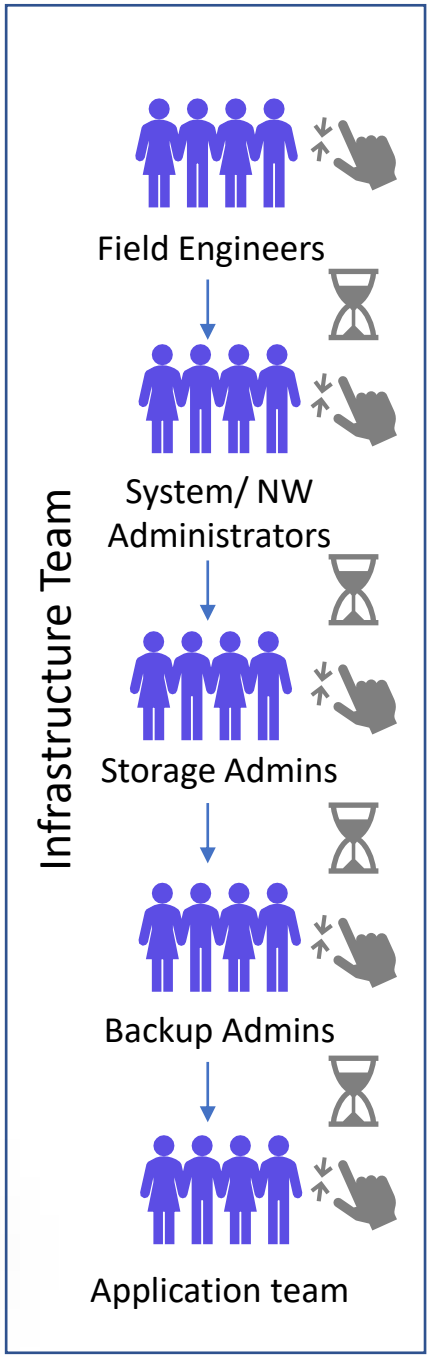
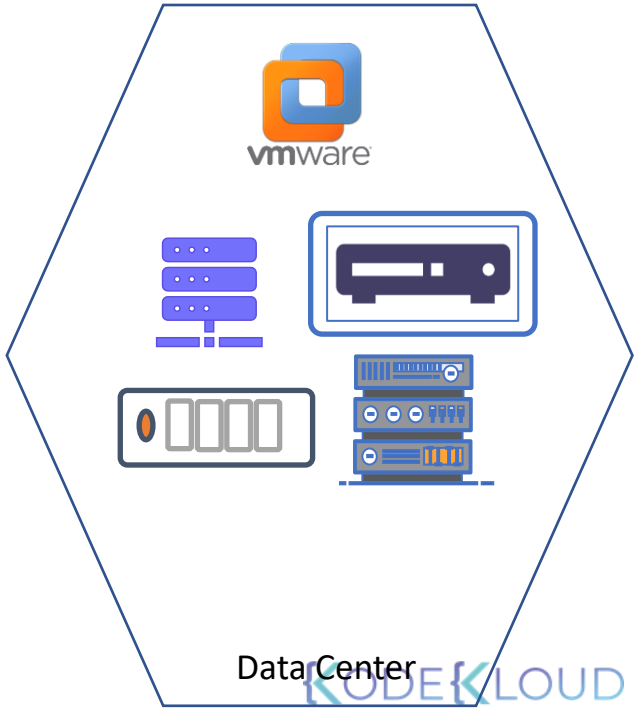
Traditional IT & Challenges

- Slow Deployment
- Expensive
- Limited Automation
- Human Error
- Inconsistency
- Wasted Resources





aws Services Resource Groups

1. Choose AMI | 2. Choose Instance Type | 3. Configure Instance | 4. Add Storage | 5. Add Tags | 6. Configure Security Group | 7. Review

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

AMI Details

Amazon Linux 2 AMI (HVM), SSD Volume Type - ami-0b1e2eeb33ce3d66f

Free tier eligible

Amazon Linux 2 comes with five years support. It provides Linux kernel 4.14 tuned for optimal performance on Amazon EC2, systemd 219, GCC 7.3, Glibc 2.26, Binutils 2.29.1, and the latest software packages through extra

Root Device Type: ebs Virtualization type: hvm

Instance Type

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

Security group name launch-wizard-1
Description launch-wizard-1 created 2020-07-09T15:48:36.426-04:00

Type	Protocol	Port Range	Source	Description

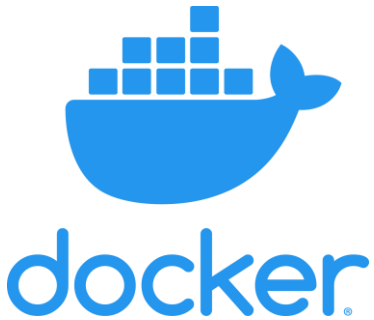
This security group has no rules

Instance Details

Number of instances 1
Network vpc-fe3baa86
Subnet No preference (default subnet in any Availability Zone)

Purchasing option On demand

Infrastructure as Code

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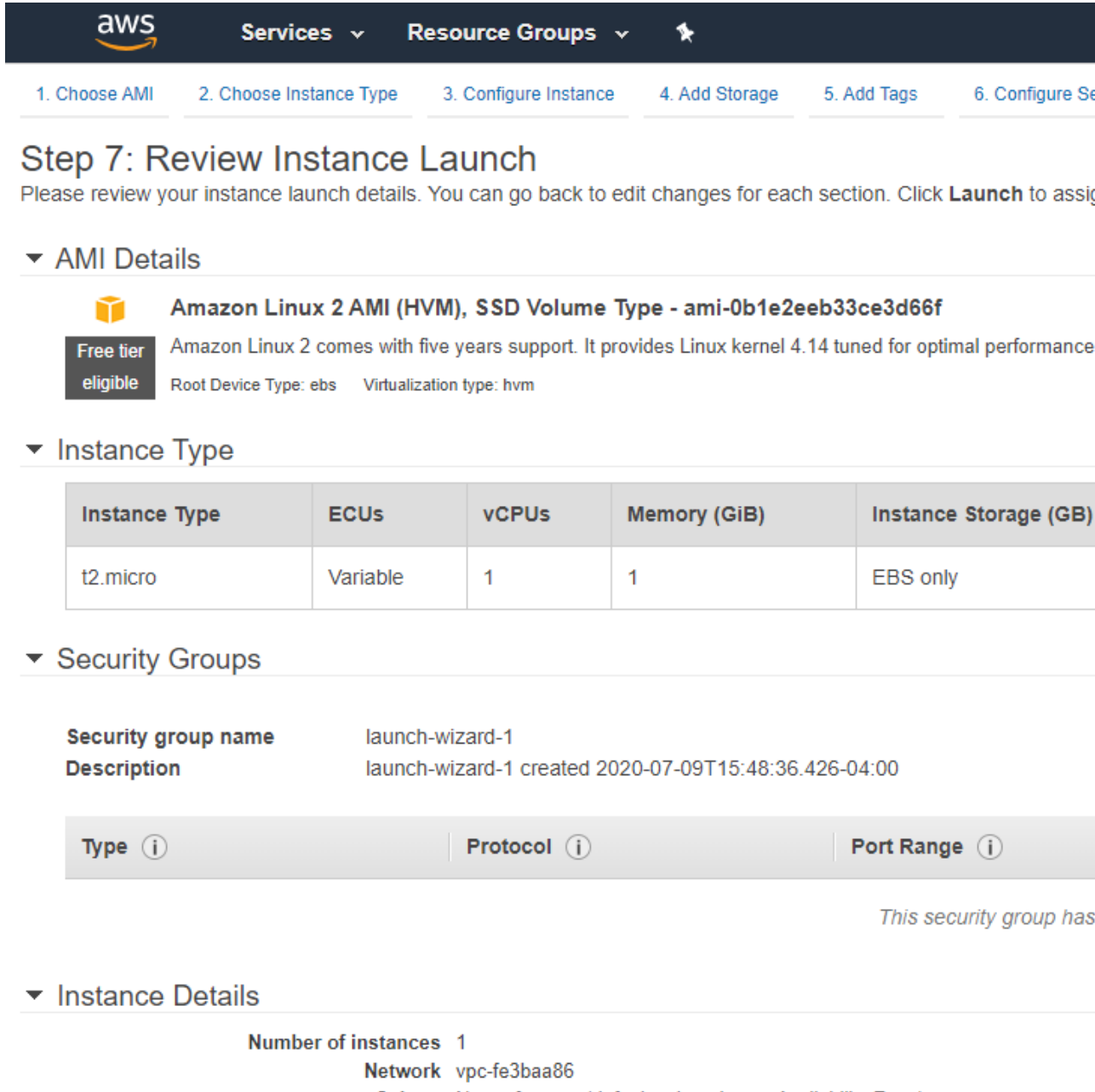
Infrastructure as Code

Infrastructure as Code

ec2.sh

```
#!/bin/bash

IP_ADDRESS="10.2.2.1"

EC2_INSTANCE=$(ec2-run-instances --instance-type
t2.micro ami-0edab43b6fa892279)

INSTANCE=$(echo ${EC2_INSTANCE} | sed 's/*INSTANCE //'
| sed 's/ .*//')

# Wait for instance to be ready
while ! ec2-describe-instances $INSTANCE | grep -q
"running"
do
  echo Waiting for $INSTANCE is to be ready...
done

# Check if instance is not provisioned and exit
if [ ! $(ec2-describe-instances $INSTANCE | grep -q
"running") ]; then
  echo Instance $INSTANCE is stopped.
  exit
fi

ec2-associate-address $IP_ADDRESS -i $INSTANCE

echo Instance $INSTANCE was created successfully!!!
```



Infrastructure as Code

ec2.sh

```
#!/bin/bash

IP_ADDRESS="10.2.2.1"

EC2_INSTANCE=$(ec2-run-instances --instance-type
t2.micro ami-0edab43b6fa892279)

INSTANCE=$(echo ${EC2_INSTANCE} | sed 's/*INSTANCE //'
| sed 's/ .*//')

# Wait for instance to be ready
while ! ec2-describe-instances $INSTANCE | grep -q
"running"
do
  echo Waiting for $INSTANCE is to be ready...
done

# Check if instance is not provisioned and exit
if [ ! $(ec2-describe-instances $INSTANCE | grep -q
"running") ]; then
  echo Instance $INSTANCE is stopped.
  exit
fi

ec2-associate-address $IP_ADDRESS -i $INSTANCE

echo Instance $INSTANCE was created successfully!!!
```

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
}
```

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Infrastructure as Code

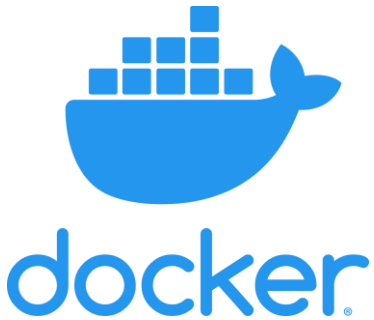
ec2.yaml

```yaml
- amazon.aws.ec2:
    key_name: mykey
    instance_type: t2.micro
    image: ami-123456
    wait: yes
    group: webserver
    count: 3
    vpc_subnet_id: subnet-29e63245
    assign_public_ip: yes
```

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
}
```

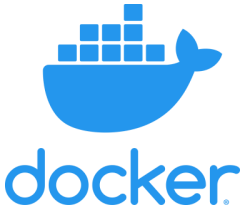
Types of IAC Tools



Types of IAC Tools

Configuration Management

Server Templating



HashiCorp
Vagrant

Provisioning Tools

CloudFormation

Types of IAC Tools

Configuration Management

Designed to Install and Manage Software

Maintains Standard Structure

Version Control

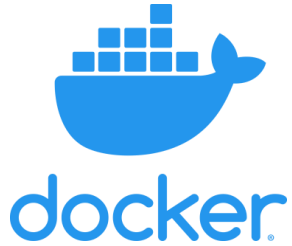
Idempotent

Server Templating Tools

Pre Installed Software and Dependencies

Virtual Machine or Docker Images

Immutable Infrastructure



Provisioning Tools

Deploy Immutable Infrastructure resources

Servers, Databases, Network Components etc.

Multiple Providers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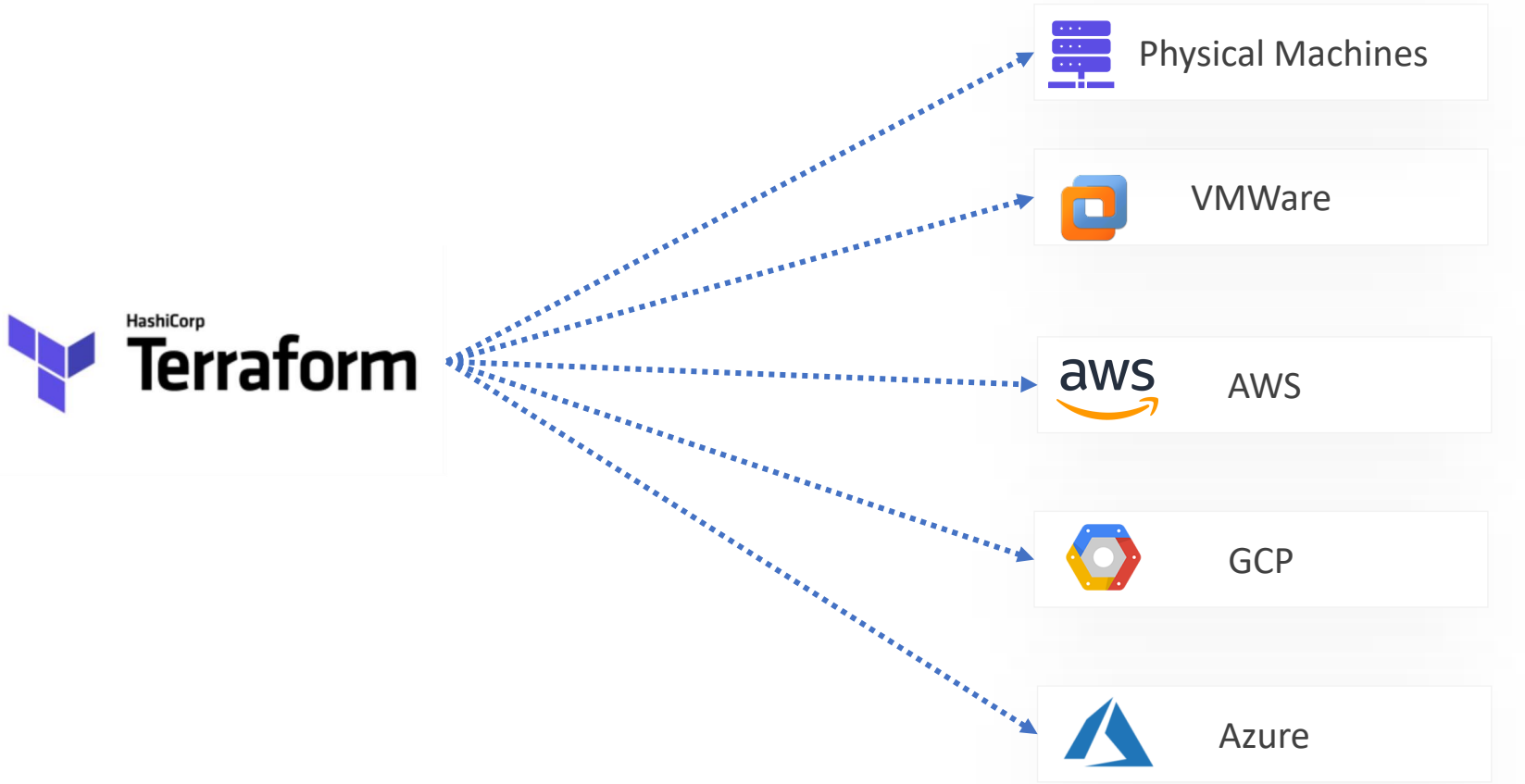
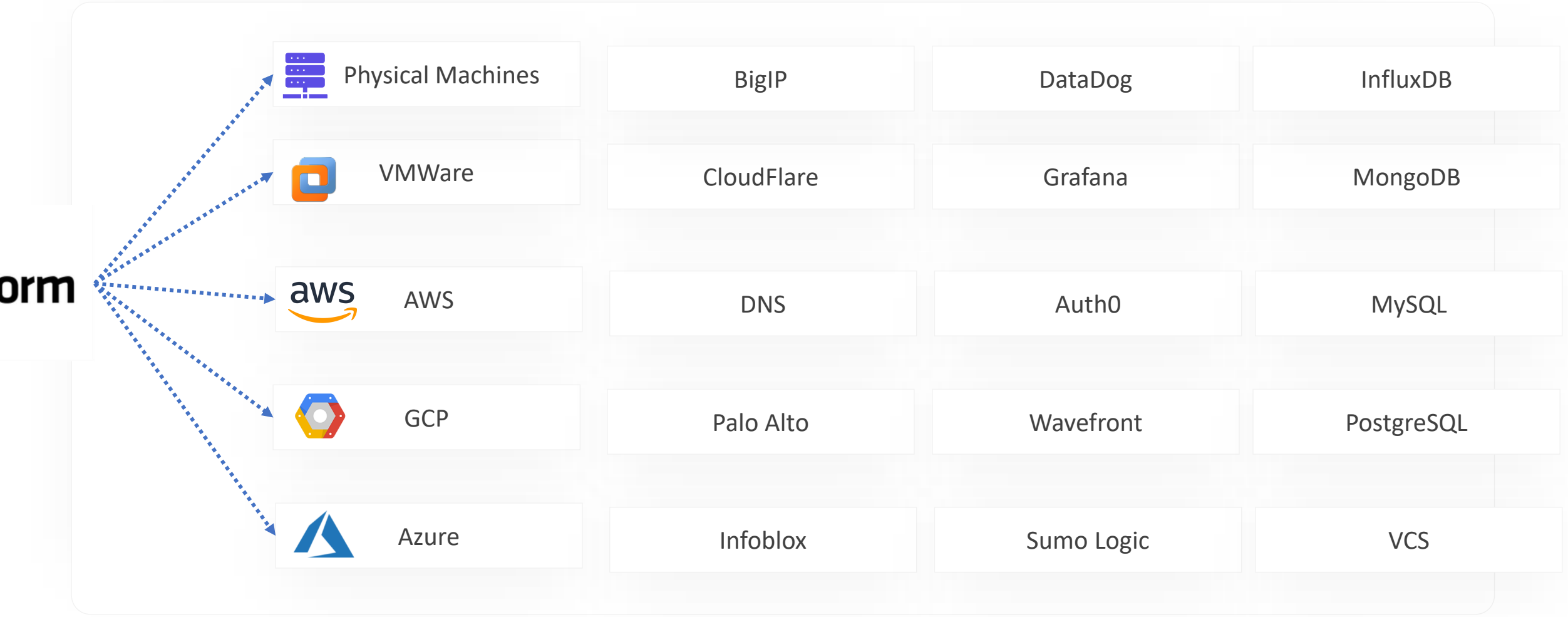
Terraform

Why Terraform?



Providers



HashiCorp Configuration Language

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
}

resource "aws_s3_bucket" "finance" {
    bucket = "finanace-21092020"
    tags   = {
        Description = "Finance and Payroll"
    }
}
 resource "aws_iam_user" "admin-user" {
     name = "lucy"
     tags = {
       Description = "Team Leader"
     }
 }
```

Declarative

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
}

resource "aws_s3_bucket" "finance" {
    bucket = "finanace-21092020"
    tags   = {
        Description = "Finance and Payroll"
    }
}
 resource "aws_iam_user" "admin-user" {
     name = "lucy"
     tags = {
       Description = "Team Leader"
     }
 }
```

Init

Plan

Apply

Real World Infrastructure

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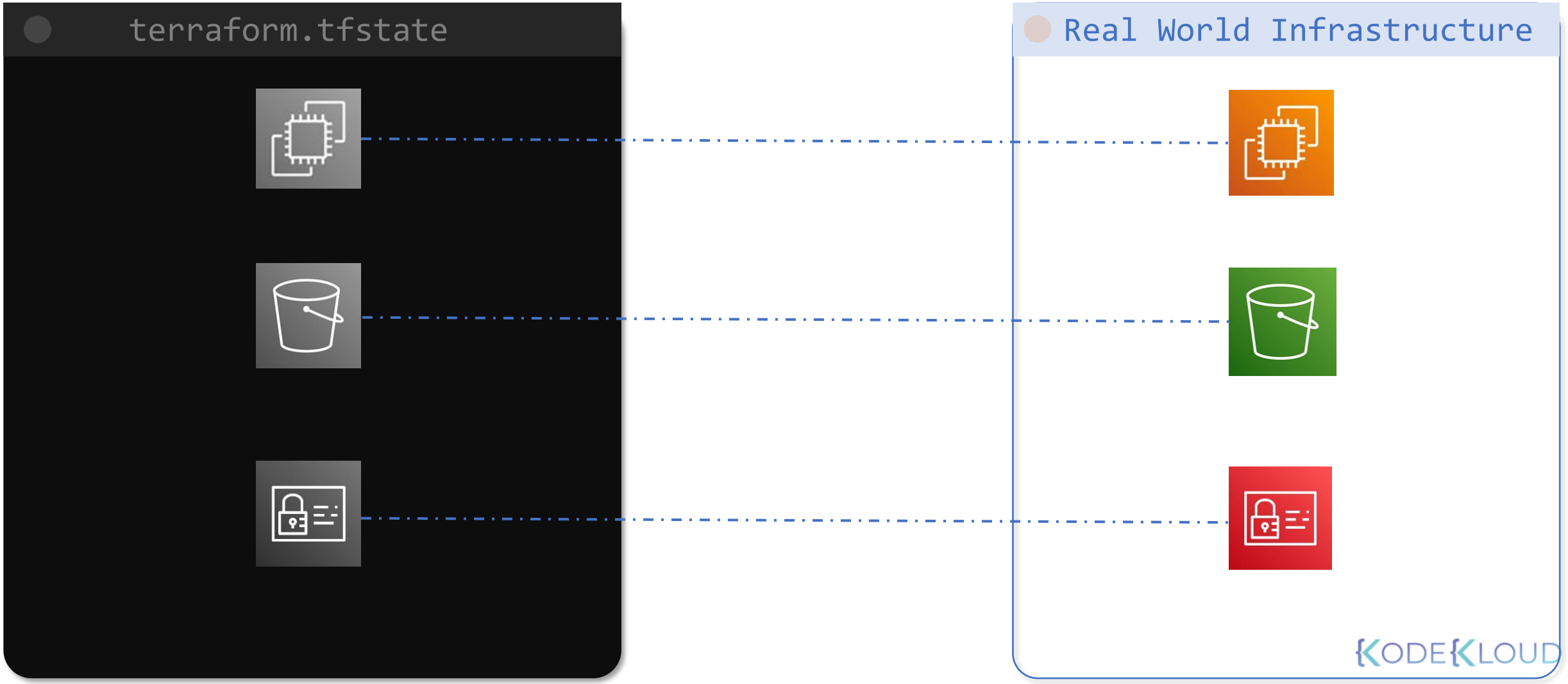
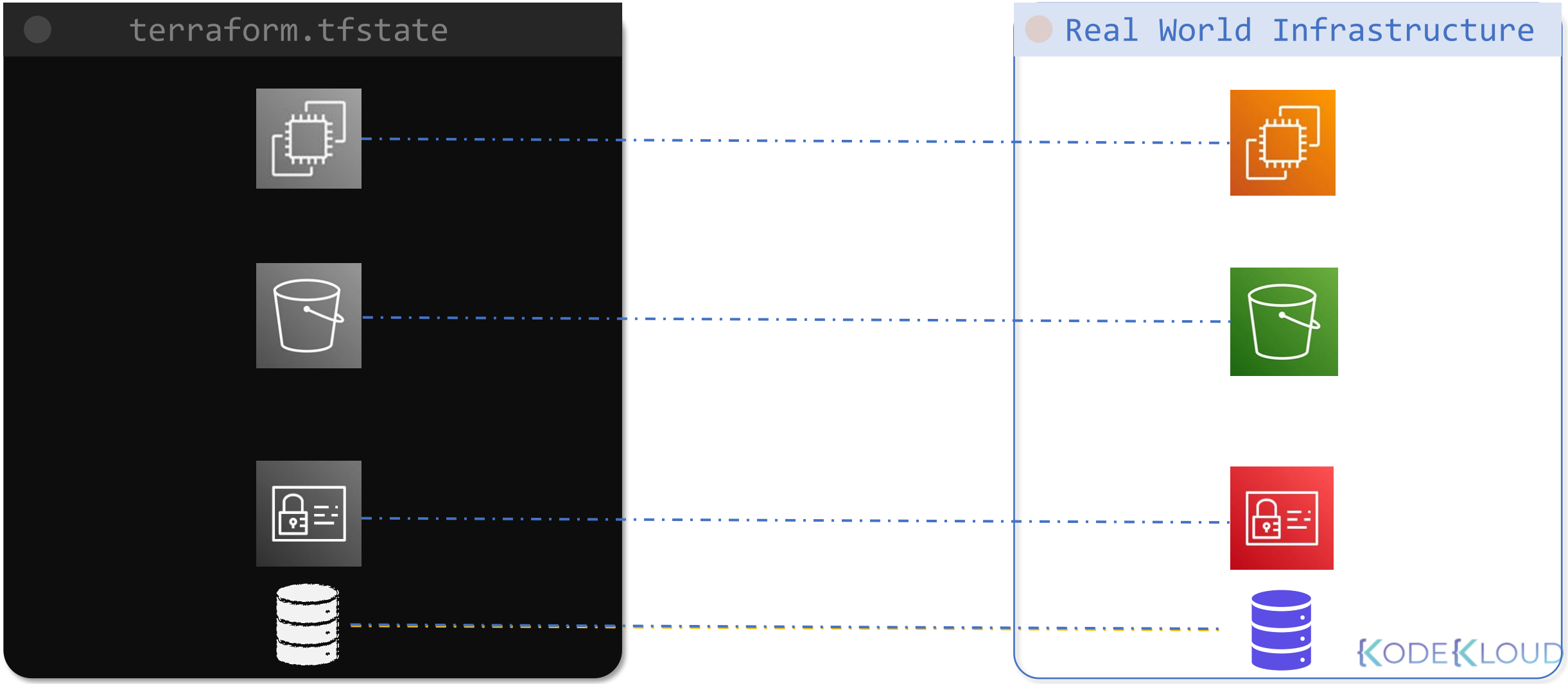
Resource

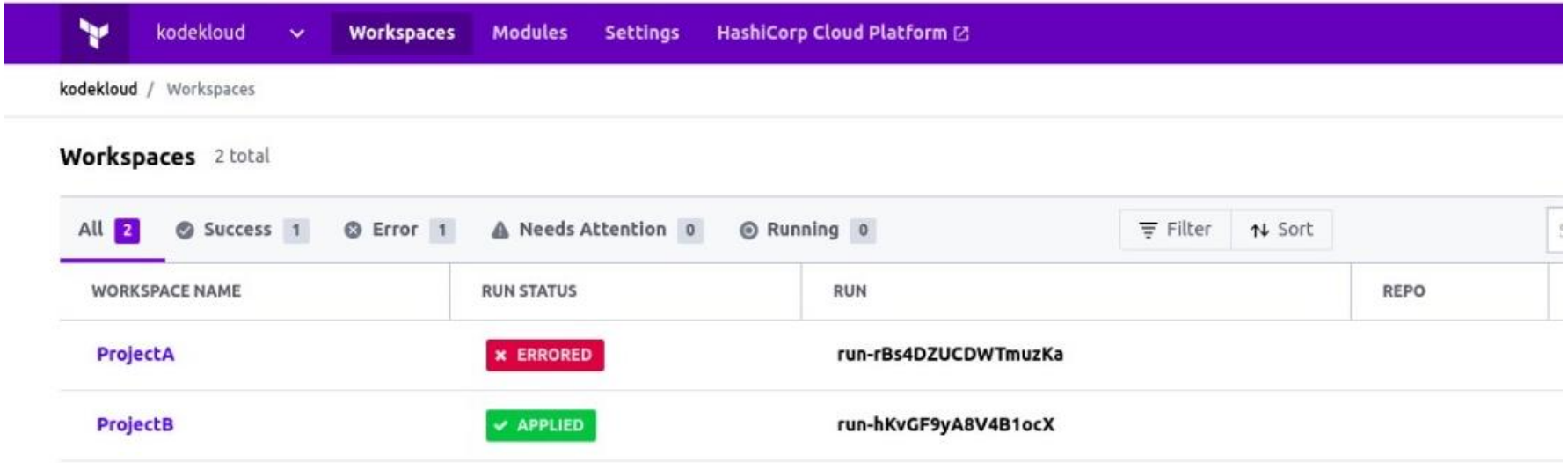
Terraform State



Terraform Import



Terraform Cloud and Terraform Enterprise

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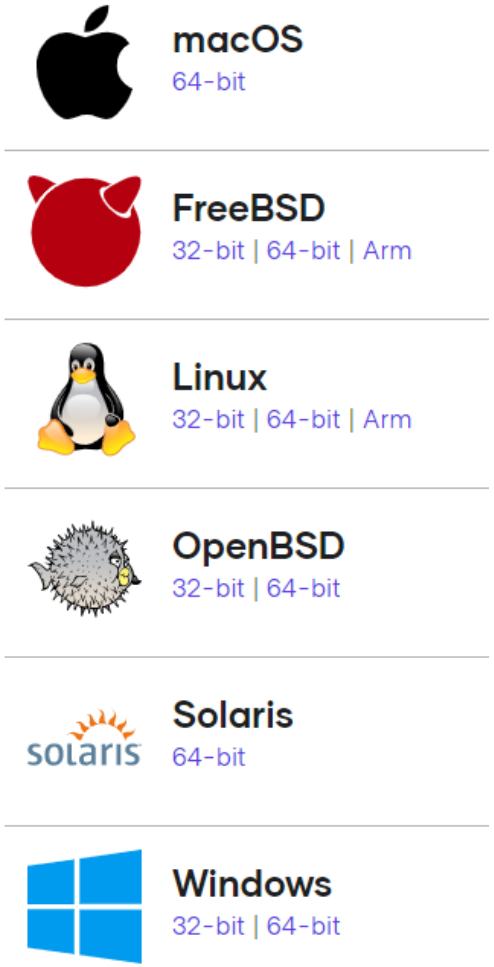
Installing Terraform

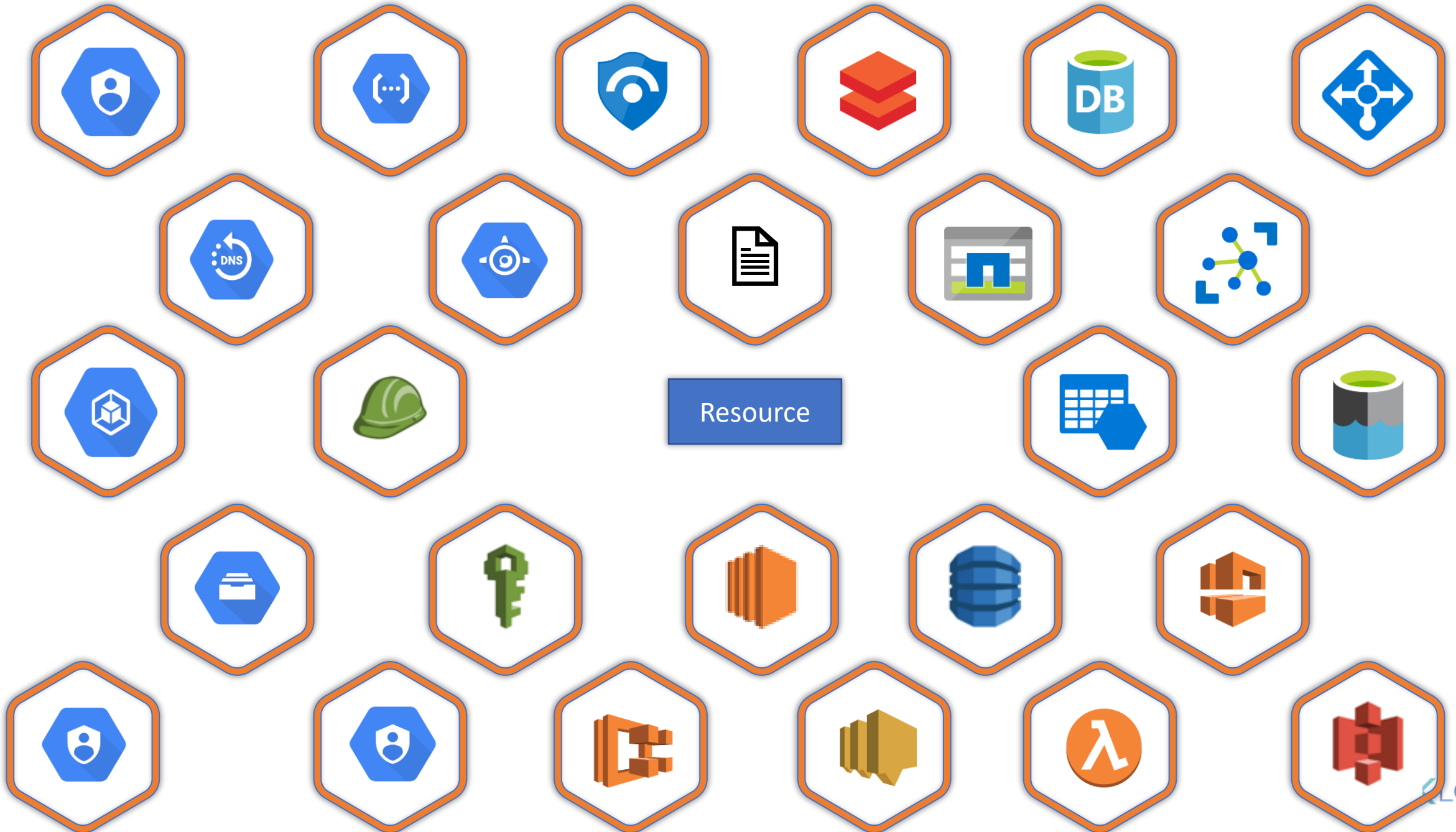
```
>_

$ wget https://releases.hashicorp.com/terraform/0.13.0/terraform_0.13.0_linux_amd64.zip
$ unzip terraform_0.13.0_linux_amd64.zip
$ mv terraform /usr/local/bin
$ terraform version
  Terraform v0.13.0
```



HCL – Declarative Language

aws.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-0c2f25c1f66a1ff4d"
    instance_type = "t2.micro"
}
```


DB
DNS
Resource

Resource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HCL Basics

```
>_
$ mkdir /root/terraform-local-file
$ cd /root/terraform-local-file
```

local.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content = "We love pets!"
}
```


local=provide
r
file=resource
Block Name
Resource Type
Resource Name
FILENAME
CONTENT
local.tf
resource "local_file" "pet" {
filename = "/root/pets.txt"
content = "We love pets!"
}
Arguments

aws-ec2.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-0c2f25c1f66a1ff4d"
    instance_type = "t2.micro"
}
```

aws-s3.tf

```
resource "aws_s3_bucket" "data" {
    bucket = "webserver-bucket-org-2207"
    acl    = "private"
 }
```

local.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content = "We love pets!"
}
```

local.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content = "We love pets!"
}
```

>_

```
$ terraform init
Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/local...
- Installing hashicorp/local v1.4.0...
- Installed hashicorp/local v1.4.0 (signed by HashiCorp)

The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, we recommend adding version constraints in a required_providers block
in your configuration, with the constraint strings suggested below.

* hashicorp/local: version = "~> 1.4.0"

Terraform has been successfully initialized!
```

```
$ terraform plan
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.


------------------------------------------------------------------------

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # local_file.pet will be created
  + resource "local_file" "pet" {
      + content              = "We love pets!"
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
      + id                   = (known after apply)
    }

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

------------------------------------------------------------------------

Note: You didn't specify an "-out" parameter to save this plan, so
Terraform
can't guarantee that exactly these actions will be performed if
"terraform apply" is subsequently run.
```

```
$ terraform apply
An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # local_file.pet will be created
  + resource "local_file" "pet" {
      + content              = "We love pets!"
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
      + id                   = (known after apply)
    }

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

local_file.new_file: Creating...
local_file.new_file: Creation complete after 0s
[id=521c5c732c78cb42cc9513ecc7c0638c4a115b55]
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.

$ cat /root/pets.txt
We love pets!
```

```
$ terraform show
# local_file.pet:
resource "local_file" “pet" {
    content              = "We love pets!"
    directory_permission = "0777"
    file_permission      = "0777"
    filename             = "/root/pets.txt"
    id                   = "cba595b7d9f94ba1107a46f3f731912d95fb3d2c"
}
```

local=provide
r
file=resource

Resource Type

local.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content = "We love pets!"
}
```

https://registry.terraform.io/providers/hashicorp/local/latest/docs

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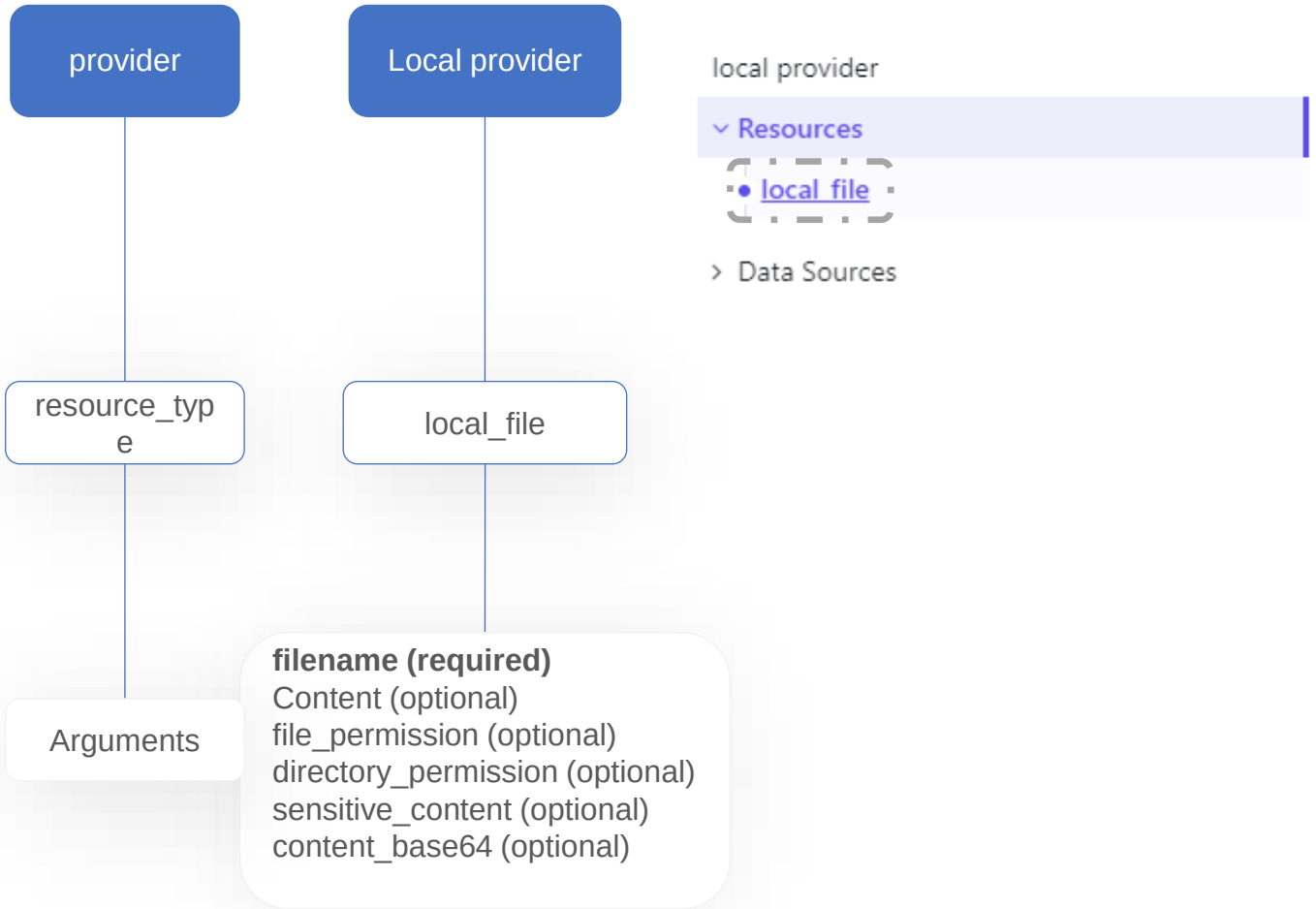

Argument Reference

The following arguments are supported:

- `content` - (Optional) The content of file to create. Conflicts with `sensiti` `content_base64` .
- `sensitive_content` - (Optional) The content of file to create. Will not be c Conflicts with `content` and `content_base64` .
- `content_base64` - (Optional) The base64 encoded content of the file to c when dealing with binary data. Conflicts with `content` and `sensitive_co`
- `filename` - (Required) The path of the file to create.
- `file_permission` - (Optional) The permission to set for the created file. E string. The default value is `"0777"` .
- `directory_permission` - (Optional) The permission to set for any directori Expects a string. The default value is `"0777"` .


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Update and Destroy Infrastructure

local.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
    file_permission = "0700"

}
```

```
$ terraform plan
local_file.pet: Refreshing state...
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]

------------------------------------------------------------------------
An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
-/+ destroy and then create replacement

Terraform will perform the following actions:

  # local_file.pet must be replaced
-/+ resource "local_file" "pet" {
        content              = "We love pets!"
        directory_permission = "0777"
      ~ file_permission      = "0777" -> "0700" # forces replacement
        filename             = "/root/pet.txt"
      ~ id                   =
"5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf" -> (known after apply)
    }

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

------------------------------------------------------------------------
Note: You didn't specify an "-out" parameter to save this plan, so
Terraform
can't guarantee that exactly these actions will be performed if
"terraform apply" is subsequently run.
```

```
$ ls -ltr /root/pets.txt
-rwx------  1 root root 30 Aug 17 23:20 pet.txt
```

```
$ terraform apply
# local_file.pet must be replaced
-/+ resource "local_file" "pet" {
        content              = "We love pets!"
        directory_permission = "0777"
      ~ file_permission      = "0777" -> "0700" # forces replacement
        filename             = "/root/pet.txt"
      ~ id                   =
"5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf" -> (known after apply)
    }

Plan: 1 to add, 0 to change, 1 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

local_file.pet: Destroying...
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]
local_file.pet: Destruction complete after 0s
local_file.pet: Creating...
local_file.pet: Creation complete after 0s
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]

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

```
$ terraform destroy
local_file.pet: Refreshing state...
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  - destroy

Terraform will perform the following actions:

  # local_file.pet will be destroyed
  - resource "local_file" "pet" {
      - content              = "My favorite pet is a gold fish" -> null
      - directory_permission = "0777" -> null
      - file_permission      = "0700" -> null
      - filename             = "/root/pet.txt" -> null
      - id                   = "5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf" -
> null
    }

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

local_file.pet: Destroying... [id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]
local_file.pet: Destruction complete after 0s

Destroy complete! Resources: 1 destroyed.
```


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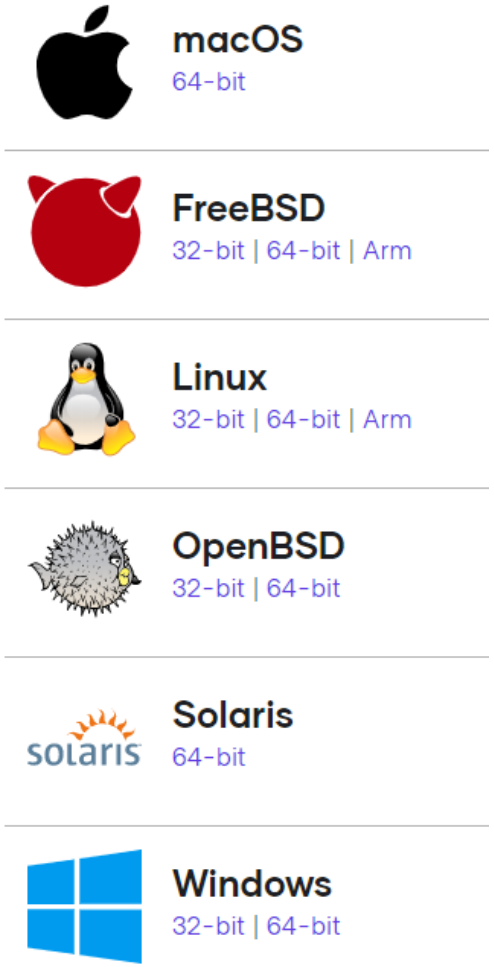
Installing Terraform

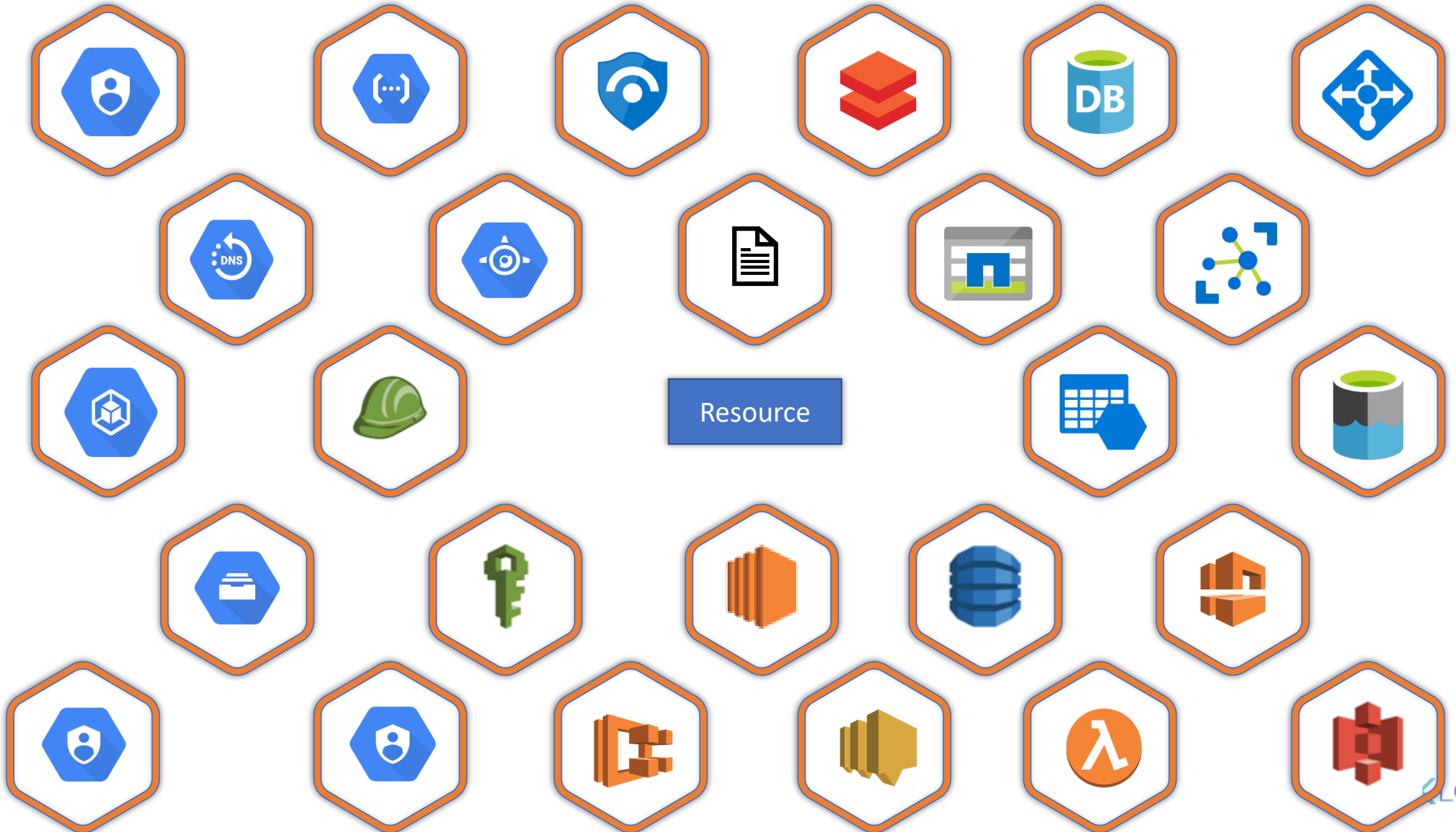
```
>_

$ wget https://releases.hashicorp.com/terraform/0.13.0/terraform_0.13.0_linux_amd64.zip
$ unzip terraform_0.13.0_linux_amd64.zip
$ mv terraform /usr/local/bin
$ terraform version
  Terraform v0.13.0
```



HCL – Declarative Language

aws.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-0c2f25c1f66a1ff4d"
    instance_type = "t2.micro"
}
```


DB
DNS
Resource

Resource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Using Terraform Providers

```
>_

$ terraform init
```

Official

Verified

bigip

by: F5Networks

heroku

by: heroku

digitalocean

by: digitalocean

Community

activedirectory

ucloud

netapp-gcp

registry.terraform.io

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```
$ terraform init
Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/local...
- Installing hashicorp/local v2.0.0...
- Installed hashicorp/local v2.0.0 (signed by HashiCorp)

The following providers do not have any version constraints in
configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may
contain breaking
changes, we recommend adding version constraints in a
required_providers block
in your configuration, with the constraint strings suggested
below.

* hashicorp/local: version = "~> 2.0.0"

Terraform has been successfully initialized!
```

```
$ ls /root/terraform-local-file/.terraform
plugins
```

To prevent automatic upgrades to new maj
contain breaking
changes, we recommend adding version con
required_providers block
in your configuration, with the constrai
below.

```
* hashicorp/local: version = "~> 2.0.0"
```

Organizational Namespace

Type

Terraform has been successfully initiali

To prevent automatic upgrades to new maj
contain breaking
changes, we recommend adding version con
required_providers block
in your configuration, with the constrai
below.

```
*    registry.terraform.io/ hashicorp/ loc
```

Hostname

Organizational Namespace

Ty

Terraform has been successfully initiali

```
Initializing provider plugins...
- Finding latest version of hashicorp/local...
- Installing hashicorp/local v2.0.0...
- Installed hashicorp/local v2.0.0 (signed by H

The following providers do not have any version
configuration,
so the latest version was installed.

To prevent automatic upgrades to new major vers
contain breaking
changes, we recommend adding version constraint
required_providers block
```


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Configuration Directory

```
>_

[terraform-local-file]$ ls /root/terraform-local-file
local.tf
```

local.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
}
```

cat.tf

```
resource "local_file"  "cat" {
    filename = "/root/cat.txt"
    content = "My favorite pet is Mr. Whiskers"

}
```

local.tf

cat.tf

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
}

resource "local_file"  "cat" {
    filename = "/root/cat.txt"
    content = "My favorite pet is Mr. Whiskers"

}
```

File Name	Purpose
main.tf	Main configuration file containing resource definition
variables.tf	Contains variable declarations
outputs.tf	Contains outputs from resources
provider.tf	Contains Provider definition


KODEKLOUD

Multiple Providers

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
}
```

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
}


resource "random_pet" "my-pet" {
    prefix = "Mrs"
    separator = "."
    length = "1"
}
```

random provider

Resources

- random_id
- random_integer
- random_password
- random_pet
- random_shuffle
- random_string
- random_uuid

Argument Reference

The following arguments are supported:

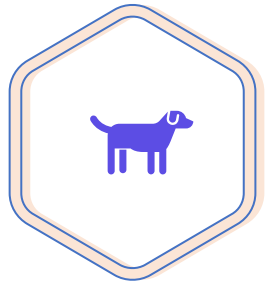
- `keepers` - (Optional) Arbitrary map of values that, w
  to be generated. See the main provider documentati
- `length` - (Optional) The length (in words) of the pet
- `prefix` - (Optional) A string to prefix the name with
- `separator` - (Optional) The character to separate wo

```
$ terraform plan
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but
will not be
persisted to local or remote state storage.

local_file.pet: Refreshing state...
[id=d1a31467f206d6ea8ab1cad382bc106bf46df69e]

.
.
  # random_pet.my-pet will be created
  + resource "random_pet" "my-pet" {
      + id        = (known after apply)
      + length    = 1
      + prefix    = "Mrs"
      + separator = "."
    }

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



```
$ terraform init
Initializing the backend...

Initializing provider plugins...
- Using previously-installed hashicorp/local v2.0.0
- Finding latest version of hashicorp/random...
- Installing hashicorp/random v2.3.0...
- Installed hashicorp/random v2.3.0 (signed by HashiCorp)

The following providers do not have any version constraints in
configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain
breaking
changes, we recommend adding version constraints in a required_providers
block
in your configuration, with the constraint strings suggested below.

* hashicorp/local: version = "~> 2.0.0"
* hashicorp/random: version = "~> 2.3.0"

Terraform has been successfully initialized!
```

```
$ terraform apply
local_file.new_file: Refreshing state...
[id=d1a31467f206d6ea8ab1cad382bc106bf46df69e]

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # random_pet.my-pet will be created
  + resource "random_pet" "my-pet" {
      + id        = (known after apply)
      + length    = 1
      + prefix    = "Mrs"
      + separator = "."
    }

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

random_pet.my-pet: Creating...
random_pet.my-pet: Creation complete after 0s [id=Mrs.hen]

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

Mrs.hen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Define Input Variables

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"

}

resource "random_pet" "my-pet" {
    prefix = "Mrs"
    separator = "."
    length = "1"
}
```

Argument	Value
filename	"/root/pets.txt"
content	"We love pets!"
prefix	"Mrs"
separator	"."
length	"1"

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"

}

resource "random_pet" "my-pet" {
    prefix = "Mrs"
    separator = "."
    length = "1"
}
```

variables.tf

```
variable "filename" {
        default = "/root/pets.txt"
}
variable "content" {
        default = "We love pets!"
}
variable "prefix" {
        default = "Mrs"
}
variable "separator" {
        default = "."
}
variable "length" {
        default = "1"
}
```

main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content = var.content

}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```

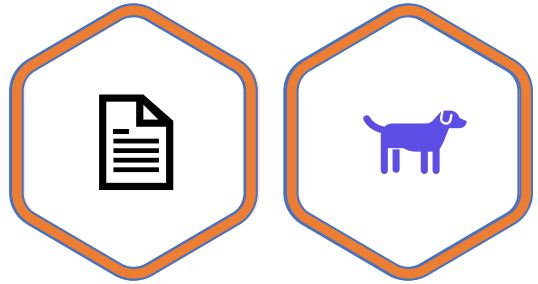
variables.tf

```
variable "filename" {
        default = "/root/pets.txt"
}
variable "content" {
        default = "We love pets!"
}
variable "prefix" {
        default = "Mrs"
}
variable "separator" {
        default = "."
}
variable "length" {
        default = "1"
}
```

```
$ terraform apply
# local_file.pet will be created
  + resource "local_file" "pet" {
      + content              = “We love pets!"
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pet.txt"
      + id                   = (known after apply)
    }

  # random_pet.my-pet will be created
  + resource "random_pet" "my-pet" {
      + id        = (known after apply)
      + length    = 1
      + prefix    = "Mrs"
      + separator = "."
    }

Plan: 2 to add, 0 to change, 0 to destroy.
.
.
random_pet.my-pet: Creating...
random_pet.my-pet: Creation complete after 0s [id=Mrs.ram]
local_file.pet: Creating...
local_file.pet: Creation complete after 0s
[id=f392b4bcf5db76684f719bf72061627a9a177de1]
```



main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content = var.content

}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```

variables.tf

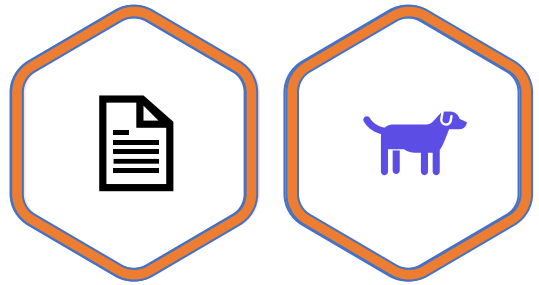
```
variable "filename" {
    default = "/root/pets.txt"
}
variable "content" {
    default = "My favorite pet is Mrs. Whiskers"
}
variable "prefix" {
    default = "Mrs"
}
variable "separator" {
    default = "."
}
variable "length" {
    default = "2"
}
```

```
$ terraform apply
Terraform will perform the following actions:

-/+ resource "local_file" "pet" {
      ~ content              = “We love pets!" -> "My favorite pet is Mrs. Whiskers!" # forces replacement
        directory_permission = "0777"
        file_permission      = "0777"
        filename             = "/root/pet.txt"
      ~ id                   = "bc9cabef1d8b0071d3c4ae9959a9c328f35fe697" -> (known after apply)
    }

  # random_pet.my-pet must be replaced
-/+ resource "random_pet" "my-pet" {
      ~ id        = "Mrs.Hen" -> (known after apply)
      ~ length    = 1 -> 2 # forces replacement
        prefix    = "Mrs"
        separator = "."
    }

Plan: 2 to add, 0 to change, 2 to destroy.
random_pet.my-pet: Destroying... [id=Mrs.hen]
random_pet.my-pet: Destruction complete after 0s
local_file.pet: Destroying... [id=bc9cabef1d8b0071d3c4ae9959a9c328f35fe697]
local_file.pet: Destruction complete after 0s
random_pet.my-pet: Creating...
local_file.pet: Creating...
```



main.tf

```
resource "aws_instance" "webserver" {
  ami           = var.ami
  instance_type = var.instance_type
}
```

variables.tf

```
variable "ami" {
  default = "ami-0edab43b6fa892279"
}
variable "instance_type" {
  default = "t2.micro"
}
```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Understanding the Variable Block

variables.tf

```
variable "filename" {
   default = "/root/pets.txt"
}
variable "content" {
    default = "I love pets!"
}
variable "prefix" {
    default = "Mrs"
}
variable "separator" {
    default = "."
}
variable "length" {
    default = "1"
}
```

variables.tf

```
variable "filename" {
   default = "/root/pets.txt"
   type = string
   description = "the path of local file"

}
variable "content" {
    default = "I love pets!"
    type = string
    description = “the content of the file"

}
variable "prefix" {
    default = "Mrs"
    type = string
    description = "the prefix to be set"

}
variable "separator" {
    default = "."
```

variables.tf

```
variable "filename" {
   default = "/root/pets.txt"
   type = string
   description = "the path of local file"

}
variable "content" {
    default = "I love pets!"
    type = string
    description = “the content of the file"

}
variable "prefix" {
    default = "Mrs"
    type = string
    description = "the prefix to be set"

}
variable "separator" {
    default = "."
```

Type	Example
string	"/root/pets.txt"
number	1
bool	true/false
any	Default Value

variables.tf

```
variable "length" {
  default = "2"
  type = number
  description = "length of the pet name"
}

variable "password_change" {
  default = "true"
  type = bool
}
```

Type	Example
string	"/root/pets.txt"
number	1
bool	true/false
any	Default Value
list	["cat", "dog"]
map	pet1 = cat pet2 = dog
object	Complex Data Structure
tuple	Complex Data Structure

List

variables.tf

```
variable "prefix" {
  default = ["Mr", "Mrs", "Sir"]
  type = list  0     1      2
}
```

maint.tf

```
resource "random_pet" "my-pet" {
  prefix    = var.prefix[0]
}
```

Index	Value
0	Mr
1	Mrs
2	Sir

Map

variables.tf

```
variable file-content {
  type        = map
  default     = {
      "statement1" = "We love pets!"
      "statement2" = “We love animals!"
  }
 }
```

maint.tf

```
resource local_file my-pet {
  filename  = "/root/pets.txt"
  content =  var.file-content["statement2"]
}
```

Key	Value
statement1	We love pets!
statement2	We love animals!

List of a Type

variables.tf

```
variable "prefix" {
  default = ["Mr", "Mrs", "Sir"]
  type = list(string)
}
```

variables.tf

```
variable "prefix" {
  default = ["Mr", "Mrs", "Sir"]
  type = list(number)
}
```

variables.tf

```
variable "prefix" {
  default = ["1", "2", "3"]
  type = list(number)
}
```

>_

```
$ terraform plan
Error: Invalid default value for variable

  on variables.tf line 3, in variable "prefix":
   3:   default     = ["Mr", "Mrs", "Sir"]

This default value is not compatible with the
variable's type constraint: a number is required.
```

Map of a Type

variables.tf

```
variable "cats" {
  default = {
    "color" = "brown"
    "name" = "bella"
  }
  type = map(string)
}
```

variables.tf

```
variable "pet_count" {
  default = {
    "dogs" = "3"
    "cats" = "1"
    "goldfish" = "2"
  }
  type = map(number)
}
```

Set

variables.tf

```
variable "prefix" {
  default = ["Mr", "Mrs", "Sir"]
  type = set(string)
}
```

variables.tf

```
variable "prefix" {
  default = ["Mr", "Mrs", "Sir", "Sir"]
  type = set(string)
}
```

variables.tf

```
variable "fruit" {
  default = ["apple", “banana"]
  type = set(string)
}
```

variables.tf

```
variable "fruit" {
  default = ["apple", "banana", "banana"]
  type = set(string)
}
```

variables.tf

```
variable "age" {
  default = ["10", "12", "15"]
  type = set(number)
}
```

variables.tf

```
variable "age" {
  default = ["10", "12", "15", "10"]
  type = set(number)
}
```

Objects

Key	Example	Type
name	bella	string
color	brown	string
age	7	number
food	["fish", "chicken", "turkey"]	list
favorite_pet	true	bool

variables.tf

```
variable  "bella"  {
  type = object({
      name = string
      color = string
      age = number
      food = list(string)
      favorite_pet = bool
  })

  default = {
      name = "bella"
      color = "brown"
      age = 7
      food = ["fish", "chicken", "turkey"]
      favorite_pet = true
  }
}
```

Tuples

variables.tf

```
variable kitty {
  type        = tuple([string, number, bool])
  default     = ["cat", 7, true]

}
```

variables.tf

```
variable kitty {
  type        = tuple([string, number, bool])
  default     = ["cat", 7, true, "dog"]

}
```

>_

```
$ terraform plan

  Error: Invalid default value for variable

    on variables.tf line 3, in variable "kitty":
     3:   default     = ["cat", 7, true, "dog"]

  This default value is not compatible with the
  variable's type constraint:
  tuple required.
```


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Using Variables in Terraform

main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content = var.content

}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```

variables.tf

```
variable "filename" {
        default = "/root/pets.txt"
}
variable "content" {
        default = "We love pets!"
}
variable "prefix" {
        default = "Mrs"
}
variable "separator" {
        default = "."
}
variable "length" {
        default = 2
}
```

main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content = var.content

}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```

variables.tf

```
variable "filename" {

}
variable "content" {

}
variable "prefix" {

}
variable "separator" {

}
variable "length" {

}
```

Interactive Mode

```
$ terraform apply
var.content
  Enter a value: We love Pets!

var.filename
  Enter a value:  /root/pets.txt

var.length
  Enter a value:  2

var.prefix
  Enter a value:  Mrs.

var.separator
  Enter a value: .
```

Command Line Flags

```
>_

$ terraform apply -var "filename=/root/pets.txt" -var "content=We love
Pets!"  -var "prefix=Mrs" -var "separator=." -var "length=2"
```

Environment Variables

```
>_

$ export TF_VAR_filename="/root/pets.txt"
$ export TF_VAR_content="We love pets!"
$ export TF_VAR_prefix="Mrs"
$ export TF_VAR_separator="."
$ export TF_VAR_length="2"
$ terraform apply
```

Variable Definition Files

terraform.tfvars

```
filename = "/root/pets.txt"
content = "We love pets!"
prefix = "Mrs"
separator = "."
length = "2"
```

>_

```
$ terraform apply -var-file variables.tfvars
```

Automatically Loaded

terraform.tfvars	terraform.tfvars.json
*.auto.tfvars	*.auto.tfvars.json

KODEKLOUD

Variable Definition Precedence

main.tf

```
resource local_file pet {
  filename = var.filename
}
```

variables.tf

```
variable filename {
  type    = string
}
```

>_

```
$ export TF_VAR_filename="/root/cats.txt"
```

?

terraform.tfvars

```
filename = "/root/pets.txt"
```

?

variable.auto.tfvars

```
filename = "/root/mypet.txt"
```

?

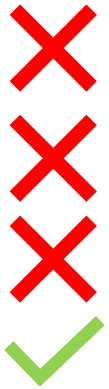
>_

```
$ terraform apply -var "filename=/root/best-pet.txt"
```

?

Variable Definition Precedence

Order	Option
1	Environment Variables
2	terraform.tfvars
3	*.auto.tfvars (alphabetical order)
4	-var or –var-file (command-line flags)



```
>_
$ export TF_VAR_filename="/root/cats.txt" 1
```

```
terraform.tfvars
filename = "/root/pets.txt" 2
```

```
variable.auto.tfvars
filename = "/root/mypet.txt" 3
```

```
>_
$ terraform apply -var "filename=/root/best-pet.txt" 4
```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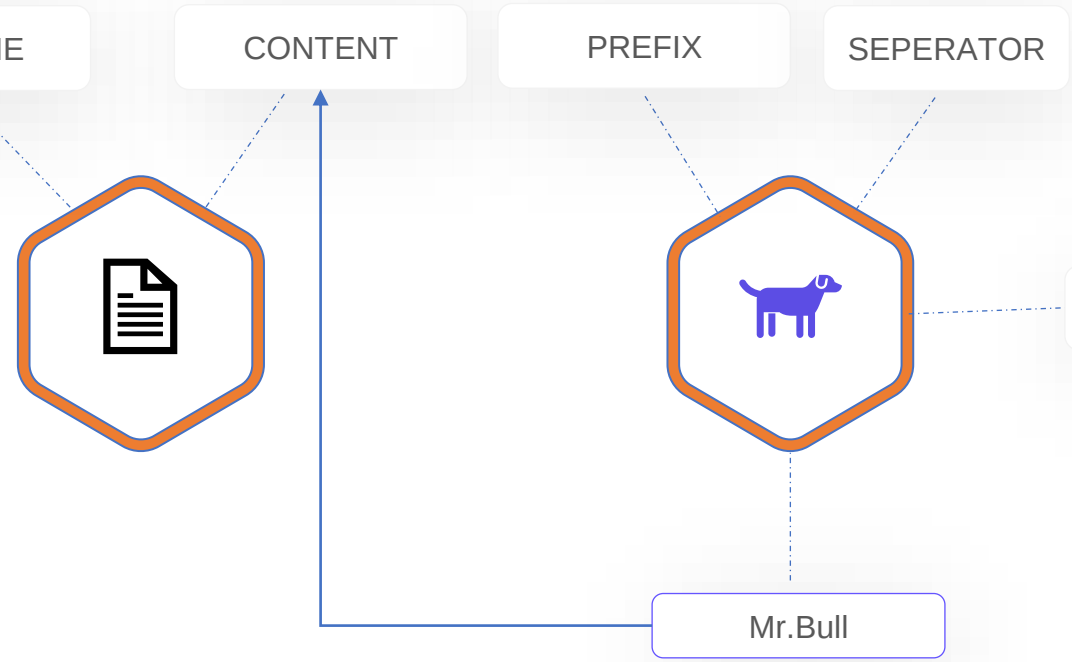
Resource Attribute Reference



main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content =  "My favorite pet is ${random_pet.my-pet.id}"
}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```

```
>_

random_pet.my-pet: Creating...
local_file.pet: Creating...
random_pet.my-pet: Creation complete after 0s [id=Mr.bull]
local_file.pet: Creation complete after 0s
[id=059090e865809f9b6debfda7aebf48fdce2220a6]

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

Attribute Reference

The following attributes are supported:

- `id` - (string) The random pet name

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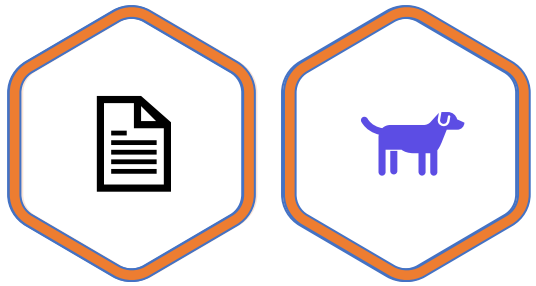
```
_file" "pet" {
var.filename

My favorite pet is Mr.Bull"


om_pet" "my-pet" {
r.prefix
var.separator
r.length
```



```
$ terraform apply
.
.
.
  # local_file.pet must be replaced
-/+ resource "local_file" "pet" {
      ~ content              = "My favorite pet is Mrs.Cat!" -> "My favorite pet is Mr.bull" # forces replacement
        directory_permission = "0777"
        file_permission      = "0777"
        filename             = "/roots/pets.txt"
      ~ id                   = "98af5244e23508cffd4a0c3c46546821c4ccbbd0" -> (known after apply)
    }
.
.
local_file.pet: Destroying... [id=98af5244e23508cffd4a0c3c46546821c4ccbbd0]
local_file.pet: Destruction complete after 0s
local_file.pet: Creating...
local_file.pet: Creation complete after 0s [id=e56101d304de7cf1b1001102923c6bdeaa60c523]

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

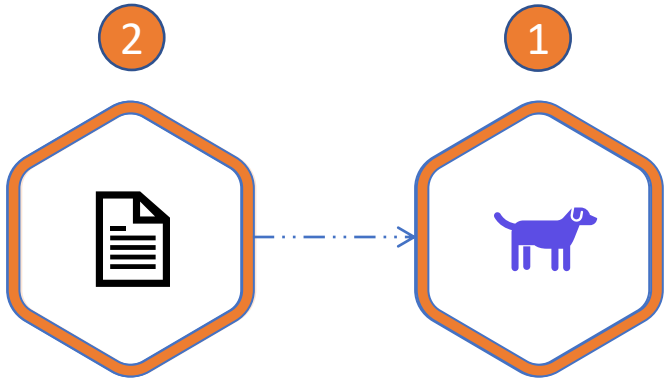

KODEKLOUD

Resource Dependencies

Implicit Dependency

main.tf

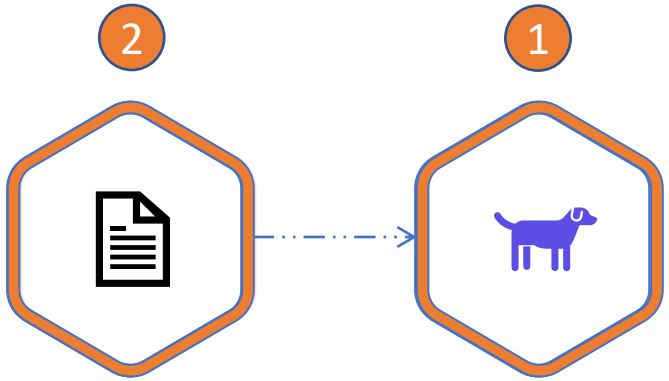
```
resource "local_file" "pet" {
    filename = var.filename
    content =  "My favorite pet is ${random_pet.my-pet.id}"
}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```



Explicit Dependency

main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content =  "My favorite pet is Mr.Cat"

    depends_on = [
      random_pet.my-pet
    ]


}

resource "random_pet" "my-pet" {
    prefix = var.prefix
    separator = var.separator
    length = var.length
}
```




KODEKLOUD

Output Variables

main.tf

```
resource "local_file" "pet" {
   filename = var.filename
   content =  "My favorite pet is ${random_pet.my-pet.id}"
}

resource "random_pet" "my-pet" {
   prefix = var.prefix
   separator = var.separator
   length = var.length
}

output pet-name {
  value       = random_pet.my-pet.id
  description = "Record the value of pet ID generated by the
 random_pet resource"
}
```

variables.tf

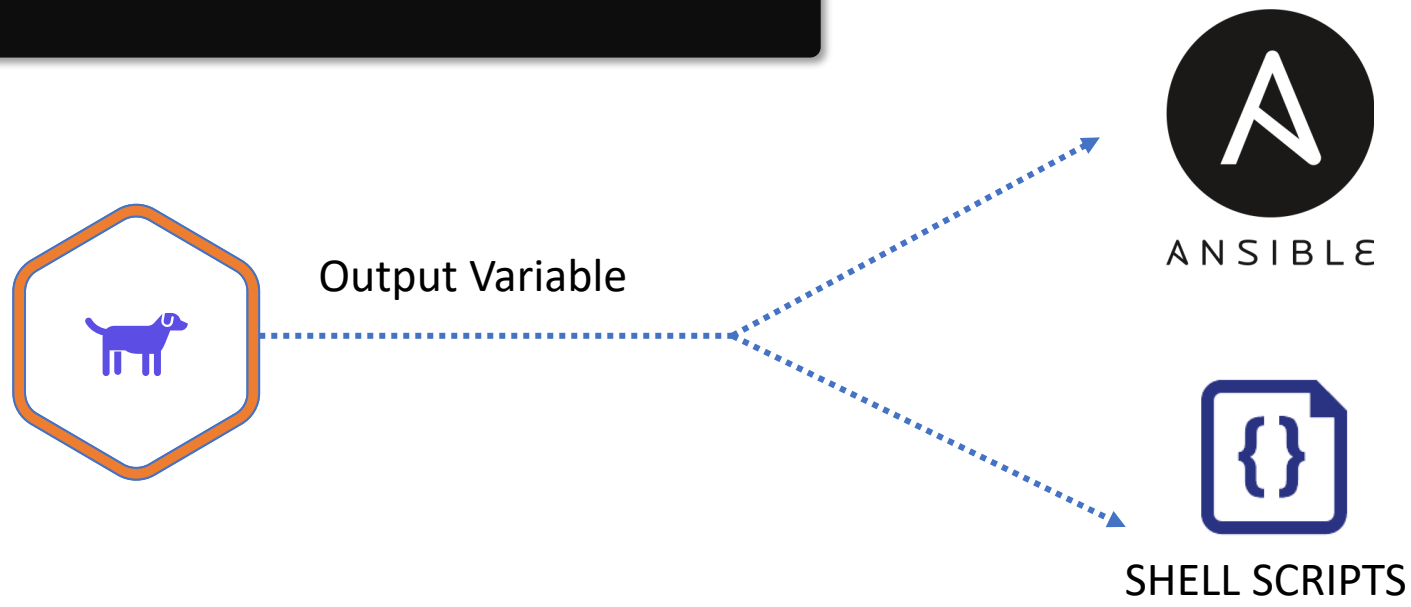
```
variable "filename" {
         default = "/root/pets.txt"
}
variable "content" {
         default = "I love pets!"
}
variable "prefix" {
         default = "Mrs"
}
variable "separator" {
         default = "."
}
variable "length" {
         default = "1"
}
```

```
output "<variable_name>" {
  value = "<variable_value>"
  <arguments>
}
```

```
>_
 $ terraform apply

 .
 .

Outputs:

pet-name = Mrs.gibbon
```

```
>_
$ terraform output
pet-name = Mrs.gibbon
```

```
>_
$ terraform output pet-name
Mrs.gibbon
```




KODEKLOUD

Introduction to Terraform State

```
>_
$ ls terraform-local-file
main.tf variables.tf
```

main.tf

```hcl
resource "local_file" "pet" {
  filename = var.filename
  content  = var.content
}
```

variables.tf

```hcl
variable "filename" {
  default = "/root/pets.txt"
}
variable "content" {
  default = "I love pets!"
}
```


```
>_
$ cd terraform-local-file

[terraform-local-file]$ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/local...
- Installing hashicorp/local v1.4.0...
- Installed hashicorp/local v1.4.0 (signed by HashiCorp)

The following providers do not have any version constraints
in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that
may contain breaking
changes, we recommend adding version constraints in a
required_providers block
in your configuration, with the constraint strings
suggested below.

* hashicorp/local: version = "~> 1.4.0"

Terraform has been successfully initialized!
```

```
>_

$ ls terraform-local-file
main.tf variables.tf
```

main.tf

```
resource "local_file" "pet" {
  filename = var.filename
  content  = var.content
}
```

variables.tf

```
variable "filename" {
  default = "/root/pets.txt"
}
variable "content" {
  default = "I love pets!"
}
```


```
>_

[terraform-local-file]$ terraform plan

Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan,
persisted to local or remote state storage.


------------------------------------------------------------

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbol
  + create

Terraform will perform the following actions:

  # local_file.pet will be created
  + resource "local_file" "pet" {
      + content              = "I love pets!"
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
      + id                   = (known after apply)
    }

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

------------------------------------------------------------

Note: You didn't specify an "-out" parameter to save thi
```

```
>_

$ ls terraform-local-file
main.tf variables.tf
```

main.tf

```hcl
resource "local_file" "pet" {
  filename = var.filename
  content  = var.content
}
```

variables.tf

```hcl
variable "filename" {
  default = "/root/pets.txt"
}
variable "content" {
  default = "I love pets!"
}
```


```
>_

[terraform-local-file]$ terraform apply

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbol
  + create

Terraform will perform the following actions:

  # local_file.pet will be created
  + resource "local_file" "pet" {
      + content              = "I love pets!"
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
      + id                   = (known after apply)
    }

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

local_file.pet: Creating...
local_file.pet: Creation complete after 0s
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68]
```

```
>_

[terraform-local-file]$ cat /root/pets
I love pets!
```


```
>_

[terraform-local-file]$ terraform apply
local_file.pet: Refreshing state...
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68]

Apply complete! Resources: 0 added, 0 changed, 0 destro
```

```
>_

[terraform-local-file]$ ls
main.tf variables.tf terraform.tfstate
```


```
>_

[terraform-local-file]$ cat  terraform.tfstate
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 1,
  "lineage": "e35dde72-a943-de50-3c8b-1df8986e5a31"
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "provider":
"provider[\"registry.terraform.io/hashicorp/local\"
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "I love pets!",
            "content_base64": null,
            "directory_permission": "0777",
            "file_permission": "0777",
            "filename": "/root/pets.txt",
            "id":
"7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68",
            "sensitive_content": null
          },
          "private": "bnVsbA=="
```

variables.tf

```
variable "filename" {
  default = "/root/pets.txt"
}
variable "content" {
  default = "We love pets!"
}
```

>_

```
$ terraform plan
Refreshing Terraform state in-memory
prior to plan...
The refreshed state will be used to
calculate this plan, but will not be
persisted to local or remote state
storage.

local_file.pet: Refreshing state...
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e
1b68]
.
.
.
[Output Truncated ]
```

>_

```
[terraform-local-file]$ cat  terraform.tfstate
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 1,
  "lineage": "e35dde72-a943-de50-3c8b-1df8986e5a31"
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "provider":
"provider[\"registry.terraform.io/hashicorp/local\"
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "I love pets!",
            "content_base64": null,
            "directory_permission": "0777",
            "file_permission": "0777",
            "filename": "/root/pets.txt",
            "id":
"7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68",
            "sensitive_content": null
          },
          "private": "bnVsbA=="
```

variables.tf

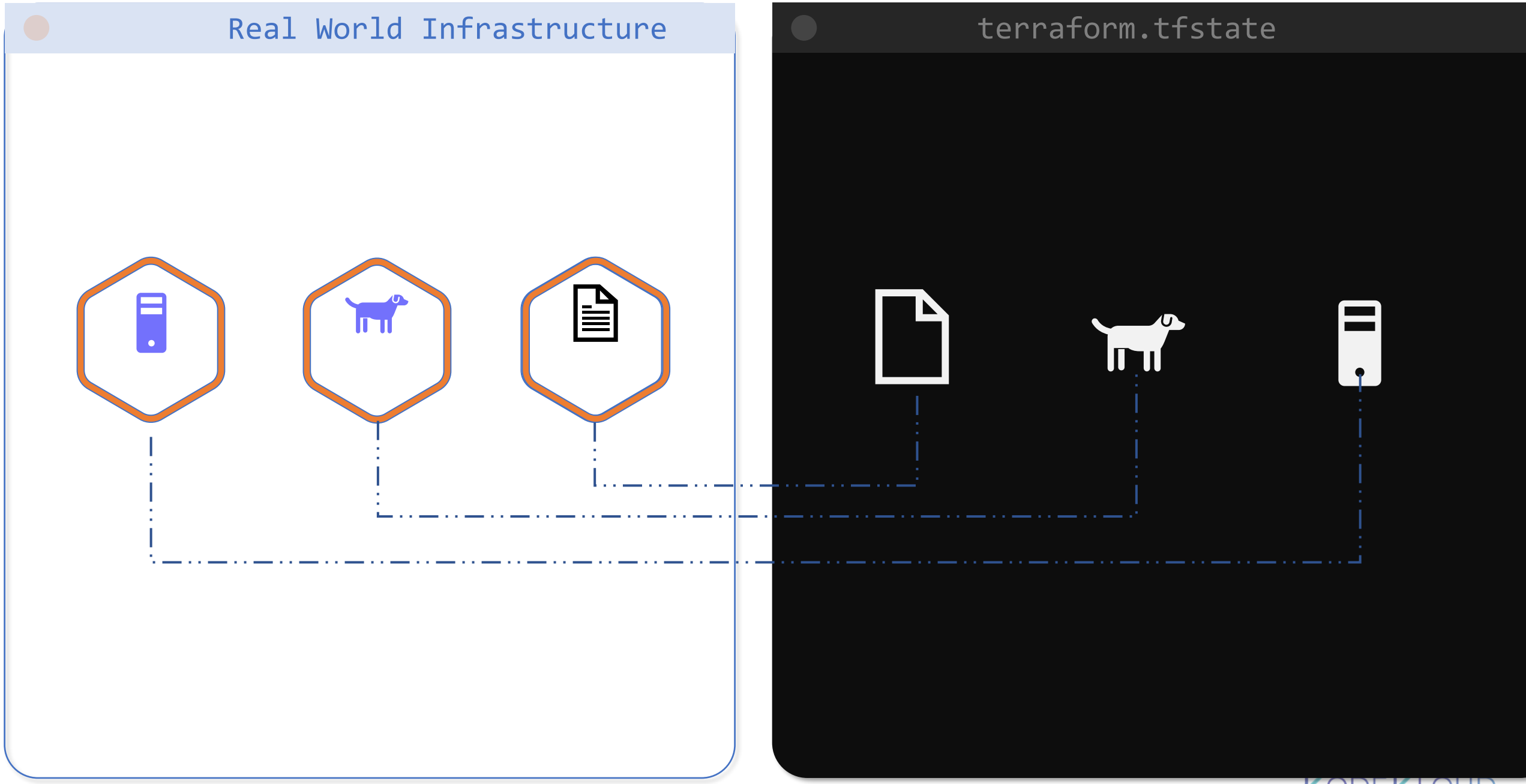
```
variable "filename" {
  default = "/root/pets.txt"
}
variable "content" {
  default = "We love pets!"
}
```

>_

```
$ terraform apply
local_file.pet: Refreshing state...
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68]

Terraform will perform the following actions:

  # local_file.pet must be replaced
-/+ resource "local_file" "pet" {
      ~ content              = "I love pets!" -
> "We love pets!" # forces replacement
        directory_permission = "0777"
        file_permission      = "0777"
        filename             = "/root/pets.txt"
      ~ id                   =
"7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68" ->
(known after apply)
    }
```

>_

```
[terraform-local-file]$ cat  terraform.tfstate
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 1,
  "lineage": "e35dde72-a943-de50-3c8b-1df8986e5a31"
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "provider":
"provider[\"registry.terraform.io/hashicorp/local\"
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "We love pets!",
            "content_base64": null,
            "directory_permission": "0777",
            "file_permission": "0777",
            "filename": "/root/pets.txt",
            "id":
"7e4db4fbfdbb108bdd04692602bae3e9bc4d1c14",
            "sensitive_content": null
          },
          "private": "bnVsbA=="
```


Real World Infrastructure
terraform.tfstate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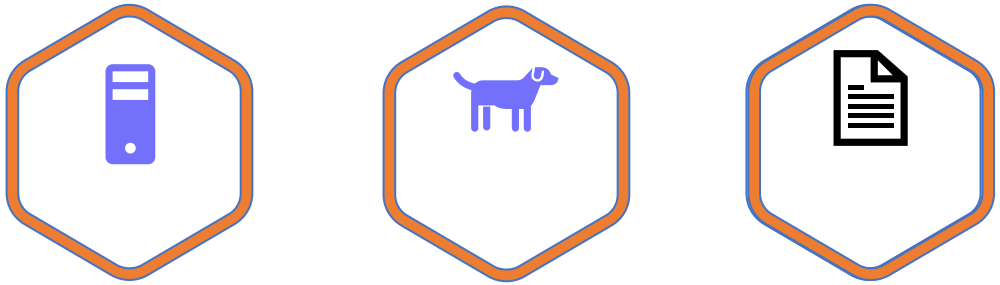
Purpose of State

Real World Infrastructure



terraform.tfstate

id=aabbcc

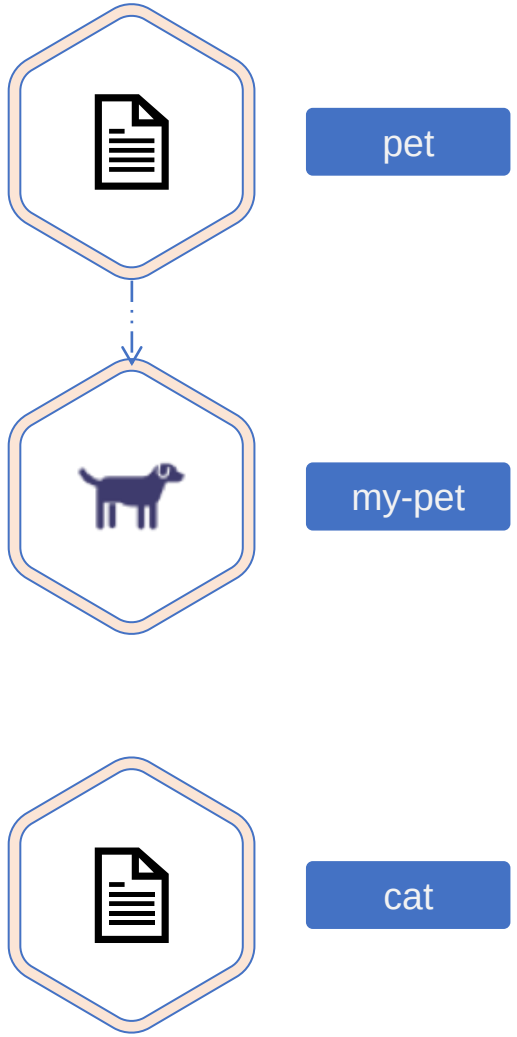
id=eeddff

id=gghhhii

Tracking Metadata

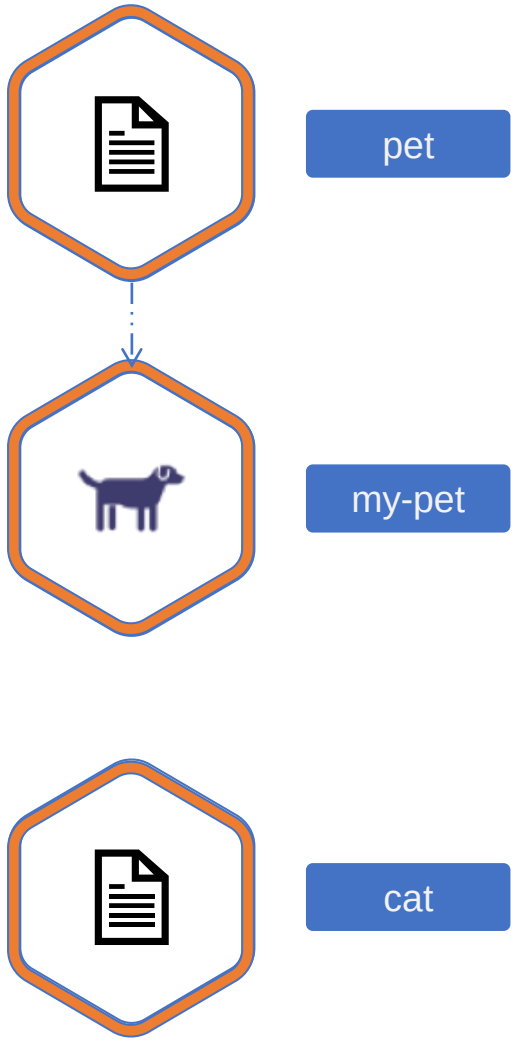
main.tf

```
resource "local_file" "pet" {
  filename = "/root/pet.txt"
  content  = "My favorite pet is ${random_pet.my-pet.id}!"
}
resource "random_pet" "my-pet" {
  length = 1
}
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```



Tracking Metadata

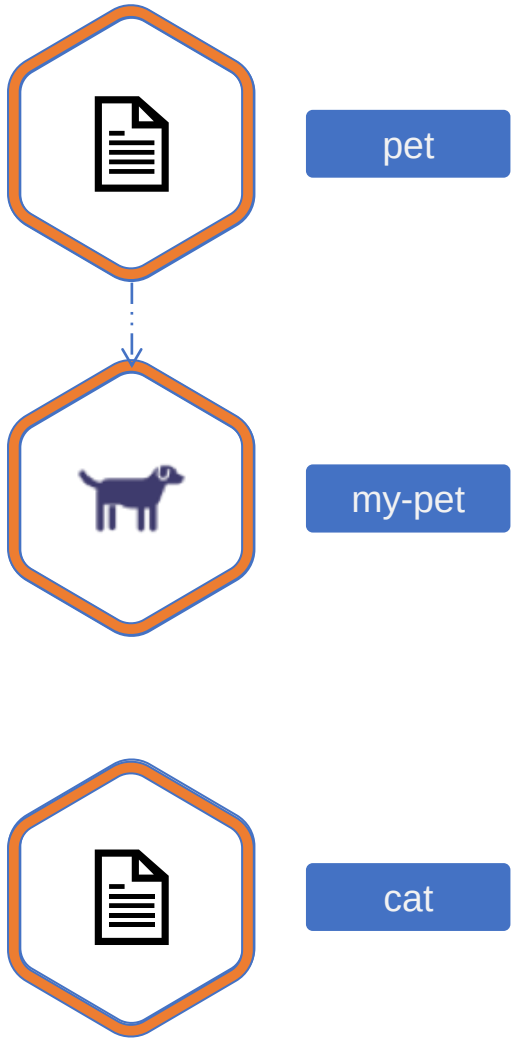
```
$ terraform apply

.
.
.
Plan: 3 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

local_file.cat: Creating...
random_pet.my-pet: Creating...
local_file.cat: Creation complete after 0s
[id=fe448888891fc40342313bc44a1f1a8986520c89]
random_pet.my-pet: Creation complete after 0s [id=yak]

local_file.pet: Creating...
local_file.pet: Creation complete after 0s
[id=28b373c6c1fa3fce132a518eadd0175c98f37f20]

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



Tracking Metadata

main.tf

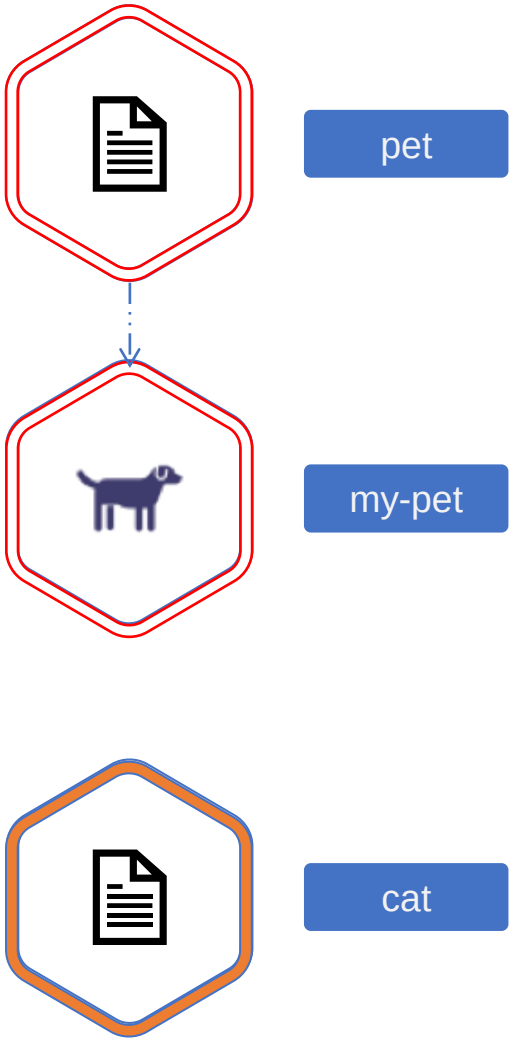
```
resource "local_file" "pet" {
  filename = "/root/pet.txt"
  content  = "My favorite pet is ${random_pet.my-pet.id}!"
}
resource "random_pet" "my-pet" {
  length = 1
}
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```



Tracking Metadata

main.tf

```
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```



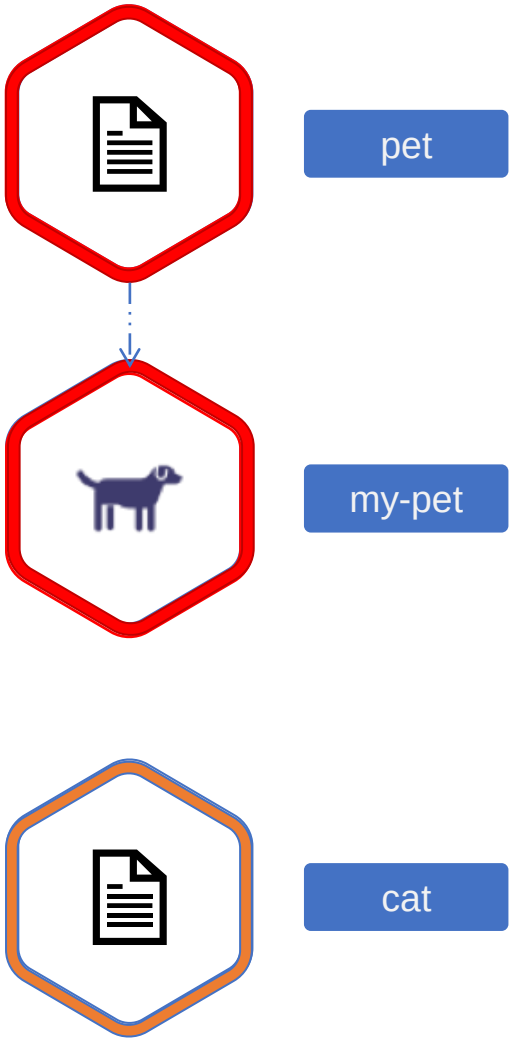
Tracking Metadata

main.tf

```
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```

>_

```
$ cat terraform.tfstate
{
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "My favorite pet is yak!",
.           },
          "private": "bnVsbA==",
          "dependencies": [
            "random_pet.my-pet"
          ]
```



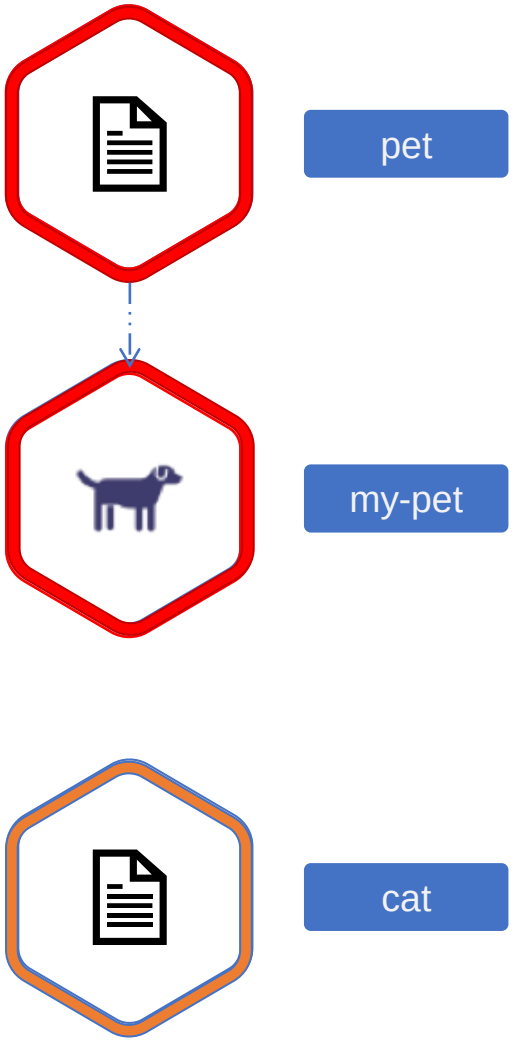
Tracking Metadata

main.tf

```
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```

>_

```
$ terraform apply

Plan: 0 to add, 0 to change, 2 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

local_file.pet: Destroying...
[id=28b373c6c1fa3fce132a518eadd0175c98f37f20]
local_file.pet: Destruction complete after 0s


random_pet.my-pet: Destroying... [id=yak]
```



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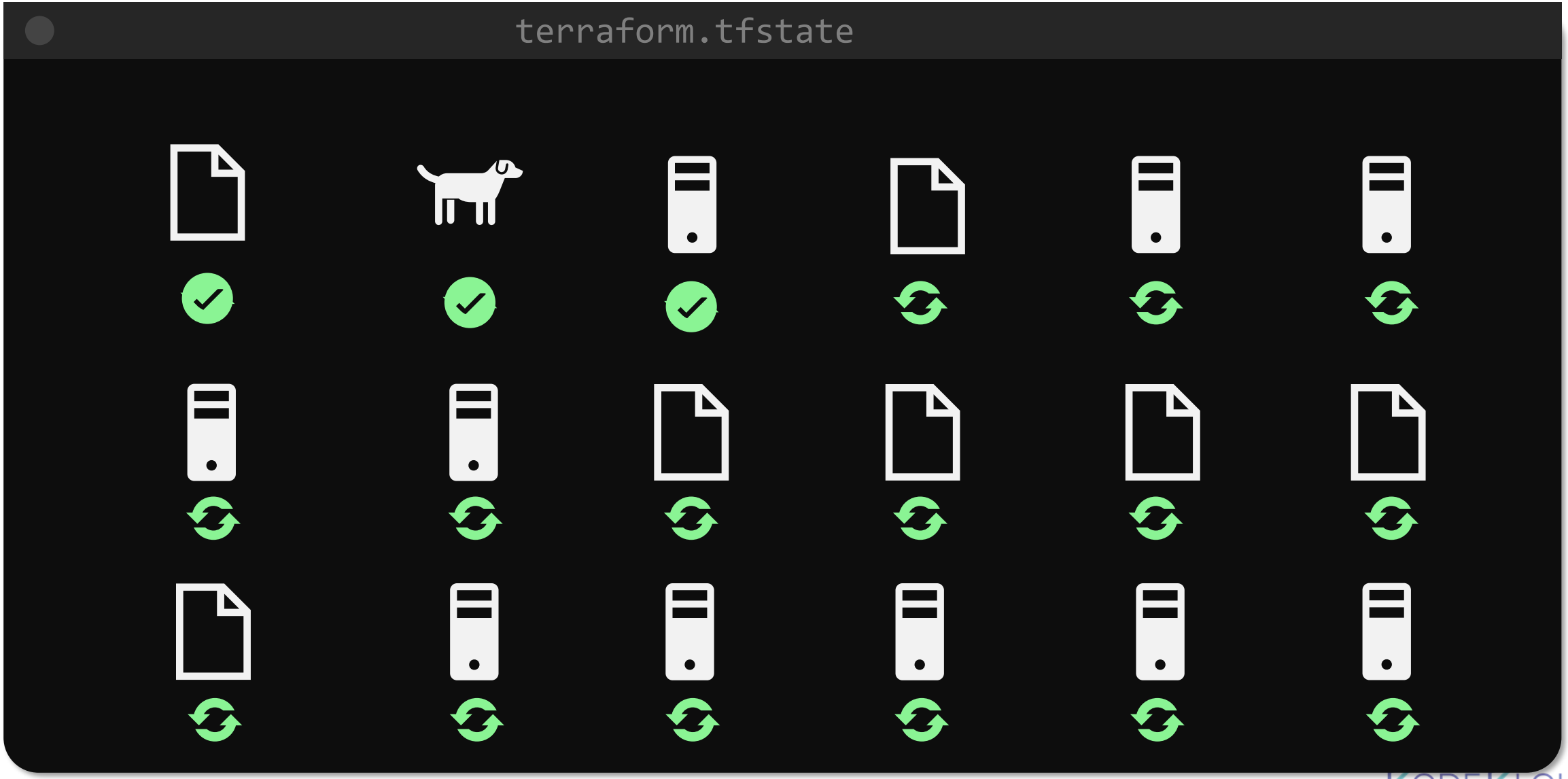
Performance



Performance

terraform.tfstate

```
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 4,
  "lineage": "e35dde72-a943-de50-3c8b-1df8986e5a31",
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "We love pets!",
            "content_base64": null,
            "directory_permission": "0777",
...
```

>_

```
$ terraform plan --refresh=false

An execution plan has been generated and is shown
below.
Resource actions are indicated with the following
symbols:
-/+ destroy and then create replacement

Terraform will perform the following actions:

  # local_file.cat must be replaced
-/+ resource "local_file" "pet" {
      ~ content              = "I like cats too!" ->
"Dogs are awesome!" # forces replacement
        directory_permission = "0777"
        file_permission      = "0777"
        filename             = "/root/pets.txt"
      ~ id                   =
"cba595b7d9f94ba1107a46f3f731912d95fb3d2c" -> (known
after apply)
    }

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

------------------------------------------------
```

Collaboration

terraform.tfstate

```
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 4,
  "lineage": "e35dde72-a943-de50-3c8b-1df8986e5a31",
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "We love pets!",
            "content_base64": null,
            "directory_permission": "0777",
...
```

```
>_

$ ls

main.tf variables.tf terraform.tfstate
```

Collaboration

AWS S3

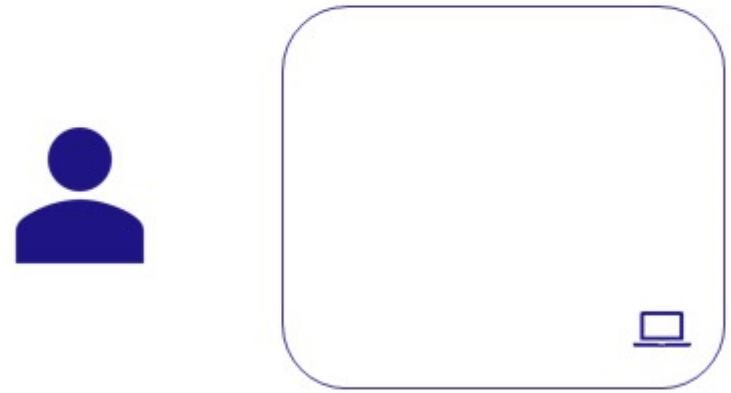
Google Cloud Storage

HashiCorp Consul

Terraform Cloud

terraform.tfstate

```
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 4,
  "lineage": "e35dde72-a943-de50-3c8b-1df8986e5a31",
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "local_file",
      "name": "pet",
      "instances": [
        {
          "schema_version": 0,
          "attributes": {
            "content": "We love pets!",
            "content_base64": null,
            "directory_permission": "0777",
...
```

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Terraform State Considerations

Sensitive Data

terraform.tfstate


```
{
      "mode": "managed",
      "type": "aws_instance",
      "name": "dev-ec2",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-0a634ae95e11c6f91",
.
.
.
            "primary_network_interface_id": "eni-0ccd57b1597e633e0",
            "private_dns": "ip-172-31-7-21.us-west-2.compute.internal",
            "private_ip": "172.31.7.21",
            "public_dns": "ec2-54-71-34-19.us-west-2.compute.amazonaws.com",
            "public_ip": "54.71.34.19",
            "root_block_device": [
              {
                "delete_on_termination": true,
                "device_name": "/dev/sda1",
                "encrypted": false,
                "iops": 100,
                "kms_key_id": ""
```

Terraform State Considerations

Remote State Backends

Version Control

terraform.tfstate

```
{
      "mode": "managed",
      "type": "aws_instance",
      "name": "dev-ec2",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-0a634ae95e11c6f91",
.
.
.
            "primary_network_interface_id": "eni-0ccd57b1597e633e0",
            "private_dns": "ip-172-31-7-21.us-west-2.compute.internal",
            "private_ip": "172.31.7.21",
            "public_dns": "ec2-54-71-34-19.us-west-2.compute.amazonaws.com",
            "public_ip": "54.71.34.19",
            "root_block_device": [
              {
                "delete_on_termination": true,
                "device_name": "/dev/sda1",
                "encrypted": false,
                "iops": 100,
                "kms_key_id": "",
                "volume_id": "vol-070720a3636979c22",
                "volume_size": 8,
```

main.tf

```
resource "local_file" "pet" {
  filename = "/root/pet.txt"
  content  = "My favorite pet is Mr.Whiskers!"
}
resource "random_pet" "my-pet" {
  length = 1
}
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```

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No Manual Edits

terraform.tfstate


```
{
      "mode": "managed",
      "type": "aws_instance",
      "name": "dev-ec2",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-0a634ae95e11c6f91",
.
.
.
            "primary_network_interface_id": "eni-0ccd57b1597e633e0",
            "private_dns": "ip-172-31-7-21.us-west-2.compute.internal",
            "private_ip": "172.31.7.21",
            "public_dns": "ec2-54-71-34-19.us-west-2.compute.amazonaws.com",
            "public_ip": "54.71.34.19",
            "root_block_device": [
              {
                "delete_on_termination": true,
                "device_name": "/dev/sda1",
                "encrypted": false,
                "iops": 100,
```


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Terraform Commands

terraform validate

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
    file_permissions = "0700"
}
```

>_

```
$ terraform validate
Success! The configuration is valid.

$ terraform validate

Error: Unsupported argument

  on main.tf line 4, in resource "local_file" "pet":
   4:    file_permissions = "0777"

An argument named "file_permissions" is not expected
here. Did you mean "file_permission"?
```

terraform fmt

main.tf

```
resource "local_file" "pet" {
    filename        = "/root/pets.txt"
    content         = "We love pets!"
    file_permission = "0700"
}
```

>_

```
$ terraform fmt
main.tf
```

terraform show

```
$ terraform show
# local_file.pet:
resource "local_file" "pet" {
    content              = "We love pets!"
    directory_permission = "0777"
    file_permission      = "0777"
    filename             = "/root/pets.txt"
    id                   =
"cba595b7d9f94ba1107a46f3f731912d95fb3d2c"
}
```

```
$ terraform show -json
{"format_version":"0.1","terraform_version":"0.13.0
","values":{"root_module":{"resources":[{"address":
"local_file.pet","mode":"managed","type":"local_fil
e","name":"pet","provider_name":"registry.terraform
.io/hashicorp/local","schema_version":0,"values":{"
content":"We love
pets!","content_base64":null,"directory_permission"
:"0777","file_permission":"0777","filename":"/root/
pets.txt","id":"cba595b7d9f94ba1107a46f3f731912d95f
b3d2c","sensitive_content":null}}]}}}
```

terraform providers

main.tf

```
resource "local_file" "pet" {
    filename        = "/root/pets.txt"
    content         = "We love pets!"
    file_permission = "0700"
}
```

>_

```
$ terraform providers
Providers required by configuration:
.
└── provider[registry.terraform.io/hashicorp/local]

Providers required by state:

    provider[registry.terraform.io/hashicorp/local]



$ terraform providers mirror /root/terraform/new_local_file
- Mirroring hashicorp/local...
  - Selected v1.4.0 with no constraints
  - Downloading package for windows_amd64...
  - Package authenticated: signed by HashiCorp
```

terraform output

main.tf

```
resource "local_file" "pet" {
  filename        = "/root/pets.txt"
  content         = "We love pets!"
  file_permission = "0777"
}
resource "random_pet" "cat" {
  length    = "2"
  separator = "-"
}
output content {
  value       = local_file.pet.content
  sensitive   = false
  description = "Print the content of the file"

}
output pet-name {
  value       = random_pet.cat.id
  sensitive   = false
  description = "Print the name of the pet"

}
```

>_

```
$ terraform output
content = We love pets!
pet-name = huge-owl
```

```
$ terraform output pet-name
pet-name = huge-owl
```

terraform refresh

main.tf

```
resource "local_file" "pet" {
  filename        = "/root/pets.txt"
  content         = "We love pets!"
  file_permission = "0777"
}
resource "random_pet" "cat" {
  length    = "2"
  separator = "-"
}
```

>_

```
$ terraform refresh
random_pet.cat: Refreshing state... [id=huge-owl]
local_file.pet: Refreshing state...
[id=cba595b7d9f94ba1107a46f3f731912d95fb3d2c]



$ terraform plan
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this
plan, but will not be
persisted to local or remote state storage.

random_pet.cat: Refreshing state... [id=huge-owl]
local_file.pet: Refreshing state...
[id=cba595b7d9f94ba1107a46f3f731912d95fb3d2c]
------------------------------------------------------------

No changes. Infrastructure is up-to-date.
```

terraform graph

main.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content  = "My favorite pet is ${random_pet.my-pet.id}"
}
resource "random_pet" "my-pet" {
  prefix = "Mr"
  separator = "."
  length = "1"
}
```

>_

```
 $ terraform graph
digraph {
        compound = "true"
        newrank = "true"
        subgraph "root" {
                "[root] local_file.pet (expand)" [label = "local_file.pet", shape = "box"]
                "[root] provider[\"registry.terraform.io/hashicorp/local\"]" [label = "provider[\"registry.terraform.io/hashicorp/local\"]", shape = "diamond"]
                "[root] provider[\"registry.terraform.io/hashicorp/random\"]" [label = "provider[\"registry.terraform.io/hashicorp/random\"]", shape = "diamond"]
                "[root] random_pet.my-pet (expand)" [label = "random_pet.my-pet", shape = "box"]
                "[root] local_file.pet (expand)" -> "[root] provider[\"registry.terraform.io/hashicorp/local\"]"
                "[root] local_file.pet (expand)" -> "[root] random_pet.my-pet (expand)"
                "[root] meta.count-boundary (EachMode fixup)" -> "[root] local_file.pet (expand)"
                "[root] provider[\"registry.terraform.io/hashicorp/local\"] (close)" ->
```

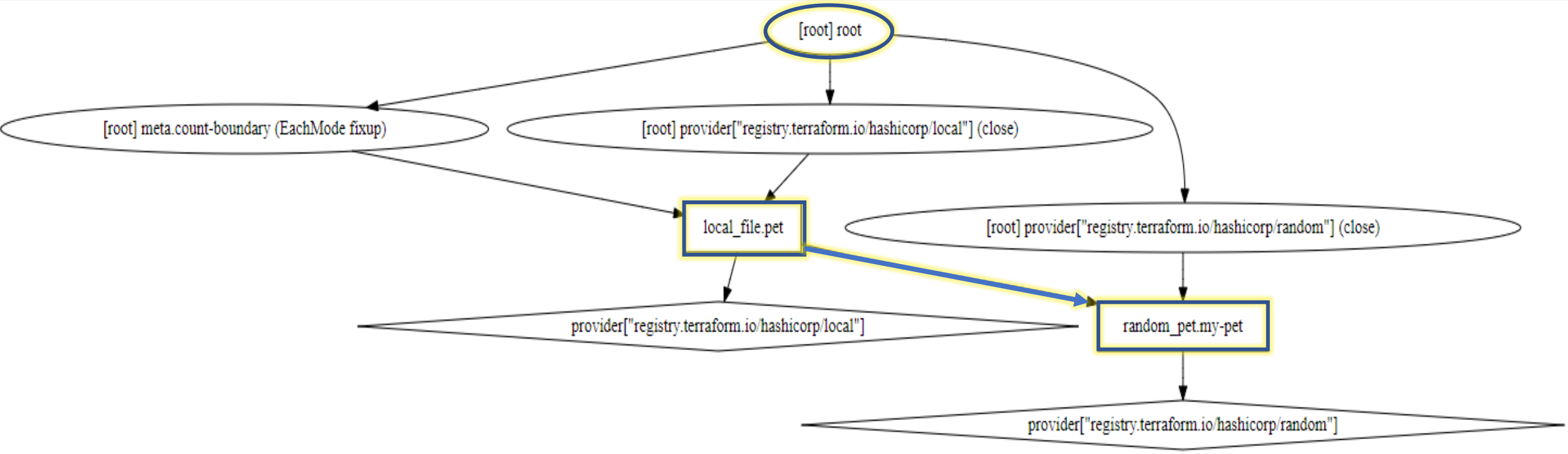
terraform graph

main.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content  = "My favorite pet is ${random_pet.my-pet.id}"
}
```

>_

```
$ apt update
$ apt install graphviz -y
$ terraform graph | dot -Tsvg > graph.svg
```




KODEKLOUD

Mutable vs Immutable Infrastructure

terraform validate

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
    file_permission = "0700"
}
```

>_

```
 $ terraform apply

# local_file.pet must be replaced
-/+ resource "local_file" "pet" {
        content              = "We love pets!"
        directory_permission = "0777"
      ~ file_permission      = "0777" -> "0700" # forces
replacement
        filename             = "/root/pet.txt"
      ~ id                   =
"5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf" -> (known after
apply)
    }

Plan: 1 to add, 0 to change, 1 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

local_file.pet: Destroying...
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]
local_file.pet: Destruction complete after 0s
```

upgrade-nginx.sh

Configuration Drift

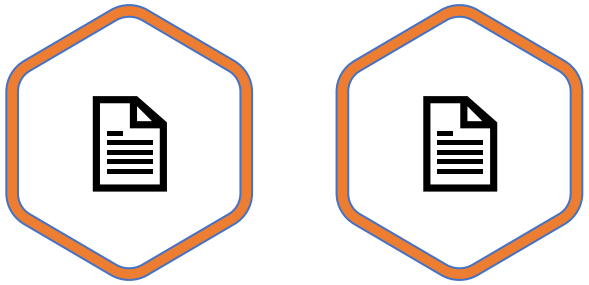
Immutable Infrastructure

Immutable Infrastructure

Immutable Infrastructure

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
    file_permission = "0700"
}
```



>_

```
$ terraform apply

# local_file.pet must be replaced
-/+ resource "local_file" "pet" {
        content              = "We love pets!"
        directory_permission = "0777"
      ~ file_permission      = "0777" -> "0700" # forces
replacement
        filename             = "/root/pet.txt"
      ~ id                   =
"5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf" -> (known after
apply)
    }

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

local_file.pet: Destroying...
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]
local_file.pet: Destruction complete after 0s
local_file.pet: Creating...
local_file.pet: Creation complete after 0s
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]

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

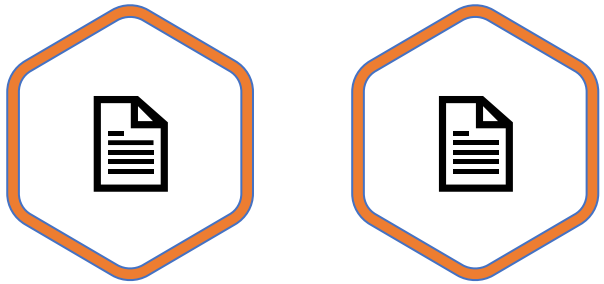

KODEKLOUD

Lifecycle Rules

create_before_destroy

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
    file_permission = "0700"

    lifecycle  {
        create_before_destroy  = true
    }


}
```



>_

```
$ terraform apply

# local_file.pet must be replaced
-/+ resource "local_file" "pet" {
        content              = "We love pets!"
        directory_permission = "0777"
      ~ file_permission      = "0777" -> "0755" # forces repl
        filename             = "/root/pet.txt"
      ~ id                   =
"5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf" -> (known after ap
    }

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

...

local_file.pet: Creating...
local_file.pet: Creation complete after 0s
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]

local_file.pet: Destroying...
[id=5f8fb950ac60f7f23ef968097cda0a1fd3c11bdf]
local_file.pet: Destruction complete after 0s

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

prevent_destroy

main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
    file_permission = "0700"

    lifecycle  {
        prevent_destroy  = true
    }


}
```

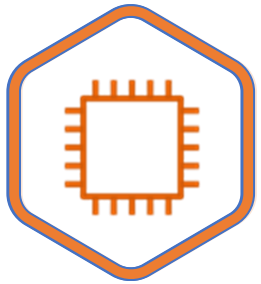
>_

```
$ terraform apply
local_file.my-pet: Refreshing state...
[id=cba595b7d9f94ba1107a46f3f731912d95fb3d2c]

Error: Instance cannot be destroyed

  on main.tf line 1:
   1: resource "local_file" "my-pet" {

Resource local_file.my-pet has
lifecycle.prevent_destroy set, but the plan calls
for this resource to be destroyed. To avoid this error
and continue with the plan, either disable
lifecycle.prevent_destroy or reduce the scope of the
plan using the -target flag.
```

ignore_changes

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
      Name = “ProjectA-Webserver"
  }
 }
```



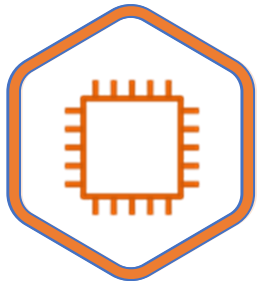
>_

```
$ terraform apply

...
Terraform will perform the following actions:

  # aws_instance.webserver will be created
  + resource "aws_instance" "webserver" {
      + ami                          = "ami-0edab43b6fa892279"
      + get_password_data            = false
      + host_id                      = (known after apply)
      + id                           = (known after apply)
      + instance_state               = (known after apply)
      + instance_type                = "t2.micro“
      + tags                         {
          + "Name"       = "ProjectA-WebServer"
        }
.
aws_instance.webserver: Creation complete after 33s [id=i-
05cd83b221911acd5]

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

ignore_changes

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
      Name = “ProjectA-Webserver"
  }
 }
```



>_

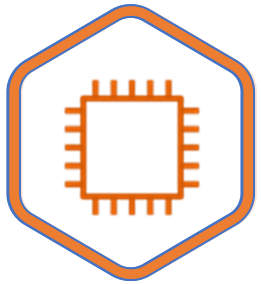
```
$ terraform apply

aws_instance.webserver: Refreshing state... [id=i-
05cd83b221911acd5]

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  ~ update in-place

Terraform will perform the following actions:

  # aws_instance.webserver will be updated in-place
  ~ resource "aws_instance" "webserver" {
.
.
~ tags                          = {
  ~ "Name"       = "ProjectB-WebServer" -> "ProjectA-WebServer"
      }
.
.
Apply complete! Resources: 0 added, 1 changed, 0 destroyed.
```

☑	ProjectB-WebServer	i-05cd83b221911acd5	Running	t2.micro	2/2 checks ...

ignore_changes

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
      Name = “ProjectA-Webserver"
  }
  lifecycle {
        ignore_changes = [
          tags

        ]
    }
}
```



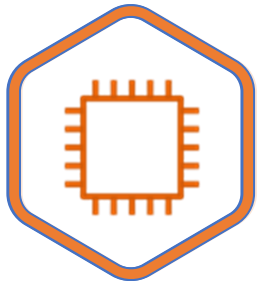
>_

```
$ terraform apply

aws_instance.webserver: Refreshing state... [id=i-
05cd83b221911acd5]

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

ignore_changes

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
      Name = “ProjectA-Webserver"
  }
  lifecycle {
        ignore_changes = all



    }
}
```



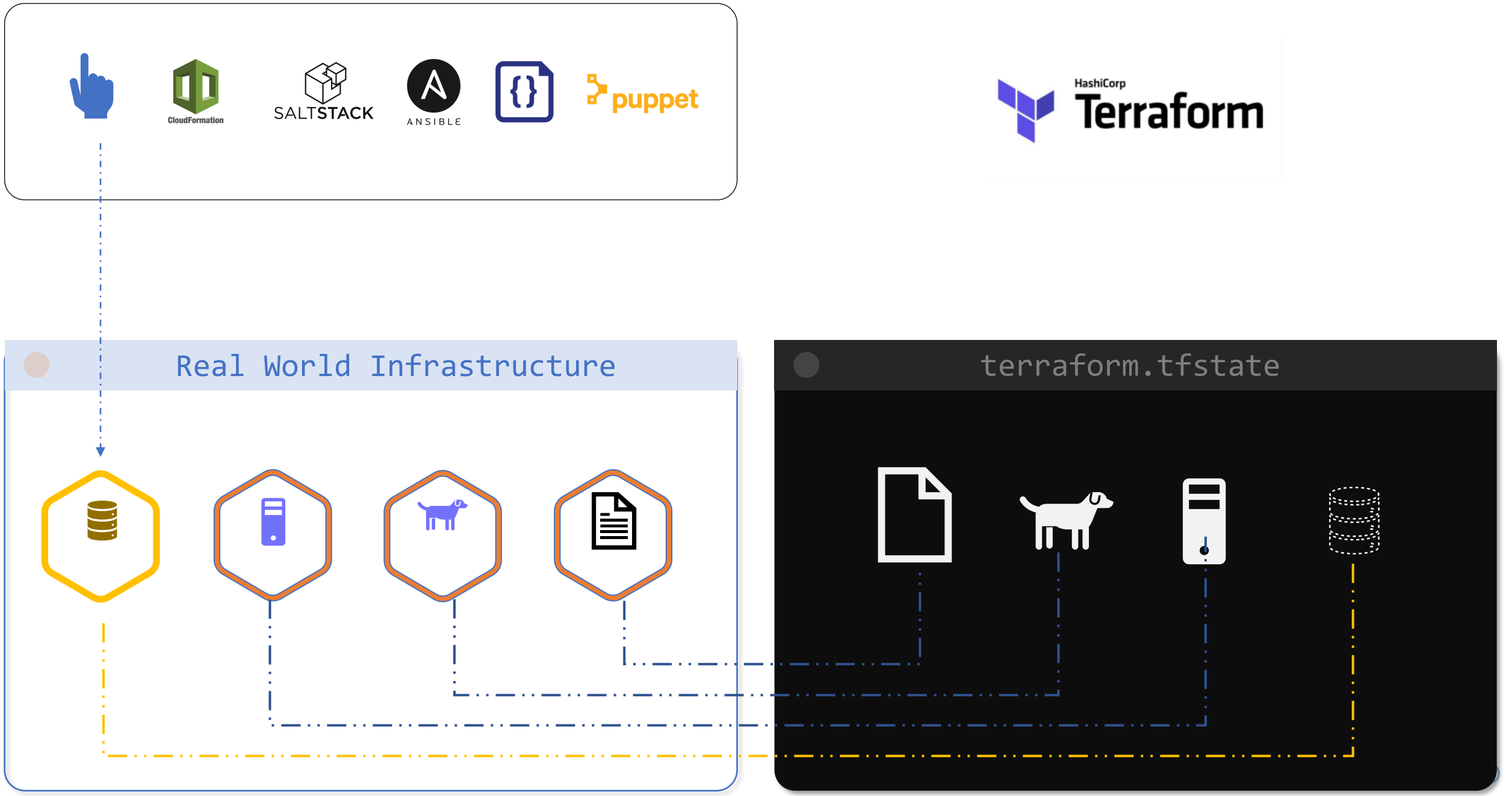
>_

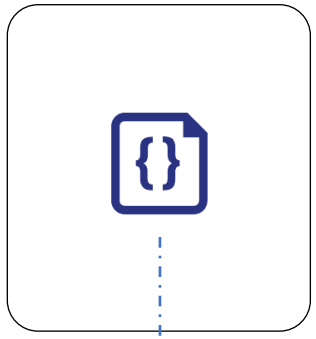
```
$ terraform apply

aws_instance.webserver: Refreshing state... [id=i-
05cd83b221911acd5]

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

Order	Option	
1	create_before_destroy	Create the resource first and then destroy older
2	prevent_destroy	Prevents destroy of a resource
3	ignore_changes	Ignore Changes to Resource Attributes (specific/all)


KODEKLOUD

Data Sources


CloudFormation
SALTSTACK
ANSIBLE
puppet
HashiCorp
Terraform
Real World Infrastructure
terraform.tfstate



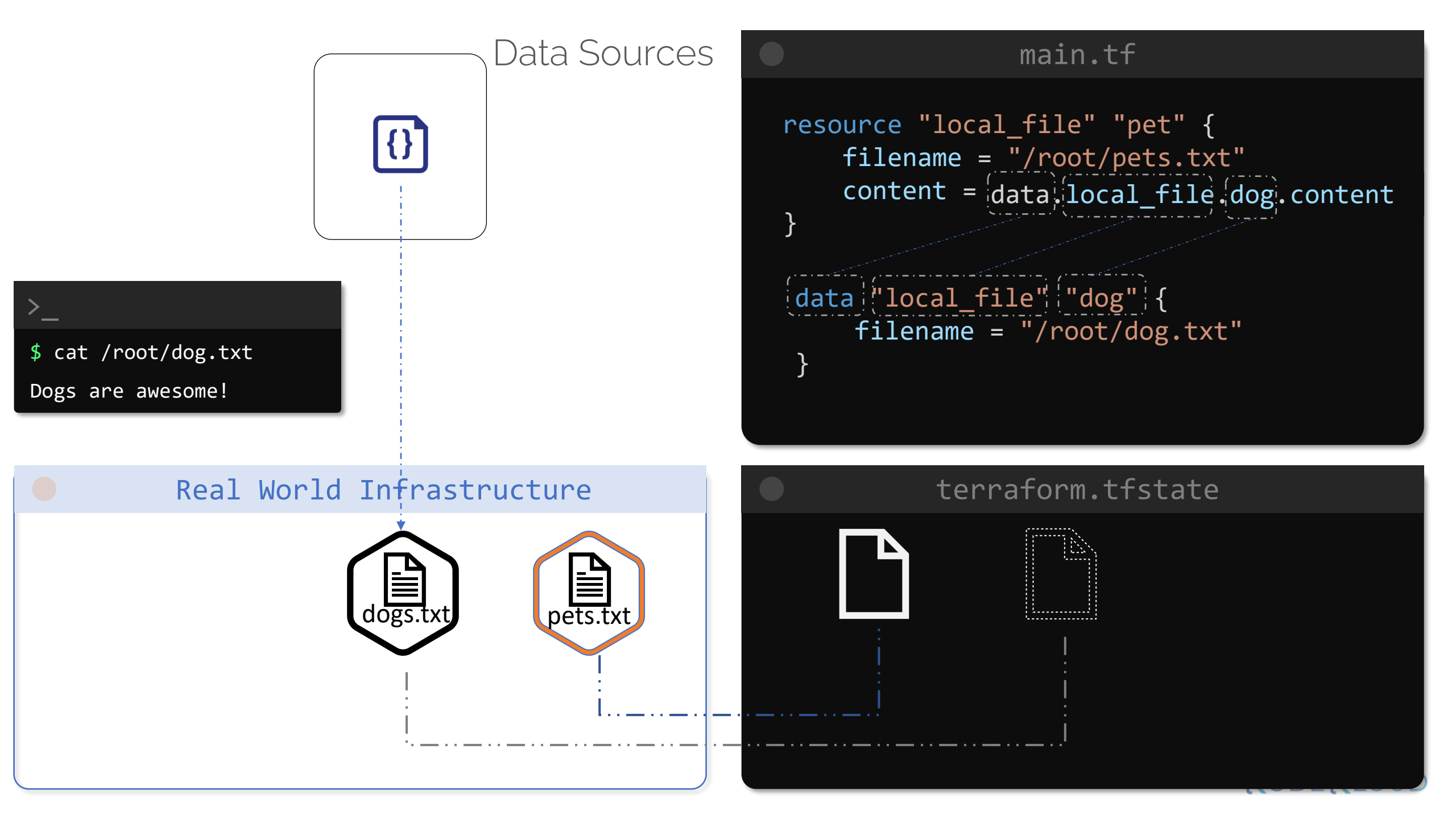
main.tf

```
resource "local_file" "pet" {
    filename = "/root/pets.txt"
    content = "We love pets!"
}
```

```
>_
$ cat /root/dog.txt
Dogs are awesome!
```

Real World Infrastructure

terraform.tfstate


Data Sources
main.tf
resource "local_file" "pet" {
filename = "/root/pets.txt"
content = data.local_file.dog.content
}
data "local_file" "dog" {
filename = "/root/dog.txt"
}
>_
$ cat /root/dog.txt
Dogs are awesome!
Real World Infrastructure
dogs.txt
pets.txt
terraform.tfstate

LOCAL DOCUMENTATION

Filter

local provider

- Resources
  - local_file
- Data Sources
  - local_file

Argument Reference

The following argument is required:

- `filename` - (Required) The path to the file that will be read. The data source will return an error if the file does not exist.

Attributes Exported

The following attribute is exported:

- `content` - The raw content of the file that was read.
- `content_base64` - The base64 encoded version of the file content (use this when dealing with binary data).

Resource	Data Source
Keyword: **resource**	Keyword: **data**
Creates, Updates, Destroys Infrastructure	Only **Reads** Infrastructure
Also called **Managed Resources**	Also called **Data Resources**


KODEKLOUD

Meta Arguments

main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    content = var.content

}
```

variables.tf

```
variable "filename" {
  default = "/root/pets.txt"
}
variable "content" {
  default = "I love pets!"
}
```

Shell Scripts

create_files.sh

```
#!/bin/bash

for i in {1..3}
  do
    touch /root/pet${i}
  done
```

>_

```
$ ls -ltr /root/
-rw-r--r-- 1 root root    0 Sep  9 02:04 pet2
-rw-r--r-- 1 root root    0 Sep  9 02:04 pet1
-rw-r--r-- 1 root root    0 Sep  9 02:04 pet3
```

Iteration	filename
1	/root/pet1
2	/root/pet2
3	/root/pet3

Meta Arguments

depends_on

main.tf

```
resource "local_file" "pet" {
  filename = var.filename
  content  = var.content
  depends_on = [
    random_pet.my-pet
  ]
}
resource "random_pet" "my-pet" {
  prefix    = var.prefix
  separator = var.separator
  length    = var.length
}
```

lifecycle

main.tf

```
resource "local_file" "pet" {
   filename = "/root/pets.txt"
   content = "We love pets!"
   file_permission = "0700
   lifecycle  {
     create_before_destroy  = true
   }
}
```


KODEKLOUD

Count

count

main.tf

```
resource "local_file" "pet" {
    filename = var.filename

    count    = 3

}
```

variables.tf

```
variable "filename" {
  default = "/root/pets.txt"
}
```

>_

```
$ terraform plan

[Output Truncated]
Terraform will perform the following actions:
...
# local_file.pet[2] will be created
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
      + id                   = (known after apply)
    }

Plan: 3 to add, 0 to change, 0 to destroy.
```

count

main.tf

```
resource "local_file" "pet" {
    filename = var.filename

    count    = 3

}
```

variables.tf

```
variable "filename" {
  default = "/root/pets.txt"
}
```

>_

```
$ terraform apply
[Output Truncated]
.

local_file.pet[2]: Creating...
local_file.pet[0]: Creating...
local_file.pet[1]: Creating...
local_file.pet[0]: Creation complete after 0s
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68]
local_file.pet[2]: Creation complete after 0s
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68]
local_file.pet[1]: Creation complete after 0s
[id=7e4db4fbfdbb108bdd04692602bae3e9bd1e1b68]

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

count

main.tf

```
resource "local_file" "pet" {
    filename = var.filename

    count    = 3

}
```

variables.tf

```
variable "filename" {
  default = "/root/pets.txt"
}
```

>_

```
$ ls /root
pet.txt
```

count

main.tf

```
resource "local_file" "pet" {
    filename = var.filename[count.index]
    count    = 3
}
```

variables.tf

```
variable "filename" {
  default = [
    "/root/pets.txt",
    "/root/dogs.txt",
    "/root/cats.txt"
  ]
}
```

>_

```
$ ls /root
pets.txt
dogs.txt
cats.txt
```

Length Function

main.tf

```
resource "local_file" "pet" {
    filename = var.filename[count.index]
    count    = length(var.filename)
}
```

variables.tf

```
variable "filename" {
  default = [
    "/root/pets.txt",
    "/root/dogs.txt",
    "/root/cats.txt",
    "/root/cows.txt",
    "/root/ducks.txt"
  ]
}
```


```
>_
$ ls /root
pets.txt
dogs.txt
cats.txt
```

Length Function

variable	function	value
fruits = ["apple", "banana", "orange"]	length(fruits)	3
cars = [“honda”, “bmw”, “nissan”, “kia”]	length(cars)	4
colors = [“red”, “purple”]	length(colors)	2

LengthFunction

main.tf

```
resource "local_file" "pet" {
    filename = var.filename[count.index]
    count    = length(var.filename)
}
```

variables.tf

```
variable "filename" {
  default = [
    "/root/pets.txt",
    "/root/dogs.txt",
    "/root/cats.txt",
    "/root/cows.txt",
    "/root/ducks.txt"
  ]
}
```


```
>_
$ ls /root
pets.txt
dogs.txt
cats.txt
```

```
$ terraform apply

.
.
Terraform will perform the following actions:

  # local_file.pet[0] will be created
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
      + id                   = (known after apply)
    }

  # local_file.pet[1] will be created
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/dogs.txt"
      + id                   = (known after apply)
    }

  # local_file.pet[2] will be created
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/cats.txt"
      + id                   = (known after apply)
    }
```

```
$ ls /root
pet.txt
dogs.txt
cats.txt
```

main.tf

```
resource "local_file" "pet" {
    filename = var.filename[count.index]
    count    = length(var.filename)
}
```

variables.tf

```
variable "filename" {
  default = [
    "/root/dogs.txt",
    "/root/cats.txt"
  ]
}
```

main.tf

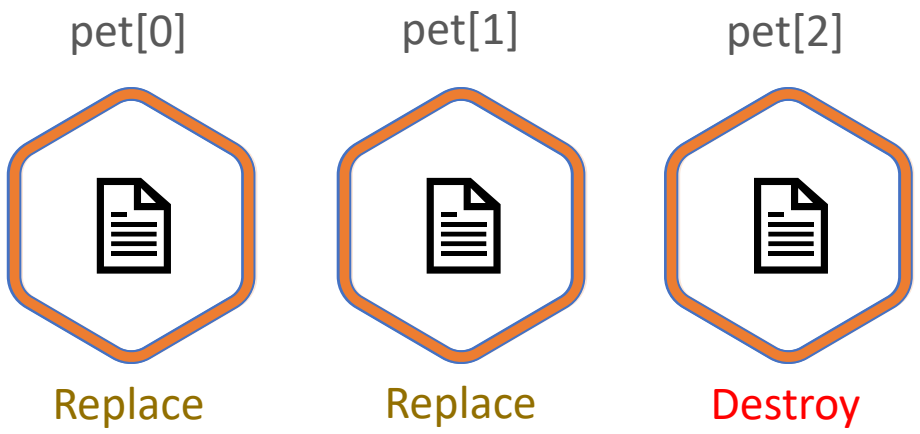
```
resource "local_file" "pet" {
    filename = var.filename[count.index]

    count    = length(var.filename)
}
```

variables.tf

```
variable "filename" {
    default = [

      "/root/dogs.txt",
      "/root/cats.txt"
    ]

}
```

>_

```
$ terraform plan

...
  # local_file.pet[0] must be replaced
-/+ resource "local_file" "pet" {
        directory_permission = "0777"
        file_permission      = "0777"
      ~ filename             = "/root/pets.txt" -> "/root/dogs.txt" #
forces replacement
    }
  # local_file.pet[1] must be replaced
-/+ resource "local_file" "pet" {
        directory_permission = "0777"
        file_permission      = "0777"
      ~ filename             = "/root/dogs.txt" -> "/root/cats.txt" #
forces replacement
    }
  # local_file.pet[2] will be destroyed
  - resource "local_file" "pet" {
      - directory_permission = "0777" -> null
      - file_permission      = "0777" -> null
```

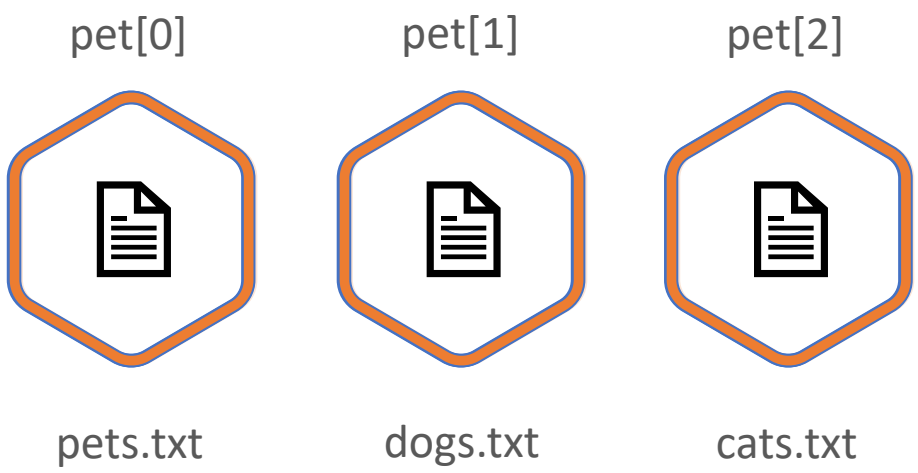


main.tf

```
resource "local_file" "pet" {
    filename = var.filename[count.index]

    count    = length(var.filename)
}

output "pets" {
  value = local_file.pet
}
```

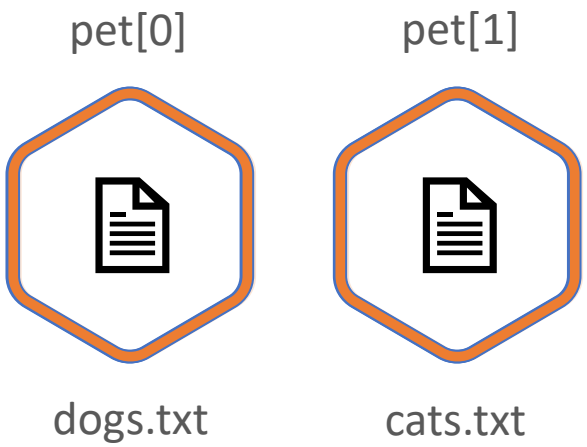
>_

```
$ terraform output
Outputs:

pets = [
  {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/pets.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  },
  {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/dogs.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  },
  {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/cats.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  },
]
```



variables.tf

```
variable "filename" {
  default = [

    "/root/dogs.txt",
    "/root/cats.txt"
  ]

}
```



variables.tf

```
variable "filename" {
  default = [

    "/root/dogs.txt",
    "/root/cats.txt"
  ]

}
```

Resource	Resource Updates	Action
pet[0]	/root/pets.txt" -> "/root/dogs.txt"	Destroy and Replace
pet[1]	"/root/dogs.txt" -> "/root/cats.txt"	Destroy and Replace
pet[2]	Does not Exist	Destroy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for_each

for_each

main.tf

```
resource "local_file" "pet" {
    filename = each.value

    for_each = var.filename

}
```

variables.tf

```
variable "filename" {
  type=set(string)
   default = [
     "/root/pets.txt",
     "/root/dogs.txt",
     "/root/cats.txt"
   ]

}
```

>_

```
$ terraform plan
Terraform will perform the following actions:
  # local_file.pet["/root/cats.txt"] will be created
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/cats.txt"
    }
... <output trimmed>
Plan: 3 to add, 0 to change, 0 to destroy.
```

for_each

main.tf

```
resource "local_file" "pet" {
    filename = each.value
    for_each = toset(var.filename)
}
```

variables.tf

```
variable "filename" {
  type=set(string)
  default = [
    "/root/pets.txt",
    "/root/dogs.txt",
    "/root/cats.txt"
  ]
}
```

>_

```
$ terraform plan
Terraform will perform the following actions:
  # local_file.pet["/root/cats.txt"] will be created
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/cats.txt"
    }
... <output trimmed>
Plan: 3 to add, 0 to change, 0 to destroy.
```

for_each

main.tf

```
resource "local_file" "pet" {
    filename = each.value

    for_each = toset(var.filename)
}

output "pets" {
  value = local_file.pet
}
```

variables.tf

```
variable "filename" {
  type=list(string)

  default = [

    "/root/dogs.txt",
    "/root/cats.txt"
  ]

}
```

>_

```
$ terraform plan
Terraform will perform the following actions:
  # local_file.pet["/root/pets.txt"] will be destroyed
  + resource "local_file" "pet" {
      + directory_permission = "0777"
      + file_permission      = "0777"
      + filename             = "/root/pets.txt"
    }
... <output trimmed>
Plan: 0 to add, 0 to change, 1 to destroy.
```

for_each

main.tf

```
resource "local_file" "pet" {
    filename = each.value

    for_each = toset(var.filename)
}

output "pets" {
  value = local_file.pet
}
```

>_

```
$ terraform output
pets = {
  "/root/cats.txt" = {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/cats.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  }


  "/root/dogs.txt" = {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/dogs.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  }
}
```

count

```
$ terraform output
pets = [
  {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/pets.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  },
  {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/dogs.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  },
  {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/cats.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  },
]
```

for_each

```
$ terraform output
pets = {
  "/root/cats.txt" = {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/cats.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  }


  "/root/dogs.txt" = {
    "directory_permission" = "0777"
    "file_permission" = "0777"
    "filename" = "/root/dogs.txt"
    "id" = "da39a3ee5e6b4b0d3255bfef95601890afd80709"
  }
}
```


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Version Constraints

main.tf

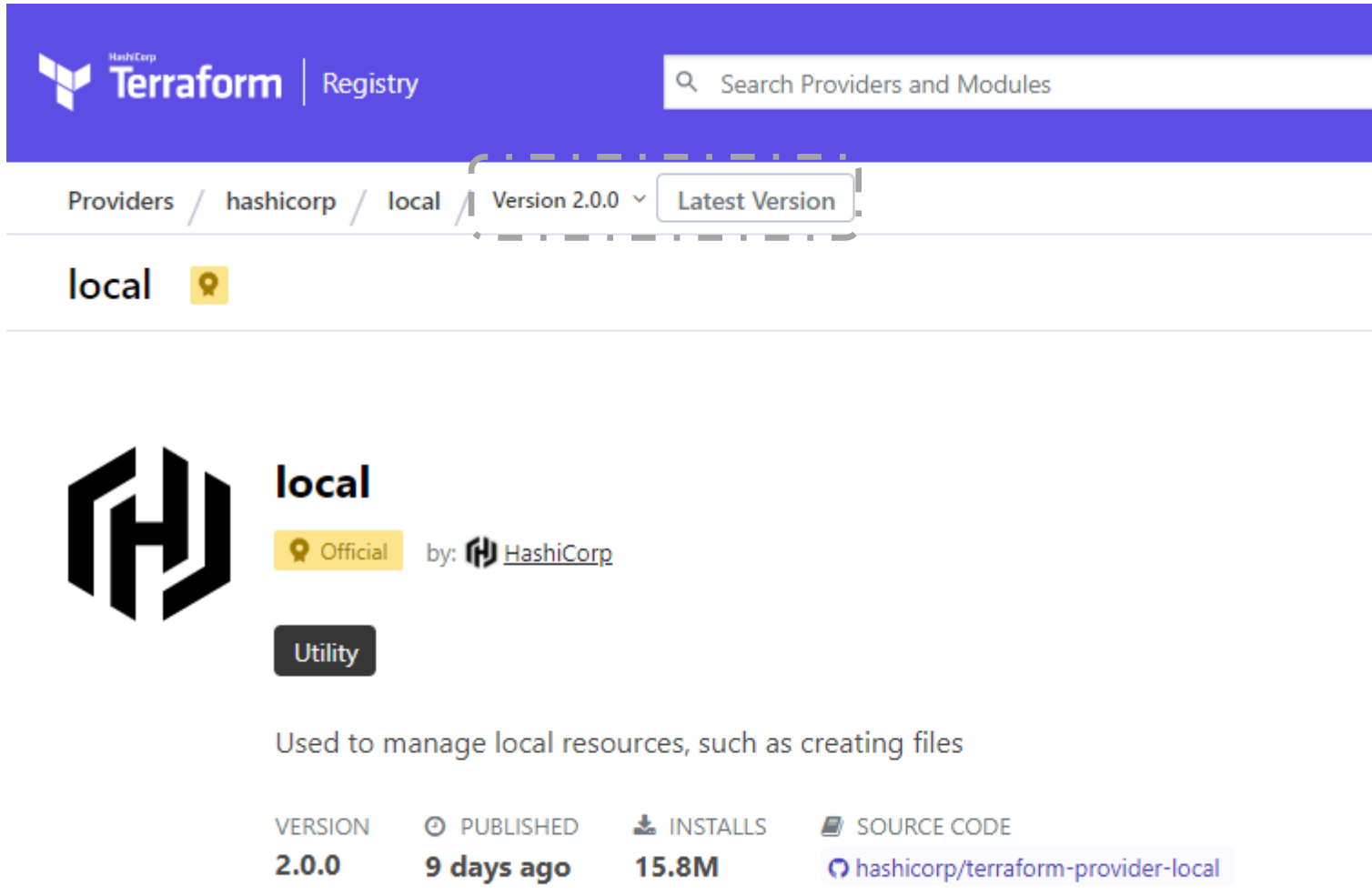
```
resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```

>_

```
$ terraform init
Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/local...
- Installing hashicorp/local v1.4.0...
- Installed hashicorp/local v1.4.0 (signed by HashiCorp)

The following providers do not have any version constraints
in configuration, so the latest version was installed.

To prevent automatic upgrades to new major versions that may
contain breaking
changes, we recommend adding version constraints in a
required_providers block
in your configuration, with the constraint strings suggested
below.

* hashicorp/local: version = "~> 1.4.0"

Terraform has been successfully initialized!
```

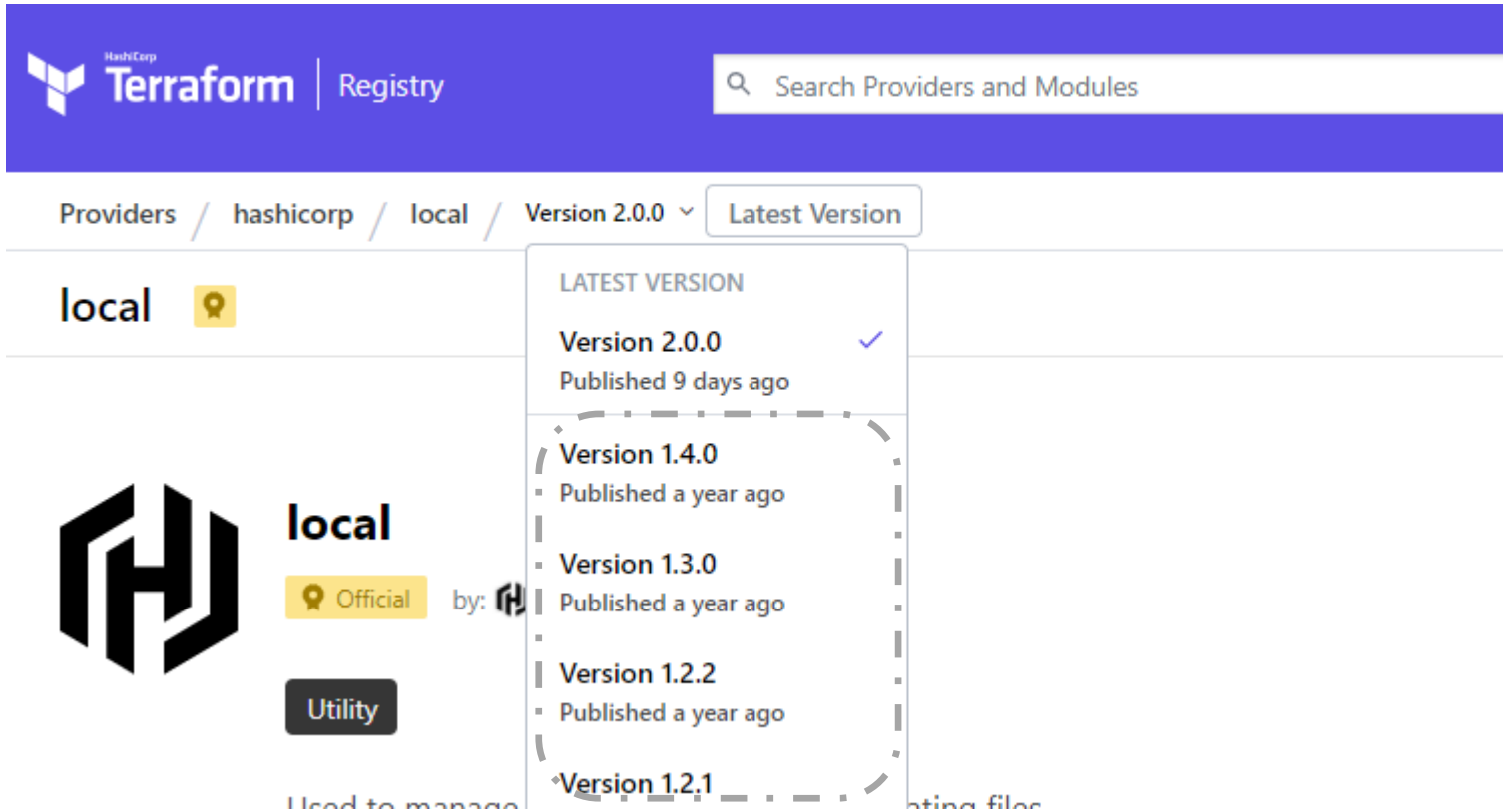
main.tf

```
resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```



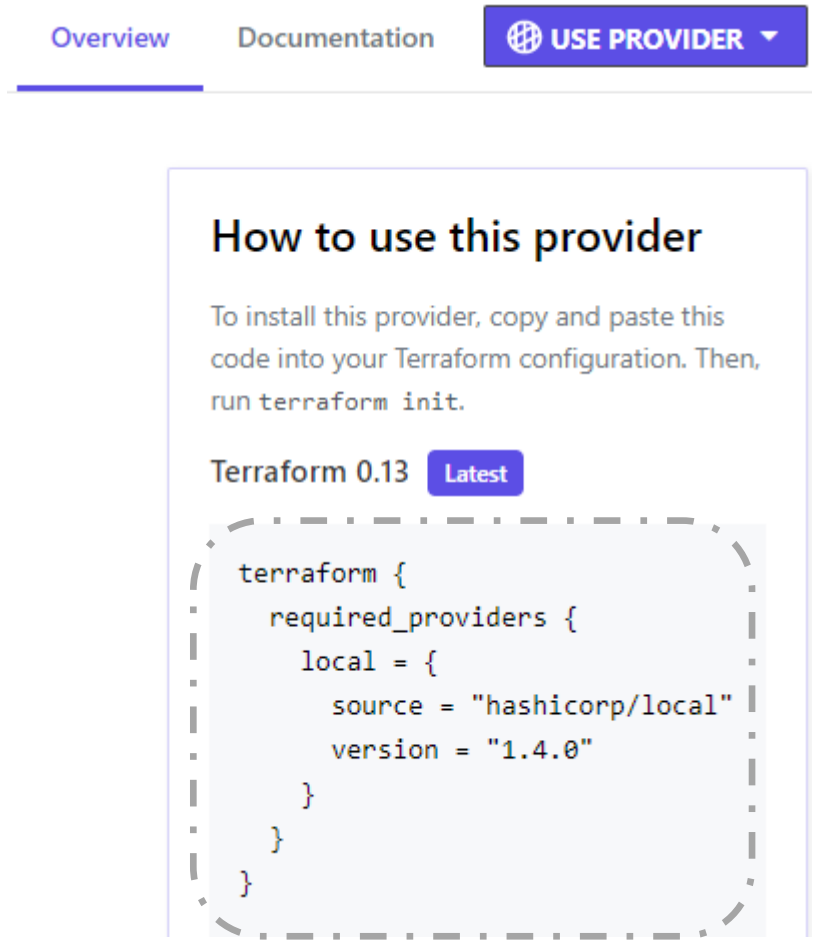
main.tf

```
resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```



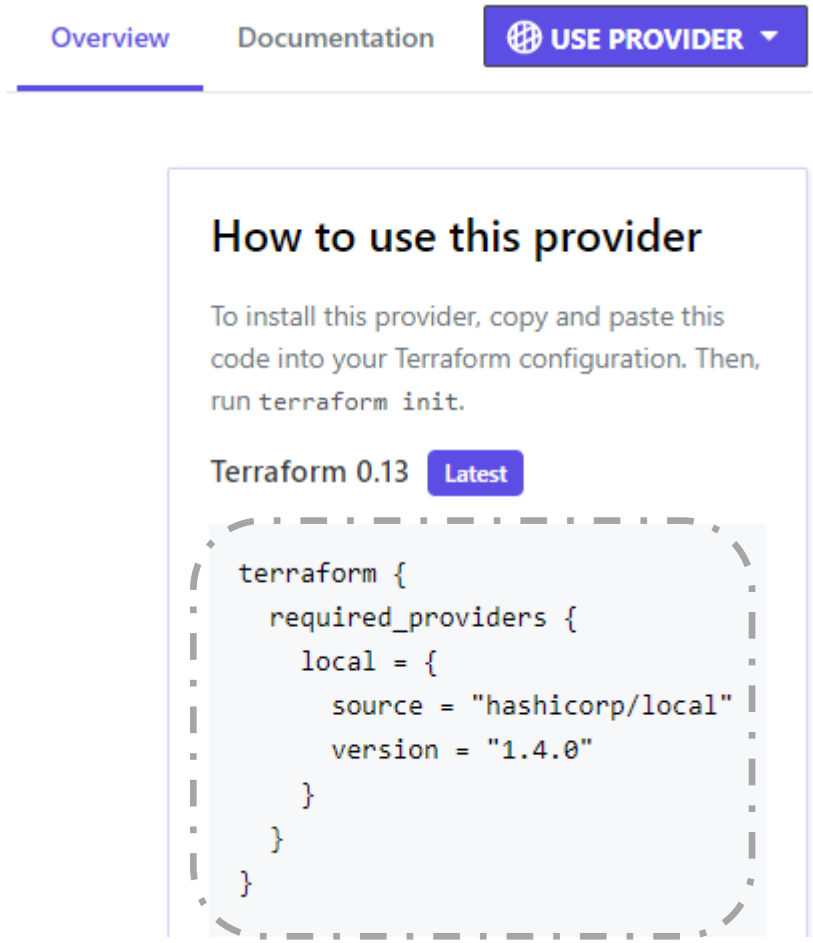
main.tf

```
resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```



main.tf

```
terraform {
  required_providers {
    local = {
      source = "hashicorp/local"
      version = "1.4.0"
    }
  }
}

resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```



main.tf

```
terraform {
  required_providers {
    local = {
      source = "hashicorp/local"
      version = "1.4.0"
    }
  }
}

resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```

>_

```
$ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding hashicorp/local versions matching "1.4.0"...
- Installing hashicorp/local v1.4.0...
- Installed hashicorp/local v1.4.0 (signed by HashiCorp)

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.
```

main.tf

```
terraform {
  required_providers {
    local = {
      source = "hashicorp/local"
      version = "> 1.2.0, < 2.0.0, != 1.4.0"
    }
  }
}

resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```

>_

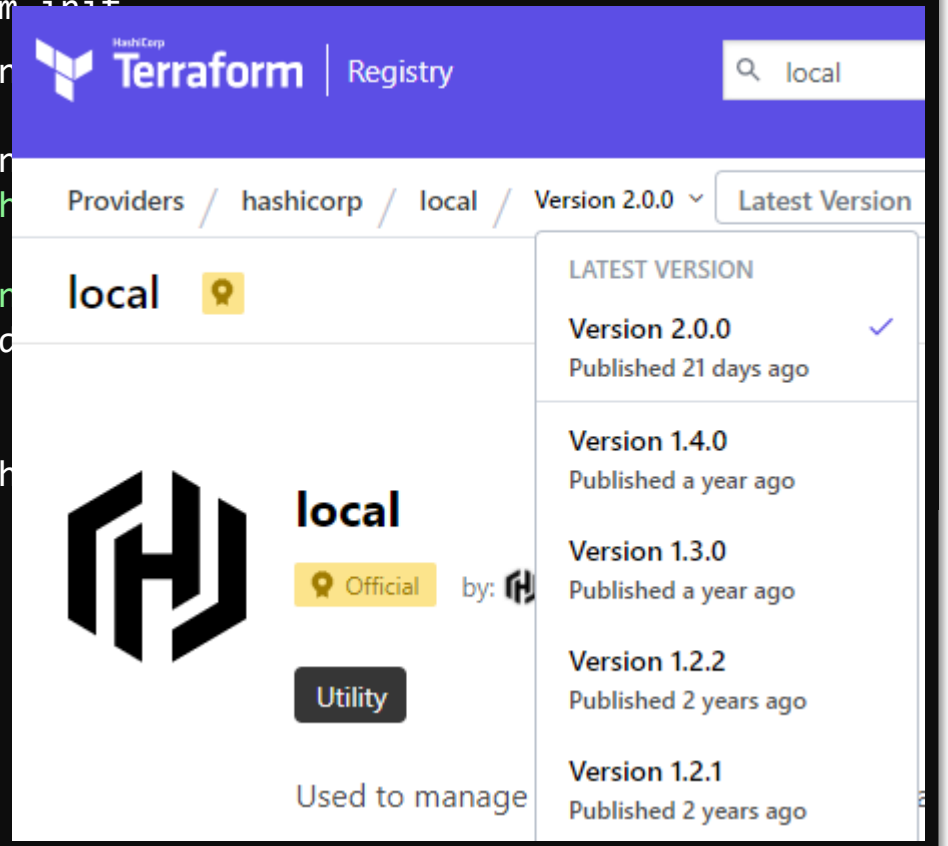
```
$ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding hashicorp/local versions matching "> 1.2.0, < 2.0.0, != 1.4.0"...
- Installing hashicorp/local v1.3.0...
- Installed hashicorp/local v1.3.0 (signed by HashiCorp)

Terraform has been successfully initialized!
```

main.tf

```
terraform {
  required_providers {
    local = {
      source = "hashicorp/local"
      version = "~> 1.2.0"
    }
  }
}

resource "local_file" "pet" {
  filename     = "/root/pet.txt"
  content  = "We love pets!"
}
```

>_

```
$ terraform init

Initializin

Initializin
- Finding h
1.2.0"...
- Installin
- Installed
HashiCorp)

Terraform h
```



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Getting Started with AWS

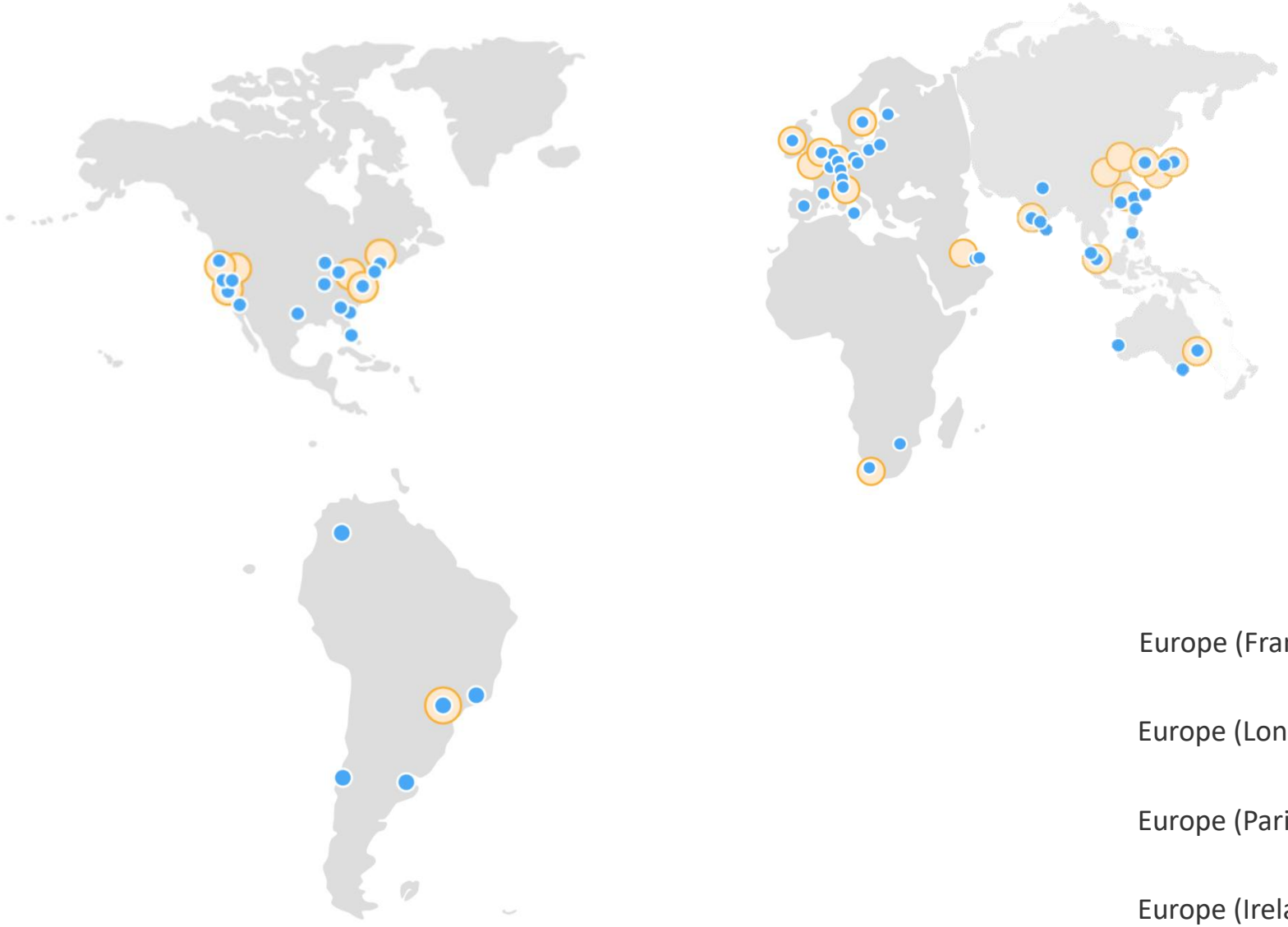
Why AWS?

https://aws.amazon.com/blogs/aws/aws-named-as-a-cloud-leader-for-the-10th-consecutive-year-in-gartners-infrastructure-platform-services-magic-quadrant/

Why AWS?

Compute	Databases	Storage	Machine Learning	Analytics	IoT

Why AWS?



US East (Ohio) Region

US West (Oregon) Region

US West (Northern California) Region

GovCloud (US-West) Region

GovCloud (US-East) Region

Canada (Central) Region

South America (São Paulo) Region

Europe (Frankfurt) Region

Europe (London) Region

Europe (Paris) Region

Europe (Ireland) Region

Europe (Milan) Region

Mainland China (Beijing) Region

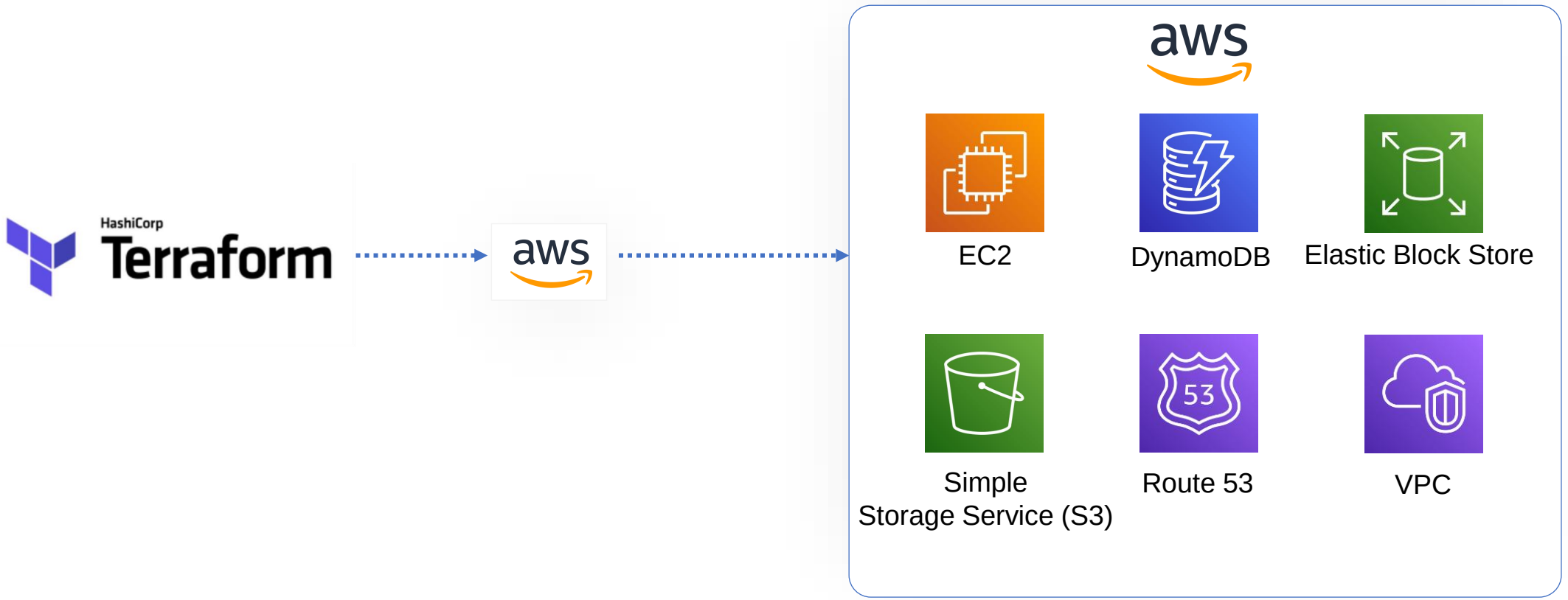
Asia Pacific (Sydney) Region

Asia Pacific (Tokyo) Region

Asia Pacific (Mumbai) Region

Asia Pacific (Hong Kong) Region

Why AWS with Terraform?



Getting Started with AWS

Demo: Setup an AWS Account

Introduction to IAM

Demo: IAM

Programmatic Access

IAM with Terraform

Introduction to AWS S3

S3 with Terraform

Introduction to DynamoDB

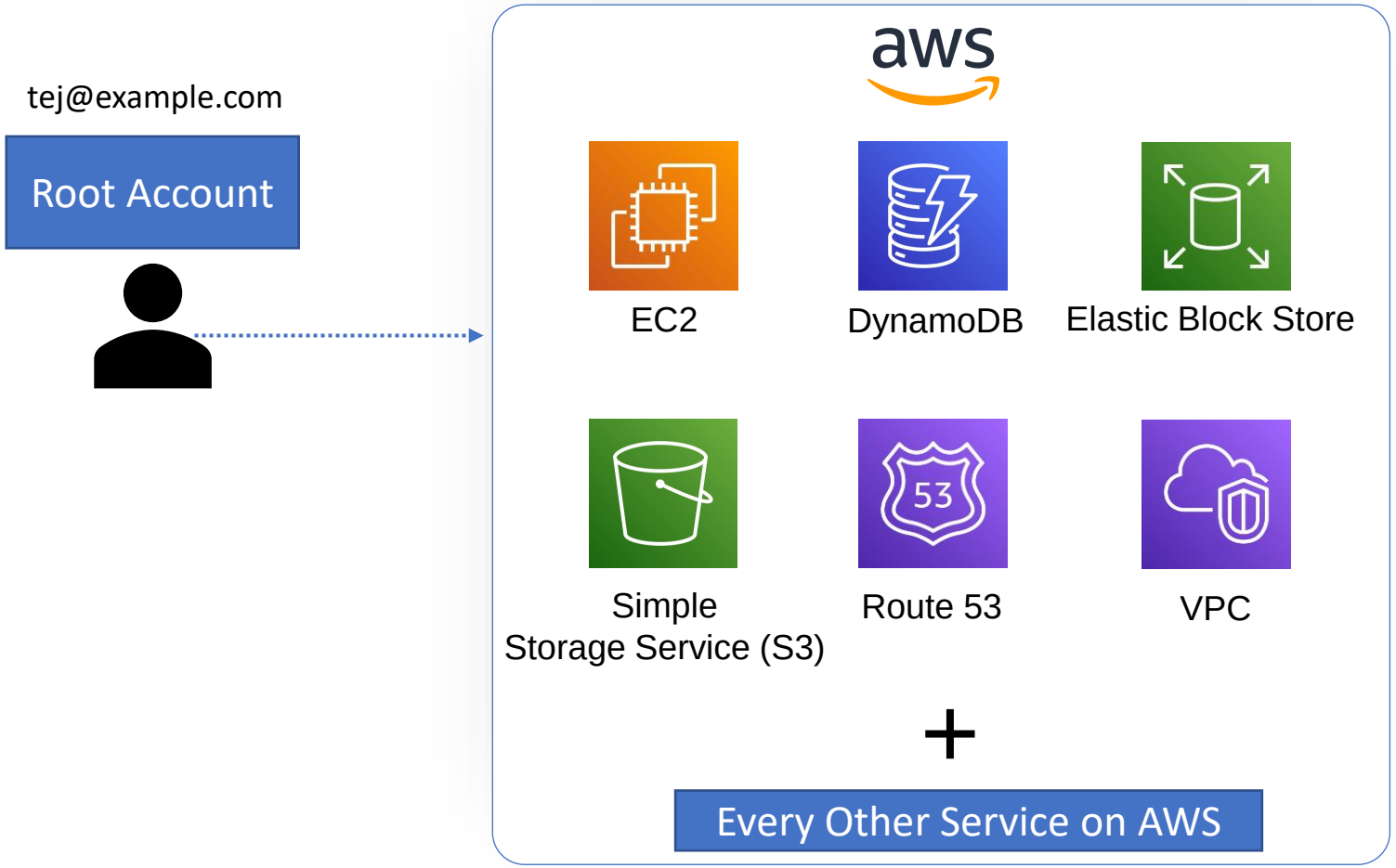
Demo DynamoDB

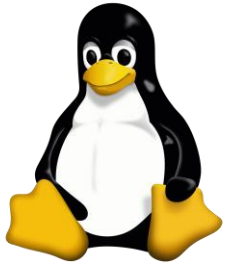
DynamoDB with Terraform


KODEKLOUD

Introduction to IAM

Identity and Access Management in AWS





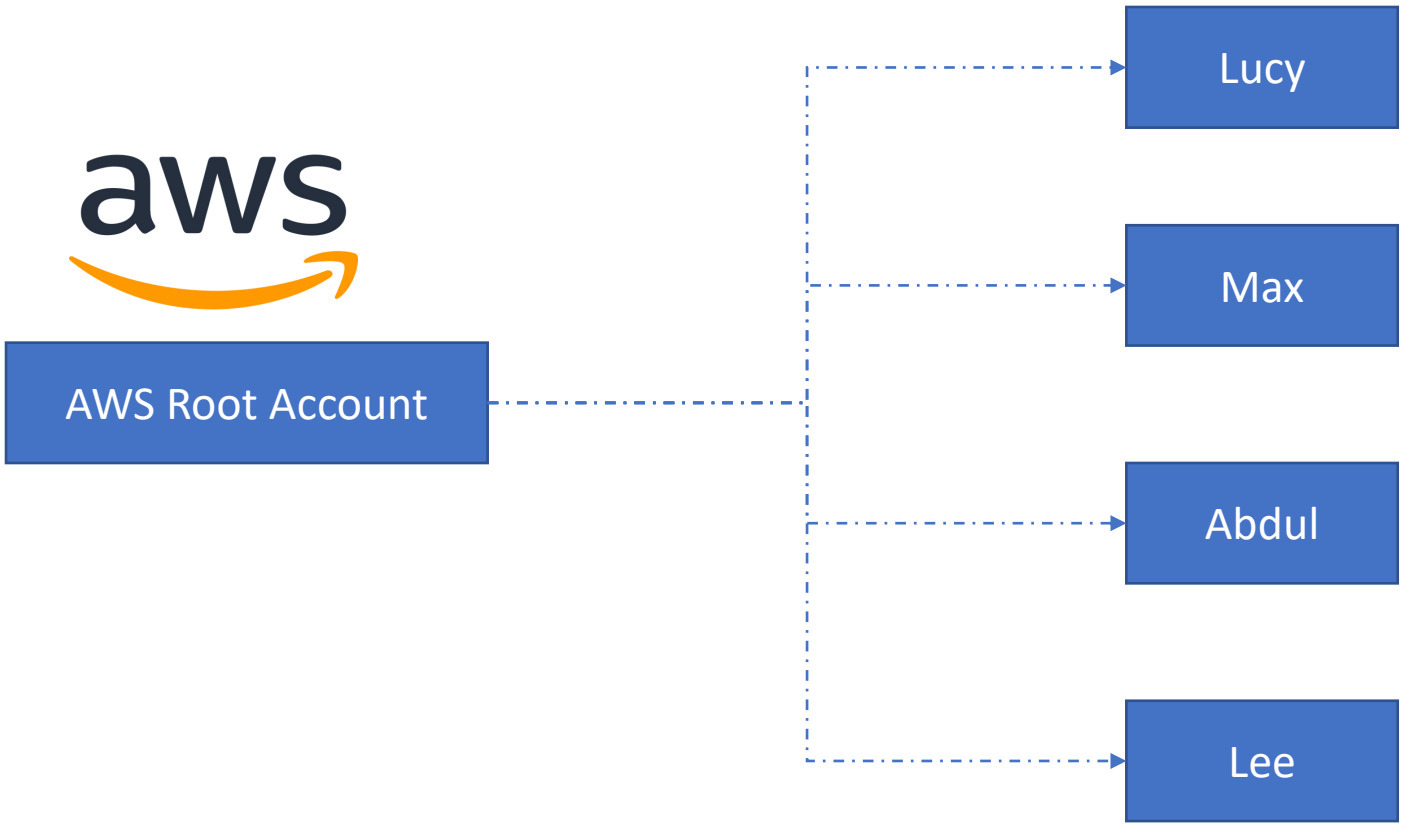
Linux Root User

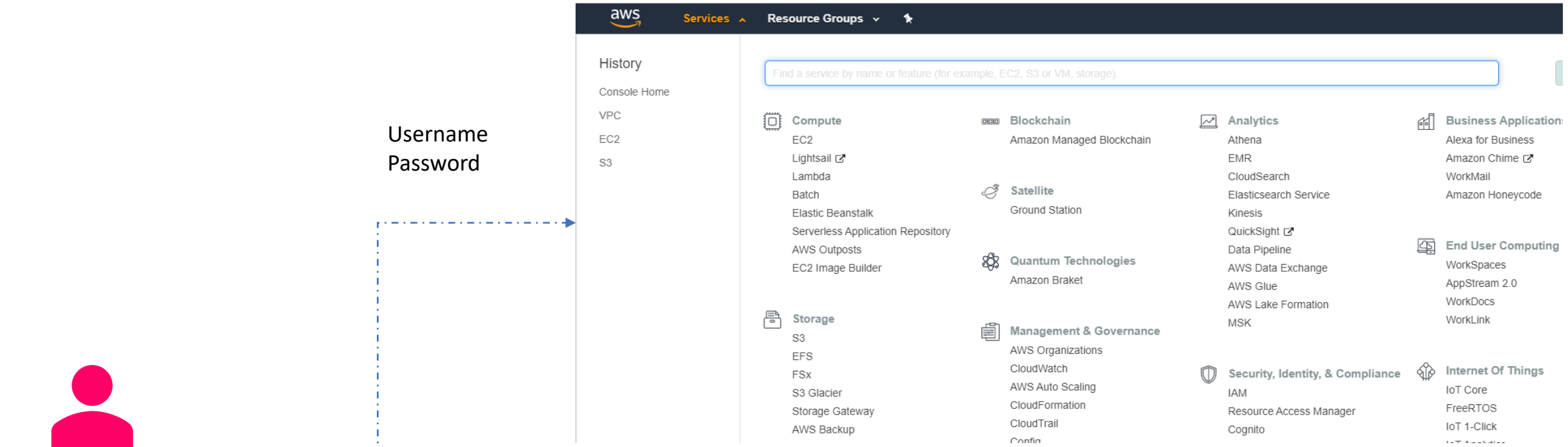
Windows

Windows Admin User

aws

AWS Root Account





Username
Password

console.aws.com

Lucy

```
$ aws s3api create-bucket –bucket my-bucket –region us-east-1
```

Access Key ID
Secret Access Key


{
"Version": "2012-10-17",
"Statement": [
{
"Effect": "Allow",
"Action": "*",
"Resource": "*"
}
]
}
AdministratorAccess Policy
Lucy
IAM Policy
AdministratorAccess

AdministratorAccess

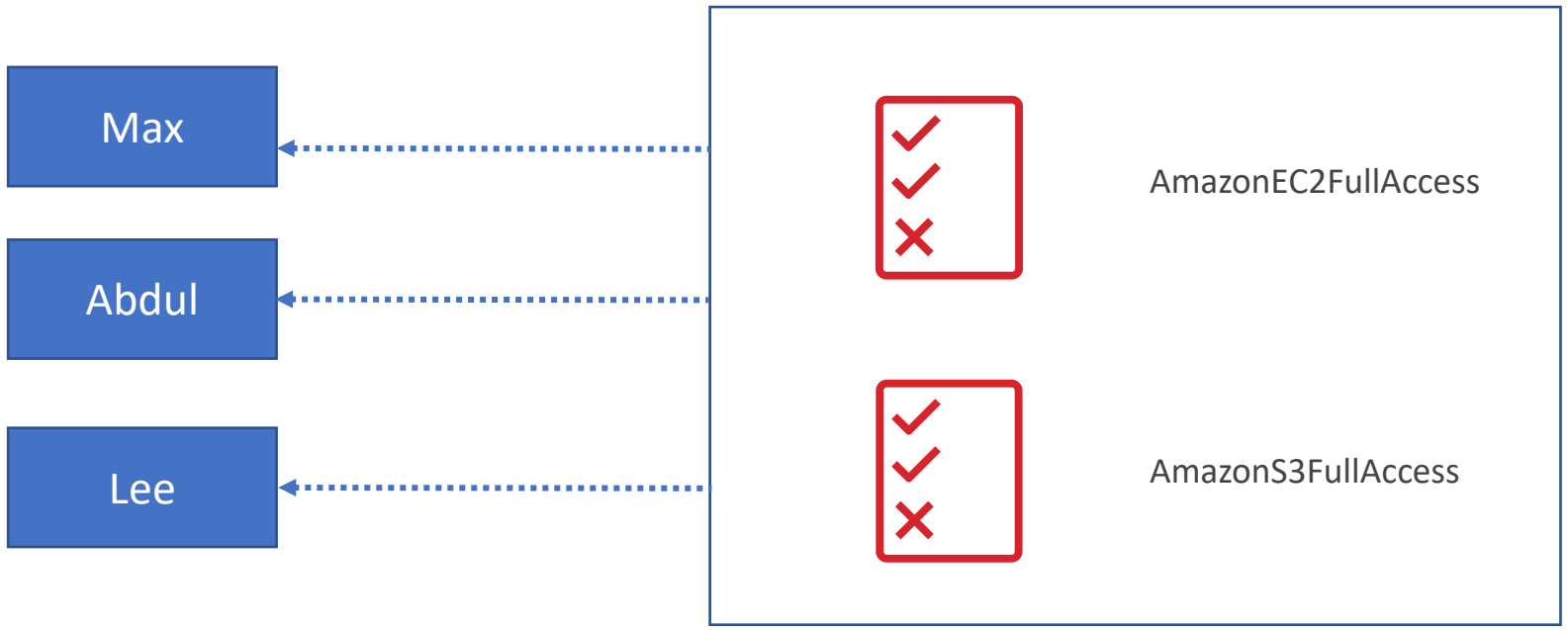
Filter policies | Search | Showing 583 results

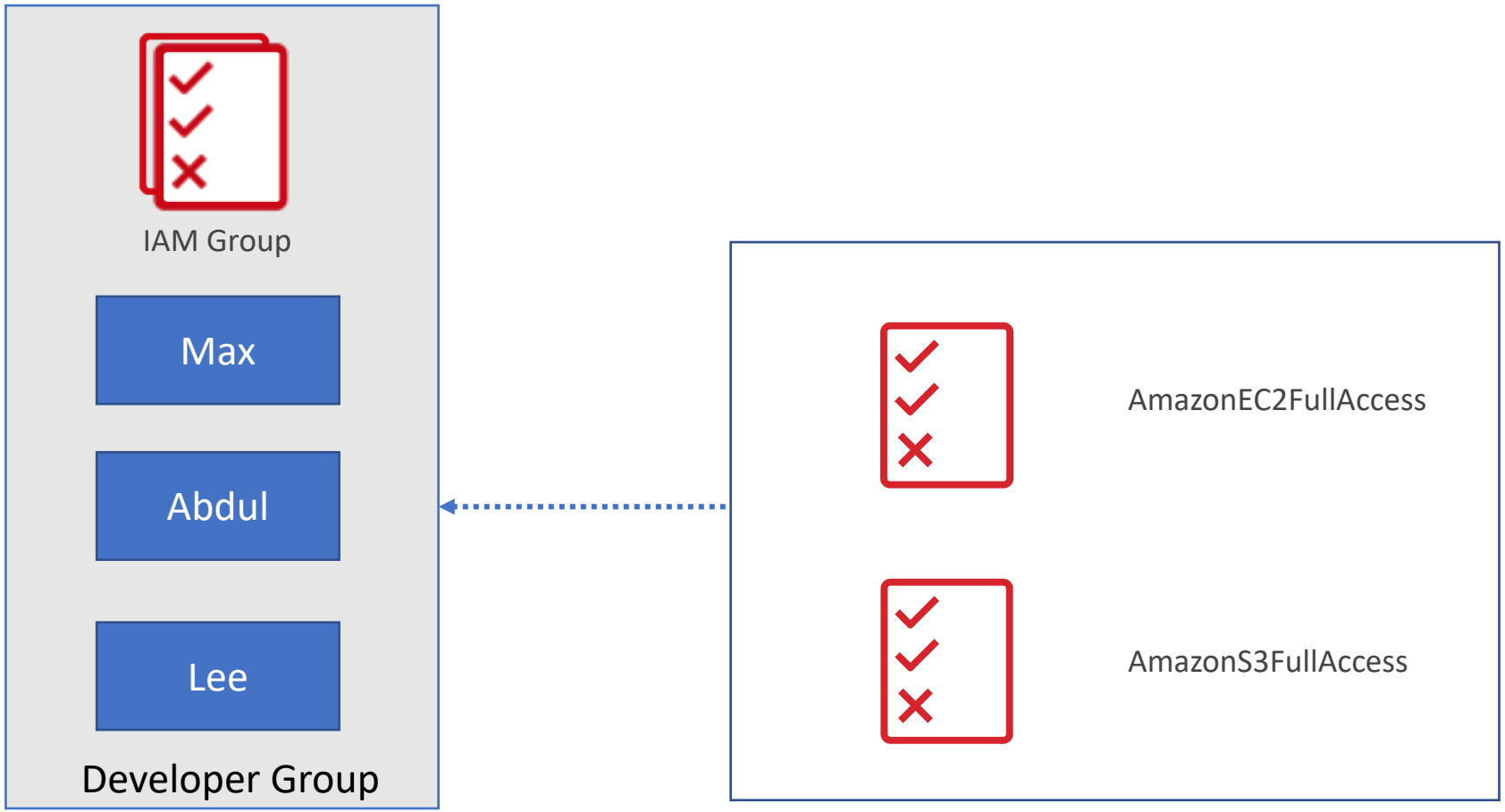
Policy name	Type	Used as
AdministratorAccess	Job function	Permissions policy (2)
AlexaForBusinessDeviceSetup	AWS managed	None
AlexaForBusinessFullAccess	AWS managed	None
AlexaForBusinessGatewayExecution	AWS managed	None
AlexaForBusinessLifesizeDelegatedAccessPolicy	AWS managed	None
AlexaForBusinessPolyDelegatedAccessPolicy	AWS managed	None
AlexaForBusinessReadOnlyAccess	AWS managed	None
AmazonAPIGatewayAdministrator	AWS managed	None

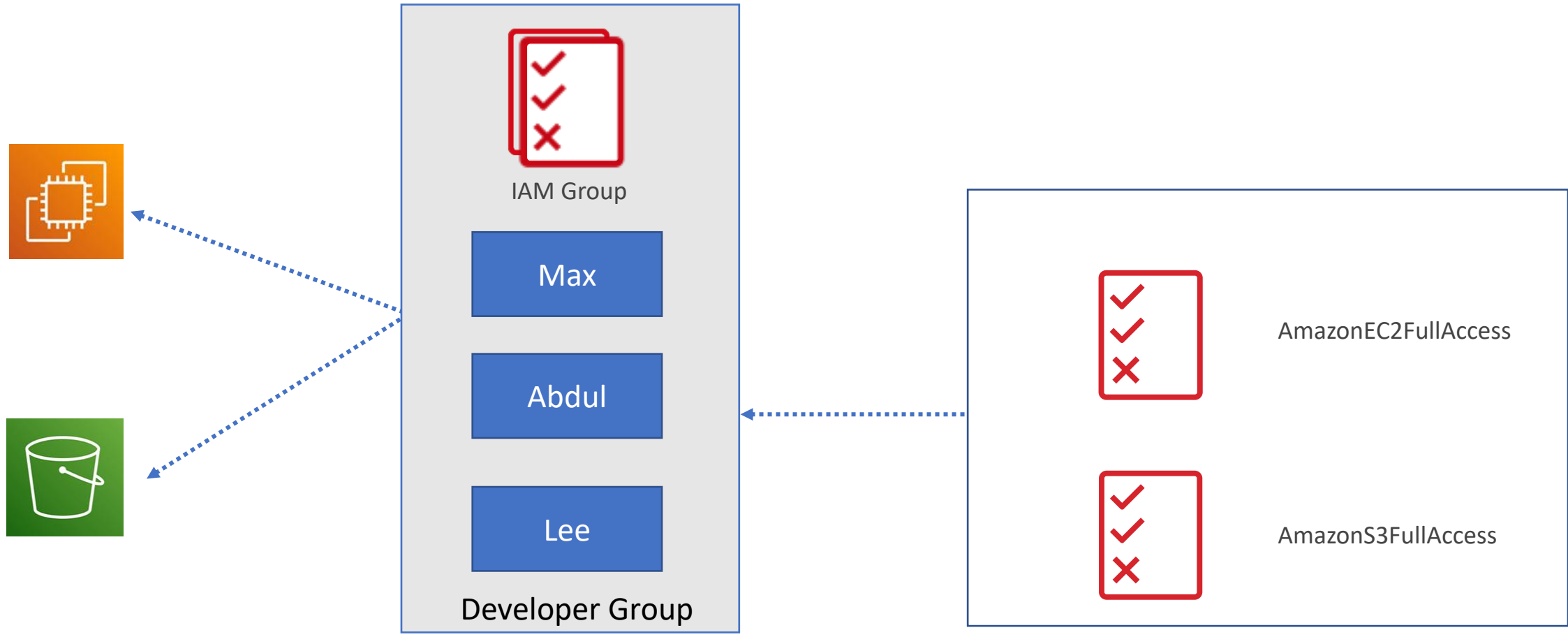
https://docs.aws.amazon.com/IAM/latest/UserGuide/access_policies_job-functions.html

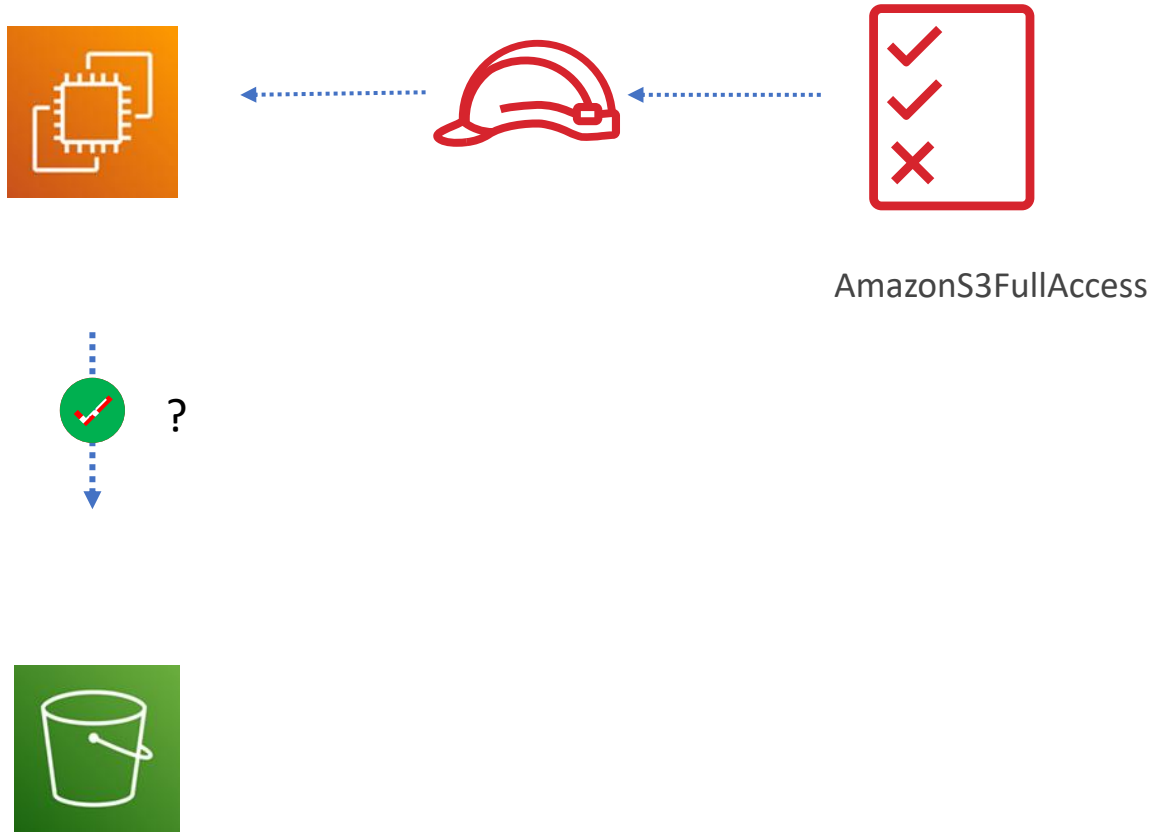
Job Function	Policy Name
Administrator	AdministratorAccess
Billing	Billing
Database Administrator	DatbaseAdministrator
Network Administrator	NetworkAdministrator
View-Only User	ViewOnlyAccess

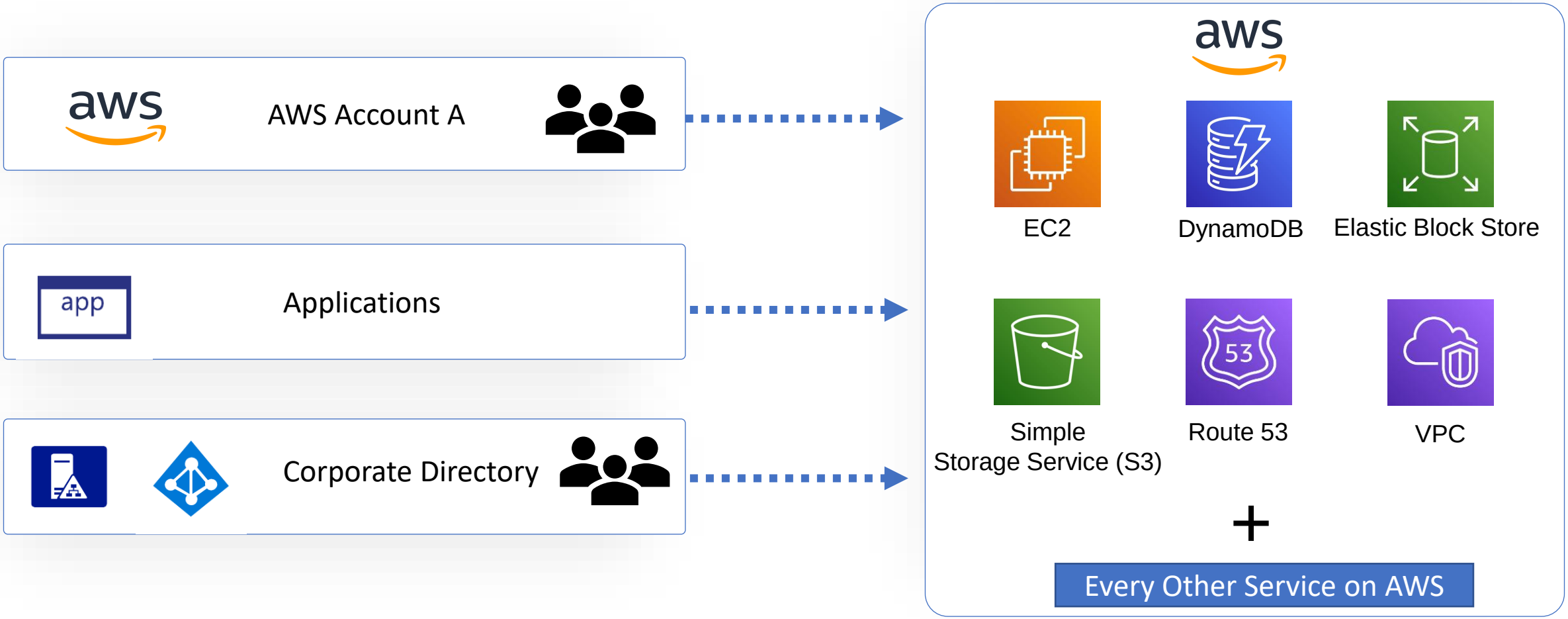
https://docs.aws.amazon.com/IAM/latest/UserGuide/access_policies_job-functions.html




IAM Group
Max
Abdul
Lee
Developer Group
AmazonEC2FullAccess
AmazonS3FullAccess


IAM Group
Max
Abdul
Lee
Developer Group
AmazonEC2FullAccess
AmazonS3FullAccess



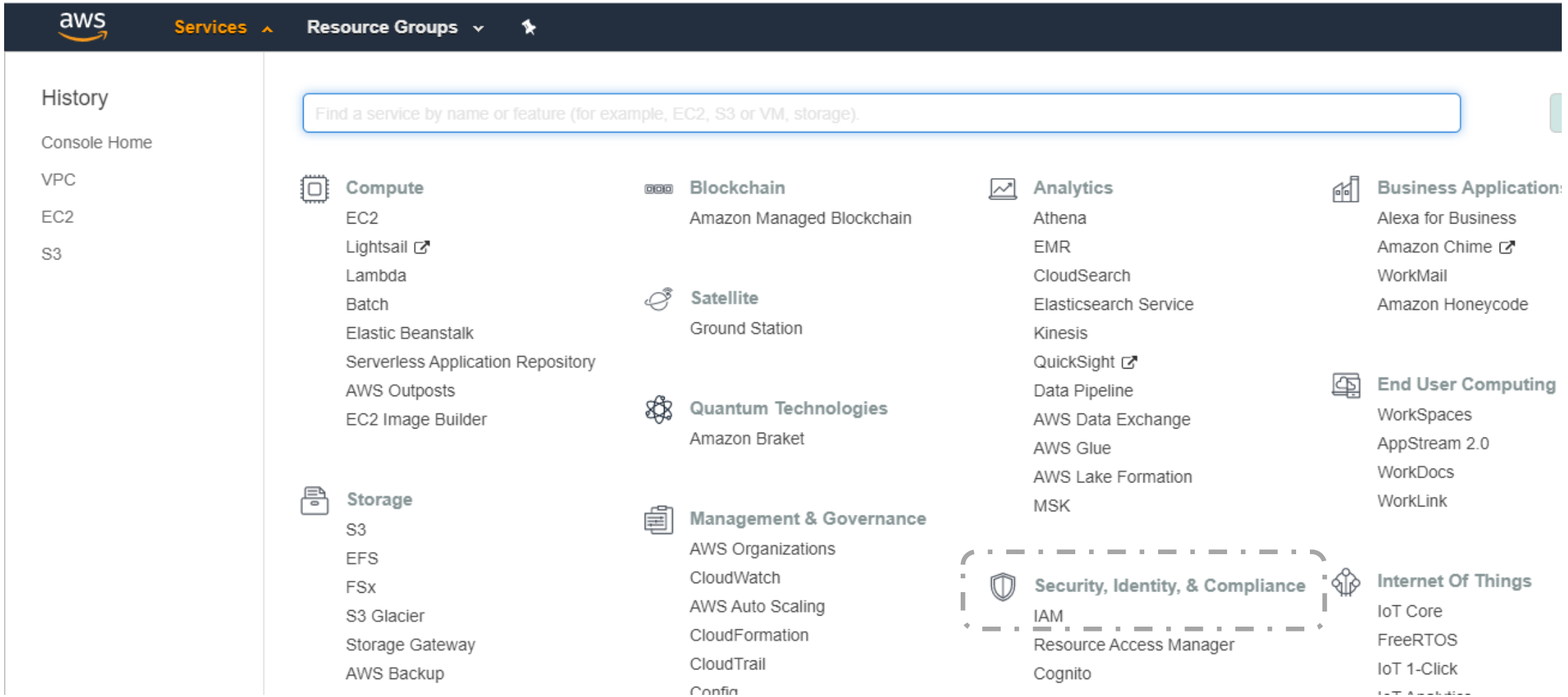

AWS Account A
Applications
Corporate Directory
EC2
DynamoDB
Elastic Block Store
Simple
Storage Service (S3)
Route 53
VPC
+
Every Other Service on AWS

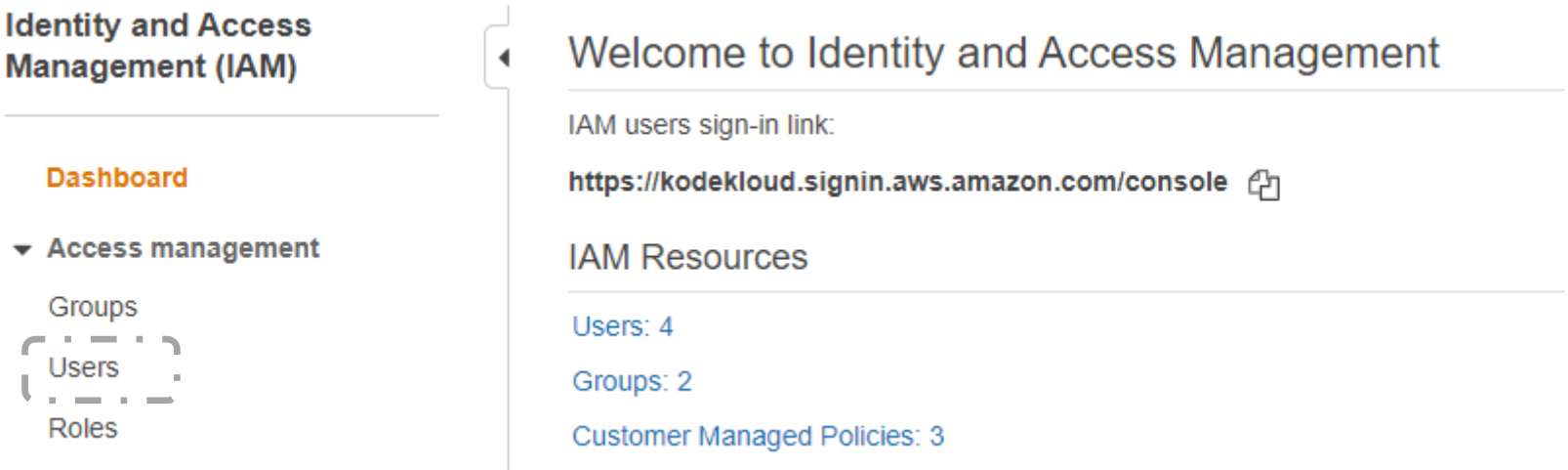
CreateEC2TagsPolicy

```
{
        "Version": "2012-10-17",
        "Statement": [
            {
                "Effect": "Allow",
                "Action": [
                    "ec2:DeleteTags",
                    "ec2:CreateTags"
                ],
                "Resource": "*"
            }
        ]
```

Filter policies | CreateEC2TagsPolicy

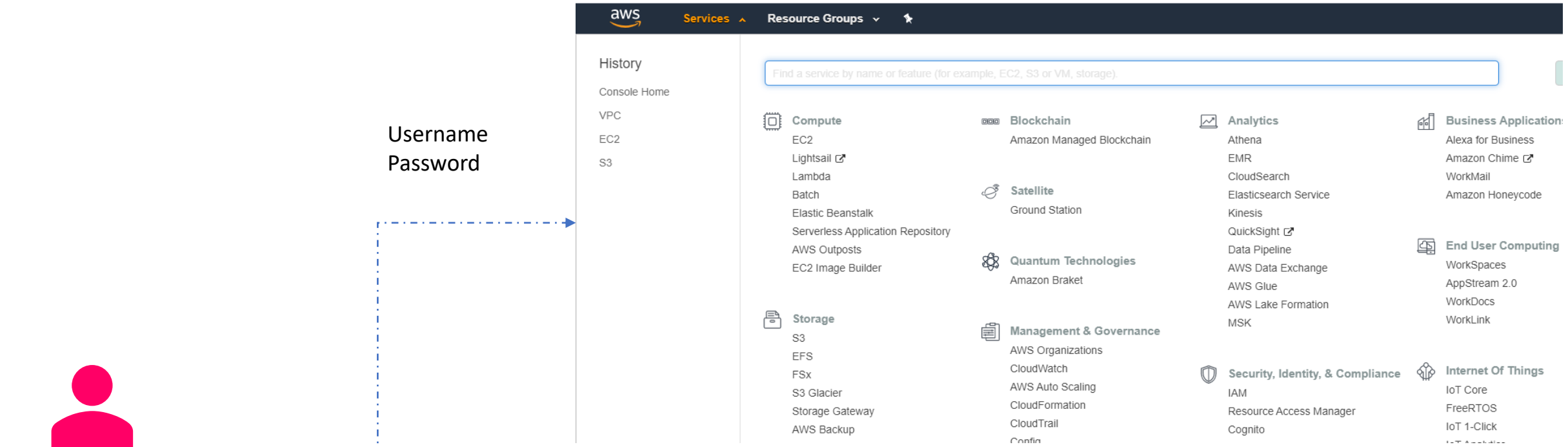
Policy name	Type	Used as	Description
CreateEC2TagsPolicy	Customer managed	*None*	Permission to create and delete EC2 Tags


aws
Services
Resource Groups
History
Console Home
VPC
EC2
S3
Find a service by name or feature (for example, EC2, S3 or VM, storage).
Compute
EC2
Lightsail
Lambda
Batch
Elastic Beanstalk
Serverless Application Repository
AWS Outposts
EC2 Image Builder
Storage
S3
EFS
FSx
S3 Glacier
Storage Gateway
AWS Backup
Blockchain
Amazon Managed Blockchain
Satellite
Ground Station
Quantum Technologies
Amazon Braket
Management & Governance
AWS Organizations
CloudWatch
AWS Auto Scaling
CloudFormation
CloudTrail
Config
Analytics
Athena
EMR
CloudSearch
Elasticsearch Service
Kinesis
QuickSight
Data Pipeline
AWS Data Exchange
AWS Glue
AWS Lake Formation
MSK
Security, Identity, & Compliance
IAM
Resource Access Manager
Cognito
Business Applications
Alexa for Business
Amazon Chime
WorkMail
Amazon Honeycode
End User Computing
WorkSpaces
AppStream 2.0
WorkDocs
WorkLink
Internet Of Things
IoT Core
FreeRTOS
IoT 1-Click


Identity and Access Management (IAM)
Dashboard
Access management
Groups
Users
Roles
Welcome to Identity and Access Management
IAM users sign-in link:
https://kodekloud.signin.aws.amazon.com/console
IAM Resources
Users: 4
Groups: 2
Customer Managed Policies: 3


KODEKLOUD

Programmatic Access



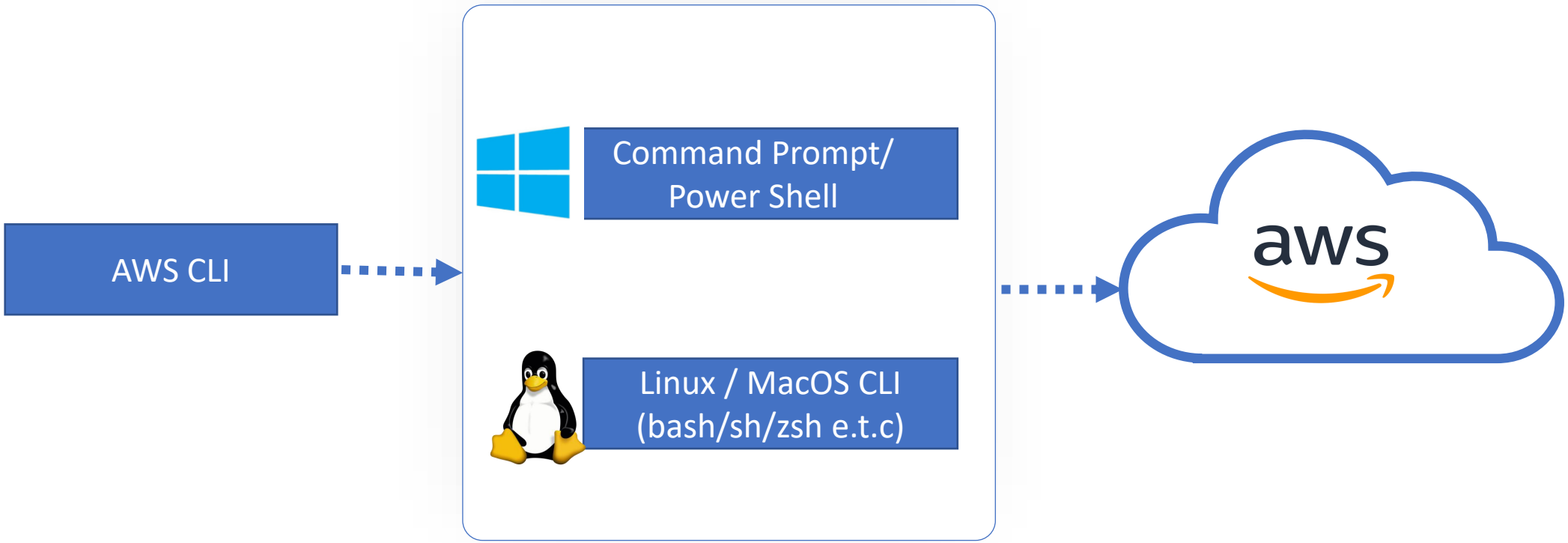
Username
Password

console.aws.com

Lucy

```
$ aws s3api create-bucket –bucket my-bucket –region us-east-1
```

Access Key ID
Secret Access Key



https://aws.amazon.com/cli/

```
$ curl "https://awscli.amazonaws.com/awscli-exe-linux-x86_64-2.0.30.zip" -o "awscliv2.zip"
$ unzip awscliv2.zip
$ sudo ./aws/install
```

```
$ aws --version
aws-cli/2.0.47 Python/3.7.4 Linux/4.14.133-113.105.amzn2.x86_64 botocore/2.0.0
```

Download and Install https://awscli.amazonaws.com/AWSCLIV2.msi

```
C:\> aws –version
aws-cli/2.0.47 Python/3.7.4 Windows/10 botocore/2.0.0
```

Download and Install
https://awscli.amazonaws.com/AWSCLIV2.pkg

```
$ aws –version
aws-cli/2.0.47 Python/3.7.4 Darwin/18.7.0 botocore/2.0.0
```

```
$ aws configure
  AWS Access Key ID [None]: AKIAI44QH8DHBEXAMPLE
  AWS Secret Access Key [None]: je7MtGbClwBF/2Zp9Utk/h3yCo8nvbEXAMPLEKEY
  Default region name [None]: us-west-2
  Default output format [None]:  json
```

```
$ cat .aws/config/config
[default]
region = us-west-2
output = text
```

```
$ cat .aws/config/credentials
[default]
aws_access_key_id = AKIAI44QH8DHBEXAMPLE
aws_secret_access_key = je7MtGbClwBF/2Zp9Utk/h3yCo8nvbEXAMPLEKEY
```

```
$ aws <command> <subcommand> [options and parameters]
```

```
$ aws iam create-user --user-name lucy
{
    "User": {
        "UserName": "lucy",
        "Tags": [],
        "CreateDate": "2020-09-15T23:40:11.168Z",
        "UserId": "h9r2sc5br8ss7uzhs2qm",
        "Path": "/",
        "Arn": "arn:aws:iam::000000000000:user/lucy"
    }
}
```

Command	Value
command	iam
subcommand	create-user
option	--user-name
parameter	lucy

```
$ aws help

AWS()

NAME
       aws -

DESCRIPTION
       The  AWS  Command  Line  Interface is a unified tool to
manage your AWS
       services.

SYNOPSIS
          aws [options] <command> <subcommand> [parameters]

       Use aws command help for information on a  specific
command.  Use  aws
       help  topics  to view a list of available help topics. The
synopsis for
       each command shows its parameters and their usage.
Optional  parameters
       are shown in square brackets.
.
.
[Output Truncated]
```

```
$ aws iam help

IAM()

NAME
       iam -

DESCRIPTION
       AWS  Identity and Access Management (IAM) is a web service
for securely
       controlling access to AWS services. With IAM, you can
centrally  manage
       users,  security  credentials such as access keys, and
permissions that
       control which AWS resources users and applications can
access. For more
       information about IAM, see AWS Identity and Access
Management (IAM) and
       the AWS Identity and Access Management User Guide .

AVAILABLE COMMANDS
       o add-client-id-to-open-id-connect-provider

       o add-role-to-instance-profile
.
.
[Output Truncated]
```

```
$ aws <command> help
```

https://docs.aws.amazon.com/cli/latest/reference

```
$ aws iam create-user help
NAME
       create-user -

DESCRIPTION
       Creates a new IAM user for your AWS account.

       The number and size of IAM resources in an AWS account are
limited. For
       more information, see IAM and STS Quotas in the IAM User
Guide .

       See also: AWS API Documentation

       See 'aws help' for descriptions of global parameters.

SYNOPSIS
            create-user
          [--path <value>]
          --user-name <value>
          [--permissions-boundary <value>]
          [--tags <value>]
          [--cli-input-json <value>]
          [--generate-cli-skeleton <value>]
```

```
$ aws <command> <subcommand> help
```


KODEKLOUD

IAM with Terraform

Filter

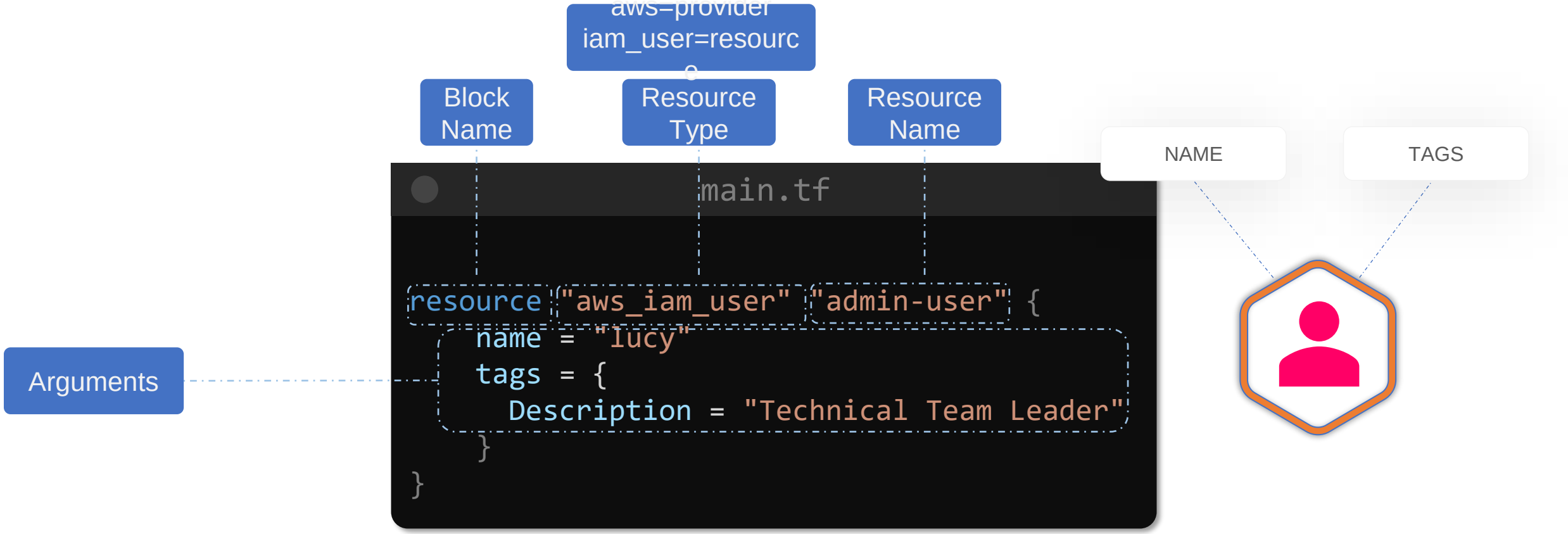
- GuardDuty
- IAM
  - Resources
    - aws_iam_access_key
    - aws_iam_account_alias
    - aws_iam_account_password_policy
    - aws_iam_group
    - aws_iam_role
    - aws_iam_role_policy
    - aws_iam_role_policy_attachment
    - aws_iam_saml_provider
    - aws_iam_server_certificate
    - aws_iam_service_linked_role
    - aws_iam_user
    - aws_iam_user_group_membership
    - aws_iam_user_login_profile
    - aws_iam_user_policy

```
EOF
}
```

Argument Reference

The following arguments are supported:

- `name` - (Required) The user's name. The name must consist of upper and lowercase alphanumeric characters with no spaces. You can also include any of the following characters: `=,.@-_.` . User names are not distinguished by case. For example, you cannot create users named both "TESTUSER" and "testuser".
- `path` - (Optional, default "/") Path in which to create the user.
- `permissions_boundary` - (Optional) The ARN of the policy that is used to set the permissions boundary for the user.
- `force_destroy` - (Optional, default false) When destroying this user, destroy even if it has non-Terraform-managed IAM access keys, login profile or MFA devices. Without `force_destroy` a user with non-Terraform-managed access keys and login profile will fail to be destroyed.
- `tags` - Key-value map of tags for the IAM user


aws=provider
iam_user=resourc
e
Block Name
Resource Type
Resource Name
main.tf
resource "aws_iam_user" "admin-user" {
name = "lucy"
tags = {
Description = "Technical Team Leader"
}
}
Arguments
NAME
TAGS

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```

>_

```
$ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v3.6.0...
- Installed hashicorp/aws v3.6.0 (signed by HashiCorp)

The following providers do not have any version constraints in
configuration, so the latest version was installed.

To prevent automatic upgrades to new major versions that may
contain breaking changes, we recommend adding version
constraints in a required_providers block in your configuration,
with the constraint strings suggested below.

* hashicorp/aws: version = "~> 3.6.0"

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
```

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```

>_

```
$ terraform plan

provider.aws.region
  The region where AWS operations will take place. Examples
  are us-east-1, us-west-2, etc.


  Enter a value: us-west-1
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but
will not be
persisted to local or remote state storage.


Error: error configuring Terraform AWS Provider: no valid
credential sources for Terraform AWS Provider found.


Please see
https://registry.terraform.io/providers/hashicorp/aws
for more information about providing credentials.


Error: NoCredentialProviders: no valid providers in chain.
Deprecated.
        For verbose messaging see
aws.Config.CredentialsChainVerboseErrors
```

main.tf

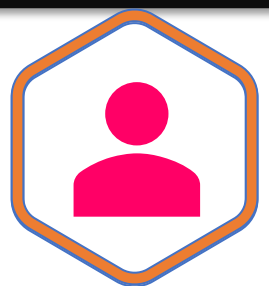
```
provider "aws" {
    region = "us-west-2"
    access_key = "AKIAI44QH8DHBEXAMPLE"
    secret_key = "je7MtGbClwBF/2tk/h3yCo8n…"
}
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```

>_

```
$ terraform plan
.
.
+ create

Terraform will perform the following actions:

  # aws_iam_user.admin-user will be created
  + resource "aws_iam_user" "admin-user" {
      + arn           = (known after apply)
      + force_destroy = false
      + id            = (known after apply)
      + name          = "Lucy"
      + path          = "/"
      + tags          = {
          + "Description" = "Technical Team Lead"
        }
      + unique_id     = (known after apply)
    }

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

------------------------------------------------------------
----------

Note: You didn't specify an "-out" parameter to save this
```

main.tf

```
provider "aws" {
    region = "us-west-2"
    access_key = "AKIAI44QH8DHBEXAMPLE"
    secret_key = "je7MtGbClwBF/2tk/h3yCo8n…"
}
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```



>_

```
$ terraform apply


# aws_iam_user.admin-user will be created
  + resource "aws_iam_user" "admin-user" {
      + arn           = (known after apply)
      + force_destroy = false
      + id            = (known after apply)
      + name          = "Lucy"
      + path          = "/"
      + tags          = {
          + "Description" = "Technical Team Lead"
        }
      + unique_id     = (known after apply)
    }

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

aws_iam_user.admin-user: Creating...
aws_iam_user.admin-user: Creation complete after 1s
[id=Lucy]

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

main.tf

```
provider "aws" {
    region = "us-west-2"
    access_key = "AKIAI44QH8DHBEXAMPLE"
    secret_key = "je7MtGbClwBF/2tk/h3yCo8n…"
}
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```

.aws/config/credentials

```
[default]
aws_access_key_id =
aws_secret_access_key =
```

main.tf

```
provider "aws" {
    region = "us-west-2"


}
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```

.aws/config/credentials

```
[default]
aws_access_key_id = AKIAI44QH8DHBEXAMPLE
aws_secret_access_key = je7MtGbClwBF/2tk/h3yCo8n…
```

>_

```
$ export AWS_ACCESS_KEY_ID=

$ export AWS_SECRET_ACCESS_KEY_ID=
```

main.tf

```
provider "aws" {
    region = "us-west-2"


}
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```

.aws/config/credentials

```
[default]
aws_access_key_id =
aws_secret_access_key =
```

>_

```
$ export AWS_ACCESS_KEY_ID=AKIAI44QH8DHBEXAMPLE
$ export AWS_SECRET_ACCESS_KEY_ID=je7MtGbClwBF/2tk/h3yCo8n…
$ export AWS_REGION=us-west-2
```


KODEKLOUD

IAM policies with Terraform

main.tf

```hcl
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
```


```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "*",
            "Resource": "*"
        }
    ]
}
```

AdministratorAccess Policy

Argument Reference

The following arguments are supported:

- `description` - (Optional, Forces new resource) Description of the IAM policy.
- `name` - (Optional, Forces new resource) The name of the policy. If omitted, Terraform will assign a random, unique name.
- `name_prefix` - (Optional, Forces new resource) Creates a unique name beginning with the specified prefix. Conflicts with `name` .
- `path` - (Optional, default "/") Path in which to create the policy. See IAM Identifiers fo more information.
- `policy` - (Required) The policy document. This is a JSON formatted string. For more information about building AWS IAM policy documents with Terraform, see the AWS I Policy Document Guide

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}

resource "aws_iam_policy" "adminUser" {
  name   = "AdminUsers"
  policy = ?
}
```


```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "*",
            "Resource": "*"
        }
    ]
}
```

AdministratorAccess Policy

```
[COMMAND] <<DELIMITER
  Line1
  Line2
  Line3
DELIMITER
```

Heredoc Syntax

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}

resource "aws_iam_policy" "adminUser" {
  name   = "AdminUsers"
  policy =  <<EOF

  EOF
}
```


```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "*",
            "Resource": "*"
        }
    ]
}
```

AdministratorAccess Policy

```
[COMMAND] <<DELIMITER
  Line1
  Line2
  Line3
DELIMITER
```

Heredoc Syntax

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
resource "aws_iam_policy" "adminUser" {
   name        = "AdminUsers"
   policy =  <<EOF
    {
        "Version": "2012-10-17",
        "Statement": [
            {
                "Effect": "Allow",
                "Action": "*",
                "Resource": "*"
            }
        ]
    }
   EOF
}

  resource "aws_iam_user_policy_attachment" "lucy-admin-access" {

      user = aws_iam_user.admin-user.name

      policy_arn = aws_iam_policy.adminUser.arn

  }
```

AdministratorAccess Policy

```
[COMMAND] <<DELIMITER
  Line1
  Line2
  Line3
DELIMITER
```

Heredoc Syntax

??

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
resource "aws_iam_policy" "adminUser" {
  name   = "AdminUsers"
  policy =  <<EOF
    {
        "Version": "2012-10-17",
        "Statement": [
            {
                "Effect": "Allow",
                "Action": "*",
                "Resource": "*"
            }
        ]
    }
   EOF
}

 resource "aws_iam_user_policy_attachment" "lucy-admin-access" {

     user = aws_iam_user.admin-user.name

     policy_arn = aws_iam_policy.adminUser.arn

 }
```

>_

```
$ terraform apply

# aws_iam_policy.adminUser will be created
  + resource "aws_iam_policy" "adminUser" {
      + arn    = (known after apply)
      + id     = (known after apply)
      + name   = "AdminUsers"
      + path   = "/"
      + policy = jsonencode(
            {
              + Statement = [
                  + {
                      + Action   = "*"
                      + Effect   = "Allow"
                      + Resource = "*"
                    },
                ]
              + Version   = "2012-10-17"
            }
        )
    }
.
.[Output Truncated]
aws_iam_user.lucy: Creating...
aws_iam_policy.adminUser: Creating...
aws_iam_user.lucy: Creation complete after 0s [id=lucy]
aws_iam_policy.adminUser: Creation complete after 0s
[id=arn:aws:iam::000000000000:policy/AdminUsers]
aws_iam_user_policy_attachment.lucy-admin-access: Creating...
aws_iam_user_policy_attachment.lucy-admin-access: Creation complete
after 0s [id=lucy-20200919034158686100000001]

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

main.tf

```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}

resource "aws_iam_policy" "adminUser" {
  name   = "AdminUsers"
  policy =  <<EOF
   {
       "Version": "2012-10-17",
       "Statement": [
           {
               "Effect": "Allow",
               "Action": "*",
               "Resource": "*"
           }
       ]
   }
  EOF
}

 resource "aws_iam_user_policy_attachment" "lucy-admin-access" {

     user = aws_iam_user.admin-user.name

     policy_arn = aws_iam_policy.adminUser.arn

 }
```

admin-policy.json

main.tf

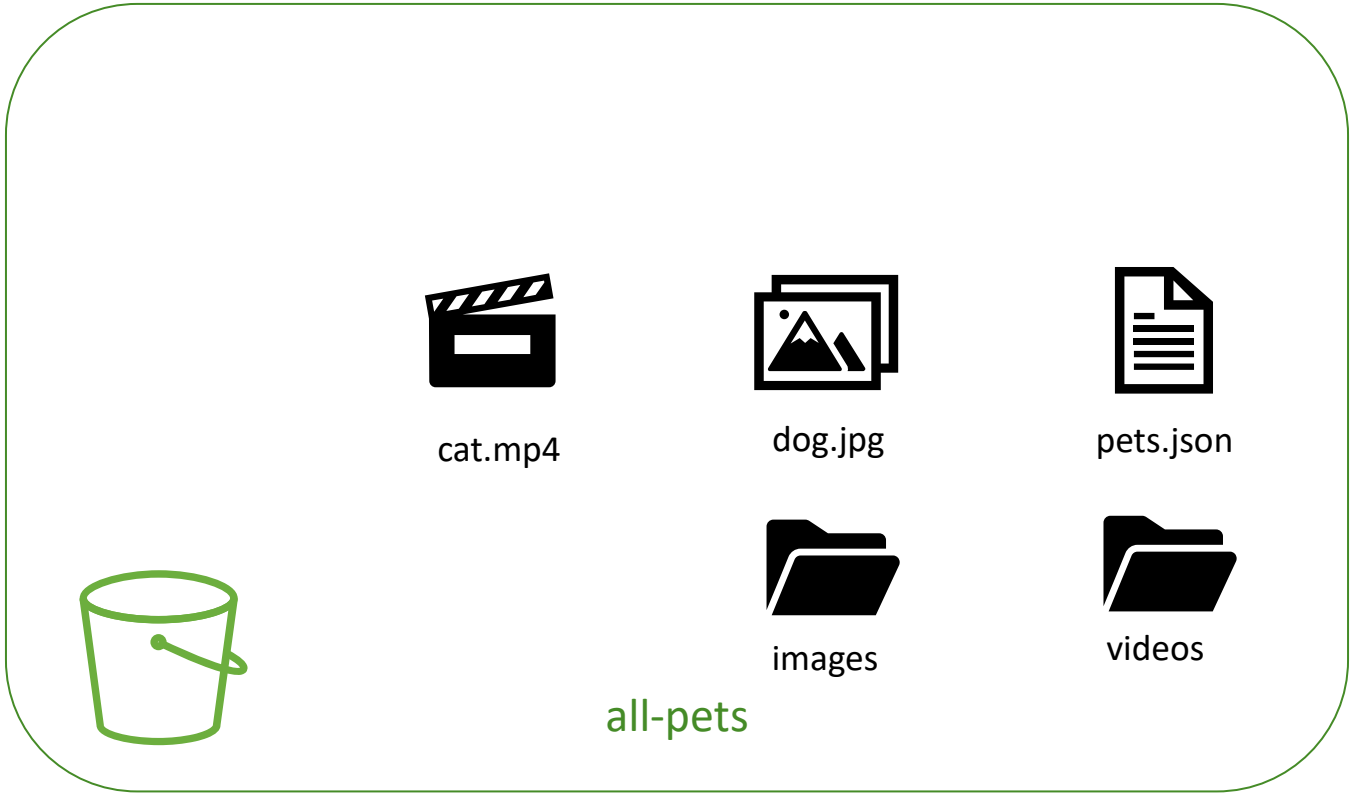
```
resource "aws_iam_user" "admin-user" {
    name = "lucy"
    tags = {
      Description = "Technical Team Leader"
    }
}
resource "aws_iam_policy" "adminUser" {
  name   = "AdminUsers"
  policy = file("admin-policy.json")


  EOF
}
resource "aws_iam_user_policy_attachment" "lucy-admin-access" {

    user = aws_iam_user.admin-user.name

    policy_arn = aws_iam_policy.adminUser.arn

}
```

admin-policy.json

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "*",
            "Resource": "*"
        }
    ]
}
```


KODEKLOUD

AWS S3



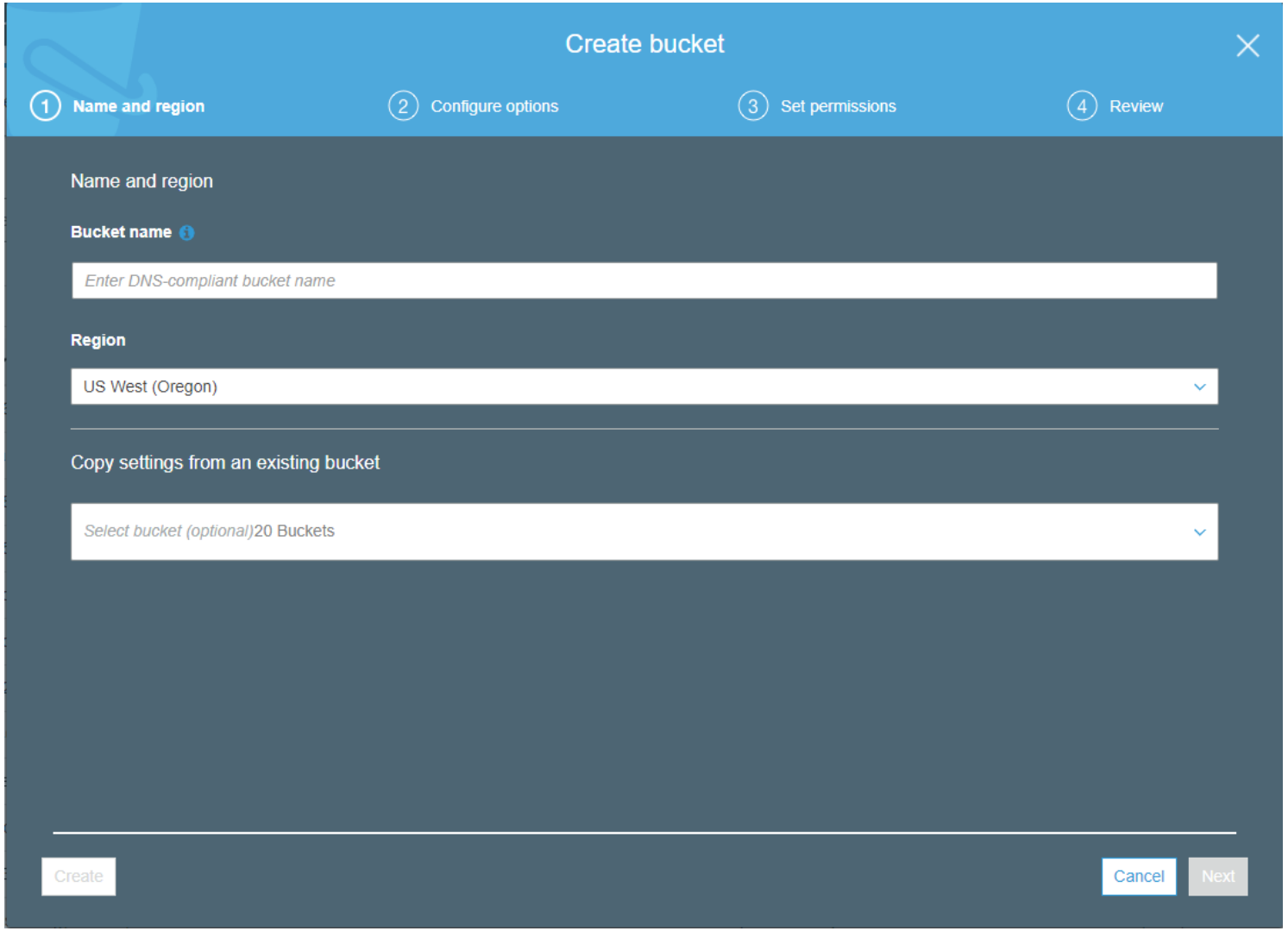
Object #	Name
1	pets.json
2	dog.jpg
3	cat.mp4
4	pictures/cat.jpg
5	videos/dog.mp4

https://docs.aws.amazon.com/AmazonS3/latest/dev/BucketRestrictions.html

Unique Bucket Name

DNS Compliant Name

Files size between 0 to 5TB



KODEKLOUD

https://<bucket_name>.<region>.amazonaws.com

https://all-pets.us-west-1.amazonaws.com

Object #	Name	Address
1	pets.json	https://all-pets.us-west-1.amazonaws.com/pets.json
2	dog.jpg	https://all-pets.us-west-1.amazonaws.com/dog.jpg
3	cat.mp4	https://all-pets.us-west-1.amazonaws.com/cat.mp4
4	pictures/cat.jpg	https://all-pets.us-west-1.amazonaws.com/pictures/cat.jpg
5	videos/dog.mp4	https://all-pets.us-west-1.amazonaws.com/videos/dog.mp4

dog.jpg

Key = dog.jpg

Value = Data

Object data

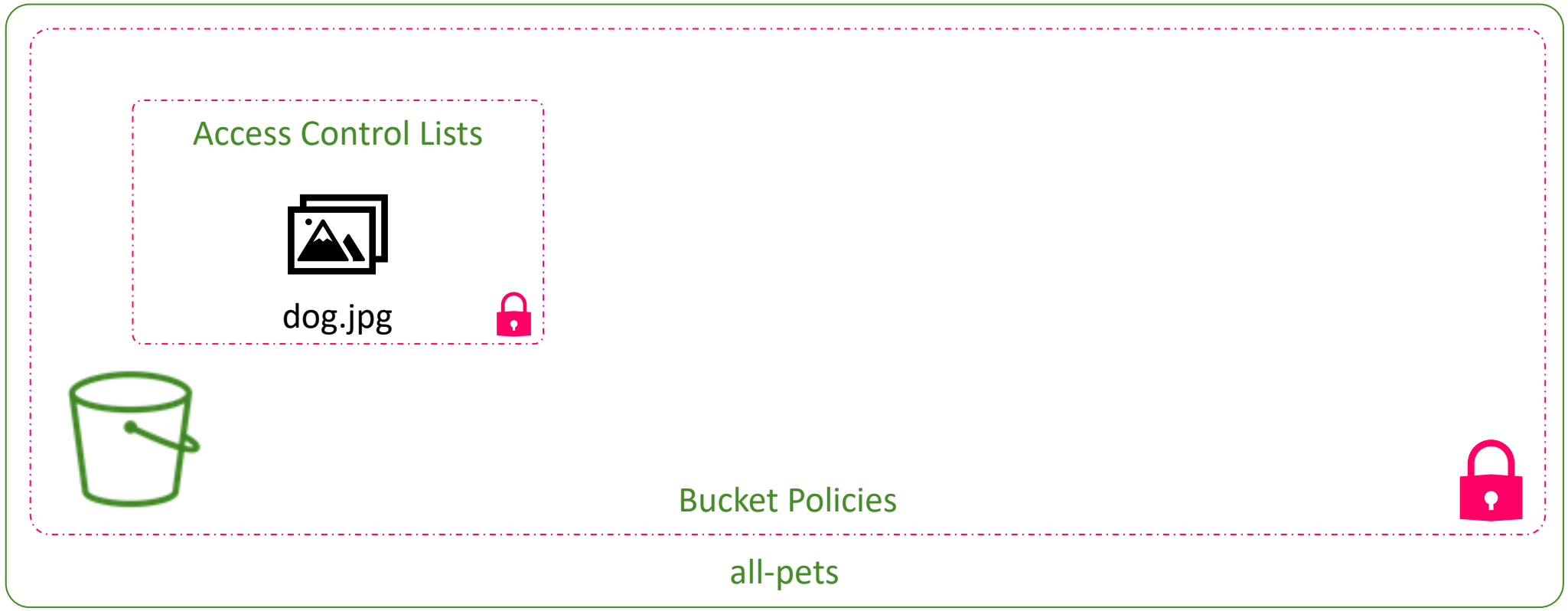
Owner = Lucy

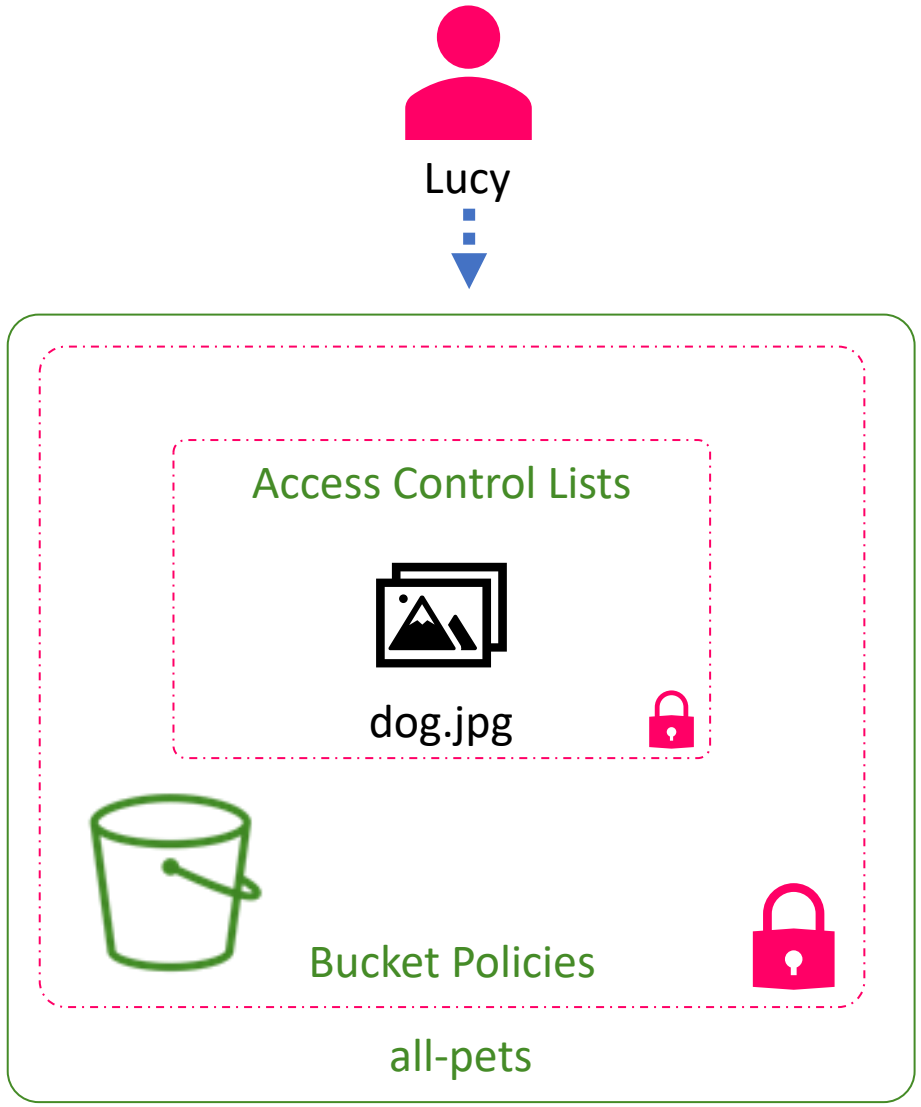
Size = 5MB

Last Modified = Jan 26, 2020 12:55:21 AM GMT-0500

Metadata

all-pets






```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "s3:GetObject"
            ],
            "Effect": "Allow",
            "Resource": "arn:aws:s3:::all-pets/*",
            "Principal": {
                "AWS": [
                    "arn:aws:iam::123456123457:user/Lucy"
                ]
            }
        }
    ]
}
```

read-objects.json


KODEKLOUD

S3 with Terraform

main.tf

```
resource "aws_s3_bucket" "finance" {
    bucket = "finanace-21092020"
    tags   = {
        Description = "Finance and Payroll"
    }
}
```

>_

```
$ terraform apply
Terraform will perform the following actions:

  # aws_s3_bucket.finance will be created
  + resource "aws_s3_bucket" "finance" {
      + acceleration_status  = (known after apply)
      + acl                  = "private"
      + arn                  = (known after apply)
      + bucket               = "finanace-21092020"
.
.
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_s3_bucket.finance: Creating...
aws_s3_bucket.finance: Creation complete after 0s
[id=finanace-21092020]

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

main.tf

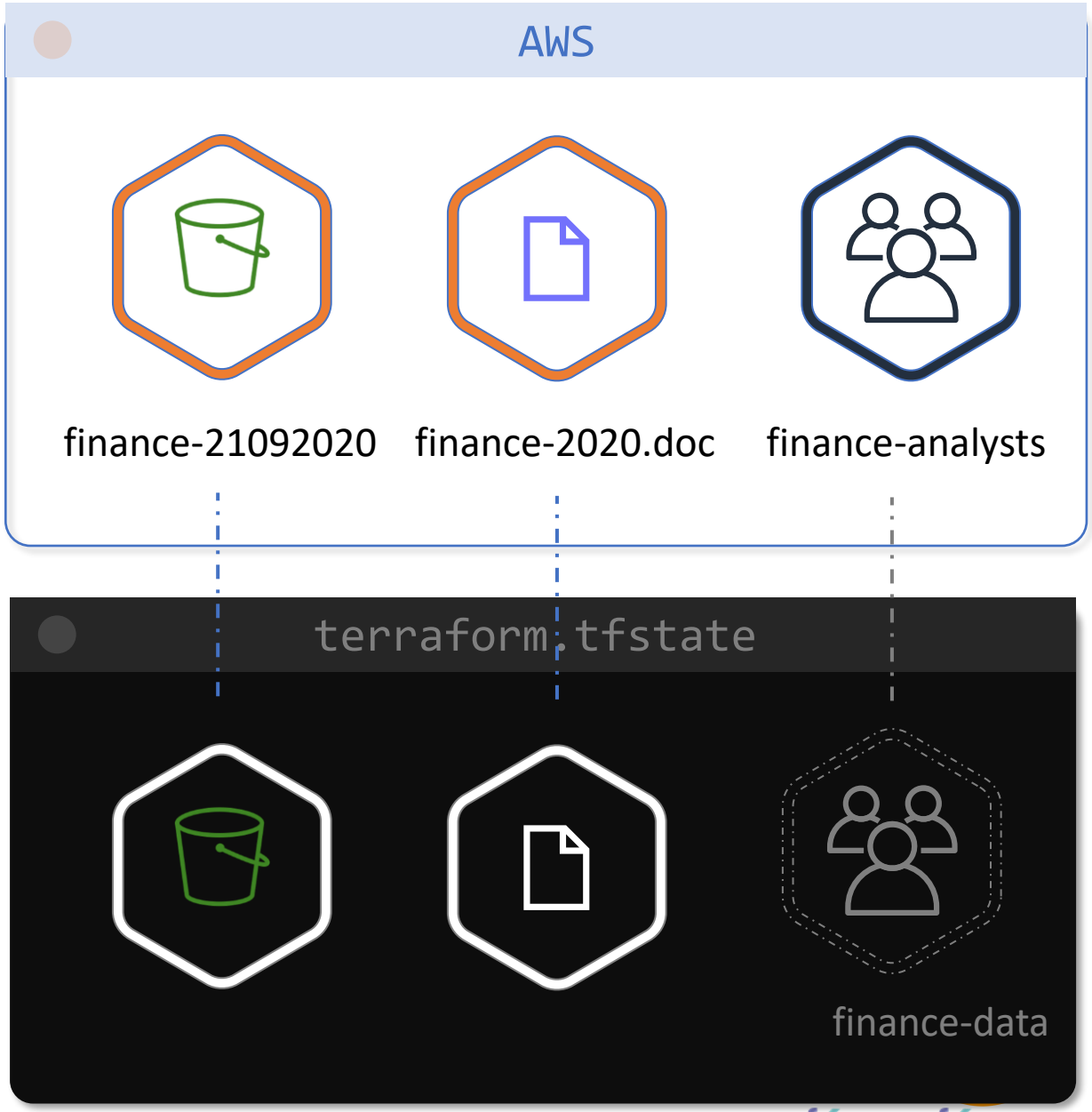
```
resource "aws_s3_bucket" "finance" {
    bucket = "finanace-21092020"
    tags   = {
        Description = "Finance and Payroll"
    }
}

resource "aws_s3_bucket_object" "finance-2020" {
    content = "/root/finance/finance-2020.doc"
    key     = "finance-2020.doc"
    bucket = aws_s3_bucket.finance.id
}
```

>_

```
$ terraform apply
.
.
Terraform will perform the following actions:

  # aws_s3_bucket_object.finance-2020 will be created
  + resource "aws_s3_bucket_object" "finance-2020" {
      + acl                    = "private"
      + bucket                 = "finanace-21092020"
      + content                = "/root/finance/finance-
2020.doc"
+ force_destroy          = false
      + id                     = (known after apply)
      + key                    = "finance/finance-
2020.doc"

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_s3_bucket_object.finance-2020: Creating...
aws_s3_bucket_object.finance-2020: Creation complete
after 0s [id=finance/finance-2020.doc]
```

main.tf

```
resource "aws_s3_bucket" "finance" {
    bucket = "finanace-21092020"
    tags   = {
        Description = "Finance and Payroll"
    }
}

resource "aws_s3_bucket_object" "finance-2020" {
    content = "/root/finance/finance-2020.doc"
    key     = "finance-2020.doc"
    bucket = aws_s3_bucket.finance.id
}

data "aws_iam_group" "finance-data" {
  group_name = "finance-analysts"

}
```



```
    content = "/root/finance/finance-2020.doc"
    key     = "finance-2020.doc"
    bucket = aws_s3_bucket.finance.id
}

data "aws_iam_group" "finance-data" {
  group_name = "finance-analysts"

}
resource "aws_s3_bucket_policy" "finance-policy" {
  bucket = aws_s3_bucket.finance.id
  policy = <<EOF




EOF
}
```

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": “*",
            "Effect": "Allow",
            "Resource": "arn:aws:s3:::<<bucket-name>>/*",
            "Principal": {
                "AWS": [
                    “<<   arn    >>"
                ]
            }
        }
    ]
}
```

read-objects.json

```
    content = "/root/finance/finance-2020.doc"
    key     = "finance-2020.doc"
    bucket = aws_s3_bucket.finance.id
}

data "aws_iam_group" "finance-data" {
  group_name = "finance-analysts"

}

resource "aws_s3_bucket_policy" "finance-policy" {
  bucket = aws_s3_bucket.finance.id
  policy = <<EOF

  {
      "Version": "2012-10-17",
      "Statement": [
          {
              "Action": "*",
              "Effect": "Allow",
              "Resource": "arn:aws:s3:::${aws_s3_bucket.finance.id}/*",
              "Principal": {
                  "AWS": [
                      "${data.aws_iam_group.finance-data.arn}"
                  ]
              }
          }
      ]
  }

EOF
}
```

```
>_
$ terraform apply
.
.
Terraform will perform the following actions:

  # aws_s3_bucket_object.finance-2020 will be created
  + resource "aws_s3_bucket_object" "finance-2020" {
      + acl                    = "private"
      + bucket                 = "finanace-21092020"
      + content                = "/root/finance/finance-2020.doc"
+ force_destroy          = false
      + id                     = (known after apply)
      + key                    = "finance/finance-2020.doc"

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_s3_bucket_object.finance-2020: Creating...
aws_s3_bucket_object.finance-2020: Creation complete after 0s
[id=finance/finance-2020.doc]

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


KODEKLOUD

Introduction to DynamoDB

DynamoDB

- Highly Scalable
- Fully Managed by AWS
- NoSQL Database
- Single-Digit MilliSecond Latency
- Data Replicated across Regions

Manufacturer	Model
Toyota	Corolla
Honda	Civic
Dodge	Journey
Ford	F150

	Manufacturer	Model	Year	VIN
Item 1	Toyota	Corolla	2004	4Y1SL65848Z411439
Item 2	Honda	Civic	2017	DY1SL65848Z411432
Item 3	Dodge	Journey	2014	SD1SL65848Z411443
Item 4	Ford	F150	2020	DH1SL65848Z41100

Manufacturer	Model	Year	VIN
Toyota	Corolla	2004	4Y1SL65848Z411439
Honda	Civic	2017	DY1SL65848Z411432
Dodge	Journey	2014	SD1SL65848Z411443
Ford	F150	2020	DH1SL65848Z41100

cars


```
{
    "Manufacturer": "Toyota",
    "Make": "Corolla",
    "Year": 2004,
    "VIN" : "4Y1SL65848Z411439"
}
```

```
{
    "Manufacturer": "Honda",
    "Make": "Civic",
    "Year": 2017,
    "VIN" : "DY1SL65848Z411432"
}
```

```
{
    "Manufacturer": "Dodge",
    "Make": "Journey",
    "Year": 2014,
    "VIN" : "SD1SL65848Z411443"
}
```

```
{
    "Manufacturer": "Ford",
    "Make": "F150",
    "Year": 2020,
    "VIN" : "DH1SL65848Z41100"
}
```

PRIMARY KEY

Manufacturer	Model	Year	VIN
Toyota	Corolla	2004	4Y1SL65848Z411439
Honda	Civic	2017	DY1SL65848Z411432
Dodge	Journey	2014	SD1SL65848Z411443
Ford	F150	2020	DH1SL65848Z41100


```
    "Manufacturer": "Honda",
    "Make": "Civic",
    "Year": 2017,
    "VIN" : "DY1SL65848Z411432"
}
```

```
{
    "Manufacturer": "Dodge",
    "Make": "Journey",
    "Year": 2014,
    "VIN" : "SD1SL65848Z411443"
}
```

```
{
    "Manufacturer": "Ford",
    "Make": "F150",
    "Year": 2020,
    "VIN" : "DH1SL65848Z41100"
}
```

```
{
    "Manufacturer": "Jaguar",
    "Make": "",
    "Year": "",
    "VIN" : "LB1SL65848Z41123"
    }
```


KODEKLOUD

DynamoDB with Terraform

main.tf

```hcl
resource "aws_dynamodb_table" "cars" {
  name      = "cars"
  hash_key = "VIN"
  billing_mode = "PAY_PER_REQUEST"
  attribute {
    name = "VIN"
    type = "S"
  }
}
```

- `billing_mode` - (Optional) Controls how you are charged for read and write throughput and how you manage capacity. The valid values are `PROVISIONED` and `PAY_PER_REQUEST`. Defaults to `PROVISIONED`.

- `write_capacity` - (Optional) The number of write units for this table. If the `billing_mode` is `PROVISIONED`, this field is required.

- `read_capacity` - (Optional) The number of read units for this table. If the `billing_mode` is `PROVISIONED`, this field is required.

main.tf

```
resource "aws_dynamodb_table" "cars" {
  name     = "cars"
  hash_key = "VIN"
  billing_mode = "PAY_PER_REQUEST"
  attribute {
    name = "VIN"
    type = "S"
  }
}
```

>_

```
$ terraform apply
+ create

Terraform will perform the following actions:

  # aws_dynamodb_table.cars will be created
  + resource "aws_dynamodb_table" "cars" {
      + arn              = (known after apply)
      + billing_mode     = "PAY_PER_REQUEST"
      + hash_key         = "VIN"
      + id               = (known after apply)
      + name             = "cars"
      + stream_arn       = (known after apply)
      + stream_label     = (known after apply)
      + stream_view_type = (known after apply)

      + attribute {
          + name = "VIN"
          + type = "S"
        }

      + point_in_time_recovery {
          + enabled = (known after apply)
        }
.
.
aws_dynamodb_table.cars: Creating...
aws_dynamodb_table.cars: Creation complete after 0s [id=cars]
```

main.tf

```
resource "aws_dynamodb_table" "cars" {
  name      = "cars"
  hash_key = "VIN"
  billing_mode = "PAY_PER_REQUEST"
  attribute {
    name = "VIN"
    type = "S"
  }
}
resource "aws_dynamodb_table_item" "car-items" {
  table_name = aws_dynamodb_table.cars.name
  hash_key   = aws_dynamodb_table.cars.hash_key
  item       = <<EOF




EOF
}
```

cars

```
{
    "Manufacturer": "Toyota",
    "Make": "Corolla",
    "Year": 2004,
    "VIN" : "4Y1SL65848Z411439"
}
```

```
{
    "Manufacturer": "Honda",
    "Make": "Civic",
    "Year": 2017,
    "VIN" : "DY1SL65848Z411432"
}
```

```
{
    "Manufacturer": "Dodge",
    "Make": "Journey",
    "Year": 2014,
    "VIN" : "SD1SL65848Z411443"
}
```

```
{
    "Manufacturer": "Ford",
    "Make": "F150",
    "Year": 2020,
    "VIN" : "DH1SL65848Z41100"
}
```

main.tf

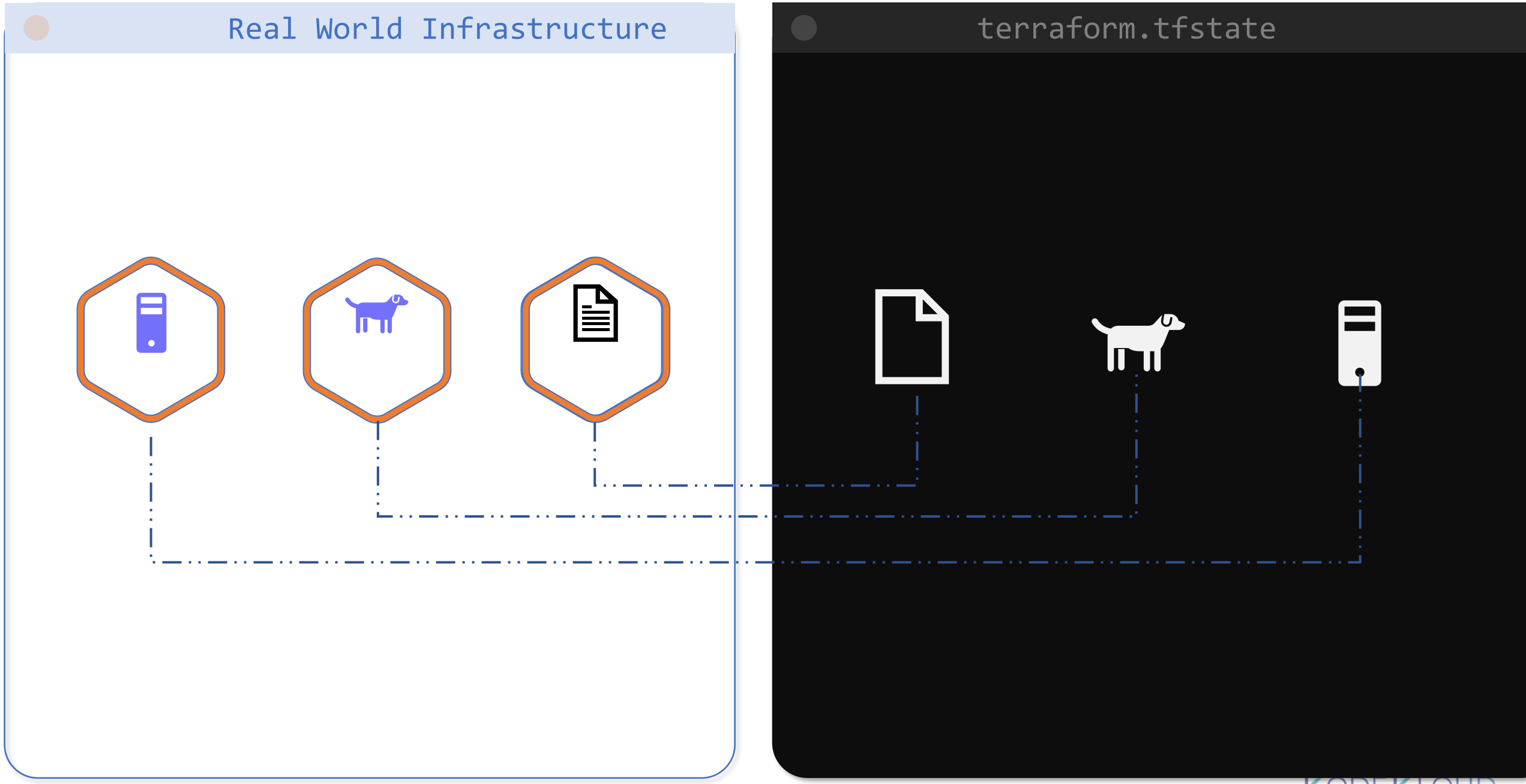
```
resource "aws_dynamodb_table" "cars" {
  name      = "cars"
  hash_key = "VIN"
  billing_mode = "PAY_PER_REQUEST"
  attribute {
    name = "VIN"
    type = "S"
  }
}
resource "aws_dynamodb_table_item" "car-items" {
  table_name = aws_dynamodb_table.cars.name
  hash_key   = aws_dynamodb_table.cars.hash_key
  item       = <<EOF

  {
      "Manufacturer": {"S": "Toyota"},
      "Make": {"S": "Corolla"},
      "Year": {"N": "2004"},
      "VIN" : {"S": "4Y1SL65848Z411439"},
  }
EOF
}
```

>_

```
$ terraform apply

  # aws_dynamodb_table_item.car-items will be created
  + resource "aws_dynamodb_table_item" "car-items" {
      + hash_key   = "VIN"
      + id         = (known after apply)
      + item       = jsonencode(
            {
              + Manufacturer = {
                  + S = "Toyota"
                }
              + Model        = {
                  + S = "Corolla"
                }
              + VIN          = {
                  + S = "4Y1SL65848Z411439"
                }
              + Year         = {
                  + N = "2004"
                }
            }
        )
      + table_name = "cars"
    }

Plan: 1 to add, 0 to change, 0 to destroy.
.
.
aws_dynamodb_table_item.car-items: Creating...
```


KODEKLOUD

Remote State


Real World Infrastructure
terraform.tfstate

Mapping Configuration to Real World

Tracking Metadata

Performance

Collaboration

```
>_

$ ls
main.tf variables.tf terraform.tfstate
```

Version Control

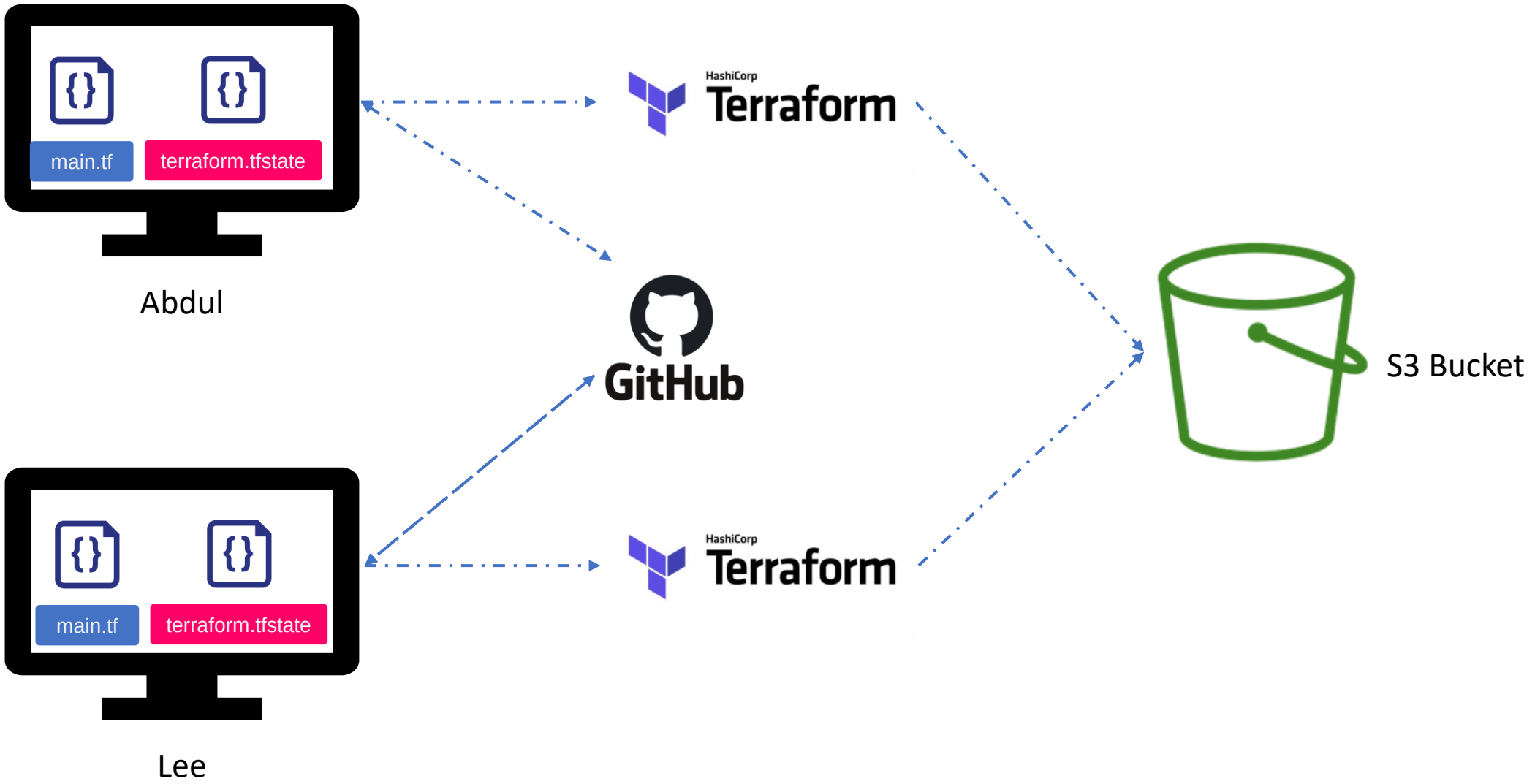
Remote State Backends

main.tf

```
resource "local_file" "pet" {
  filename = "/root/pet.txt"
  content  = "My favorite pet is Mr.Whiskers!"
}
resource "random_pet" "my-pet" {
  length = 1
}
resource "local_file" "cat" {
  filename = "/root/cat.txt"
  content  = "I like cats too!"
}
```

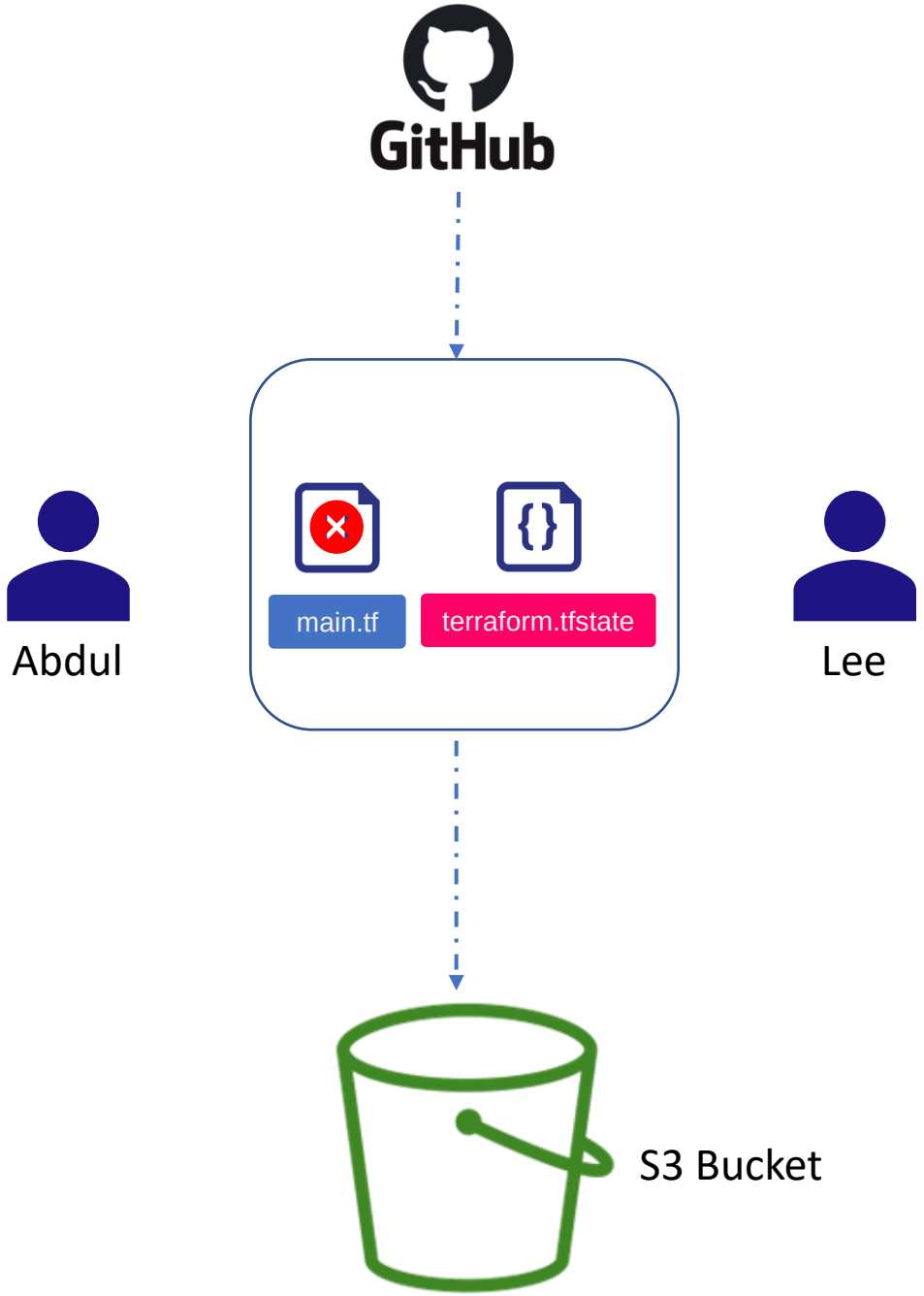
terraform.tfstate

```
{
      "mode": "managed",
      "type": "aws_instance",
      "name": "dev-ec2",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-0a634ae95e11c6f91",
.
.
.
            "primary_network_interface_id": "eni-0ccd57b1597e633e0",
            "private_dns": "ip-172-31-7-21.us-west-2.compute.internal",
            "private_ip": "172.31.7.21",
            "public_dns": "ec2-54-71-34-19.us-west-2.compute.amazonaws.com",
            "public_ip": "54.71.34.19",
            "root_block_device": [
              {
                "delete_on_termination": true,
                "device_name": "/dev/sda1",
                "encrypted": false,
                "iops": 100,
                "kms_key_id": "",
                "volume_id": "vol-070720a3636979c22",
                "volume_size": 8,
                "volume_type": "gp2"
              }
```


main.tf
terraform.tfstate
Abdul
HashiCorp
Terraform
GitHub
S3 Bucket
main.tf
terraform.tfstate
Lee
HashiCorp
Terraform

terraform.tfstate


```
{
      "mode": "managed",
      "type": "aws_instance",
      "name": "dev-ec2",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-0a634ae95e11c6f91",
.
.
.
            "primary_network_interface_id": "eni-0ccd57b1597e633e0",
            "private_dns": "ip-172-31-7-21.us-west-2.compute.internal",
            "private_ip": "172.31.7.21",
            "public_dns": "ec2-54-71-34-19.us-west-2.compute.amazonaws.com",
            "public_ip": "54.71.34.19",
            "root_block_device": [
              {
                "delete_on_termination": true,
                "device_name": "/dev/sda1",
                "encrypted": false,
                "iops": 100,
                "kms_key_id": "",
                "volume_id": "vol-070720a3636979c22",
                "volume_size": 8,
                "volume_type": "gp2"
              }
            ],
```



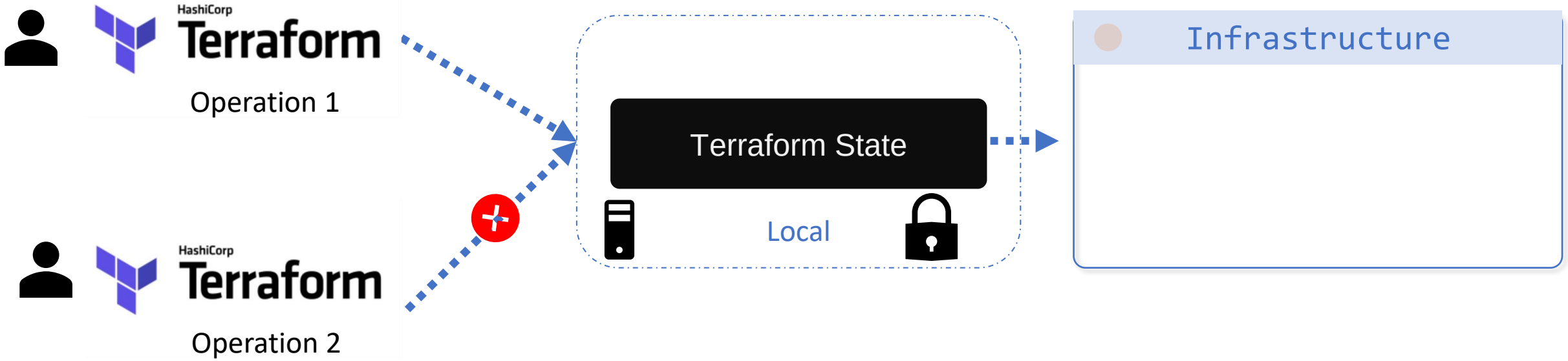
>_ Terminal 1

```
$ terraform apply
.
.
."
      + server_side_encryption = (known after apply)
      + storage_class          = (known after apply)
      + version_id             = (known after apply)
    }

Plan: 2 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_s3_bucket_object.finance-2020: Creating...
aws_s3_bucket.finance: Creating...
aws_s3_bucket_object.finance-2020: Still creating...
[10s elapsed]
aws_s3_bucket.finance: Still creating... [10s
elapsed]
aws_s3_bucket_object.finance-2020: Still creating...
[20s elapsed]
aws_s3_bucket.finance: Still creating... [20s
```

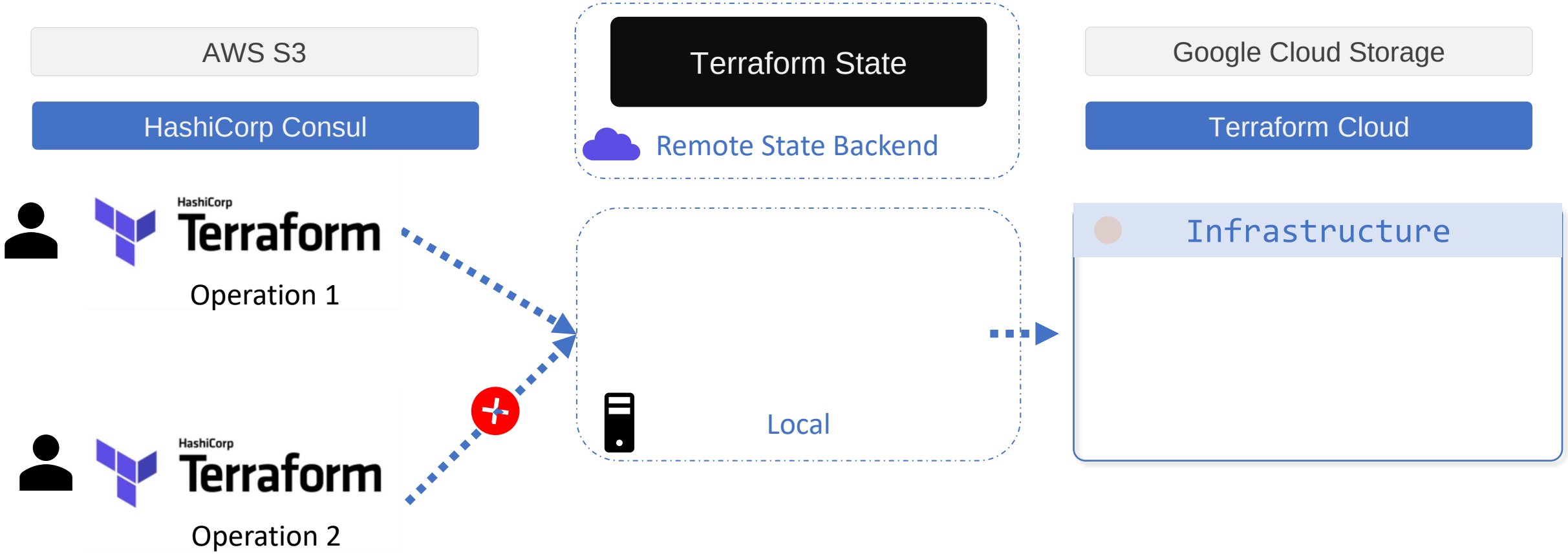
>_ Terminal 2

```
$ terraform apply
Error: Error locking state: Error acquiring the state
lock: resource temporarily unavailable
Lock Info:
  ID:        fefe3806-007c-084b-be61-cef4cdc77dee
  Path:      terraform.tfstate
  Operation: OperationTypeApply
  Who:       root@iac-server
  Version:   0.13.3
  Created:   2020-09-22 20:35:27.051330492 +0000 UTC
  Info:


Terraform acquires a state lock to protect the state from
being written
by multiple users at the same time. Please resolve the
issue above and try
again. For most commands, you can disable locking with
the "-lock=false"
flag, but this is not recommended.
```

State Locking



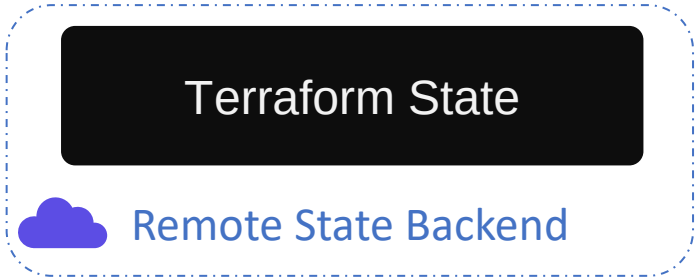
State Locking



State Locking

AWS S3

HashiCorp Consul



Google Cloud Storage

Terraform Cloud

Automatically Load and Upload State File

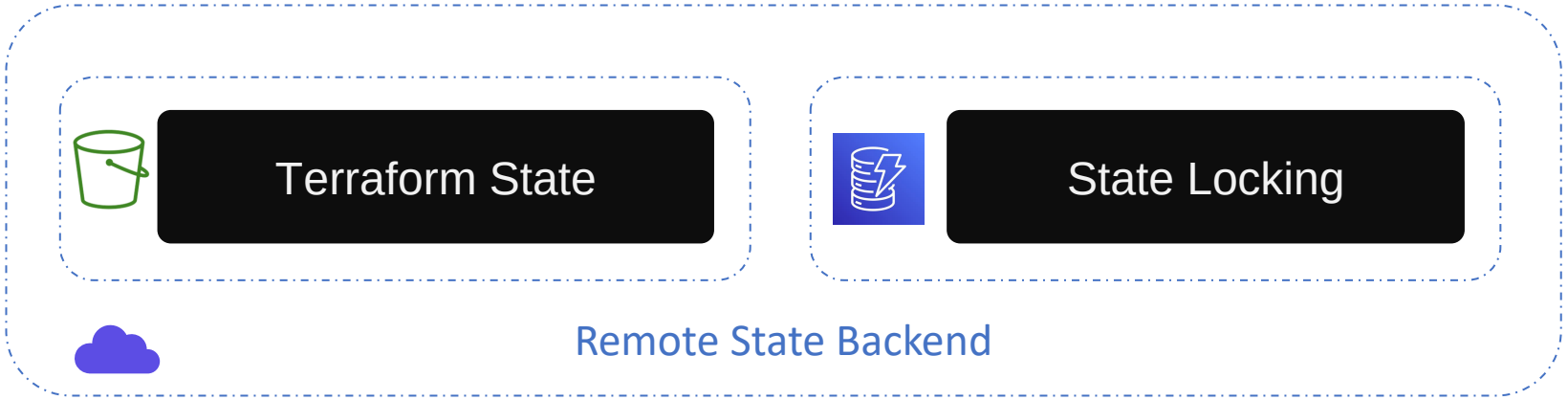
Many Backends Support State Locking

Security


KODEKLOUD

Remote Backends with S3

Remote Backend



Object	Value
Bucket	kodekloud-terraform-state-bucket01
Key	finance/terraform.tfstate
Region	us-west-1
DynamoDB Table	state-locking

main.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content = "We love pets!"
}



terraform {
  backend "s3" {
    bucket         = "kodekloud-terraform-state-bucket01"
    key            = "finance/terraform.tfstate"
    region         = "us-west-1"
    dynamodb_table = "state-locking"
  }
}
```

>_

```
$ ls
main.tf  terraform.tfstate
```

Object	Value
Bucket	kodekloud-terraform-state-bucket01
Key	finance/terraform.tfstate
Region	us-west-1
DynamoDB Table	state-locking

main.tf

```
resource "local_file" "pet" {
  filename = "/root/pets.txt"
  content = "We love pets!"
}
```

terraform.tf

```
terraform {
  backend "s3" {
    bucket         = "kodekloud-terraform-state-bucket01"
    key            = "finance/terraform.tfstate"
    region         = "us-west-1"
    dynamodb_table = "state-locking"
  }
}
```

>_

```
$ terraform apply
Backend reinitialization required. Please run "terraform init". Reason: Initial configuration of the requested backend "s3"

The "backend" is the interface that Terraform uses to store state, perform operations, etc. If this message is showing up, it means
that the Terraform configuration you're using is using a custom configuration for the Terraform backend.

Changes to backend configurations require reinitialization. This allows Terraform to setup the new configuration, copy existing
state, etc. This is only done during "terraform init". Please run that command now then try again.

Error: Initialization required. Please see the error message above.
```

```
$ terraform init
Initializing the backend...
Do you want to copy existing state to the new backend?
  Pre-existing state was found while migrating the previous "local" backend to the newly configured "s3" backend. No existing state
was found in the newly configured "s3" backend. Do you want to copy this state to the new "s3"
  backend? Enter "yes" to copy and "no" to start with an empty state.

  Enter a value: yes

Successfully configured the backend "s3"! Terraform will automatically use this backend unless the backend configuration changes.

Initializing provider plugins...
- Using previously-installed hashicorp/aws v3.7.0
.
.[Output Truncated]
```

```
$ rm -rf terraform.tfstate
```

```
$ terraform apply
Acquiring state lock. This may take a few moments...
aws_s3_bucket.terraform-state: Refreshing state... [id=kodekloud-terraform-state-bucket01]
aws_dynamodb_table.state-locking: Refreshing state... [id=state-locking]

Apply complete! Resources: 0 added, 0 changed, 0 destroyed.
Releasing state lock. This may take a few moments.
```


KODEKLOUD

Terraform State Commands

```
>_

$ vi terraform.tfstate
$ terraform state show aws_s3_bucket.finance
# terraform state <subcommand> [options] [args]
```

Sub-command
list
mv
pull
rm
show

terraform.tfstate


```
{
      "mode": "managed",
      "type": "aws_instance",
      "name": "dev-ec2",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-0a634ae95e11c6f91",
.
.
.
            "primary_network_interface_id": "eni-0ccd57b1597e633e0",
            "private_dns": "ip-172-31-7-21.us-west-2.compute.internal",
            "private_ip": "172.31.7.21",
            "public_dns": "ec2-54-71-34-19.us-west-2.compute.amazonaws.com",
            "public_ip": "54.71.34.19",
            "root_block_device": [
              {
                "delete_on_termination": true,
                "device_name": "/dev/sda1",
                "encrypted": false,
                "iops": 100,
                "kms_key_id": "",
                "volume_id": "vol-070720a3636979c22",
                "volume_size": 8,
                "volume_type": "gp2"
              }
            ],
```

```
>_

# terraform state list [options] [address]

$ terraform state list
aws_dynamodb_table.cars
aws_s3_bucket.finance-2020922

$ terraform state list aws_s3_bucket.finance-2020922

aws_s3_bucket.finance-2020922
```

```
>_

# terraform state show [options] [address]

$ terraform state show aws_s3_bucket.finance-2020922

resource "aws_s3_bucket" "terraform-state" {
    acl                         = "private"
    arn                         = "arn:aws:s3::: finance-2020922 "
    bucket                      = "finance-2020922 "
    bucket_domain_name          = "finance-2020922.s3.amazonaws.com"
    bucket_regional_domain_name = " finance-2020922.s3.us-west-1.amazonaws.com"
    force_destroy               = false
    hosted_zone_id              = "Z2F5ABCDE1ACD"
    id                          = "finance-2020922 "
    region                      = "us-west-1"
    request_payer               = "BucketOwner"
    tags                        = {
        "Descritpion" = "Bucket to store Finance and Payroll Information"
    }

    versioning {
        enabled    = false
        mfa_delete = false
    }
}
```

main.tf

```
resource "aws_dynamodb_table" "state-locking" {
    name = "state-locking-db"
    billing_mode = "PAY_PER_REQUEST"
    hash_key = "LockID"
    attribute {
        name =  "LockID"
        type = "S"
    }
}
```

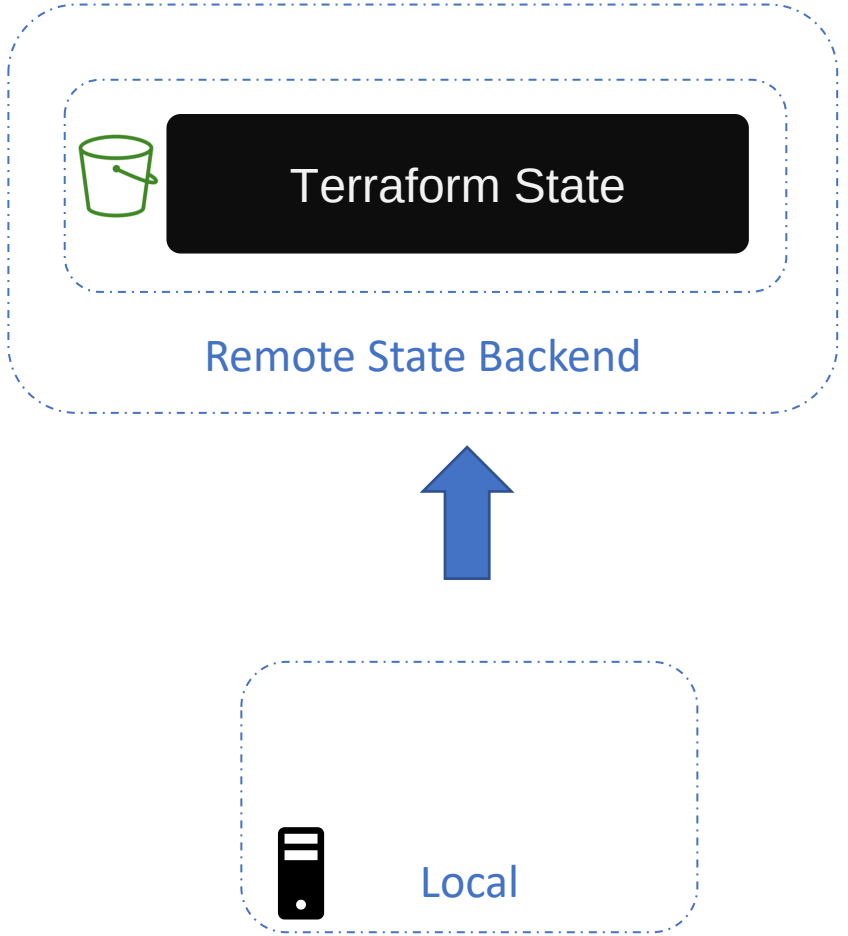
terraform.tfstate

```
"resources": [
    {
      "mode": "managed",
      "type": "aws_dynamodb_table",
      "name": "state-locking-db"
      "provider":
"provider[\"registry.terraform.io/hashicorp/aws\"
]",
.
.
```

>_

```
# terraform state mv [options] SOURCE  DESTINATION

$ terraform state mv aws_dynamodb_table.state-locking aws_dynamodb_table.state-locking-db
Move "aws_dynamodb_table.state-locking" to "aws_dynamodb_table.state-locking-db"
Successfully moved 1 object(s).

$ terraform apply

aws_dynamodb_table.state-locking-db: Refreshing state... [id=state-locking]

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

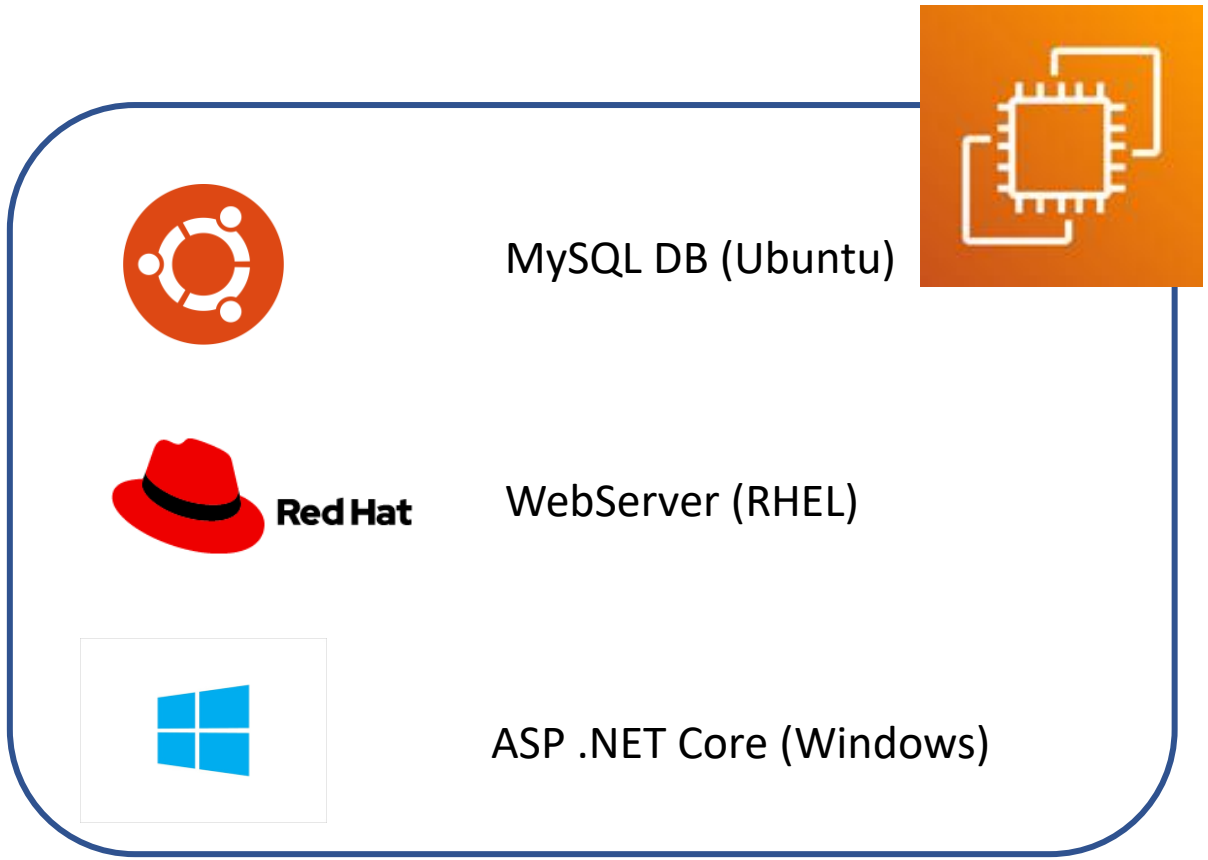
```
>_
$ ls
main.tf  provider.tf

#  terraform state pull [options] SOURCE  DESTINATION

$ terraform state pull
{
  "version": 4,
  "terraform_version": "0.13.0",
  "serial": 0,
  "lineage": "b6e2cf0e-ef8d-3c59-1e11-c6520dcd745c",
  "resources": [
    {
      "mode": "managed",
      "type": "aws_dynamodb_table",
      "name": "state-locking-db",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
...

$ terraform state pull | jq '.resources[] | select(.name  == "state-locking-
db")|.instances[].attributes.hash_key'
"LockID"
```



```
>_

#  terraform state rm ADDRESS

$ terraform state rm aws_s3_bucket.finance-2020922
Acquiring state lock. This may take a few moments...
Removed aws_s3_bucket.finance-2020922
Successfully removed 1 resource instance(s).
Releasing state lock. This may take a few moments...
```


KODEKLOUD

Introduction to AWS EC2


Elastic Compute Cloud
MySQL DB (Ubuntu)
Red Hat
WebServer (RHEL)
ASP .NET Core (Windows)

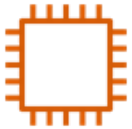
Amazon Machine Image (AMI's)

Amazon Linux 2 AMI ami-0c2f25c1f66a1ff4d

Red Hat Enterprise Linux 8 ami-04312317b9c8c4b51

Ubuntu Server 20.04 LTS ami-0edab43b6fa892279

Instance Types



General Purpose

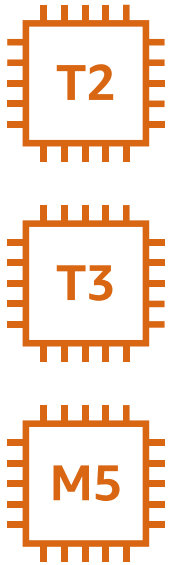
Compute Optimized

Memory Optimized

https://aws.amazon.com/ec2/instance-types/

T2 General Purpose

Instance Type	vCPU	Memory (GB)
t2.nano	1	0.5
t2.micro	1	1
t2.small	1	2
t2.medium	2	4
t2.large	2	8
t2.xlarge	4	16
t2.2xlarge	8	32



https://aws.amazon.com/ebs/volume-types/

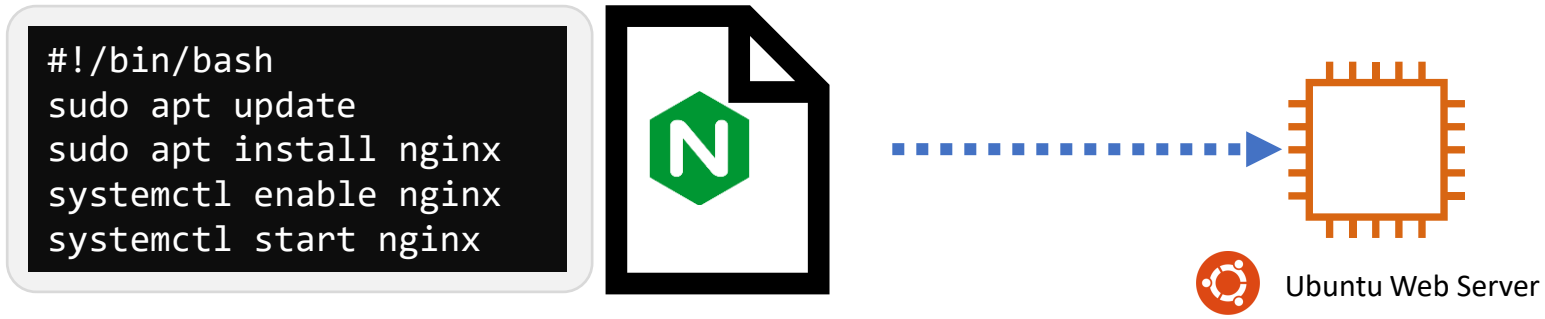
EBS Volume

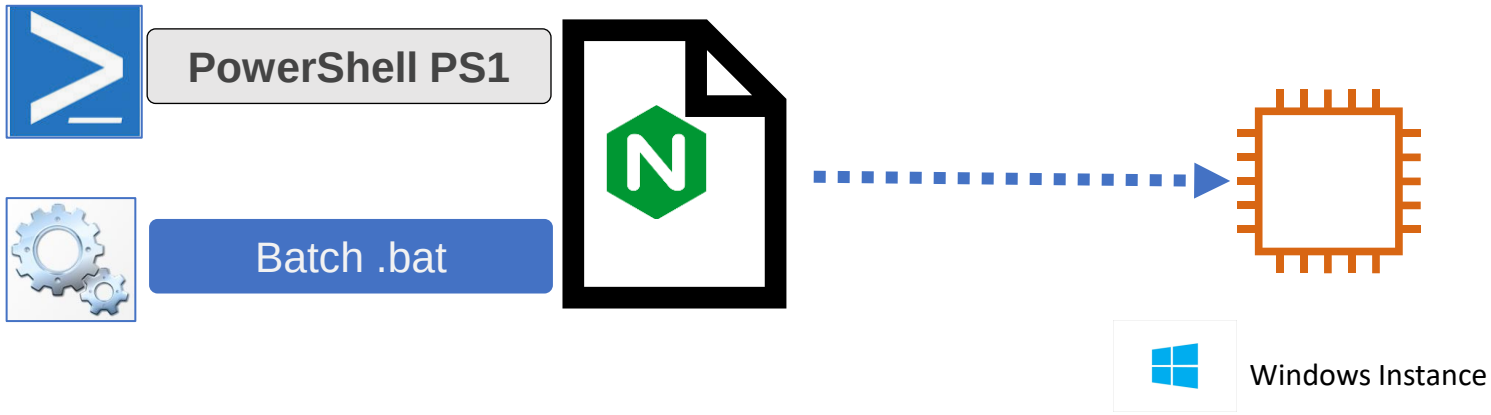
EBS Volume Types

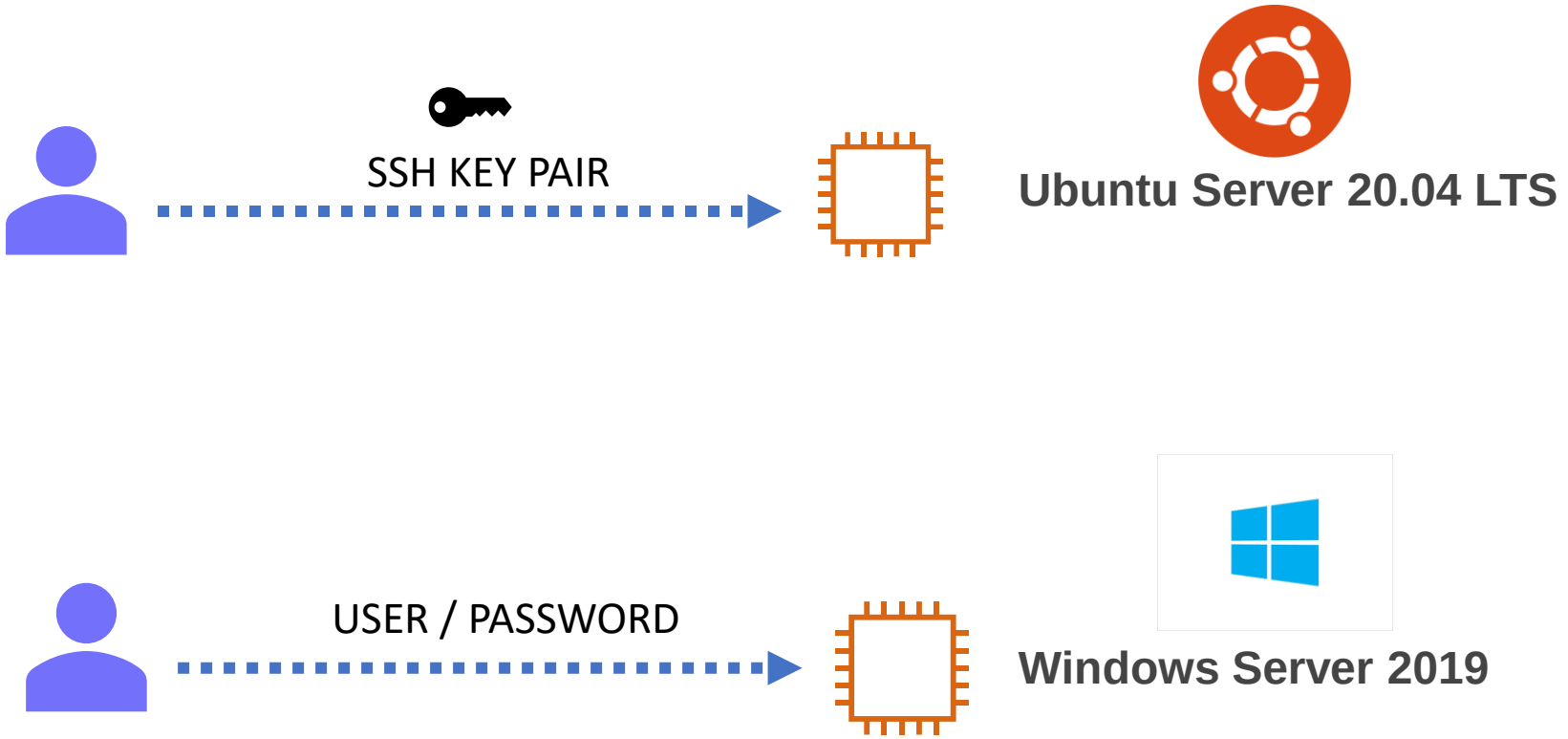
Name	Type	Description
io1	SSD	For business-critical Apps
io2	SSD	For latency-sensitive transactional workloads
gp2	SSD	General Purpose
st1	HDD	Low Cost HDD frequently accessed, throughput-intensive workloads
sc1	HDD	Lowest cost HDD volume designed for less frequently accessed workloads

User Data

```
#!/bin/bash
sudo apt update
sudo apt install nginx
systemctl enable nginx
systemctl start nginx
```






SSH KEY PAIR
Ubuntu Server 20.04 LTS
USER / PASSWORD
Windows Server 2019


KODEKLOUD

AWS EC2 With Terraform

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
}
```

Argument Reference

The following arguments are supported:

- `ami` - (Required) The AMI to use for the instance.
- `instance_type` - (Required) The type of instance to start. Updates to this field will trigger a stop/start of the EC2 instance.
- `tags` - (Optional) A map of tags to assign to the resource.

provider.tf

```
provider "aws" " {
  region = “us-west-1"
}
```

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name        = "webserver"
    Description = "An Nginx WebServer on Ubuntu"
  }

}
```

provider.tf

```
provider "aws" " {
  region = “us-west-1"
}
```

Argument Reference

The following arguments are supported:

- `ami` - (Required) The AMI to use for the instance.
- `instance_type` - (Required) The type of instance to start. Updates to this field will trig
  a stop/start of the EC2 instance.
- `tags` - (Optional) A map of tags to assign to the resource.

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name        = "webserver"
    Description = "An Nginx WebServer on Ubuntu"
  }
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
}
```

provider.tf

```
provider "aws" " {
  region = “us-west-1"
}
```

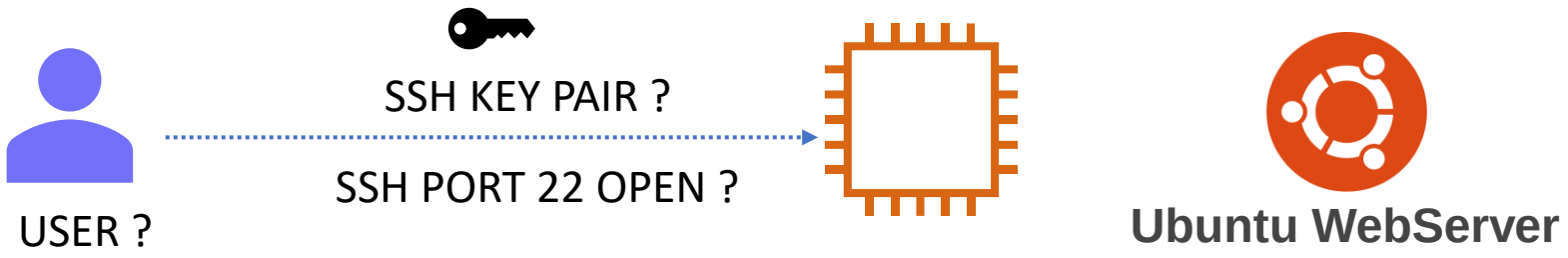
Argument Reference

The following arguments are supported:

- `ami` - (Required) The AMI to use for the instance.
- `instance_type` - (Required) The type of instance to start. Updates to this field will trig
a stop/start of the EC2 instance.
- `tags` - (Optional) A map of tags to assign to the resource.
- `user_data` - (Optional) The user data to provide when launching the instance. Do n
pass gzip-compressed data via this argument; see `user_data_base64` instead.

```
>_

$ terraform apply

  # aws_instance.webserver will be created
  + resource "aws_instance" "webserver" {
      + ami                          = "ami-0edab43b6fa892279"
.
.
      + instance_type                = "t2.micro"
      + ipv6_address_count           = (known after apply)
      + public_ip                    = (known after apply)
      + source_dest_check            = true
      + subnet_id                    = (known after apply)
      + tags                         = {
          + "Description" = "An NGINX WebServer on Ubuntu"
          + "Name"        = "webserver"
        }
      + tenancy                      = (known after apply)
      + user_data                    = "527516162d9d8675a26b6ca97664226e6e2bff82"
      + volume_tags                  = (known after apply)
      + vpc_security_group_ids       = (known after apply)
.
.
aws_instance.webserver: Creating...
aws_instance.webserver: Still creating... [20s elapsed]
aws_instance.webserver: Creation complete after 22s [id=i-0085e5d0f442f7c4f]

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

Name	Instance ID	Instance state	Instance type	Status check	Alarm Status	Availability zone
webserver	i-0085e5d0f442f7c4f	Running	t2.micro	2/2 checks ...	No alarms	ca-central-1a



Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about removing existing key pairs from a public AMI.

Create a new key pair

Key pair name

webserver

Download Key Pair

You have to download the **private key file** (*.pem file) before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

Cancel Launch Instances

KODEKLOUD

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name        = "webserver"
    Description = "An Nginx WebServer on Ubuntu"
  }
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
}
```

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name        = "webserver"
    Description = "An Nginx WebServer on Ubuntu"
  }
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
}
resource "aws_key_pair" "web" {
    public_key = file("/root/.ssh/web.pub")
}
```

main.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-0edab43b6fa892279"
    instance_type = "t2.micro"
    tags = {
        Name = "webserver"
        Description = "An NGINX WebServer on Ubuntu"
    }
    user_data =<<-EOF
    #!/bin/bash
    sudo apt update
    sudo apt install nginx -y
    systemctl enable nginx
    systemctl start nginx
    EOF
}
resource "aws_key_pair" "web" {
    public_key = "ssh-
rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQDicpU+kT9isaZy7cHYa
+oCTUolS6Tg6vCEq+ufucIMrA7RLTngi+YfTfvgrY2UiHGxuuJ1lE
yT0x2UrGexVx4G2TzX/am2WFzNbcGSg2bCXTkVQY93KOhbW9y851a
+g1wI7TODC0oxEMFr/CVsrJ4bfbp8S896VKBxC1WpSU9GscPP28GV
uDgm2ATBuL78AF root@iac-server"
}
```

KODEKLOUD

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name        = "webserver"
    Description = "An Nginx WebServer on Ubuntu"
  }
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
  key_name  = aws_key_pair.web.id
}

resource "aws_key_pair" "web" {
    public_key = file("/root/.ssh/web.pub")
}
```

Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the low

Number of instances 1 Launch into Auto Scaling Group

Purchasing option Request Spot instances

Network vpc-7da8d215 (default) Create new VPC

Subnet No preference (default subnet in any Availability Zon Create new subnet

Auto-assign Public IP Use subnet setting (Enable)

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet HTTP and HTTPS ports. You can create a new security group or select from an existing one below. Learn more about Amazon EC2 security groups.

Assign a security group: Create a **new** security group

Select an **existing** security group

Security group name: ssh-access

Description: SSH Access from the Internet

Type	Protocol	Port Range	Source
SSH	TCP	22	Custom 0.0.0.0/0

Add Rule

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name        = "webserver"
    Description = "An Nginx WebServer on Ubuntu"
  }
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF

  key_name  = aws_key_pair.web.id

}
resource "aws_key_pair" "web" {
    public_key = file("/root/.ssh/web.pub")
}
```

```
  }
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
  key_name  = aws_key_pair.web.id
}
resource "aws_key_pair" "web" {
    public_key = file("/root/.ssh/web.pub")
}
resource "aws_security_group" "ssh-access" {
  name        = "ssh-access"
  description = "Allow SSH access from the Internet"
  ingress {
    from_port   = 22
    to_port     = 22
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

The `ingress` block supports:

- `cidr_blocks` - (Optional) List of CIDR blocks.
- `to_port` - (Required) The end range port (or ICMP code if protocol is "icmp"
- `from_port` - (Required) The start port (or ICMP type number if protocol is "ic "icmpv6")
- `protocol` - (Required) The protocol. If you select a protocol of "-1" (semanticall equivalent to `"all"`, which is not a valid value here), you must specify a "from_ and "to_port" equal to 0. If not icmp, icmpv6, tcp, udp, or "-1" use the protocol

```
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF

  key_name  = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]

}
resource "aws_key_pair" "web" {
    public_key = file("/root/.ssh/web.pub")
}
resource "aws_security_group" "ssh-access" {
  name        = "ssh-access"
  description = "AllowSSH access from the Internet"
  ingress {
    from_port   = 22
    to_port     = 22
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

```
              systemctl start nginx
              EOF
  key_name  = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]

}
resource "aws_key_pair" "web" {
    public_key = file("/root/.ssh/web.pub")
}
resource "aws_security_group" "ssh-access" {
  name        = "ssh-access"
  description = "AllowSSH access from the Internet"
  ingress {
    from_port   = 22
    to_port     = 22
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
 output publicip {
   value       = aws_instance.webserver.public_ip
 }
```

```
$ terraform apply

Plan: 3 to add, 0 to change, 1 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.webserver: Destroying... [id=i-015b579d0ea84fbb7]
aws_key_pair.web: Creating...
aws_security_group.ssh-access: Creating...
aws_key_pair.web: Creation complete after 1s [id=terraform-
20201014034144926200000001]
aws_security_group.ssh-access: Creation complete after 1s [id=sg-
0f02f3ea92b14bed8]
aws_instance.webserver: Still destroying... [id=i-015b579d0ea84fbb7, 10s elapsed]
aws_instance.webserver: Still destroying... [id=i-015b579d0ea84fbb7, 20s elapsed]
aws_instance.webserver: Destruction complete after 30s
aws_instance.webserver: Creating...
aws_instance.webserver: Still creating... [10s elapsed]
aws_instance.webserver: Still creating... [20s elapsed]
aws_instance.webserver: Still creating... [30s elapsed]
aws_instance.webserver: Creation complete after 32s [id=i-0fd2c1c5eb0762ff5]

Apply complete! Resources: 3 added, 0 changed, 1 destroyed.
Outputs:

publicip = 3.96.203.171
```

```
$ ssh -i /root/.ssh/web ubuntu@3.96.203.171
ubuntu@ip-172-31-19-161:~$

[ubuntu@ip-172-31-19-161]$ systemctl status nginx
nginx.service - A high performance web server and a reverse
proxy server
   Loaded: loaded (/lib/systemd/system/nginx.service; enabled;
vendor preset: enabled)
   Active: active (running) since Wed 2020-11-02 22:17:38 UTC;
2 min ago
  Process: 303 ExecStart=/usr/sbin/nginx -g daemon on;
master_process on; (code=exited, status=0
  Process: 264 ExecStartPre=/usr/sbin/nginx -t -q -g daemon
on; master_process on; (code=exited,
 Main PID: 304 (nginx)
```

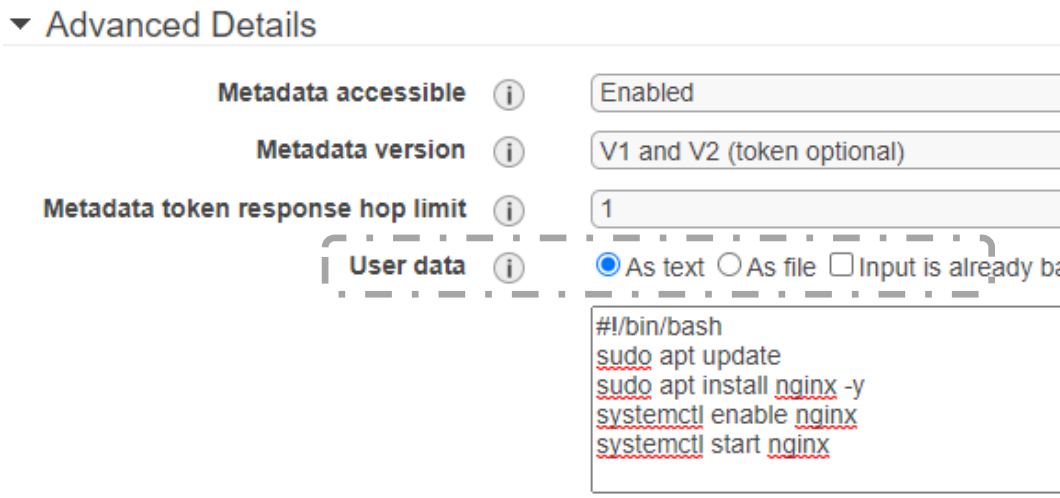

KODEKLOUD

Terraform Provisioners

Provisioners

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
  key_name   = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]

}

resource "aws_key_pair" "web" {
     << code hidden >>
}

resource "aws_security_group" "ssh-access" {
     << code hidden >>
}
```

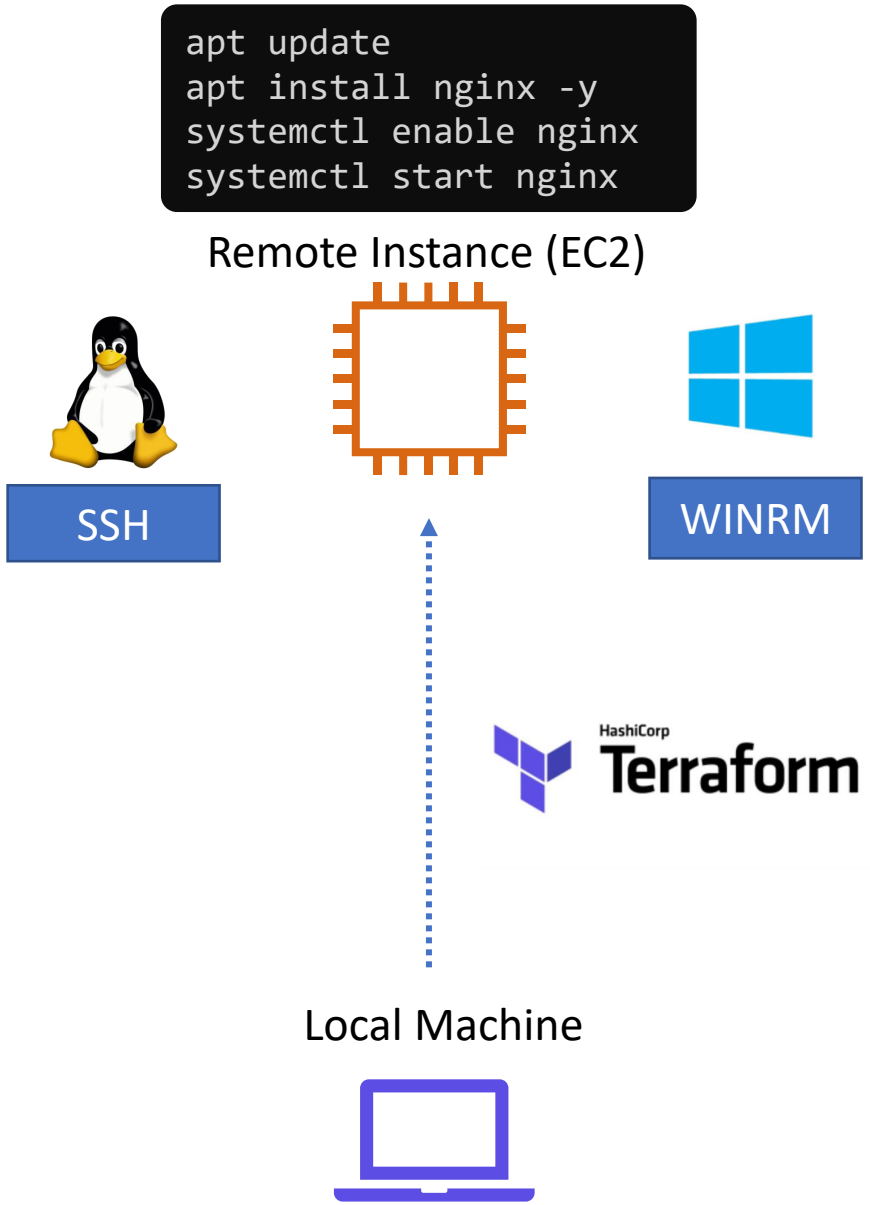


Remote Exec

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  user_data = <<-EOF
              #!/bin/bash
              sudo apt update
              sudo apt install nginx -y
              systemctl enable nginx
              systemctl start nginx
              EOF
  key_name   = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]

}

resource "aws_key_pair" "web" {
    << code hidden >>
}

resource "aws_security_group" "ssh-access" {
    << code hidden >>
}
```

```
apt update
apt install nginx -y
systemctl enable nginx
systemctl start nginx
```



- ✓ Network Connectivity (Security Group)
- ✓ Authentication (SSH Key Pair)

Remote Exec

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  provisioner "remote-exec" {
      inline = [ "sudo apt update",
                 "sudo apt install nginx -y",
                 "sudo systemctl enable nginx",
                 "sudo systemctl start nginx",
               ]
    }
  key_name  = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]

}

resource "aws_key_pair" "web" {
     << code hidden >>
}

resource "aws_security_group" "ssh-access" {
     << code hidden >>
}
```

Remote Exec

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  provisioner "remote-exec" {
      inline = [ "sudo apt update",
                 "sudo apt install nginx -y",
                 "sudo systemctl enable nginx",
                 "sudo systemctl start nginx",
               ]
    }
  connection {
     type        = "ssh"
     host        = self.public_ip
     user        = "ubuntu"
     private_key = file("/root/.ssh/web")
   }
  key_name  = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]
}
resource "aws_key_pair" "web" {
     << code hidden >>
}
```

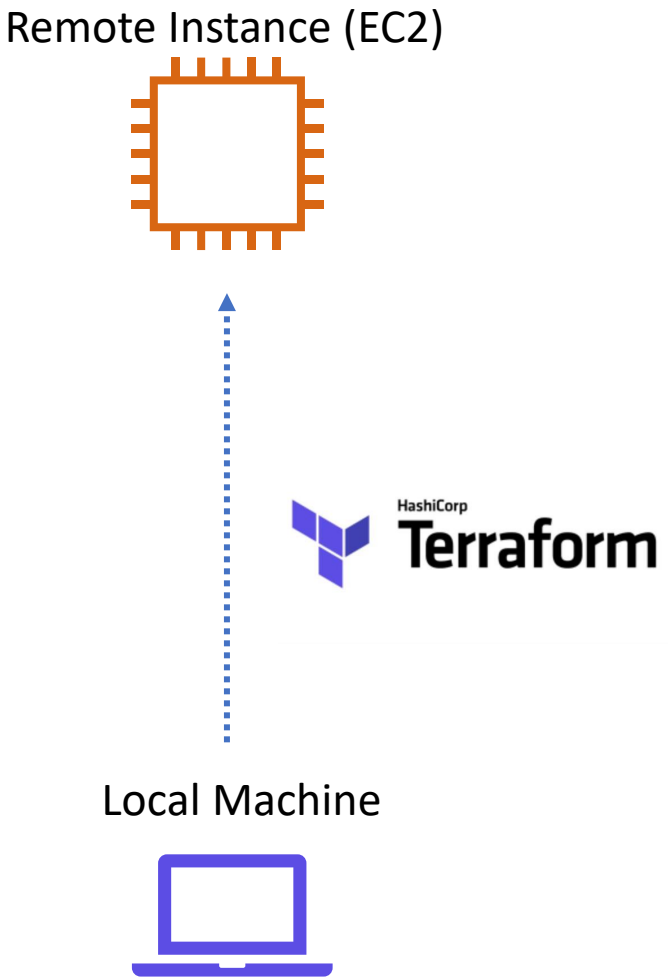
>_

```
$ terraform apply
aws_key_pair.web: Creating...
aws_security_group.ssh-access: Creating...
aws_key_pair.web: Creation complete after 0s [id=terraform-
20201015013048509100000001]
aws_security_group.ssh-access: Creation complete after 1s [id=sg-0
aws_instance.webserver: Creating...
aws_instance.webserver: Still creating... [10s elapsed]
aws_instance.webserver: Still creating... [20s elapsed]
aws_instance.webserver: Still creating... [30s elapsed]
aws_instance.webserver: Provisioning with 'remote-exec'...
aws_instance.webserver (remote-exec): Connecting to remote host vi
aws_instance.webserver (remote-exec):   Host: 3.96.136.157
aws_instance.webserver (remote-exec):   User: ubuntu
aws_instance.webserver (remote-exec):   Password: false
aws_instance.webserver (remote-exec):   Private key: true
aws_instance.webserver (remote-exec):   Certificate: false
aws_instance.webserver (remote-exec):   SSH Agent: false
aws_instance.webserver (remote-exec):   Checking Host Key: false
aws_instance.webserver: Still creating... [40s elapsed]
aws_instance.webserver (remote-exec): Connecting to remote host vi
aws_instance.webserver (remote-exec):   Host: 3.96.136.157
aws_instance.webserver (remote-exec):   User: ubuntu
aws_instance.webserver (remote-exec):   Password: false
aws_instance.webserver (remote-exec):   Private key: true
aws_instance.webserver (remote-exec):   Certificate: false
aws_instance.webserver (remote-exec):   SSH Agent: false
aws_instance.webserver (remote-exec):   Checking Host Key: false
aws_instance.webserver (remote-exec): Connected!
aws_instance.webserver: Still creating... [50s elapsed]
aws_instance.webserver: Creation complete after 50s [id=i-068fad30
```

Local Exec

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  provisioner "remote-exec" {
      inline = [ "sudo apt update",
                 "sudo apt install nginx -y",
                 "sudo systemctl enable nginx",
                 "sudo systemctl start nginx",
               ]
    }
  connection {
     type        = "ssh"
     host        = self.public_ip
     user        = "ubuntu"
     private_key = file("/root/.ssh/web")
   }
  key_name  = aws_key_pair.web.id
  vpc_security_group_ids = [ aws_security_group.ssh-access.id ]
}
resource "aws_key_pair" "web" {
     << code hidden >>
}
```



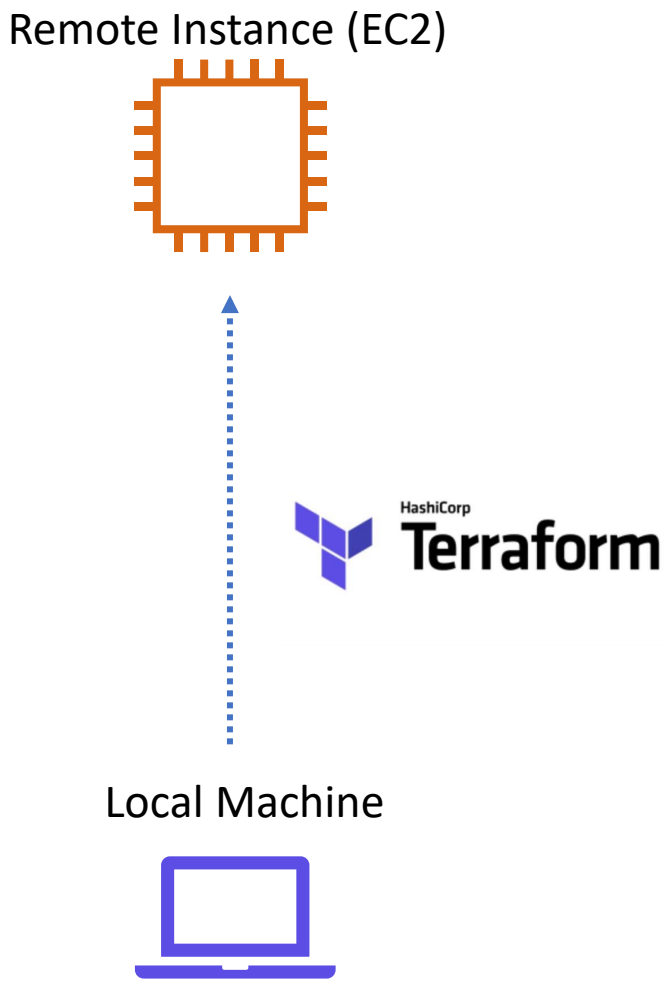
Local Exec

main.tf

```
resource "aws_instance" "webserver" {
  ami           = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"

  provisioner "local-exec" {
    command = "echo ${aws_instance.webserver2.public_ip} >> /tmp/ips.txt"
  }



}
```

```
>_

$ cat /tmp/ips.txt
54.214.68.27
```

- `command` - (Required) This is the command to execute. It can be provided as a relative path to the current working directory or as an absolute path. It is evaluated in a shell, and can use environment variables or Terraform variables.




```
echo ${aws_instance.webserver.public_ip} >> /tmp/ip.txt"
```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Provisioner Behavior

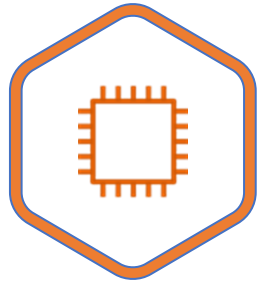
Creation Time Provisioner

main.tf

```
resource "aws_instance" "webserver" {
  ami                    = "ami-0edab43b6fa892279"
  instance_type          = "t2.micro"
  provisioner "local-exec" {
     command = "echo Instance ${aws_instance.webserver.public_ip} Created! > /tmp/instance_state.txt"
  }
}
```

>_

```
$ cat /tmp/instance_state.txt
  Instance 3.96.136.157 Created!
```



Destroy Time Provisioner

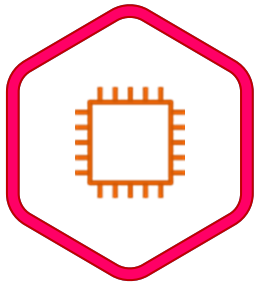
main.tf

```
resource "aws_instance" "webserver" {
  ami                    = "ami-0edab43b6fa892279"
  instance_type          = "t2.micro"
  provisioner "local-exec" {
     command = "echo Instance ${aws_instance.webserver.public_ip} Created! > /tmp/instance_state.txt"
  }

  provisioner "local-exec" {
     when    = destroy
     command = "echo Instance ${aws_instance.webserver.public_ip} Destroyed! > /tmp/instance_state.txt"
   }
}
```

>_

```
$ cat /tmp/instance_state.txt
  Instance 3.96.136.157 Deleted!
```



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Failure Behavior

main.tf

```
resource "aws_instance" "webserver" {
  ami                    = "ami-0edab43b6fa892279"
  instance_type          = "t2.micro"
  provisioner "local-exec" {
     on_failure = fail
     command = "echo Instance ${aws_instance.webserver.public_ip} Created! > /temp/instance_state.txt"
  }

  provisioner "local-exec" {
     when    = destroy
     command = "echo Instance ${aws_instance.webserver.public_ip} Destroyed! > /tmp/instance_state.txt"
   }
}
```

>_

```
$ terraform apply

  Error: Error running command 'echo 35.183.14.192 > /temp/pub_ip.txt': exit status 1.
  Output: The system cannot find the path specified.
```

KODEKLOUD

Failure Behavior

main.tf

```
resource "aws_instance" "webserver" {
  ami                    = "ami-0edab43b6fa892279"
  instance_type          = "t2.micro"
  provisioner "local-exec" {
     on_failure = continue
     command = "echo Instance ${aws_instance.webserver.public_ip} Created! > /temp/instance_state.txt"
  }

  provisioner "local-exec" {
     when    = destroy
     command = "echo Instance ${aws_instance.webserver.public_ip} Destroyed! > /tmp/instance_state.txt"
   }
}
```

>_

```
$ terraform apply
  aws_instance.webserver (local-exec) The system cannot find the path specified.
  aws_instance.project: Creation complete after 22s [id=i-01585c2b9dbc445db]

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


KODEKLOUD

Considerations with Provisioners

Local-Exec | Remote-Exec

main.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-0edab43b6fa892279"
    instance_type = "t2.micro"
    tags = {
        Name = "webserver"
        Description = "An NGINX WebServer on Ubuntu"
    }
    provisioner "remote-exec" {
    inline = ["echo $(hostname -i) >> /tmp/ips.txt"]
  }
}
```

No Provisioner Information in Plan

Network Connectivity and Authentication

main.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-0edab43b6fa892279"
    instance_type = "t2.micro"
    tags = {
        Name = "webserver"
        Description = "An NGINX WebServer on Ubuntu"
    }
    user_data = <<-EOF
                #!/bin/bash
                sudo apt update
                sudo apt install nginx -y
                systemctl enable nginx
                systemctl start nginx
                EOF
}
```

Provider	Resource	Option
AWS	aws_instance	user_data
Azure	azurrerm_virtual_machine	custom_data
GCP	google_compute_instance	meta_data
Vmware vSphere	vsphere_virtual_machine	user_data.txt

main.tf

```
resource "aws_instance" "webserver" {
    ami = "ami-XYZ"
    instance_type = "t2.micro"
    tags = {
        Name = "webserver"
        Description = "An NGINX WebServer on Ubuntu"
    }
}
```

Custom AMI with NGINX

nginx-build.json


KODEKLOUD

Terraform Taint

Taint

main.tf

```
resource "aws_instance" "webserver-3" {
  ami                    = "ami-0edab43b6fa892279"
  instance_type          = "t2.micro"
  key_name               = "ws"
  provisioner "local-exec" {
    command = "echo ${aws_instance.webserver-3.public_ip} > /temp/pub_ip.txt"
  }
```

>_

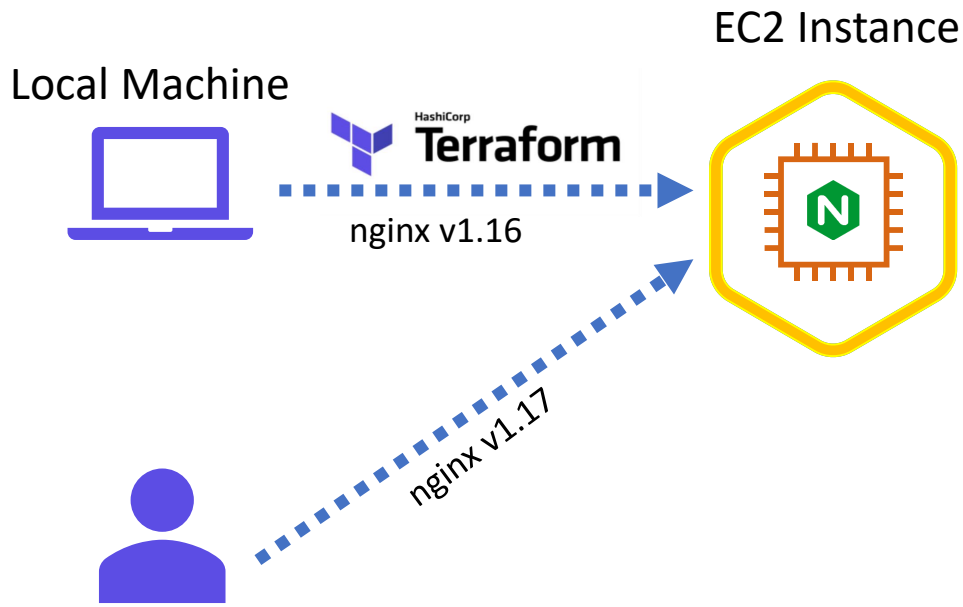
```
$ terraform apply

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


aws_instance.webserver: Creating...
aws_instance.webserver: Still creating... [10s elapsed]
aws_instance.webserver: Still creating... [20s elapsed]
aws_instance.webserver: Still creating... [30s elapsed]
aws_instance.webserver: Provisioning with 'local-exec'...
aws_instance.webserver (local-exec): Executing: ["cmd" "/C" "echo 35.183.14.192 > /temp/pub_ip.txt"]
aws_instance.webserver (local-exec): The system cannot find the path specified.


Error: Error running command 'echo 35.183.14.192 > /temp/pub_ip.txt': exit status 1. Output: The system
cannot find the path specified.
```

Taint

```
>_

$ terraform plan
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not
be
persisted to local or remote state storage.

aws_instance.webserver: Refreshing state... [id=i-0dba2d5dc22a9a904]

------------------------------------------------------------------------
-

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
-/+ destroy and then create replacement

Terraform will perform the following actions:

  # aws_instance.webserver is tainted, so must be replaced
-/+ resource "aws_instance" "webserver-3" {
```

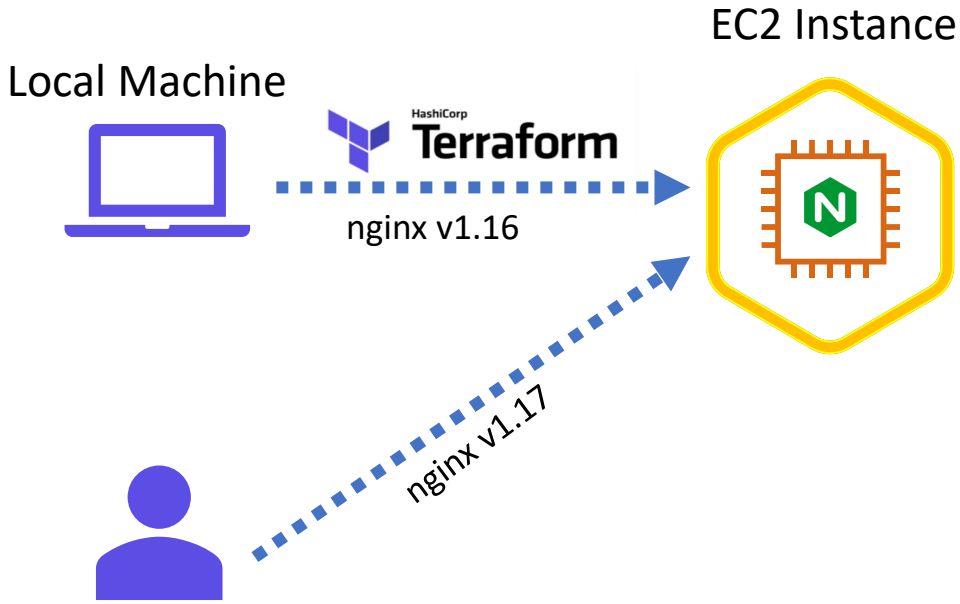
Taint

```
$ terraform taint aws_instance.webserver

Resource instance aws_instance.webserver has been marked as tainted.

$ terraform plan

Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.

aws_instance.webserver: Refreshing state... [id=i-0fd3946f5b3ab8af8]

------------------------------------------------------------------------

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
-/+ destroy and then create replacement

Terraform will perform the following actions:

  # aws_instance.webserver is tainted, so must be replaced
-/+ resource "aws_instance" "webserver" {
```



Taint

```
$ terraform untaint aws_instance.webserver

Resource instance aws_instance.webserver has been successfully
untainted.


$ terraform plan

Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.

aws_instance.webserver: Refreshing state... [id=i-0fd3946f5b3ab8af8]

------------------------------------------------------------------------

No changes. Infrastructure is up-to-date.

This means that Terraform did not detect any differences between your
configuration and real physical resources that exist. As a result, no
actions need to be performed.
```

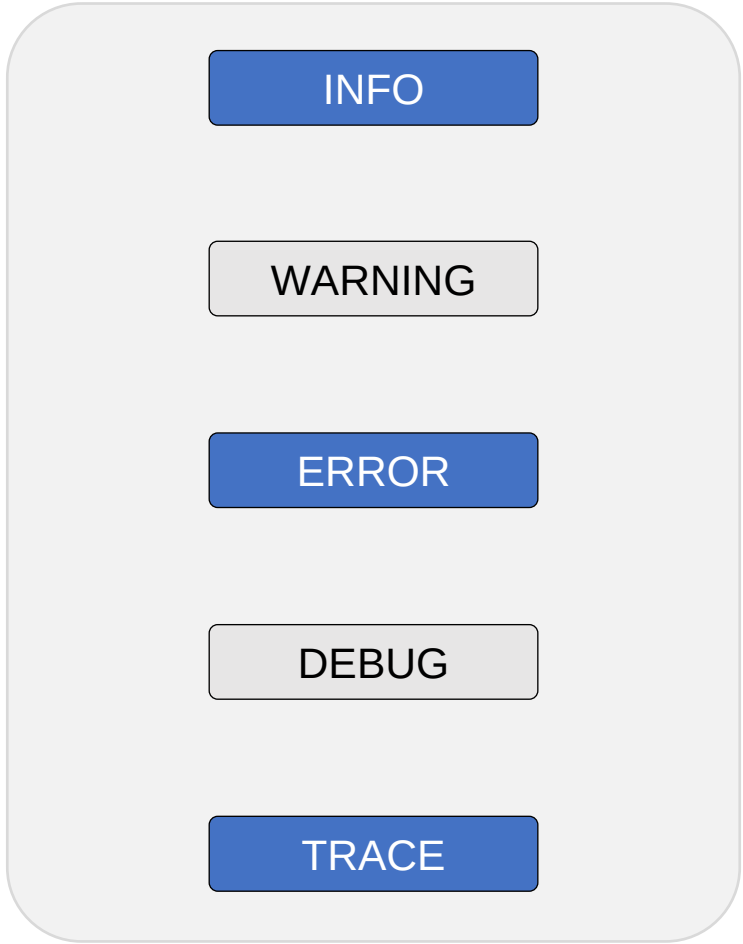



KODEKLOUD

Debugging

Log Levels

```
>_

# export TF_LOG=<log_level>
$ export TF_LOG=TRACE
```



```
>_

  $ terraform plan
 ----
2020/10/18 22:08:30 [INFO] Terraform version: 0.13.0
2020/10/18 22:08:30 [INFO] Go runtime version: go1.14.2
2020/10/18 22:08:30 [INFO] CLI args: []string{"C:\\Windows\\system32\\terraform.exe", "plan"}
2020/10/18 22:08:30 [DEBUG] Attempting to open CLI config file: C:\Users\vpala\AppData\Roaming\terraform.rc
2020/10/18 22:08:30 [DEBUG] File doesn't exist, but doesn't need to. Ignoring.
2020/10/18 22:08:30 [DEBUG] ignoring non-existing provider search directory terraform.d/plugins
2020/10/18 22:08:30 [DEBUG] ignoring non-existing provider search directory C:\Users\vpala\AppData\Roaming\terraform.d\plugins
2020/10/18 22:08:30 [DEBUG] ignoring non-existing provider search directory
C:\Users\vpala\AppData\Roaming\HashiCorp\Terraform\plugins
2020/10/18 22:08:30 [INFO] CLI command args: []string{"plan"}
2020/10/18 22:08:30 [WARN] Log levels other than TRACE are currently unreliable, and are supported only for backward
compatibility.
  Use TF_LOG=TRACE to see Terraform's internal logs.
  ----
2020/10/18 22:08:30 [DEBUG] New state was assigned lineage "f413959c-538a-f9ce-524e-1615073518d4"
2020/10/18 22:08:30 [DEBUG] checking for provisioner in "."
2020/10/18 22:08:30 [DEBUG] checking for provisioner in "C:\\Windows\\system32"
2020/10/18 22:08:30 [INFO] Failed to read plugin lock file .terraform\plugins\windows_amd64\lock.json: open
.terraform\plugins\windows_amd64\lock.json: The system cannot find the path specified.
2020/10/18 22:08:30 [INFO] backend/local: starting Plan operation
2020-10-18T22:08:30.625-0400 [INFO]  plugin: configuring client automatic mTLS
2020-10-18T22:08:30.646-0400 [DEBUG] plugin: starting plugin:
path=.terraform/plugins/registry.terraform.io/hashicorp/aws/3.11.0/windows_amd64/terraform-provider-aws_v3.11.0_x5.exe
args=[.terraform/plugins/registry.terraform.io/hashicorp/aws/3.11.0/windows_amd64/terraform-provider-aws_v3.11.0_x5.exe]
2020-10-18T22:08:30.935-0400 [DEBUG] plugin: plugin started:
path=.terraform/plugins/registry.terraform.io/hashicorp/aws/3.11.0/windows_amd64/terraform-provider-aws_v3.11.0_x5.exe
pid=34016
2020-10-18T22:08:30.935-0400 [DEBUG] plugin: waiting for RPC address:
path=.terraform/plugins/registry.terraform.io/hashicorp/aws/3.11.0/windows_amd64/terraform-provider-aws_v3.11.0_x5.exe
2020-10-18T22:08:30.974-0400 [INFO]  plugin.terraform-provider-aws_v3.11.0_x5.exe: configuring server automatic mTLS:
```

```
$ export TF_LOG_PATH=/tmp/terraform.log


$ head -10 /tmp/terraform.logs
----
2020/10/18 22:08:30 [INFO] Terraform version: 0.13.0
2020/10/18 22:08:30 [INFO] Go runtime version: go1.14.2
2020/10/18 22:08:30 [INFO] CLI args: []string{"C:\\Windows\\system32\\terraform.exe",
"plan"}
2020/10/18 22:08:30 [DEBUG] Attempting to open CLI config file:
C:\Users\vpala\AppData\Roaming\terraform.rc
2020/10/18 22:08:30 [DEBUG] File doesn't exist, but doesn't need to. Ignoring.
2020/10/18 22:08:30 [DEBUG] ignoring non-existing provider search directory
terraform.d/plugins
2020/10/18 22:08:30 [DEBUG] ignoring non-existing provider search directory
C:\Users\vpala\AppData\Roaming\terraform.d\plugins
2020/10/18 22:08:30 [DEBUG] ignoring non-existing provider search directory
C:\Users\vpala\AppData\Roaming\HashiCorp\Terraform\plugins
2020/10/18 22:08:30 [INFO] CLI command args: []string{"plan"}


$ unset TF_LOG_PATH
```


KODEKLOUD

Terraform Import

HashiCorp Terraform


EC2


DynamoDB


Elastic Block Store


S3


Route 53


VPC

ANSIBLE


EC2


DynamoDB


Route 53

AWS Management Console


S3


Elastic Block Store


EC2

HashiCorp Terraform


EC2


DynamoDB


Elastic Block Store


EC2


DynamoDB

Route 53


S3

Route 53


VPC


S3


Elastic Block Store


EC2

Data Source

main.tf

```
.
.
data "aws_instance" "newserver" {
    instance_id = "i-026e13be10d5326f7"
}
output newserver {
  value       = data.aws_instance.newserver.public_ip
 }
```

>_

```
$ terraform apply

$ data.aws_instance.newserver: Refreshing state... [id=i-026e13be10d5326f7]
aws_key_pair.web: Refreshing state... [id=terraform-20201015013048509100000001]
aws_security_group.ssh-access: Refreshing state... [id=sg-0a543f25009e14628]
aws_instance.webserver: Refreshing state... [id=i-068fad300d9df27ac]

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

Outputs:

newserver = 15.223.1.176
```

Terraform Import

```
>_

# terraform import  <resource_type>.<resource_name> <attribute>
$ terraform import aws_instance.webserver-2 i-026e13be10d5326f7

Error: resource address "aws_instance.webserver-2" does not exist
in the configuration.

Before importing this resource, please create its configuration in
the root module. For example:

resource "aws_instance" "webserver-2" {
  # (resource arguments)
}
```

Terraform Import

main.tf

```
resource "aws_instance" "webserver-2" {
  # (resource arguments)
}
```

>_

```
$ terraform import aws_instance.webserver-2 i-026e13be10d5326f7

aws_instance.webserver-2: Importing from ID "i-026e13be10d5326f7"...
aws_instance.webserver-2: Import prepared!
  Prepared aws_instance for import
aws_instance.webserver-2: Refreshing state... [id=i-026e13be10d5326f7]

Import successful!

The resources that were imported are shown above. These resources are now in
your Terraform state and will henceforth be managed by Terraform.
```

Instance summary for i-0d7c0088069819ff8 (old-ec2) Info

Updated less than a minute ago

Connect | Actions

Instance ID i-0d7c0088069819ff8 (old-ec2)	Public IPv4 address 15.223.5.69 | open address	Private IPv4 addresses 172.31.23.147
Instance state Running	Public IPv4 DNS ec2-15-223-5-69.ca-central-1.compute.amazonaws.com | open address	Private IPv4 DNS ip-172-31-23-147.ca-central-1.compute.internal
Instance type t2.micro	Elastic IP addresses –	VPC ID vpc-7da8d215
IAM Role –	Subnet ID subnet-c6c0a8ae	

AWS Compute Optimizer

Opt-in to AWS Compute Optimizer for recommendations. Learn more

Details | Security | Networking | Storage | Monitoring | Tags

Instance details Info

Platform Ubuntu (Inferred)	AMI ID ami-0edab43b6fa892279	Monitoring disabled

terraform.tfstate


```
{
    "mode": "managed",
    "type": "aws_instance",
    "name": "webserver-2",
    "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
    "instances": [
      {
        "schema_version": 1,
        "attributes": {
          "ami": "ami-0edab43b6fa892279",
          "instance_state": "running",
          "instance_type": "t2.micro",
          "key_name": "ws",
           .
          "tags": {
            "Name": "old-ec2"
          },
           .
           .
          "vpc_security_group_ids": [
            "sg-8064fdee"
          ]
        },
           .
           .
      }
    ]
  },
```

main.tf

```
resource "aws_instance" "webserver-2" {
   ami                    = "ami-0edab43b6fa892279"
   instance_type          = "t2.micro"
   key_name               = "ws"
   vpc_security_group_ids = ["sg-8064fdee"]

}
```

>_

```
$ terraform plan

Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.

aws_instance.webserver-2: Refreshing state... [id=i-0d7c0088069819ff8]

------------------------------------------------------------------------

No changes. Infrastructure is up-to-date.

This means that Terraform did not detect any differences between your
configuration and real physical resources that exist. As a result, no
actions need to be performed.
```


KODEKLOUD

Terraform Modules

main.tf

```
resource  "aws_instance" "weberver" {
  # configuration here
}
resource "aws_key_pair" "key" {
  # configuration here
}
resource "aws_security_group" "ssh-access" {
  # configuration here
}
resource  "aws_s3_bucket" "data-bucket" {
  # configuration here
}
resource  "aws_dynamodb_table" "user-data" {
  # configuration here
}
resource "aws_instance" "web-server-2" {
  # configuration here
}
```

aws_instance

aws_key_pair

aws_iam_policy

aws_s3_bucket

aws_dynamodb_table

aws_instance

main.tf

```
resource  "aws_instance" "webserver" {
  # configuration here
}
```

key_pair.tf

```
resource "aws_key_pair" "web" {
  # configuration here
}
```

dynamodb_table.tf

```
resource  "aws_dynamodb_table" "state-locking" {
  # configuration here
}
```

security_group.tf

```
resource "aws_security_group" "ssh-access"
  # configuration here
}
```

ec2_instance.tf

```
resource "aws_instance" "webserver-2" {
  # configuration here
}
```

s3_bucket.tf

```
resource  "aws_s3_bucket" "terraform-state
  # configuration here
}
```

```
>_

$ ls
provider.tf
id_rsa
id_rsa.pub
main.tf
pub_ip.txt
terraform.tfstate.backup
terraform.tfstate
iam_roles.tf
iam_users.tf
security_groups.tf
variables.tf
outputs.tf
s3_buckets.tf
dynamo_db.tf
local.tf
```

- Complex Configuration Files
- Duplicate Code
- Increased Risk
- Limits Reusability

Root Module

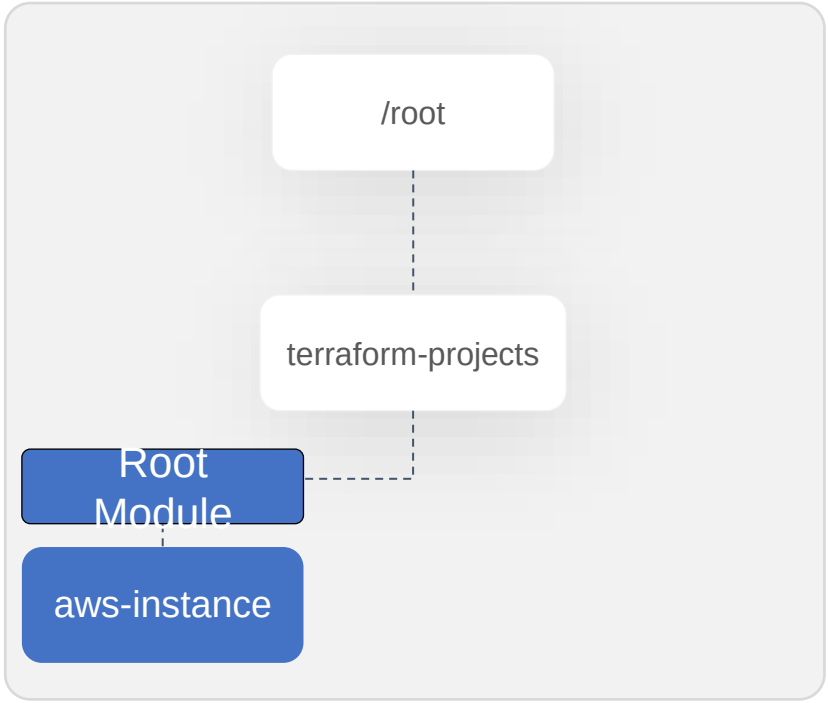
```
>_
$ ls /root/terraform-projects/aws-instance
main.tf      variables.tf
```

main.tf

```
resource "aws_instance" "webserver" {
    ami = var.ami
    instance_type = var.instance_type
    key_name = var.key
}
```

variables.tf

```
variable ami {
  type        = string
  default     = "ami-0edab43b6fa892279"
  description = "Ubuntu AMI ID in the ca-
central-1 region"
}
```

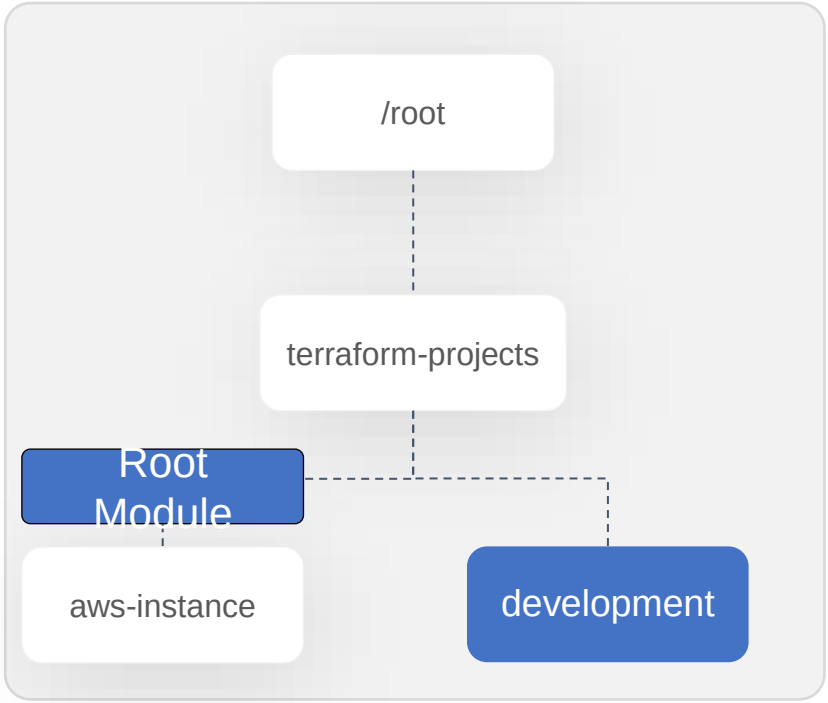


Root Module

```
>_

$ mkdir /root/terraform-projects/development

main.tf
```

main.tf

```
module "dev-webserver" {
  source = "../aws-instance"
}
```

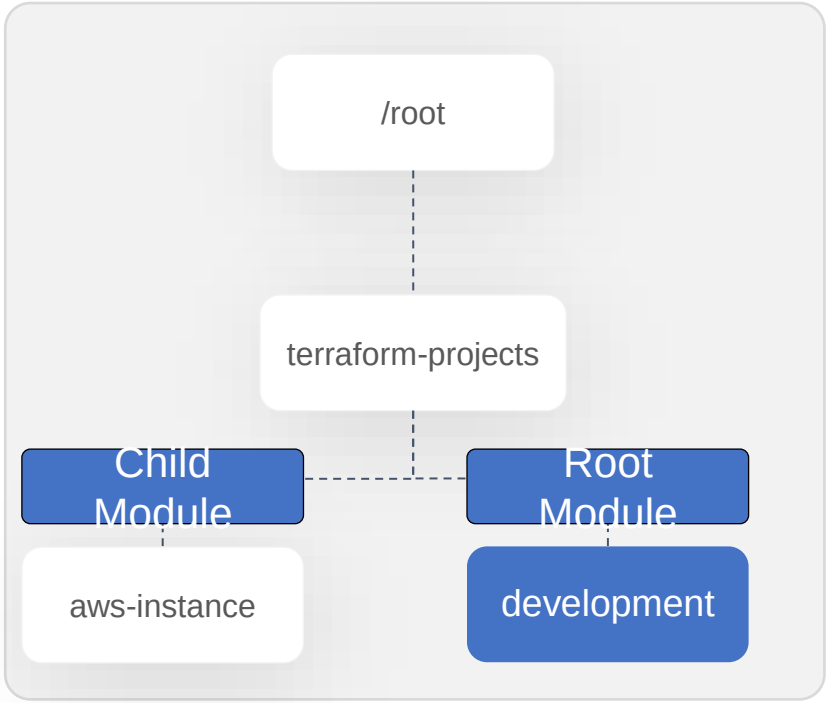


Root Module

```
>_

$ mkdir /root/terraform-projects/development

main.tf
```

main.tf

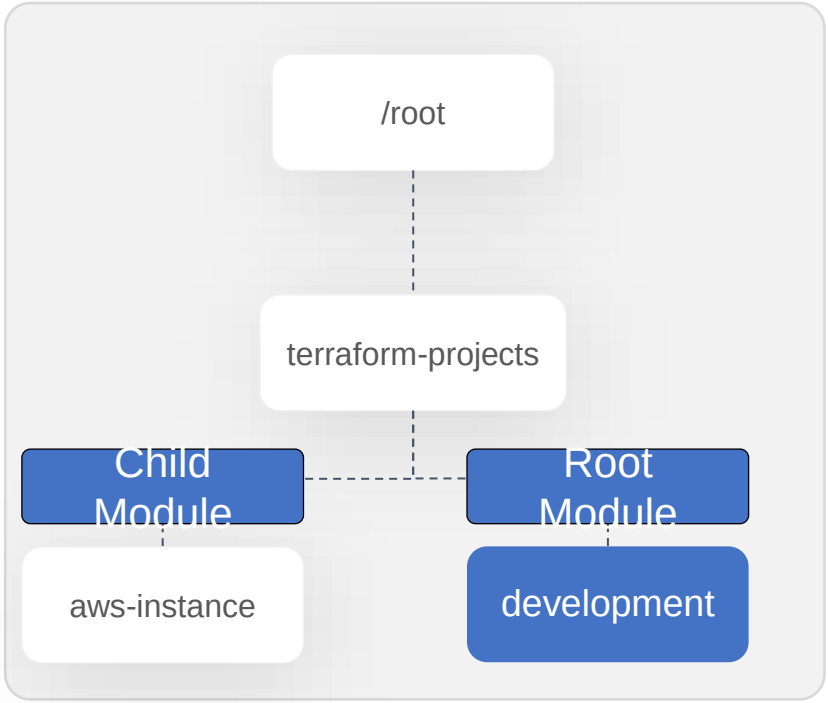
```
module "dev-webserver" {
  source = "../aws-instance"
}
```



```
>_

$ mkdir /root/terraform-projects/development

main.tf
```

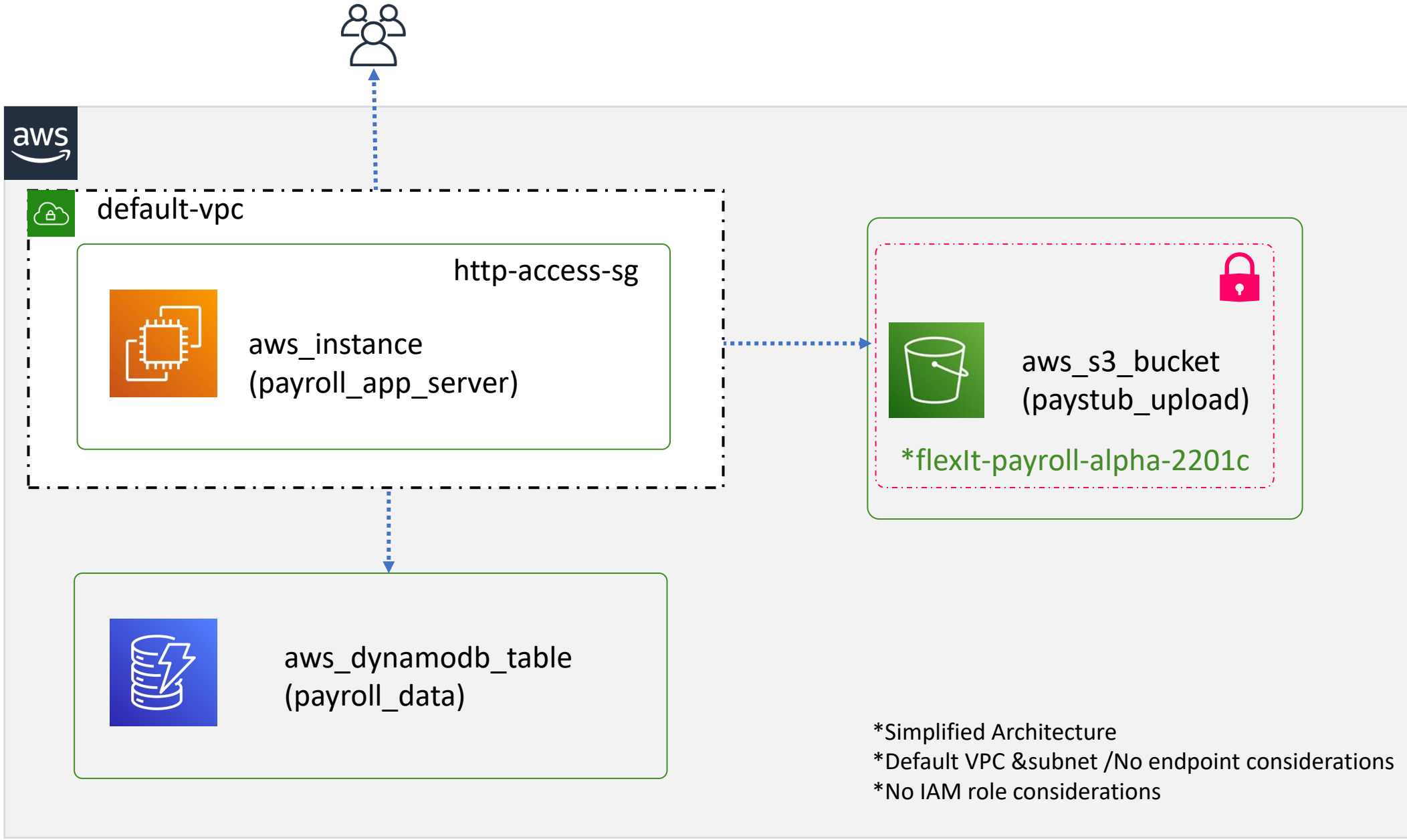
main.tf

```
module "dev-webserver" {
  source = "../aws-instance"
}
```

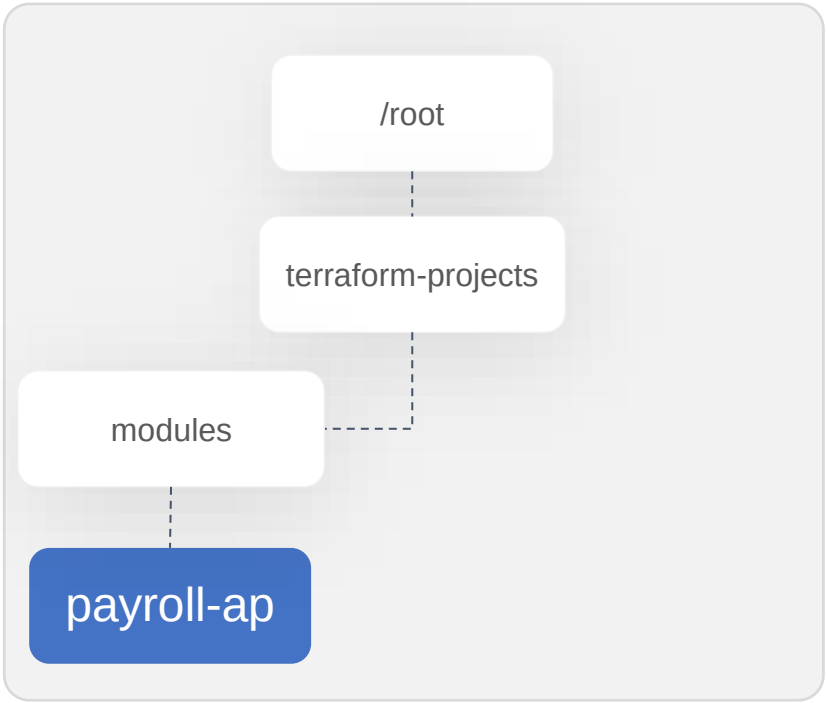



KODEKLOUD

Creating and Using a Module


aws
default-vpc
http-access-sg
aws_instance
(payroll_app_server)
aws_s3_bucket
(paystub_upload)
*flexIt-payroll-alpha-2201c
aws_dynamodb_table
(payroll_data)
*Simplified Architecture
*Default VPC &subnet /No endpoint considerations
*No IAM role considerations

```
>_

$ mkdir /root/terraform-projects/modules/payroll-app

app_server.tf dynamodb_table.tf s3_bucket.tf variables.tf
```



app_server.tf

```
resource "aws_instance" "app_server" {
  ami           = var.ami
  instance_type =  "t2.medium"
   tags = {
     Name = "${var.app_region}-app-server"
   }
  depends_on = [ aws_dynamodb_table.payroll_db,
                 aws_s3_bucket.payroll_data
               ]
}
```

dynamodb_table.tf

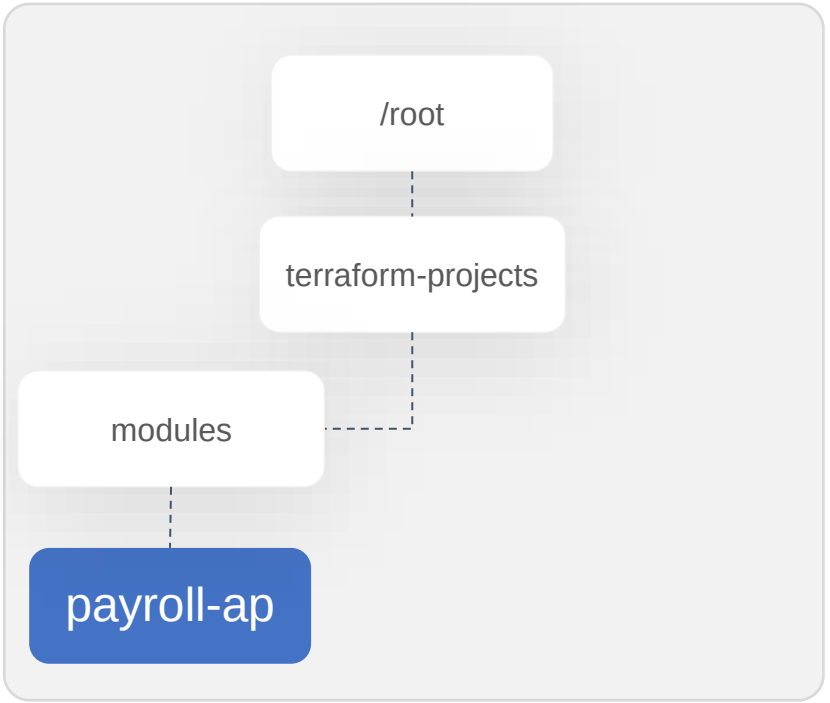
```
resource "aws_dynamodb_table" "payroll_db" {
  name           = "user_data"
  billing_mode   = "PAY_PER_REQUEST"
  hash_key       = "EmployeeID"

  attribute {
    name = "EmployeeID"
    type = "N"
  }
}
```

s3_bucket.tf

```
resource  "aws_s3_bucket"  "payroll_data" {
  bucket = "${var.app_region}-${var.bucket}"
}
```

variables.tf

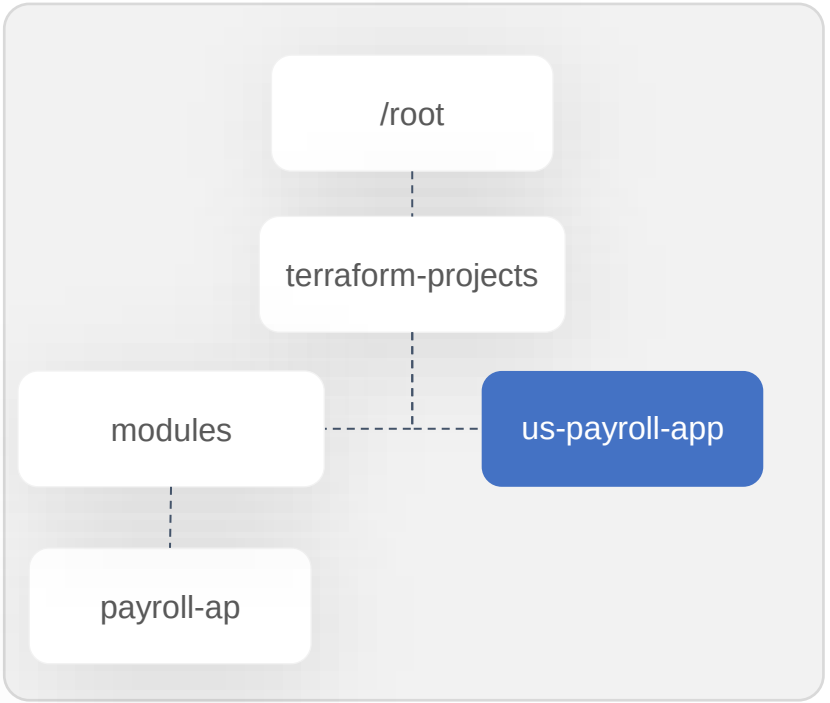
```
variable  "app_region" {
    type = string
}
variable "bucket" {
    default = "flexit-payroll-alpha-22001c"
}
variable "ami" {
    type = string
}
```



```
>_

$ mkdir /root/terraform-projects/us-payroll-app

main.tf provider.tf
```

main.tf

```
module  "us_payroll" {
  source = "../modules/payroll-app"
  app_region = "us-east-1"
  ami        = "ami-24e140119877avm"
}
```



```
$ terraform init

Initializing modules...
- us_payroll in .terraform/modules/us_payroll

Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v3.11.0...
- Installed hashicorp/aws v3.11.0 (signed by HashiCorp)

The following providers do not have any version constraints in
configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain
breaking
changes, we recommend adding version constraints in a required_providers
block
in your configuration, with the constraint strings suggested below.

* hashicorp/aws: version = "~> 3.11.0"

Terraform has been successfully initialized!
```

```
$ terraform apply

.
.

Terraform will perform the following actions:

  # module.us_payroll.aws_dynamodb_table.payroll_db will be created
  + resource "aws_dynamodb_table" "payroll_db" {
      + arn              = (known after apply)
      + billing_mode     = "PAY_PER_REQUEST"
      + hash_key         = "EmployeeID"
      + name             = "user_data"
.
.
# module.us_payroll.aws_instance.app_server will be created
  + resource "aws_instance" "app_server" {
      + ami                          = "ami-24e140119877avm"
      + instance_type                = "t2.medium“
.
.
+ resource "aws_s3_bucket" "payroll_data" {
      + acceleration_status         = (known after apply)
      + acl                         = "private"
      + arn                         = (known after apply)
      + bucket                      = "us-east-1-flexit-payroll-alpha-22001c"
Enter a value: yes

module.us_payroll.aws_dynamodb_table.payroll_db: Creating...
module.us_payroll.aws_s3_bucket.payroll_data: Creating...
```

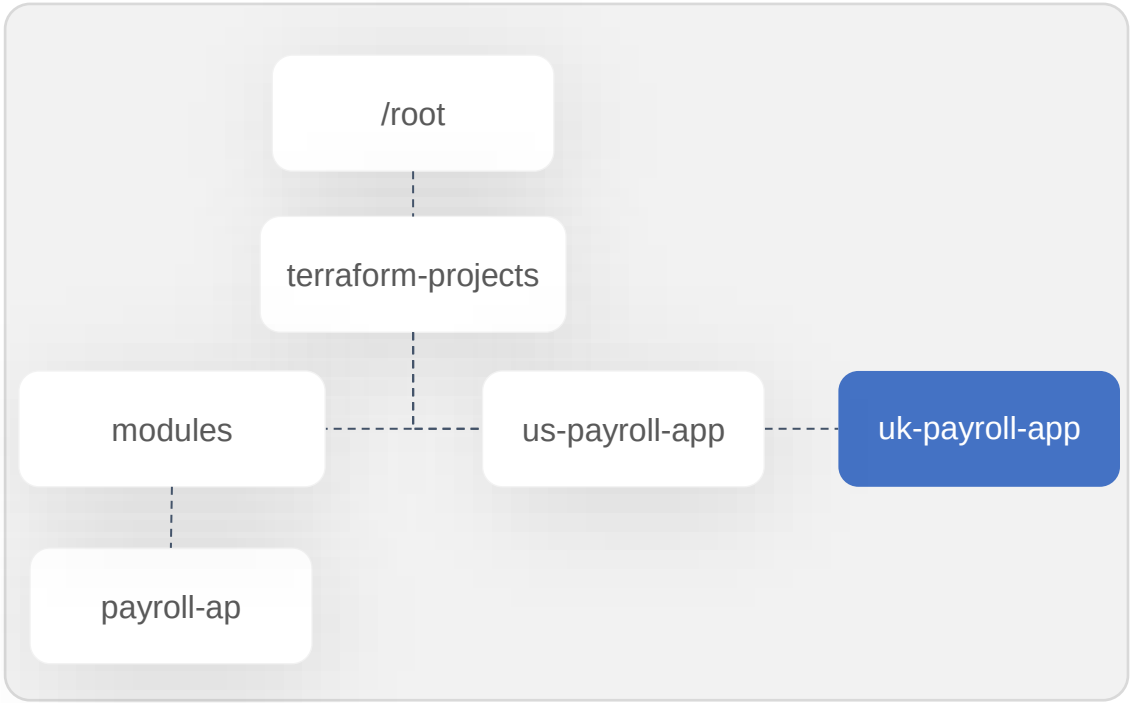
```
>_

$ mkdir /root/terraform-projects/uk-payroll-app

main.tf provider.tf
```

main.tf

```
module  "uk_payroll" {
  source = "../modules/payroll-app"
  app_region = "eu-west-2"
  ami        = "ami-35e140119877avm"
}
```

provider.tf

```
provider "aws" {
  region    = "eu-west-2"
}
```

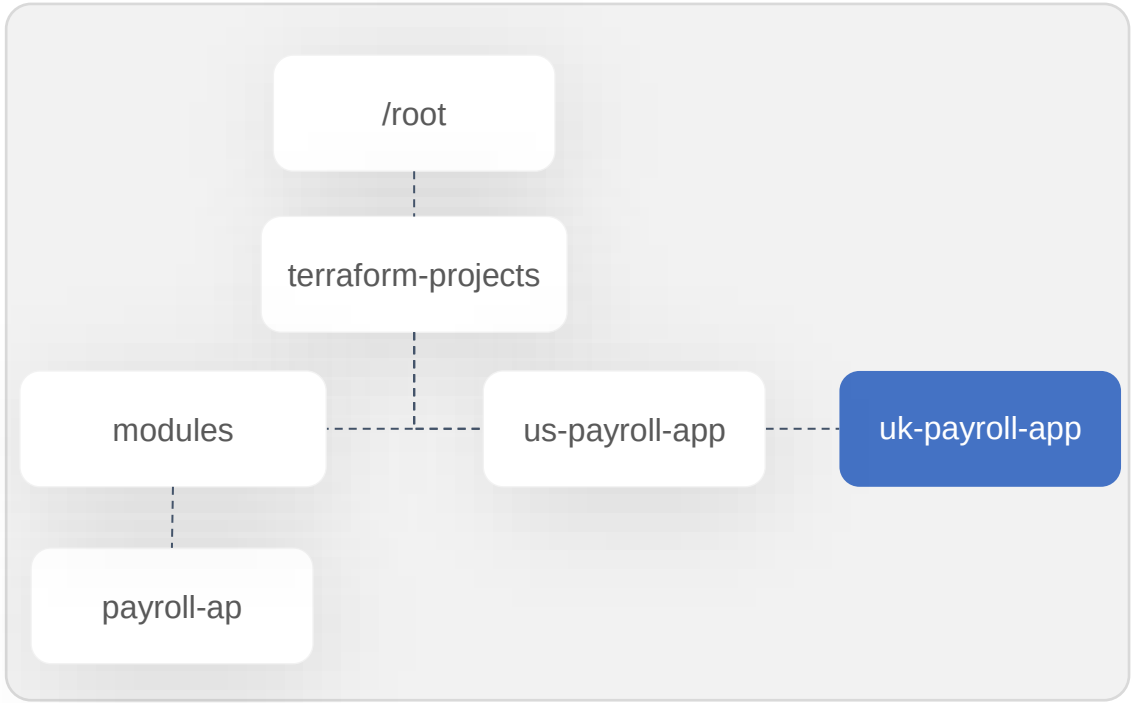


```
>_
$ terraform apply
.
.

Terraform will perform the following actions:

  # module.us_payroll.aws_dynamodb_table.payroll_db will be created
  + resource "aws_dynamodb_table" "payroll_db" {
      + arn              = (known after apply)
      + billing_mode     = "PAY_PER_REQUEST"
      + hash_key         = "EmployeeID"
      + name             = "user_data"
.
.
# module.us_payroll.aws_instance.app_server will be created
  + resource "aws_instance" "app_server" {
      + ami                          = "ami-35e140119877avm"
      + instance_type                = "t2.medium"
.
.
+ resource "aws_s3_bucket" "payroll_data" {
      + acceleration_status         = (known after apply)
      + acl                         = "private"
      + arn                         = (known after apply)
      + bucket                      = "eu-west-2-flexit-payroll-alpha-22001c"
Enter a value: yes

module.us_payroll.aws_dynamodb_table.payroll_db: Creating...
module.us_payroll.aws_s3_bucket.payroll_data: Creating...
module.us_payroll.aws_dynamodb_table.payroll_db: Creation complete after 1s [id=user_data]
```

```
.
.

Terraform will perform the following actions:

  # module.us_payroll.aws_dynamodb_table.payroll_db will be c
  + resource "aws_dynamodb_table" "payroll_db" {
      + arn              = (known after apply)
      + billing_mode     = "PAY_PER_REQUEST"
      + hash_key         = "EmployeeID"
      + name             = "user_data"
.
.
# module.us_payroll.aws_instance.app_server will be created
  + resource "aws_instance" "app_server" {
      + ami                          = "ami-35e140119877avm"
```

main.tf

```
module  "us_payroll" {
  source = "../modules/payroll-app"
  app_region = "eu-west-2“
  ami        = "ami-35e140119877avm"
}
```



Simpler Configuration Files

Lower Risk

Re-Usability

Standardized Configuration

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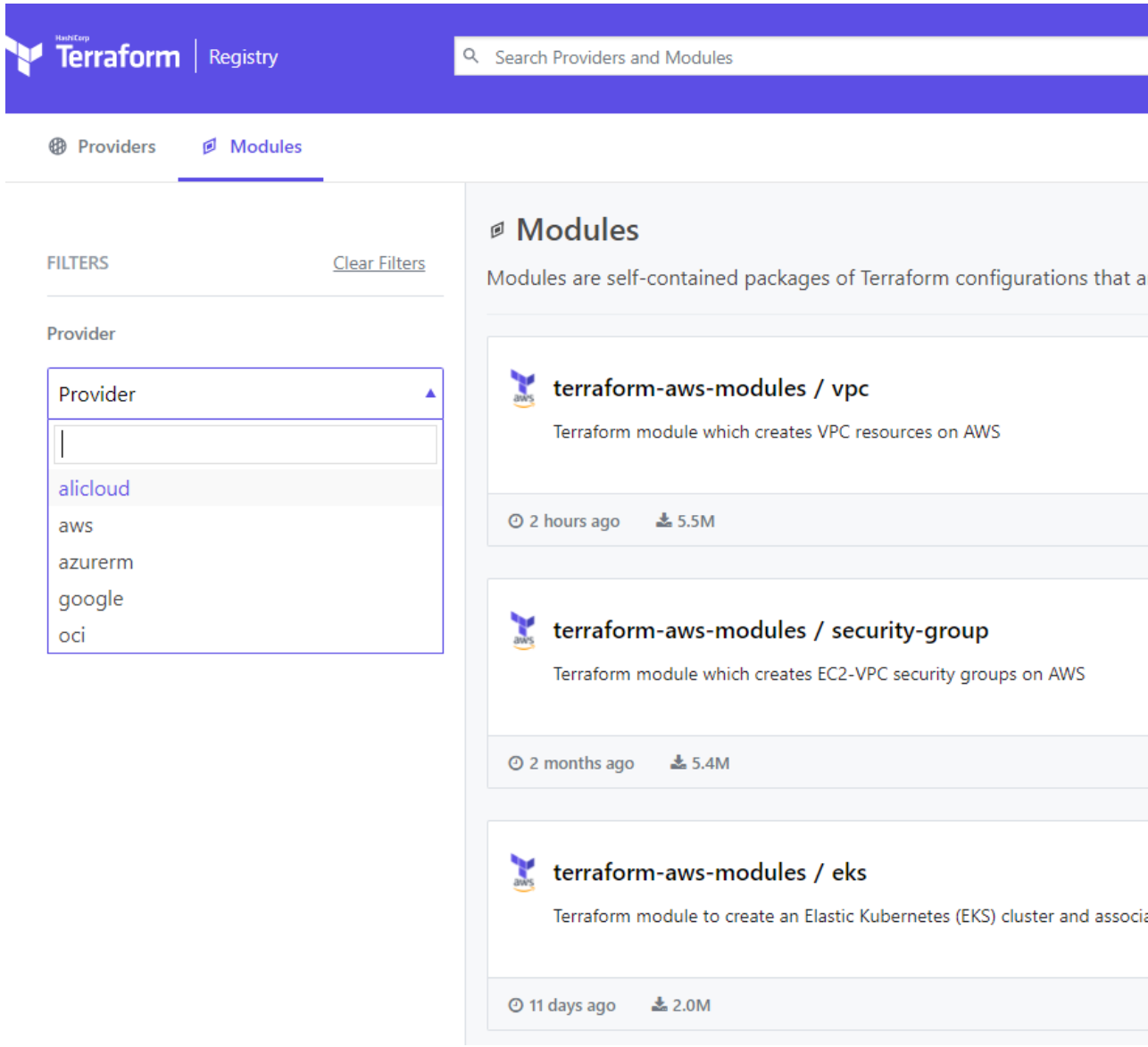
Using Modules from Registry

Local Module

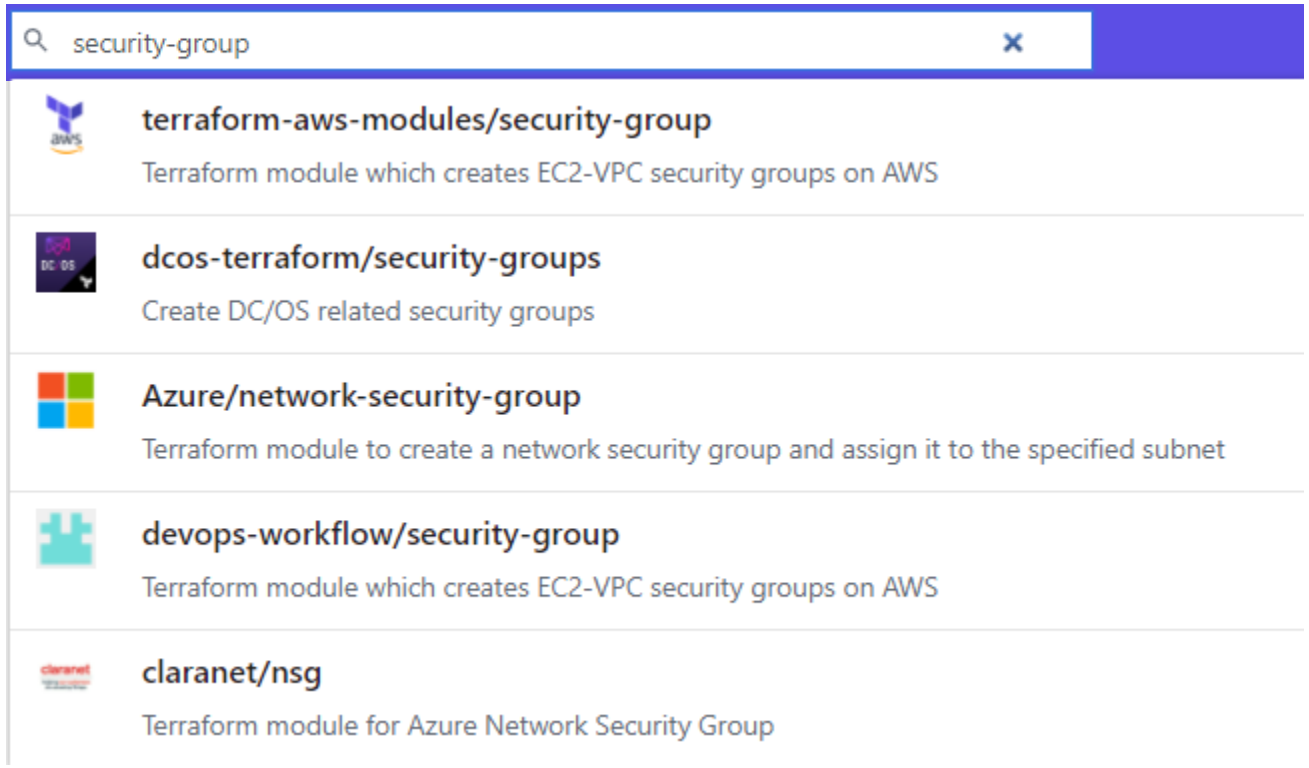
main.tf

```
module "dev-webserver" {

  source = "../aws-instance/"

  key    =  "webserver"
}
```



https://registry.terraform.io/browse/modules

Terraform Registry



Terraform Module

Terraform Module

security-group

AWS

Terraform module which creates EC2-VPC security groups on AWS

Version 3.16.0 (latest)

Published August 20, 2020 by terraform-aws-modules

Module managed by antonbabenko

Total provisions: 5.4M

Source Code: github.com/terraform-aws-modules/terraform-aws-security-group (report an issue)

Submodules | Examples

- activemq
- alertmanager
- carbon-relay-ng
- cassandra
- consul
- docker-swarm
- elasticsearch
- grafana
- graphite-statsd
- http-80
- http-8080
- https-443

Provision Instructions

Copy and paste into your Terraform configuration, insert the variables, and run `terraform init` :

```
module "security-group" {
  source  = "terraform-aws-modules/security-group/
  version = "3.16.0"
  # insert the 2 required variables here
}
```

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main.tf

```
module "security-group_ssh" {
  source  = "terraform-aws-modules/security-group/aws/modules/ssh"
  version = "3.16.0"
  # insert the 2 required variables here
  vpc_id = "vpc-7d8d215"
  ingress_cidr_blocks = [ "10.10.0.0/16"]
  name = "ssh-access"

}
```

Provision Instructions

Copy and paste into your Terraform configuration, insert the variables, and run `terraform init` :

```
module "security-group" {
  source  = "terraform-aws-modules/security-group/
  version = "3.16.0"
  # insert the 2 required variables here
}
```

>_

```
$ terraform get

Downloading terraform-aws-modules/security-group/aws 3.16.0 for security-group_ssh...
- security-group_ssh in .terraform\modules\security-group_ssh\modules\ssh
```

https://registry.terraform.io/modules/terraform-aws-modules/security-group/aws/latest/submodules/ssh


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Terraform Functions

Functions

main.tf

```
resource "aws_iam_policy" "adminUser" {
  name   = "AdminUsers"
  policy = file("admin-policy.json")
}

resource "local_file" "pet" {
    filename = var.filename
    count = length(var.filename)
}
```

main.tf

```
resource "local_file" "pet" {
    filename = var.filename
    for_each = toset(var.region)
}

variable region {
  type        = list
  default     = ["us-east-1",
                 "us-east-1",
                 "ca-central-1"]
  description = "A list of AWS Regions"
}
```

>_

```
$ terraform console
>file("/root/terraform-projects/main.tf)
 resource "aws_instance" "development" {
   ami           = "ami-0edab43b6fa892279"
   instance_type = "t2.micro"
 }
> length(var.region)
3
> toset(var.region)
[
  "ca-central-1",
  "us-east-1",

]
>
```

Functions

Numeric Functions

String Functions

Collection Functions

Type Conversion Functions

Numeric Functions

variables.tf

```
variable "num" {
    type = set(number)
    default = [ 250, 10, 11, 5]
    description = "A set of numbers"
}
```

>_

```
$ terraform console

> max (-1, 2, -10, 200, -250)
200

> min (-1, 2, -10, 200, -250)
-250

> max(var.num...)
250

> ceil(10.1)
11

> ceil(10.9)
11

> floor(10.1)
10

> floor(10.9)
10
```

String Functions

variables.tf

```
variable "ami" {
  type = string
  default = "ami-xyz,AMI-ABC,ami-efg"
  description = "A string containing ami ids"
}
```

>_

```
$ terraform console
> split(",", "ami-xyz,AMI-ABC,ami-efg")
[ "ami-xyz","AMI-ABC","ami-efg" ]

> split(",", var.ami)
[ "ami-xyz","AMI-ABC","ami-efg“ ]

> lower(var.ami)
ami-xyz,ami-abc,ami-efg

> upper(var.ami)
AMI-XYZ,AMI-ABC,AMI-EFG

> title(var.ami)
Ami-Xyz,AMI-ABC,Ami-Efg

> substr(var.ami, 0, 7)
ami-xyz

> substr(var.ami, 8, 7)
AMI-ABC

> substr(var.ami, 16, 7)
ami-efg
```

String Functions

variables.tf

```
variable "ami" {
  type = list
  default = ["ami-xyz", "AMI-ABC", "ami-efg"]
    description = "A list of numbers"
}
```

>_

```
$ terraform console
> join(",", ["ami-xyz", "AMI-ABC", "ami-efg"])
ami-xyz,AMI-ABC,ami-efg

> join(",", var.ami)
ami-xyz,AMI-ABC,ami-efg
```

Collection Functions

variables.tf

```
variable "ami" {
  type = list
  default = ["ami-xyz", "AMI-ABC", "ami-efg"]
    description = "A list of numbers"
}
```

>_

```
$ terraform console
> length(var.ami)
3

> index(var.ami, "AMI-ABC")
1

> element(var.ami,2)
ami-efg

> contains(var.ami, "AMI-ABC")
true

> contains(var.ami, "AMI-XYZ")
false
```

Map Functions

variables.tf

```
variable "ami" {
  type = map
  default = { "us-east-1" = "ami-xyz",
              "ca-central-1" = "ami-efg",
              "ap-south-1" = "ami-ABC"
  }
  description = "A map of AMI ID's for specific regions"
}
```

>_

```
$ terraform console
> keys(var.ami)
[
  "ap-south-1",
  "ca-central-1",
  "us-east-1",
]

> values(var.ami)
[
  "ami-ABC",
  "ami-efg",
  "ami-xyz",
]

> lookup(var.ami, "ca-central-1")
ami-efg
```

Map Functions

variables.tf

```
variable "ami" {
  type = map
  default = { "us-east-1" = "ami-xyz",
              "ca-central-1" = "ami-efg",
              "ap-south-1" = "ami-ABC"
  }
  description = "A map of AMI ID's for specific regions"
}
```

>_

```
$ terraform console

> lookup(var.ami, "us-west-2")
Error: Error in function call

  on <console-input> line 1:
  (source code not available)
    |----------------
    | var.ami is map of string with 3 elements

Call to function "lookup" failed: lookup failed
to find 'us-west-2'.

> lookup (var.ami, "us-west-2", "ami-pqr")
ami-pqr
```


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Operators & Conditional Expressions

Numeric Operators

```
>_

$ terraform console
> 1 + 2
3

> 5 - 3
2

> 2 * 2
4

> 8 / 2
4
```

Equality Operators

```
>_

$ terraform console

> 8 == 8
true

8 == 7
false

> 8 != "8"
true
```

Comparison Operators

```
>_

 $ terraform console

> 5 > 7
false

> 5 > 4
true

> 5 > 5
False

> 5 >= 5
true

> 4 < 5
true

> 3 <= 4
true
```

Logical Operators

```
>_

$ terraform console

> 8 > 7 && 8 < 10
true

> 8 > 10 && 8 < 10
false

> 8 > 9 || 8 < 10
True

> var.special
true

> ! var.special
false


> ! (var.b > 30)
true
```

variables.tf

```
variable special {
  type        = bool
  default     = true
  description = "Set to true to
      use special characters"
}

variable b {
    type = number
    default = 25
}
```

Logical Operators

```
>_
$ terraform console

> var.a > var.b
true

> var.a < var.b
false

> var.a + var.b
75
```

variables.tf

```
variable a {
    type = number
    default = 50
}
variable b {
    type = number
    default = 25
}
```

main.tf

```
resource "random_password" "password-generator" {
    length  = var.length
}

output password {
  value  = random_password.password-generator.result
}
```

variables.tf

```
variable length {
  type        = number
  description = "The length of the password"
}
```

>_

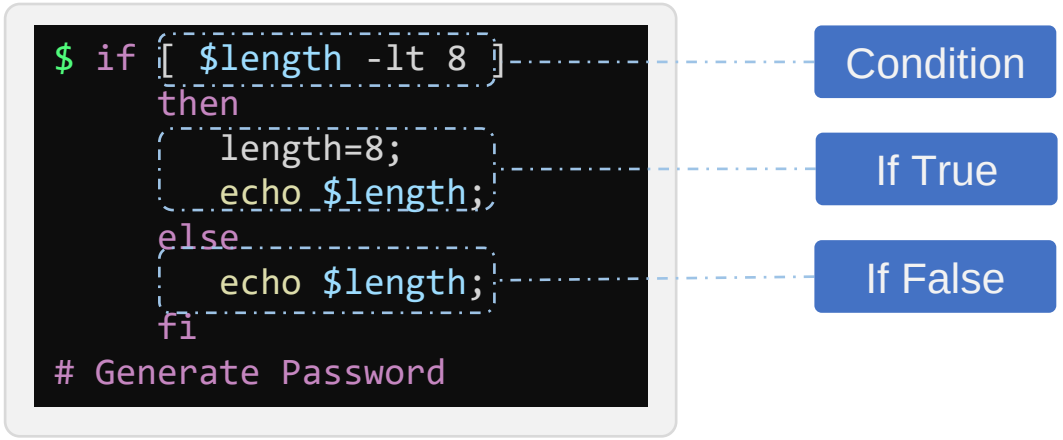
```
$ terraform apply -var=length=5 -auto-approve

random_password.password-generator: Creating...
random_password.password-generator: Creation
complete after 0s [id=none]

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

Outputs:

password = sjsrW]
```



condition | If True | If False

main.tf

```
resource "random_password" "password-generator" {
    length  = var.length < 8 ? 8 : var.length
}

output password {
  value  = random_password.password-generator.result
}
```

```
condition ? true_val : false_val
```

variables.tf

```
variable length {
  type        = number
  description = "The length of the password"
}
```

```
$ if [ $length -lt 8 ]
    then
      length=8;
      echo $length;
    else
      echo $length;
    fi
# Generate Password
```

Condition

If True

If False

```
$ terraform apply -var=length=5
Terraform will perform the following actions:

  # random_password.password-generator will be created
  + resource "random_password" "password-generator" {
      + id          = (known after apply)
      + length      = 8
.
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.

Outputs:
password = &(1Beiaq

$ terraform apply -var=length=12
Terraform will perform the following actions:

 # random_password.password-generator must be replaced
-/+ resource "random_password" "password-generator" {
      ~ id          = "none" -> (known after apply)
      ~ length      = 8 -> 12 # forces replacement.
.
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.

Outputs:

password = 8B@o}{cUzrZ7
```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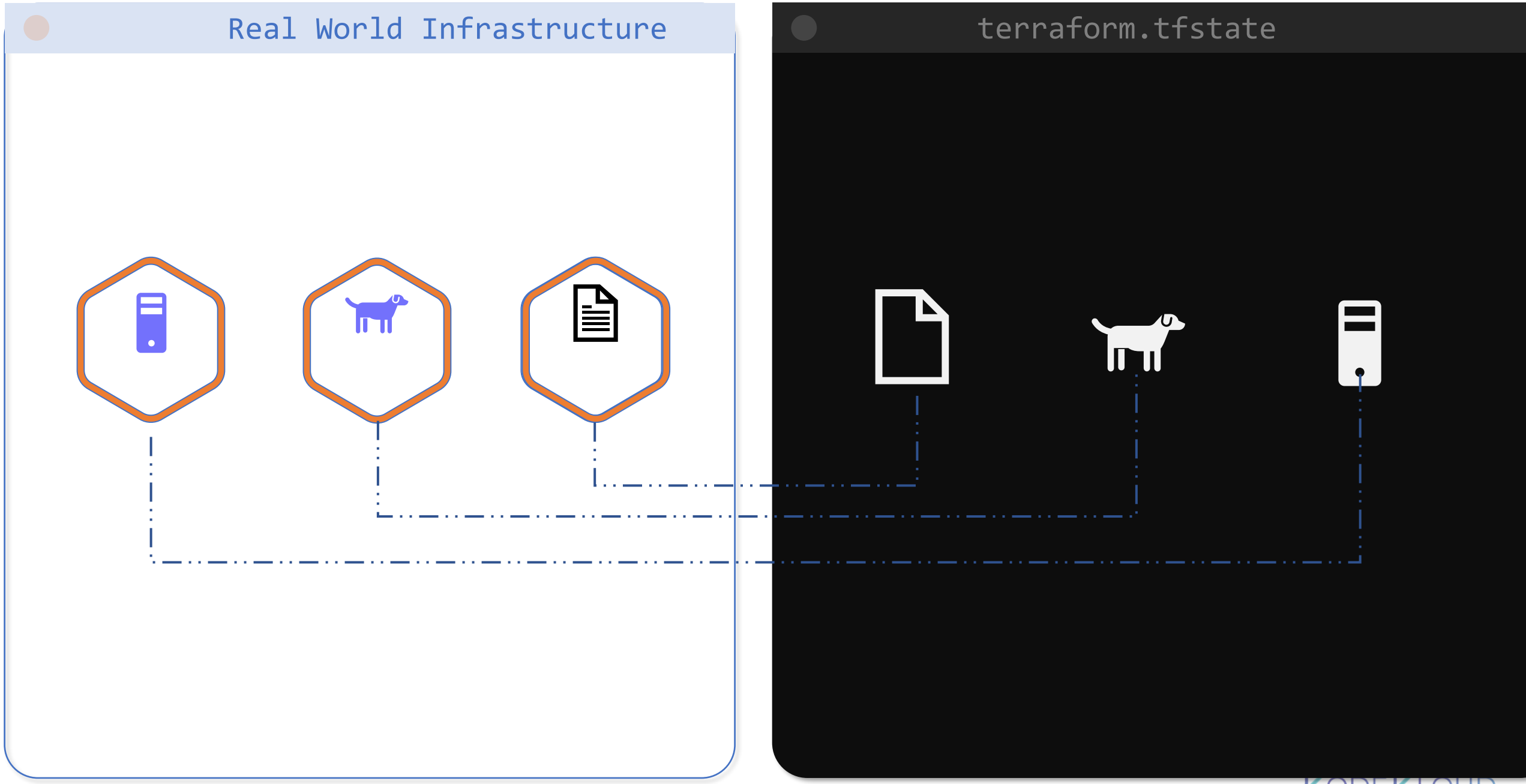
Terraform Workspaces


Real World Infrastructure
terraform.tfstate

/root/terraform-projects/projectA

/root/terraform-projects/projectB

main.tf

```
resource "aws_instance" "projectA" {
  ami = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name = "ProjectA"
  }
}
```

main.tf

```
resource "aws_instance" "projectB" {
  ami = "ami-0c2f25c1f66a1ff4d"
  instance_type = "t2.micro"
  tags = {
    Name = "ProjectB"
  }
}
```

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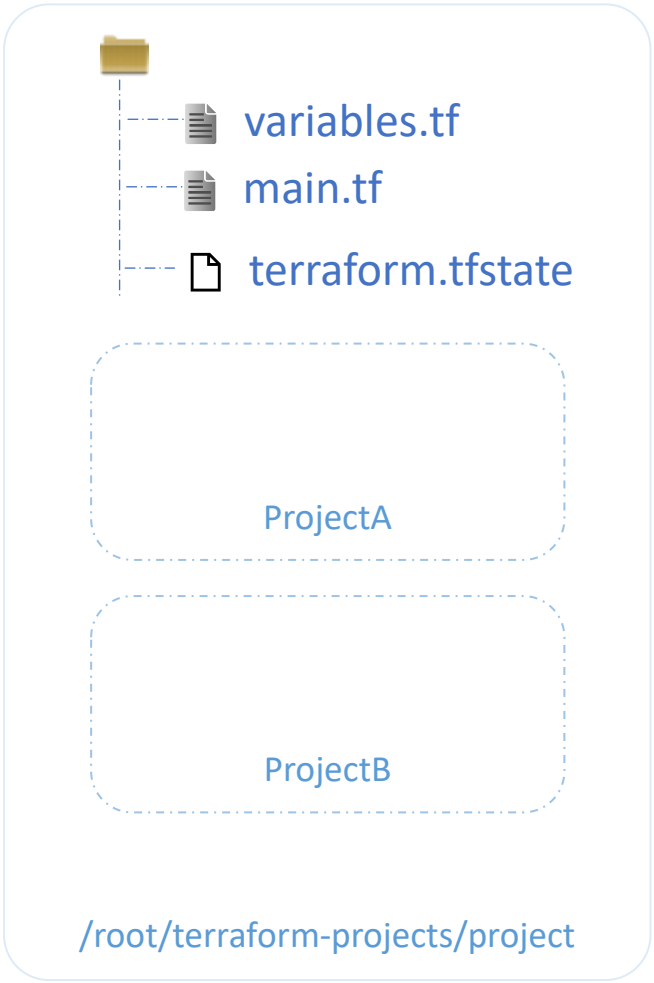
Workspace



main.tf

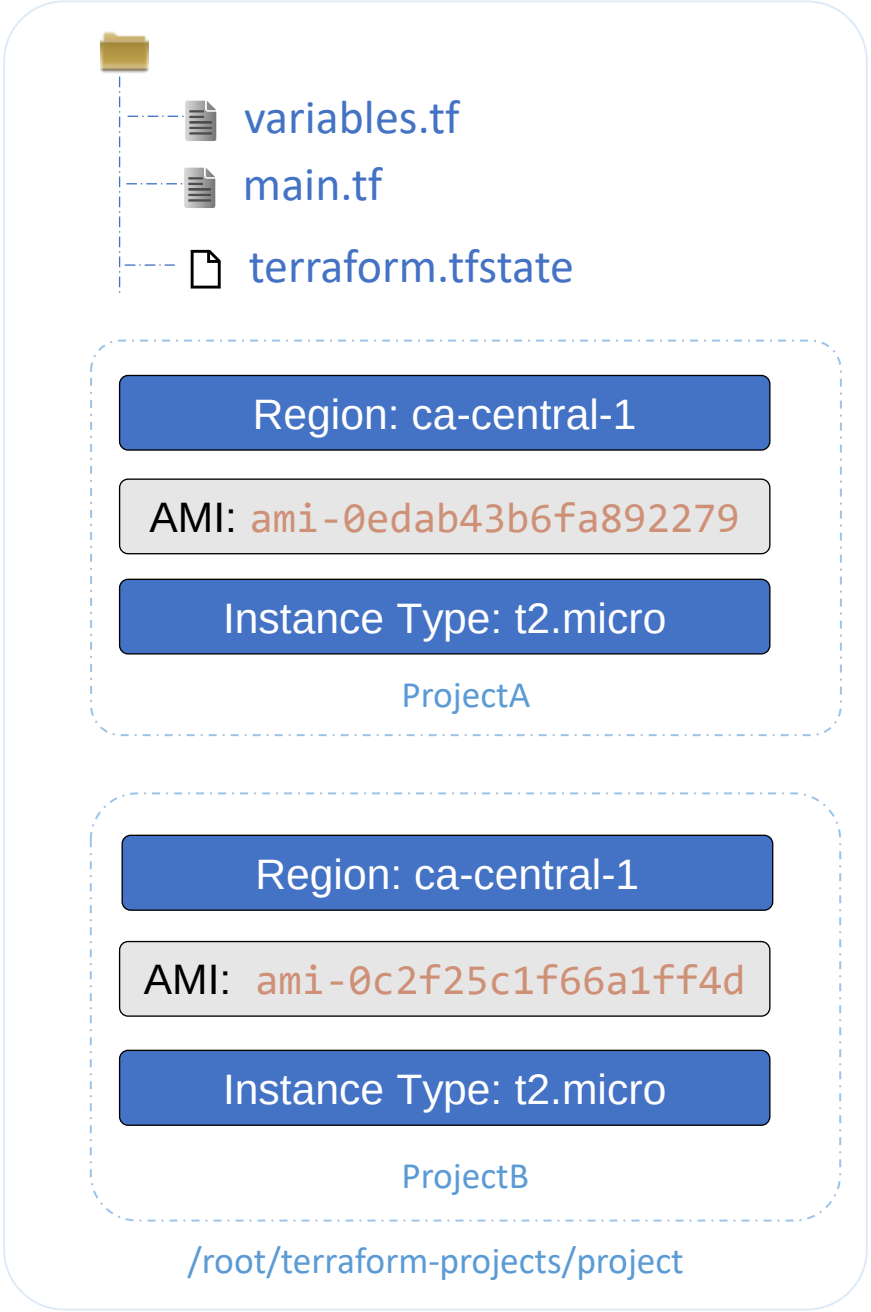
```
resource "aws_instance" "projectA" {
  ami = "ami-0edab43b6fa892279"
  instance_type = "t2.micro"
  tags = {
    Name = "ProjectA"
  }
}
```

Workspace

```
$ terraform workspace new ProjectA
Created and switched to workspace "ProjectA"!

You're now on a new, empty workspace. Workspaces isolate their state,
so if you run "terraform plan" Terraform will not see any existing state
for this configuration.


$ terraform workspace list
  default
* ProjectA
```



variables.tf

```
variable region {
  default = "ca-central-1"
}
variable instance_type {
  default = "t2.micro"
}
variable ami {
  type        = map
  default     = {
    "ProjectA" = "ami-0edab43b6fa892279",
    "ProjectB" = "ami-0c2f25c1f66a1ff4d"
  }
}
```

main.tf

```
resource "aws_instance" "projectA" {
  ami = "                    "
  instance_type = "        "
  tags = {
    Name = "           "
  }
}
```

variables.tf

```
variable region {
  default = "ca-central-1"
}
variable instance_type {
  default = "t2.micro"
}
variable ami {
  type        = map
  default     = {
    "ProjectA" = "ami-0edab43b6fa892279",
    "ProjectB" = "ami-0c2f25c1f66a1ff4d"
  }
}
```

main.tf

```
resource "aws_instance" "projectA" {
  ami = lookup(var.ami, terraform.workspace)
  instance_type =  var.instance_type
  tags = {
    Name = terraform.workspace
  }
}
```

```
$ terraform plan
Terraform will perform the following actions:

  # aws_instance.project will be created
  + resource "aws_instance" "project" {
      + ami                          = "ami-0edab43b6fa892279"
      + instance_type                = "t2.micro"
      + tags                         = {
          + "Name" = "ProjectA"
        }
  .
  .

$ terraform workspace new ProjectB
Created and switched to workspace "ProjectB"!

You're now on a new, empty workspace. Workspaces isolate their state,
so if you run "terraform plan" Terraform will not see any existing state
for this configuration.
```

```
$ terraform plan
Terraform will perform the following actions:

  # aws_instance.project will be created
  + resource "aws_instance" "project" {
      + ami                          = "ami-0c2f25c1f66a1ff4d"
      + instance_type                = "t2.micro"
      + tags                         = {
          + "Name" = "ProjectB"
        }
  .
  .
  .



$ terraform workspace select ProjectA
Switched to workspace "ProjectA".
```

```
$ ls
main.tf  provider.tf  terraform.tfstate.d  variables.tf



$ tree terraform.tfstate.d/
terraform.tfstate.d/
|-- ProjectA
|   `-- terraform.tfstate
`-- ProjectB
    `-- terraform.tfstate

2 directories, 2 files
```