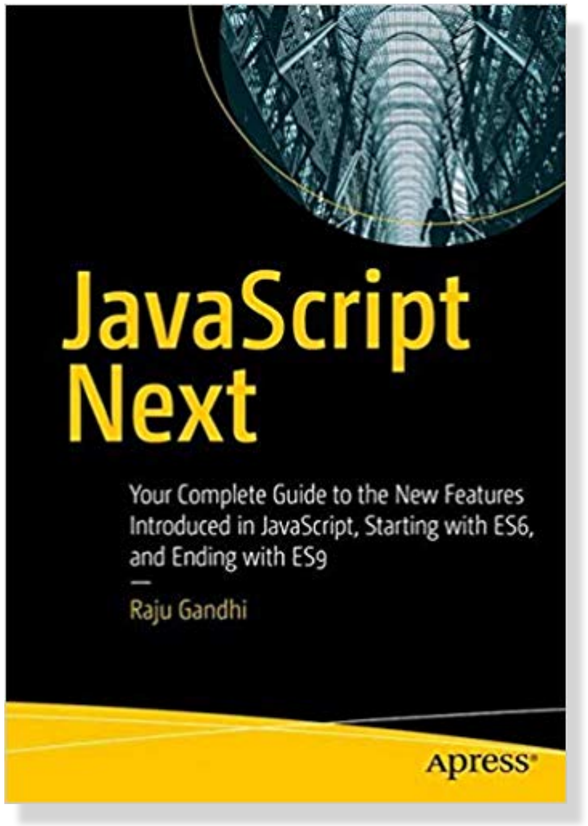
Terraform-ing your cloud

Raju Gandhi

@looselytyped


JavaScript
Next
Your Complete Guide to the New Features
Introduced in JavaScript, Starting with ES6,
and Ending with ES9
Raju Gandhi
Apress

DevOps

IT'S *about*

better collaboration
automating everything
measurements
extending sdlc

(POLL - Single Choice)

Embracing DevOps

- We do it all — Ci/Cd pipelines, Everything-as-Code, Centralized log/event/monitoring etc
- We have a few pieces in the works
- Just getting started

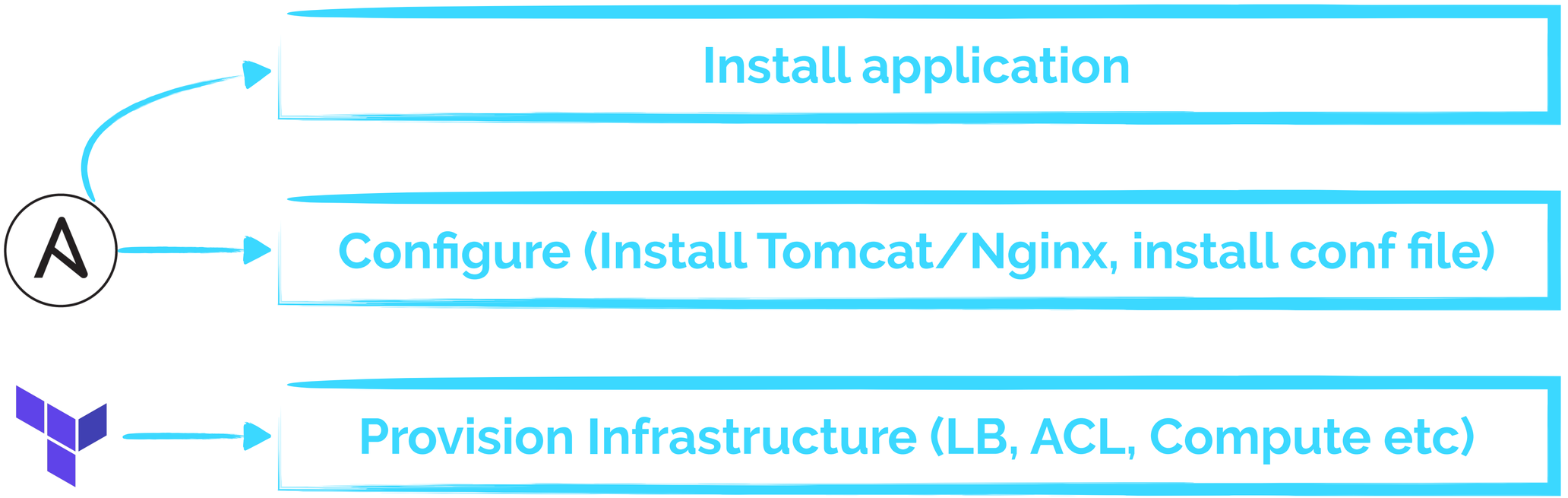
~~FEAR~~ CHANGE

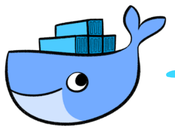
“

Infrastructure is **all** what is needed to support the **computing** requirements of an **application**.

- @antonbabenko

Terraform


Install application
Configure (Install Tomcat/Nginx, install conf file)
Provision Infrastructure (LB, ACL, Compute etc)



Configuration + Application

Provision Infrastructure (LB, ACL, Compute etc)

+ 130 more

Providers

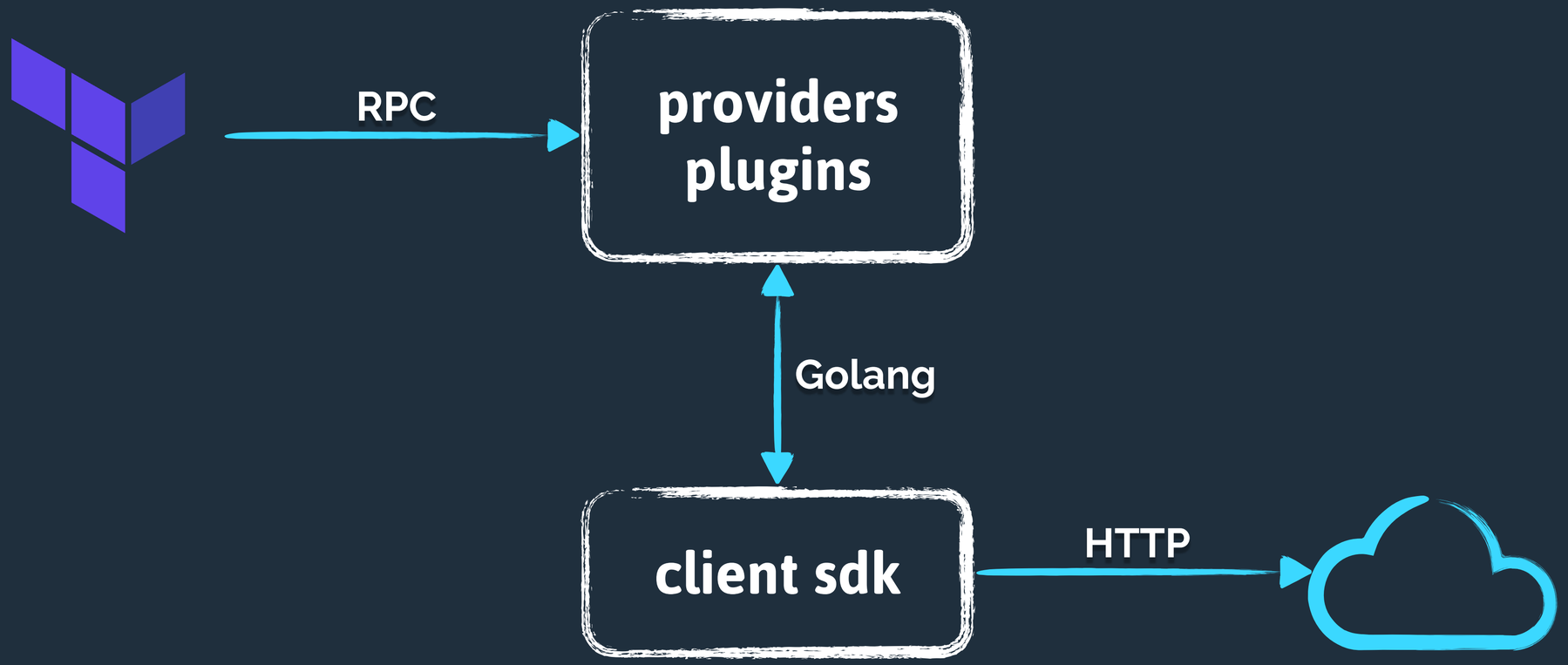

Ops

(POLL - Single Choice)

Usage of "everything as code" in your organization

- We do it all —IaC (e.g Terraform), CaC (e.g Ansible), DbaC (e.g Liquibase), Builds-as-Code (e.g Jenkinsfile)
- We have a few pieces in the works
- Terraform is our first go at this

Architecture


RPC
providers
plugins
Golang
client sdk
HTTP

HCL

Simple, easy to learn
In-built **type** system
Supports **for**-loops, **dynamic blocks, conditionals**, string interpolation

Providers

```
provider "aws" {
  region  = "us-east-1"
  profile = "default"
}
```

Resource

```
provider "aws" {
  region  = "us-east-1"
  profile = "default"
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

Resource

```
provider "aws" {
  region  = "us-east-1"
  profile = "default"
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

<provider_type> syntax

Resource

```
provider "aws" {
  region  = "us-east-1"
  profile = "default"
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

terraform resource name

Resource

```
provider "aws" {
  region  = "us-east-1"
  profile = "default"
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

Name of AWS resource

Resource

```
provider "aws" {
  region  = "us-east-1"
  profile = "default"
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

#protip — Tag it appropriately


Exercise

References

```
resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = 8080
    to_port     = 8080
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"
  vpc_security_group_ids = [aws_security_group.sec-8080.id]

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

References

```
resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = 8080
    to_port     = 8080
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}

resource "aws_instance" "example" {
  ami           = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"
  vpc_security_group_ids = [aws_security_group.sec-8080.id]

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

References

```
resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = 8080
    to_port     = 8080
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}

resource "aws_instance" "example" {
  ami             = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"
  vpc_security_group_ids = [aws_security_group.sec-8080.id]

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

reference an existing resource

References

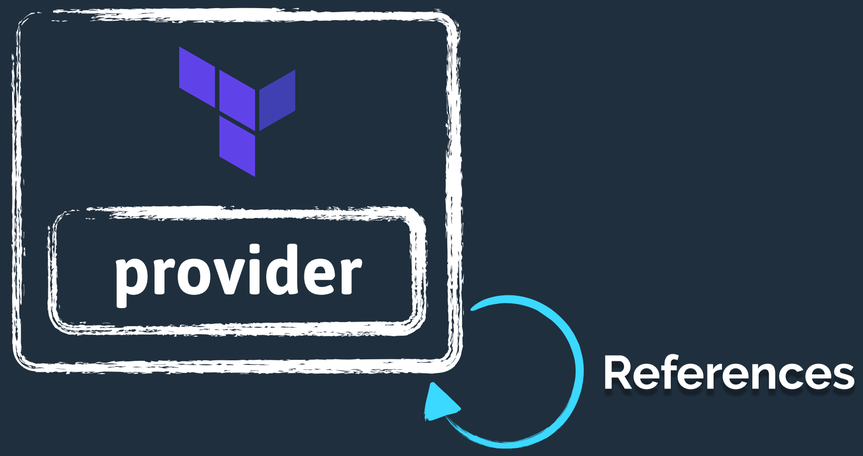
```
resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = 8080
    to_port     = 8080
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}

resource "aws_instance" "example" {
  ami             = "ami-07ebfd5b3428b6f4d"
  instance_type = "t2.micro"
  vpc_security_group_ids = [aws_security_group.sec-8080.id]

  tags = {
    Name = "demo-example"
    Terraform = true
  }
}
```

this is an **implicit** reference


provider
References


Exercise

Outputs

```
resource "aws_instance" "example" {
  # truncated for brevity
}

output "example-ip" {
  value       = aws_instance.example.public_ip
  description = "The public IP address of our demo server"
}
```

output the value of a variable

Outputs

```
resource "aws_instance" "example" {
  # truncated for brevity
}

output "example-ip" {
  value       = aws_instance.example.public_ip
  description = "The public IP address of our demo server"
}
```

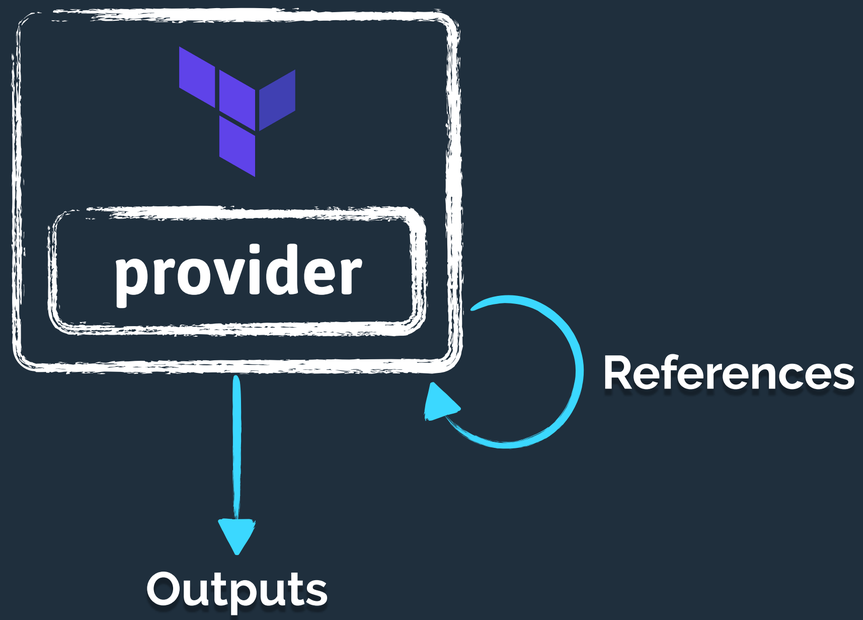
Outputs

```
resource "aws_instance" "example" {
  # truncated for brevity
}

output "example-ip" {
  value       = aws_instance.example.public_ip
  description = "The public IP address of our demo server"
}
```

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

Outputs:
example-ip = 3.83.133.229
```


provider
References
Outputs


Exercise

Variables

```
variable "port" {
  description = "The port to expose on the server"
  type = number
  default = 8080
}

resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = var.port
    to_port     = var.port
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

Variables


```
variable "port" {
  description = "The port to expose on the server"
  type = number
  default = 8080
}

resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = var.port
    to_port     = var.port
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

Variables

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variable "port" {
  description = "The port to expose on the server"
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  default = 8080
}

resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = var.port
    to_port     = var.port
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

type and **default**

Variables

```
variable "port" {
  description = "The port to expose on the server"
  type = number
  default = 8080
}

resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = var.port
    to_port     = var.port
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

Variables

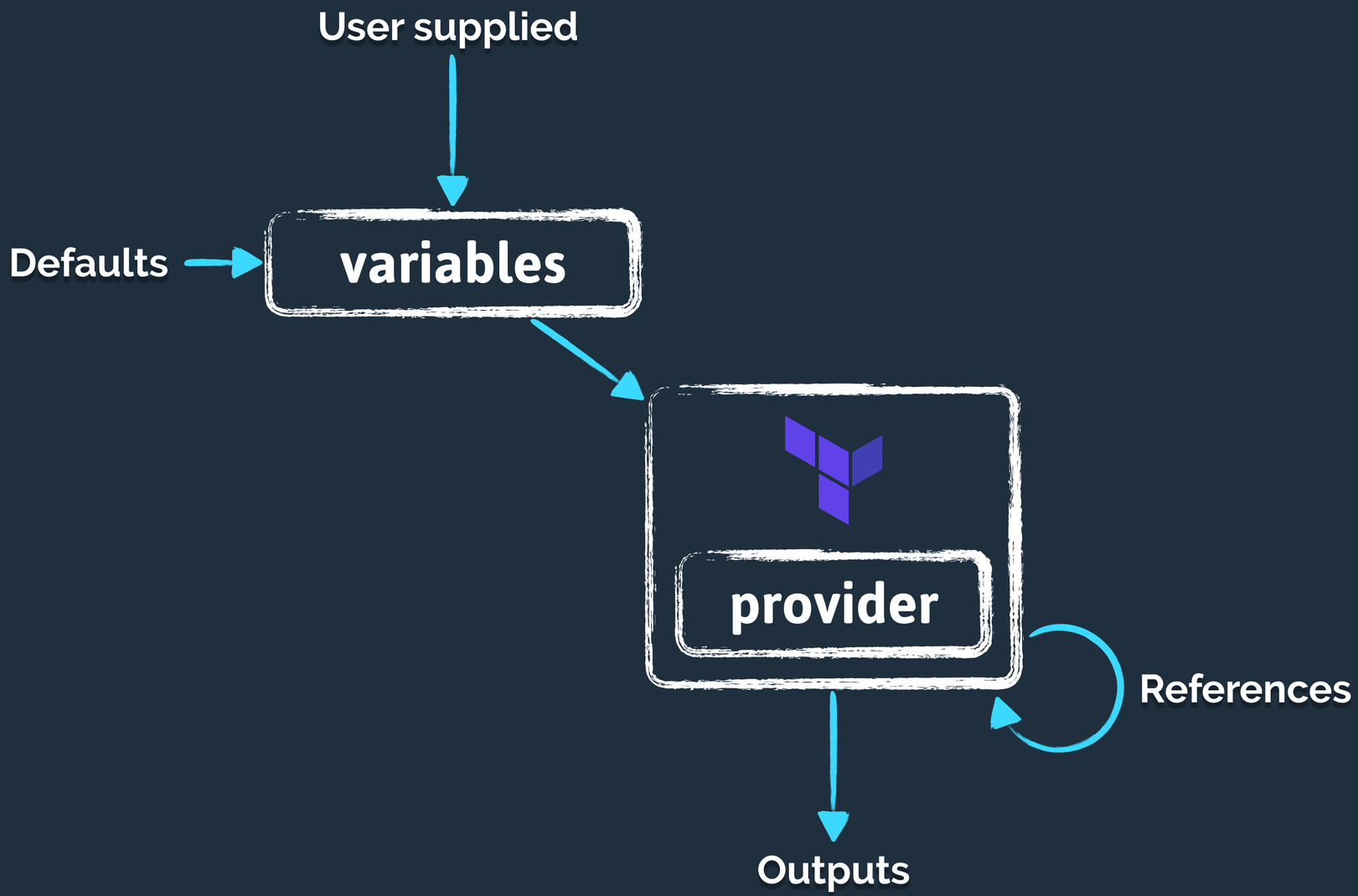
```
variable "port" {
  description = "The port to expose on the server"
  type = number
  default = 8080
}

resource "aws_security_group" "sec-8080" {
  name = "terraform-example-instance"

  ingress {
    from_port   = var.port
    to_port     = var.port
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }
}
```

override the variable at runtime

```
❯ terraform apply -var="port=8081"
```


User supplied
Defaults
variables
provider
References
Outputs


Exercise

(POLL - Single Choice)

Who owns what?

- Development own everything — Ops is focused on SRE
- OPS manages core infra — Development is only responsible for the application layer
- OPS manages everything
- Other (Post in chat)

Data

```
data "aws_ami" "ubuntu" {
  most_recent = true

  filter {
    name   = "name"
    values = ["ubuntu/images/hvm-ssd/ubuntu-bionic-18.04-amd64-server-*"]
  }

  filter {
    name   = "virtualization-type"
    values = ["hvm"]
  }

  owners = ["099720109477"] # Canonical
}
```

Data

data lookup

filter criteria

```
data "aws_ami" "ubuntu" {
  most_recent = true

  filter {
    name   = "name"
    values = ["ubuntu/images/hvm-ssd/ubuntu-bionic-18.04-amd64-server-*"]
  }

  filter {
    name   = "virtualization-type"
    values = ["hvm"]
  }

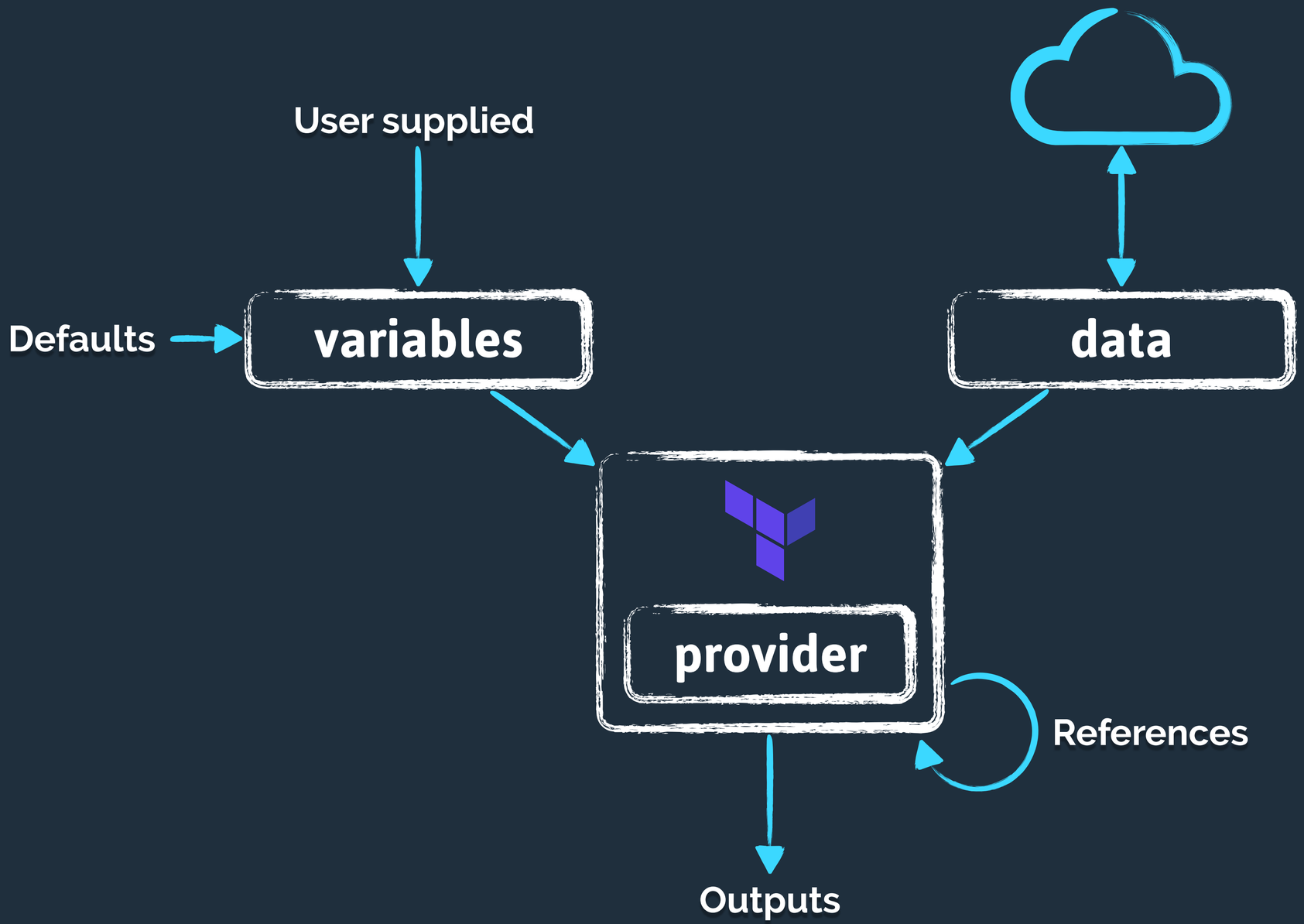
  owners = ["099720109477"] # Canonical
}
```

Data

```
# ─── Look up a AMI by criteria ──────────────────────────────
data "aws_ami" "ubuntu" {
  # ...
}

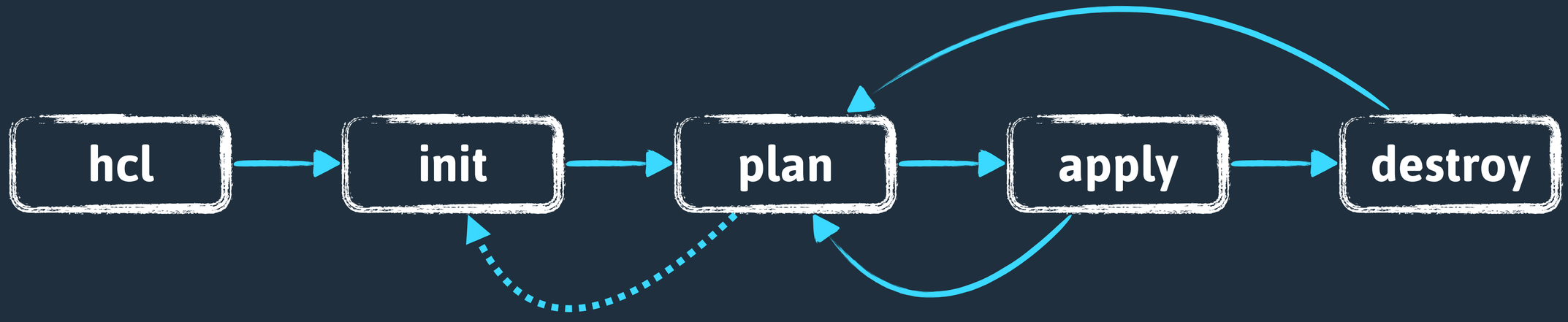
# ─── Defining resources ─────────────────────────────────────
resource "aws_instance" "example" {
  ami                    = data.aws_ami.ubuntu.id
  instance_type          = "t2.micro"
  # ...
}

# ─── Output useful ids ──────────────────────────────────────
output "ami_id" {
  value       = data.aws_ami.ubuntu.id
  description = "The image ID we interrogated for Ubuntu AMI"
}
```


User supplied
Defaults
variables
data
provider
References
Outputs


Exercise

CLI >_


hcl
init
plan
apply
destroy

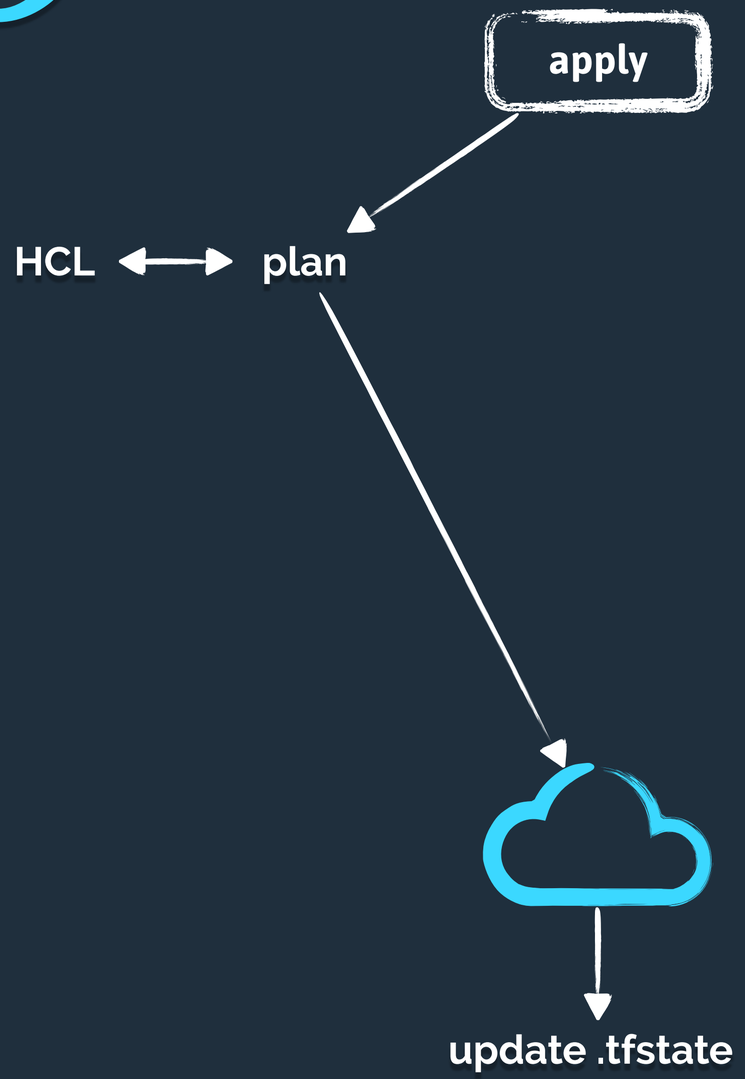
State

State

The **secret sauce** of Terraform

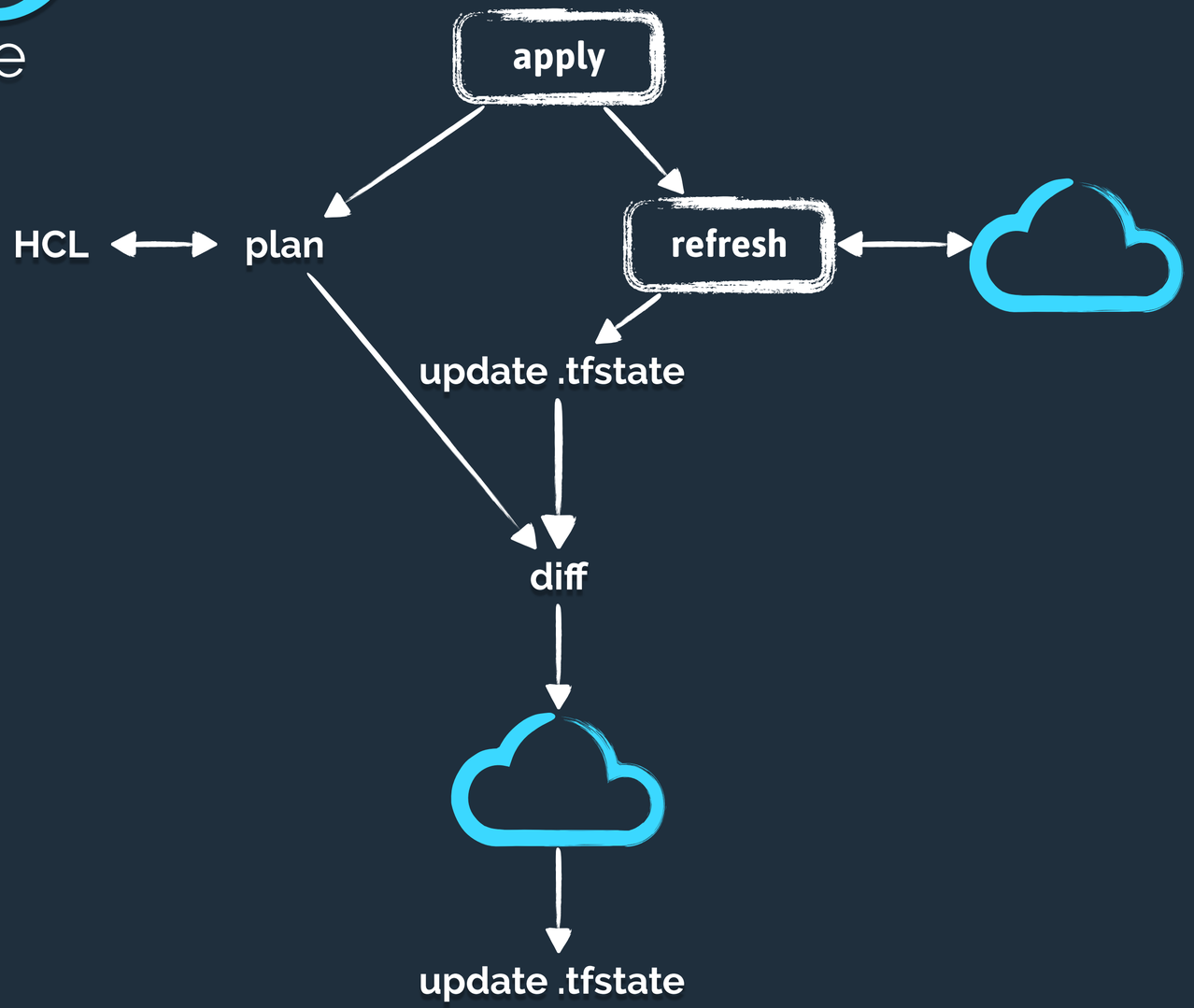
State

First time



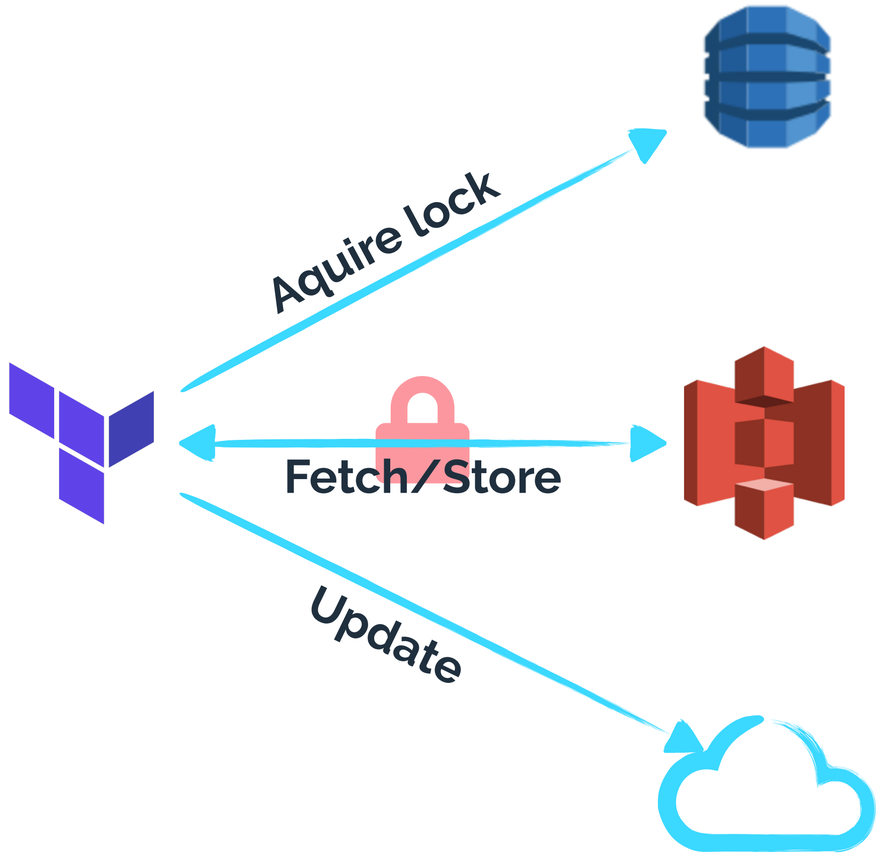
State

Every other time



```
{
  "version": 4,
  "terraform_version": "0.12.20",
  "serial": 3,
  "resources": [
    {
      "mode": "managed",
      "type": "aws_instance",
      "name": "example",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-07ebfd5b3428b6f4d",
            "id": "i-004b5de49844c74df",
            // truncated for brevity
            "tags": {
              "Foo": "bar",
              "Name": "demo-example",
              "Terraform": "true"
            },
          "dependencies": [
            "aws_security_group.sec-8080"
          ]
        }
      ]
    }
  ]
}
```

```
{
  "version": 4,
  "terraform_version": "0.12.20",
  "serial": 3,
  "resources": [
    {
      "mode": "managed",
      "type": "aws_instance",
      "name": "example",
      "instances": [
        {
          "schema_version": 1,
          "attributes": {
            "ami": "ami-07ebfd5b3428b6f4d",
            "id": "i-004b5de49844c74df",
            // truncated for brevity
            "tags": {
              "Foo": "bar",
              "Name": "demo-example",
              "Terraform": "true"
            },
          "dependencies": [
            "aws_security_group.sec-8080"
          ]
        }
      ]
    }
  ]
}
```


Aquire lock
Fetch/Store
Update

```
resource "aws_s3_bucket" "my_terraform_state" {
  bucket = "looselytyped.com.nfjs.terraforming-your-cloud-state-demo"

  # Prevent accidental deletion of this S3 bucket
  # If you decide to destroy this be sure to destroy my_terraform_locks as well
  lifecycle {
    prevent_destroy = true
  }

  # Enable versioning so we can see the full revision history of our
  # state files
  versioning {
    enabled = true
  }

  # Enable server-side encryption by default
  server_side_encryption_configuration {
    rule {
      apply_server_side_encryption_by_default {
        sse_algorithm = "AES256"
      }
    }
  }
}
```

```
resource "aws_dynamodb_table" "my_terraform_locks" {
  name         = "terraforming-your-cloud-state-demo"
  billing_mode = "PAY_PER_REQUEST"
  hash_key     = "LockID"

  # Prevent accidental deletion of this table
  # If you decide to destroy this be sure to destroy my_terraform_state as well
  lifecycle {
    prevent_destroy = true
  }

  attribute {
    name = "LockID"
    type = "S"
  }
}
```

HAS to be this name

```
terraform {
  backend "s3" {
    bucket         = "looselytyped.com.nfjs.terraforming-your-cloud-state-demo"
    key            = "looselytyped/dev/terraform.tfstate"
    region         = "us-east-1"

    dynamodb_table = "terraforming-your-cloud-state-demo"
    encrypt        = true
  }
}

output "s3_bucket_arn" {
  value       = aws_s3_bucket.my_terraform_state.arn
  description = "The ARN of the S3 bucket"
}

output "dynamodb_table_name" {
  value       = aws_dynamodb_table.my_terraform_locks.name
  description = "The name of the DynamoDB table"
}
```

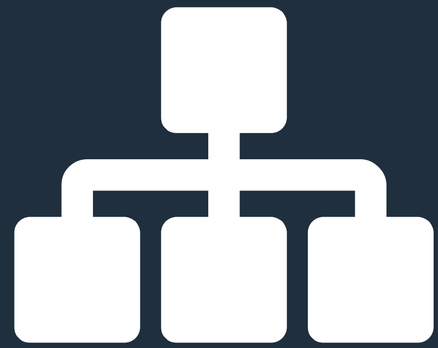
Demo

(POLL - Single Choice)

CI/CD strategy

- We use one set of tooling (Gitlab/AWS/Azure DevOps/Jenkins) for both CI/CD
- We separate responsibilities (e.g Jenkins for CI, Octopus for CD/ promotions)
- Other (Post in chat)

Organization



One FOR One

```
├── base/
│   ├── base.tfvars
│   └── outputs.tf
├── dev/
│   ├── locals.tf
│   ├── main.tf
│   ├── providers.tf
│   └── terraform.tfvars
├── prod/
│   ├── locals.tf
│   ├── main.tf
│   ├── providers.tf
│   └── terraform.tfvars
├── modules/
│   ├── main.tf
│   ├── outputs.tf
│   └── variables.tf
├── env.example
├── initialize.tf
└── variables.tf
```

Modules 

Module

code **reuse**

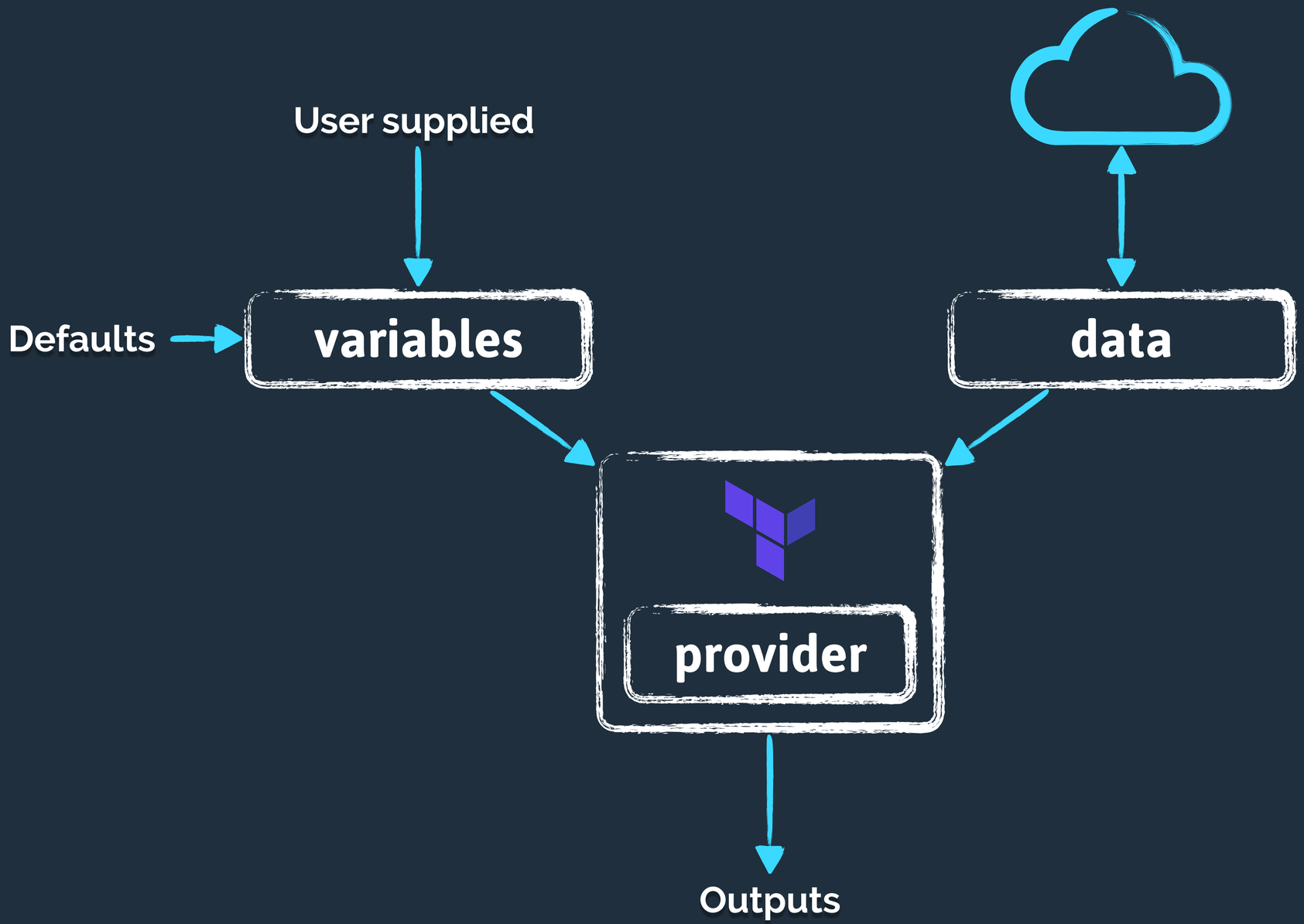
```
❯ tree modules
modules
└── my-company.module-name/
    ├── examples/
    │   └── without-dns/
    │       ├── README.md
    │       ├── main.tf
    │       └── variables.tf
    ├── README.md
    ├── main.tf
    ├── outputs.tf
    └── variables.tf
```

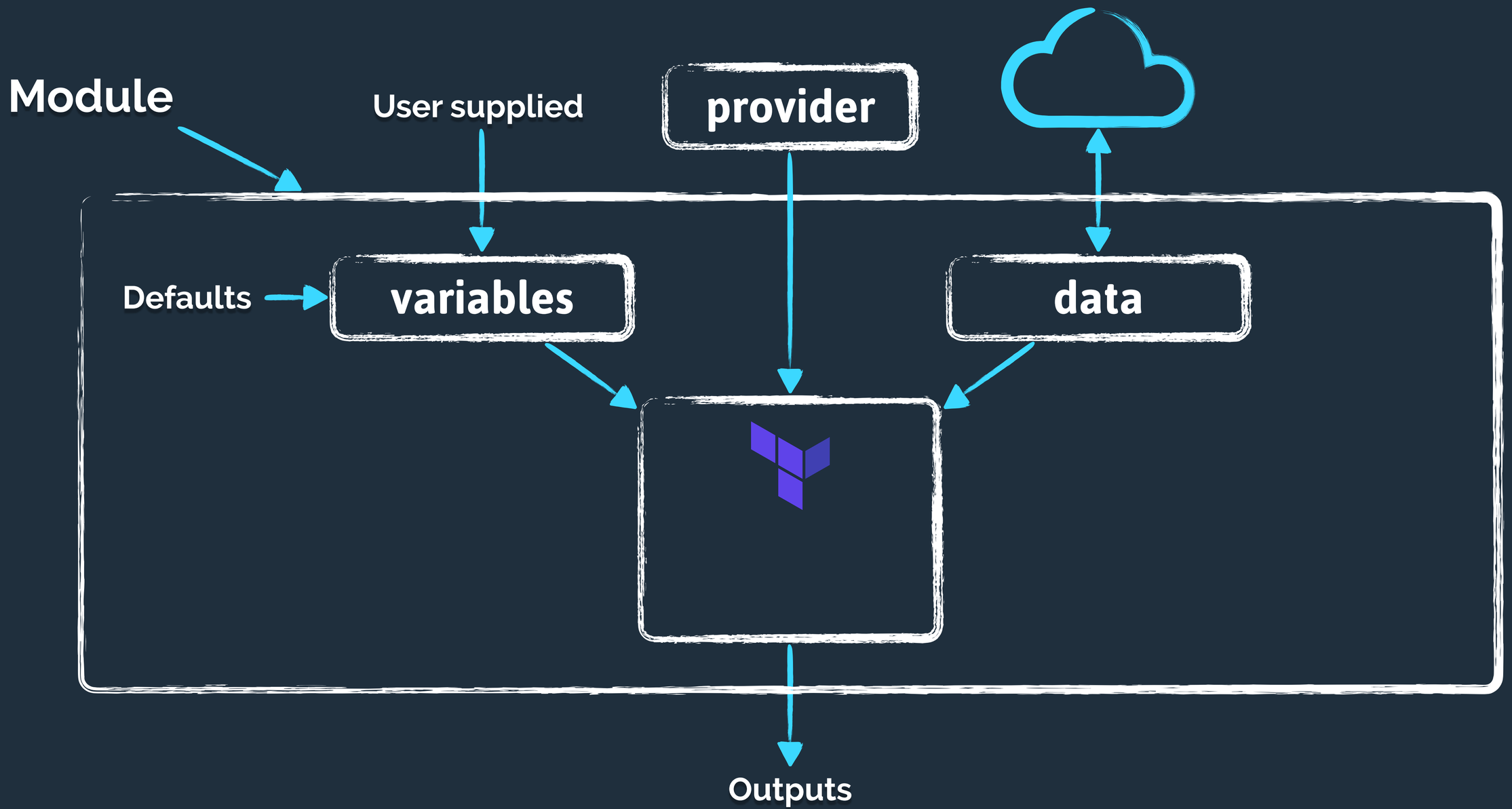
```
module "static_media_cdn" {
  source = "../my-company.module-name"

  name = "example"
  ip = var.ip
}
```

Module Sources

Demo


User supplied
Defaults
variables
data
provider
Outputs


Module
User supplied
provider
Defaults
variables
data
Outputs


Checking

terraform fmt
terraform validate
terraform plan
tflint

} *static* ANALYSIS

terratest
deploy
validate
destroy

} *integration* TESTS

use a sandbox env } *integration* TESTS

#protip

Sentinel

Orchestration

Terragrunt

DRY

LIFECYCLE

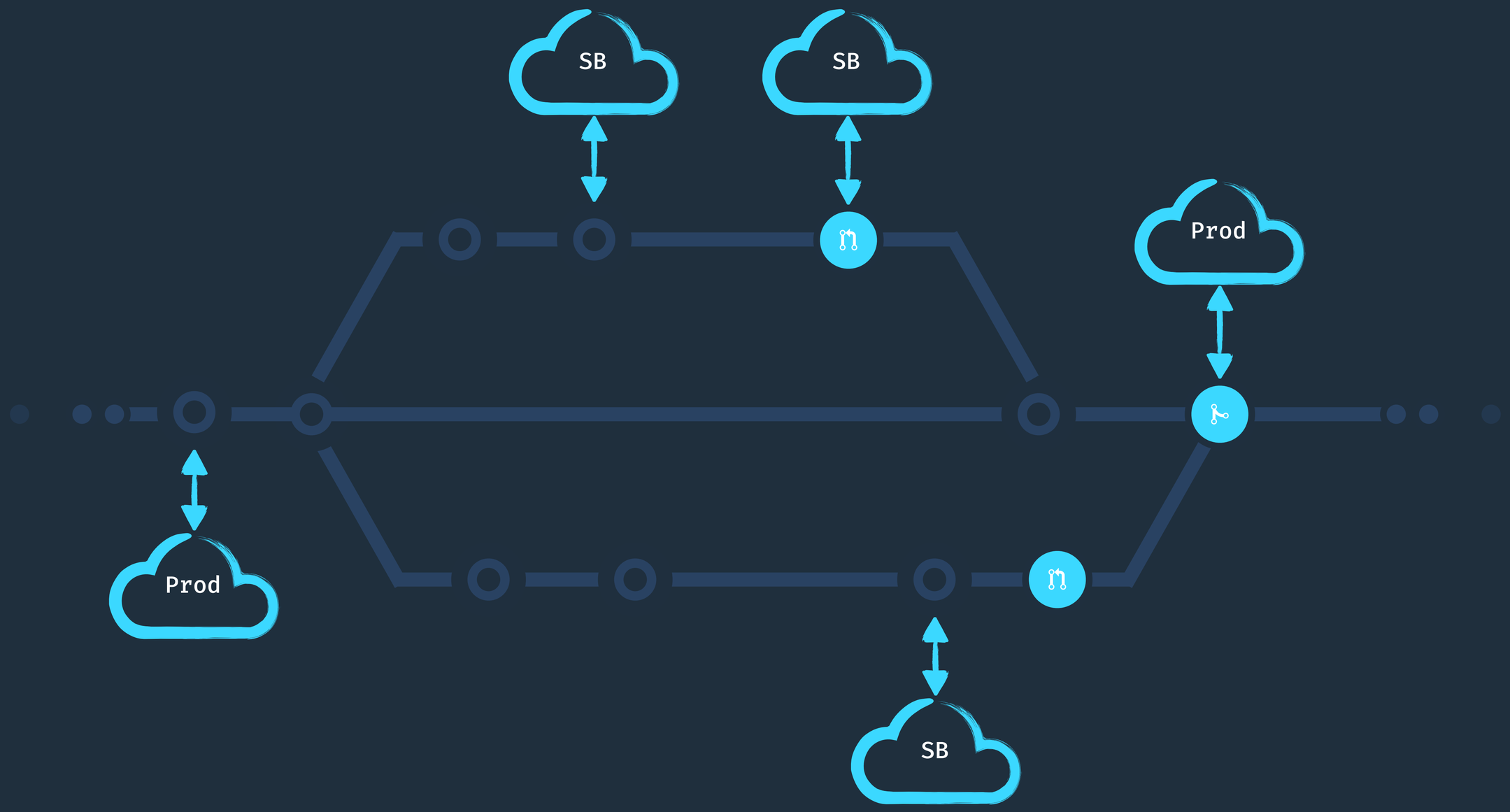
EASY CLI

MULTI-AWS

RETRY

Ansible

Terraform IN PRODUCTION


SB
SB
Prod
Prod
SB

in a *nutshell*

Terraform is a **simple** tool

in a *nutshell*

Terraform makes provisioning **repeatable**

in a *nutshell*

Leverage the **ecosystem** around Terraform

Thanks

Resources

Terraform Registry

Credits

Theme

Cover Slide **Background**