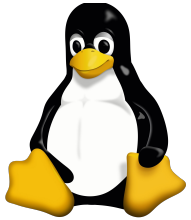
Infrastructure as Code with Terraform

greg@blacksintechnology:~$ whoami

Insight Digital Innovation

PER SCHOLAS

bit
BLACKS IN TECHNOLOGY



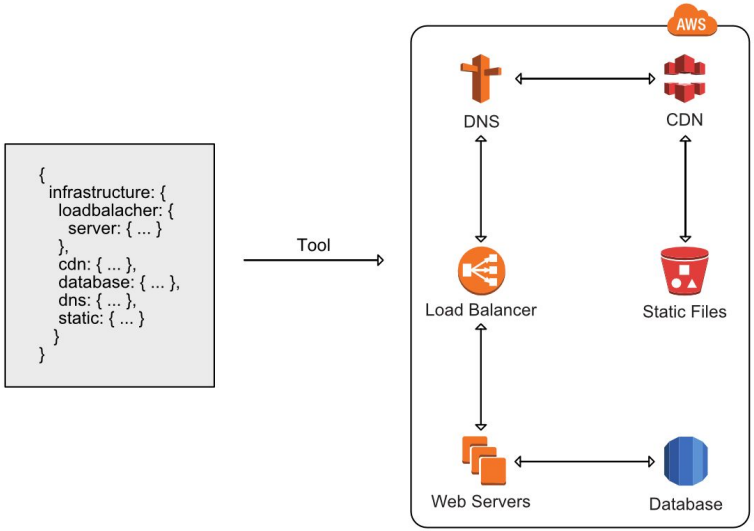
Greg Greenlee

Agenda

- What is IaC?
  - Benefits
- What is Terraform?
- Why do we need Terraform?
- How do we use Terraform?
  - Providers
  - Resources
  - Variables (inputs)
  - Outputs
  - Data Structures
  - Modules
  - Conditionals
  - Iterations
  - Terraform State
- How do I get started?

What Is Infrastructure as Code?

The ability to describe/define your infrastructure and application in source code



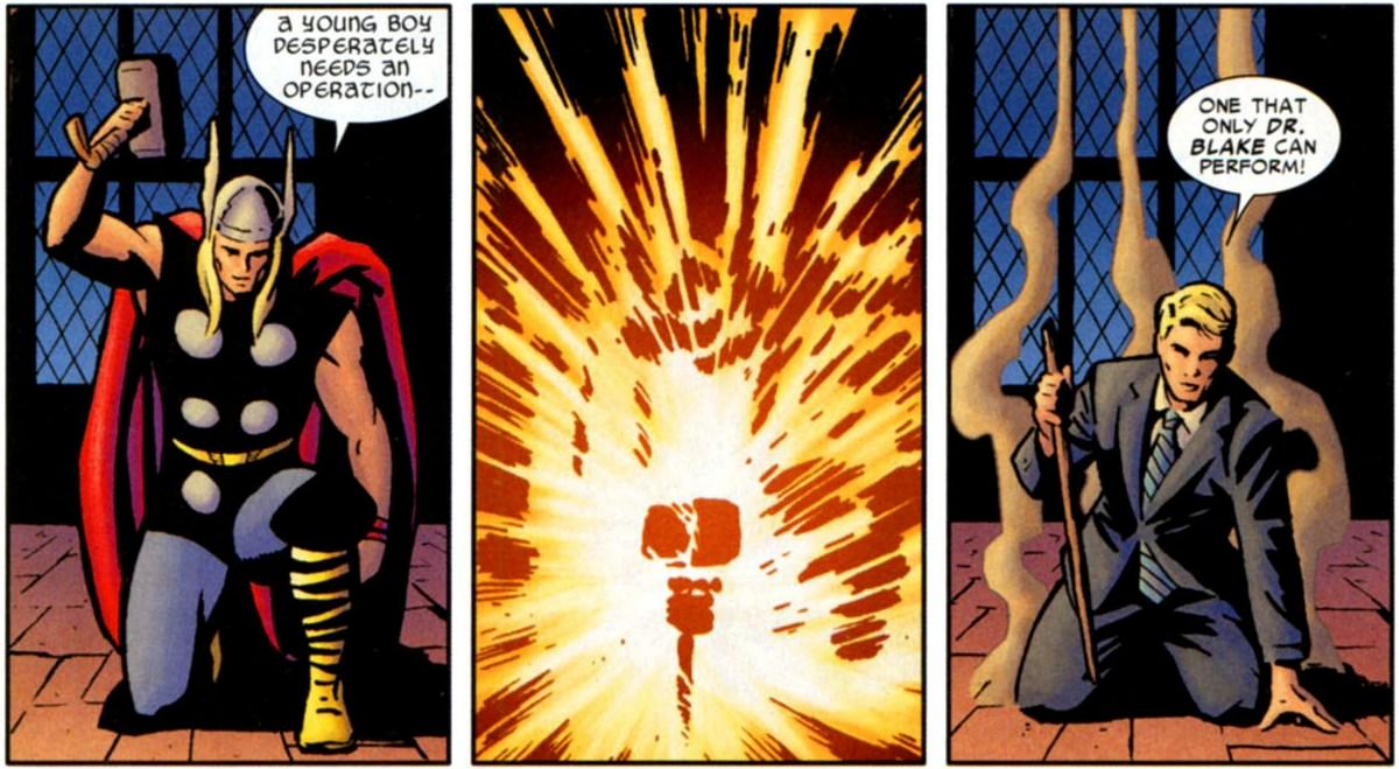
Benefits of IaC

- Software methodologies, tools and practices
  - Code reviews
  - Automated testing
  - linting

Automation

Version Control


POW!
ZOK



Thor-1.0

Rollback

Thor-1.no

Documentation

Also….

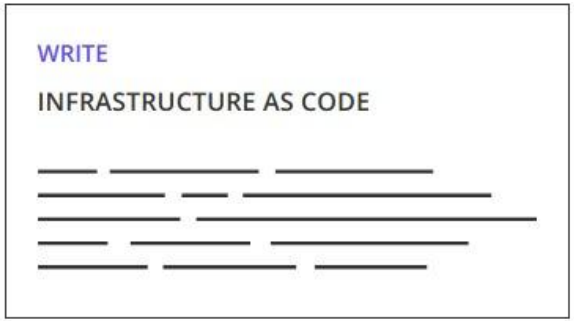
Correlation

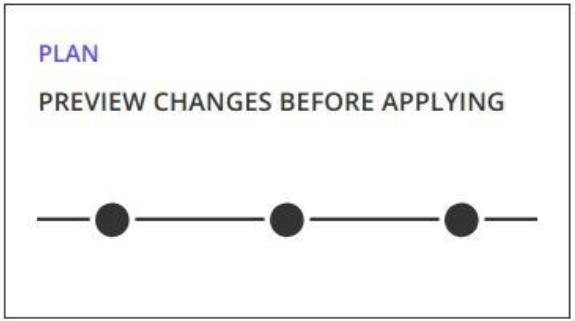
Visibility

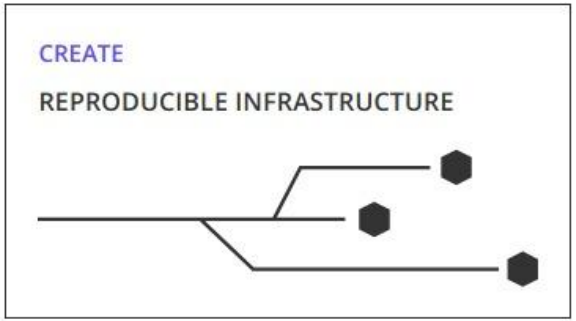
Traceability

What is Terraform?

- Infrastructure as code management tool that uses a declarative language to build infrastructure
- Written in Go
- terraform.io







Imperative vs Declarative

Imperative (How)

- Buy chocalate cake mix
- Open cake mix box
- Pour cake mix in bowl
- Add ingredients
- Stir
- Pour in pan
- Preheat oven to 350
- Place pan in oven
- Bake at 350
- etc

Declarative (What)

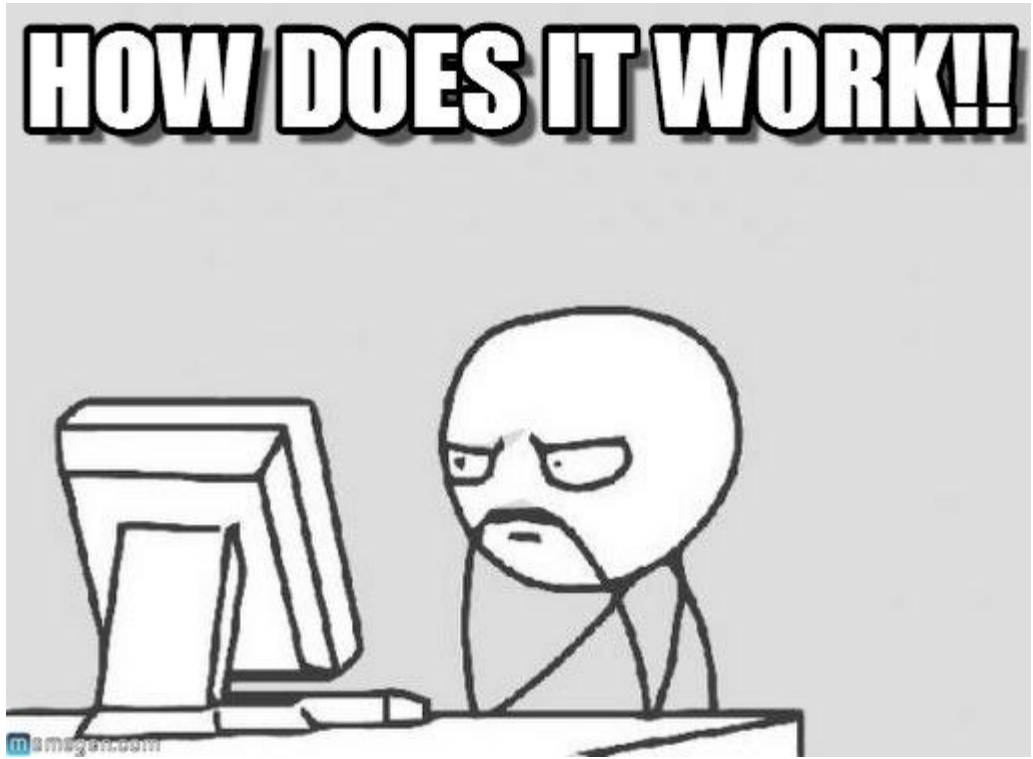
I need a chocolate cake big enough to feed 20 people

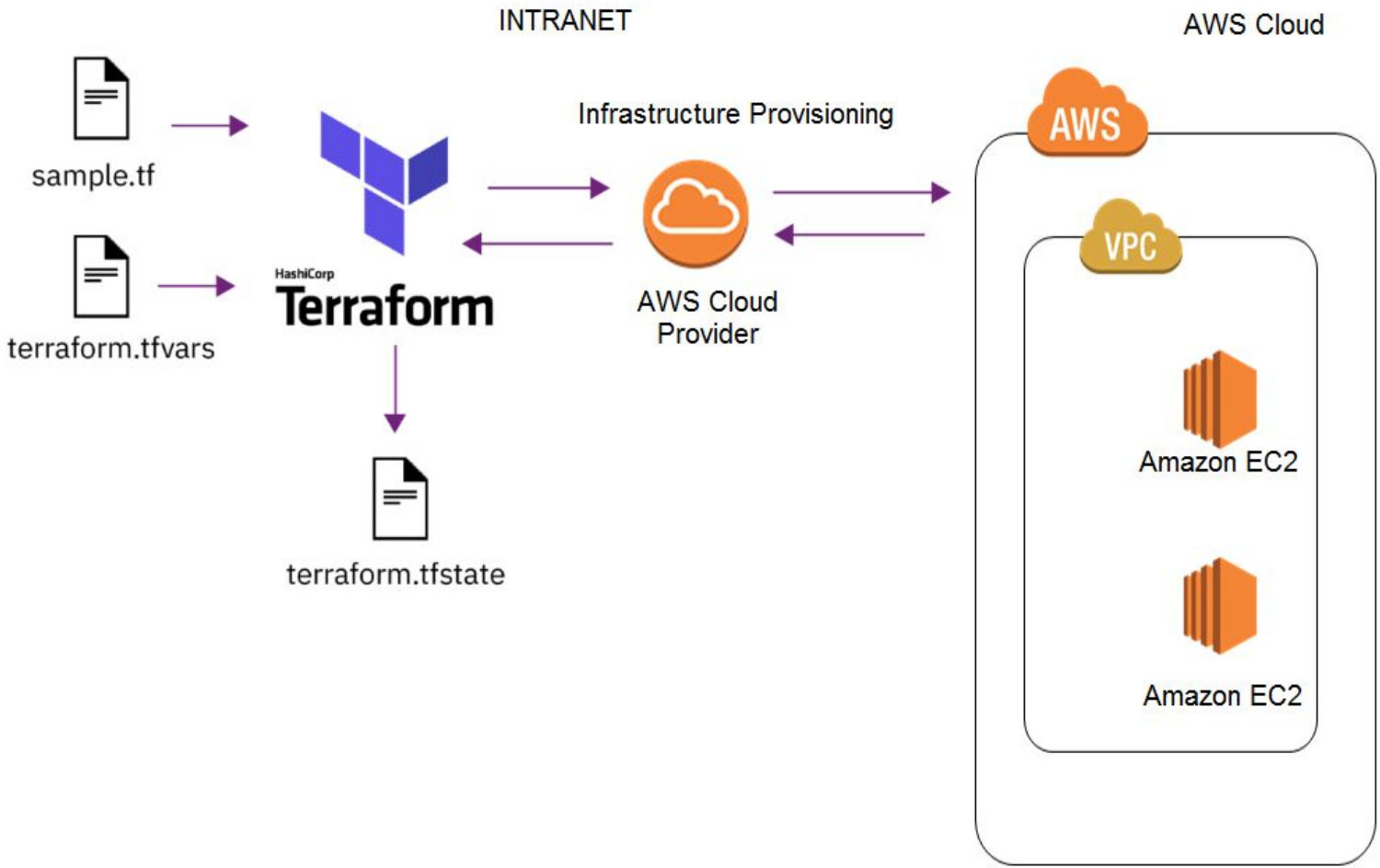
Why do we need Terraform?

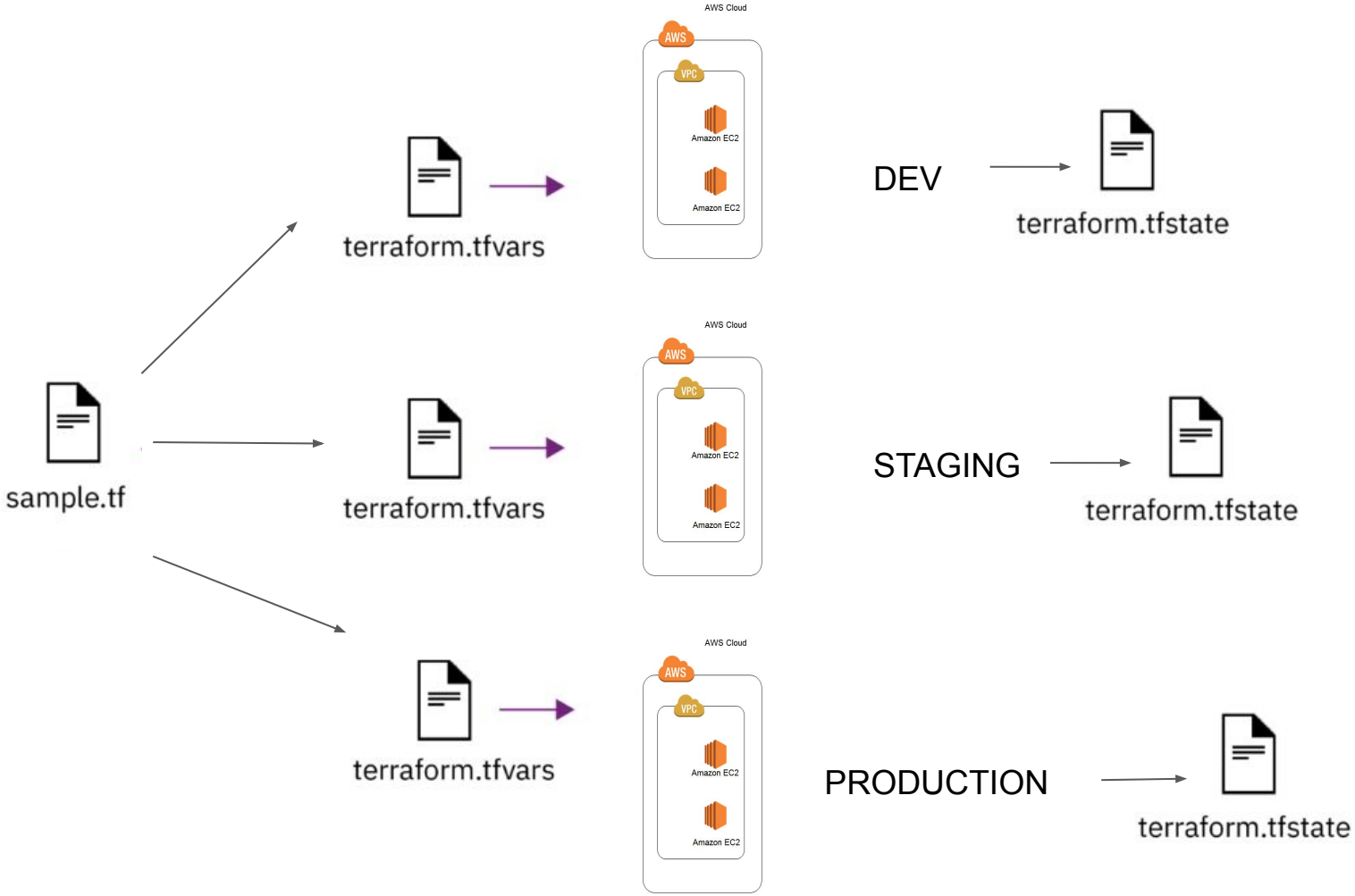
Infrastructure is hard!

Idempotent

Cloud ~~agnostic~~


HOW DOES IT WORK!!


INTRANET
AWS Cloud
sample.tf
terraform.tfvars
HashiCorp
Terraform
terraform.tfstate
Infrastructure Provisioning
AWS Cloud
Provider
AWS
VPC
Amazon EC2
Amazon EC2


sample.tf
terraform.tfvars
terraform.tfvars
terraform.tfvars
AWS Cloud
AWS
VPC
Amazon EC2
Amazon EC2
AWS Cloud
AWS
VPC
Amazon EC2
Amazon EC2
AWS Cloud
AWS
VPC
Amazon EC2
Amazon EC2
DEV
terraform.tfstate
STAGING
terraform.tfstate
PRODUCTION
terraform.tfstate

How do we use Terraform?

Installs as a single binary (https://www.terraform.io/downloads.html)

- MacOS
- Linux
- Windows
- FreeBSD
- Solaris

Usage

- Terraform init
  - initializes terraform directory
  - pulls in plugins for specified provider
  - Pulls in modules
- Terraform fmt
  - Rewrites terraform config files to canonical format and style
- Terraform validate
  - Runs checks that verify whether a configuration is syntactically valid and internally consistent
- terraform plan
  - A preview of what changes will be made
- Terraform apply
  - Applies changes
- Terraform destroy
  - Destroys all changes
- Terraform show
  - Shows resources from state file

Providers

Way to interact with service providers (which API to use)

```
# The default provider configuration

provider "aws" {

  region = "us-east-1"

}
```

Resources

Bread and butter that represents the infrastructure components you want to manage

- Virtual machines
- Load balancers
- Firewall rules
- Virtual Networks
- Databases
- Message queues
- Data warehouses
- ….etc

Resources - code example

```
resource "aws_instance" "web" {

  ami           = "${data.aws_ami.ubuntu.id}"

  instance_type = "t2.micro"



  tags = {

    Name = "HelloWorld"

  }

   }
```

```
resource "aws_elb" "bar" {

  name                = "foobar-terraform-elb"

  availability_zones = ["us-west-2a", "us-west-2b",
"us-west-2c"]



  instances                   = ["${aws_instance.web.id}" ]

  tags = {

    Name = "foobar-terraform-elb"

  }

   }
```

Variables

- Environment
  - Begins with TF_VAR_
    - export TF_VAR_somevariable=somevalue
- Inputs
- Ouputs
- Data Structures
  - Strings
  - Arrays
  - Maps

Variable example code

```
variable "image_id" {

  type = string

  default = "ami-abc123"

}
```

```
resource "aws_instance" "web" {

  instance_type = "t2.micro"

  ami           = var.image_id

  }
```

Conditionals

If statements

If/else

Boolean operations

Conditional example

```
resource "aws_instance" "vpn" {

  count = "${var.something ? 1 : 0}"

          CONDITION ? TRUEVAL : FALSEVAL

}
```

Iteration

```
resource "aws_iam_user" "example" {
 count = length(var.user_names)
 name  = var.user_names[count.index]
}


variable “user_names” {
 description = “names of users”
 type = “list”
```

Modules

Reusable code

Collection of resources

Conforms to D-R-Y (don’t repeat yourself) methodology

Module example

SQL module (tf_azurem_sql)

```
resource "azurerm_sql_server" "test" {

  name                         = "${var.sql_server_name}"

  resource_group_name          = "${var.resource_group_name}"

  location                     = "${var.resource_group_location}"

}

resource "azurerm_sql_database" "test" {

  name                = "${var.sql_database_name}"

  resource_group_name = "${var.resource_group_name}"

 location                     = "${var.resource_group_location}"

  server_name         = "${var.my_sql_server_name}"
```

SQL module instantiation

```
module "sql_server_database" {

 source                = "git::https://myrepo/sql/_git/tf_azurerm_sql?ref=1.7"

 resource_group_name     = "my_resource_group"

 resource_group_location = "useast1"

 sql_server_name         = "my_sql_server_name"

 sql_database_name       = "my-sql-database"

}
```

Functions

- String manipulation
- Numeric
- Collection
- Date and time
- ….more

Ex.

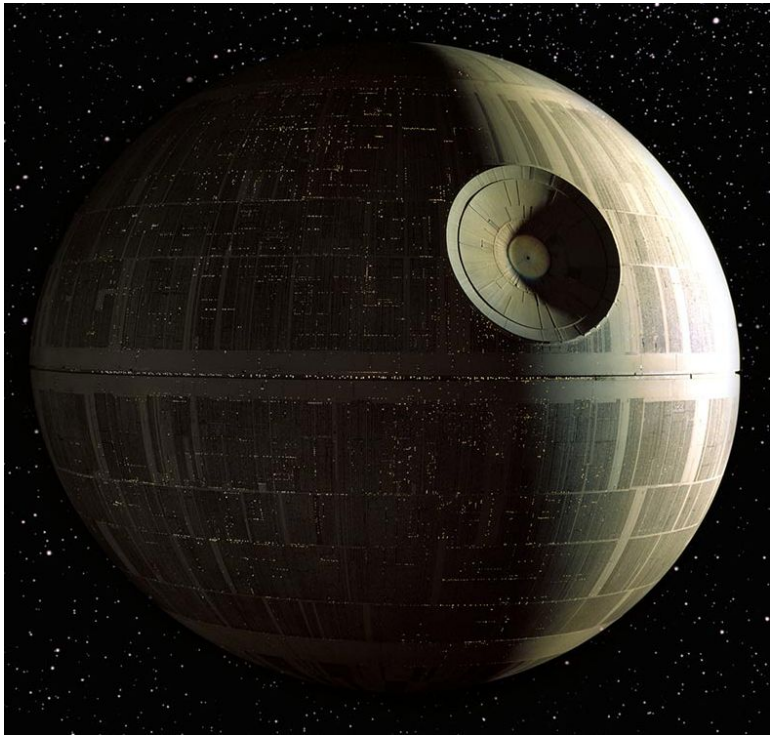
```
> max(12, 54, 3) 54

> join(", ", ["foo", "bar", "baz"])foo, bar, baz

> timestamp() 2018-05-13T07:44:12Z

> cidrhost("10.12.127.0/20", 16)10.12.112.16

> concat(["a", ""], ["b", "c"])["a","","b","c",]
```

State

- Terraform stores state about your managed infrastructure and configuration.
- Used by Terraform to map
    - real world resources to your configuration
    - keep track of metadata
    - improve performance for large infrastructures.
- This state is stored by default in a local file named "terraform.tfstate"
- can also be stored remotely (works better in a team environment)
- uses local state to create plans and make changes to your infrastructure. Prior to any operation, Terraform does a refresh to update the state with the real infrastructure.

Current State

Desired State



How do I get started?

Understand the resources of the provider (very important)

Get a free tier account with a provider (GCP, AWS, Azure)

Download the binary

Read the docs

Use it

Recommendations

Use terraform plan output

Use remote state

Backup your statefile

Review plans (two sets of eyes)

Use secret management - don’t store secrets directly in tf config files or env variables

Plan structure

Resources

- Terraform.io
- The Terraform Book - James Turnbull
- Terraform Up and Running - Yevginy Brikman
- Me
  - greg.greenlee@insight.com
  - @BIT_greggreenle