

# Infrastructure as Code

CSSE6400

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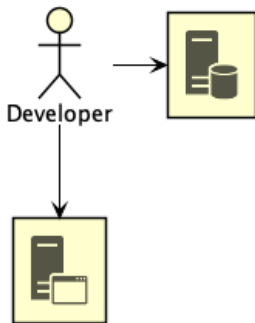
Infrastructure as Code

# How did we get here?

Pre-2000

# The *Iron Age*

## Iron Age



## Iron Age



Introducing...

# The *Cloud Age*

## The Cloud Age



When faced with complexity

**Automate it!**



# The larger story

Server Config Config Management

# The larger story

Server Config   Config Management  
Application Config   Config Files

# The larger story

Server Config   Config Management  
Application Config   Config Files  
Provisioning   Infrastructure Code

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Server Config	Config Management
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Provisioning	Infrastructure Code
Building	Continuous Integration

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Database Administration   Schema Migration

# The larger story

Server Config   Config Management

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Provisioning   Infrastructure Code

Building   Continuous Integration

Deployment   Continuous Deployment

Testing   Automated Tests

Database Administration   Schema Migration

Specifications   Behaviour Driven Development



### Definition 1. Infrastructure Code

Code that provisions and manages *infrastructure resources*.

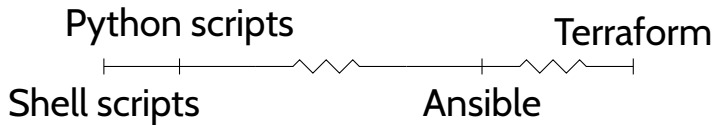
## Definition 2. Infrastructure Code

Code that provisions and manages *infrastructure resources*.

## Definition 3. Infrastructure Resources

Compute resources, networking resources, and storage resources.

## Infrastructure Code



```
1  #!/bin/bash
3  SG=$(aws ec2 create-security-group ...)
5  aws ec2 authorize-security-group-ingress --group-id "$SG"
7  INST=$(aws ec2 run-instances --security-group-ids "$SG" \
8      --instance-type t2.micro)
```

```
1 import boto3

3 def create_instance():
4     ec2_client = boto3.client("ec2", region_name="us-east-1")
5     response = ec2.create_security_group(...)
6     security_group_id = response['GroupId']

8     data = ec2.authorize_security_group_ingress(...)

10    instance = ec2_client.run_instances(
11        SecurityGroups=[security_group_id],
12        InstanceType="t2.micro",
13        ...
14    )
```

```
1 resource "aws_instance" "hextris-server" {
2     instance_type = "t2.micro"
3     security_groups = [aws_security_group.hextris-server.name]
4     ...
5 }

7 resource "aws_security_group" "hextris-server" {
8     ingress {
9         from_port = 80
10        to_port = 80
11        ...
12    }
13    ...
14 }
```

Question

Notice anything different?

The *main* difference

# Imperative vs. declarative



## Infrastructure Code

- Provisions and manages *infrastructure resources*.

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- Provisions and manages *infrastructure resources*.
- Only one part of the movement to *automate* the complexities of development.
- Ranges from simple shell scripts up to...?
- Tendancy to be *declarative*.

Typo?

Infrastructure Code  $\neq$  Infrastructure *as* Code

#### Definition 4. Infrastructure as Code

Following the same *good coding practices* to manage Infrastructure Code as standard code.

Warning!

Infrastructure as Code still *early* and quite *bad*.

Question

What are *good coding practices*?



Good Coding Practice #1

*Everything* as code

```
1  #!/bin/bash
3  ./download-dependencies
4  ./build-resources
5  cp -r output/* artifacts/
```

```
1  #!/bin/bash
3  ./download-dependencies
4  ./build-resources
5  cp -r output/* artifacts/
```

```
1  $ cp: directory artifacts does not exist
```

```
1 resource "aws_instance" "hextris-server" {  
2     instance_type = "t2.micro"  
3     security_groups = ["sg-6400"]  
4     ...  
5 }
```

```
1 resource "aws_instance" "hextris-server" {
2     instance_type = "t2.micro"
3     security_groups = [aws_security_group.hextris-server.name]
4     ...
5 }

7 resource "aws_security_group" "hextris-server" {
8     ingress {
9         from_port = 80
10        to_port = 80
11        ...
12    }
13    ...
14 }
```

Everything as code avoids

# Configuration drift

Configuration drift creates

# Snowflakes

## Benefits

1. Reproducible.



Good Coding Practice #2

# Version control

## Benefits

1. Restorable.
2. Accountable.

Good Coding Practice #3

# Automation

## Benefits

### 1. Consistent.

Good Coding Practice #4

# Code Reuse

## Benefits

1. Better<sup>1</sup> code.
2. Less work.
3. Only one place to update (or verify).

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<sup>1</sup>generally

Good Coding Practice #5

# Testing

# Test Pyramid





# laC Test Pyramid



```
1 func TestTerraformAwsInstance(t *testing.T) {
2     terraformOptions := terraform.WithDefault(t, &terraform.Options{
3         TerraformDir: "../week03/",
4     })
5
6     defer terraform.Destroy(t, terraformOptions)
7     terraform.InitAndApply(t, terraformOptions)
8
9     publicIp := terraform.Output(t, terraformOptions, "public_ip")
10    url := fmt.Sprintf("http://%s:8080", publicIp)
11
12    http_helper.HttpGetWithCustomValidation(t, url, nil, 200,
13        func(code, resp) { code == 200 &&
14            strings.Contains(resp, "hextris")})
15 }
```

```
1 Feature: Define AWS Security Groups

3 Scenario: Only selected ports should be publicly open
4     Given I have AWS Security Group defined
5     When it contains ingress
6     Then it must only have tcp protocol and port 22,443 for 0.0.0.0/0
```

## Benefits

### 1. Trust.