

# Infrastructure as Code

*Software Architecture*

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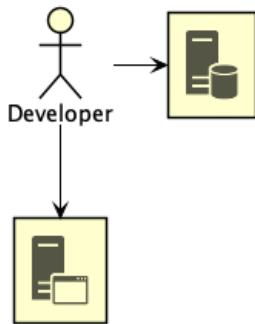
*Infrastructure as Code*

How did we get here?

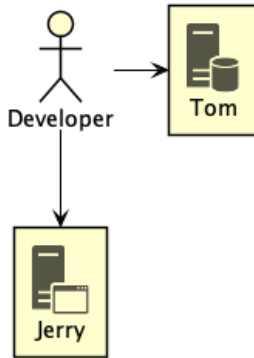
*Pre-2000*

The *Iron Age*

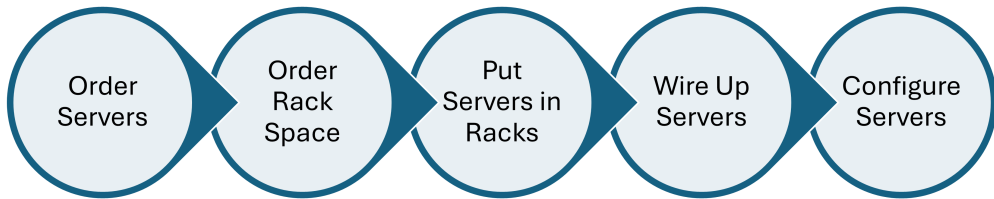
## *Iron Age*



## *Iron Age*



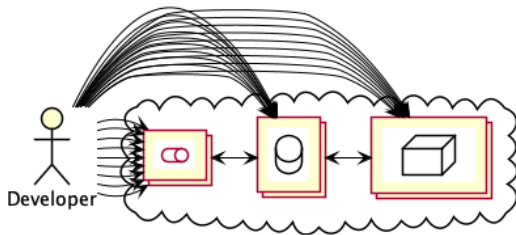
## *Scaling*



*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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Building   Continuous Integration

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Testing   Automated Tests

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Testing   Automated Tests

Database Administration   Schema Migration



# The larger story

Server Config   Config Management

Application Config   Config Files

Provisioning   Infrastructure Code

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Testing   Automated Tests

Database Administration   Schema Migration

Specifications   Behaviour Driven Development

*Definition 0.* Infrastructure Code

Code that provisions and manages *infrastructure resources*.

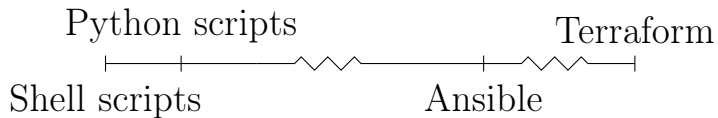
*Definition 0. Infrastructure Code*

Code that provisions and manages *infrastructure resources*.

*Definition 0. Infrastructure Resources*

Compute resources, networking resources, and storage resources.

## *Infrastructure Code*



# Shell Scripts

```
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)
```

# Python

```
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     )
```

# Terraform

```
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

## *Declarative IaC*

- Define your *desired* infrastructure state
  - as code
- Engine interprets difference between the *desired* and *actual* state
  - Modifying infrastructure to deliver *desired* state

## *Infrastructure Code*

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## *Infrastructure Code*

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

*Typo?*

Infrastructure Code  $\neq$  Infrastructure *as* Code

*Definition 0.* 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/
```

```
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3  ./download-dependencies
4  ./build-resources
5  cp -r output/* artifacts/
```

```
$ 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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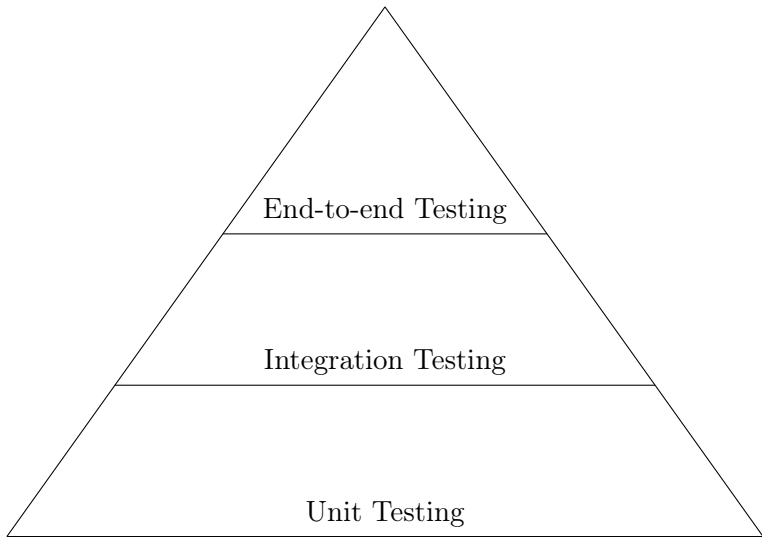
<sup>1</sup>generally



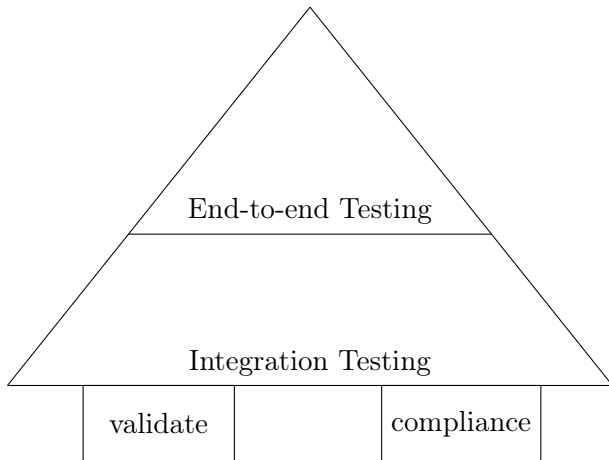
*Good Coding Practice #5*

Testing

# Test Pyramid



# IaC 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

### *Prac Next Week*

Learn how to use Terraform to write IaC and deploy resources on AWS.