

Infrastructure as Code

Software Architecture

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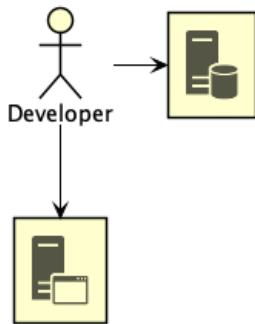
Infrastructure as Code

How did we get here?

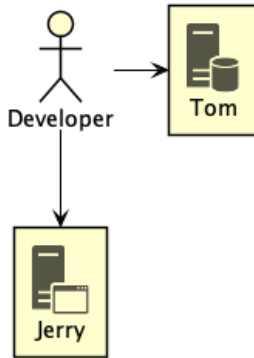
Pre-2000

The *Iron Age*

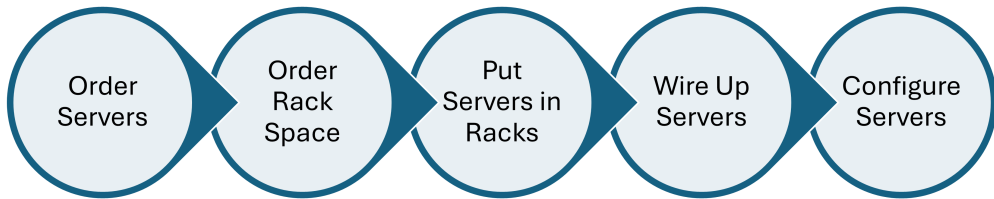
Iron Age



Iron Age



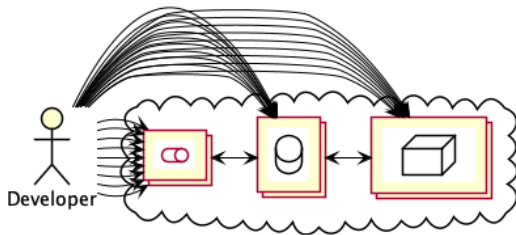
Scaling



Introducing...

The *Cloud Age*

The Cloud Age



When faced with complexity

Automate it!

The larger story

Server Config Config Management

The larger story

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Application Config Config Files

The larger story

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Provisioning Infrastructure Code

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Building Continuous Integration

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Database Administration Schema Migration

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Specifications Behaviour Driven Development

Definition 0. Infrastructure Code

Code that provisions and manages *infrastructure resources*.

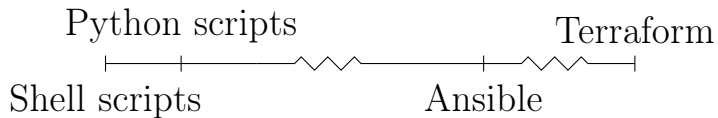
Definition 0. Infrastructure Code

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

- Provisions and manages *infrastructure resources*.

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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/
```

```
1  #!/bin/bash
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

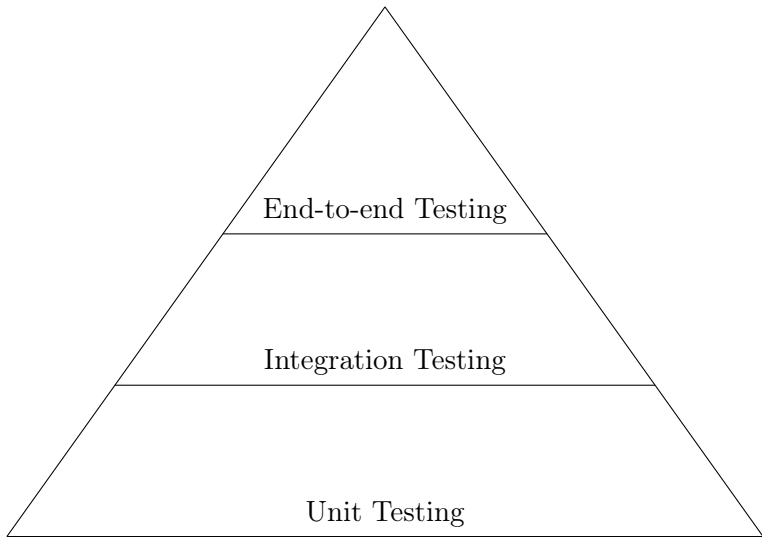
1. Better¹ code
2. Less work
3. Only one place to update (or verify)

¹generally

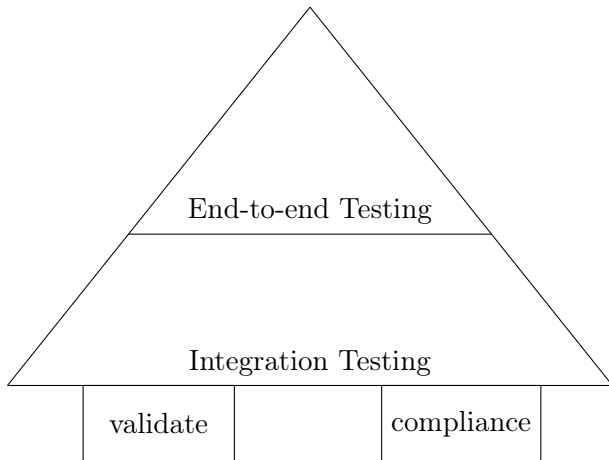
Good Coding Practice #5

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.