Testing Terraform

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Chef

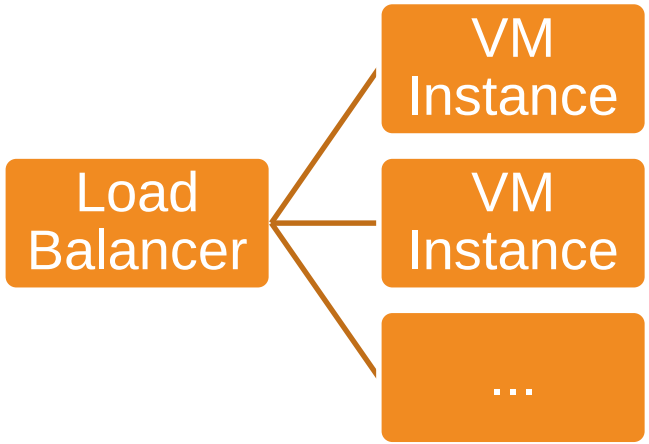
What am I talking about

- Suppose you use a tool like Terraform to create your infrastructure
- You're onboard with infrastructure as code
- Code should be tested
- How can we test Terraform?

HashiCorp Terraform

A Motivational Example

1. Deploy n-tier cloud infra
2. Deploy some app
3. Profit



A Motivational Example

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2. ~~Deploy some app~~ ???
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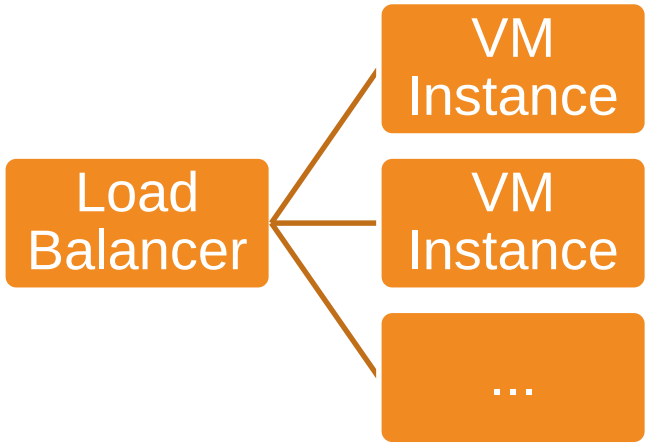

So how do you do that in Terraform?

Terraform on AWS: Define an Instance (VM)

```
resource "aws_instance" "web" {
  count         = 3
  instance_type = "t2.micro"
  ami           = "${lookup(var.aws_amis, var.aws_region)}"
  key_name      = "${var.key_name}"
  subnet_id     = "${aws_subnet.default.id}"

  vpc_security_group_ids = [
    "${aws_security_group.lb_to_webservers.id}",
    "${aws_security_group.ssh_from_office.id}",
  ]
  ...
}
```

Terraform on AWS: Define Load Balancer (ELB)

```
resource "aws_elb" "web" {
  name = "testing-terraform-elb"
  subnets = ["${aws_subnet.default.id}"]

  security_groups = [
    "${aws_security_group.world_to_elb.id}",
    "${aws_security_group.lb_to_webservers.id}",
    ]

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

  listener {
      instance_port     = 80
    instance_protocol = "http"
      lb_port         = 80
      lb_protocol     = "http"
    }
}
```

Terraform on AWS: Define a Firewall Rule

```
resource "aws_security_group" "ssh_from_office" {
  name   = "testing-terraform-ssh"
  vpc_id = "${aws_vpc.testing_terraform.id}"

  # SSH access from special office addresses
  ingress {
      from_port   = 22
      to_port     = 22
      protocol    = "tcp"
    cidr_blocks = "${var.ssh_cidrs}"
    }

  # outbound internet access
  egress {
      from_port   = 0
      to_port     = 0
      protocol    = "-1"
      cidr_blocks = ["0.0.0.0/0"]
    }
}
```

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      protocol    = "-1"
      cidr_blocks = ["0.0.0.0/0"]
    }
}
```

```
variable "ssh_cidrs" {
  default = [
    "173.239.212.22/32",
    "12.130.117.75/32"
  ]
}
```

What's the plan, Phil?

```
$ terraform plan -out plan.out
```

```
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.
...
Plan: 11 to add, 0 to change, 0 to destroy.

------------------------------------------------------------------------

This plan was saved to: plan.out

To perform exactly these actions, run the following command to apply:
    terraform apply "plan.out"
```

Make it so!

```
$ terraform apply "plan.out"
```

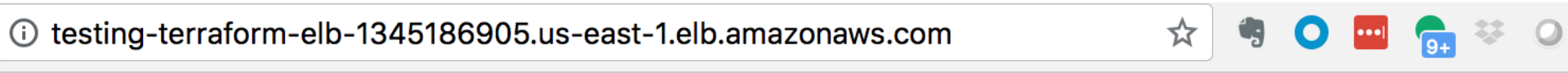
```
aws_vpc.testing_terraform: Creating...
  assign_generated_ipv6_cidr_block: "" => "false"
  cidr_block:                       "" => "10.0.0.0/16"
  default_network_acl_id:           "" => "<computed>"
  default_route_table_id:           "" => "<computed>"
  default_security_group_id:        "" => "<computed>”
...
aws_elb.web: Creation complete after 25s (ID: testing-terraform-elb)

Apply complete! Resources: 11 added, 0 changed, 0 destroyed.

Outputs:

address = testing-terraform-elb-1345186905.us-east-1.elb.amazonaws.com
```

It's alive!



Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

Thank you for using nginx.

Part of a balanced diet

Verify with Terraform

```
$ terraform plan
```

```
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.

aws_vpc.testing_terraform: Refreshing state... (ID: vpc-091427c0ca8ed3c29)
...
aws_elb.web: Refreshing state... (ID: testing-terraform-elb)

------------------------------------------------------------------------

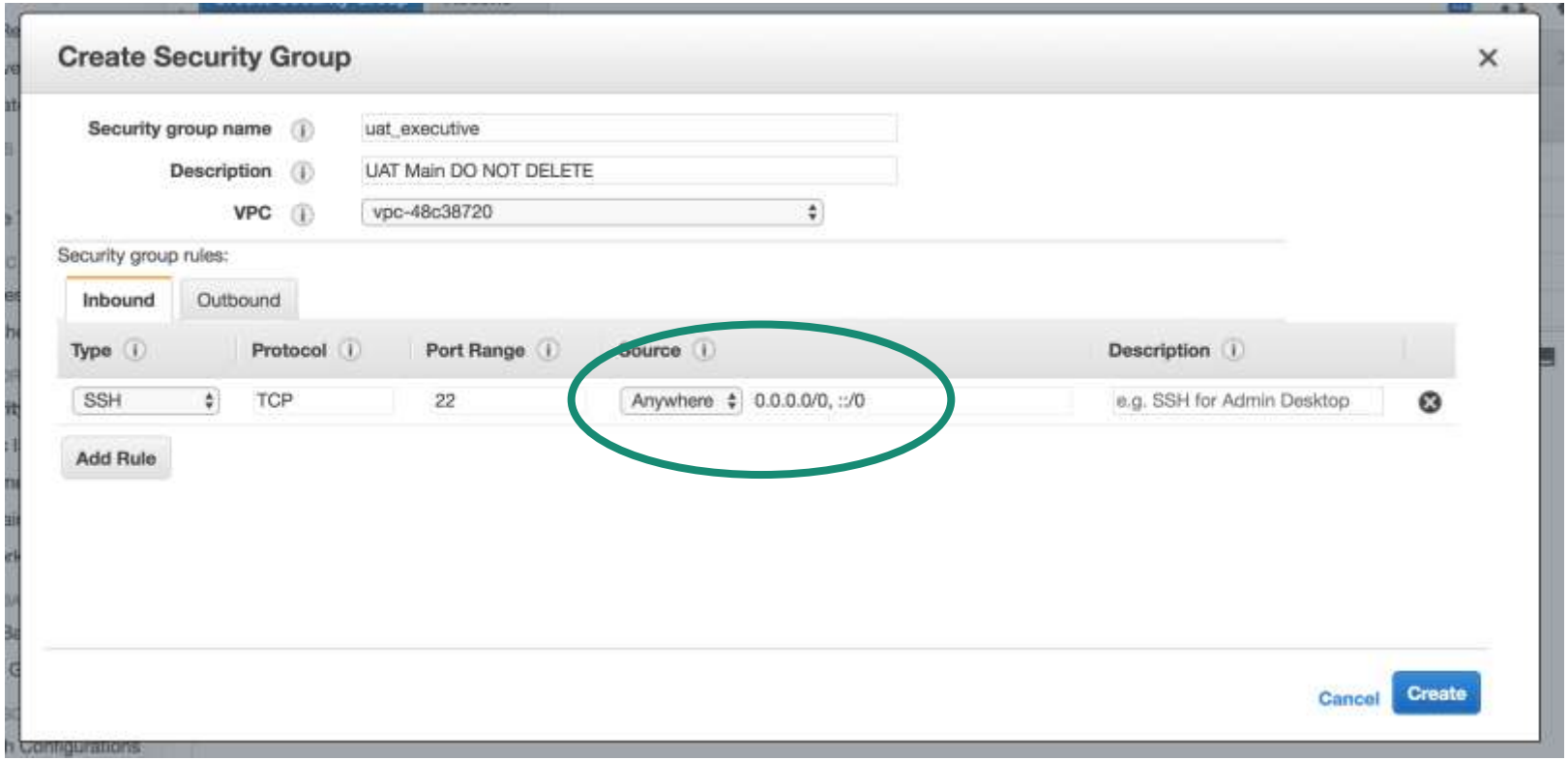
No changes. Infrastructure is up-to-date.

This means that Terraform did not detect any differences between your
configuration and real physical resources that exist. As a result, no
actions need to be performed.
```

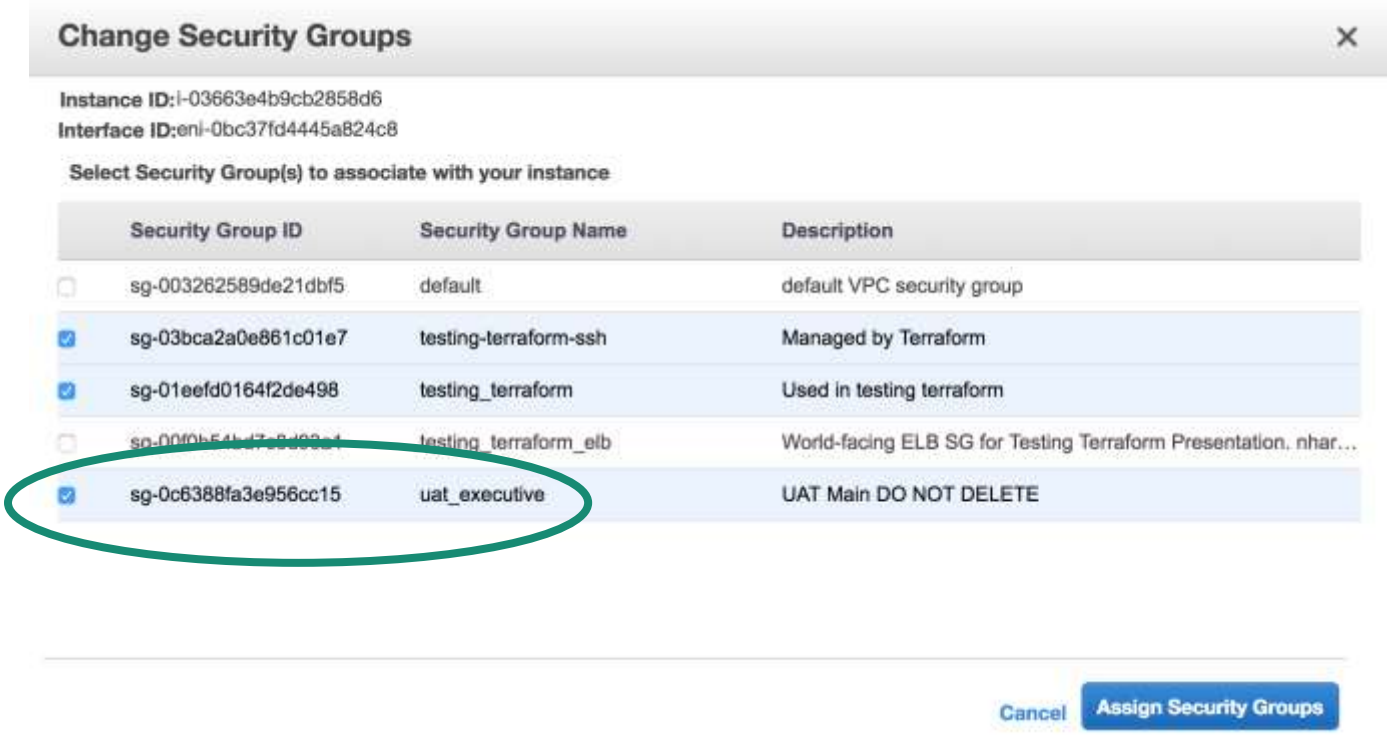
And all is well.

Meanwhile, at Team Shady….

An Innocent-Seeming Change…



An Innocent-Seeming Change…



Audit with Terraform

```
$ terraform plan
```

```
An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  ~ update in-place

Terraform will perform the following actions:

  ~ aws_instance.web[0]
      vpc_security_group_ids.#:          "3" => "2"
      vpc_security_group_ids.1298918294: "sg-01eefd0164f2de498" => "sg-01eefd0164f2de498"
      vpc_security_group_ids.35497876:   "sg-0c6388fa3e956cc15" => ""
      vpc_security_group_ids.645334896:  "sg-03bca2a0e861c01e7" => "sg-03bca2a0e861c01e7”

Plan: 0 to add, 1 to change, 0 to destroy.
```

Awesome! Terraform found the change!

Detected the new security group

Will detach it

Is that enough?

How does terraform plan fall short?

It only audits what is known in the Terraform config

All change is drift (considered bad)

Only express what you want,
not what you don't

We need something else.


INSPEC
BY CHEF™

InSpec

Turn security and compliance into code

- Translate **compliance** into Code
- **Clearly** express statements of policy
- Move risk to build/test from **runtime**
- Find issues **early**
- Write code **quickly**
- Run code **anywhere**
- **Inspect** machines, data and APIs

INSPEC

PART OF A PROCESS OF CONTINUOUS COMPLIANCE

Scan for Compliance → Build & Test Locally → Build & Test CI/CD → Remediate → Verify

A SIMPLE EXAMPLE OF AN INSPEC CIS RULE

```
control 'cis-1.4.1' do
  title '1.4.1 Enable SELinux in /etc/grub.conf'
  desc '
    Do not disable SELinux and enforcing in your GRUB
configuration. These are important security features that
prevent attackers from escalating their access to your systems.
For reference see …
    '
  impact 1.0
  expect(grub_conf.param 'selinux').to_not eq '0'
  expect(grub_conf.param 'enforcing').to_not eq '0'
end
```

@nathenharvey

InSpec Shell

```
$ inspec shell -t aws://
```

```
Welcome to the interactive InSpec Shell
To find out how to use it, type: help

You are currently running on:

    Name:      aws
    Families:  cloud, api
    Release:   aws-sdk-v2.11.50
```

InSpec Shell

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You are currently running on:

    Name:      aws
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```

Targeting AWS!

InSpec Shell – Tab Completion

```
inspec> aws_<TAB>
```

```
aws_cloudtrail_trail                aws_iam_access_keys          aws_iam_users              aws_security_group
aws_cloudtrail_trails               aws_iam_group                aws_kms_key                aws_security_groups
aws_cloudwatch_alarm                aws_iam_groups               aws_kms_keys               aws_sns_subscription
aws_cloudwatch_log_metric_filter    aws_iam_password_policy      aws_rds_instance           aws_sns_topic
aws_config_delivery_channel         aws_iam_policies             aws_route_table            aws_sns_topics
aws_config_recorder                 aws_iam_policy               aws_route_tables           aws_subnet
aws_ec2_instance                    aws_iam_role                 aws_s3_bucket              aws_subnets
aws_ec2_instances                   aws_iam_root_user            aws_s3_bucket_object       aws_vpc
aws_iam_access_key                  aws_iam_user                 aws_s3_buckets             aws_vpcs
```

Find the shady security group

```
inspec>  aws_security_group('sg-0c6388fa3e956cc15').group_name
```

```
=> "uat_executive"
```

Check the Rules

```
inspec> aws_security_group('sg-0c6388fa3e956cc15').inbound_rules
```

```
=> [{:from_port=>22,
  :ip_protocol=>"tcp",
  :ip_ranges=>[{:cidr_ip=>"0.0.0.0/0"}],
  :ipv_6_ranges=>[{:cidr_ipv_6=>"::/0"}],
  :prefix_list_ids=>[],
  :to_port=>22,
  :user_id_group_pairs=>[]}]
```

Write a proper test

```
inspec> describe aws_security_group('sg-0c6388fa3e956cc15') do
inspec>   it { should_not allow_in ipv4_range: '0.0.0.0/0' }
inspec> end
```

Write a proper test

```
inspec> describe aws_security_group('sg-0c6388fa3e956cc15') do
inspec>   it { should_not allow_in ipv4_range: '0.0.0.0/0' }
inspec> end

Profile: inspec-shell
Version: (not specified)

  EC2 Security Group sg-0c6388fa3e956cc15
     ×  should not allow in {}
     expected `EC2 Security Group sg-0c6388fa3e956cc15.allow_in?({})` to
   return false, got true

Test Summary: 0 successful, 1 failure, 0 skipped
```

An InSpec Control

security_groups.rb

```
control 'Make sure unrestricted SSH is not permitted' do
  # Loop over each of the security group IDs in the region
  aws_security_groups.group_ids.each do |group_id|
    # Examine a security group in detail
    describe aws_security_group(group_id) do
      # Examine Ingress rules, and complain if
      # there is unrestricted SSH
      it { should_not allow_in(port: 22, ipv4_range: '0.0.0.0/0') }
    end
  end
end
```

InSpec Shell

```
$ inspec exec -t aws:// secruity_groups.rb
```

```
Profile: tests from security_groups.rb (tests from security_groups.rb)
Version: (not specified)
Target:  aws://


  ×  Make sure unrestricted SSH is not permitted: EC2 Security Group sg-003262589de21dbf5 (15
failed)
     ✓  EC2 Security Group sg-003262589de21dbf5 should not allow in {}
     ✓  EC2 Security Group sg-00f0b54bd7c8d93a1 should not allow in {}
     ×  EC2 Security Group sg-0c6388fa3e956cc15 should not allow in {}
     expected `EC2 Security Group sg-0c6388fa3e956cc15.allow_in?({})` to return false, got
true
...


Profile Summary: 0 successful controls, 1 control failure, 0 controls skipped
Test Summary: 4 successful, 15 failures, 0 skipped
```

Where to next?

What else to validate?

Concern	Terraform Plan	InSpec
Number and type of instances requested	✓	✓
All instances are part of our app		✓
Right security groups created and attached	✓	✓
No security group allows in SSH		✓
Only security group open to the world should be port 80 for the ELB		✓
ELB correctly configured	✓	✓
Should only be one ELB		✓

Check instances

instances.rb

```
control "Should only have instances associated with my app" do
  aws_ec2_instances.instance_ids.each do |instance_id|
    describe aws_ec2_instance(instance_id) do
      its('instance_type') { should cmp 't2.micro' }
      its('tags') { should include(key:'X-Application', value:'Testing Terraform') }
       end
    end
end
```

More Security Groups

security_groups.rb

```
control "The only world-open security groups should be on the ELB" do
  elb_sg_ids = aws_elbs.security_group_ids
  aws_security_groups.group_ids.each do |sg_id|
    sg = aws_security_group(sg_id)
    if sg.allow_in? ipv4_range: '0.0.0.0/0'
      describe sg do
        its('group_id') { should be_in elb_sg_ids }
        it { should allow_in_only port: 80 }
          end
        end
    end
end
```

Put it all together with a profile

```
$ inspec init profile my_app
```

```
Create new profile at /Users/nathenharvey/projects/nathenharvey/testing-
terraform/inspec/profiles/my_app
 * Create directory libraries
 * Create file README.md
 * Create directory controls
 * Create file controls/example.rb
 * Create file inspec.yml
 * Create file libraries/.gitkeep
```

Put it all together with a profile

```
$ inspec exec -t aws:// my_app
```

```
Profile: tests from security_groups.rb (tests from security_groups.rb)
Version: (not specified)
Target:  aws://


  ×  Make sure unrestricted SSH is not permitted: EC2 Security Group sg-003262589de21dbf5 (15
failed)
     ✓  EC2 Security Group sg-003262589de21dbf5 should not allow in {}
     ✓  EC2 Security Group sg-00f0b54bd7c8d93a1 should not allow in {}
     ×  EC2 Security Group sg-01b504b800f32e1ff should not allow in {}
     expected `EC2 Security Group sg-01b504b800f32e1ff.allow_in?({})` to return false, got
true
...
Profile Summary: 0 successful controls, 3 control failures, 0 controls skipped
Test Summary: 43 successful, 65 failures, 0 skipped
```

Terraform and InSpec?

Terraform: A Power Tool for the Cloud!

InSpec: A Verification tool for OS's and API's

Terraform and InSpec!

Terraform: A Power Tool for the Cloud!

InSpec: A Verification tool for OS's and API's

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Bonus Round

Iggy

Install InSpec-Iggy

```
$   gem install inspec-iggy
```

```
  Successfully installed inspec-iggy-0.2.0
  1 gem installed
```

Create a Profile from tfstate file

```
$    inspec terraform generate --tfstate terraform.tfstate > my_terra.rb
```

Run InSpec

```
$   inspec exec -t aws:// my_terra.rb
```

```
inspec exec -t aws:// my_terra.rb

Profile: tests from my_terra.rb (tests from my_terra.rb)
Version: (not specified)
Target:  aws://

  ✓  aws_ec2_instance::i-03663e4b9cb2858d6: Iggy terraform.tfstate
  aws_ec2_instance::i-03663e4b9cb2858d6
     ✓  EC2 Instance i-03663e4b9cb2858d6 should exist
...
Profile Summary: 8 successful controls, 0 control failures, 0 controls skipped
Test Summary: 32 successful, 0 failures, 0 skipped
```

Join us on Slack!

- http://community-slack.chef.io
- `#general` (for Chef stuff)
- `#inspec`

What questions can I answer for you?

https://github.com/nathenharvey/testing-terraform

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