Automate All The Things!

Automate all the Things!

https://consensus.enterprises

Colan Schwartz (colan on d.o)

Christopher Gervais (ergonlogic on d.o)

Dan Friedman (llamech on d.o)

- ★ Veteran open source programmers and sysadmins
- ★ Specializing in Drupal™ and ÆGIR
- ★ Experts in end-to-end application lifecycle
- ★ Focus on social enterprises, non-profits, and public sector

Some of our Partnerships

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Health Canada

Registered Nurses' Association of Ontario
L'Association des infirmières et infirmiers autorisés de l'Ontario

Statistics Canada

Public Works and Government Services Canada

CANADIAN PUBLIC HEALTH ASSOCIATION

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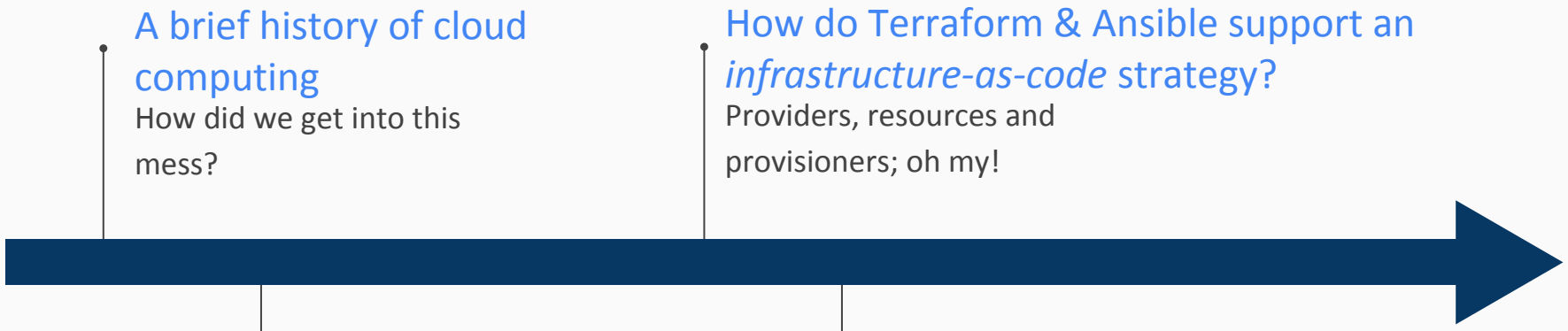
What we'll discuss



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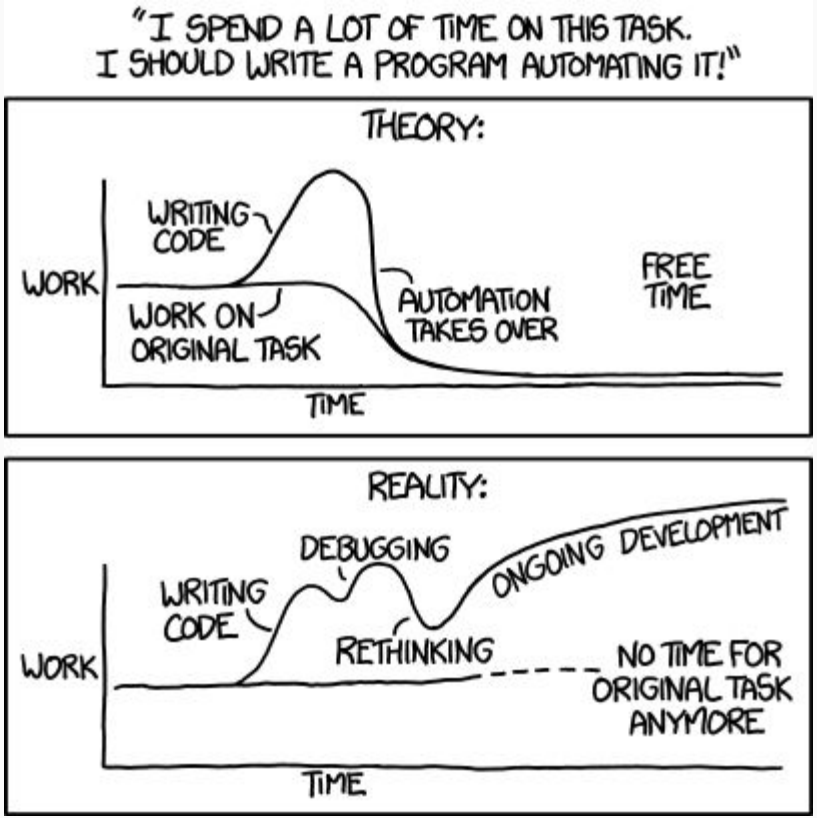
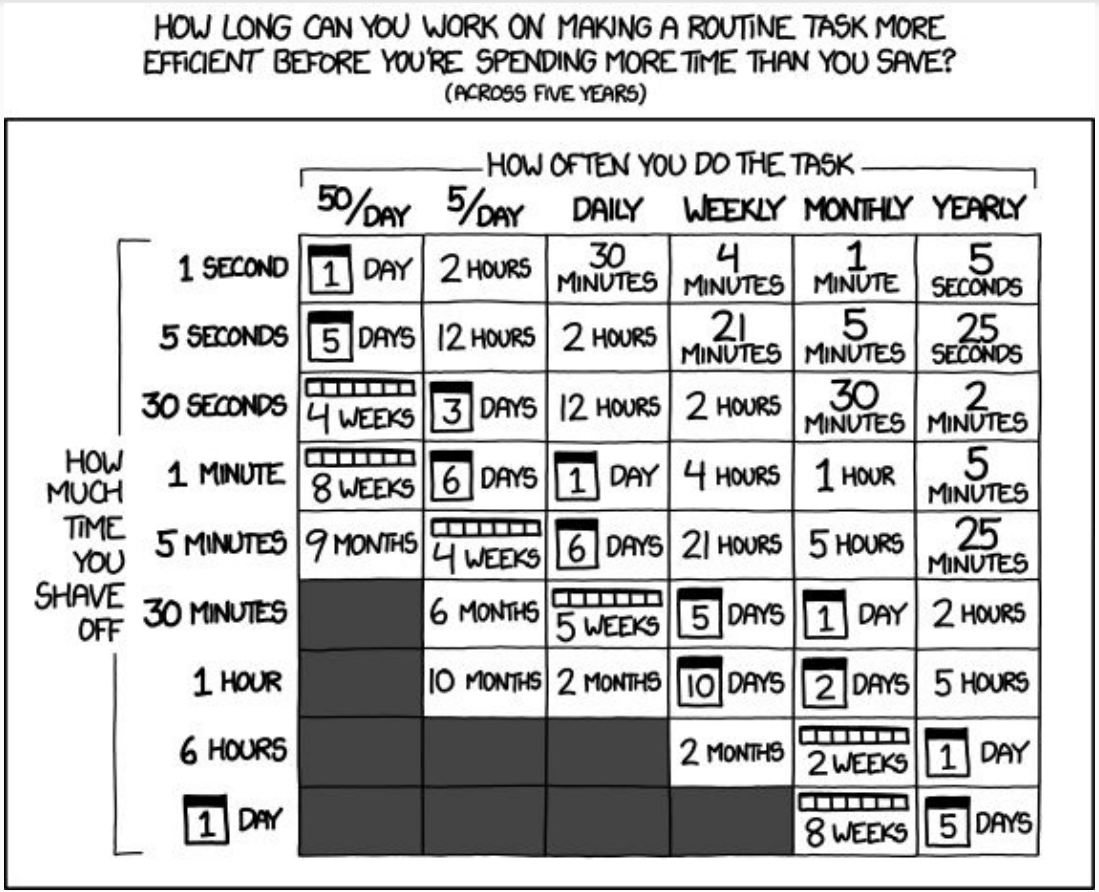
XKCD

… because, somehow, a webcomic provides the most succinct descriptions of the reality of automation.



You can never have too much *XKCD*!



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A Brief history of Cloud Computing

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- **Time-sharing**
  (government/academic)

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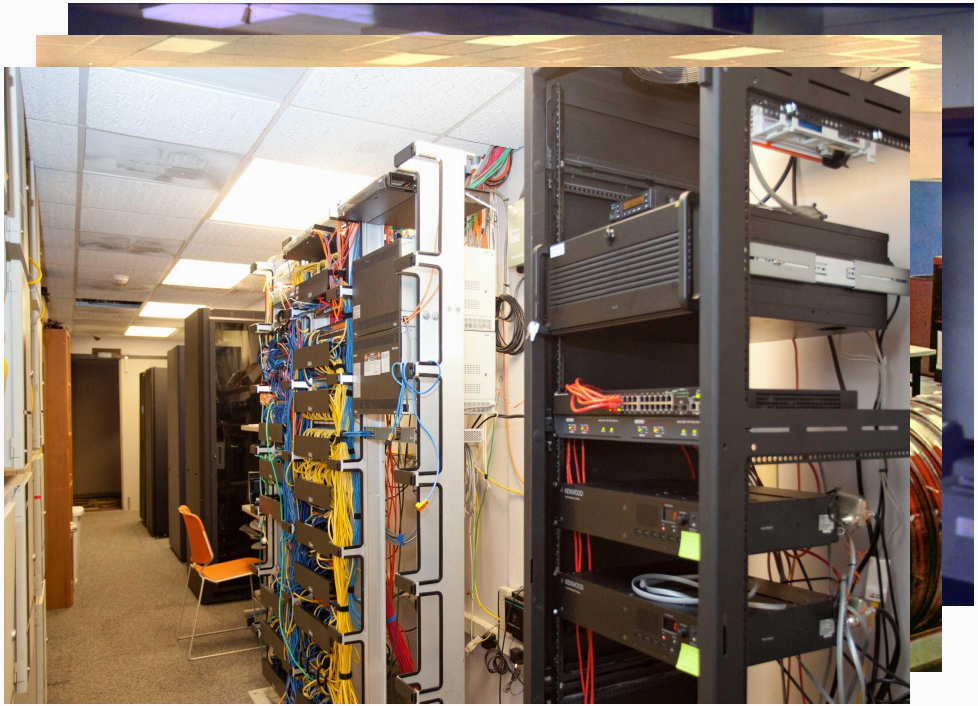

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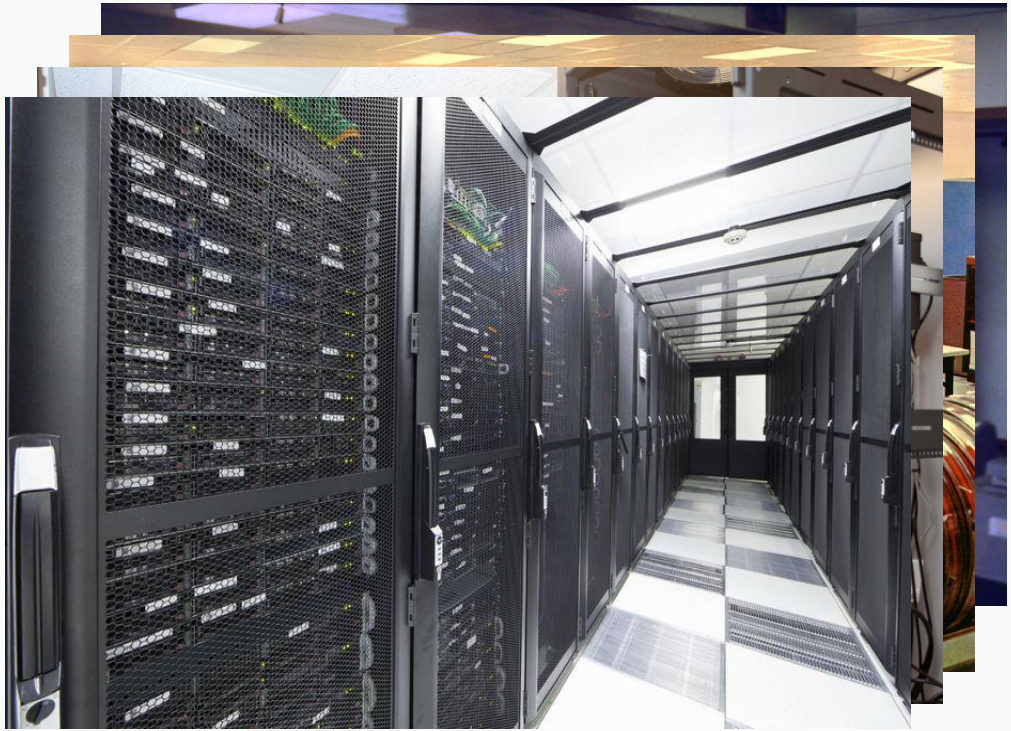

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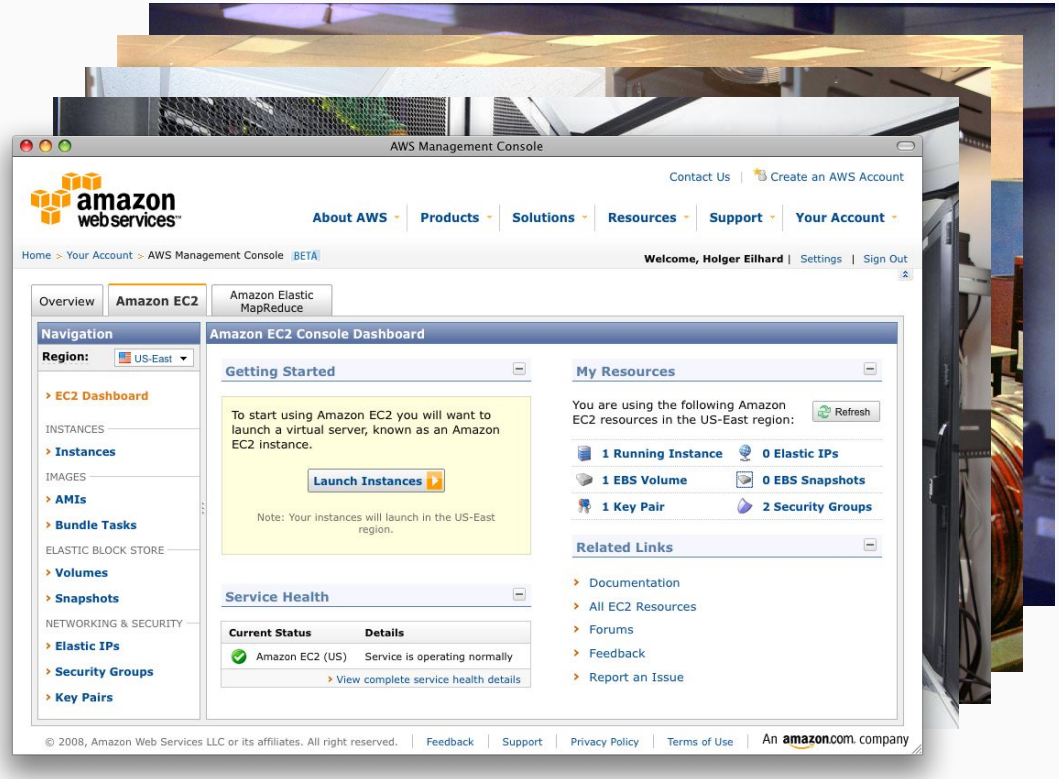
- **Cloud**
  (utility computing)



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The era of cloud computing

Benefits	Challenges
Scalability	Controlling costs

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The era of cloud computing

Benefits	Challenges
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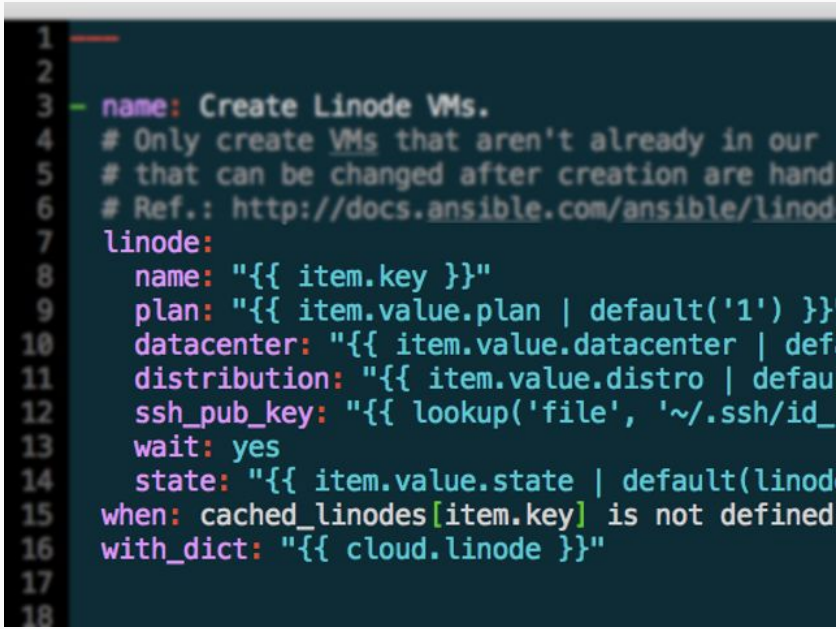
Flexibility	Increased complexity
Automation	Scarce expertise

Principles and Practices of *infrastructure-as-code*

Automate All the Things!

Infrastructure-as-code Practices

- **Define resources in code**
  (avoid snowflake servers)



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Infrastructure-as-code Practices

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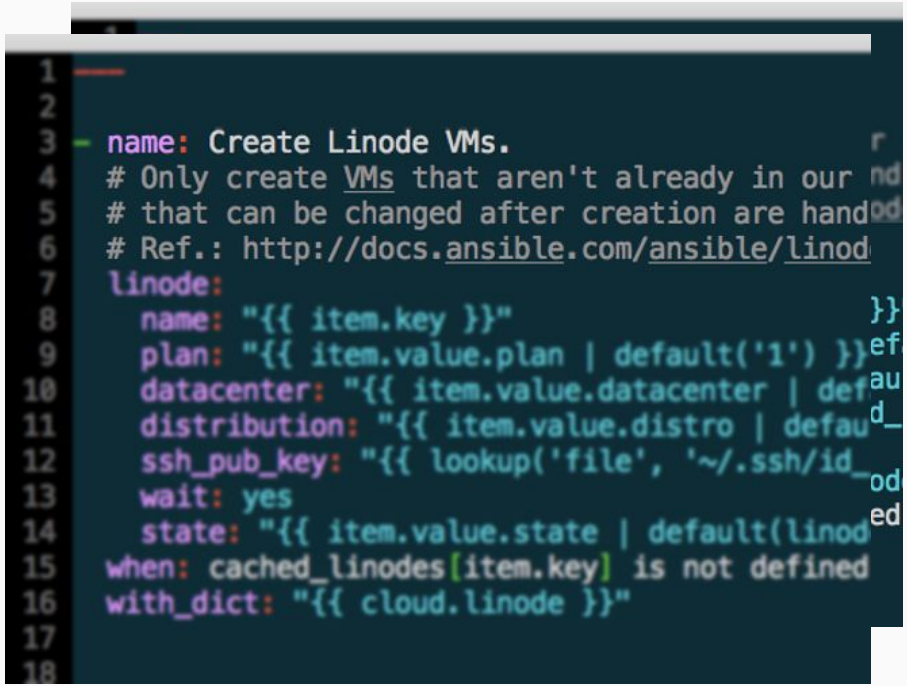

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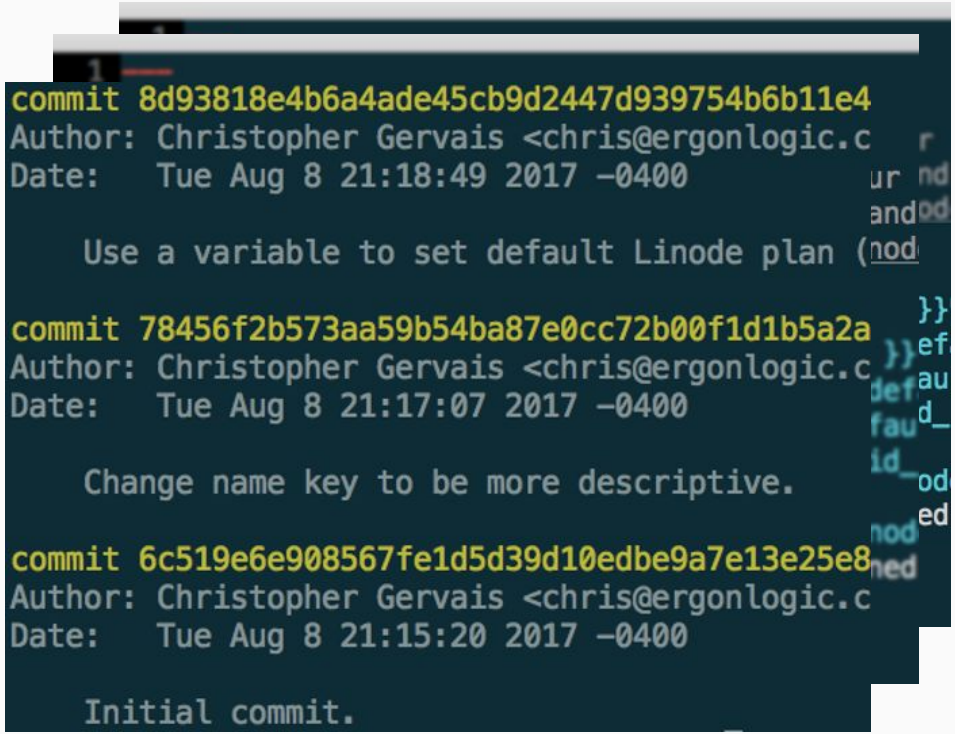

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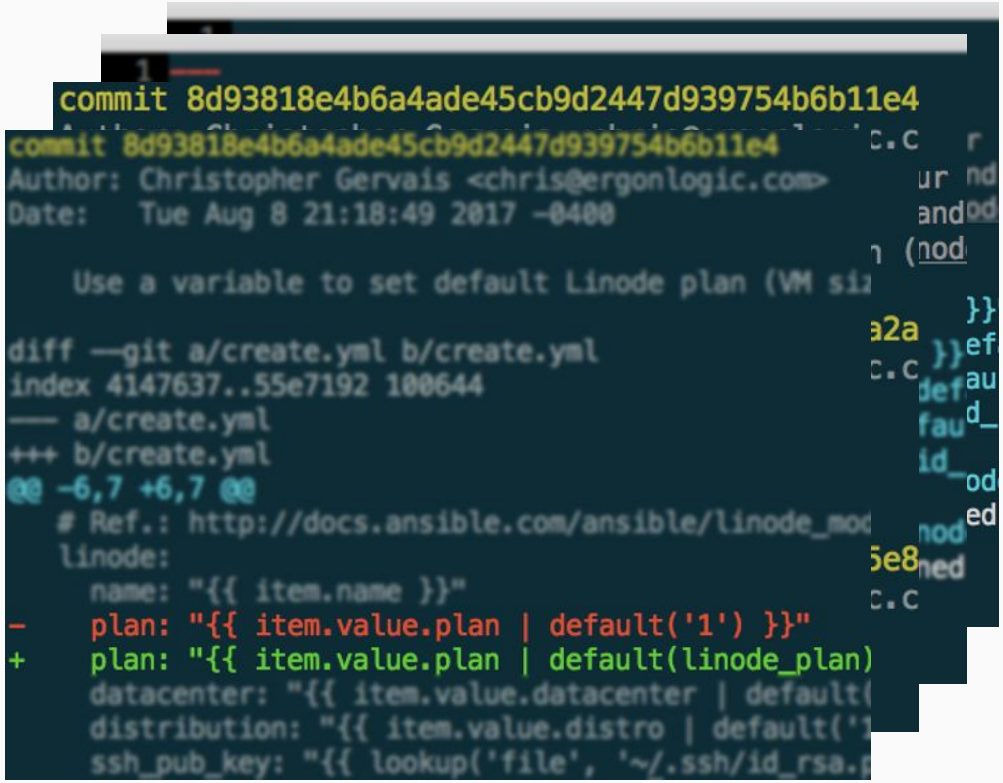

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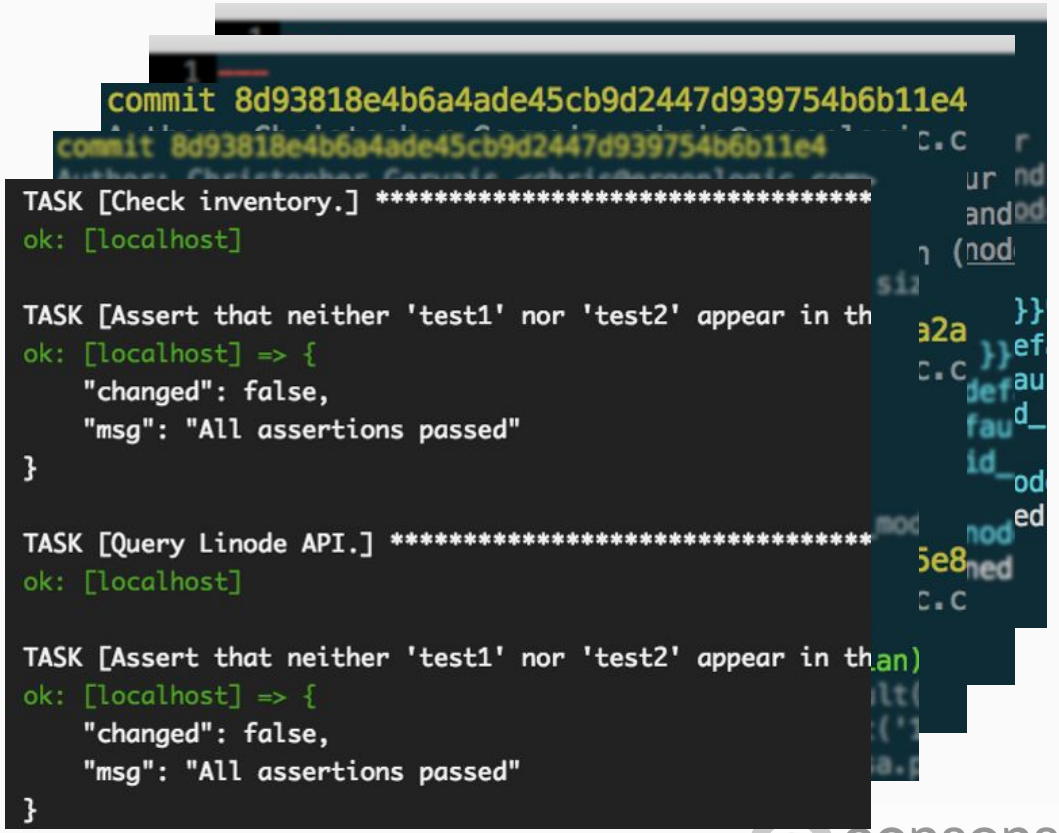
- **Test continuously**
  (fail early)



How do Terraform and Ansible support an *infrastructure-as-code* strategy?

Automate All the Things!

How does Terraform support an *infrastructure-as-code* strategy?

Terraform allows us to define infrastructure components in files written in Terraform language syntax.

These files can, in turn, be committed into version control, and thus handled as software.

```
resource "openstack_compute_instance_v2" "gateway" {
  count = 1
  name = "gateway${count.index}"
  image_id        = var.compute_image_id
  flavor_id       = var.compute_flavor_id_smallest
  key_pair        = "my-keypair"
  security_groups = ["vpn"]
  network {
    name = "Main network"
  }
  depends_on = [
    openstack_networking_secgroup_v2.vpn,
  ]
}
```

Components

Custom *infrastructure-as-code* configuration depends on Terraform providers and resources, which in turn depend on Go, which Terraform is written in.

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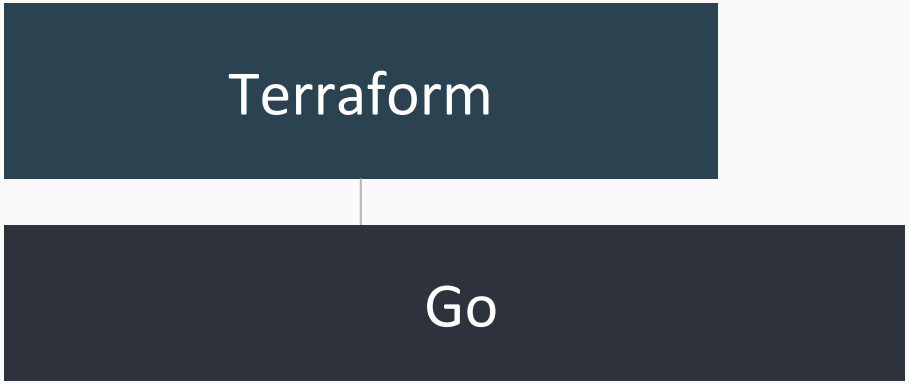

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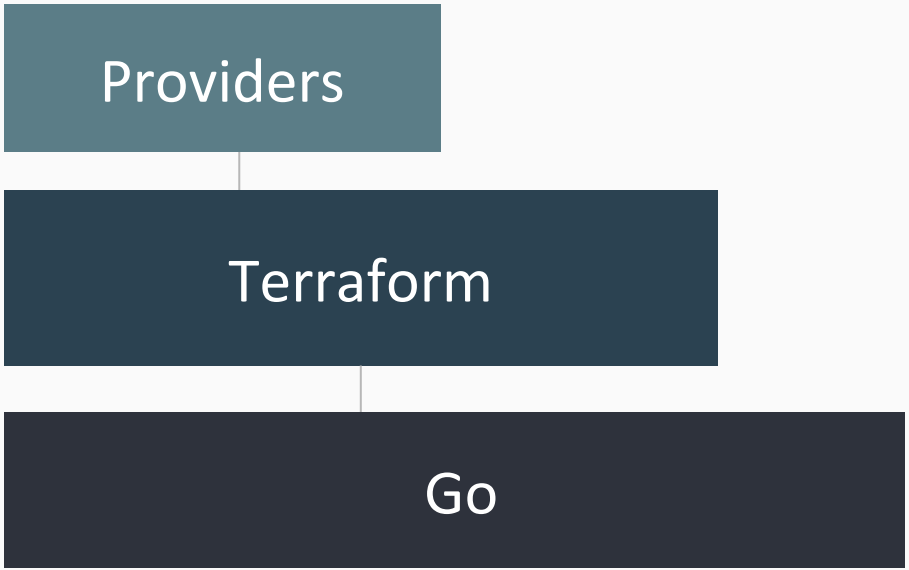

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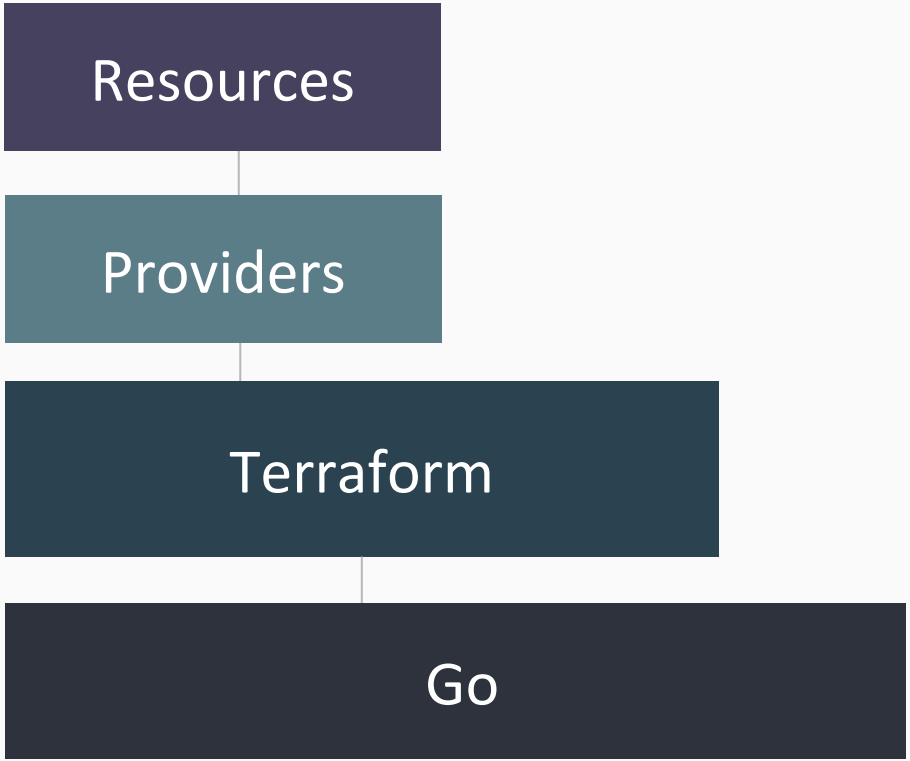

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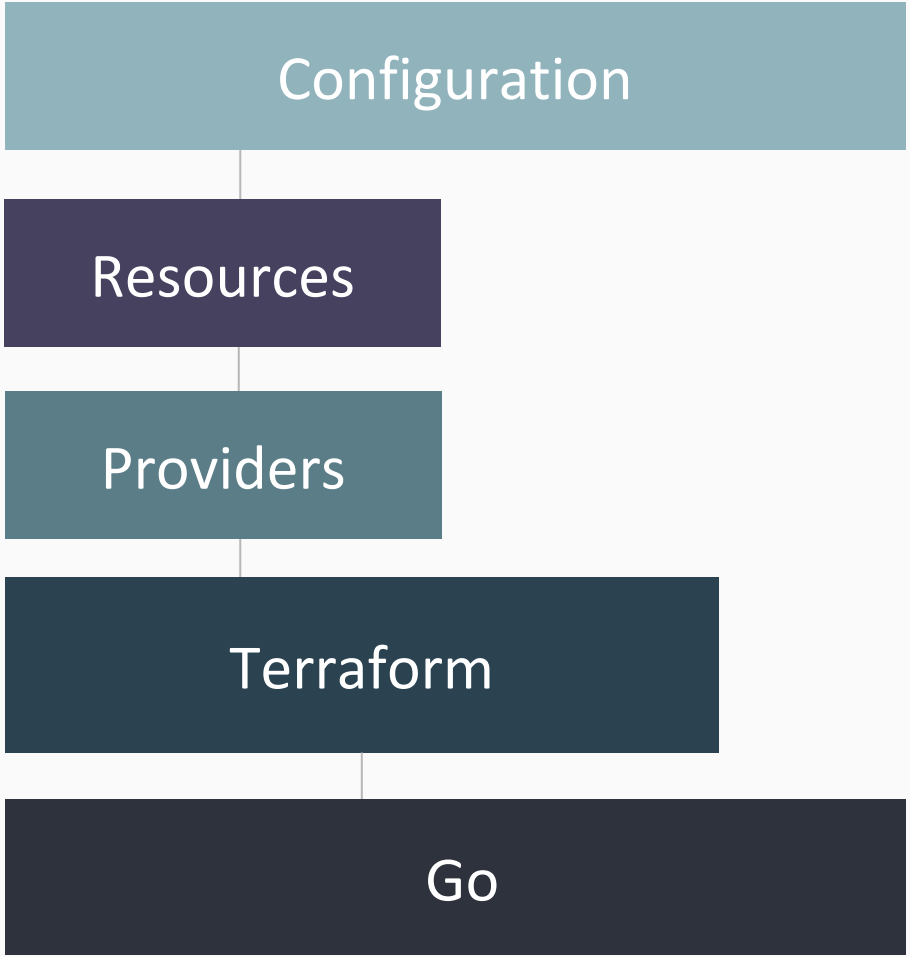

Terraform Providers

A provider is responsible for understanding API interactions and exposing resources (things you want to create). Examples of providers are OpenStack, AWS, Azure, GCP, Digital Ocean, etc.

```
provider "openstack" {
  # Use the BC data centre's resources generally, as they're cheaper.
  auth_url = var.compute_auth_url
  region = var.compute_region_name
  # Authentication variables taken from environment after running your
  # OpenStack RC file, which authenticates a bash shell session to access the
  # APIs. Download it from https://dash.ca-bc-1.clouda.ca/project/api_access/.
}
```

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That’s how many different cloud providers Terraform supports out-of-the-box. For details, see the list of providers in the Terraform Registry.

Terraform Resources

A resource is a thing you want to create at your cloud provider. Examples of resources are security groups, VMs, and networking elements such as routers and floating IP addresses.

```
resource "openstack_compute_instance_v2" "gateway" {
  count = 1
  name = "gateway${count.index}"
  image_id        = var.compute_image_id
  flavor_id       = var.compute_flavor_id_smallest
  key_pair        = "my-keypair"
  security_groups = ["vpn"]
  network {
    name = "Main network"
  }
  depends_on = [
    openstack_networking_secgroup_v2.vpn,
  ]
}
```

Terraform Variables

Just like in other types of code, variables can be used.

Format: **var.VARIABLE_ID**

```
variable "compute_image_id" {
  # `openstack image list` -> Ubuntu 18.04 x86_64 (05/31/2018)
  default = "d0daa92c-d1cd-4bbb-a2b5-0c28fb4dfe85"
}
variable "compute_flavor_id_smallest" {
  # `openstack flavor list` -> 512 MB / 1 VCPU
  default = "0e10af5c-231b-40d7-b786-b5eeb170dea1"
}
```

Security Groups

Good cloud providers will have firewall rules allowing access to resources, which act as an allow list preventing insecure access (e.g. to your DB servers).

- Rule groups can be created
- Rules can be added to each group

```
resource "openstack_networking_secgroup_v2" "web" {
  name        = "web"
  description = "Web servers"
}

resource "openstack_networking_secgroup_rule_v2" "http_connections" {
  direction         = "ingress"
  ethertype         = "IPv4"
  protocol          = "tcp"
  port_range_min    = 80
  port_range_max    = 80
  remote_ip_prefix  = "0.0.0.0/0"
  security_group_id = openstack_networking_secgroup_v2.web.id
}

resource "openstack_networking_secgroup_rule_v2" "https_connections" {
  direction         = "ingress"
  ethertype         = "IPv4"
  protocol          = "tcp"
  port_range_min    = 443
  port_range_max    = 443
  remote_ip_prefix  = "0.0.0.0/0"
  security_group_id = openstack_networking_secgroup_v2.web.id
}
```

Defining VMs/servers

Using everything we've learned so far, it's possible to configure virtual machines (VMs) to be whatever server types are required.

```
resource "openstack_compute_instance_v2" "gateway" {
  count = 1
  name = "gateway${count.index}"
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```

Configuring VMs from within Terraform

While infrastructure automation can be handled by Terraform, VM configuration can be handled by Ansible.

They can work together in several ways:

- Terraform can run Ansible playbooks. ← *Today's demo*
- Ansible can run Terraform code.
- Terraform can provide a dynamic inventory of VMs that can be used independently by Ansible.

Configuring VMs from within Terraform

```
resource "null_resource" "provision_wireguard_on_gateway" {
  depends_on = [openstack_compute_floatingip_associate_v2.public_ip_gateway0]
  connection {
    type = "ssh"
    user = "ubuntu"
    host = openstack_networking_floatingip_v2.floating_ip_gateway0.address
  }

  # Run the Ansible role to install the app.
  provisioner "local-exec" {
    command = "export ANSIBLE_STDOUT_CALLBACK=debug; ansible-playbook -vv --inve
ntory ${openstack_networking_floatingip_v2.floating_ip_gateway0.address}, --extr
a-vars 'skip_host_key_validation=true' vpn-server.yml"
    working_dir = "../playbooks/hosts"
  }
}
```

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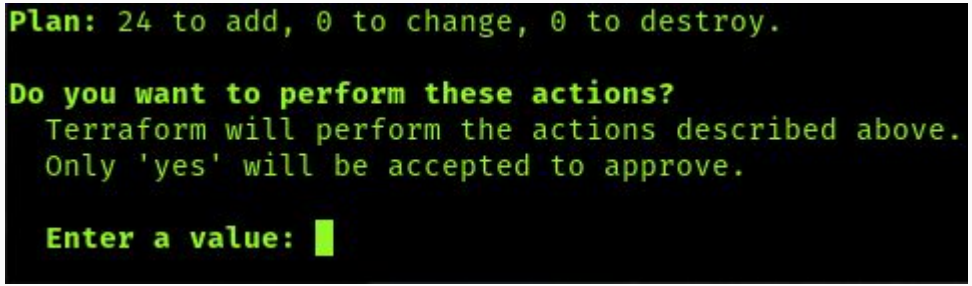
Applying defined infrastructure (& deleting it)

terraform apply commits defined infrastructure by making changes necessary to actualize the desired state.

terraform destroy removes all defined infrastructure *managed by Terraform*.



Saving State

In order keep track of IDs and other metadata, Terraform saves state. Traditionally, this was stored locally, but for enterprise/team settings, remote backends can now be used.

```
terraform {
  backend "swift" {
    container         = "terraform-state"
    archive_container = "terraform-state-archive"
    # Use the NS data centre's object store (as that's the only one).
    auth_url = "https://keystone.ca-ns-1.clouda.ca:8443/v2.0"
    region_name = "regionOne"
  }
}
```

How does Ansible support an *infrastructure-as-code* strategy?

Ansible allows us to define configuration in a simple YAML syntax.

These files can, in turn, be committed into version control, and thus handled as software.

```
- name: Create a Linode server.
  linode:
    name: linode-test1
    plan: 1
    datacenter: 2
    distribution: 99
    password: 'secureRootPassword'
    private_ip: yes
    ssh_pub_key: 'ssh-rsa qwerty'
    swap: 768
    wait: yes
    wait_timeout: 600
    state: present
```

Components

Applying configuration depends on Ansible, roles and modules, which in turn depend on various Python libraries.

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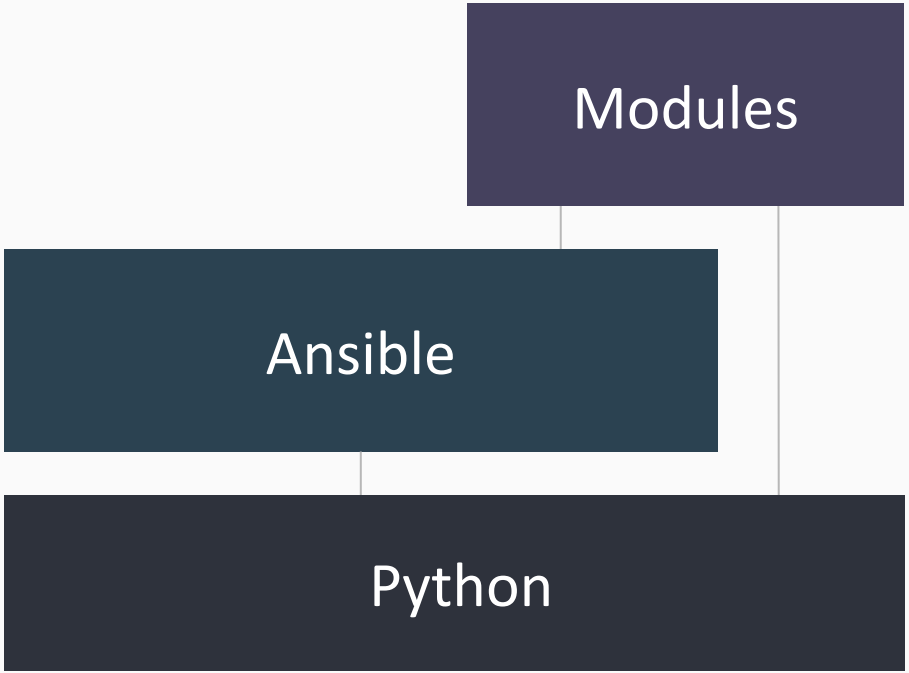

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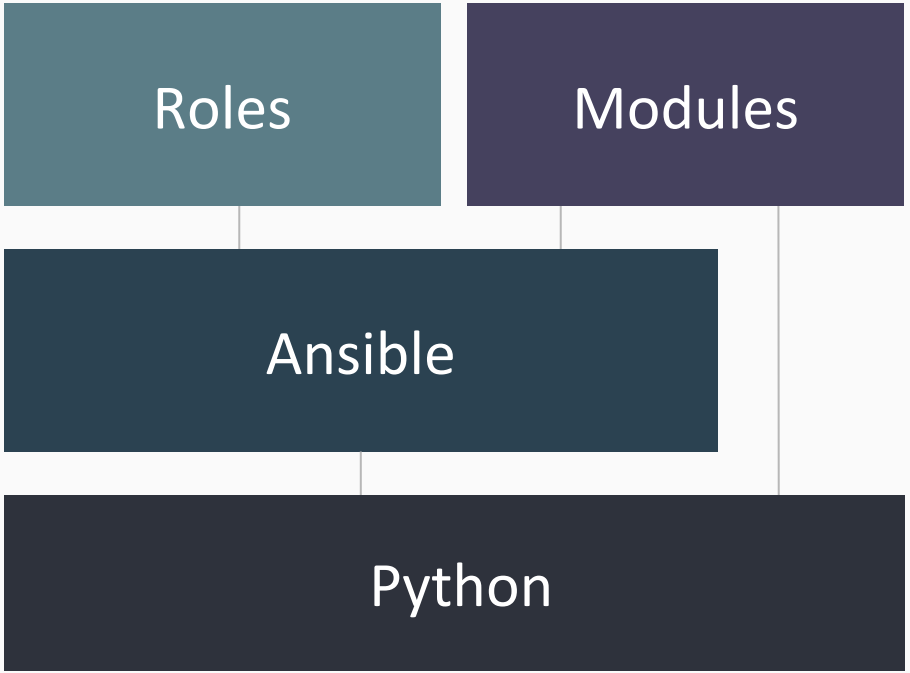

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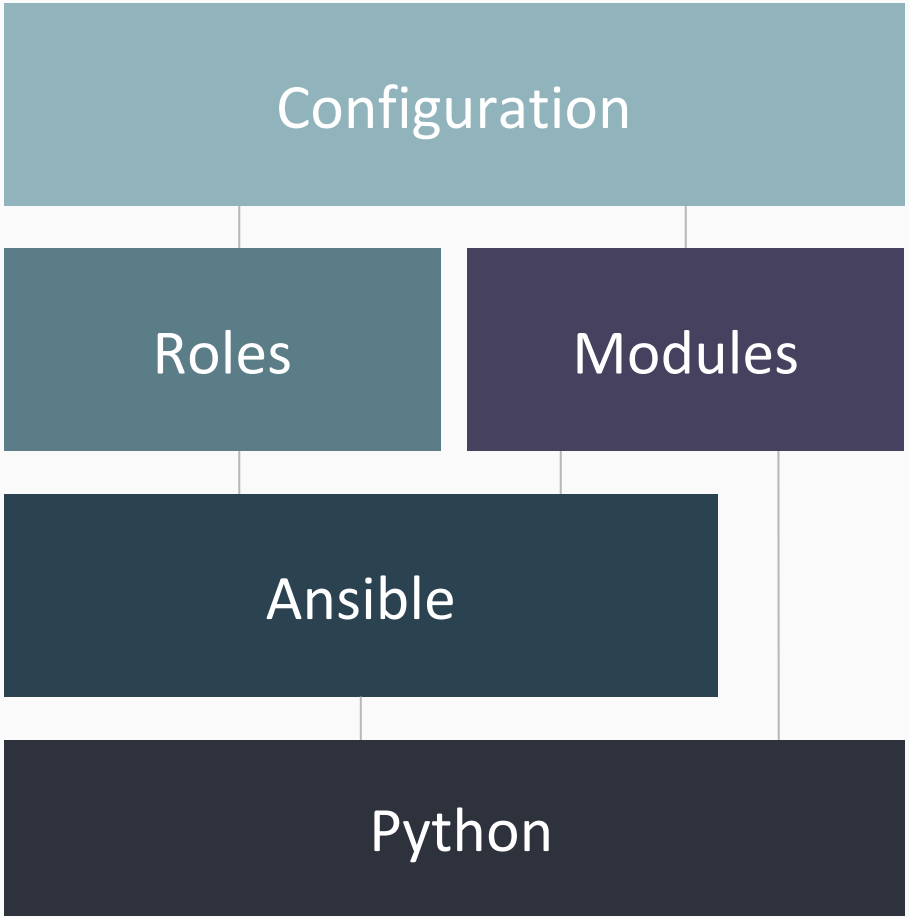


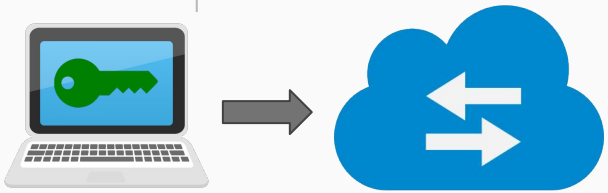
Authentication and Authorization

Authentication and Authorization

Step 1

User triggers

API call



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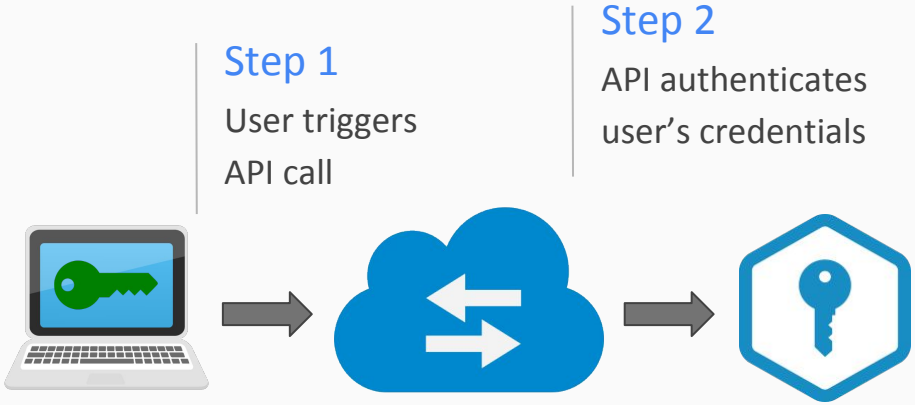

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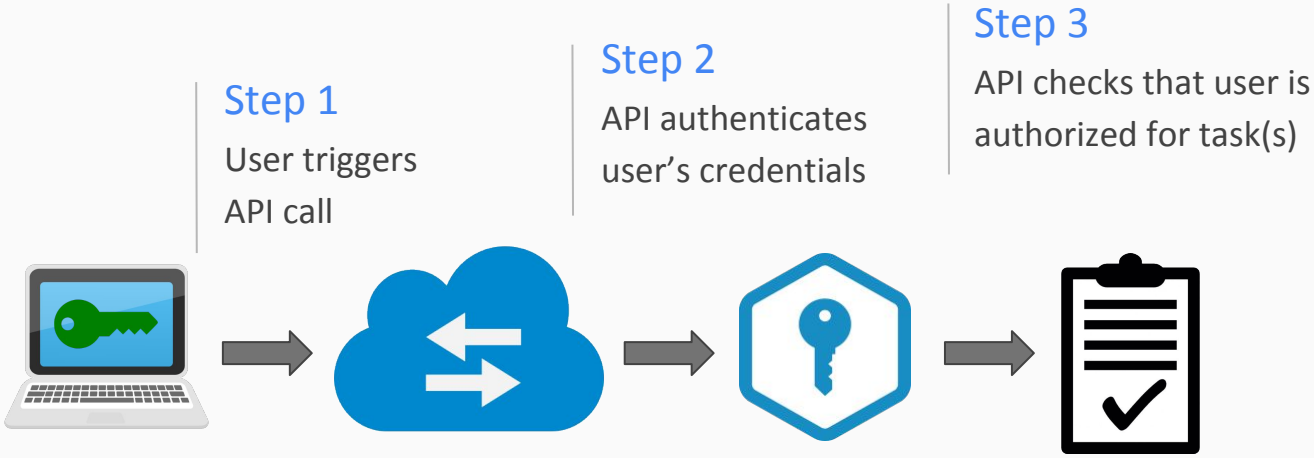
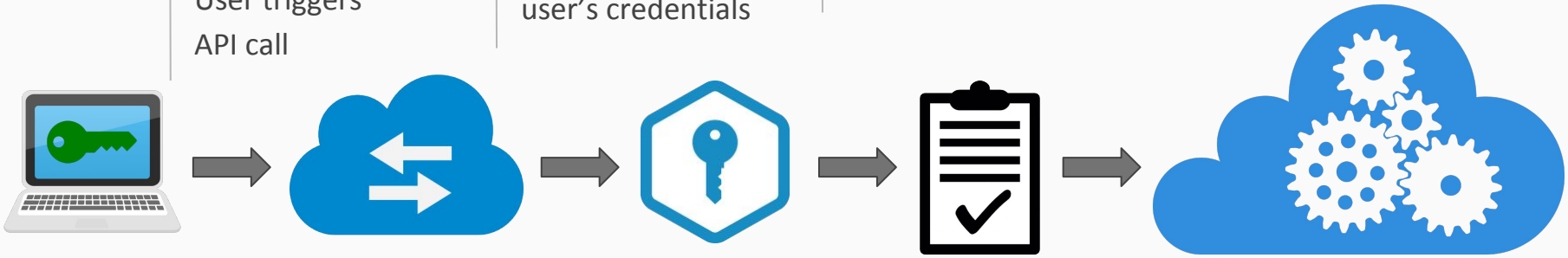


Authentication and Authorization (Terraform)



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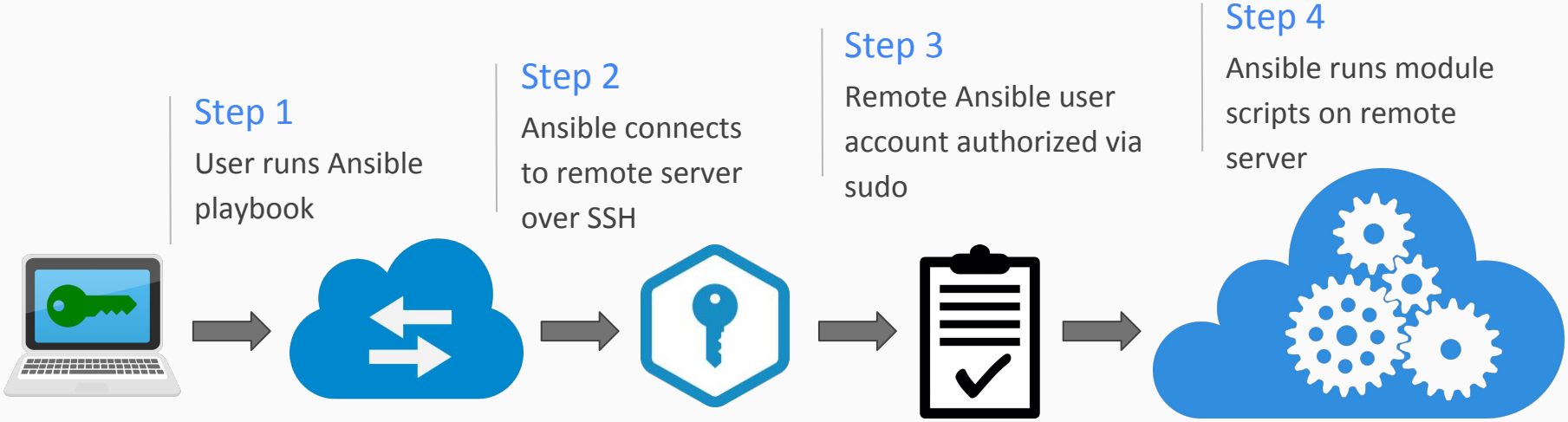

Putting It All Together

Automate All the Things!

Questions?

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