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Let’s go

#CiscoLive

The bridge to possible

Getting Started with IaC and Terraform

Have No Fear, HCL is Here!

Quinn Snyder | Technical Advocate, Cisco Learning and Certifications
@qsnyder

CISCOU-1004

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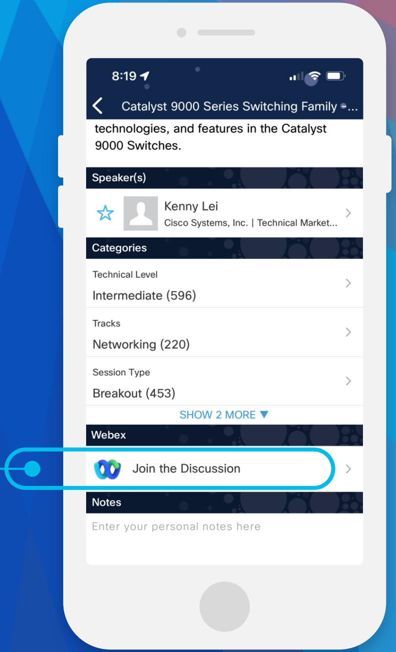
8:19
Catalyst 9000 Series Switching Family ...
technologies, and features in the Catalyst 9000 Switches.
Speaker(s)
Kenny Lei
Cisco Systems, Inc. | Technical Market...
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Agenda

- Introduction, Background
- Terraform Workflow
- HCL Syntax, Control
- Demo
- Wrap-Up

“The act of managing and provisioning computer datacenters through machine readable definition files, rather than interactive configuration tools.”

~ Wikipedia Entry on IaC

Terraform background

HashiCorp

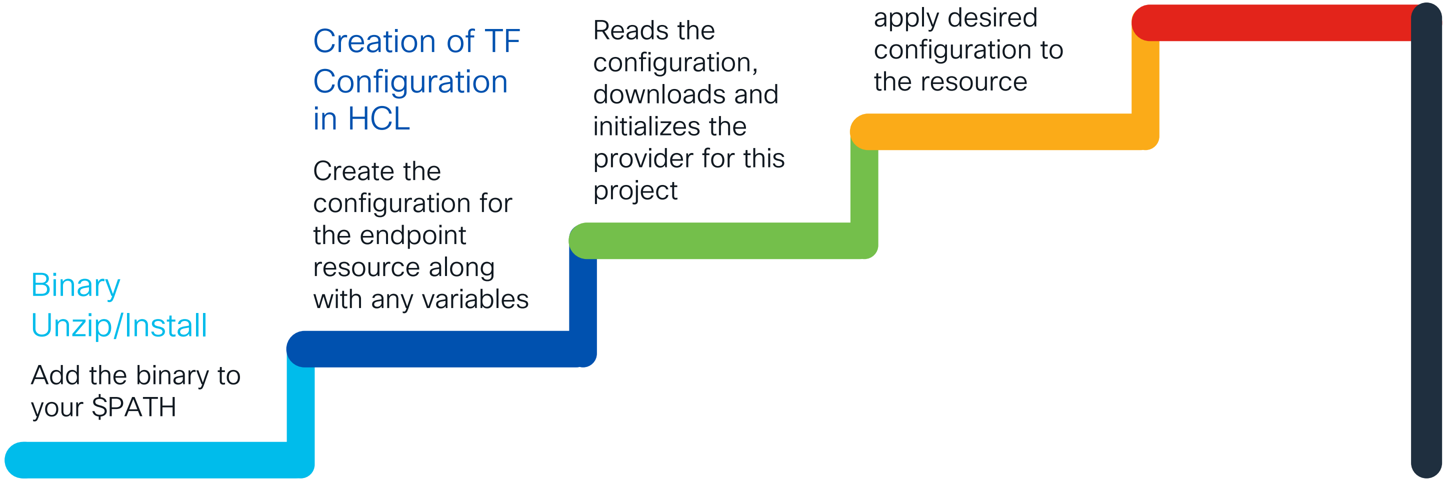
Developed by HashiCorp; initial release in July 2014

Designed to be a full Infrastructure as Code (IaC) management tool for datacenters

Completely written in Go, creating a single binary file

Fully declarative leveraging HashiCorp Configuration Language (HCL). Requires “provider” for target system/controller to be configured.

Typical Terraform workflow



Binary Unzip/Install

Add the binary to your $PATH

Creation of TF Configuration in HCL

Create the configuration for the endpoint resource along with any variables

Terraform Init

Reads the configuration, downloads and initializes the provider for this project

Terraform Plan

Determines the delta and steps to apply desired configuration to the resource

Terraform Apply

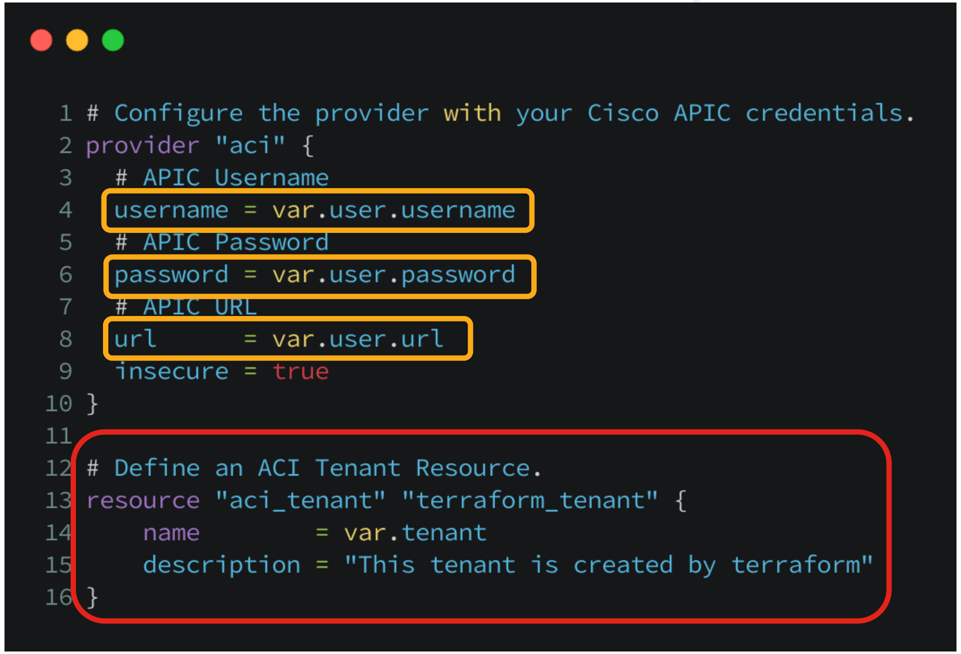
Applies the steps created from running the `plan` command

Terraform Destroy

Removes the configured state as defined within the HCL file

HashiCorp Configuration Language (HCL)

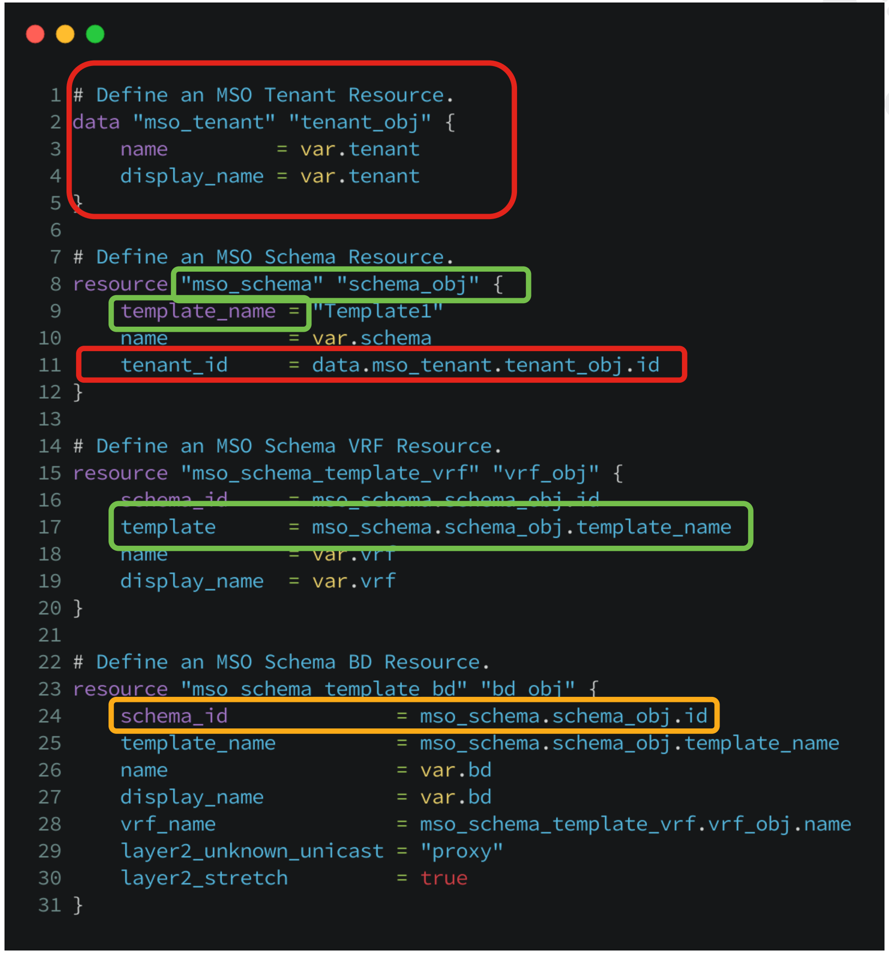
- JSON-ish in structure
- Composed of arguments and blocks
  - Arguments assign values to variables/attributes
  - Blocks serve as containers for other values and/or blocks (think: YANG style “containers”)
- Assignments for arguments can be static or set using variables



```
# Configure the provider with your Cisco APIC credentials.
provider "aci" {
  # APIC Username
  username = var.user.username
  # APIC Password
  password = var.user.password
  # APIC URL
  url      = var.user.url
  insecure = true
}

# Define an ACI Tenant Resource.
resource "aci_tenant" "terraform_tenant" {
    name        = var.tenant
    description = "This tenant is created by terraform"
}
```

HCL basics

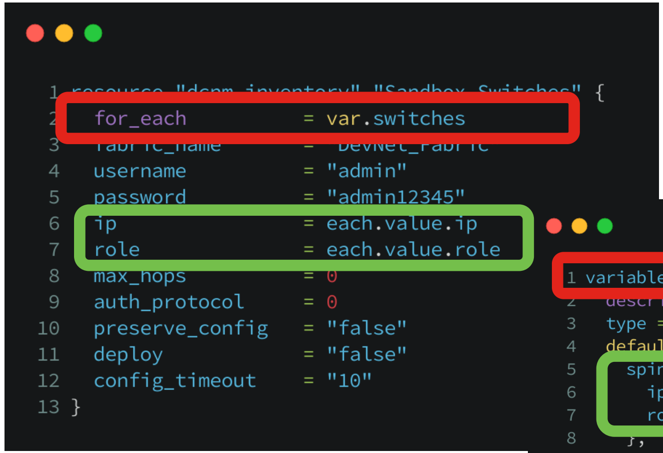
- All HCL plans of similar structure
- Possible to "read-in" for reuse without config
- Note the dotted notation nesting for relationships
- Sometimes variables are exposed without being declared as part of the provider



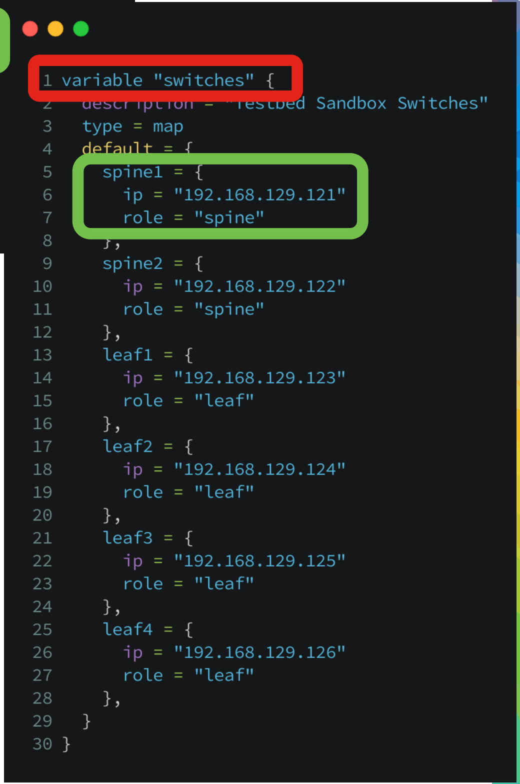
```
# Define an MSO Tenant Resource.
data "mso_tenant" "tenant_obj" {
    name         = var.tenant
    display_name = var.tenant
}

# Define an MSO Schema Resource.
resource "mso_schema" "schema_obj" {
    template_name = "Template1"
    name          = var.schema
    tenant_id     = data.mso_tenant.tenant_obj.id
}

# Define an MSO Schema VRF Resource.
resource "mso_schema_template_vrf" "vrf_obj" {
    schema_id     = mso_schema.schema_obj.id
    template      = mso_schema.schema_obj.template_name
    name          = var.vrf
    display_name  = var.vrf
}

# Define an MSO Schema BD Resource.
resource "mso_schema_template_bd" "bd_obj" {
    schema_id              = mso_schema.schema_obj.id
    template_name          = mso_schema.schema_obj.template_name
    name                   = var.bd
    display_name           = var.bd
    vrf_name               = mso_schema_template_vrf.vrf_obj.name
    layer2_unknown_unicast = "proxy"
    layer2_stretch         = true
}
```

HCL basics

- "Programmatic things" are limited similar to Ansible
- "For" loops defined by referencing top-level variable
- References to inner variables done through similar notation to "`with_items`" in Ansible; inner key-value assignments referenced in `main.tf`



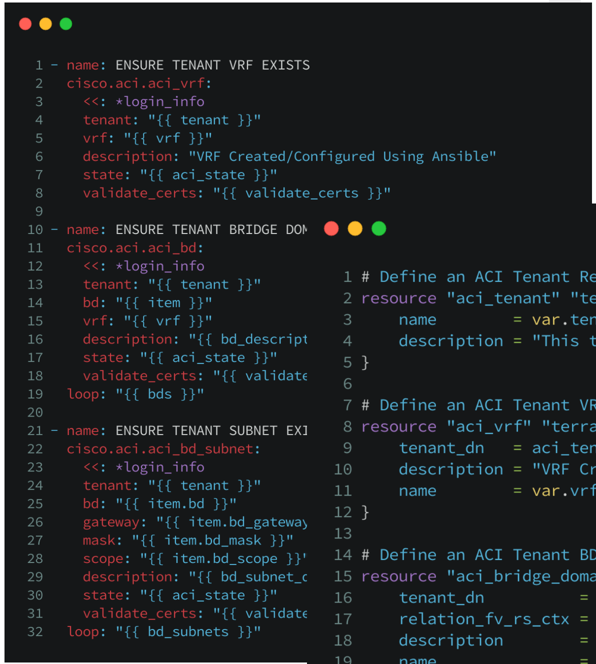
```
resource "dcnm_inventory" "Sandbox_Switches" {
  for_each                = var.switches
  fabric_name             = "DevNet_Fabric"
  username                = "admin"
  password                = "admin12345"
  ip                      = each.value.ip
  role                    = each.value.role
  max_hops                = 0
  auth_protocol           = 0
  preserve_config         = "false"
  deploy                  = "false"
  config_timeout          = "10"
}
```



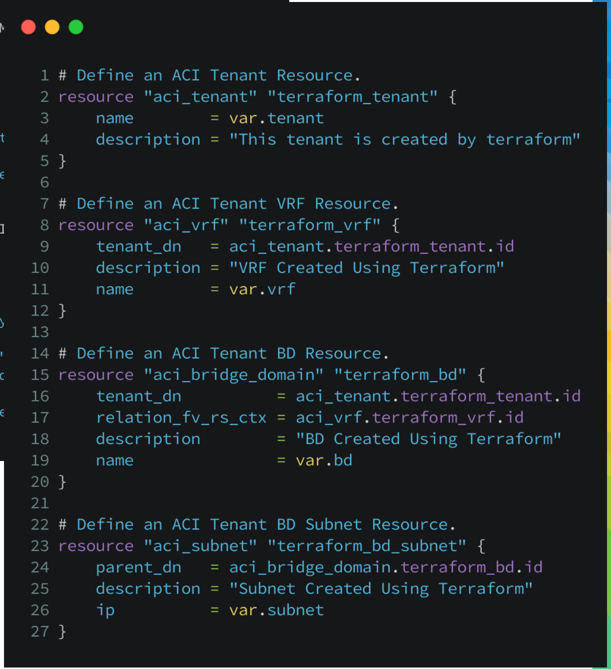
```
variable "switches" {
  description = "Testbed Sandbox Switches"
  type = map
  default = {
    spine1 = {
      ip = "192.168.129.121"
      role = "spine"
    },
    spine2 = {
      ip = "192.168.129.122"
      role = "spine"
    },
    leaf1 = {
      ip = "192.168.129.123"
      role = "leaf"
    },
    leaf2 = {
      ip = "192.168.129.124"
      role = "leaf"
    },
    leaf3 = {
      ip = "192.168.129.125"
      role = "leaf"
    },
    leaf4 = {
      ip = "192.168.129.126"
      role = "leaf"
    },
  }
}
```

Declarative vs procedural

- *Declarative* configurations define end-state in ”human language”.
  - Declarative can be “per task” or “per plan”
- *Procedural* configurations require *a priori* knowledge of configuration process to move to end state



```
- name: ENSURE TENANT VRF EXISTS
  cisco.aci.aci_vrf:
    <<: *login_info
    tenant: "{{ tenant }}"
    vrf: "{{ vrf }}"
    description: "VRF Created/Configured Using Ansible"
    state: "{{ aci_state }}"
    validate_certs: "{{ validate_certs }}"

- name: ENSURE TENANT BRIDGE DOM
  cisco.aci.aci_bd:
    <<: *login_info
    tenant: "{{ tenant }}"
    bd: "{{ item }}"
    vrf: "{{ vrf }}"
    description: "{{ bd_descript
    state: "{{ aci_state }}"
    validate_certs: "{{ validate
  loop: "{{ bds }}"

- name: ENSURE TENANT SUBNET EXI
  cisco.aci.aci_bd_subnet:
    <<: *login_info
    tenant: "{{ tenant }}"
    bd: "{{ item.bd }}"
    gateway: "{{ item.bd_gateway
    mask: "{{ item.bd_mask }}"
    scope: "{{ item.bd_scope }}'
    description: "{{ bd_subnet_c
    state: "{{ aci_state }}"
    validate_certs: "{{ validate
  loop: "{{ bd_subnets }}"
```



```
# Define an ACI Tenant Resource.
resource "aci_tenant" "terraform_tenant" {
    name        = var.tenant
    description = "This tenant is created by terraform"
}

# Define an ACI Tenant VRF Resource.
resource "aci_vrf" "terraform_vrf" {
    tenant_dn   = aci_tenant.terraform_tenant.id
    description = "VRF Created Using Terraform"
    name        = var.vrf
}

# Define an ACI Tenant BD Resource.
resource "aci_bridge_domain" "terraform_bd" {
    tenant_dn          = aci_tenant.terraform_tenant.id
    relation_fv_rs_ctx = aci_vrf.terraform_vrf.id
    description        = "BD Created Using Terraform"
    name               = var.bd
}

# Define an ACI Tenant BD Subnet Resource.
resource "aci_subnet" "terraform_bd_subnet" {
    parent_dn   = aci_bridge_domain.terraform_bd.id
    description = "Subnet Created Using Terraform"
    ip          = var.subnet
}
```

Dude, where's my code?!

Just because its not Python/Go/Node/etc; doesn't mean its not code!

- Declarative configurations are code!
- Placing all scaffolded config in HCL creates an archive of config intent
- Archived intent can be stored in VCS/SCM for versioning
- IaC + VCS = Most of a CI/CD network configuration system!

Demo

https://github.com/qsnyder/ciscou-1004

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Thank you

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