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The bridge to possible

Getting started with Infrastructure as Code with Cloud Networking

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PSODCN-2352

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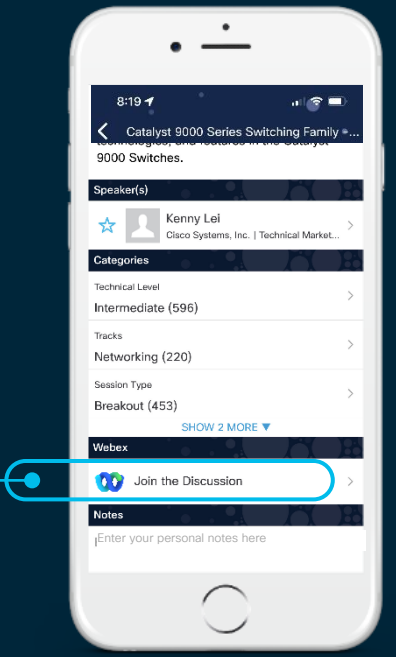

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“If I look at the switch, I can always tell which network engineer did the configuration, because they all do it differently.”

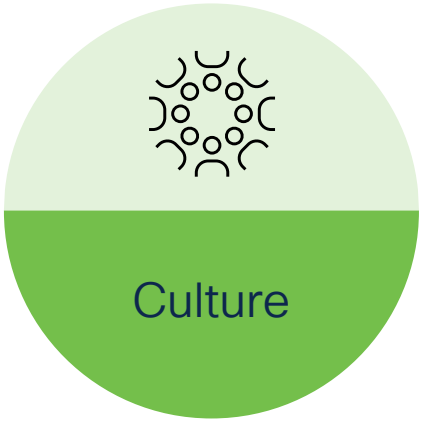
Anonymous
Sr. Manager, Network Operations
Large Financial Organization

Agenda

- **Part 1** Automation challenges in enterprise Network Operations teams.
- **Part 2** What is Infrastructure as Code? What is a CI/CD Pipeline?
- **Part 3** Why is ACI unique in the datacenter fabric landscape?
- **Part 4** Cisco Cloud Networking Integrations with HashiCorp Terraform
- **Part 5** ACI & Terraform Cloud for Business Use Cases

Part 1 Automation challenges in enterprise Network Operations teams

Automation Challenges in Enterprise Network Operations



Three considerations for a successful automation practice

Workflow identification and preparation

Characteristics of Workflows that are candidates for an automation routine

High Volume | Simple | Quality Inputs

Easier	Harder
Create a VLAN	Create routing policy for L4-L7 appliance
Create a BD/SVI default gateway	Create hypervisor virtual machine domain integration
Update access-list (permit)	Update access-list (deny)
Enable / disable interface	Route leak between VRFs

Preparing a Workflow for an automation routine

- Standardize the **configuration result**
- **Create a logical process** for inputs to produce the configuration result
- **Document** the process
- Develop **pseudo-code**

Automation is a journey, simplification is a common theme

Culture and Skillsets

Enterprise IT organization

Application Developer

Application Development

DevOps

Compute

Cloud

Security

Network

Storage

Infrastructure

Programming experience

Expert

Beginner

Different IT engineers have different programming experiences

Summary

Network Operations

Enterprise Network Operations teams are embarking on an automation journey

What are the challenges?

- **Workflow Identification and Preparation** is difficult and time consuming. What to automate? Which workflows?
- **Skillsets** Network teams have historically not required coding skills. Should I learn Python or Go? Terraform or Ansible? Where do I start?
- **Governance** How and where do we host our automation jobs to maximize security, compliance, and collaboration? Do we need CI or CD?

Network Operations Automation Challenges

Differences in mindset and culture... Network Engineer, Manager, Director

Network Engineer

- How do I evolve my skillset? Should I learn a programming language? Which one?
- How do I share this automation routine I created?

Manager, Network Operations

- How can we focus on strategic initiatives?
- How do I create an automation culture?
- How does the team share automation routines so we can all benefit?
- Are we automating the correct workflows?

Director, Information Technology

- How much does this cost? Hard costs? Soft costs?
- Are all my teams using the same tools?
- What unification opportunities do we have?
- What are security, compliance, and audit risks?
- Should we have a centralized automation team and platform?

What are the organizational challenges? What keeps us up at night?

Part 2 What is Infrastructure as Code? What is a CI/CD pipeline?

What is Infrastructure as Code?

In a true Infrastructure as Code practice:

- There must be a **single source of truth**, typically maintained in a version control system like GitHub.
- Changes are **Continuously Integrated**; “checked in” to the SSoT, Committed to a Development branch, Tested, then Merged to a Production branch.
- Changes are **Continuously Deployed**; pushed to the infrastructure using custom scripting; may include a management tool like Ansible or Terraform.

In a true IaC practice, manual changes are discouraged

Benefits of Infrastructure as Code practice

Cost reduction; focus on strategic initiatives instead of tactical manual changes.

Consistency; prevention of configuration drift

Speed; deploy infrastructure changes quickly.

SSoT, CI, and CD are the backbone of an IaC practice

Continuous Integration

Continuous Deployment

Build

Test

Deploy

SCM/VCS

git, Mercurial, github, GitLab, Bitbucket, GitBucket

CI

github, snap, TeamCity, Jenkins, Bamboo, drone.io, circleci, go, Travis CI, CODESHIP

Build

sbt, Gradle, GRUNT, docker, Maven, Gulp, Nant, Packer, MSBuild, Leiningen, RAKE

Database management

DBmaestro, DBDeploy, Flyway, redgate, Flocker, LIQUIBASE

Testing

Selenium, Jasmine, MOCHA, GAUNTLT, OWASP ZAP, Gatling, KARMA, JUnit, NUnit, FitNesse, cucumber, QUnit, Galen Framework, Batfish, JMeter, TestNG, LOAD IMPACT, BlazeMeter, pytest, SERVERSPEC, Browsersync, Pa11y, xUnit.net, NEWMAN, specflow

Deployment

Octopus Deploy, XL DEPLOY, RUNDECK, Capistrano, urban{code}, NOLIO, SSH, ElasticBox, Spinnaker, juju

Config Mgmt./Provisioning

puppet labs, CHEF, ANSIBLE, SALTSTACK, CFEngine, PowerShell DSC, VAGRANT, Terraform

Artefact Management

QUAY, docker hub, Bower, docker REGISTRY, JFrog ARTIFACTORY, python Package Index, nuget, Sonatype Nexus, archiva, npm

Network Engineer

CI CD Pipeline

SSoT

GitHub

APIC

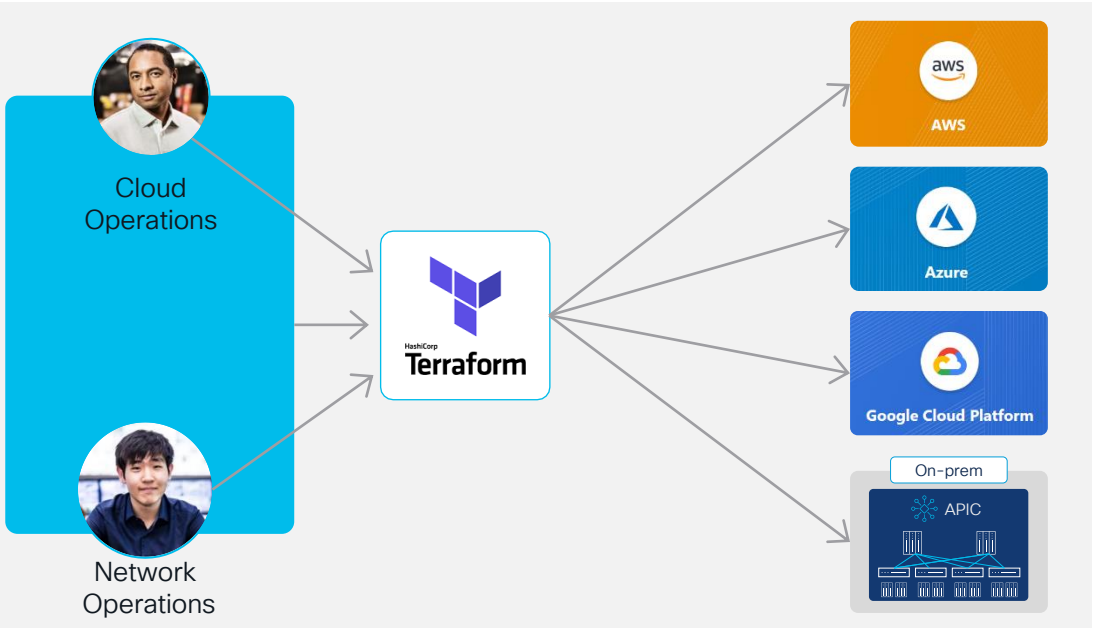
Tasks (GitHub)	
1	Make infrastructure change
2	Commit to Development Branch
3	Merge Request (to Production Branch)
4	Approvals
5	Merge to Production Branch

Tasks (Terraform Cloud or Enterprise)	
5	Implicit Pull from GitHub Repo
6	Terraform Plan
7	Terraform Apply
8	Terraform Email Notification

Part 3 How is ACI unique in the datacenter fabric landscape?

ACI IaC market differentiators

- Cloud-like consumption model with API and single source of truth
- Hybrid cloud and cloud repatriation positioning
- Robust Terraform support in Network Operations
- Unification of Cloud Operations and Network Operations workflows



Terraform is the dominant public cloud Provisioning Management Tool

Part 4 Cisco Cloud Networking Integrations with HashiCorp Terraform

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ACI and Terraform Cloud for Business

A Turnkey Infrastructure as Code Platform for Network Operators

HashiCorp Terraform Cloud

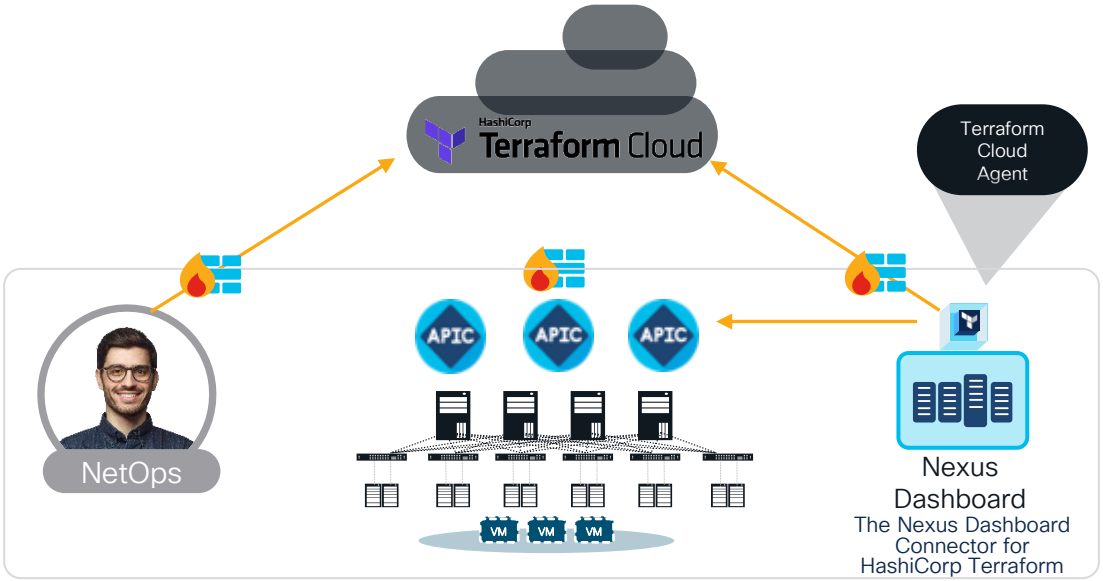
Why Terraform Cloud for Business and ACI?

- Out-of-the-box automation platform including team collaboration, version control, and CI/CD components
- Security, governance, and compliance guarantees

Step1 Network Engineer writes Terraform Plans in TCFB

Step2 Terraform Cloud Agent (running on ND) polls TFCB for jobs

Step3 Terraform Cloud Agent runs against APIC to configure ACI



Part 5 ACI & Terraform Cloud for Business Use Cases

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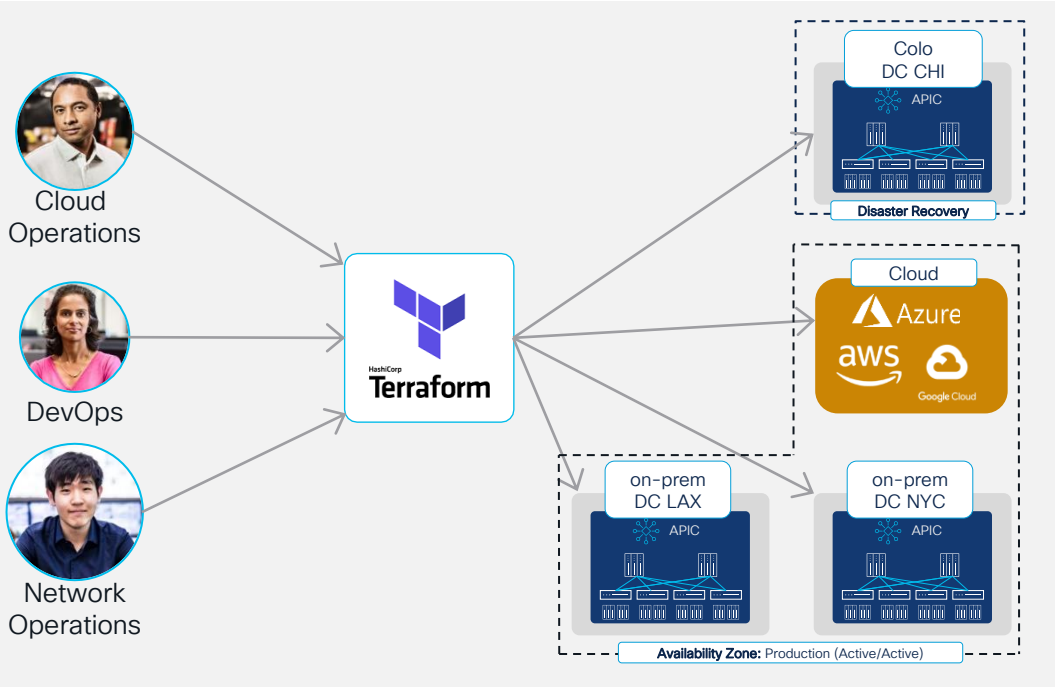
Use Case #1
Terraform as a hybrid cloud orchestrator

- Hybrid cloud and cloud repatriation cost positioning
- Common operating model for Network, Cloud, and DevOps
- Flexible application availability models



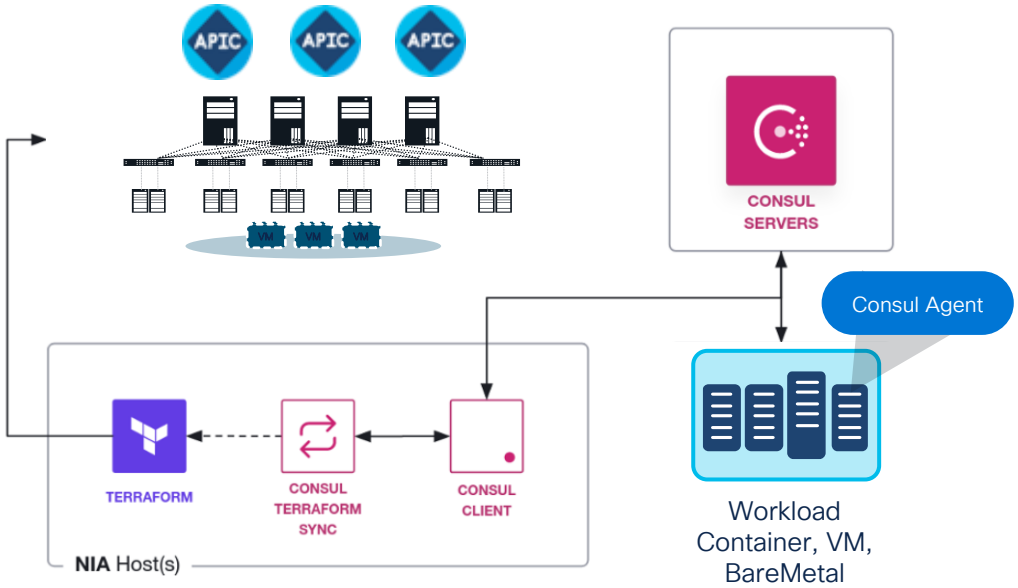
Single point of management across private and public clouds

Use Case #2
Zero Touch ACI provisioning with Consul-Terraform-Sync

Zero Touch ACI Tasks
Change Endpoint Security Posture
Make Cost Based Routing Changes ($$)
Enact Troubleshooting Change (shut/no shut)
Configure a packet monitor (SPAN/RSPAN)

HashiCorp Consul

HashiCorp Terraform Cloud



Update ACI configuration automatically using Terraform based on application health

Use Case #3 Nexus-as-Code

Roadmap

Complex L3out simplified to 23 lines of code; dependencies managed

Nexus-as-Code Example

```
apic:
  tenants:
    - name: ABC
      l3outs:
        - name: L3OUT1
          vrf: VRF1
          domain: ROUTED1
          nodes:
            - node_id: 101
              router_id: 5.5.5.5
              static_routes:
                - prefix: 2.2.2.0/24
                  description: My Desc
                  next_hops:
                    - ip: 6.6.6.6
              interfaces:
                - node_id: 101
                  port: 10
                  vlan: 301
                  ip: 14.14.14.1/24
                  bgp_peers:
                    - ip: 14.14.14.14
                      remote_as: 65010
```

Operator

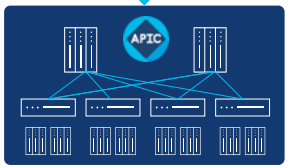
Cisco supports entire stack

Open Source — Nexus-as-Code (YAML) | CSV | Others via Ecosystem

Open Source — Publicly available ACI Terraform Modules

Open Source — Cisco Verified Terraform Provider for ACI

ACI Fabric via APIC



Nexus-as-Code is an ACI abstraction to simplify consumption using a Data Model ecosystem

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