



You make **possible**



How to be a Network Engineer in a NetDevOps Age

Go beyond Infrastructure as Code and
Automation

Hank Preston, NetDevOps Whisperer
@hfpreston

DEVNET-1725

CISCO *Live!*

Barcelona | January 27-31, 2020



Cisco Webex Teams

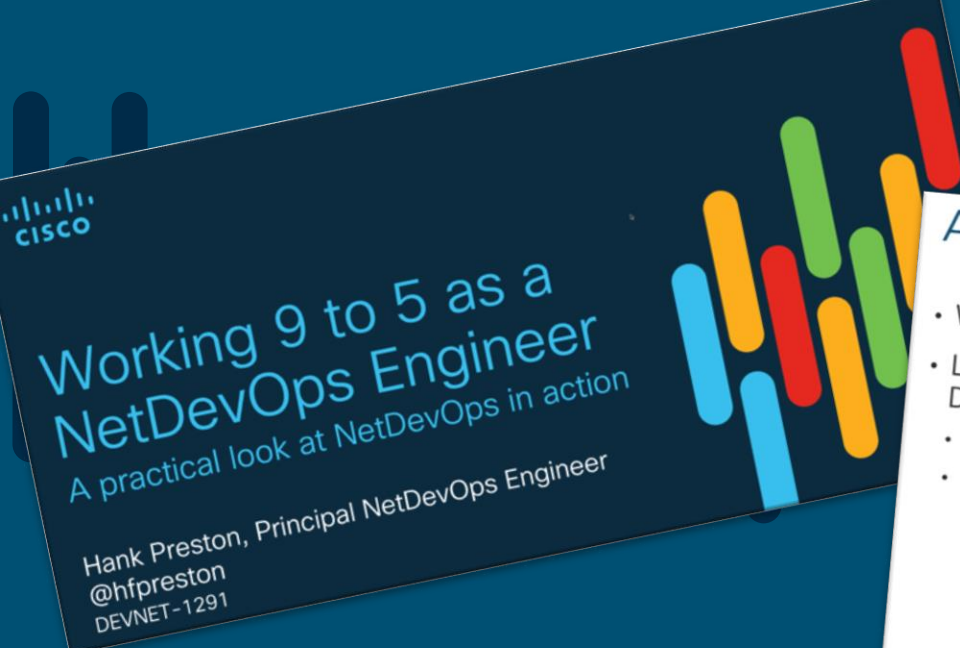
Questions?

Use Cisco Webex Teams to chat with the speaker after the session

How

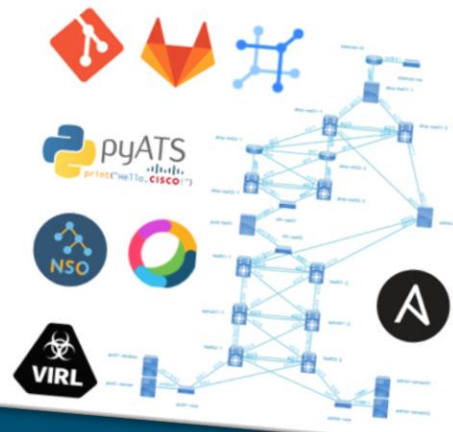
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- 2 Click “Join the Discussion”
- 3 Install Webex Teams or go directly to the team space
- 4 Enter messages/questions in the team space





Agenda

- What is NetDevOps again?
- Life as a NetDevOps Engineer – Live Demo!
- Network as Code, CI/CD, ChatOps
- Open Source and Commercial



Please stick around for the next session to continue the NetDevOps Exploration!

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* Please checkout DEVNET-1291 “Working 9 to 5 as a NetDevOps Engineer” for a detailed demonstration of the NetDevOps tools and concepts discussed in this session.

Topics to Cover

- Network Engineering in the Dark Ages
- The Four Ages of Networking
- Applying DevOps to Networking
- Today's Network Engineer

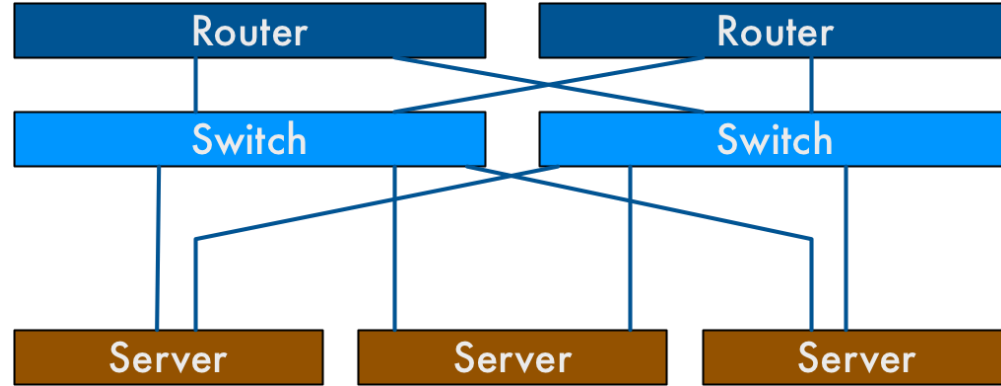
The Network Engineer Evolves



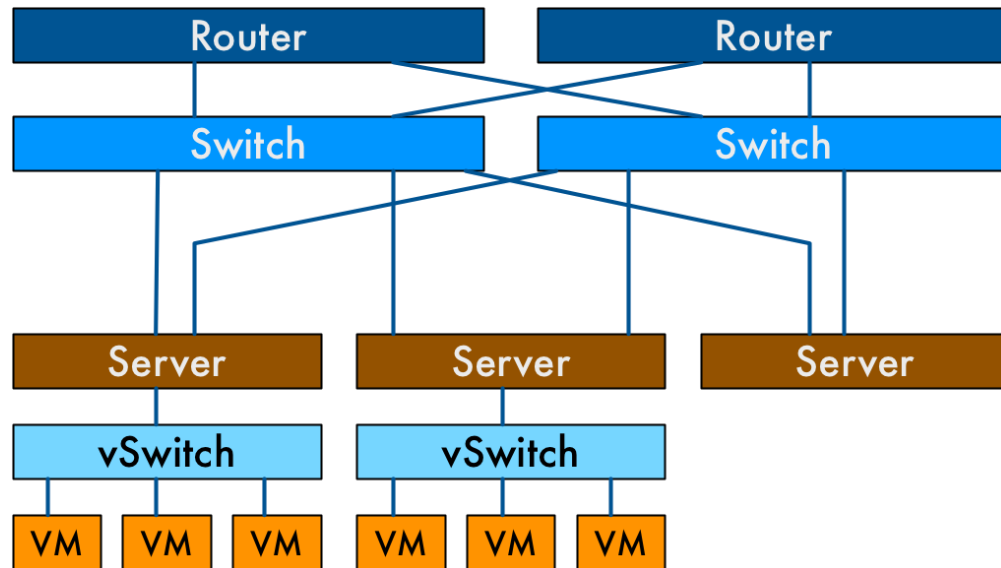
Network Engineering in the Dark Ages



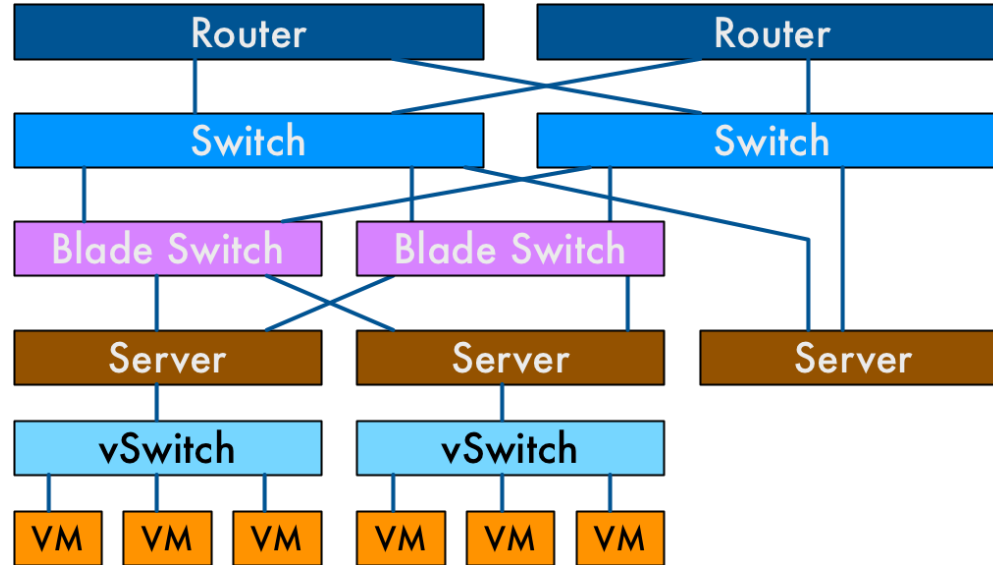
The Network...



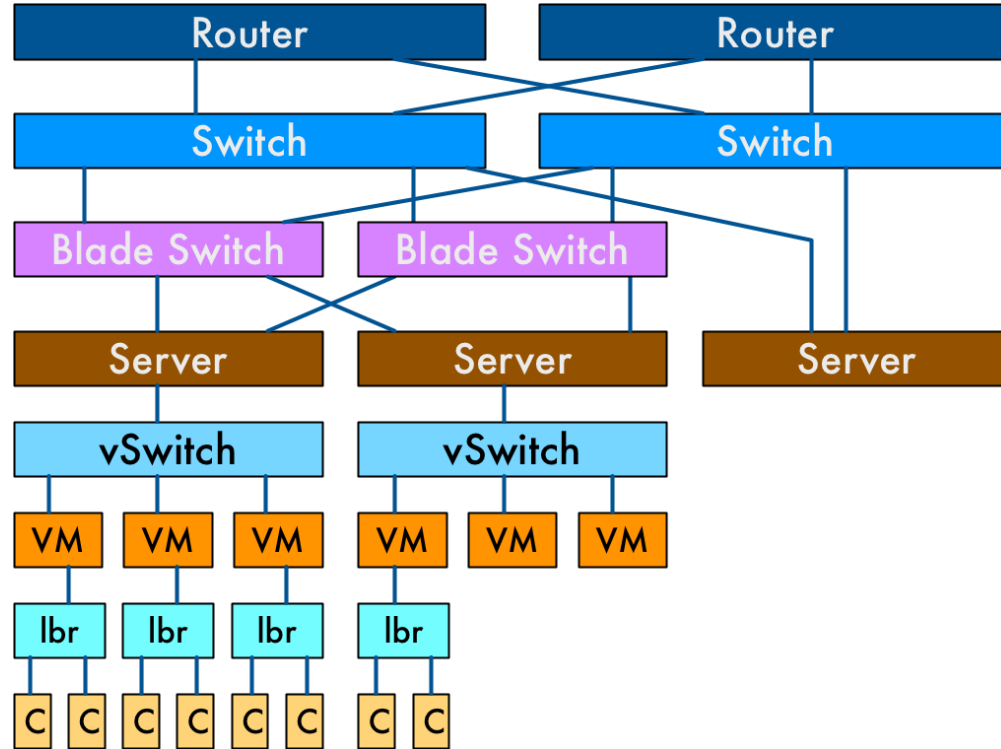
The Network...



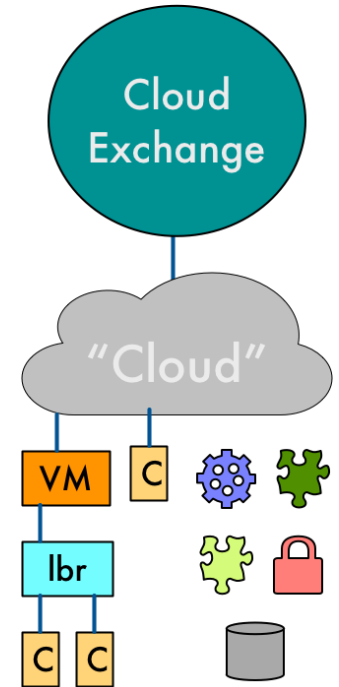
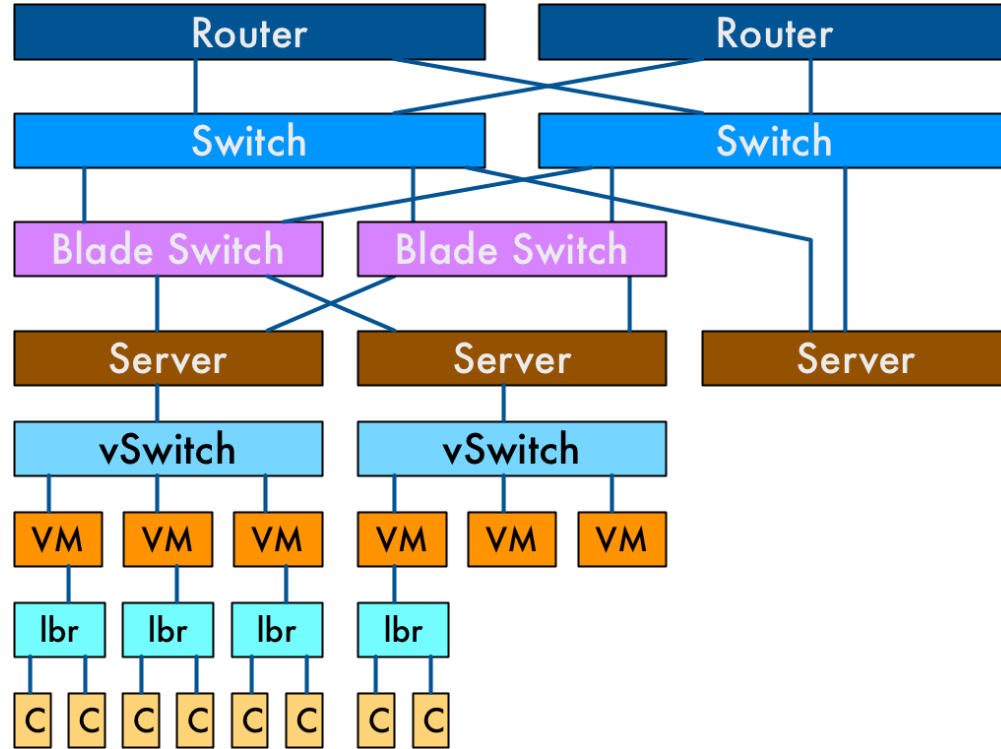
The Network...



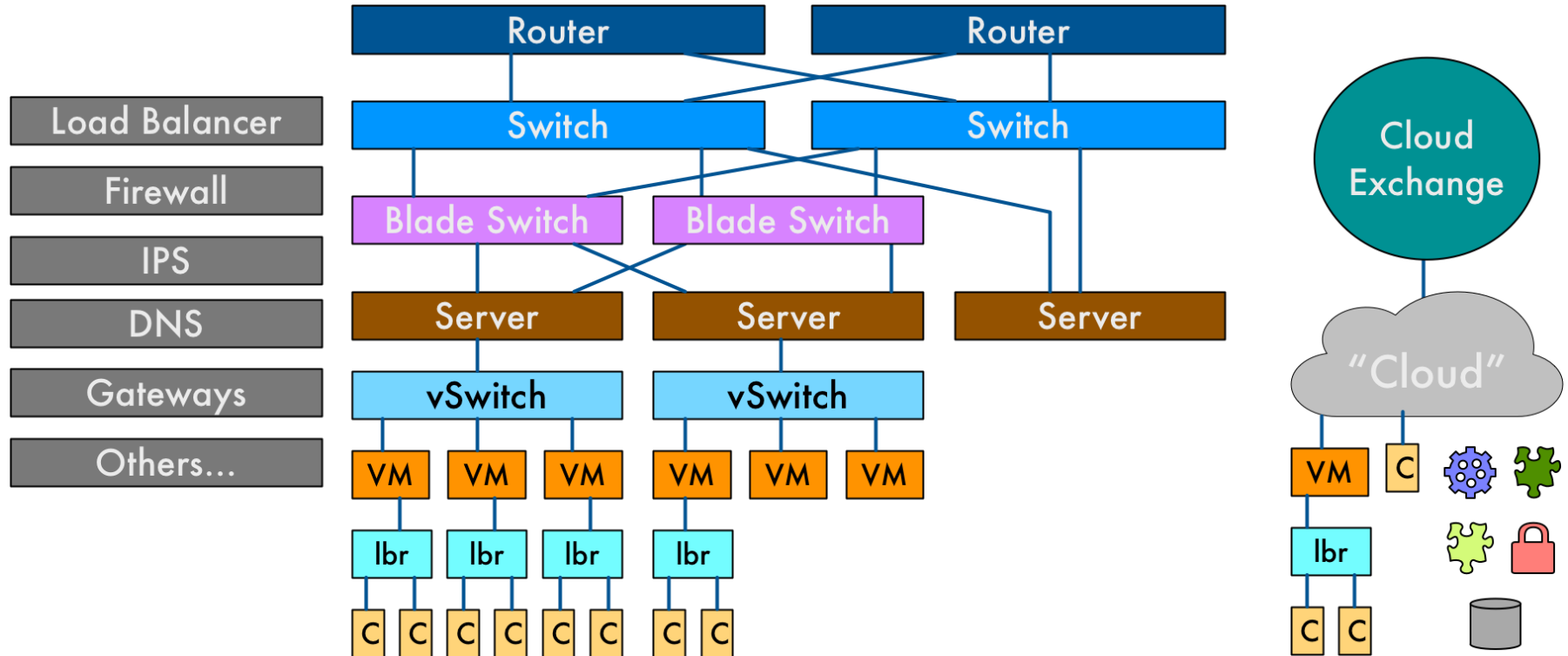
The Network...



The Network...

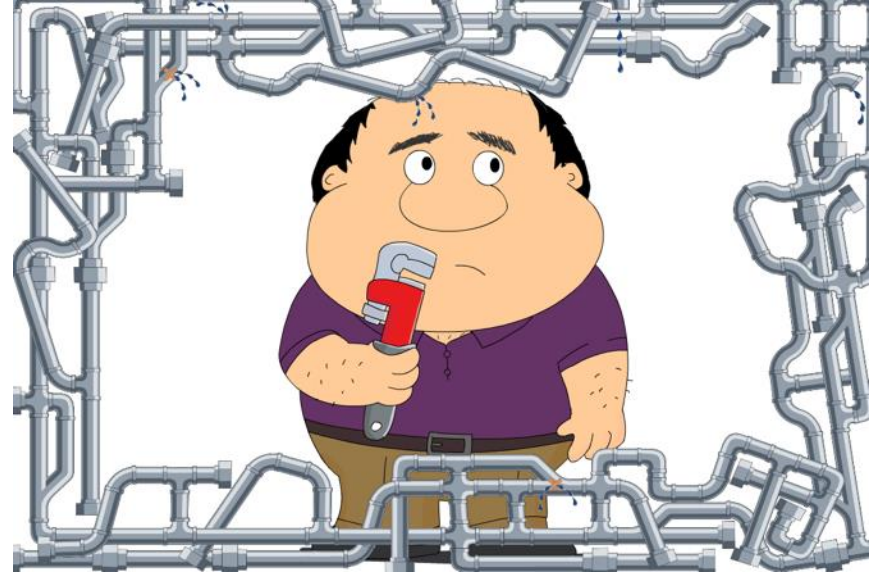


The Network...



Today's reality...

- Functional but considered fragile
- Network configuration more “art than science”
- Tribal knowledge of key engineers



“Every time we implement a network change something goes wrong...”

“Isn’t it great, our switch hasn’t been rebooted in 6 years”

“We can’t update/change the network, our business won’t allow it”

* Paraphrased quotes from actual network operators

From: [REDACTED]
Date: [REDACTED]
To: [REDACTED]
Cc: [REDACTED]
Subject: switch uptime

[REDACTED]1>sh ver

Cisco Internetwork Operating System Software

IOS (tm) s72033_rp Software (s72033_rp-ADVENTERPRISEK9_WAN-M), Version
12.2(18)SXF3, RELEASE SOFTWARE (fc1)

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Copyright (c) 1986-2006 by Cisco Systems, Inc.

Compiled Tue 14-Feb-06 17:18 by kehsiao

Image text-bas...740101...40...da...ss...042D30000

ROM: System Bootstrap, Version 12.2(17r)S2, RELEASE SOFTWARE (fc1)

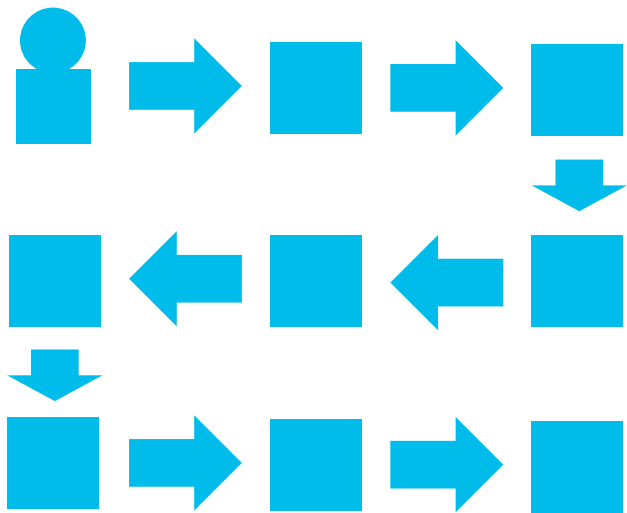
BOOTLDR: s72033_rp Software (s72033_rp-ADVENTERPRISEK9_WAN-M), Version
12.2(18)SXF3, RELEASE SOFTWARE (fc1)

[REDACTED] uptime is 11 years, 31 weeks, 1 day, 16 hours, 46 minutes
Time since r-secmgtel-1 switched to active is 11 years, 31 weeks, 1 day, 17
hours, 29 minutes

System returned to ROM by s/w reset (SP by power-on)

System restarted at 20:47:24 UTC Thu Mar 9 2006

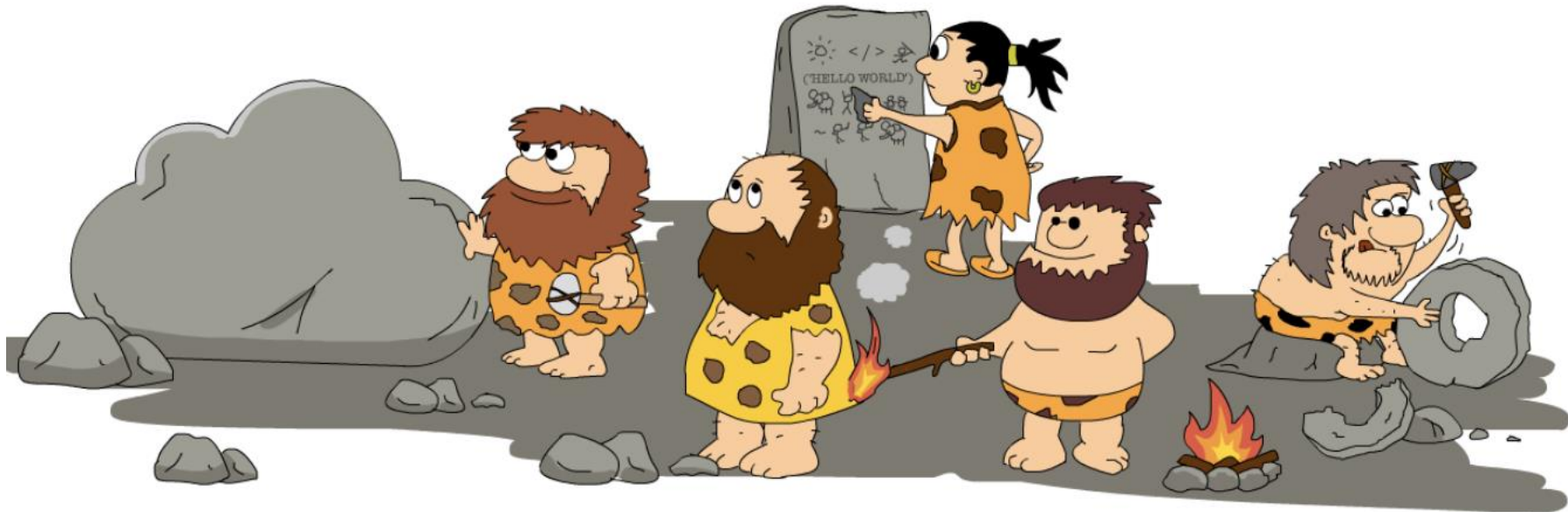
Today's Network Realities



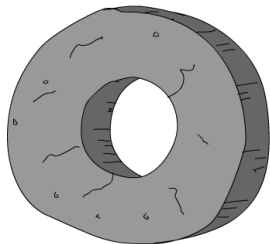
**Sequential and Manual
Infrastructure Provisioning**



**Snowflake Infrastructure with
Organic Configurations**



Networking through the ages...



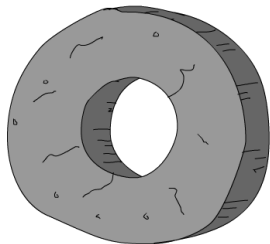
Stone Age

Spanning Tree

VLANs

The Four Ages of Networking.....

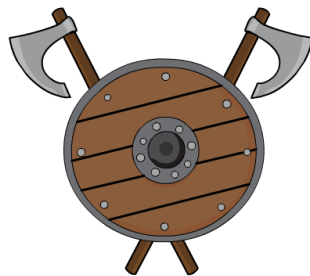
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Stone Age

Spanning Tree

VLANs



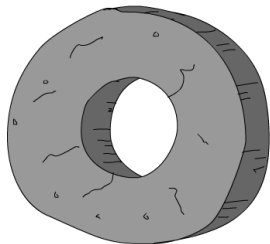
Bronze Age

Routing Protocols

WAN Design

IP-magedon

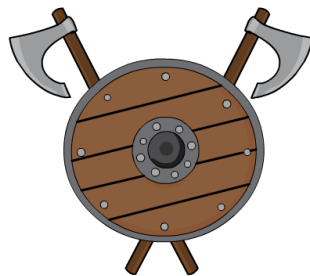
The Four Ages of Networking.....



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The Renaissance

SDN

OpenFlow

Controllers

Overlays

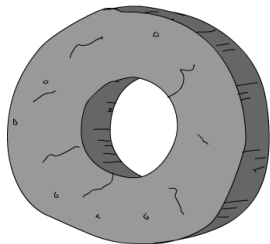
MP-BGP

VXLAN

Micro-Segmentation

White Box

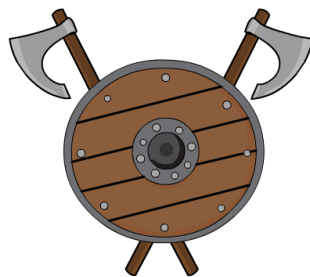
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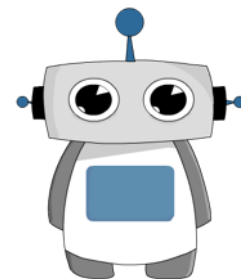
Overlays

MP-BGP

VXLAN

Micro-Segmentation

White Box



Programmable Age

Cloud

Python

REST / APIs

NETCONF / YANG

“Fabrics”

Network Function
Virtualization (NFV)

Containers

DevOps

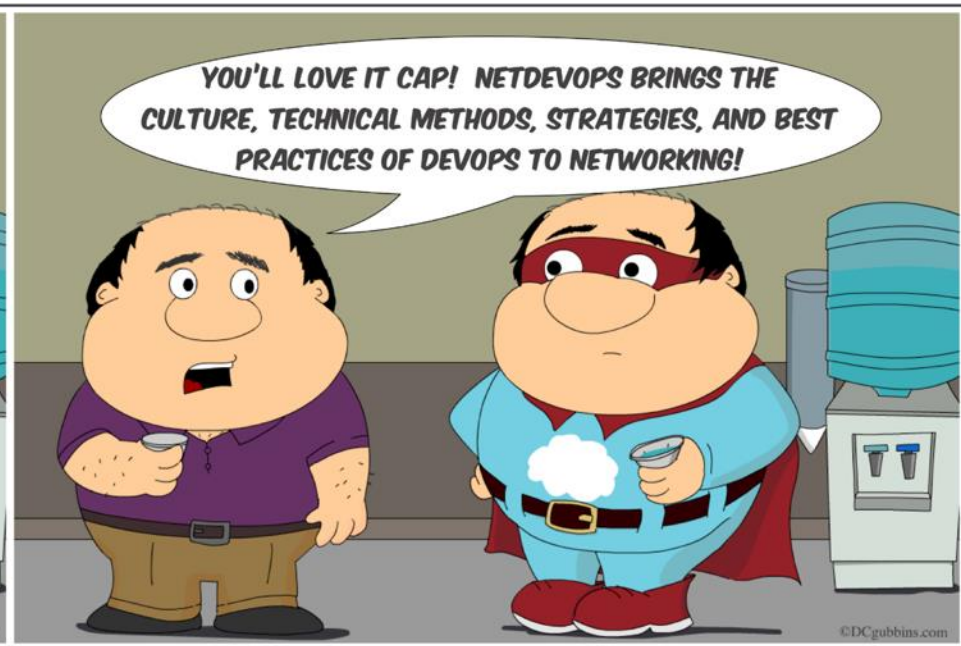
NetDevOps!

The Four Ages of Networking.....

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The Age of Enlightenment and NetDevOps





Consider the Network Stakeholders



Network Builders

- Traditional networking teams
- Design, Build, and Maintain the Network
- Responsible for Care and Feeding

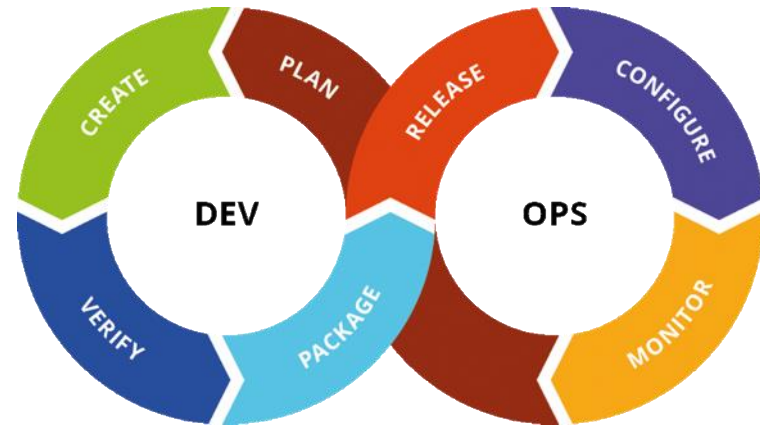


Network Consumers

- The users of the network
- Looking to consume network “services”
- The network is a “utility” – It should just work

What is the “DevOps Culture”?

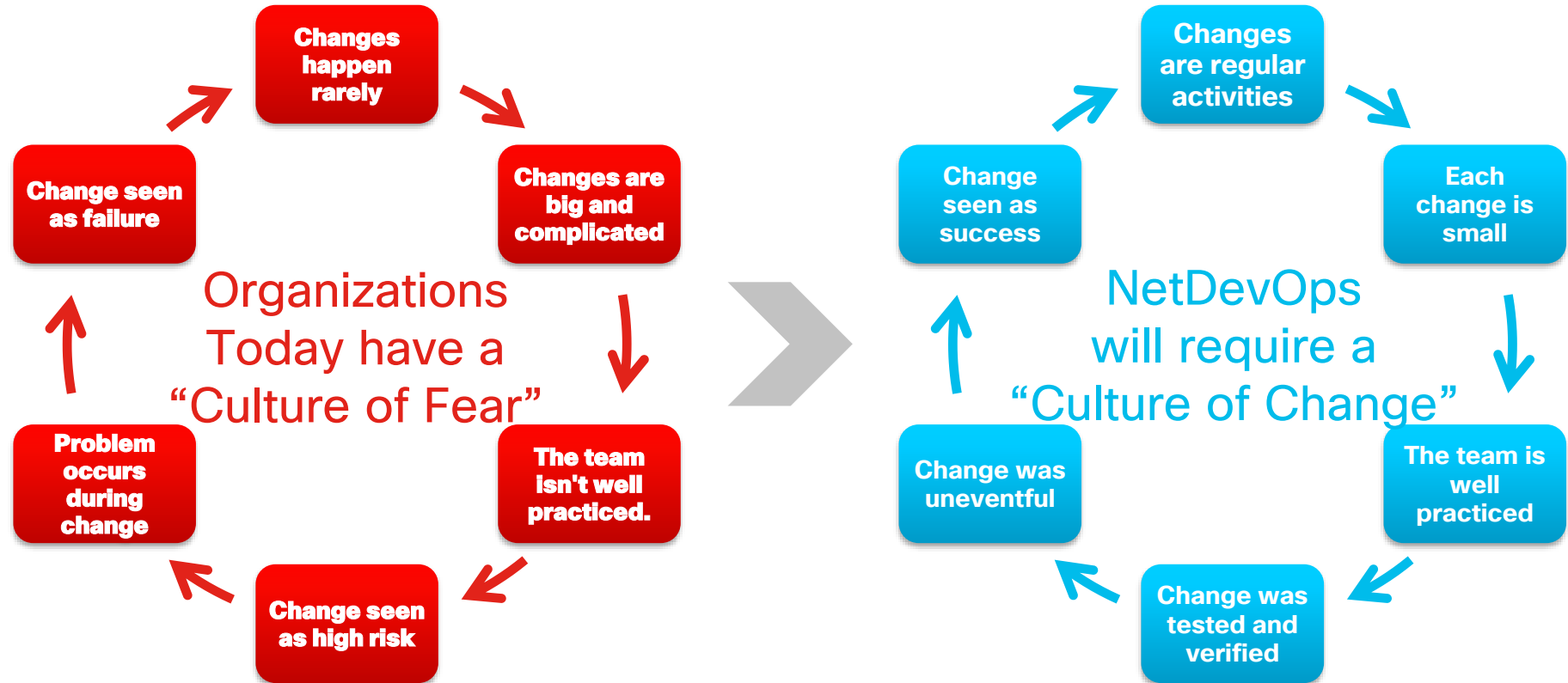
- Embrace failure
- Change is good
- Active collaboration
- Empowered accountability
- Feedback systems
- Automation



Moving to a NetDevOps Culture and Mindset

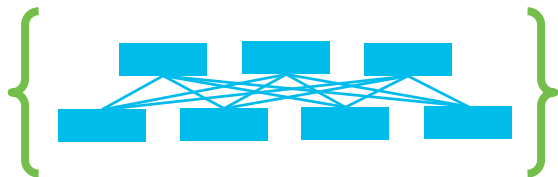


Moving to a NetDevOps Culture and Mindset



NetDevOps Operational Models

Network as Code



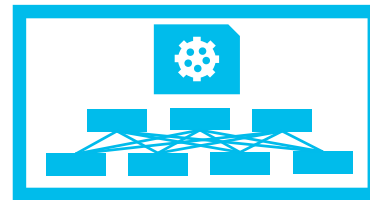
- Git based workflows
- Close alignment to software DevOps approaches
- Leverage abstractions, such as controllers, when possible

IT as a Service



- Service Catalog based workflows
- Deliver End User Self Service experience in “eStores”

Controller Driven



- Network Controller based workflows
- Evolving traditional network operation model

Configuration, Automation & Monitoring Principles

- **Network as Code** and **Configuration Management** strategies
- **Continuous Development** approach to network changes.
- **Continuous health and improvement** approach to monitoring.



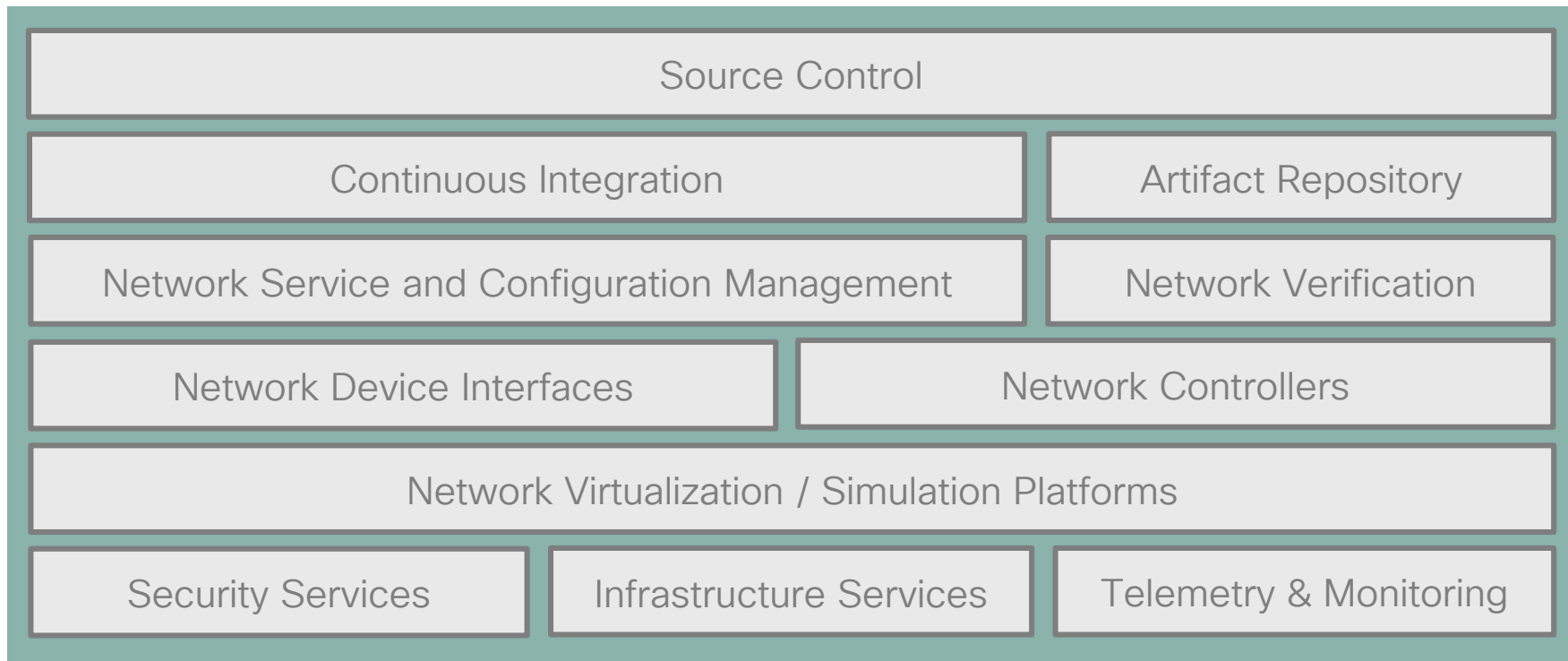
```
module "vpc" {  
  source = "terraform-aws-modules/vpc/aws"  
  
  name = "my-vpc"  
  cidr = "10.0.0.0/16"  
  
  azs          = ["eu-west-1a", "eu-west-1b", "eu-west-1c"]  
  private_subnets = ["10.0.1.0/24", "10.0.2.0/24", "10.0.3.0/24"]  
  public_subnets  = ["10.0.101.0/24", "10.0.102.0/24", "10.0.103.0/24"]  
  
  enable_nat_gateway = true  
  enable_vpn_gateway = true
```

This doesn't count as "Network as Code"

(or at least isn't ENOUGH)

```
tags = {  
  Terraform = "true"  
  Environment = "dev"  
}
```

The NetDevOps Engineers Tool Chest



The NetDevOps Engineers Tool Chest

Source Control systems enable easy management of documents, code, and other pieces of information with tooling to support collaboration, revision management, and easy distribution.



Source Control

Network Device Interfaces

Network Controllers

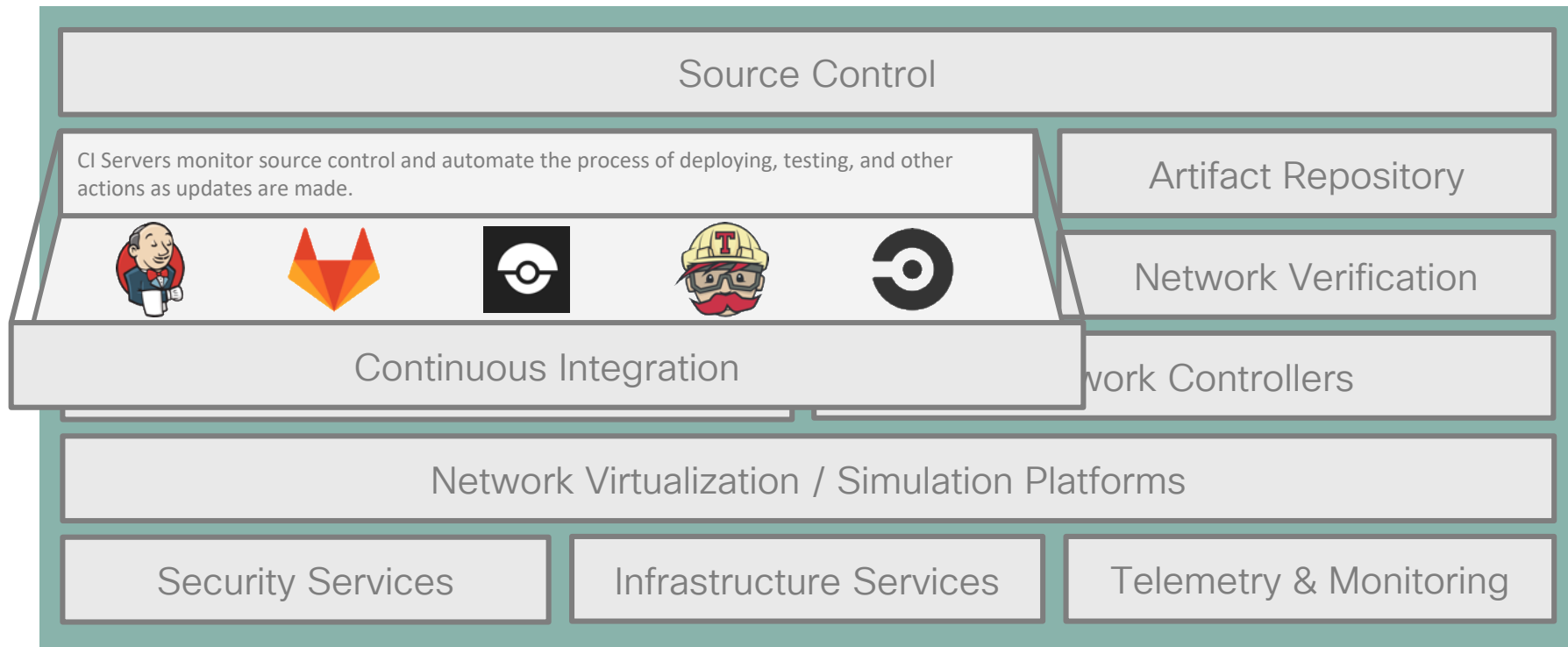
Network Virtualization / Simulation Platforms

Security Services

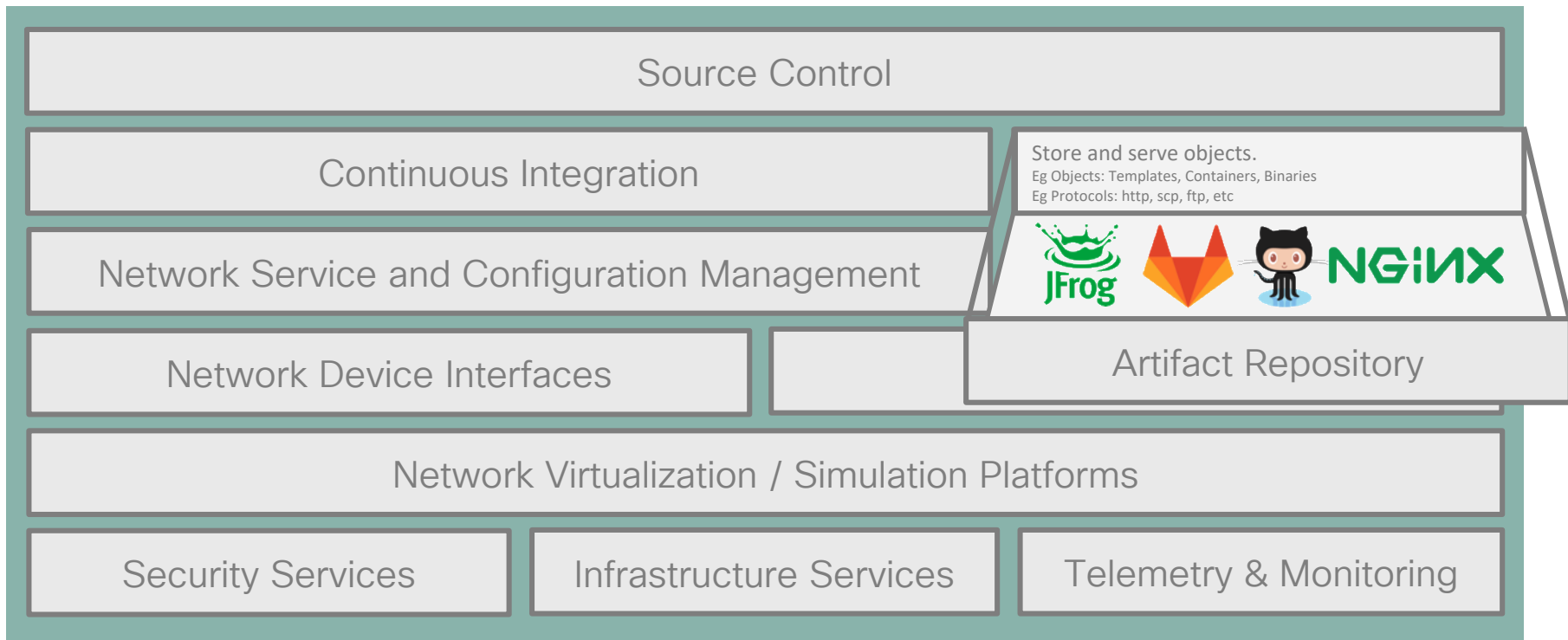
Infrastructure Services

Telemetry & Monitoring

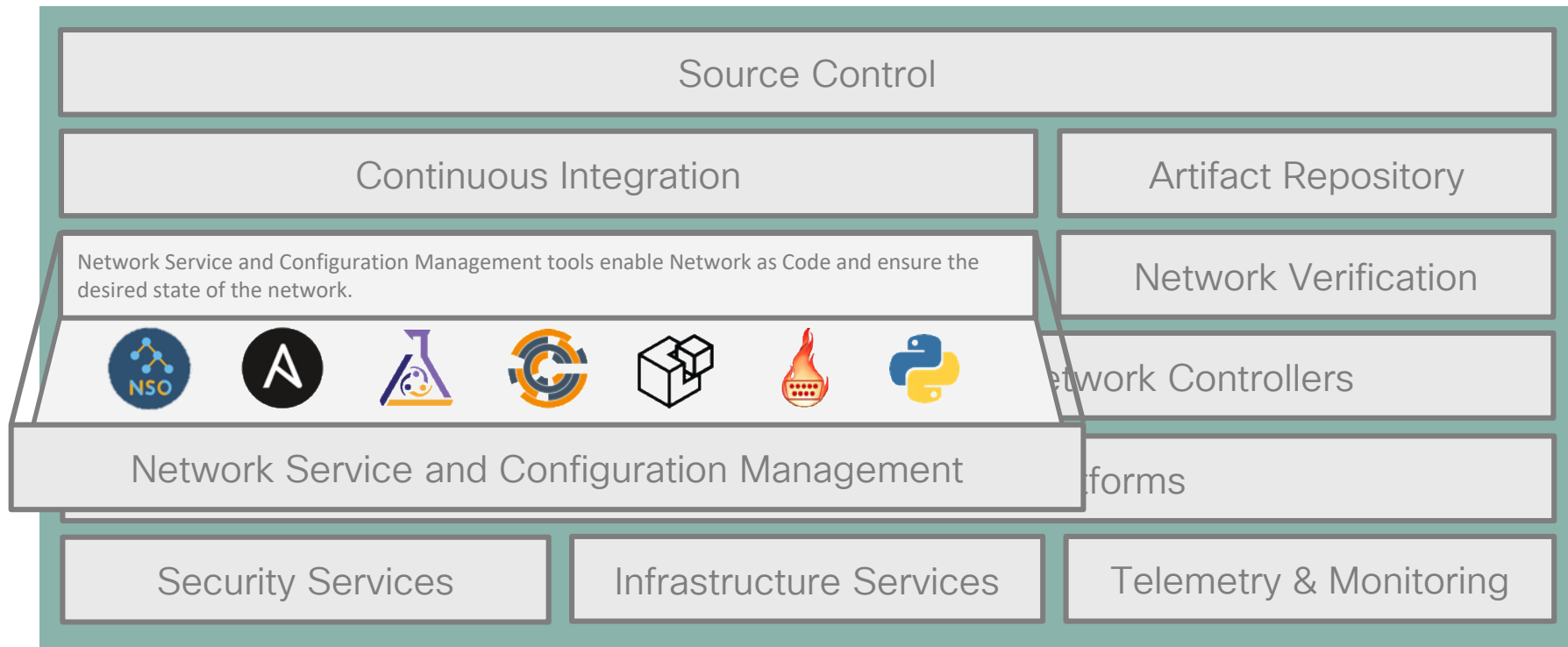
The NetDevOps Engineers Tool Chest



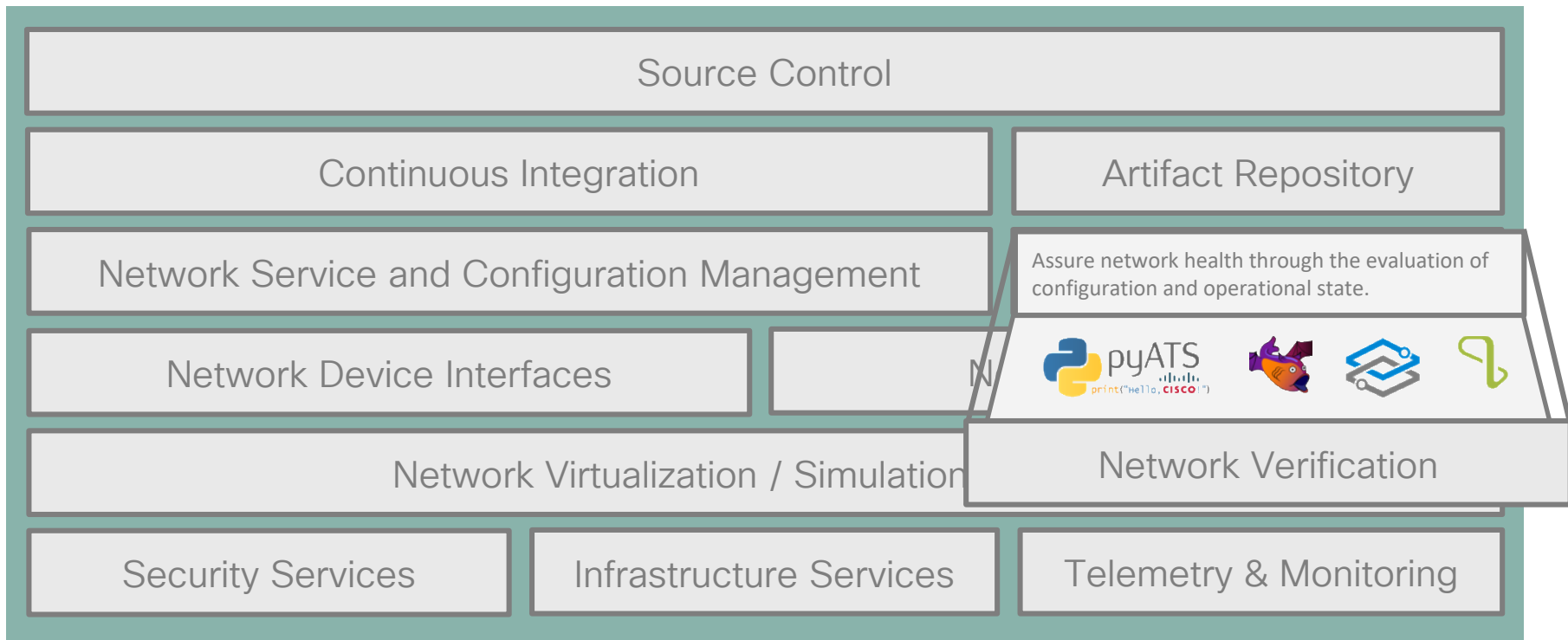
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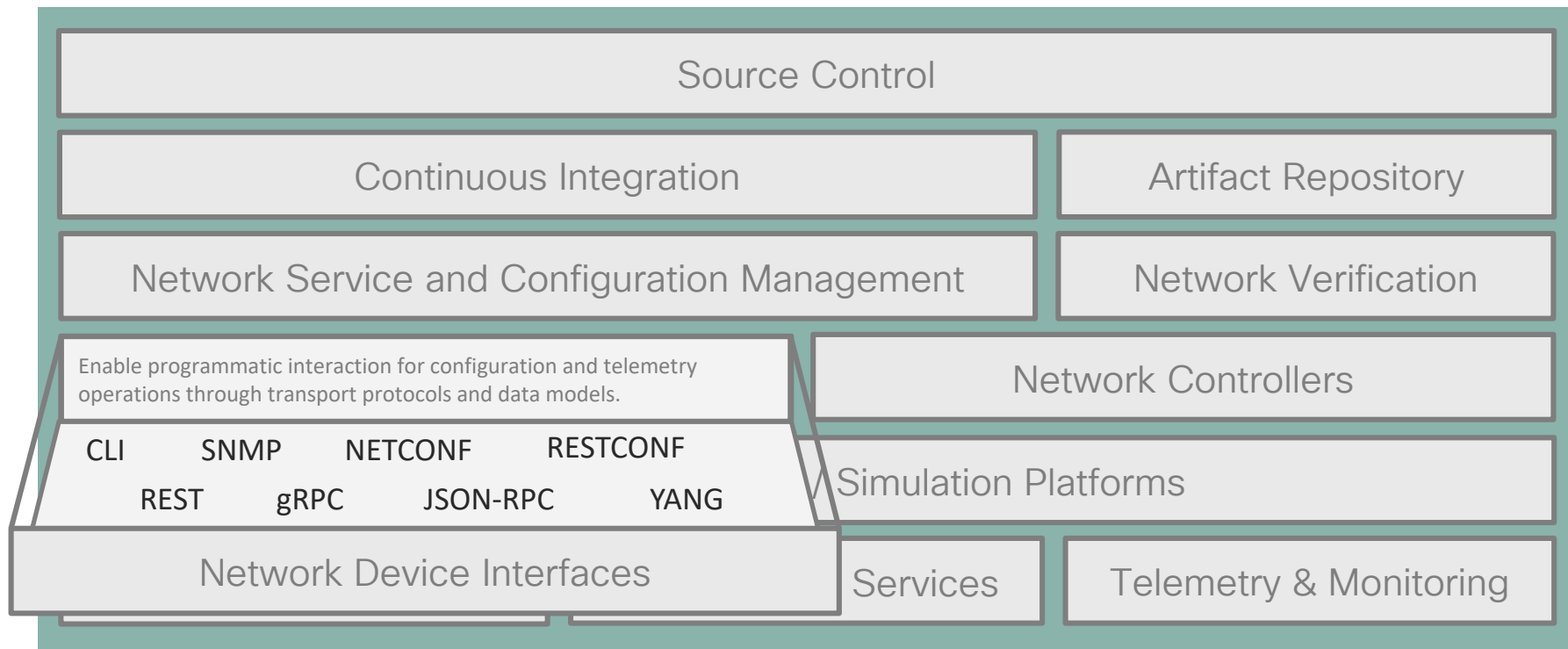
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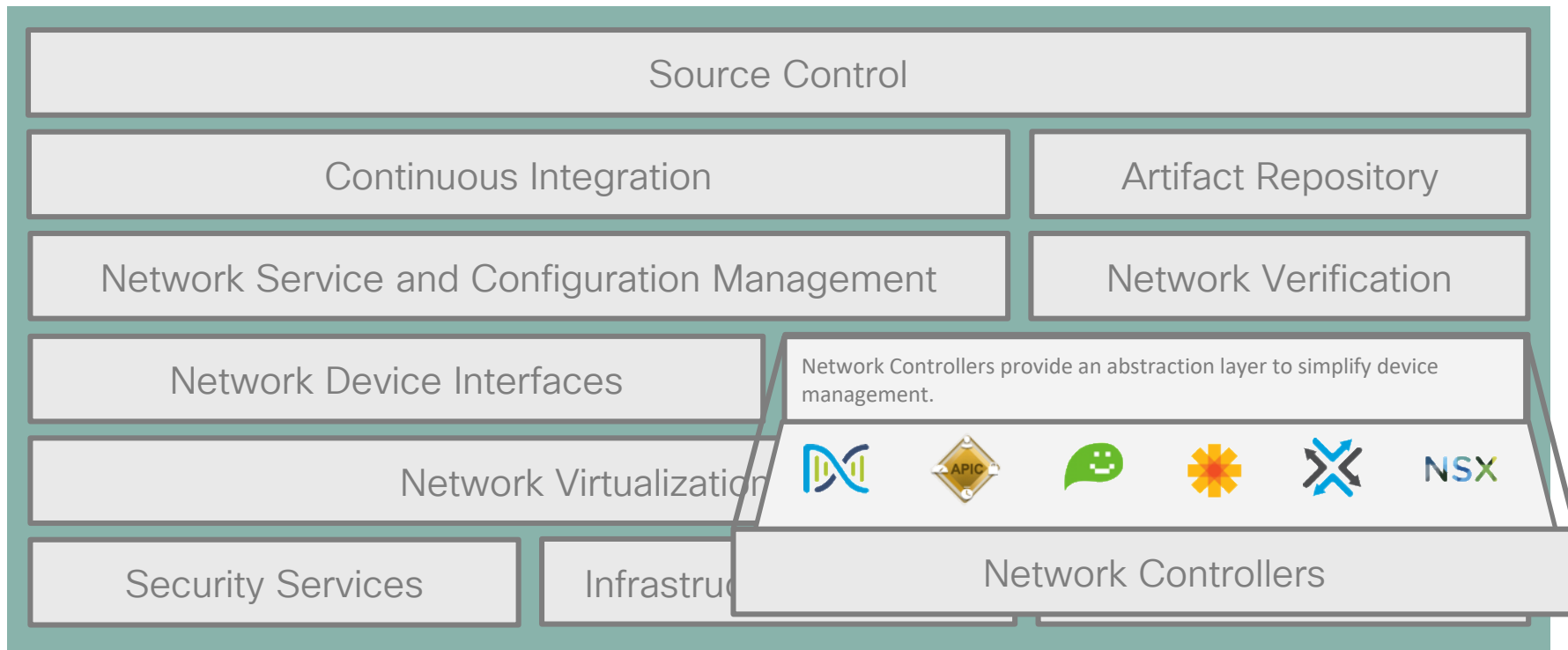
The NetDevOps Engineers Tool Chest



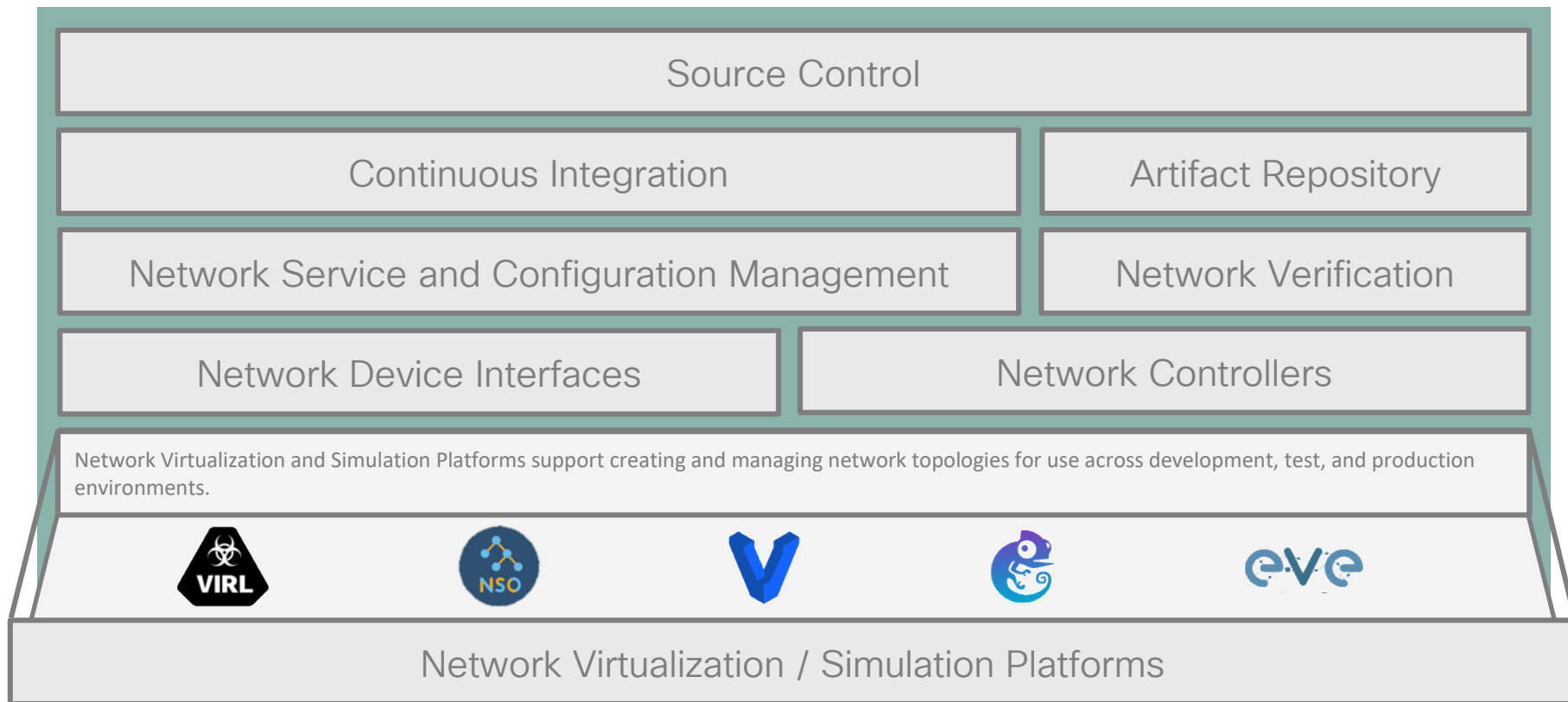
The NetDevOps Engineers Tool Chest



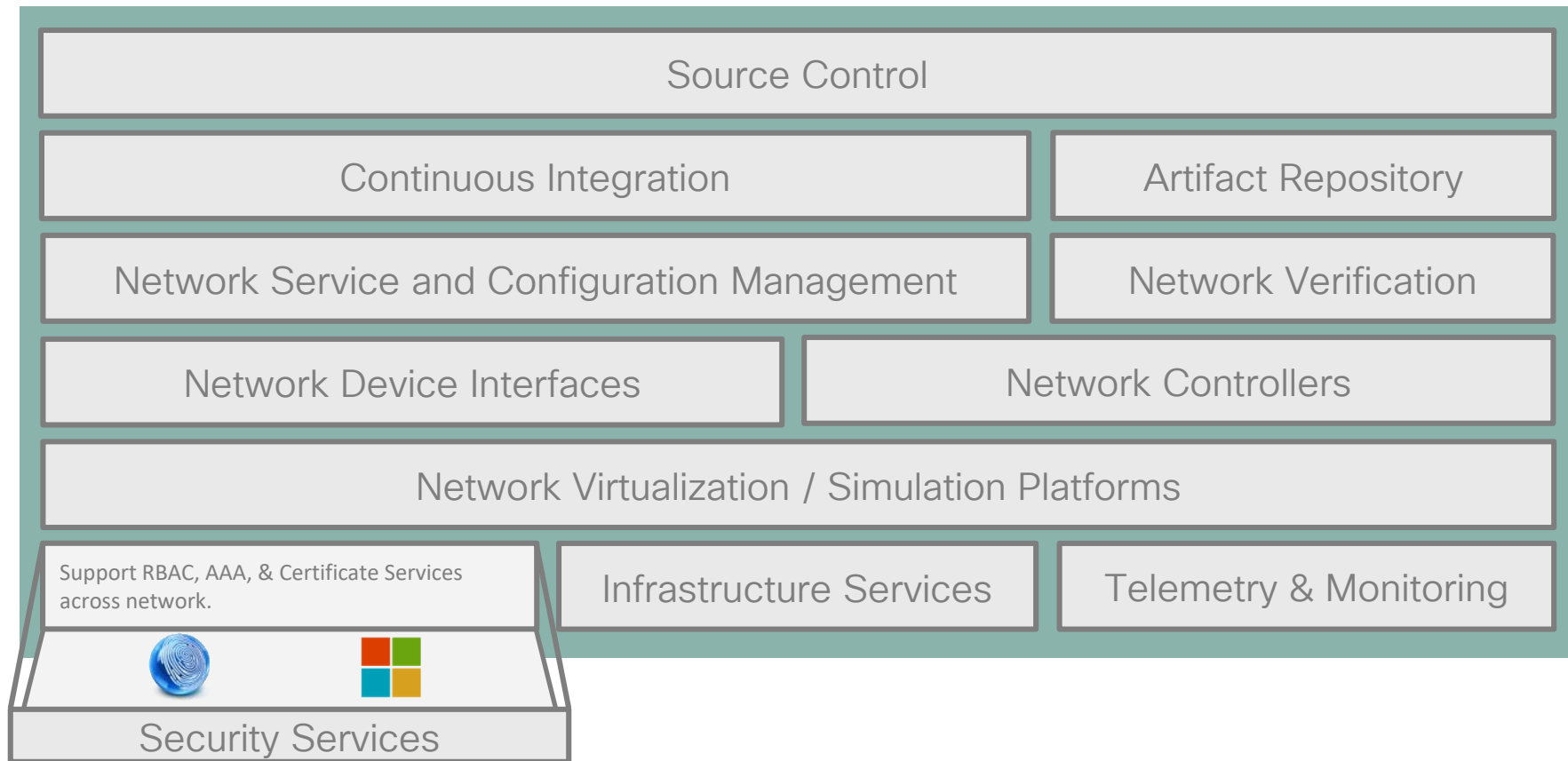
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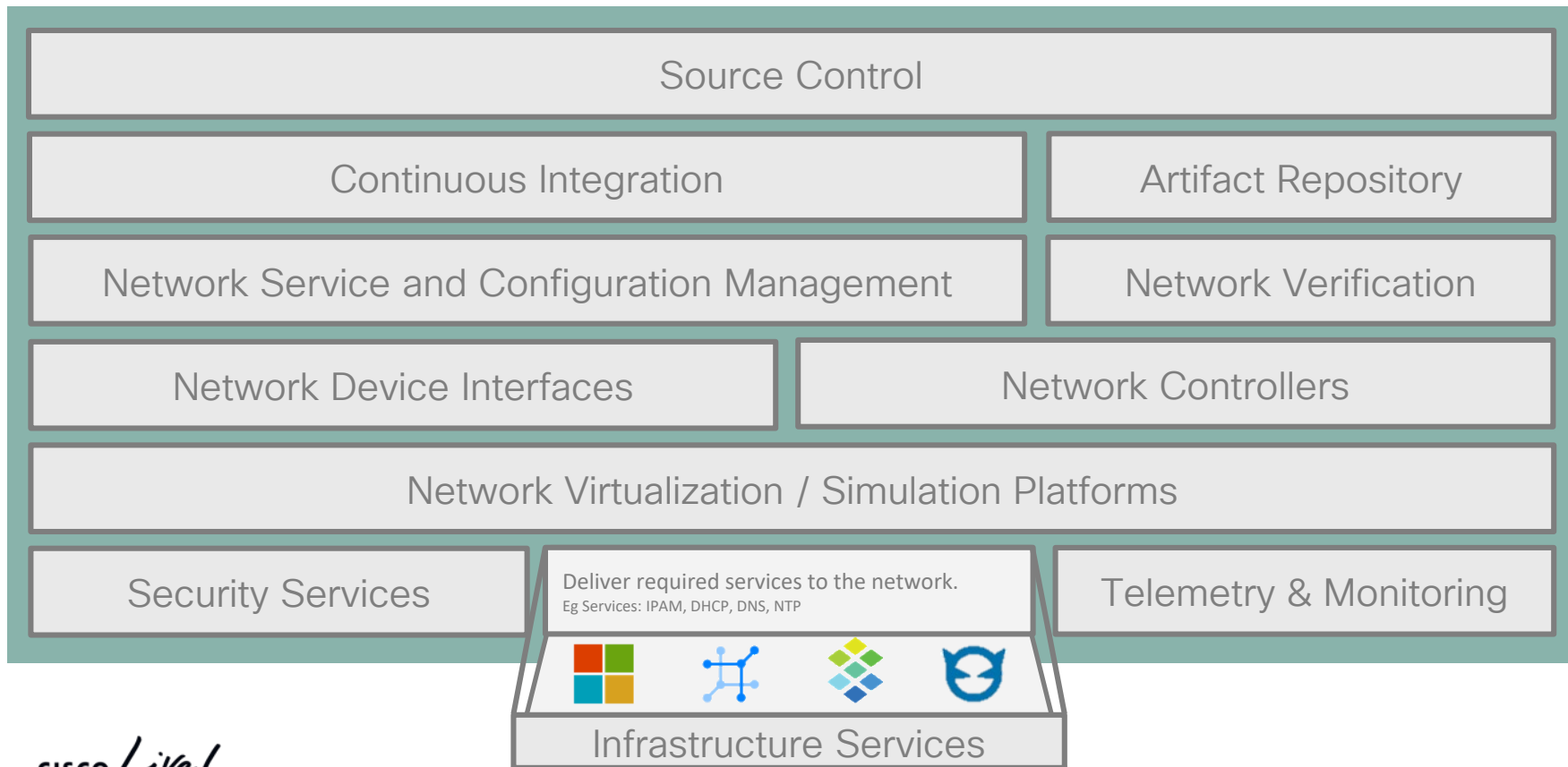
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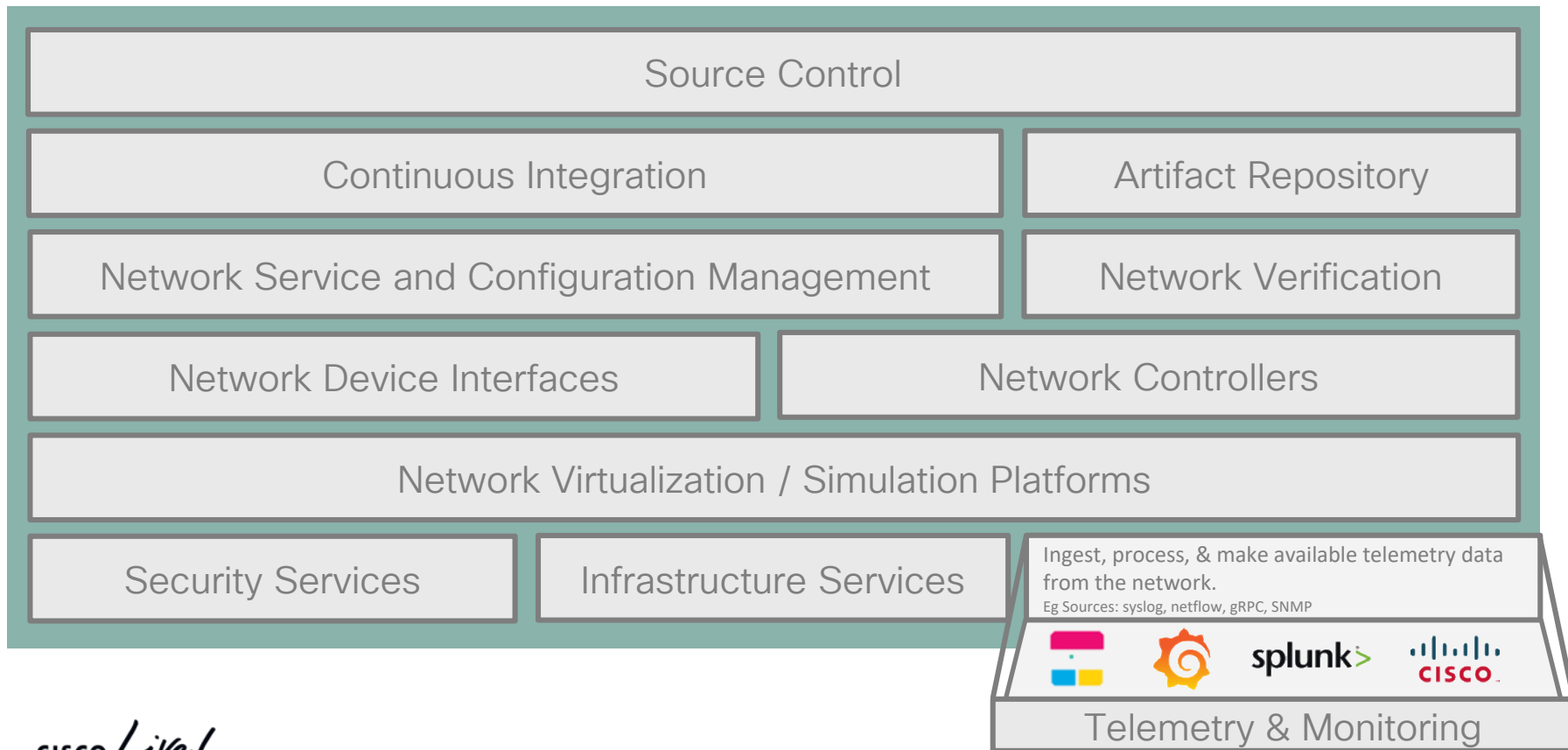
The NetDevOps Engineers Tool Chest



The NetDevOps Engineers Tool Chest



The NetDevOps Engineers Tool Chest



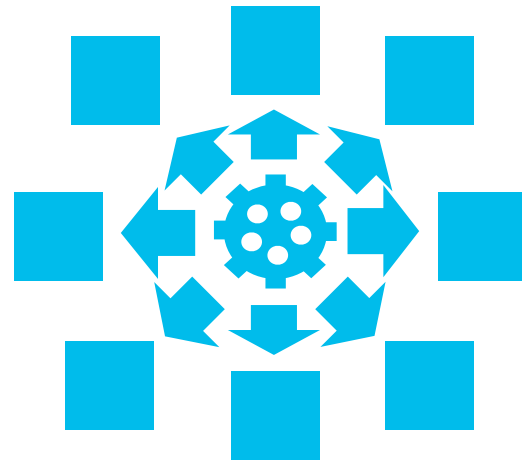
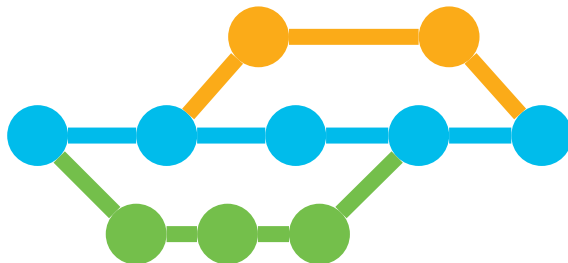
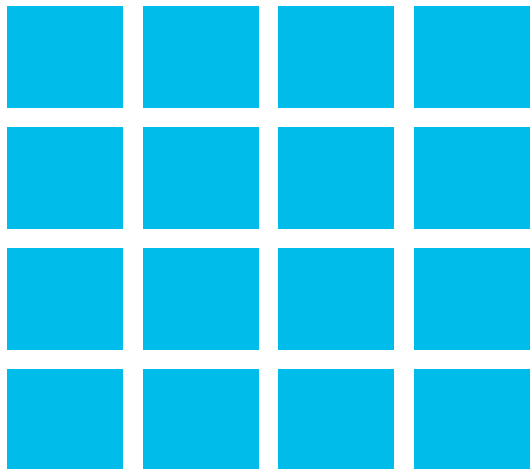
How to pick a tool? (Not in priority order)

- Commercial vs Open Source
- Programming language
- Supported integrations
- Popularity in community
- Relevant examples
- Tool Capabilities
- Used elsewhere in organization



*Often no one tool will fit,
using multiple is okay too!*

NetDevOps Will Deliver



**Consistent Version Controlled Infrastructure deployed
with Parallel & Automated Provisioning**



A "Traditional" Network Engineer Profile



Network Skills

- Spanning-Tree
- Routing Protocols
- QoS
- VPN Design
- Spanning-Tree
- VOIP
- Fibre Channel
- Security Policy
- MPLS
- Did we mention Spanning-Tree?

Programming Skills

- TCL
- EEM
- Expect Scripts

A Profile of a NetDevOps Engineer!



Network Skills

- Layer 2 & 3 Fundamentals
- Quality of Service
- Security and Segmentation
- Linux Networking
- Container Networking
- Cloud Networking
- IOT Networking
- Model Driven Programmability
- Network Function Virtualization

Platform Skills

- Linux Administration
- Container Fundamentals
- Micro Service Platforms
- Cloud Fundamentals

Programming Skills

- Data Formats (ex: JSON, YAML, etc)
- Python and APIs (ex: REST, NETCONF, etc)
- Source Control (ex: git, GitLab, etc)
- Configuration Management (ex: NSO, Ansible, Puppet, etc)

Carl's 3 Step Approach to Network Programmability

Phase 1

- Python
- REST APIs
- JSON/XML/YAML
- git/GitHub

Phase 2

- Linux Skills
- Config Management
- Docker
- NETCONF/YANG

Phase 3

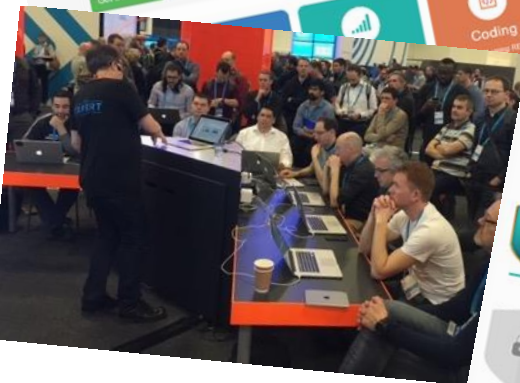
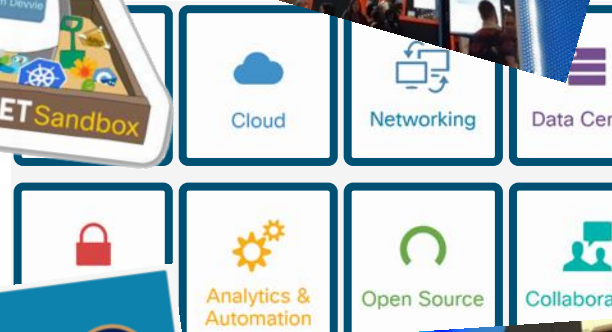
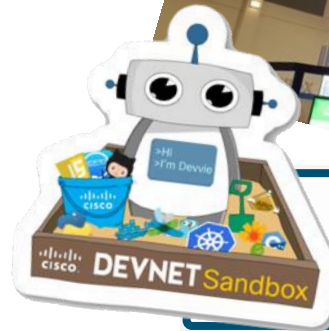
- Linux Networking
- Container Networking
- Network Function Virtualization

As Needed

- Network Controllers
- IOT Networking
- Cloud Networking
- "DevOps"







Introduction to Device Level Interfaces (ex: NETCONF/YANG)

Understand model-driven programmability and how NETCONF, YANG, and RESTCONF fit into the next generation of standard device-level interfaces.
⌚ 1 Hour 15 Minutes

- 🔑 Introduction to Standard Device Interfaces
Understanding how NETCONF/YANG fit into Network Management technologies.
- 🔑 Introduction to YANG Data Modeling
Understand what a Data Model is and what YANG provides for Network Management.
- 🔑 Introduction to the NETCONF Protocol
Explore the key elements of the NETCONF Protocol and how to use it.
- 🔑 Introduction to the RESTCONF Protocol
Explore the key elements of the RESTCONF Protocol and how to use it.

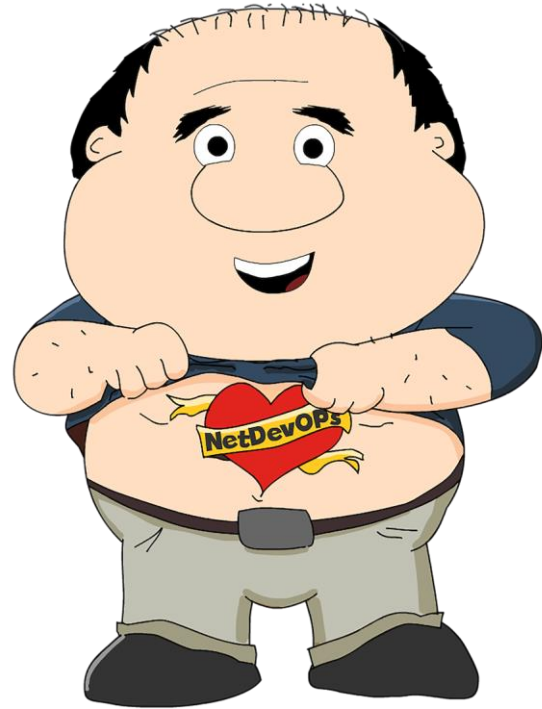


TRUST the `</>` AUTOMATION

Summing up

Review

- We looked back on the history of the network and network engineering
- Traveled through the Four Ages of Networking
- Explored how NetDevOps will change Networking
- Considered the skills a network engineer needs today





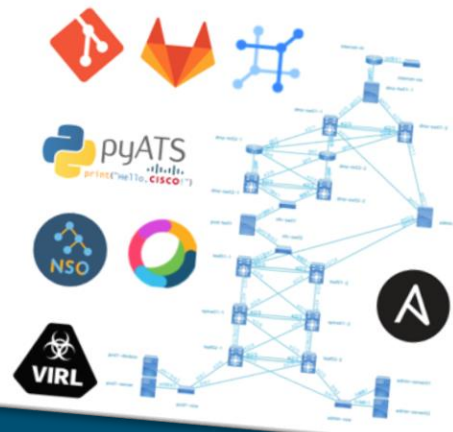
Working 9 to 5 as a NetDevOps Engineer

A practical look at NetDevOps in action

Hank Preston, Principal NetDevOps Engineer
@hfpreston
DEVNET-1291

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What do do next?

- NetDevOps Readings

- [Embrace NetDevOps, Say Goodbye to a "Culture of Fear"](#)
- [NetDevOps Goes Beyond Infrastructure as Code](#)
- [What does "Network as Code" Mean?](#)
- [A Network Engineers Journey in Programmability](#)
- [NetDevOps and the Rise of the Programmable Network](#)

- NetDevOps Learning Resources

- [Network Programmability Basics Video Course](#)
- [NetDevOps Learning Labs](#)
- [NetDevOps Live!](#)

- NetDevOps Videos

- [How to be a Network Engineer in a Programmable Age](#)
- [Network as Code in Action](#)
- [Benefits of Configuration Management](#)

Learn more about the new DevNet Certifications and how you can prepare now!

Associate Level

Specialist Level

Professional Level

Expert Level

Engineering



Software



Future
Offering

Start Here | Upcoming Cisco DevNet Certifications

- Start at **Meet DevNet**

DEVNET-2864: Getting ready for Cisco DevNet Certifications

Offered daily at 9am, 1pm & 4pm at Meet DevNet

- Attend a **brownbag session**

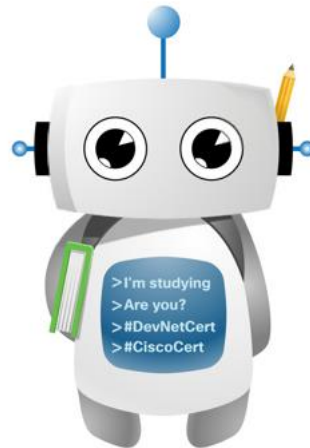
DEVNET-4099: DevNet Certifications: Bringing software practices & software skills to networking

Offered daily 12:15-12:45 in the DevNet Zone Theater

- Visit the **Learning@Cisco** booth
- Scan this code to **sign up** for the latest updates or go to <http://cs.co/20eur02>



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Got more questions? Stay in touch!



Hank Preston



hapresto@cisco.com



@hfpreston



<http://github.com/hpreston>

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developer.cisco.com



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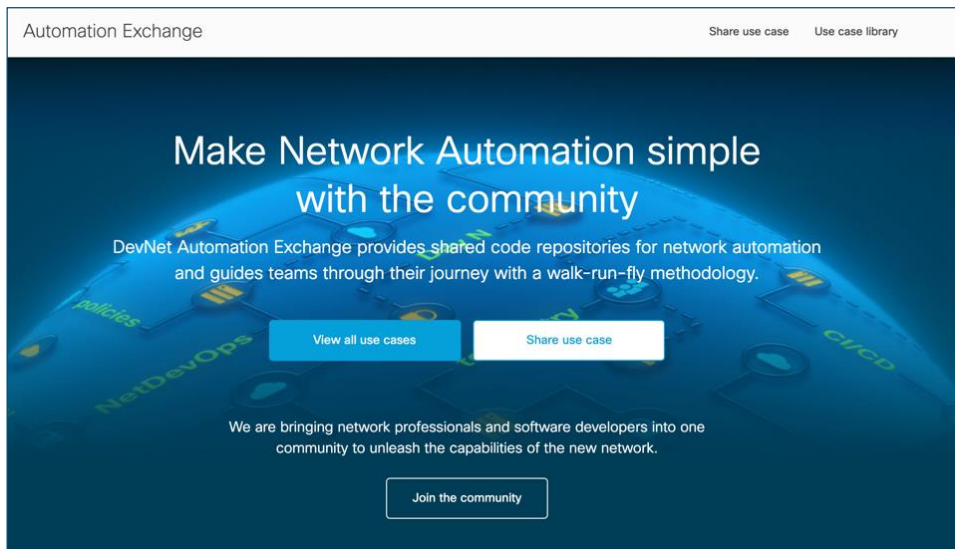
facebook.com/ciscocodevnet/



<http://github.com/CiscoDevNet>

Find shared code repositories of use cases for network automation & more

Don't miss our 5
Automate Infrastructure
demos in the
DevNet Zone!



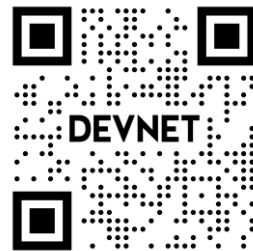
Start at **Meet DevNet**

DEVNET-3010 [a-j] Learn how to make Network Automation Simple with the Community

Offered Monday 2pm & 5pm, Tuesday & Wednesday 10am, 2pm & 5pm, and Thursday 10am & 5pm at Meet DevNet

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Scan this code or go to the URL to **learn more**



<http://cs.co/20eur01>

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Walk-In Labs



Meet the Engineer
1:1 meetings



Related sessions



Thank you





You make **possible**