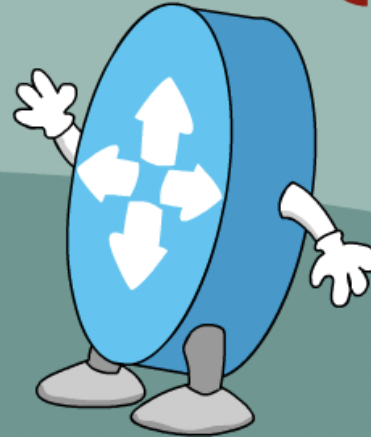




# NETDEVOPS {LIVE!}



DEVNET

## It's Not a Dream, NetDevOps CI/CD Pipelines Can Develop, Test, and Deploy Network Configurations Today

Hank Preston, ccie 38336 R/S

Developer Advocate, DevNet

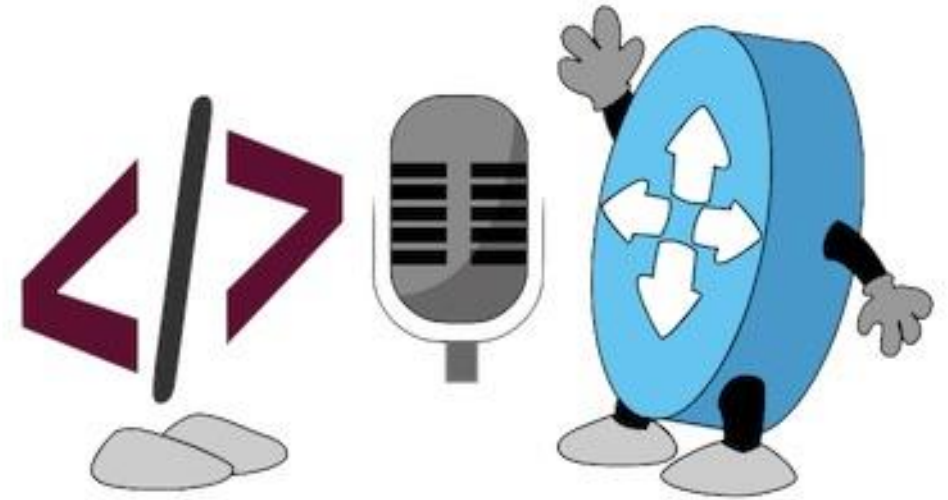
Twitter: @hfpreston

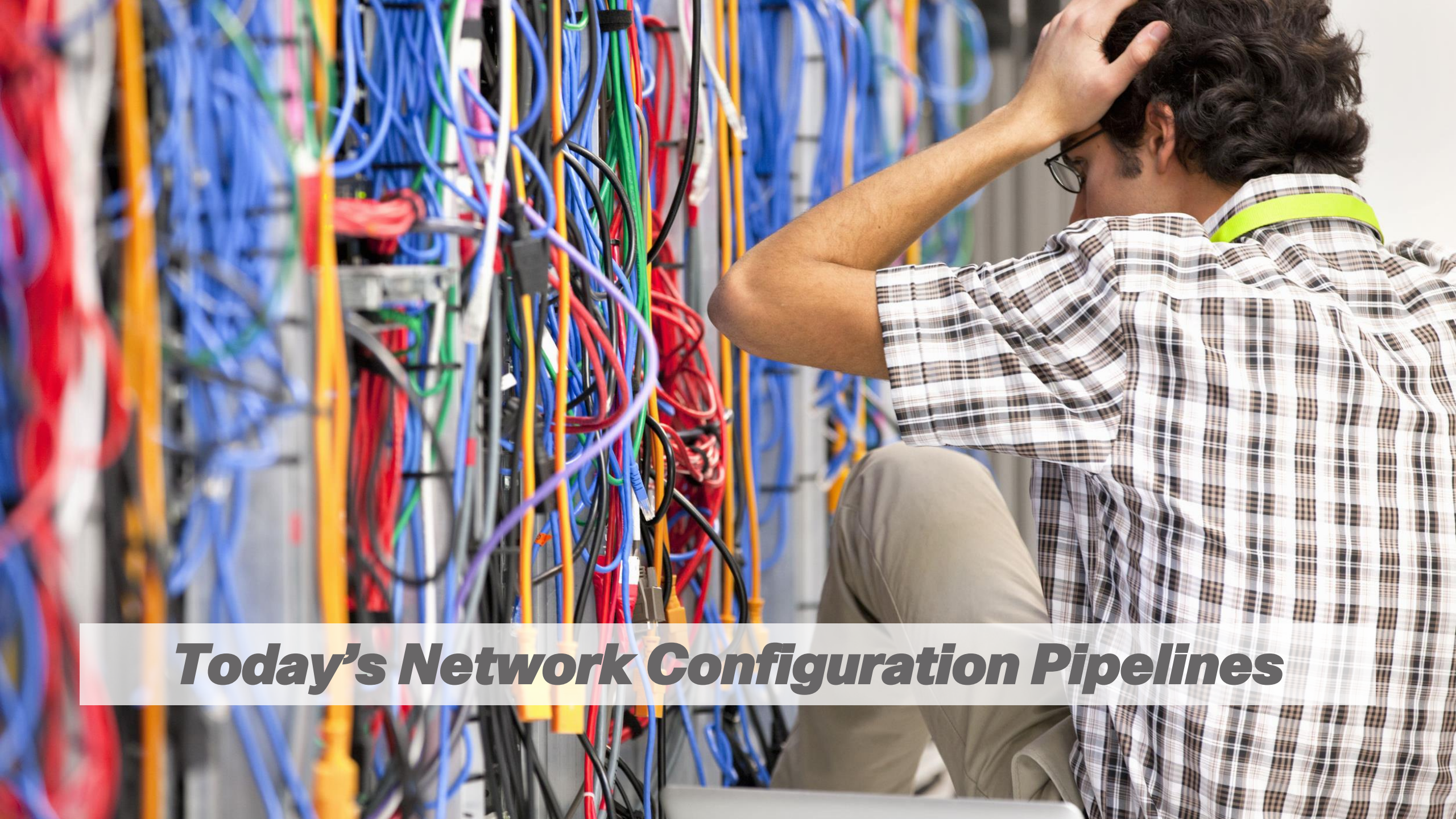
Season 1, Talk 2

<https://developer.cisco.com/netdevops/live>

# What are we going to talk about?

- Today's Network Configuration Pipelines
- NetDevOps CI/CD Pipeline in Concept
- NetDevOps CI/CD in Action





## ***Today's Network Configuration Pipelines***

***“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*

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From  
Date  
To:  
Cc:  
Subject: switch uptime

```
r-secmgtel-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)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Tue 14-Feb-06 17:18 by kehsiao
Image text-base: 0x40101040, data-base: 0x42D00000
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)
```

***Don't encourage this  
kind of behavior!!!!***

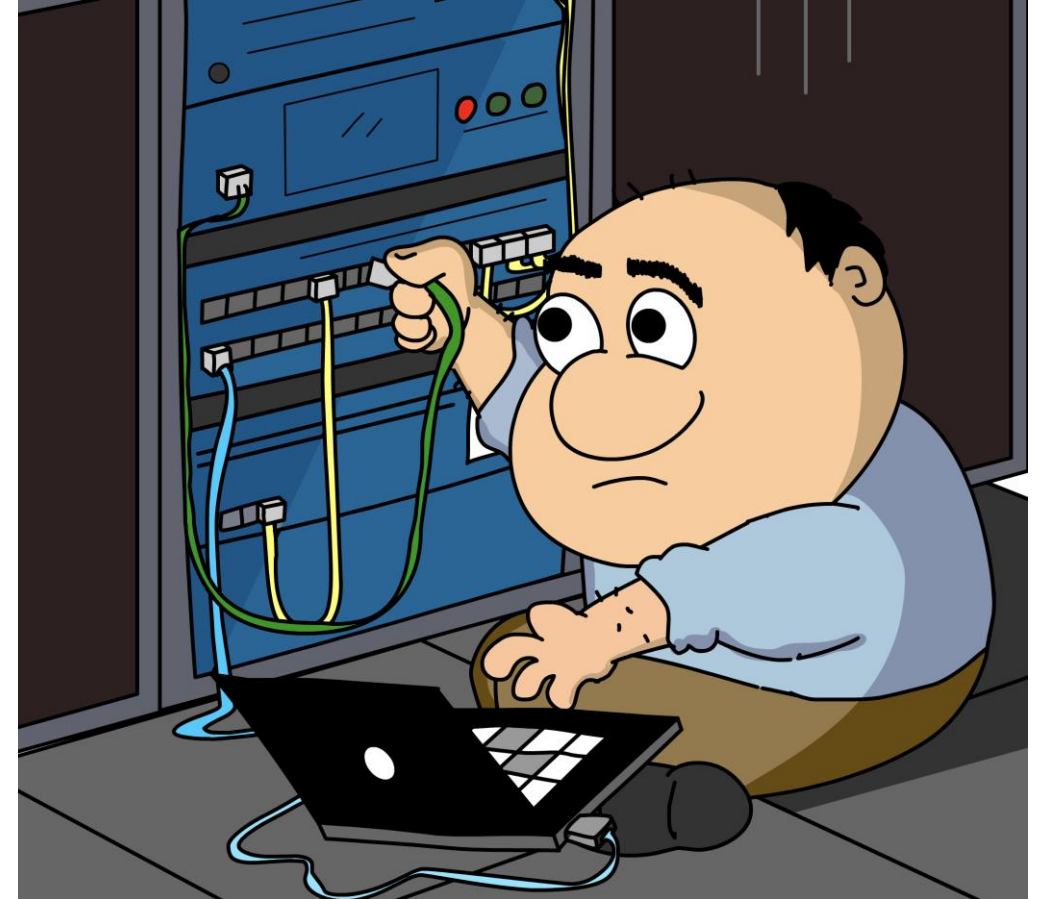
```
r-secmgtel-1 uptime is 11 years, 31 weeks, 1 day, 16 hours, 46 minutes
Time since r-secmgtel-1 switched to active is 11 years, 31 weeks, 1 day, 17
hours, 29 minutes
```

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

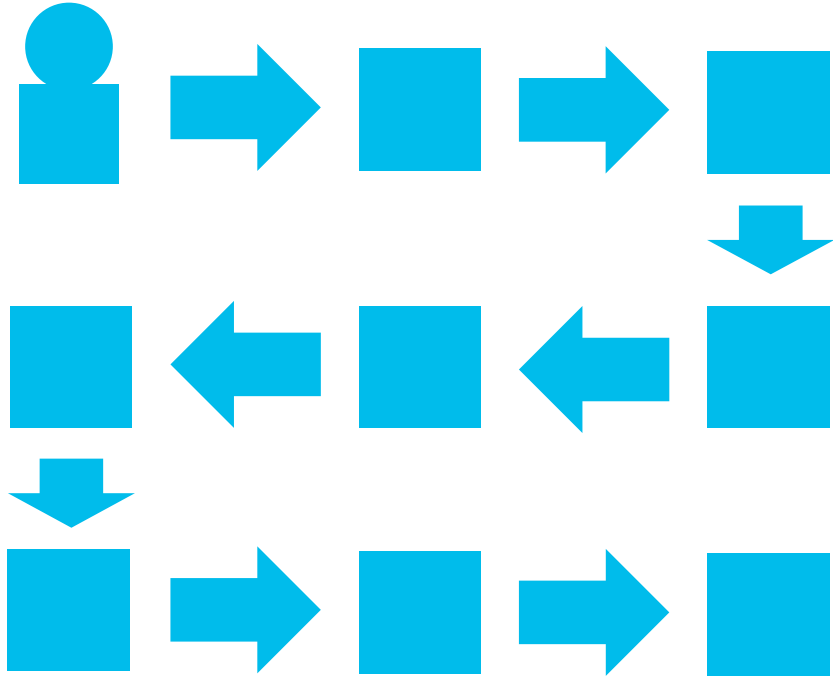
```
System restarted at 20:47:24 UTC Thu Mar 9 2006
```

# Today's reality...

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



# Today's Pipeline Realities



Sequential and Manual Infrastructure Provisioning



Snowflake Infrastructure with Organic Configurations

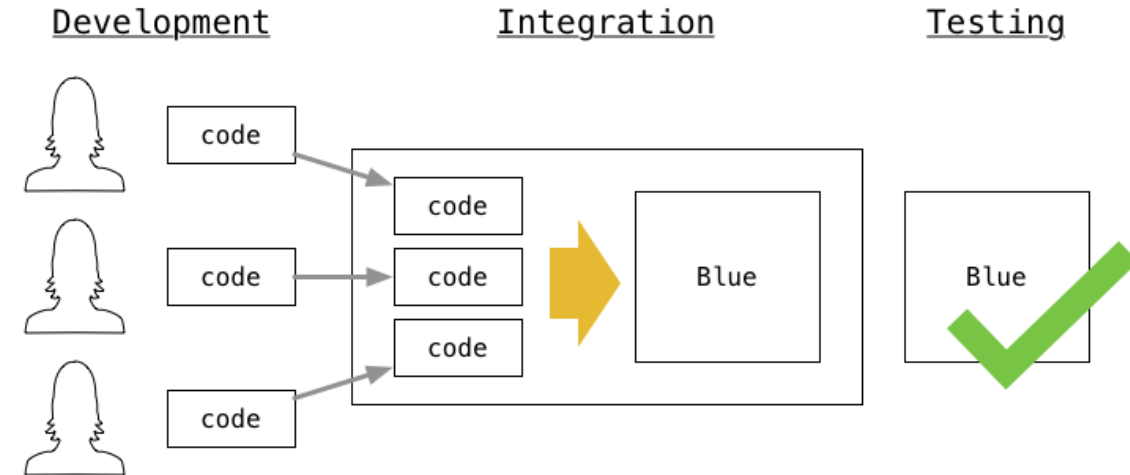
A man in a blue plaid shirt is holding a laptop in a server room. He is looking directly at the camera with a serious expression. The server racks in the background are filled with equipment, including switches and servers, with various cables and indicator lights visible. The text "NetDevOps CI/CD Pipeline in Concept" is overlaid on the bottom of the image in a bold, italicized font.

***NetDevOps CI/CD Pipeline in Concept***



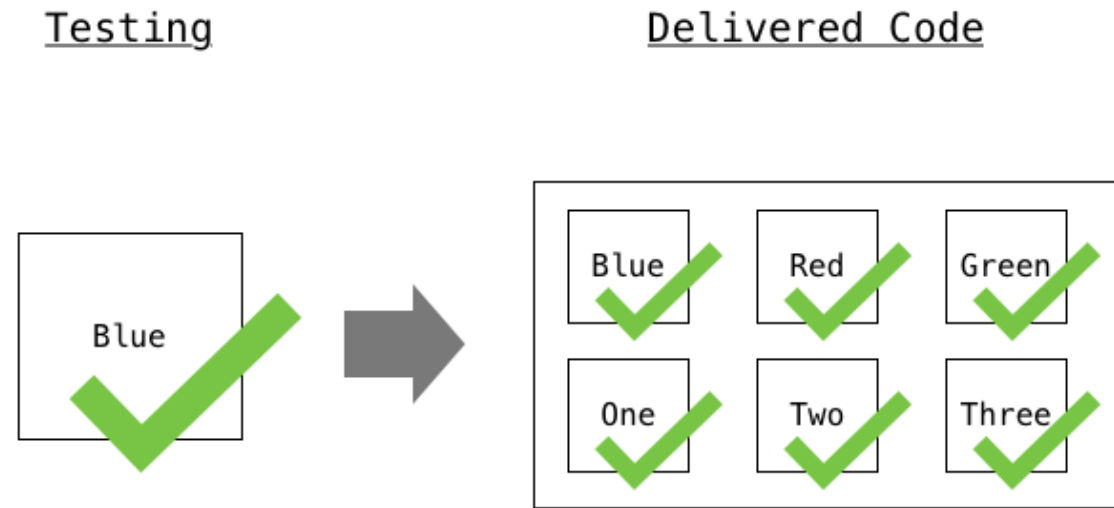
# Software Development Process – Integration

- Bring together individual developers code
- Compile/Build components
- Execute Tests



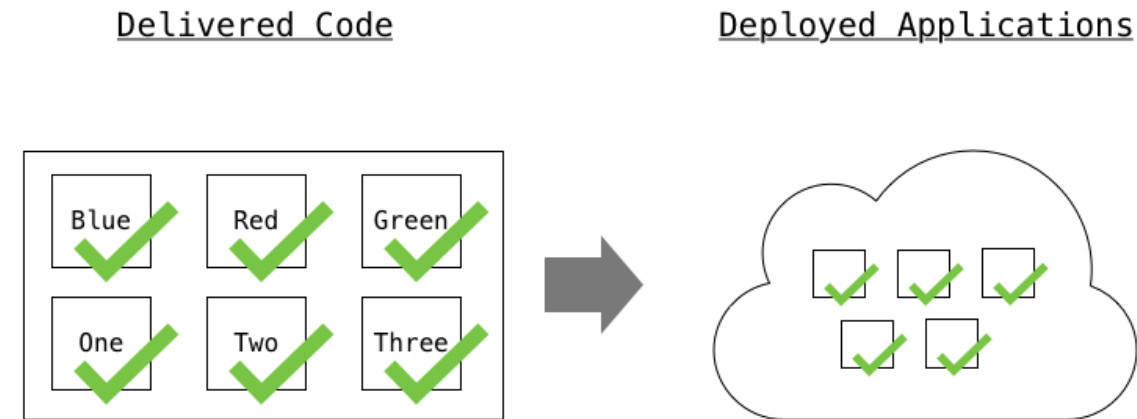
# Software Development Process – Delivery

- On tested and working code
- Create final artifacts
- Make available for usage



# Software Development Process – Deployment

- Install application
- Configure for use

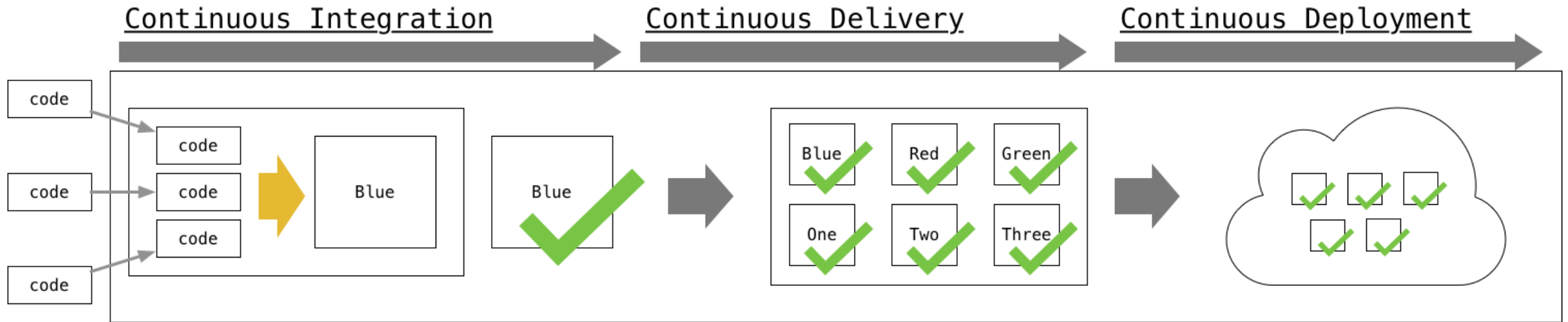


# Continuous Development (or CI/CD)

- Continuous development is the natural progression of iteration times shrinking into insignificance. Through heavy use of automation, flexible infrastructure and modular architecture, software development leaders have come to the point where each code change is its own deployment.

<http://searchsoftwarequality.techtarget.com/essentialguide/Next-generation-Agile-Guide-to-continuous-development>

# Continuous Development Process Flow



## Continuous Integration

Merging of development work with code base constantly so that automated testing can catch problems early

## Continuous Delivery

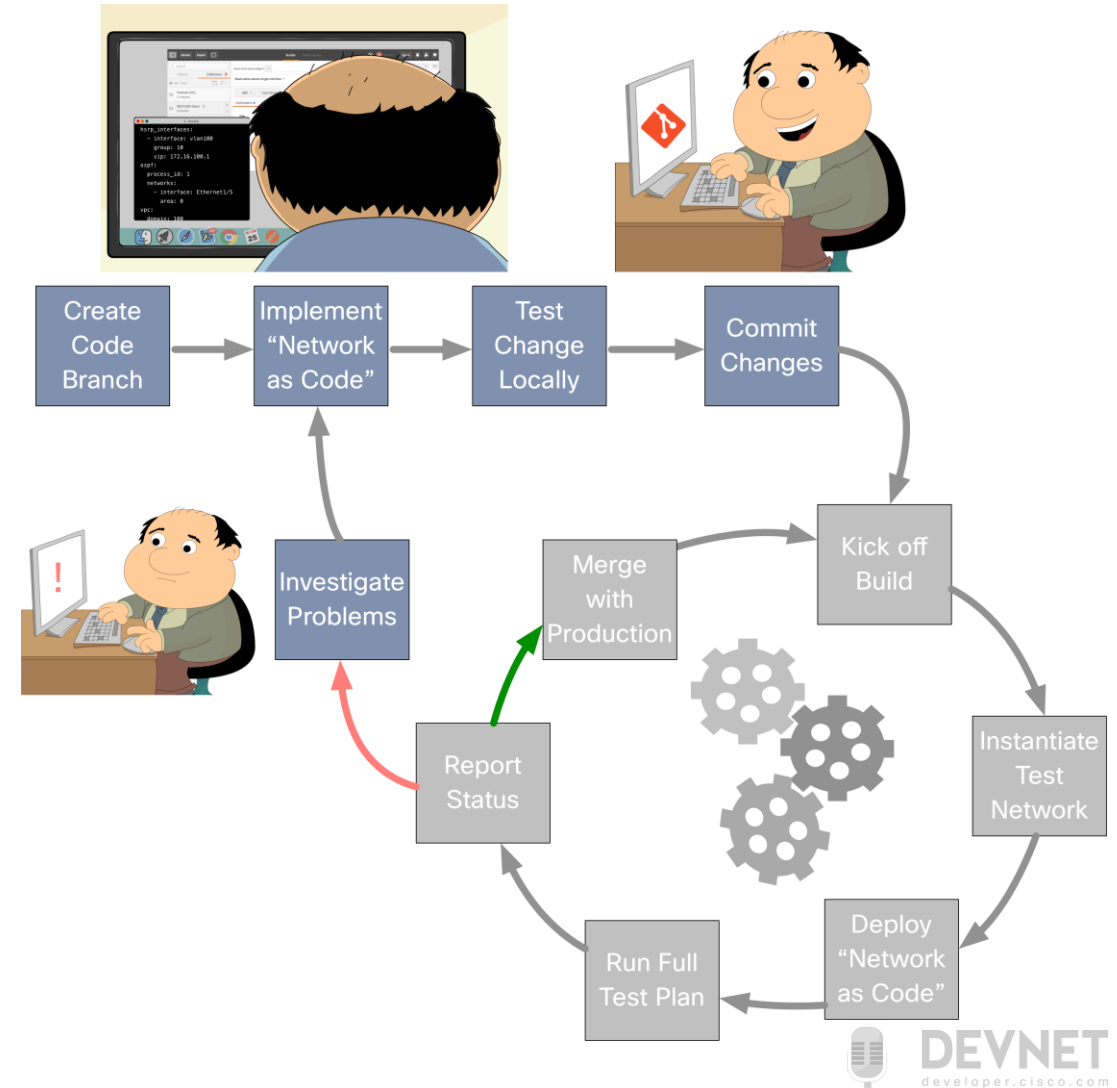
Software package delivery mechanism for releasing code to staging for review and inspection

## Continuous Deployment

Relies on CI and CD to automatically release code into production as soon as it is ready. Constant flow of new features into production

# NetDevOps Configuration Pipeline

- “Treating the Network as Code”
- Network Configuration stored in Source Control
- Changes are proposed in code “branches”
- CI/CD Build Servers deploy and test proposed configurations
- Successful configurations ready for deployment to “Production”



# The NetDevOps Engineers Tool Bag

(Example tools, not comprehensive)

## Distributed Source Control

(git, Subversion, Mercurial, GitHub, BitBucket, GitLab)

## Build Server

(GitLab, Jenkins, Team City, Drone)

## Configuration Management

(Ansible, Puppet, NSO, NAPALM, DIY)

## Network Test Tooling

(PyATS, TRex, Robot, Behave)

## Telemetry & Monitoring

(ELK, Grafana, Pipeline, UTM)

CLI

SNMP

NETCONF/  
RESTCONF

gRPC

REST APIs

YANG/Native Data Model

Configuration Data

Operational Data

Network Device

Network  
Virtualization  
Platforms  
(VIRL/CML, NFVIS,  
Vagrant)

## Development Environment

(Vagrant, NSO, VIRL/CML)

## Test Environment

(VIRL/CML)

## Production Environment



# ***NetDevOps CI/CD in Action***





D13

Get Hands-on with Network Analytics  
DEVNET

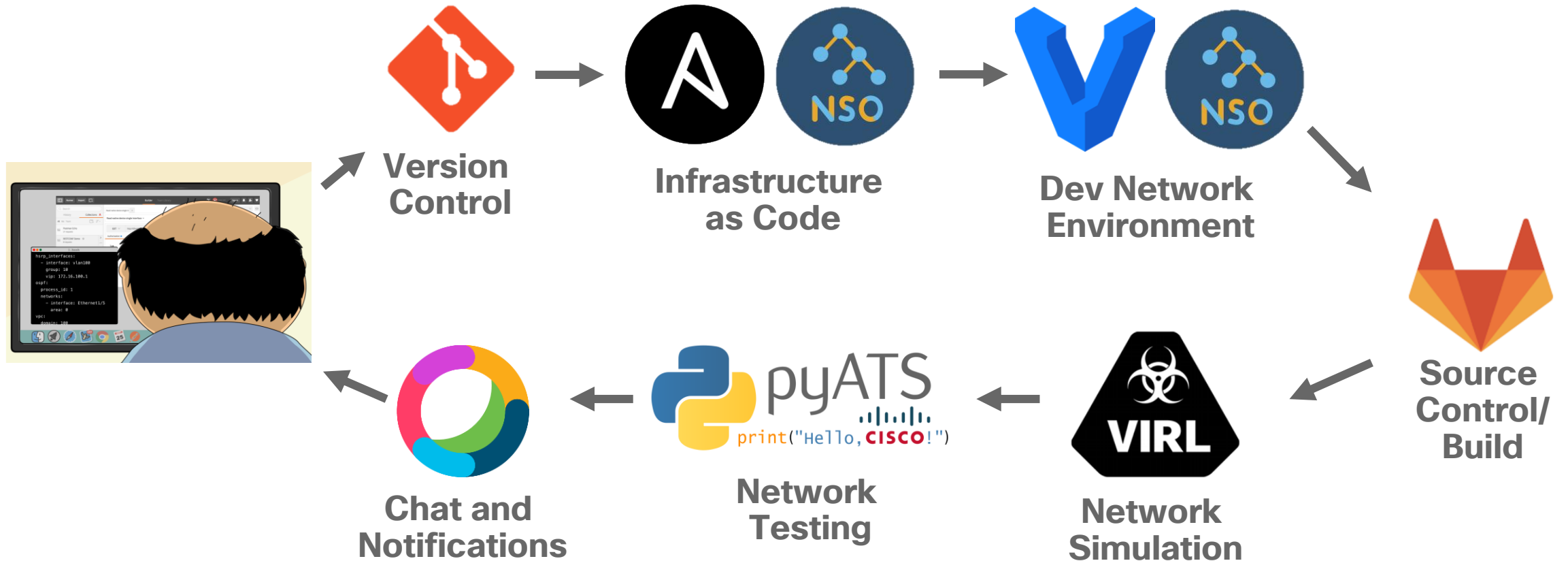
Health and Wellbeing Zone  
↑  
NOC

DEVNET

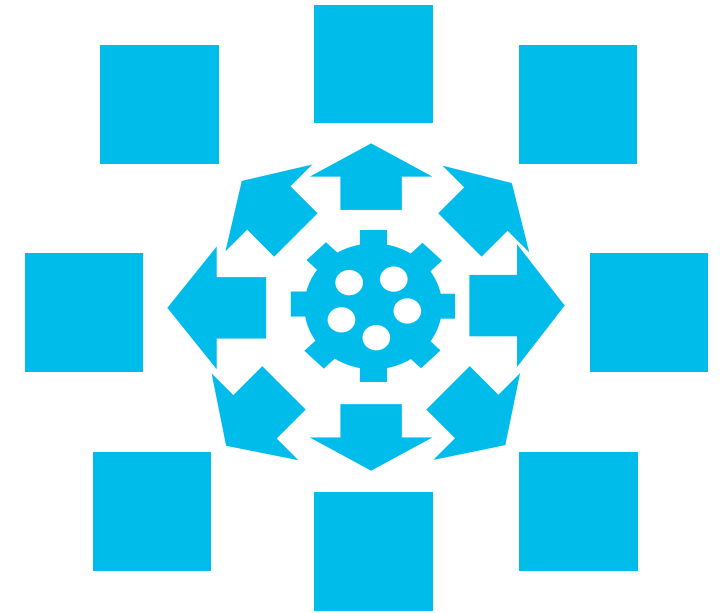
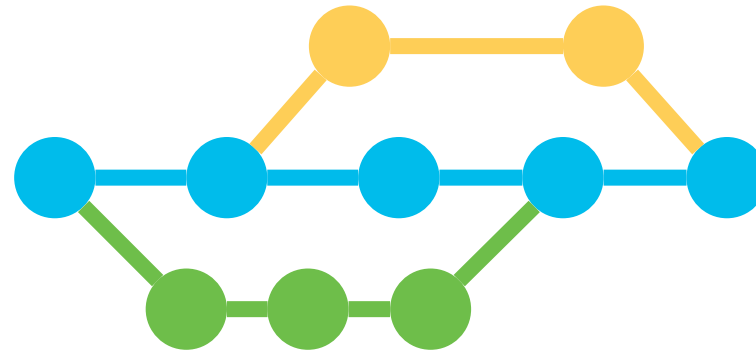
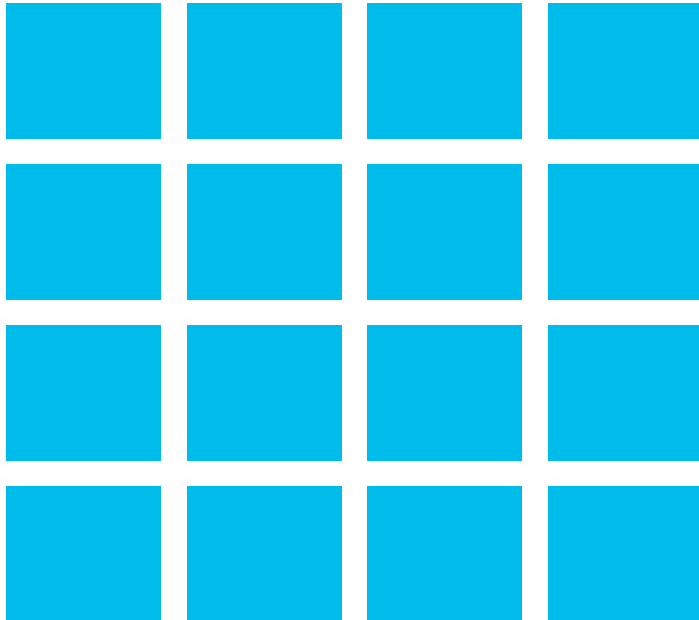
DEVNET

***So... Who's pumped about the possibilities?***

# NetDevOps CICD Demo Environment



# NetDevOps Will Deliver



Consistent Version Controlled Infrastructure  
deployed with Parallel & Automated Provisioning

# The NetDevOps Engineers Tool Bag

Distributed Source Control

Build Server

Configuration Management

Network Service Orchestrator  
(NSO)

Network Test Tooling

PyATS, TRex

Telemetry & Monitoring

Pipeline, UTR

CLI

SNMP

NETCONF/  
RESTCONF

gRPC

REST APIs

Network Virtualization  
Platforms

NFVIS  
VIRL/CML  
NSO  
VNFs

Network Device

DNA Center Platform, APIC, Meraki, IOS XE, IOS XR, NX-OS,  
Firepower, UCS

Development Environment

NSO, VIRL, VNFs

Test Environment

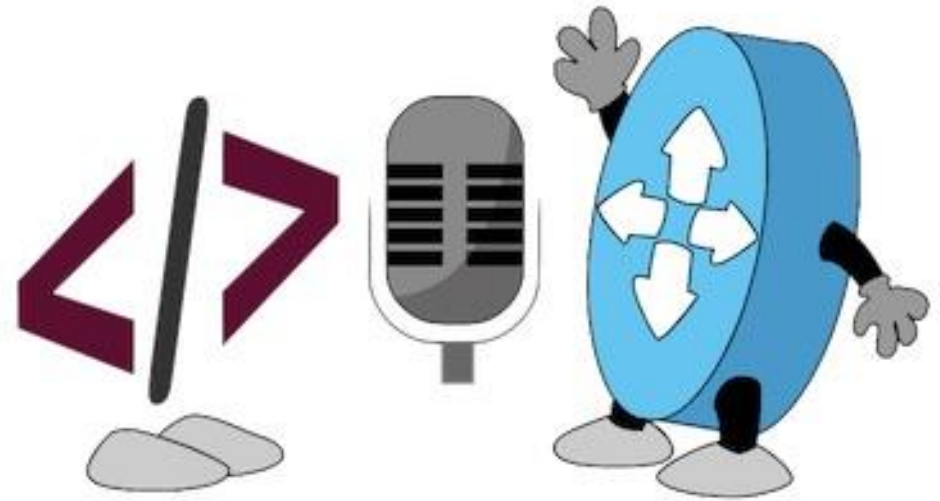
VIRL/CML

Production Environment

Summing up

# What did we talk about?

- Today's Network Configuration Pipelines
- NetDevOps CI/CD Pipeline in Concept
- NetDevOps CI/CD in Action



# Webinar Resource List



- Docs and Links

- <https://developer.cisco.com/netdevops>
- <https://developer.cisco.com/pyats>
- <http://virl.cisco.com>
- <https://developer.cisco.com/nso>

- Learning Labs

- Jumpstart Your NetDevOps Journey <http://cs.co/lab-netdevops>
- Introduction to NetDevOps CICD Pipelines <http://cs.co/lab-netcicd>
- Introduction to Ansible on IOS XE <http://cs.co/lab-ansible-iosxe>

- DevNet Sandboxes

- Multi-IOS Sandbox with CICD Demo <http://cs.co/sbx-multi>

- Code Samples

- <http://cs.co/code-sbx-multi>



# Related NetDevOps Live! Episodes

- [DevOps style configuration management for the network with Open Source](#) – Live on Oct 2<sup>nd</sup>
- [What's the big deal about Source Control? Why your network configurations should be in "git"](#) – Live on Oct 9<sup>th</sup>
- [Introduction to Network Services Orchestrator – the single API and CLI for your network](#) – Live on Oct 16<sup>th</sup>
- [Profile, test and verify your network is running smoothly with pyATS](#)  
– Live on Oct 30<sup>th</sup>



# NetDevOps Live! Code Exchange Challenge

[developer.cisco.com/codeexchange](https://developer.cisco.com/codeexchange)

**Create a sample VIRL topology file and submit to Code Exchange for others to check out.**

*Example: A Multi-Site DMVPN Network Topology.*

The image shows two overlapping screenshots of the Cisco Code Exchange website. The top screenshot is a search interface with the heading "Discover code repositories related to Cisco technologies". It includes a search bar with the placeholder text "What are you looking for?", a filter menu with "Recommended", "Python", and "Networking" selected, and icons for various technologies like Kinetic and Meraki. The bottom screenshot is the "Submit your project" form. It contains the following fields and options:

- Git Repo URL:** A text input field containing "https://github.com/organization/repository".
- Select all technologies associated with this repo:** A list of checkboxes for IoT, Cloud, Networking, Data Center, Open Source, Collaboration, Analytic & Automation, Security, and Mobility.
- Do you own or have permission to submit this repo?:** Radio buttons for Yes and No.
- Is this a Cisco repo?:** Radio buttons for Yes and No.
- Agree to Terms and Conditions:** A checkbox.
- Submit project:** A blue button.

On the right side of the bottom screenshot, there is an illustration of three people (two men and one woman) looking at a laptop, with a GitHub logo and code symbols above them.

# Looking for more about NetDevOps?

- NetDevOps on DevNet  
[developer.cisco.com/netdevops](https://developer.cisco.com/netdevops)
- NetDevOps Live!  
[developer.cisco.com/netdevops/live](https://developer.cisco.com/netdevops/live)
- NetDevOps Blogs  
[blogs.cisco.com/tag/netdevops](https://blogs.cisco.com/tag/netdevops)
- Network Programmability Basics Video Course  
[developer.cisco.com/video/net-prog-basics/](https://developer.cisco.com/video/net-prog-basics/)



Got more questions? Stay in touch!



**Hank Preston**

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 [@hfpreston](https://twitter.com/hfpreston)

 <http://github.com/hpreston>



**[developer.cisco.com](https://developer.cisco.com)**

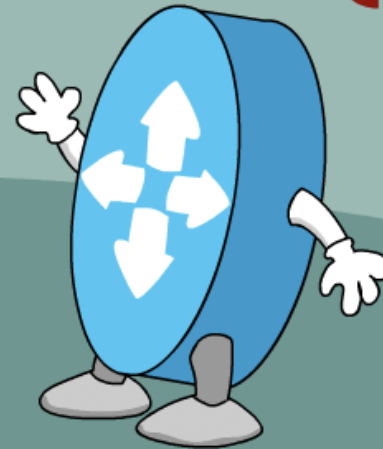
 [@CiscoDevNet](https://twitter.com/CiscoDevNet)

 [facebook.com/ciscocodevnet/](https://facebook.com/ciscocodevnet/)

 <http://github.com/CiscoDevNet>



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