# How to Build your own CICD Automation Pipeline from Scratch using CML, Ansible, PyAts, Webex and Gitlab CI

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CISCO Live!

# Cisco Webex App

## Questions?
Use Cisco Webex App to chat
with the speaker after the session

## How

1. Find this session in the Cisco Live Mobile App
2. Click "Join the Discussion"
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space
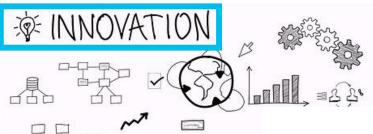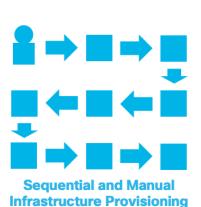
Webex spaces will be moderated
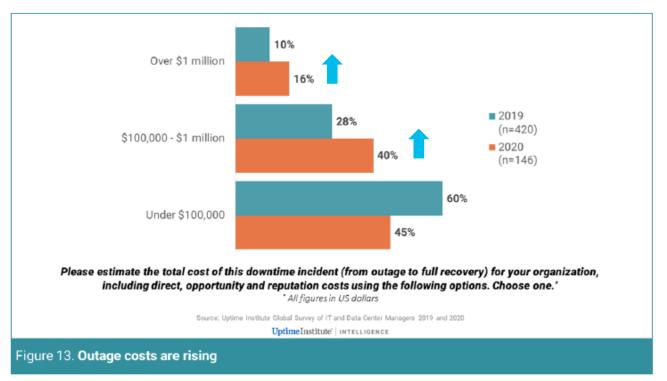until February 24, 2023.

# Agenda

- Why
- What
- How
- Demo Time

Why ??

# Why ??



## Today's Network Realities



**Sequential and Manual Infrastructure Provisioning**



**Snowflake Infrastructure with Organic Configurations**



Changes happen rarely

Changes are big and complicated

The team isn't well practiced.

Change seen as high risk

Problem occurs during change

Change seen as failure

Organizations Today have a "Culture of Fear"

# Why ??



Figure 13. **Outage costs are rising**

# Why ??



Configuration/change management failure — 58%
Third-party network provider failure — 45%
Firmware/software error — 36%
Natural disaster (e.g., public works, line breakages) — 31%
Network overload/congestion error — 28%
Corrupted firewall rules/routing table issues — 20%
Malicious cyber-attack (e.g., DDoS, network partitioning)* — 18%
Other networking-related failure — 1%

*DDoS – Distributed denial of service

**What were the most common root causes for the networking-related IT outages at your organization's data centers over the past three years? (Choose no more than three)**

Source: Uptime Institute Data Center Resiliency Survey 2021 (n=130)
Uptime Institute | INTELLIGENCE

Figure 11. **Most common causes of networking-related IT outages**

| Root Cause | Fraction (%) |
|---|---|
| Configuration Update Error | 56% |
| Configuration Generation Error | 10% |
| Device Firmware Bug | 10% |
| Human Error | 10% |
| Transient Error | 8% |
| Unknown | 6% |

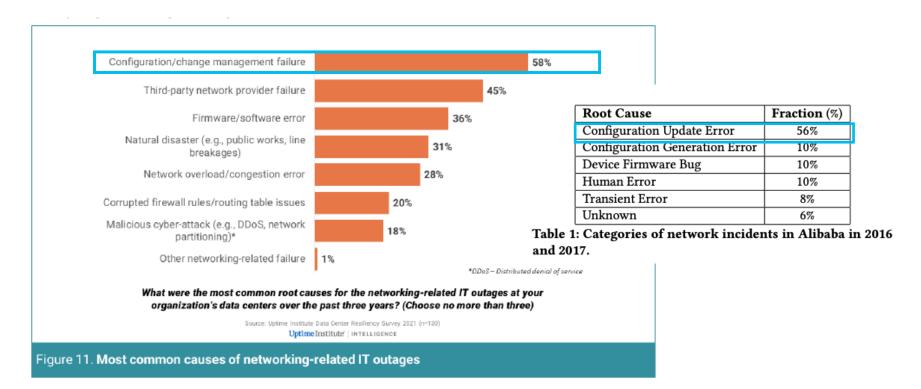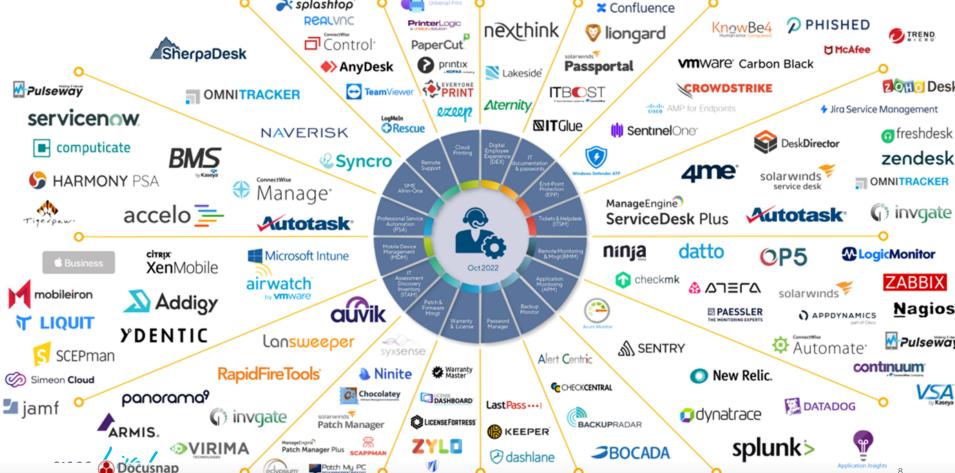**Table 1: Categories of network incidents in Alibaba in 2016 and 2017.**

What ??

# Industrial Pipeline

# KPIs of high achievers

**<1Hr**

**Time to restore service**

For the primary application or service, you work on, how long does it generally take to restore service when a service incident or a defect that impacts users occurs[2]

**<1Hr**

**Lead time for changes**

For the primary application or service, you work on, what is your lead time for changes[2]

**0%-15%**

**Change failure rate**

For the primary application or service, you work on, what percentage of changes to production or released to users result in degraded service[2]
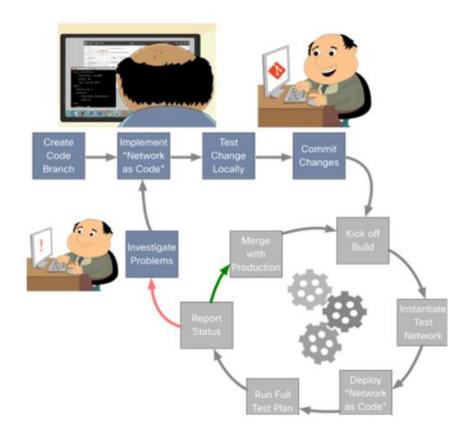
# What ??

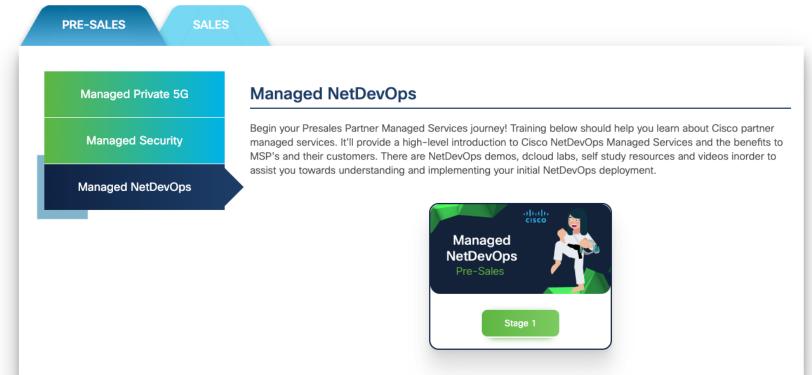CICD allows the network changes to happen faster and make it more reliable

If you need them fast and reliable, you need them in CICD.

# BlackBelt enablement for NetDevOps

# Cisco Career Certifications

## Implementing DevOps Solutions and Practices using Cisco Platforms v1.0 (300-910)

Implementing DevOps Solutions and Practices using Cisco Platforms v1.0 (DEVOPS 300-910) is a 90-minute exam associated with the DevNet Professional Certification. This exam tests a candidate's knowledge of DevOps practices as it pertains to deployment automation that enables automated configuration, management, and scalability of cloud microservices and infrastructure processes on Cisco platforms. The course, Implementing DevOps Solutions and Practices using Cisco Platforms, helps candidates to prepare for this exam.

**Sign up for updates**

## Exam overview

| 20% | 1.0 CI/CD Pipeline | ⌄ |
|-----|--------------------|---|
| 15% | 2.0 Packaging and Delivery of Applications | ⌄ |
| 20% | 3.0 Automating Infrastructure | ⌄ |
| 15% | 4.0 Cloud and Multicloud | ⌄ |
| 20% | 5.0 Logging, Monitoring, and Metrics | ⌄ |
| 10% | 6.0 Security | ⌄ |
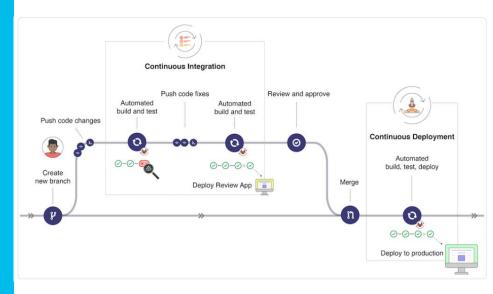
How ??

# NetDevOps CICD Pipeline



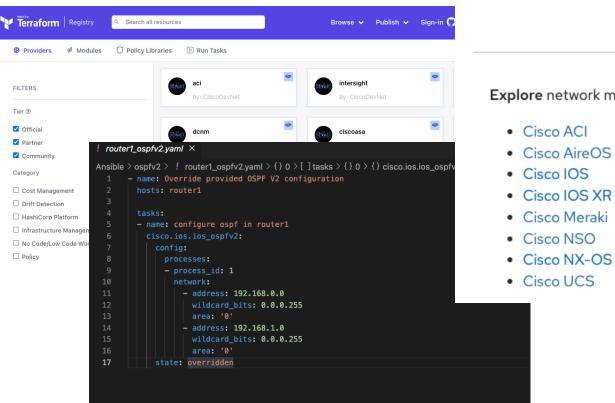https://docs.gitlab.com/ee/ci/introduction/index.html
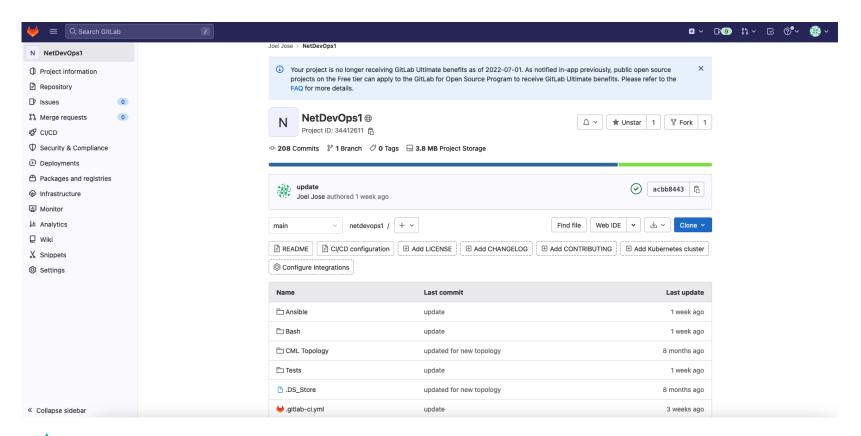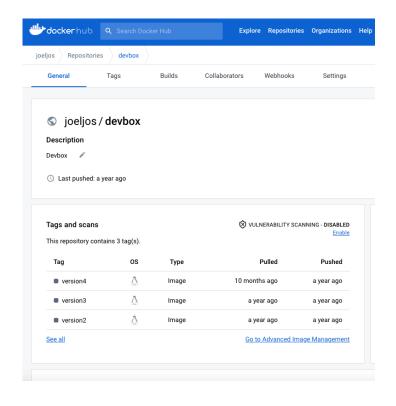
# NetDevOps Tools

# Infrastructure as Code
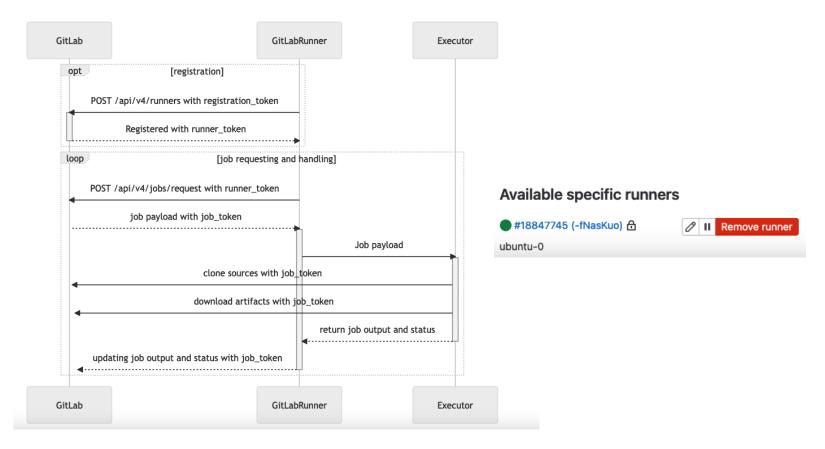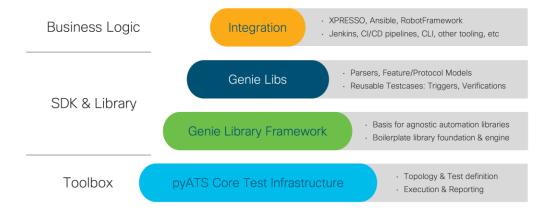
# Do you GIT me?

# Deployment environments

# CICD Runners

# Test Suites

Industry leading Test frameworks that assists in mitigating risks associated with automation and lead to decrease in change failure rate.



Business Logic

Integration
· XPRESSO, Ansible, RobotFramework
· Jenkins, CI/CD pipelines, CLI, other tooling, etc

SDK & Library

Genie Libs
· Parsers, Feature/Protocol Models
· Reusable Testcases: Triggers, Verifications

Genie Library Framework
· Basis for agnostic automation libraries
· Boilerplate library foundation & engine

Toolbox

pyATS Core Test Infrastructure
· Topology & Test definition
· Execution & Reporting

# PyAts example

```python
# MainTestcases
class MainTestcases(aetest.Testcase):
    ''' Route test'''
    @aetest.test.loop(device=('router1','router2'))
    def routecheck(self, device):
        try:
            routes = self.parameters[device].api.get_routes()
            print (routes, len(routes))
            if (len(routes) != 10):
                self.failed('routes are less', goto = ['exit'])
        except Exception as e:
            print (e)


    '''Ping test'''
    @aetest.test.loop(device=('router1','router2'), destination=('192.168.4.2','192.168.3.2'))
    def ping(self, device, destination):
        try:
            # store command result for later usage
            result = self.parameters[device].ping(destination)

        except Exception as e:
            # abort/fail the testscript if ping command returns any exception
            # such as connection timeout or command failure
            self.failed('Ping {} from device {} failed with error: {}'.format(
                                destination,
                                device,
                                str(e),
                            ),
                        goto = ['exit'])
        else:
            # extract success rate from ping result with regular expression
            match = re.search(r'Success rate is (?P<rate>\d+) percent', result)
            success_rate = match.group('rate')
            # log the success rate
            logger.info(banner('Ping {} with success rate of {}%'.format(
                                destination,
```

# Cisco® Modeling Labs key features

**Live topology modification —** drag, drop, and wire networks in a running simulation

**Device persistence —** just like shutting down a real router

Admin control of all labs

Ability to define and import keyboard, video, and mouse (KVM) images

Labs = Isolated virtual networks

Configurable network connectivity

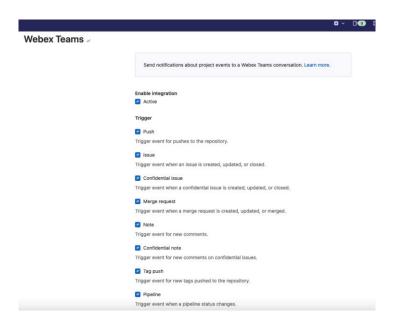Console multiplexing

Breakout client utility

Server-side labs with an easy-to-use HTML5 front end

{ REST:API }

API First Design

Swagger interface
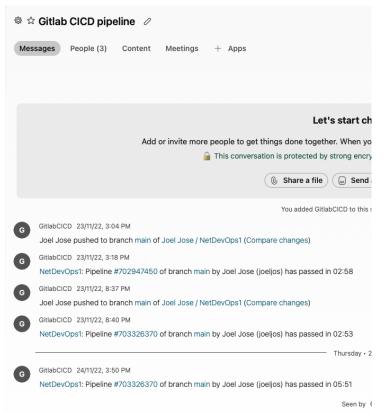
Python client library

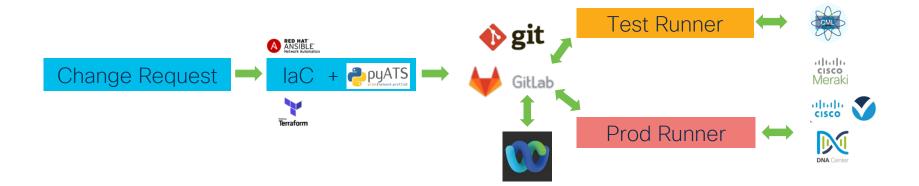CISCO *Live!*

# CML

# Webex

# If you need them fast and reliable, you need them in CICD.

# CICD Pipeline

# Demo Time

# Action plan May 2023

## Phase 1

- Understand the **importance** of Automation and NetDevOps
- Implement NetDevOps Pipeline for a simple **lab usecase**

## Phase 2

- Interconnect **Streaming Telemetry** into own Platforms or build an opensource (eg ELK Stack and Grafana) based observability capability. Recommend to integrate with Cisco FSO
- Conduct **Mock Drills** with Simulated Service Outages, SLA threshold breaches, Config drifts..etc to check the level of preparedness of the Automation Engine.

## Phase 3

- Implement in Managed Accounts using **Enterprise versions** of CML, NSO..etc and Managed devices
- Continuously **Monitor NetDevOps KPIs** like Time to restore service, Lead time for changes, Change failure rate, Deployment Frequency..etc and make Continous improvements to the NetDevOps processes.

# Resources

Network Programming Basics Video Course : https://developer.cisco.com/video/net-prog-basics/
NetDevOps Portal : https://developer.cisco.com/netdevops/
Sandbox : https://devnetsandbox.cisco.com/RM/Topology
Automation Exchange : https://developer.cisco.com/network-automation/
DevNet support : https://developer.cisco.com/site/support/
DevNet portal : https://developer.cisco.com/
Learning Tracks : https://developer.cisco.com/learning/tracks
Cisco Modeling Labs : https://www.cisco.com/c/en/us/products/cloud-systems-management/modeling-labs/index.html
DevNet Certifications : https://developer.cisco.com/certification/
Cisco IaC : https://developer.cisco.com/iac/
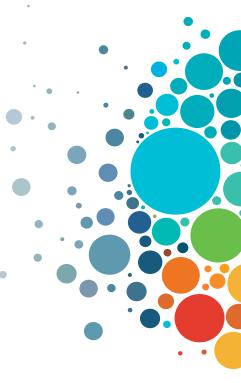Cisco PyAts : https://developer.cisco.com/docs/pyats/
NetDevOps Demo blog : https://blogs.cisco.com/developer/ci-cd-demo-netdevops-9

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- All surveys can be taken in the Cisco Events Mobile App or by logging in to the Session Catalog and clicking the "Attendee Dashboard" at

  https://www.ciscolive.com/emea/learn/sessions/session-catalog.html

# Continue Your Education

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Book your one-on-one Meet the Engineer meeting.

Attend any of the related sessions at the DevNet, Capture the Flag, and Walk-in Labs zones.

Visit the On-Demand Library for more sessions at ciscolive.com/on-demand.

Thank you

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ALL IN