



The bridge to possible

# Test Automation with Cisco Catalyst 9000 Virtual Switch

## Using Cisco Modelling Labs 2.7

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@jeremycohoe  
DEVWKS-2031

cisco *Live!*

#CiscoLive

# Cisco Webex App

## Questions?

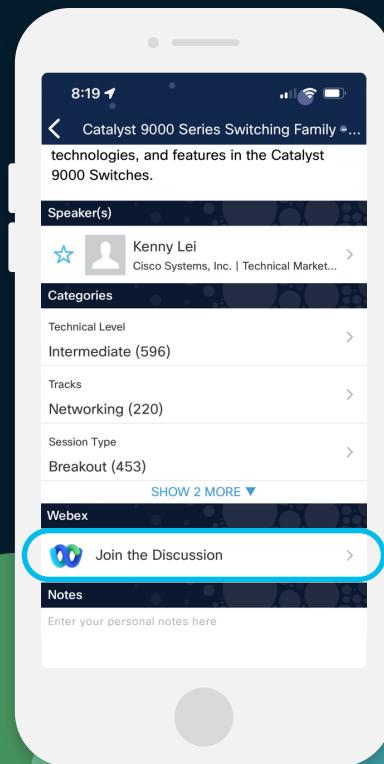
Use Cisco Webex App to chat with the speaker after the session

## How

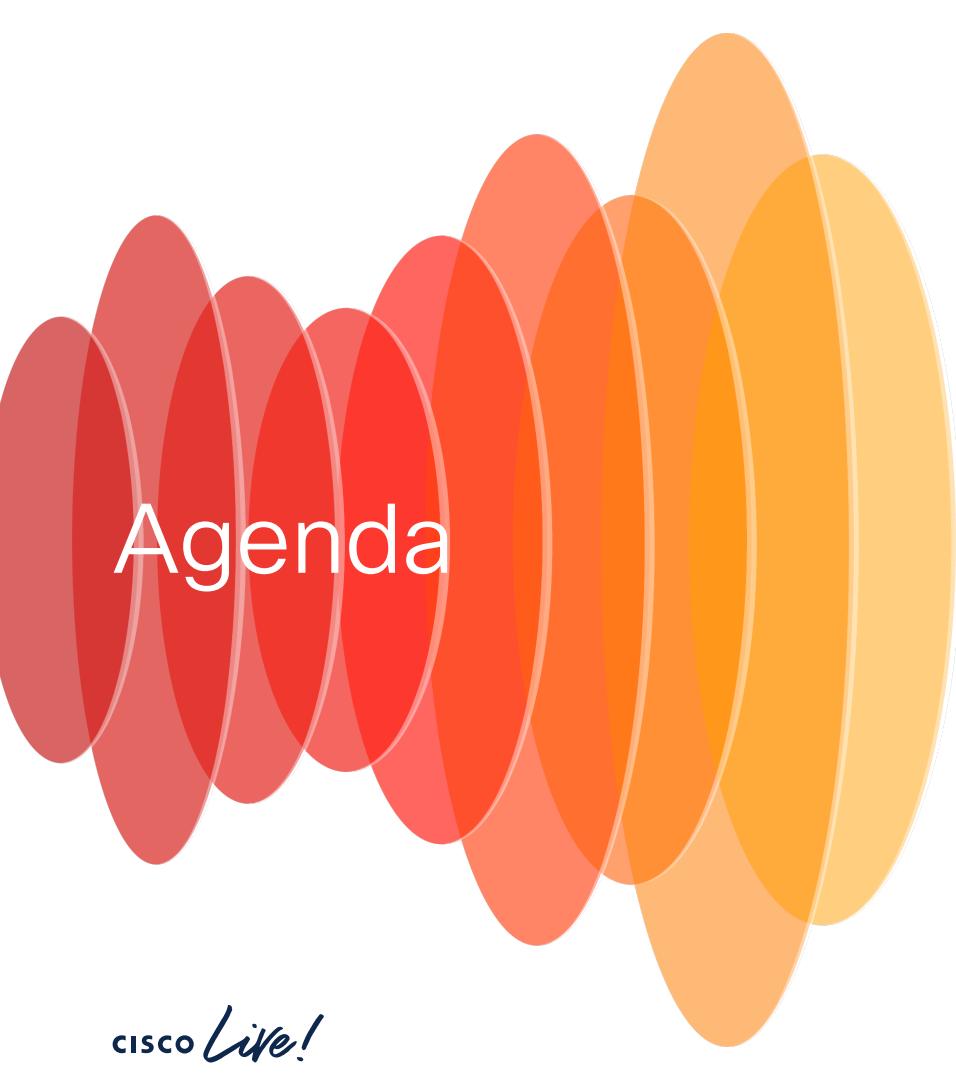
- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until June 7, 2024.

[https://ciscolive.ciscoevents.com/  
ciscolivebot/#DEVNET-1283](https://ciscolive.ciscoevents.com/ciscolivebot/#DEVNET-1283)



- Cisco Modelling Labs, Container Lab, KVM and Dockers... oh my! The way in which we can model networks and create infrastructure from code is evolving. In this session we will use virtualization technologies like CML and Docker in order to virtualize and simulate common network topologies and configurations.
- We will gain confidence in configuration management processes and tooling in the simulated lab and make the transition into production easier.
- The complete IOS XE programmability and automation lifecycle will be demonstrated and discussed using the virtual form factor alongside YANG Suite for testing and validation.



# Agenda

- Introduction
- CML
  - Demo / Hands-on
- C9KV
- IOS XE API
- Resources

# Lab Guide & Slides are available for you

<http://cs.co/devwks-2031>

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<https://github.com/jeremycohoе/CLUS24-DEVWKS-2031>

PDF Slides in Github !

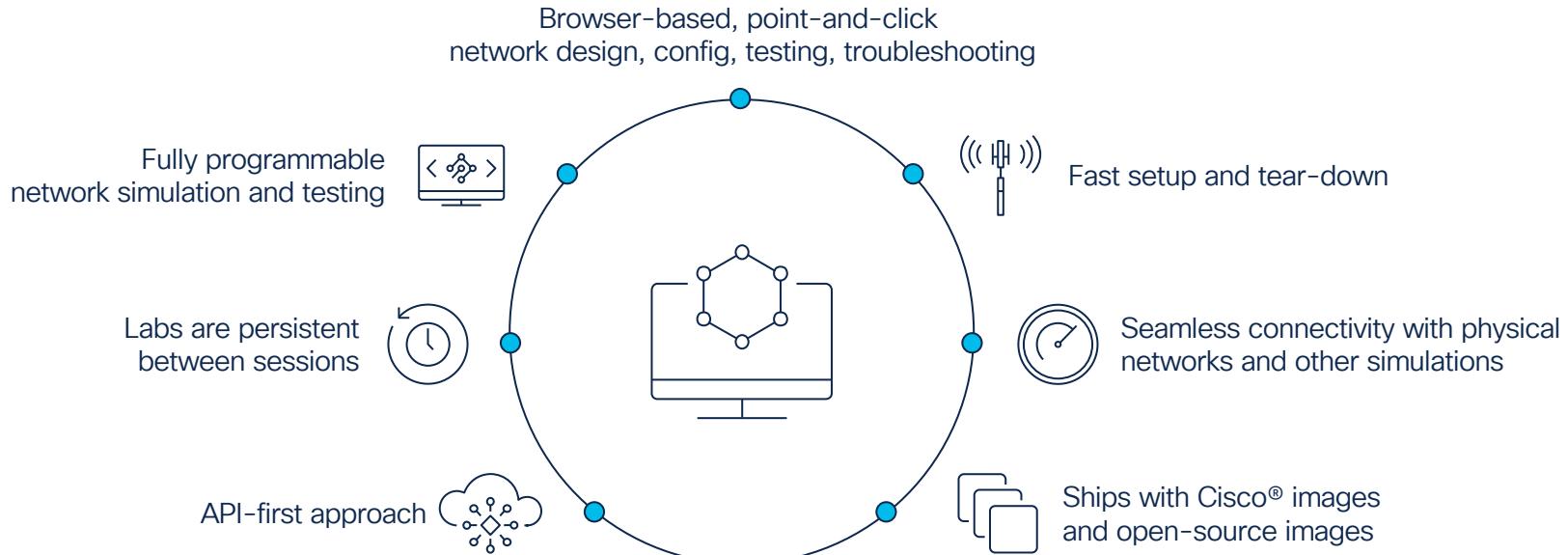


# CML

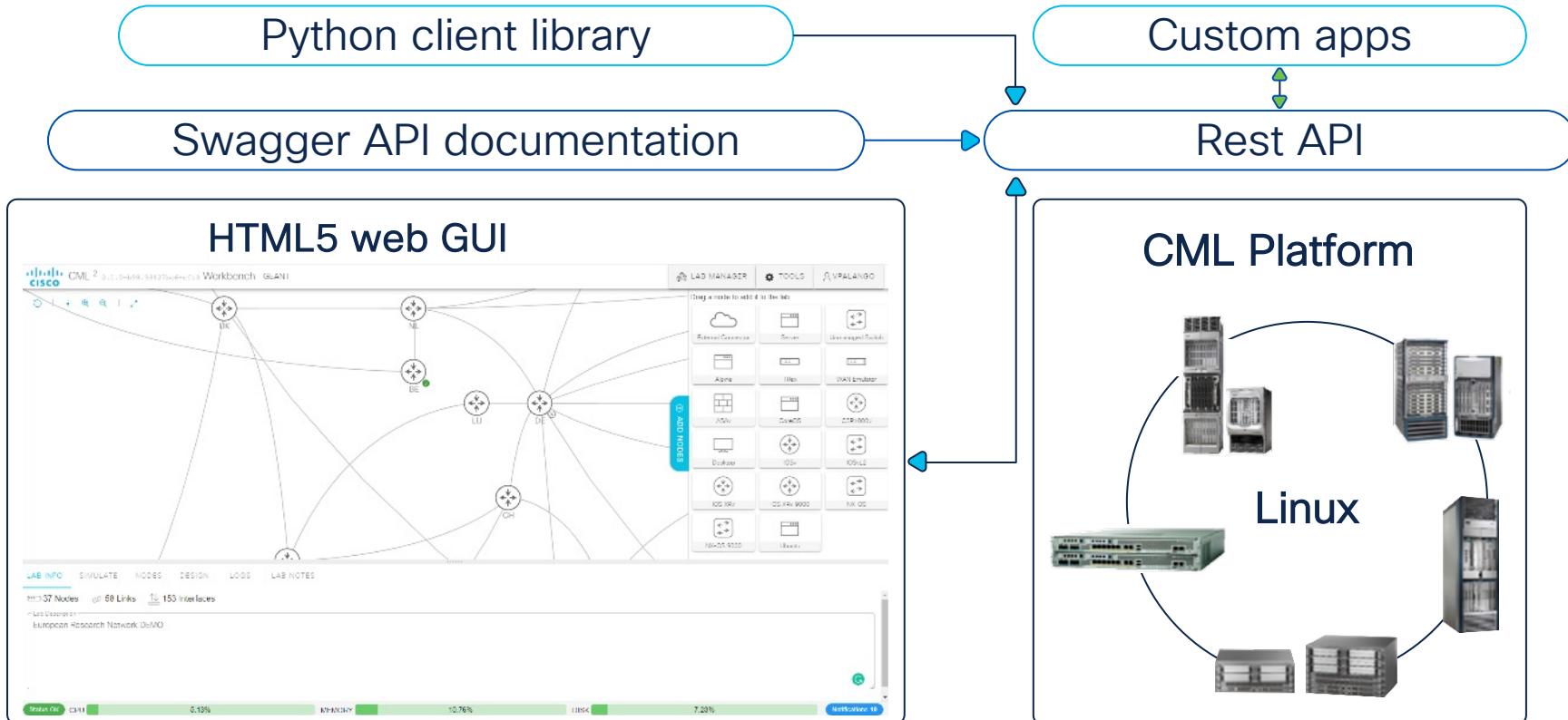
# Meet Cisco Modeling Labs

Cisco's premier platform for network simulation

CML is the Cisco Modelling Labs, it is a virtualization software for network engineers to easily create network topologies, links, and clients in order to simulate and test various topologies and features

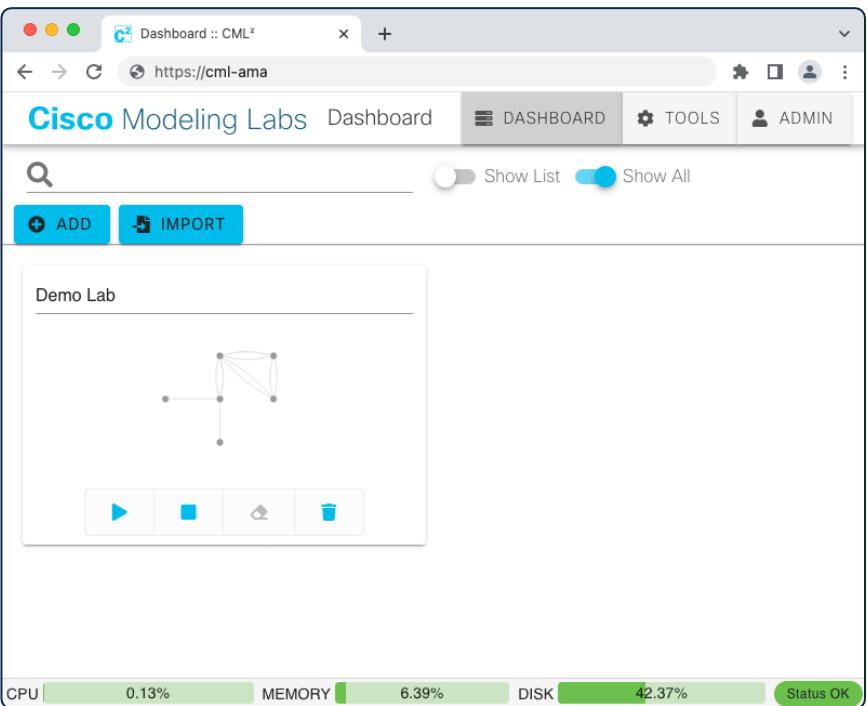


# CML Architecture overview



# Create and configure labs

- Drag and drop nodes into the canvas
- Create links between nodes
- Node configuration through the console
- Import labs and node image definitions



# Sample Lab Topologies

Cisco Modeling Labs | Sample Labs

Name	Import	Description
dfn_de	IMPORT LAB	German Research Network
garr_it	IMPORT LAB	Italian Research network
geant_eu	IMPORT LAB	European Research Network
pionier_pl	IMPORT LAB	Imported from pionier_pl.ng
wsgl_25_training	IMPORT LAB	Imported from WSGL_25_training_topo_input.virl
aarnet_au	IMPORT LAB	Imported from aarnet_au.ng
abilene_usa	IMPORT LAB	US Research Network
IOS XRv 9000 Feature Tests	IMPORT LAB	A sample lab for testing IOS XRv 9000
asa_complex	IMPORT LAB	An example ASA lab
ASAv Feature Tests	IMPORT LAB	A sample lab for testing ASAv
ums-oob-base-triangle	IMPORT LAB	A server triangle, with an OOB port
Catalyst 8000v Feature Tests	IMPORT LAB	A sample lab for testing Catalyst 8000v
CSR 1000v Feature Tests	IMPORT LAB	A sample lab for testing CSR 1000v
IOSv Feature Tests	IMPORT LAB	A sample lab for testing IOSv
NX-OS 9000v Feature Tests	IMPORT LAB	A sample lab for testing NX-OS 9000v
IOSvL2 Feature Tests	IMPORT LAB	A sample lab for testing IOSvL2

DASHBOARD | TOOLS | ADMIN

Nodes 1 | Links

Workbench DFN\_DE

LAB NODES PANES GUIDE

The interface includes a main workbench area displaying a complex network topology for 'DFN\_DE' with nodes like KIE, EWE, HAM, and GRE, and a grid of smaller network diagrams for other labs like 'garr\_it', 'geant\_eu', and 'abilene\_usa'. Each diagram has a set of four icons below it.

# What is a “node” in CML ?

The “node definitions” in CML are the Virtual Machines and Network Devices that are available for use in the lab workspace.

Node examples are: Windows 11 Desktop, Ubuntu VM, Alpine Linux, etc

Node examples are: IOS XRv, NX-OS, cat9kv, IOS, IOL, etc

The node definitions are available along side CML.OVA from [software.cisco.com](https://software.cisco.com) and is called the “reference platforms ISO file”

Software Download

Downloads Home / Cloud and Systems Management / Network Modeling / Modeling Labs / Modeling Labs- 2.2.3

Modeling Labs

Release 2.2.3

Latest Release

2.2.3

2.1.2

1.6.67

2.0.1

All Release

2.2

2.1

2.0

1.6

File Information

Cisco Modeling Labs Reference platform ISO File (May 2021). This is a required file for new installations.  
cml-refplatform-20210511-fcs.iso

Release Date

20-Oct-2021

Size

10836.52 MB

Related Links and Documentation

Known Issues in CML 2.2.3

Release Notes for 2.2.3

⚠️ CML 2.2.3 is a maintenance and bug fix release. Note that the latest refplat ISO is still refplat-20210511-fcs.iso, which can be found under the 2.2.2 release.

File Information

Cisco Modeling Labs 2.2.3 Server. This image is for deployment on VMware. Supported hypervisors can be found in the CML release notes. For best performance use the bare metal (.iso) installation file found in software center.  
cml\_controller-2.2.3-03.v0.63.x86\_64-166.ova

Release Date

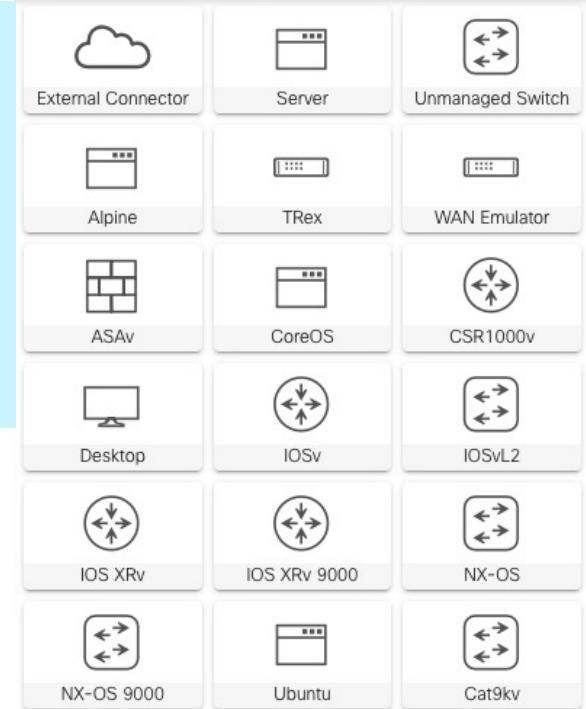
30-Aug-2021

Size

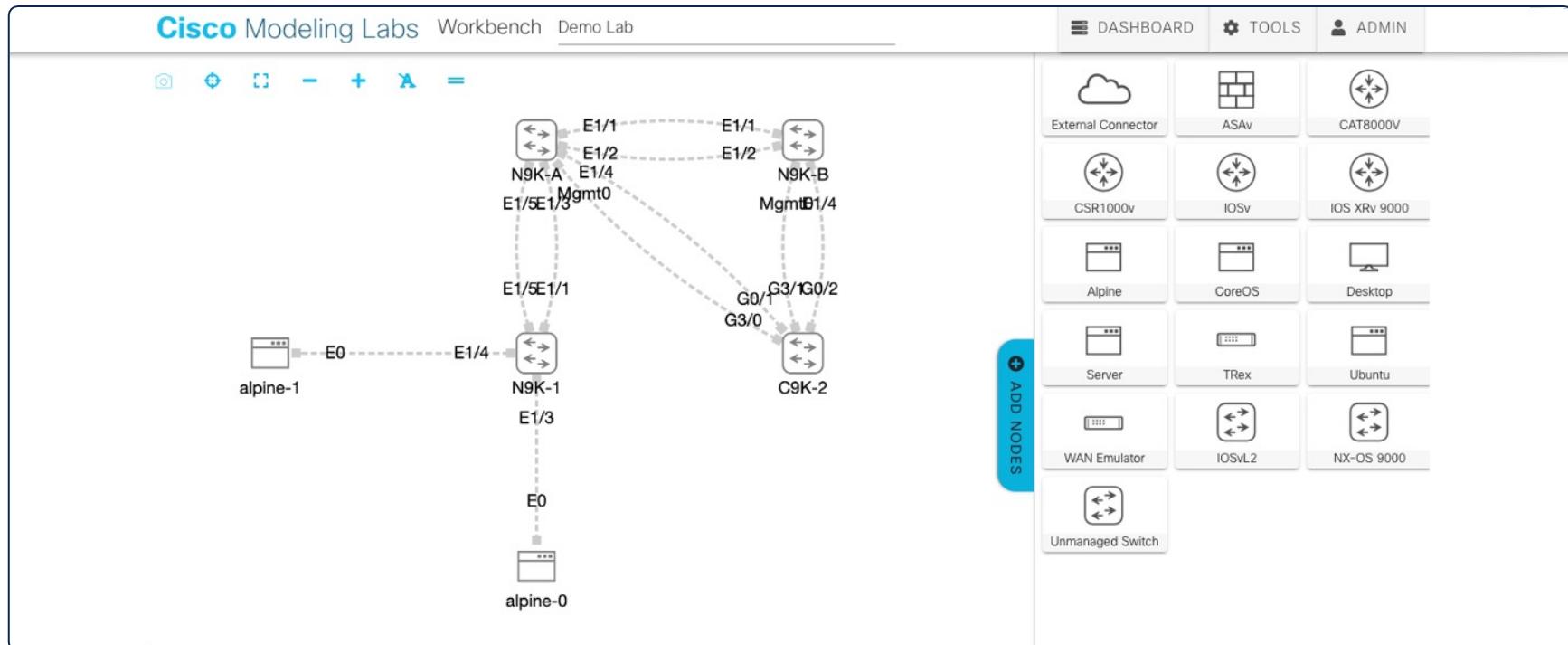
973.40 MB

Advisories

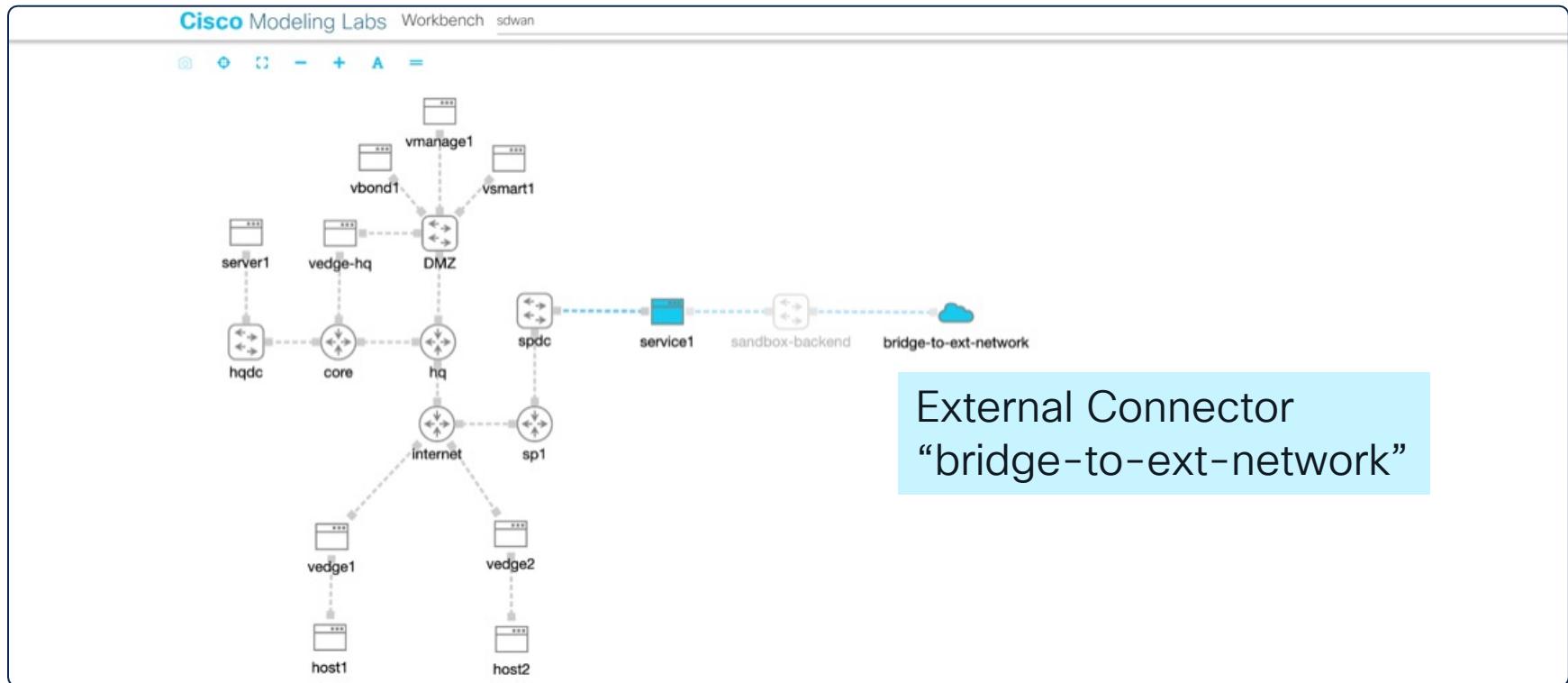
Advisories



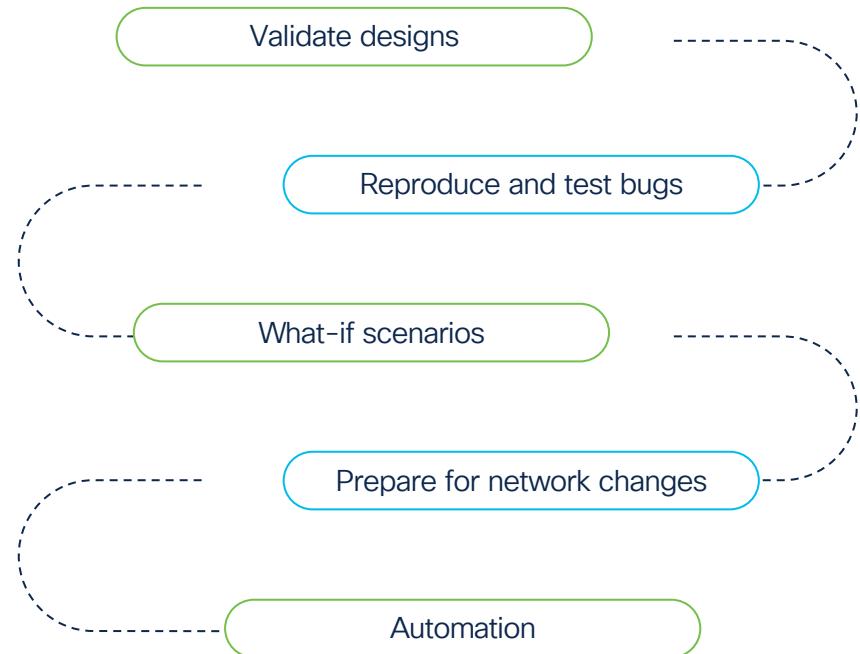
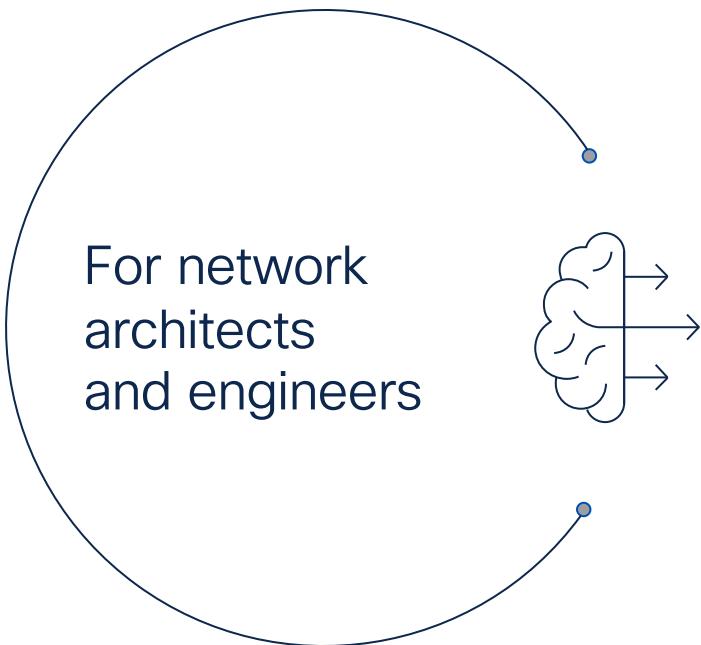
# Drag and drop nodes into the canvas



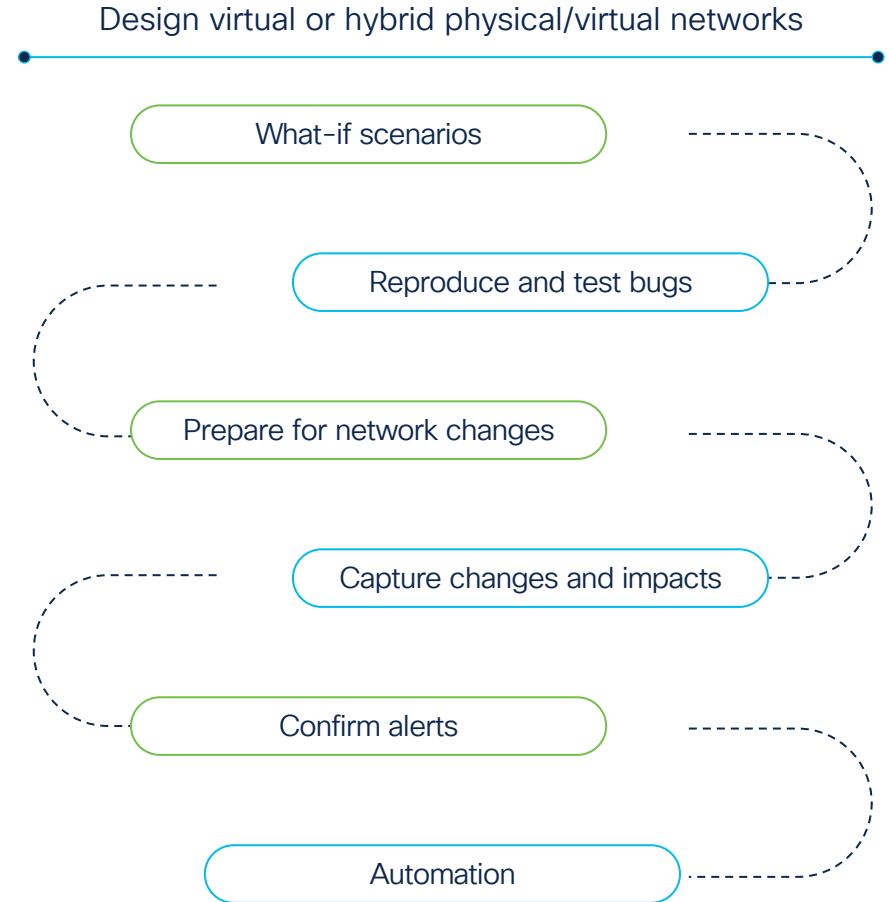
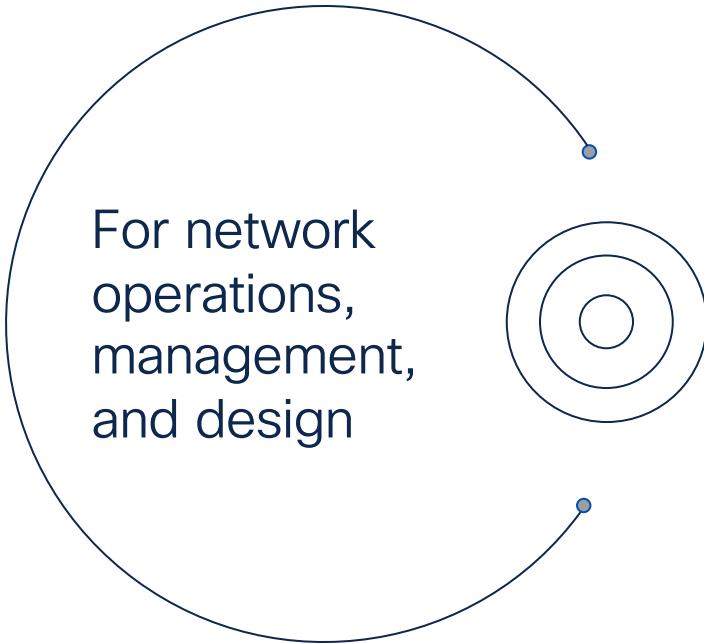
# Connect simulation to external networks / hardware



# CML usecases



# CML usecases



# CML API's for lifecycle management

## Cisco Modeling Labs (CML)

- > Authentication and General
- > Explore Existing Topology
- > Build New Topology

### Authentication and General

- > **POST** Request auth token (login)
- > **GET** Test auth token
- > **GET** Get system health
- > **GET** Get system statistics
- > **GET** Get system information
- > **GET** Get node definitions
- > **GET** Get lab schema
- > **GET** Get node definition schema

### Explore Existing Topology

- > **GET** Get labs
- > **GET** Get specific lab
- > **GET** Get lab topology
- > **GET** Get lab tile
- > **GET** Get lab simulation statistics
- > **GET** Get lab element state
- > **GET** Download lab (YAML)
- > **GET** Get lab nodes
- > **GET** Get specific node
- > **GET** Get specific link
- > **GET** Get node interfaces
- > **GET** Get specific node interface
- > **GET** Get node console keys
- > **GET** Get node layer-3 addresses

### Build New Topology

- > **POST** Create new lab
- > **POST** Create R1 node
- > **POST** Create R2 node
- > **GET** Get R1 interfaces
- > **GET** Get R2 interfaces
- > **POST** Create R1-R2 link
- > **PUT** Update R1 bootstrap config
- > **PUT** Update R2 bootstrap config
- > **GET** Review new link
- > **GET** Review connected R1 inter...
- > **GET** Review connected R2 inter...
- > **GET** Review lab topology
- > **PUT** Start lab simulation
- > **PUT** Ensure R1 is converged
- > **PUT** Ensure R2 is converged
- > **PUT** Stop lab simulation
- > **PUT** Wipe all node state
- > **DEL** Delete R1 node
- > **DEL** Delete R2 node
- > **DEL** Delete lab

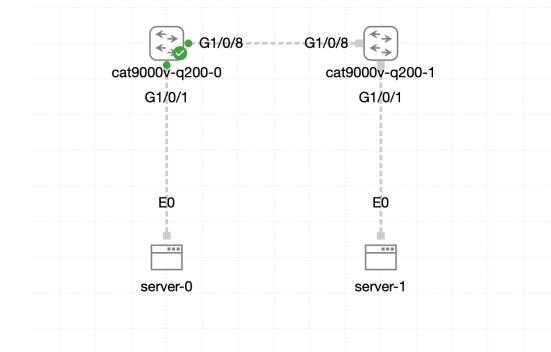
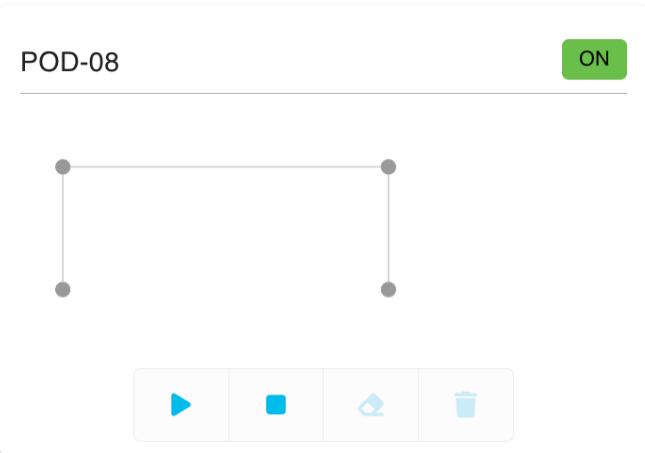
<https://www.postman.com/nirusmc/workspace/public-collections/documentation/14123647-989ab2e3-f747-4290-b099-b541baaf16c3>  
<https://www.postman.com/ciscodenvnet/workspace/cisco-devnet-s-public-workspace/overview>

CML

Lab

# CML Lab

1. Login to CML
  1. <https://cml-xelab.cisco.com>
  2. Username: \_\_\_\_\_
  3. Password: \_\_\_\_\_
2. Access POD #
  1. Access C9KV Console
  2. Access server console
3. Confirm connectivity between 2 servers



# Lab Bootstrapping Artifacts

SETTINGS CONNECTIVITY **CONFIG** INTERFACES

**i** Configuration is locked: Wipe this node to edit its configuration.

Configuration file  
iosxe\_config.txt

SAVE REFRESH FETCH RESTORE

```
1 # this is a shell script which will be sourced a
2 hostname inserthostname-here
3 # configurable user account
4 USERNAME=cisco
5 PASSWORD=cisco
6 # no password for tc user by default
7 TC_PASSWORD=
8 hostname left
9 ifconfig eth0 10.0.0.1 netmask 255.255.255.0 up
10 route add -net 10.0.0.0/8 dev eth0
```

## Servers:

1)  
hostname left  
ifconfig eth0 10.0.0.1 netmask 255.255.255.0 up  
route add -net 10.0.0.0/8 dev eth0  
2)  
hostname right  
ifconfig eth0 10.0.0.2 netmask 255.255.255.0 up  
route add -net 10.0.0.0/8 dev eth0

## Switches:

### LEFT:

```
hostname c9k-left
int range gi1/0/1 - 2
switchport access vlan 10
desc server
int gi1/0/8
switchport mode trunk
end
```

### RIGHT:

```
hostname c9k-right
int gi1/0/1
switchport access vlan 10
desc server
int gi1/0/8
switchport mode trunk
end
```

### THIRD SWITCH:

```
hostname third-c9kv
int gi1/0/1
switchport access vlan 10
desc server
int gi1/0/8
switchport mode trunk
end
```

SETTINGS CONNECTIVITY **CONFIG** INTERFACES

**i** Configuration is locked: Wipe this node to edit its configuration.

Configuration file  
iosxe\_config.txt

SAVE REFRESH FETCH RESTORE

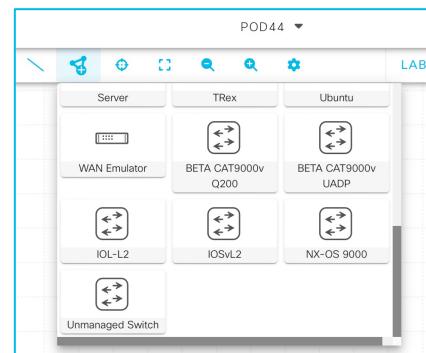
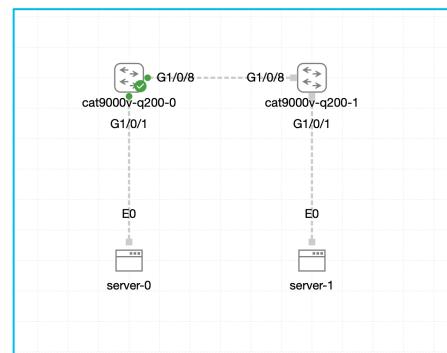
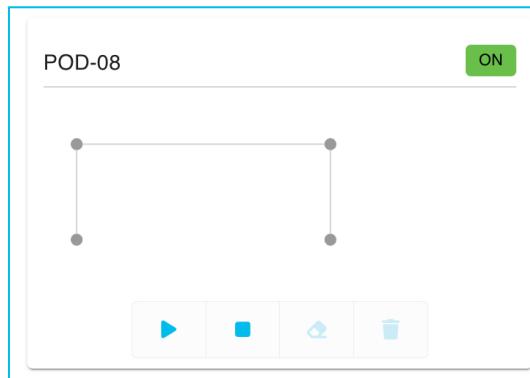
```
1 hostname c9k-left
2 int range gi1/0/1 - 2
3 switchport access vlan 10
4 desc server
5 int gi1/0/8
6 switchport mode trunk
7 end
```

# Add C9KV node to topology & connect server

Add a new “CAT9000V” node to the topology

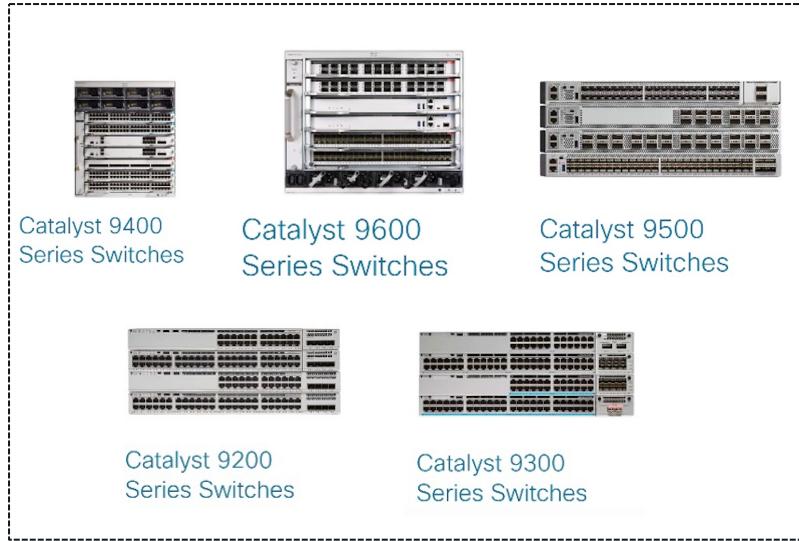
Connect the server to the new switch

Provide the bootstrapping artifacts !

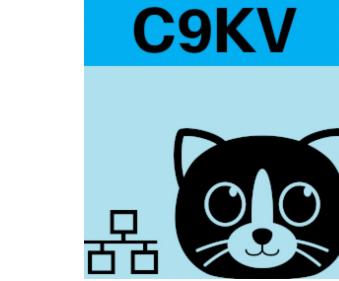


# C9KV

# C9KV Positioning within C9K Family



Catalyst 9000 Series Switches



An Independent PID & SKU!

Catalyst 9000 Virtual Switch

# Goals & Vision



## Increase Productivity

- Faster feature development unhindered by board platform dev
- Simplifies spinning up demo environments
- Flexible data-path choice on same unified image



## Enable Hybrid workplace

- Construct standard network topologies using point-and-click
- Eliminate hardware wiring requirements (no lab visit needed to change cabling)



## Facilitate Technology Adoption

- Enable GTM Modelling
- Ready access to available switching services features
- Proof of concepts and value
- what-if scenario analysis



## Access with Ease

- Deployment to private & public cloud
- Readily available VMs & Virtual Networks save time

# High Level Specification

Packaging Format	<ul style="list-style-type: none"><li>Single IOS-XE Image</li><li>Independent PID compared to hardware SKUs</li><li>Available as ISO &amp; OVA</li></ul>
Resource Requirement	<ul style="list-style-type: none"><li>4vCPU, 18G RAM (UADP)</li><li>4vCPU, 12GB RAM (Silicon 1)</li><li>Hypervisors: KVM, ESXi</li><li>Internet reachability for user telemetry</li></ul>
Deployment capabilities	<ul style="list-style-type: none"><li>8/24 interfaces+ one mgmt. port</li><li>Day 0 config support</li><li>Customization parameters (serial#)</li></ul>
Data Plane	<ul style="list-style-type: none"><li>Software data plane is one of:<ol style="list-style-type: none"><li>UADP</li><li>Silicon 1</li></ol></li></ul>
Features	<ul style="list-style-type: none"><li>Services feature parity for data plane constructs</li><li>Low packet throughput but sufficient for functional feature behavior<ul style="list-style-type: none"><li>UADP – 200-300 pps</li><li>Silicon 1 – 500-1300 pps</li></ul></li></ul>

# Comparing UADP and Silicon 1 C9KV Variants

## UADP C9KV

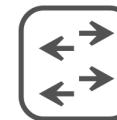
- ✓ 18GB memory required
- ✓ More feature set
- ✓ Provides support for Software Defined Access fabric, EVPN
- ✓ Can be managed in Catalyst Center



BETA CAT9000v  
UADP

## Silicon 1 C9KV

- ✓ Memory efficient with 12GB required
- ✓ Can be managed in Catalyst Center
- ✓ Higher throughput for testing



BETA CAT9000v  
Q200

Both node types  
are available in  
CML 2.7

# Speeds, Feeds, and Licensing

CML version	C9Kv version	PPS Thruput UADP/S1	Thruput
CML 2.5	17.10.01prd7	200/300	250 Kbps
CML 2.6	Same	Same	Same
CML 2.7	17.12	~1300	2 Mbps out 1.4 Mbps in

What license does C9KV come with?

- ✓ Essentials

What about Advantage features ?

- ✓ Update with: "license boot level network-advantage addon dna-advantage"
- ✓ Reboot

# C9KV 17.12 in CML 2.7

## Hardware Resources

Silicon 1 C9KV variant now requires 12GB RAM to run

## Throughput

Improved rate of 2Mbps inbound and / ~1.4Mbps outbound

## Interfaces

Increased number of interfaces supported up to 24 ports

## Day 0 config file

Path to day 0 config file is in root of CDROM file system. The filename must be iosxe\_config.txt

## Additional Feature support

MAC Learning/Aging is now supported in 17.12

Does X/Y/Z feature work? Yes.  
Unless it's listed below...

# Unsupported Functionality

Unsupported Functionality	Comments
POE	Not supported
Hardware component simulation	No PSU, Fans, Temperature Sensor, SFP, MAC/SERDES, linecards, FRUs etc. No MIB for board or components
Interrupt, DMA based features	Interrupt based features needs to be done via polling such as punt interrupt, MACSEC rekey etc.
Hardware Diagnostics	Typically achieved using loopback in hardware at MAC/SERDES.
App hosting	No Guest shell (ZTP), IOX, or Application Hosting infra
TM, QoS	Traffic Management, Queuing actions
FNF, Netflow	Currently unsupported
Stacking/SVL	Currently unsupported
Network Modules, Line cards, SFP, optics	Currently unsupported
Embedded WLC	Currently unsupported
Bundle install mode	Only install mode supported

# What are some features are being tested ?

## Interfaces

Loopbacks  
SVI  
Routed P2P (/127)  
Layer 2 Access Port  
Layer 2 Trunk Ports  
Layer 3 Sub-interfaces DHCP relay

## Security

VTY ACL  
SNMP ACL  
NAC / RADIUS  
CoPP  
DHCP Trusted Port  
IPv6 RA  
DHCPv6 Guard  
PVLAN

## Management

Hostname  
Boot / Image  
DNS  
LLDP  
SSH  
Alias  
Banner  
Local User  
TACACS  
AAA  
NTP

## Monitoring

Syslog  
SNMP  
gNMI  
NETCONF  
RESTCONF  
gRPC Dial-Out

## Overlay Control and Data Plane

BGP EVPN VxLAN BGP EVPN  
MAC-VRF Type 2 MAC  
Type 2 MAC IP  
Type 3 IMET  
Type 5 IP-Prefix  
Route target import / export  
Import / export route-maps  
VxLANv6  
Loopback - VTEP Source  
L2VNI  
L3VNI  
VXLAN SGT Inline Tagging to CMD  
SGT Inline Tagging

## Underlay Routing

eBGP  
Redistribute  
Peer-Groups  
ECMP  
Prefix List  
Route Maps  
Community List  
AS PATH Access list

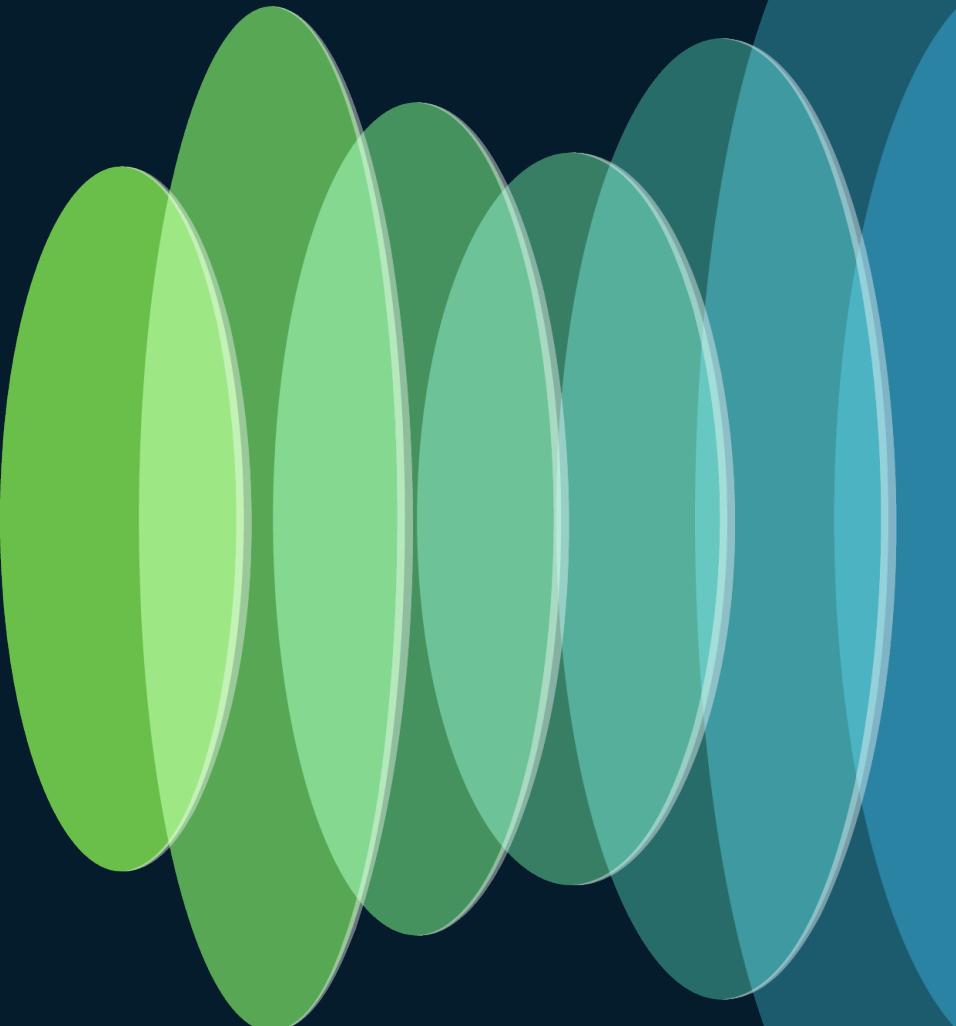
## Solutions:

SDA with Cisco DNA Center  
BGP EVPN VXLAN with YANG

This is not an extensive list of features !  
Solution level testing also in use ☺

C9KV

Lab



# C9KV Lab

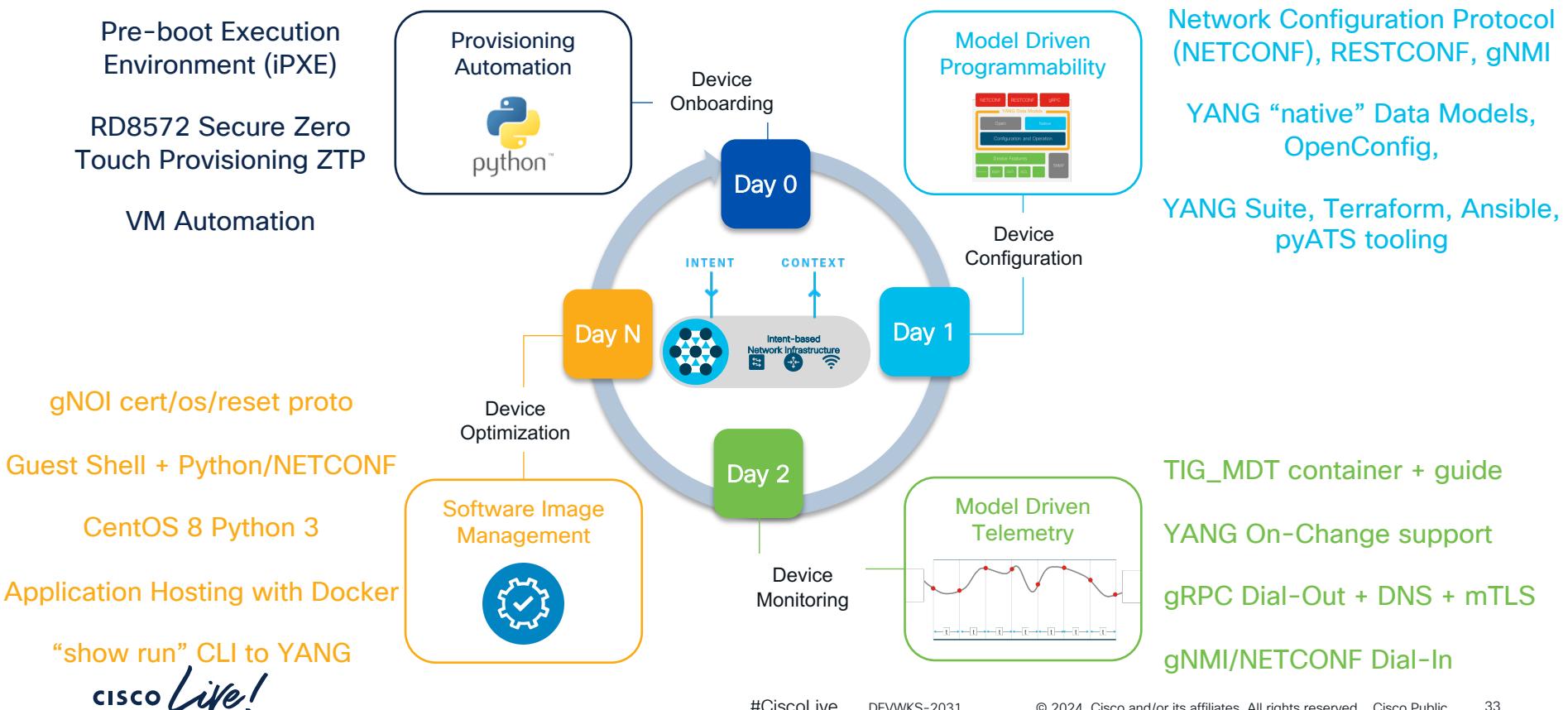
Add a new C9KV switch to the topology

Takes ~5 minutes to boot up

Move the existing Server to the new C9KV node

# IOS XE API

# IOS XE Programmability & Automation Lifecycle





# Programmable Interfaces

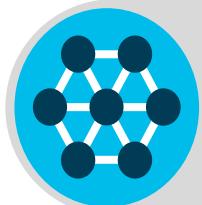
CLI

SNMP

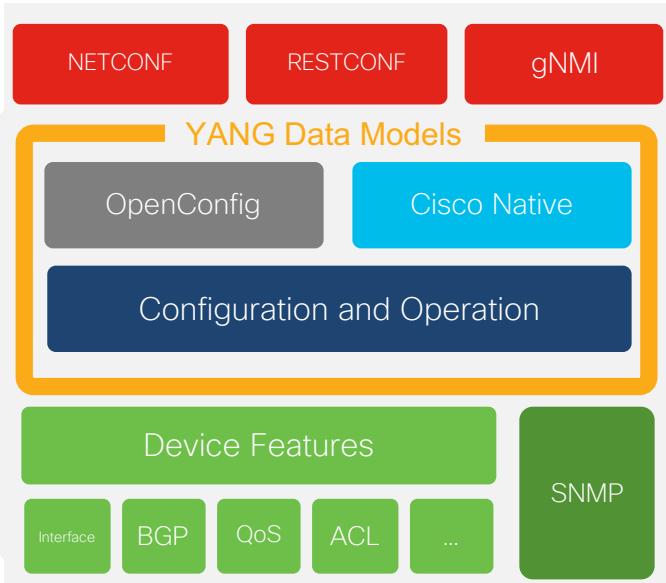
WebUI

The NETCONF, RESTCONF and gNMI are programmatic interfaces that provide additional methods for interfacing with the IOS XE device – Just like the CLI, SNMP, and WebUI is used for configuration changes and operational metrics so can the programmatic interfaces of NETCONF, RESTCONF and gNMI

YANG data models define the data that is available for configuration and streaming telemetry



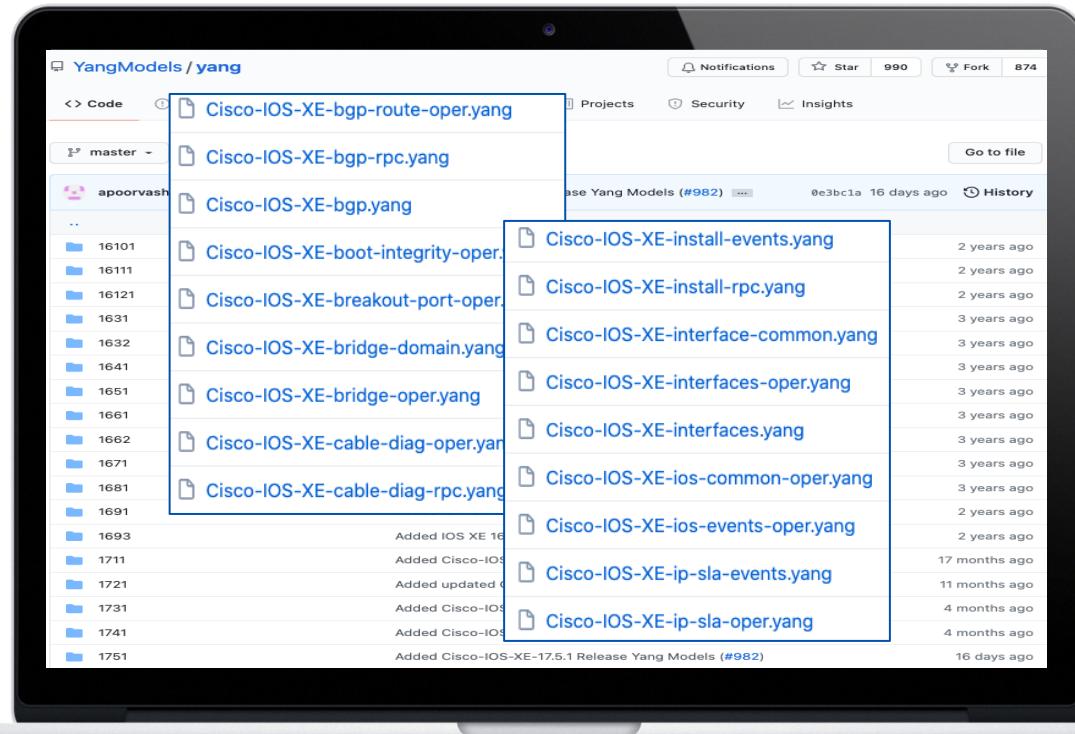
Intent-based  
Network Infrastructure



# Cisco IOS XE - YANG models on GitHub

- RFC 7950 YANG data modelling language are the API definitions for IOS XE
- The YANG modules are available for download from the API and are also published on Github.com
- Notable modules are listed below for the running-config, feature oper, actions and event notifications

YANG module name.yang	Description
Cisco-IOS-XE-native	running-config
Cisco-IOS-XE-{feature}-cfg	Feature configuration
Cisco-IOS-XE-{feature}-oper	Feature operational data
Cisco-IOS-XE-{feature}-rpc	Actions
Cisco-IOS-XE-{feature}-events	Telemetry Events
Cisco-evpn-service	EVPN service abstraction
OpenConfig-{feature}	abstraction for config & oper



<https://github.com/YangModels/yang/tree/main/vendor/cisco/xe>

# Cisco YANG Suite



YANG API Testing and Validation Environment

Construct and test YANG based APIs over  
NETCONF, RESTCONF, gRPC and gNMI

IOS XE / IOS XR / NX OS platforms

The screenshot displays two main panels of the Cisco YANG Suite. The top panel shows the 'Explore YANG Models' section for the 'Cisco-IOS-XE-interfaces-oper' module. It lists nodes like 'interfaces', 'interface', 'name', 'interface-type', etc., with detailed descriptions and statistics. The bottom panel shows the 'NETCONF' section for the same module, allowing users to build and run RPCs. A code snippet for a 'get' operation is shown in the 'RPC Options...' tab.

Now Available !

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

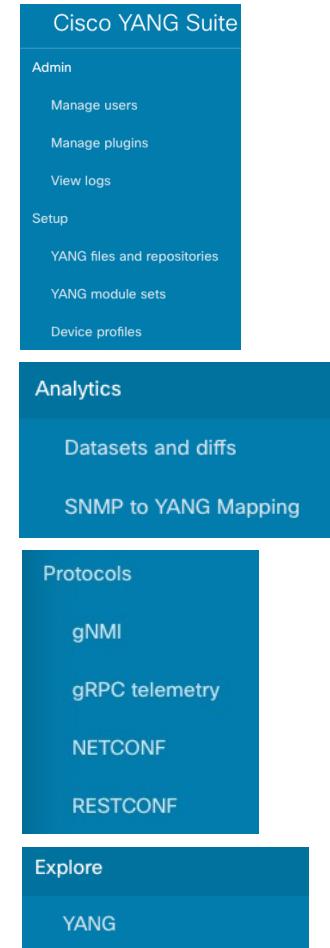
[github.com/CiscoDevNet/yangsuite](https://github.com/CiscoDevNet/yangsuite)

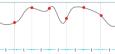
# What's Included in YANG Suite ?

## Core plugins

- Initial Release:
  - Plugin and YANG File Manager, Datasets and diffs
  - Device Manager
  - NETCONF (Python), gRPC Telemetry
  - Docker install support with HTTPS
- Second Release:
  - RESTCONF
  - gNMI
  - Python Integrations
- Third Release:
  - gRPC Telemetry with TLS Support
  - SNMP OID to YANG Xpath Mapping
  - Ansible Integrations
  - Pip install support

## Additional plugins



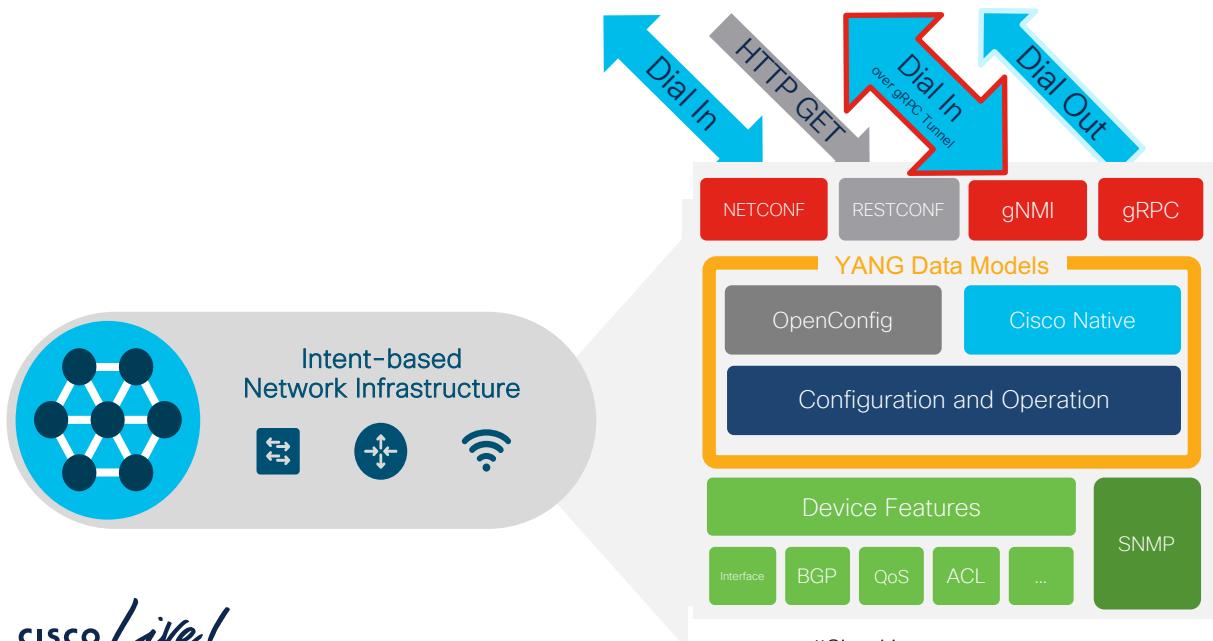


# Model Driven Telemetry Interfaces

↔ Dial In: Collector establishes a connection to the device then subscribes to telemetry (pub/sub)

← Dial Out: Telemetry is pushed from the device to the collector based off configuration (push)

## Publication / Subscription



XML, JSON, proto and  
kvGPB encoding

Consistent YANG data  
models between interfaces

On-change event and  
time-based publication  
options

# IOS XE Model Driven Telemetry

Cisco IOS XE



CLI

...or with...

YANG



gNMI Dial-In/Dynamic  
NETCONF Dial-In ↑↓ gRPC Dial-Out/Configured

Collector/Receiver  
Decodes to text



**telegraf**™



splunk>

elastic

Storage  
Time Series Database

InfluxDB

Monitoring  
and Visualizations



Grafana



[https://hub.docker.com/r/jeremycohoе/tig\\_mdt](https://hub.docker.com/r/jeremycohoе/tig_mdt)

[https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/configuration/179/b\\_179\\_programmability\\_cg/m\\_179\\_prog\\_ietf\\_telemetry.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/configuration/179/b_179_programmability_cg/m_179_prog_ietf_telemetry.html)

<https://github.com/jeremycohoе/cisco-ios-xe-mdt>

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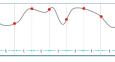
#CiscoLive

DEVWKS-2031

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Model Driven Telemetry



# Resources

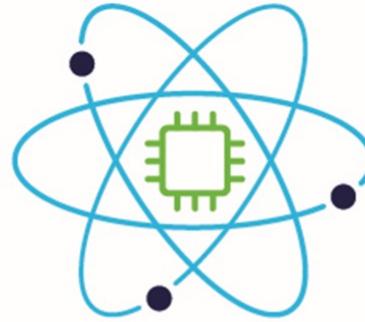
# Become a power user

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# dCloud for Programmability

<https://dcloud.cisco.com>

"Cisco Catalyst 9000 IOS XE Programmability & Automation Lab v1"

<https://dcloud2.cisco.com/demo/catalyst-9000-ios-xe-programmability-automation-lab-v1>

## Use Cases:

### EVPN:

- Ansbile with CLI deployment of EVPN solutions
- EVPN management over RESTCONF/YANG with Postman
- Declarative EVPN fabric management with Terraform

### Model Driven Telemetry

Telemetry configuration with CLI and YANG Suite  
Collection with TIG\_MDT container and tooling

### YANG Programmability

YANG Suite tooling and integrations to YANG API's  
Ansible integrations

## Tooling and Integrations

### YANG Suite

- NETCONF/RESTCONF/gNMI API
  - Ansible integration
- NETCONF/gNMI Dial-In Telemetry
- gRPC Dial-Out Telemetry receiver

### Telemetry

- TIG stack in Docker
- Grafana dashboard for device health

### Postman / RESTCONF

- EVPN fabric API calls

### Terraform/RESTCONF

- Declarative EVPN fabric management

### Ansible

- EVPN solution enablement using CLI

## Ubuntu VM Details:

Syslog receiver from all switches  
TFTP config backup

## Windows VM Details

VS Code

Terraform @ folder  
Ansible @ folder

Chrome browser

YANG Suite, Grafana

Bash/PS/Cmd shells

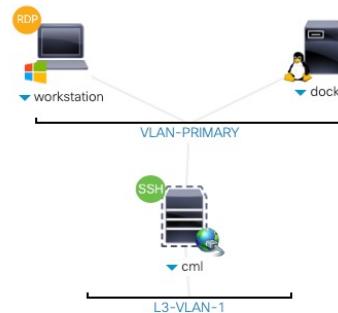
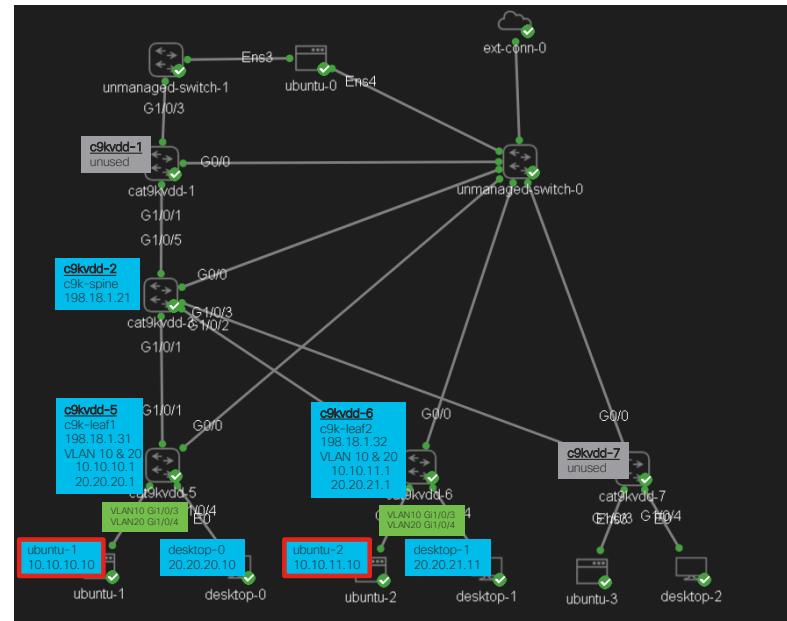
SSH into C9K or Ubuntu

Postman

Workspace for EVPN

3 configured C9KV 17.10

2 un-configured C9KV 17.10



VLAN1	c9k-spine
RDP	IP: 198.18.1.21 developer / C1sco12345
workstation	c9k-leaf1 IP: 198.18.1.31 developer / C1sco12345
VLAN-PRIMARY	c9k-leaf2 IP: 198.18.1.32 developer / C1sco12345
SSH	c9kvdd-1 - unconfigured
cml	c9kvdd-7 - unconfigured
L3-VLAN-1	

# Programmability Website

The one-stop-shop for Cisco IOS XE Programmability resources including videos, white papers, labs and more!

The screenshot shows the Cisco DevNet website with a dark blue header. The main title is "Cisco IOS XE Programmability and Automation". Below it, a sub-header reads: "Cisco IOS XE programmability and automation enables network operators and developers an alternative approach to CLI for device configuration, management and telemetry at scale." There are three cards: "Read the docs", "LIVE STREAM: Terraform + IOS XE | A Match Made on the Internet", and "WEBINAR: Automating Catalyst IOS XE". A "WHITE PAPER: Catalyst Programmability and Automation" is also visible. Below these, there are sections for "Programmability options with IOS XE" (Provisioning and Configuration management) and a "Cisco IOS XE for the Catalyst hardware has several options for programmatic configuration. Traditional methods for configuring include the CLI, SNMP, or the WebUI, but these have now...".

- Community Forum
- IOS XE FAQ
- White Papers
- Code Exchange
- IOS XE Docs & Guide
- Learning Tracks and Labs
- Sandboxes
  - ... and more !



<https://developer.cisco.com/iosxe/>

# IOS XE Sandboxes

Easily access IOS XE as part of the DevNet Sandbox

This DevNet reservable sandbox has IOS XRv + N9Kv + IOS XE  
The c8k within the DevBox is enabled for Day 0/ZTP usecases

<https://devnetsandbox.cisco.com>  
“IOS XE on Cat8kv”

The “IOS XE on Cat8kv Always On” virtual sandbox requires no reservation

The c8kv can be accessed with SSH, NETCONF, and RESTCONF  
Hostname: devnetsandboxiosxe.cisco.com  
Username: admin              Password: C1sco12345  
SSH port 22, NETCONF port 830

[devnetsandboxiosxe.cisco.com](https://devnetsandboxiosxe.cisco.com)  
“IOS XE on Cat8kv AlwaysOn”

Reservable - Physical

9300  
9300X  
9200

The physical labs are  
being rebuilt and are  
not quite ready yet

# IOS XE - Reservable Virtual Sandbox

This DevNet reservable sandbox has IOS XRv + N9Kv + IOS XE

The c8k within the DevBox is enabled for Day 0/ZTP usecases

<https://devnetsandbox.cisco.com>  
IOS XE on Cat8kv

<https://devnetsandbox.cisco.com/DevNet/catalog/IOS%20XE%20on%20Cat8kv>

The “Enterprise Networking” Learning Labs contains guides for the supported usecases

<https://developer.cisco.com/learning/>



**IOS XE on Cat8kv**

The IOS XE on Catalyst 17.9.2 Sandbox offers developers access to an IOS XE device running the latest IOS XE code release available on cisco.com. Here you can test out the newest programmability...

**Networking** **reservable**

Launch

Explore YANG data models and NETCONF to query and configure IOS XE network devices. Then use Ansible to manage configurations on your IOS XE devices, covering the fundamentals of Ansible. Lastly, enable...

① 6 hrs - 4 modules - 12 labs

**Sandbox Capabilities:**  
TIG\_MDT Telemetry  
YANG Suite API  
Terraform + Ansible  
ZTP & Guest Shell  
... and more

## Table of Contents

- [Overview](#)
- [Network Topology](#)
- [Grafana Dashboard](#)
- [Access Details](#)
- [Additional Resources](#)
- [VPN Access](#)

### Catalyst 8000v Credentials

host	port	username	password
10.10.20.48	22	developer	Cisco12345
10.10.20.48	830	developer	Cisco12345
10.10.20.48	443	developer	Cisco12345

### Developer Box Credentials

host	port	username	password
10.10.20.50	22	developer	Cisco12345
telnet localhost (CAT8k-1)	2222	developer	Cisco12345

devnetsandboxiosxe.cisco.com

# IOS XE Sandbox: Always On Virtual

The “[IOS XE on Cat8kv Always On](#)” virtual sandbox requires no reservation

The c8kv can be accessed with SSH, NETCONF, and RESTCONF

Hostname: `sandbox-iosxe-latest-1.cisco.com`

Username: `admin`      Password: `C1sco12345`

SSH port 22, NETCONF port 830, RESTCONF HTTPS

<https://devnetsandbox.cisco.com>

“[IOS XE on Cat8kv AlwaysOn](#)”

<https://devnetsandbox.cisco.com/DevNet/catalog/ios-xe-always-on>

The “Enterprise Networking” Learning Labs contains guides for the supported usecases

<https://developer.cisco.com/learning/>



Explore YANG data models and NETCONF to query and configure IOS XE network devices. Then use Ansible to manage configurations on your IOS XE devices, covering the fundamentals of Ansible. Lastly, enable...

① 6 hrs - 4 modules - 12 labs

## IOS XE on Cat8kv AlwaysOn



This AlwaysOn sandbox offers developers access to an IOS XE device running the latest IOS XE code release available on cisco.com (currently 17.11.x). Here you can test out the newest programmability feature...

Always-On



Launch

## Table of Contents

- [Overview](#)
- [Access Details](#)
- [Additional Information](#)

### Access Details:

Developers and network engineers access the IOS XE on Catalyst 17.11.x sandbox directly using the following information:

- Cat8000v Host
  - Address: `sandbox-iosxe-latest-1.cisco.com`
  - Username: `admin`
  - Password: `C1sco12345`
  - NETCONF port: 830
  - gRPC telemetry port: 57500
  - ssh port: 22

# Programmability Configuration Guide

## Preface

New and Changed Information

### ✓ Provisioning

Zero-Touch Provisioning

iPXE

### ✓ Shells and Scripting

Guest Shell

Python API

EEM Python Module

### ✓ Model-Driven Programmability

NETCONF Protocol

RESTCONF Protocol

NETCONF and RESTCONF Service-Level ACLs

gNMI Protocol

gRPC Network Operations Interface

gNMI Dial-Out Using the gRPC Tunnel Service

Model Based AAA

Model-Driven Telemetry

In-Service Model Update

### ✓ Application Hosting

Application Hosting

ThousandEyes Enterprise Agent



[https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/prog/configuration/1713/b\\_1713\\_programmability\\_cg.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/prog/configuration/1713/b_1713_programmability_cg.html)

[https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/prog/configuration/1714/b\\_1714\\_programmability\\_cg.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/prog/configuration/1714/b_1714_programmability_cg.html)

[https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/prog/configuration/1715/b\\_1715\\_programmability\\_cg.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/prog/configuration/1715/b_1715_programmability_cg.html)



The bridge to possible

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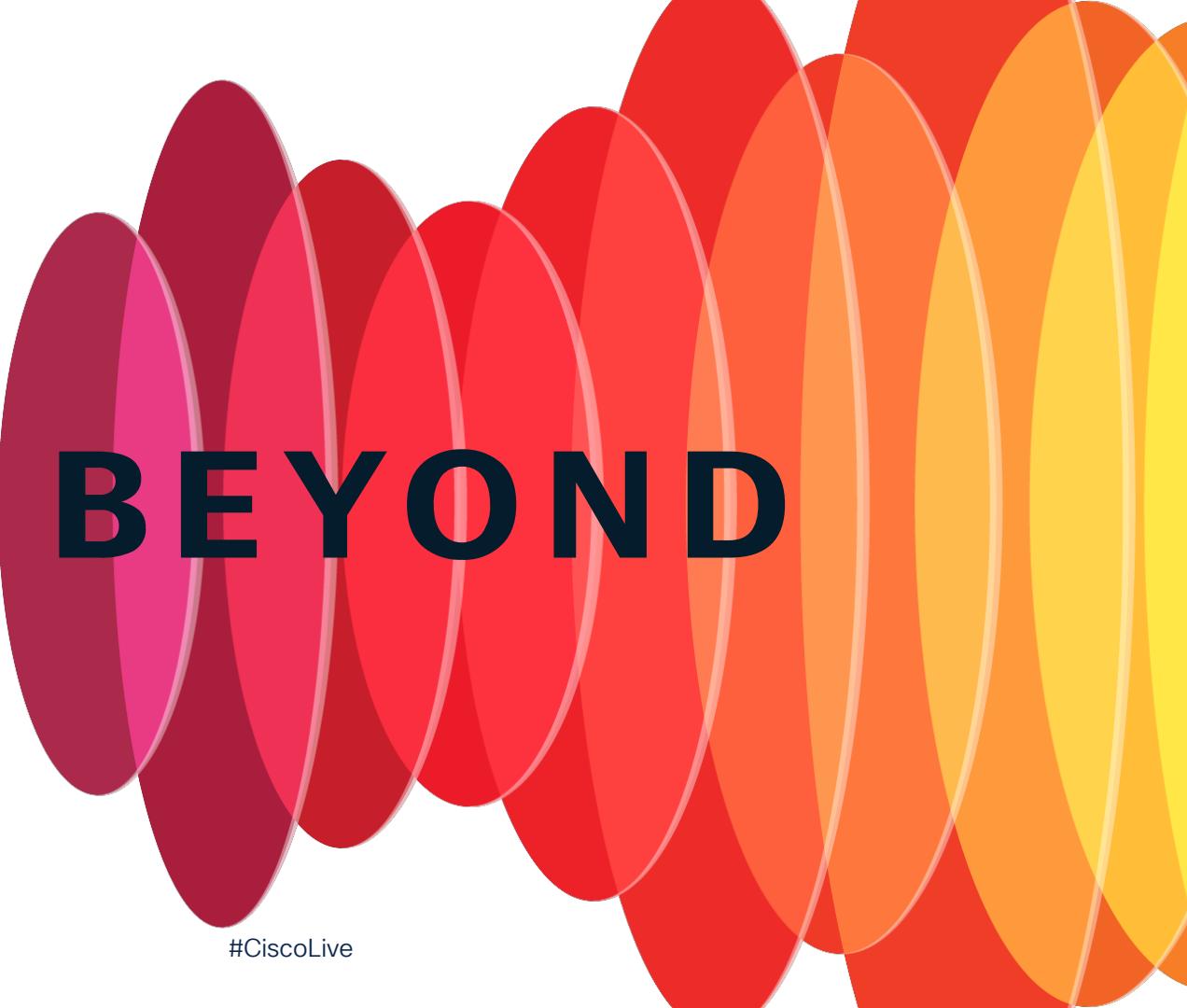


# Continue your education

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- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at [www.CiscoLive.com/on-demand](http://www.CiscoLive.com/on-demand)

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GO BEYOND

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