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The bridge to possible

Model-Driven Programmability

Nick Mortari
Technical Marketing Engineer
Cloud Networking Team

BRKDCN-2604

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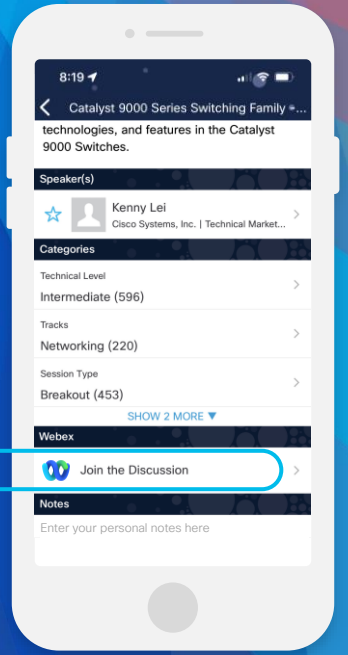

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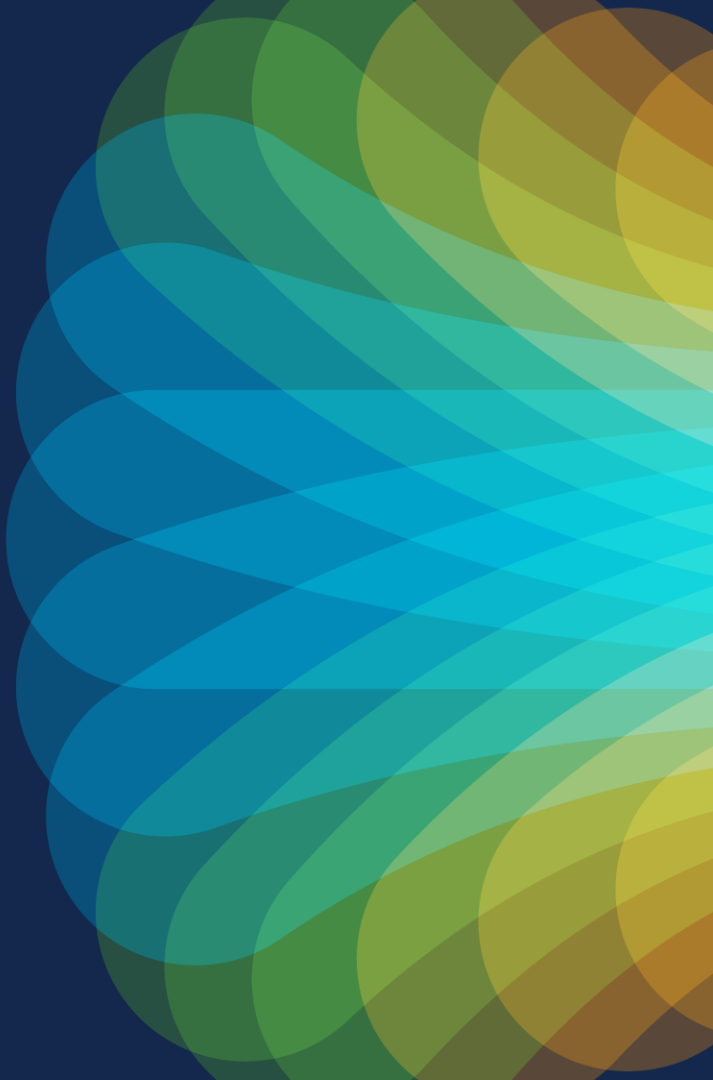
Agenda

- Model-driven programmability overview
- The building blocks of programmability on NX-OS
- Live demo

Why Model-Driven Programmability?



Why Model-Driven Programmability?

I can't remotely access some configuration elements...

I want to compare data with other devices...

My data transport is not secure...

It's difficult to structure the data I have...

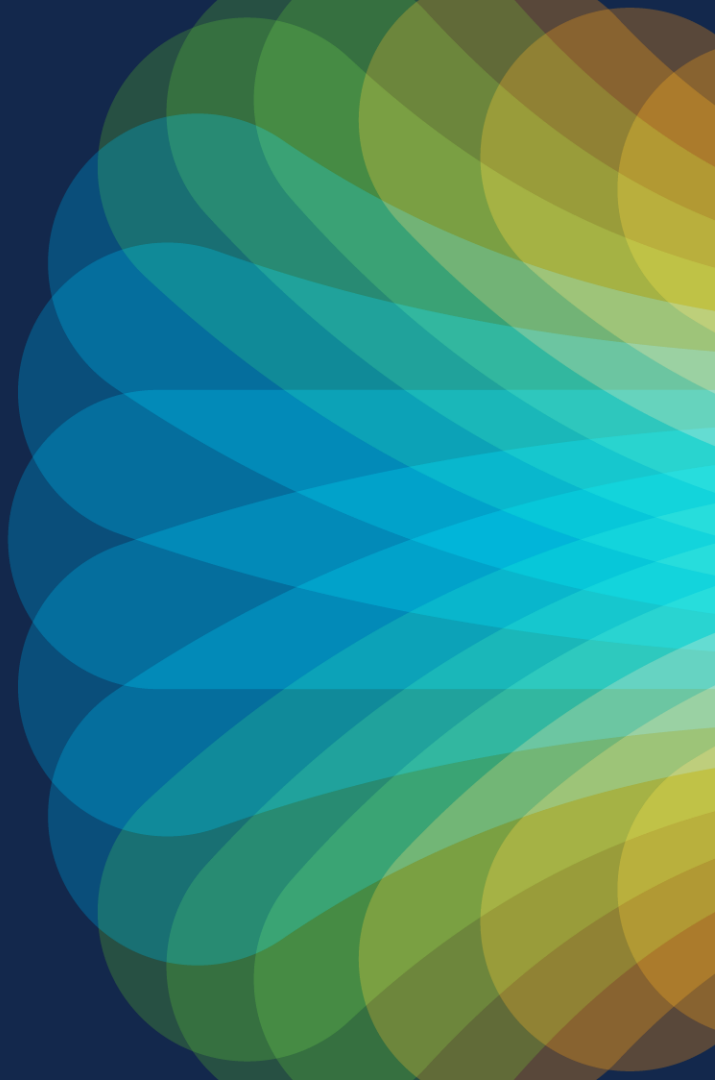
My data transport is not efficient...

The configuration tools I have don't scale well...

Why Model-Driven Programmability?

Model-driven methods save the day!

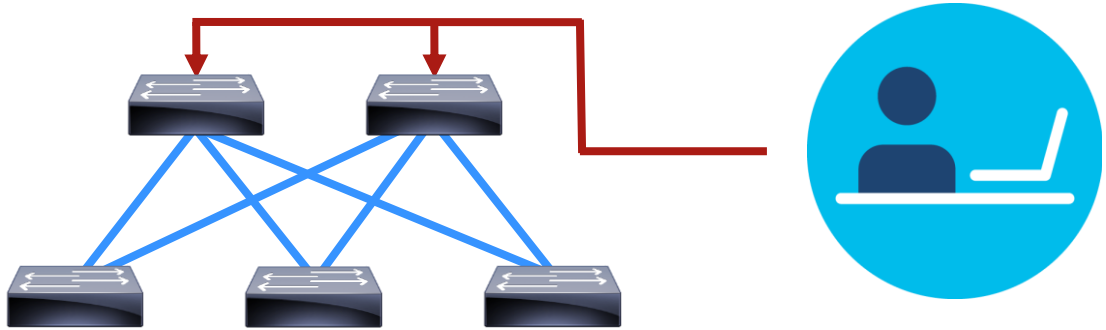
What Is Model-Driven Programmability?



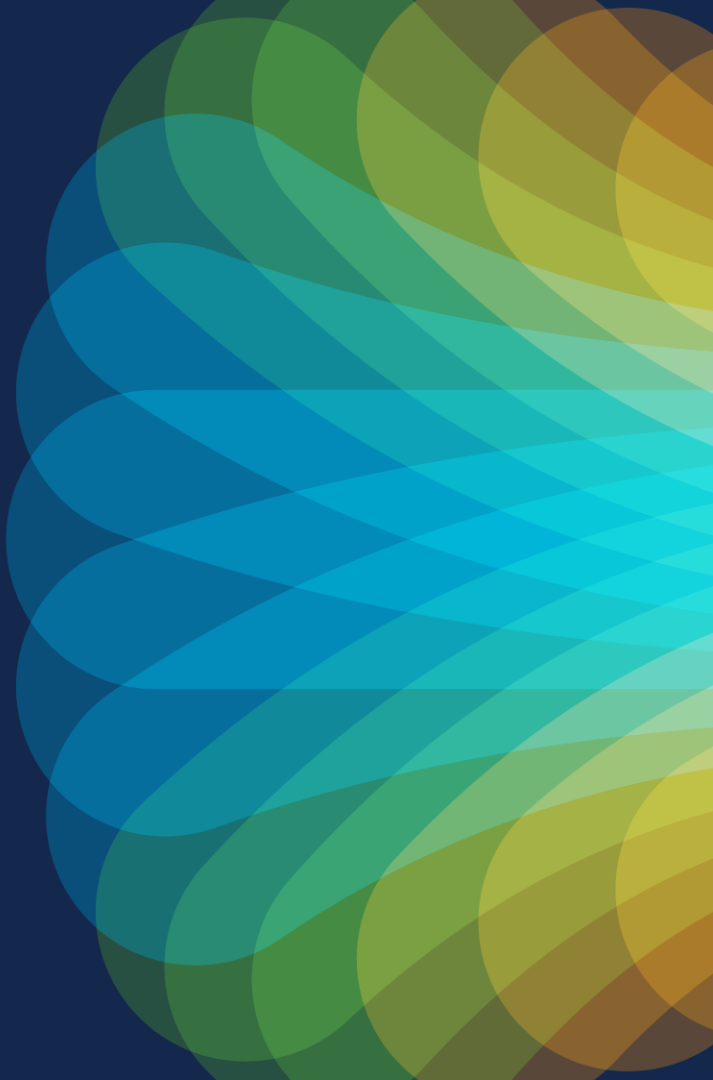
What is Model-Driven Programmability?

Real-time data collection or configuration of network devices using common models and protocols

Example: For every spine switch, set the CDP hold time to 90 seconds



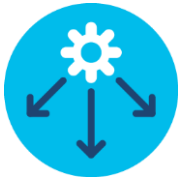
Model-Driven Programmability Advantages



Model-Driven Programmability Advantages

Scalability

Performance



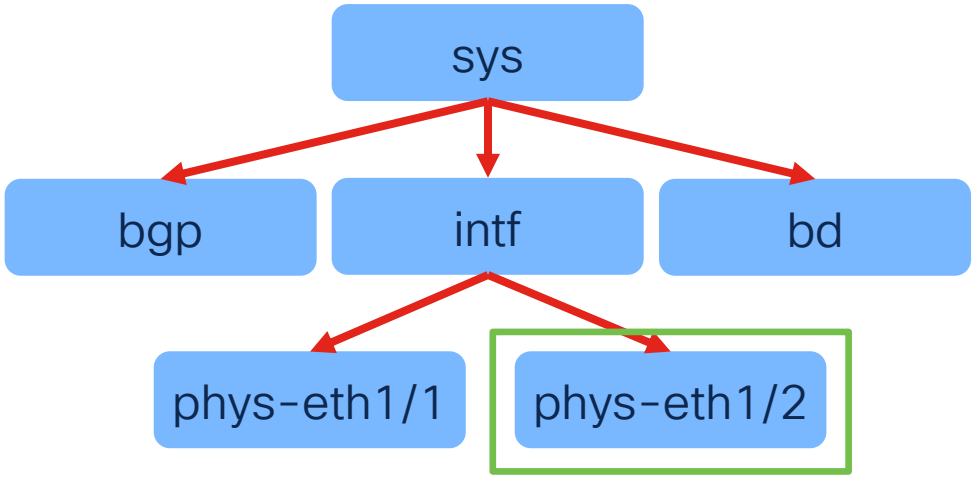
Zero-Touch Provisioning

Detailed Information

Building Blocks of NX-OS Programmability

- **Data Storage**
- Data Models
- Data Transport
- Zero-Touch Provisioning

Data Storage



- Configuration and operational data is stored in DME
- Tree structure
- .../.../.../... formatting

- sys/intf/phys-eth1/2 represents interface 2
- Stores interface configuration and state

Data Storage

l1PhysIf	
FECMode	auto
accessVlan	vlan-1
adminSt	up
autoNeg	on
beacon	off
bw	default
childAction	
controllerId	
delay	1
descr	
dfeAdaptiveTuning	enable
dfeTuningDelay	100
dn	sys/intf/phys-[eth1/33] 
dot1qEtherType	0x8100
duplex	auto

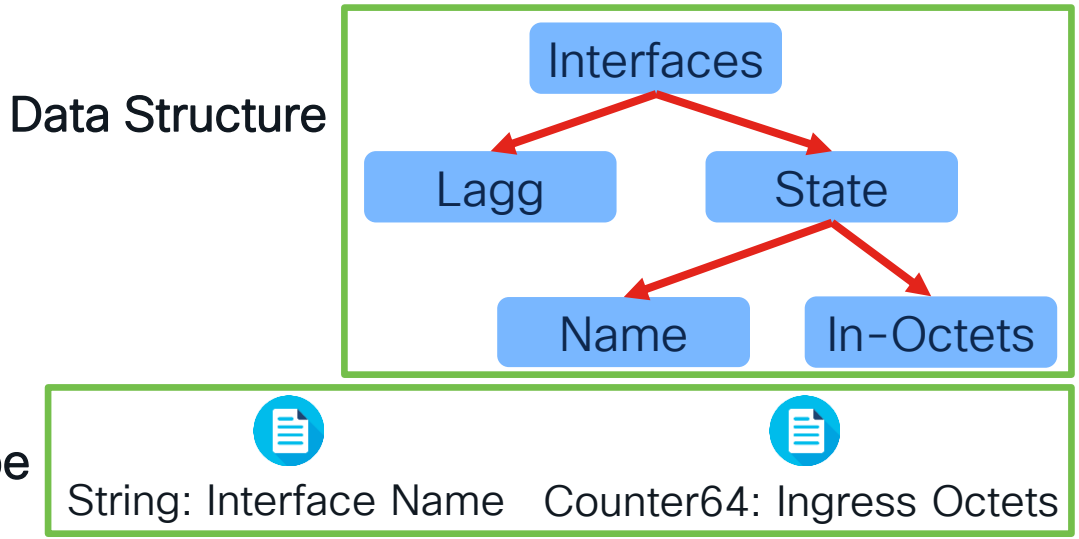
- Browse through DME with Visore
  - e.g. https://<SwitchIP>/visore.html

Building Blocks of NX-OS Programmability

- Data Storage
- **Data Models**
- Data Transport
- Zero-Touch Provisioning

Data Models

- YANG (Yet Another Next Generation) is a data modeling language
- Defines the data structure and data type for the model we use



Data Models

- NX-OS supports two YANG models for programmability
  - OpenConfig model (open-source model)
  - Cisco Native model
- Configuration elements can be accessed with a YANG model path

Change MTU

OpenConfig path example:
/interfaces/interface/config/mtu

Cisco Native path example:
/System/intf-items/phys-items/PhysIf-list/mtu

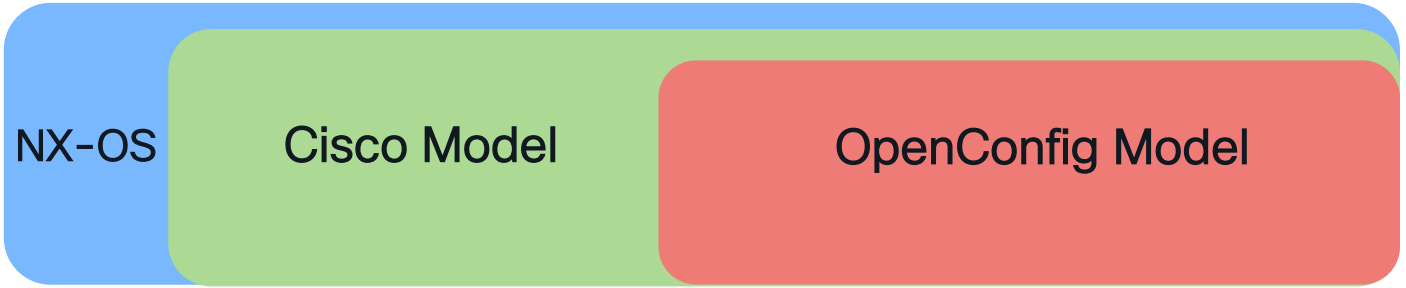
Data Models

Cisco Native Model

- Vendor specific
- Created by Cisco
- Supports almost every feature on NX-OS

OpenConfig Model

- Vendor agnostic
- Created by many networking companies (open-source)
- Does not support every feature on NX-OS

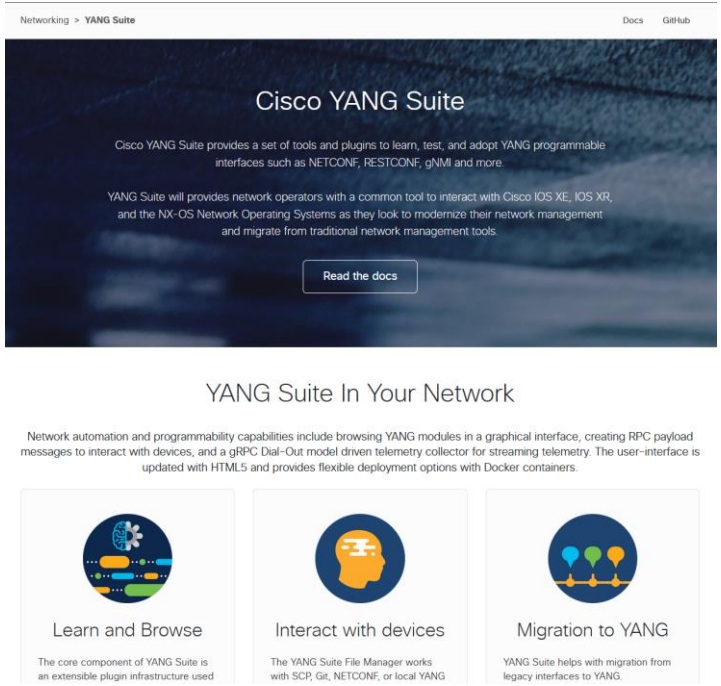


Data Models

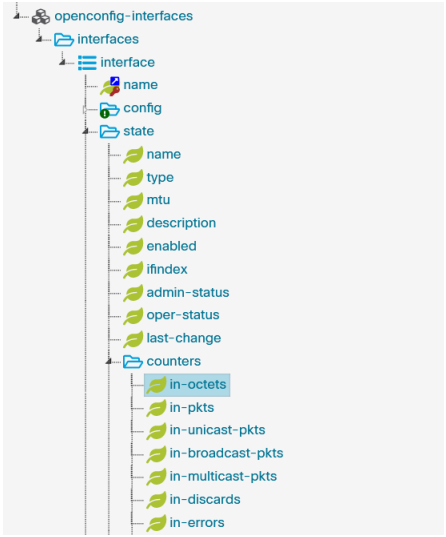
- 100+ OpenConfig modules supported
- Be aware that all paths in a module may not be supported
- These deviations happen with all vendors

Ref. - https://github.com/YangModels/yang/tree/main/vendor/cisco/nx

Data Models



- YANG Suite is a tool for programmability models
- Includes YANG browser for both models



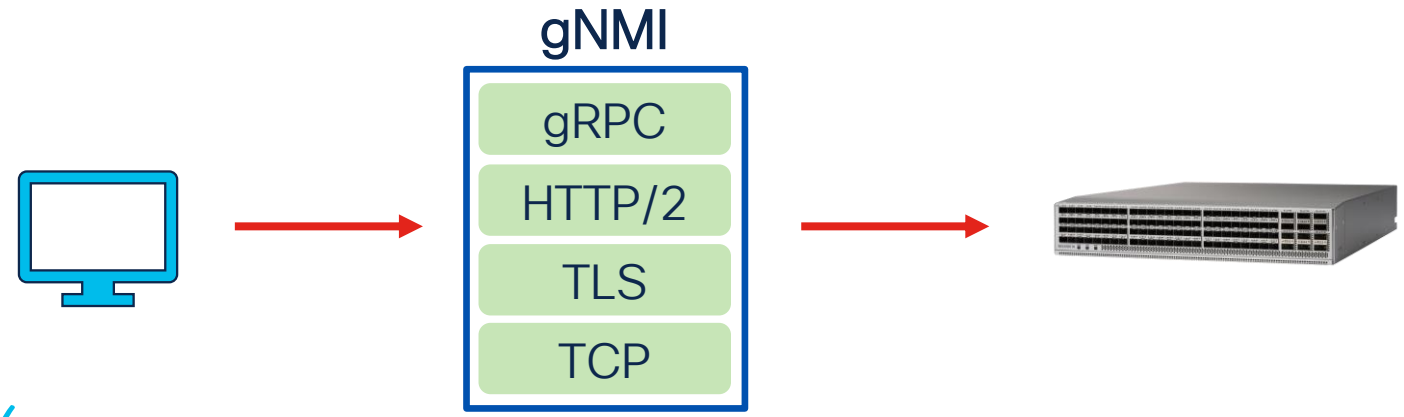
Ref. - https://developer.cisco.com/yangsuite/

Building Blocks of NX-OS Programmability

- Data Storage
- Data Models
- **Data Transport**
- Zero-Touch Provisioning

Data Transport

- gRPC Network Management Interface (gNMI) is a protocol for managing network devices
- gNMI is an alternative to NETCONF and RESTCONF
- Enables multiplexing over a single channel



Data Transport

gNMI Features

Capabilities

Collect capabilities from device

Get

Collect current data values from device

Set

Modify data on the device

Subscribe

Subscribe to a data stream for a path in the data model

Data Transport

gNMI on NX-OS

RPC	• gNMI fully supported from NX-OS 9.3.5
Security	• gNMI leverages TLS • Mutual TLS supported
Data Encoding	• Native and OpenConfig models supported • Supports Google Protobuf and JSON as encoding • Wild card supported from NX-OS 10.2.2

Building Blocks of NX-OS Programmability

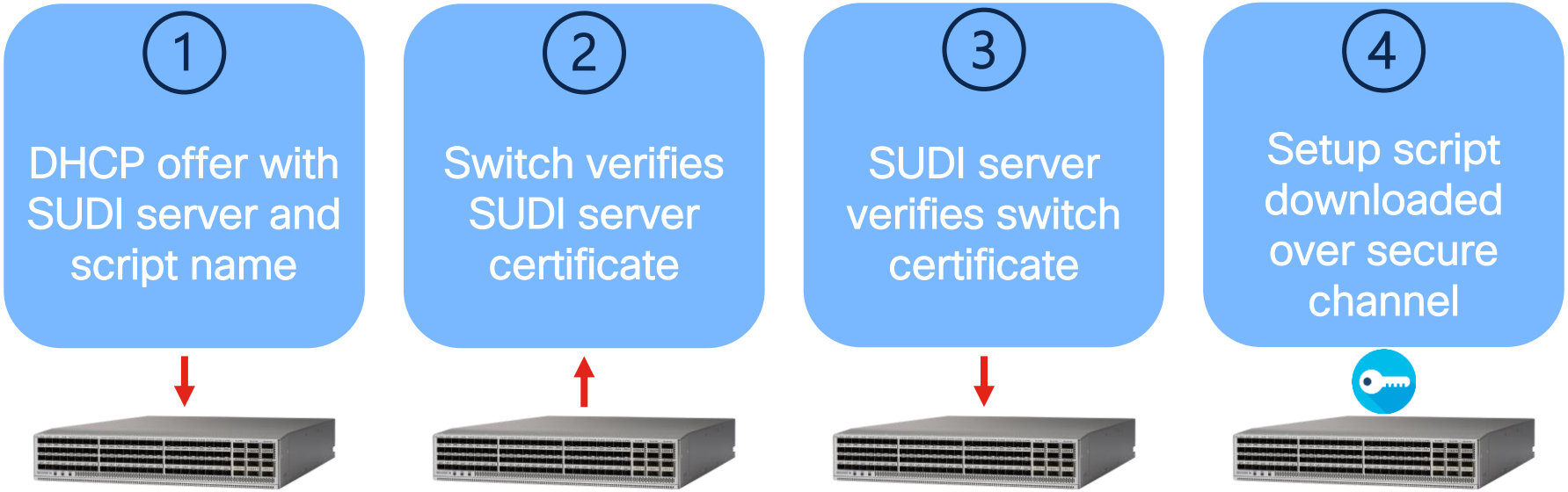
- Data Storage
- Data Models
- Data Transport
- **Zero-Touch Provisioning**

Zero-Touch Provisioning

- We can combine programmability with POAP
  - Securely deploy with POAP
  - Securely manage with gNMI

Zero-Touch Provisioning - POAP

- Starting in NX-OS 10.2.3, POAP can be secured with HTTPS
- Cisco device with a SUDI (Secure Unique Device Identifier) required



Zero-Touch Provisioning - gNMI

- Programmability server will be waiting for POAP to finish
- Finish the advanced configuration with gNMI

1

Server waits for switch to be ready

2

Server connects to gRPC agent on switch

3

Server pushes config with YANG model

Demo

Demo Keypoints – Switch Configuration

Secure POAP

Uplink setup with OpenConfig

Uplink setup with Cisco Native

Key Takeaways

Scalability

Structured Data

Zero-Touch Provisioning

Test YANG Suite

Detailed Telemetry

References

- POAP setup script
  https://github.com/datacenter/nexus9000/blob/master/nx-os/poap/poap.py
- Supported OpenConfig models
  https://github.com/YangModels/yang/tree/main/vendor/cisco/nx
- Cisco YANG Suite
  https://developer.cisco.com/yangsuite/

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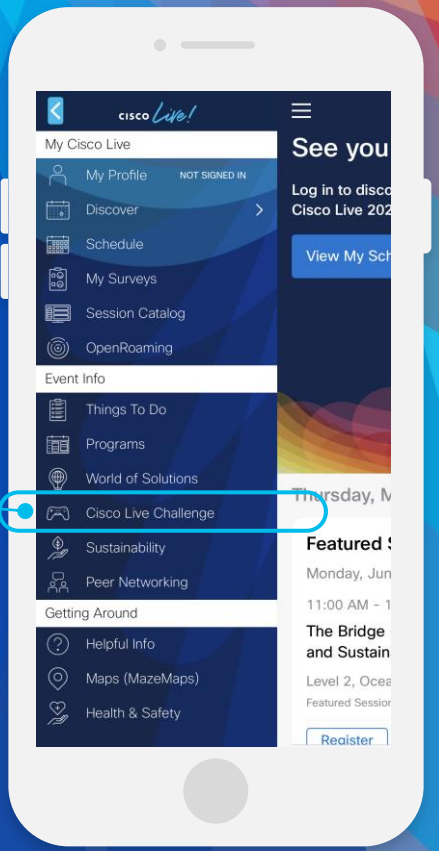


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