The bridge to possible

Simplifying Operations and Upgrades on Nexus using Modular NXOS Software

Samer Theodossy, Principal Engineer
@SamerTheodossy

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BRKDCN-2639

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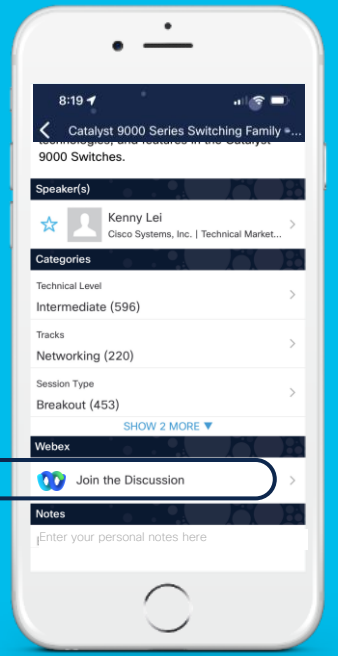
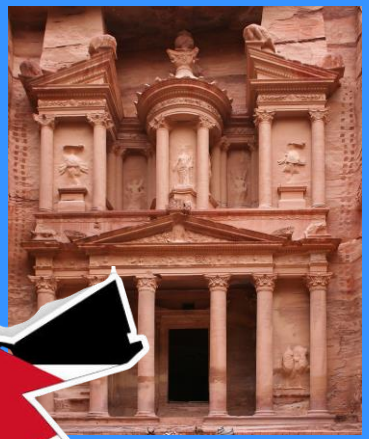


Agenda

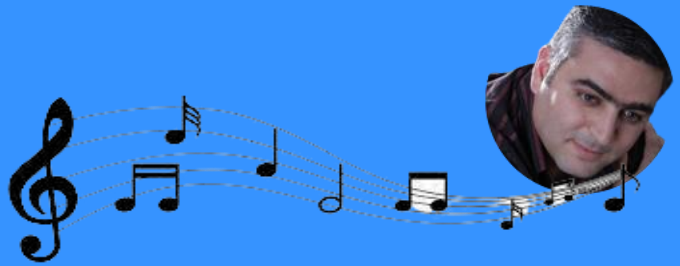
- NXOS SW Architecture
- Upgrades on the Nexus Switches
- Upgrades on ACI Switches
- Bonus: Modular Software Operations

About Me



Jordan

Bullet



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About the speaker

Samer Theodossy – Principal Engineer Cloud Networking

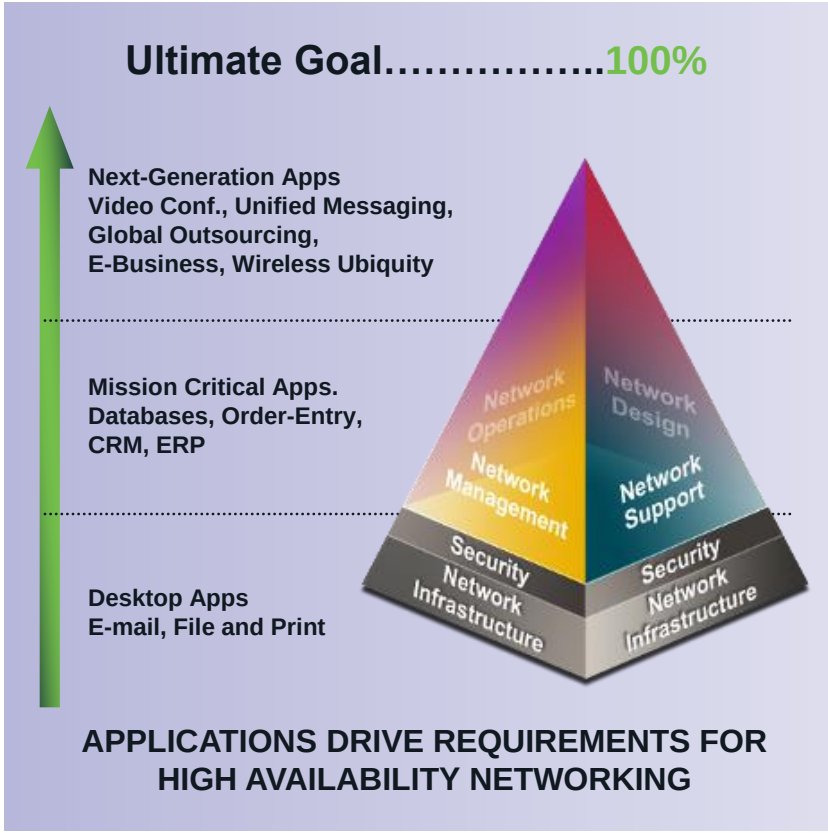
I'm a **Principal Engineer** with the Cloud Networking Software team at Cisco. I've been with Cisco for 25+ years. I have been intimately involved with the design and implementation of the systems and High Availability aspect of a lot of the platforms. Well versed in the design of the SSO/NSF technology and its interworking and helped design the first ISSU solution at Cisco that has been commended with the Pioneer Award and best in class in the industry.
I was part of the team that delivered Cat3850 Architecture and integrated the High Availability Solution on this Access Product as well as on the Cisco Cat4500.
I'm here to help you learn more about to simplify your Upgrade experience and talk about modularity of the software.

I have worked on a wide spectrum of Products in Cisco (Nexus7k, Nexus3k/9k, BPX, MGX, 7600, 7500, 7300, 7200, Cat4500, C10K and the Cat9K) and Operating Systems (NXOS, ACI, Classic IOS, IOS-XE).

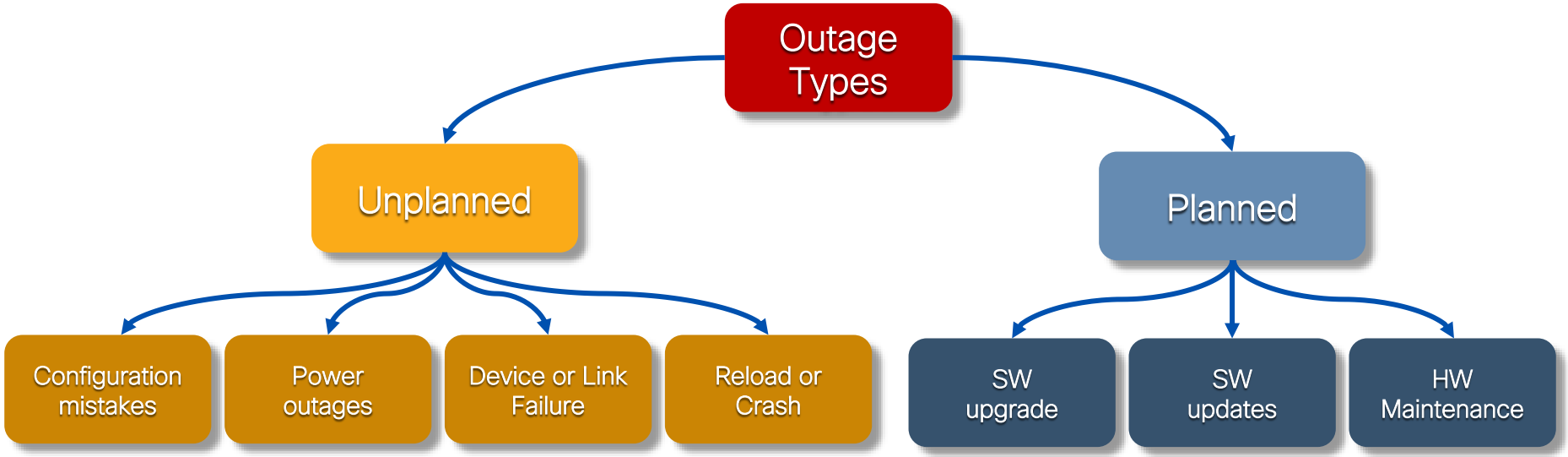
Enterprise-Class Availability

Systems Approach to High Availability

- System-level resiliency
- Network-level redundancy
- Enhanced management
- Human ear notices the difference in voice within 150–200 msec
  - 10 consecutive G711 packet loss
- Video loss is even more noticeable
- 200-msec end-to-end convergence

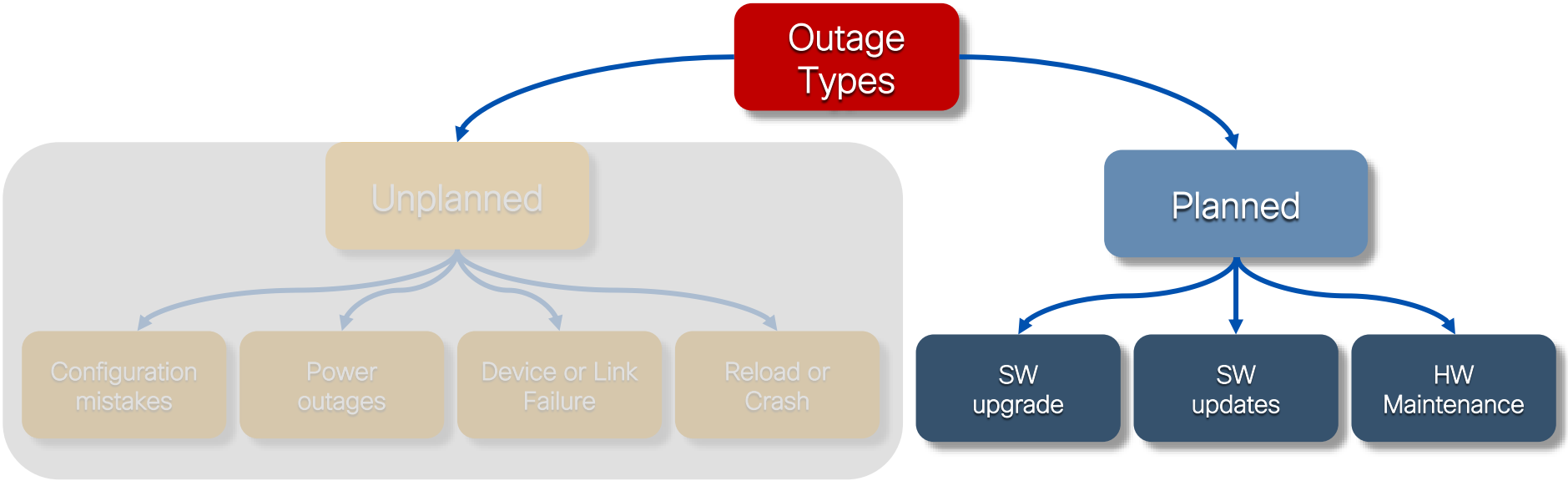


Planned vs. Unplanned Outages



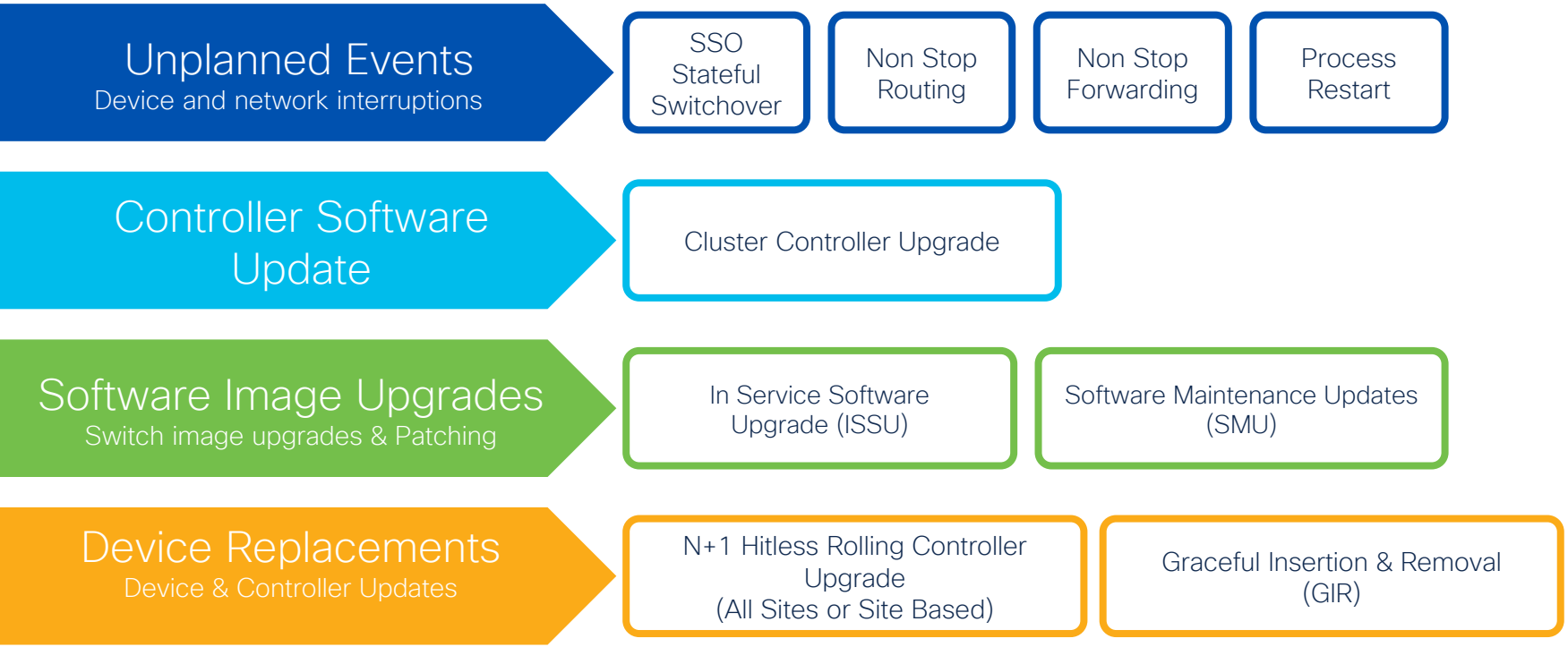
GOAL: Minimize the impact of outages on clients, network and applications

Planned vs. Unplanned Outages



GOAL: Minimize the impact of outages on clients, network and applications

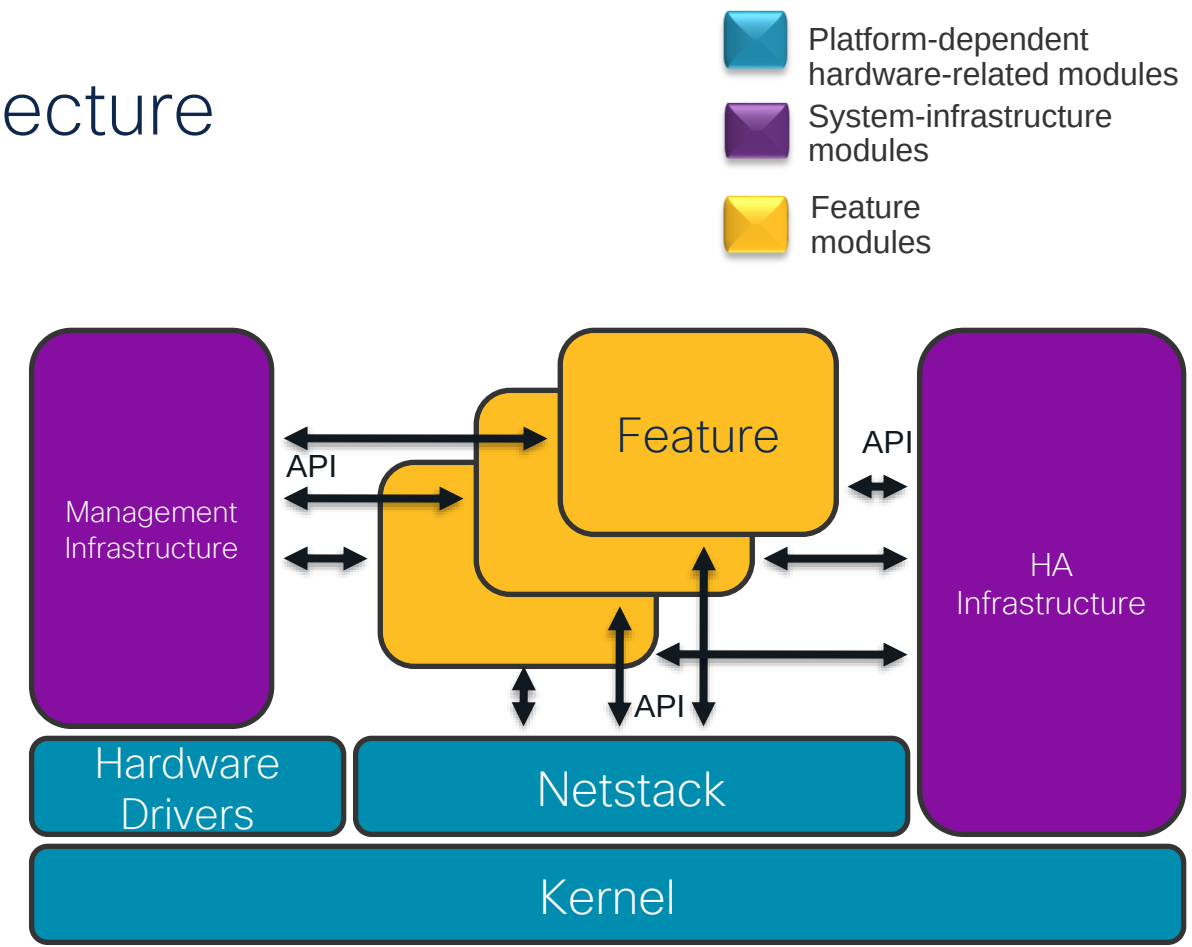
Data Center High Availability
Reducing downtime for Upgrades and Unplanned Events



NXOS SW Architecture

NX-OS HA Architecture

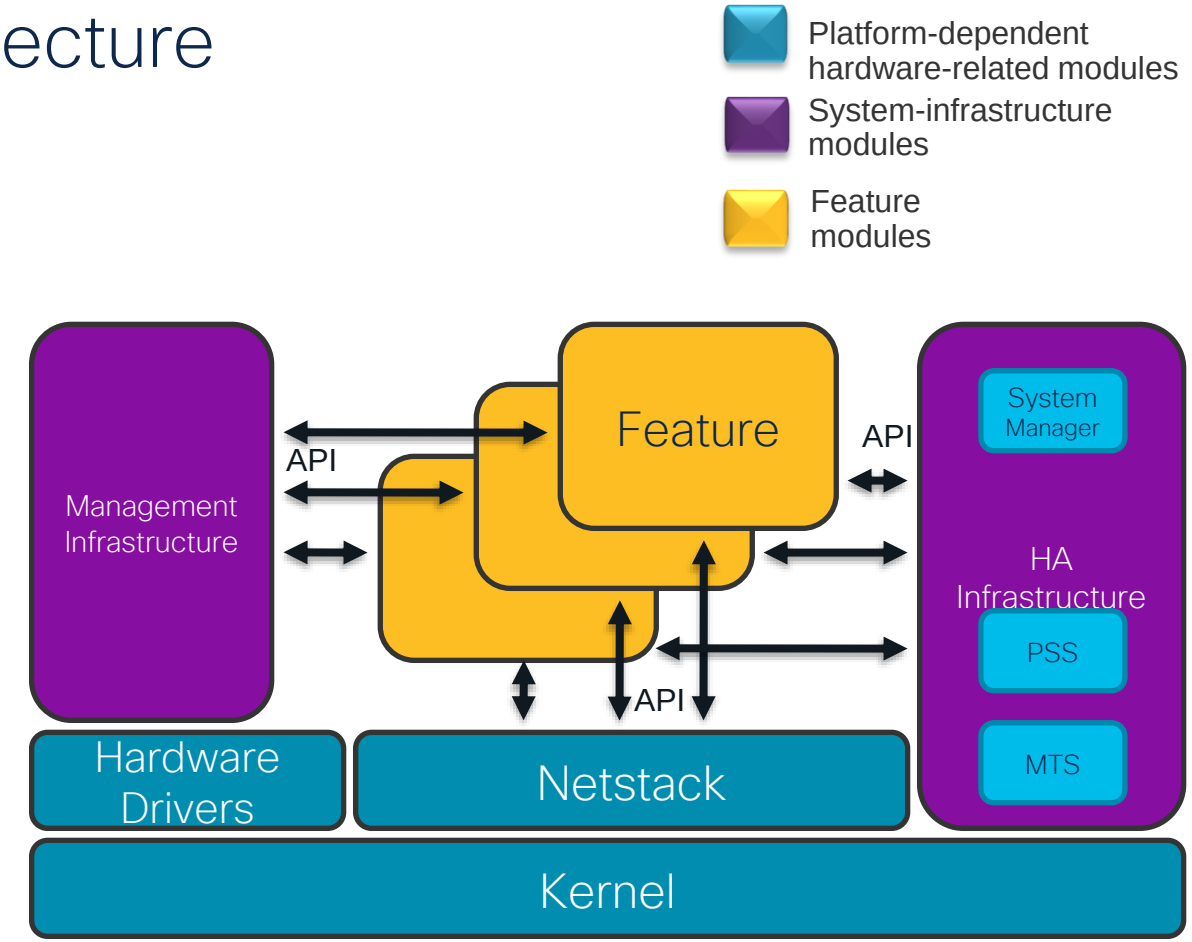
- Fully distributed modular design
- Control-plane & data-plane separation
- Service restart-ability
- Non-disruptive SSO* & ISSU



*SSO only available on dual-sup Nexus devices

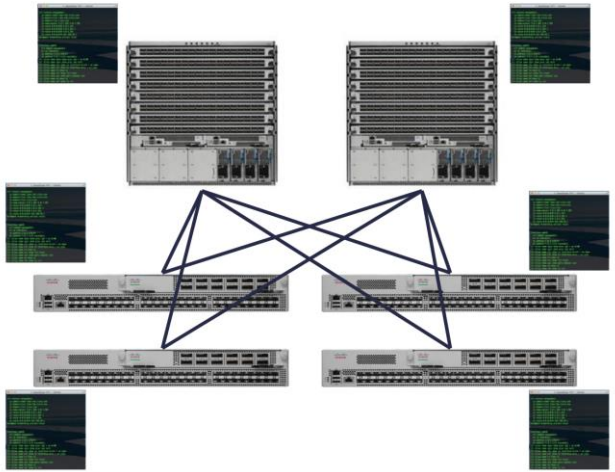
NX-OS HA Architecture

- 3 major components
  - System Manager
  - Message & Transaction Service (MTS)
  - Persistent Storage Service (PSS)



ACI Architecture

Controller Integration



Now let's imagine a network switch ... at the moment, largely configured on the CLI

APIC becomes single point of management for the entire fabric ... with a policy-based model

Interfaces, protocols, TCAM, etc … all represented in an object model, and ALL accessible through an XML/JSON API and CLI

ISSU Definitions

ISSU is recommended for Leaf/TOR

- In-Service Software Upgrade (ISSU) is a **feature that allows you to upgrade the software version of the release on a device with no data plane downtime**. ISSU is needed due to single-homed or non redundant paths in the system.
- Enhanced ISSU is feature that allows you to upgrade the software version of the release on a device with no data plane downtime **with minimal Control plane downtime when no kernel uprev is detected**.

Agenda

- NXOS SW Architecture
- Upgrades on the Nexus Switches
  - Install command
  - Enhanced mode
  - GIR
  - Upgrades from NDFC
  - Best Practices
- Upgrades on ACI Switches
- Bonus: Modular Software Operations

Planned

Patching & ISSU

Validating SMU Impact

Each SMU comes with a README file

```
##############################################################################################
#
# Readme for SMU nxos64.CSCvz98895-n9k_ALL-1.0.0-10.2.1.167.lib32_64_n9000
#
# Copyright (c) 2021 by Cisco Systems, Inc.
# All rights reserved.
#
##############################################################################################
Name:          nxos64.CSCvz98895-n9k_ALL
Version:       10.2.1.167
Compressed size:89146
DDTS:          CSCvz98895
Description:   Kr2f-122: nxpython3 core while collecting show-tech-detail > icam script is failing
Type:          non-reload
MD5 :          a64fa50587d045828421860b840cc306
```

SMU Types	Impact
Hot	Restart
Cold	Box Reload

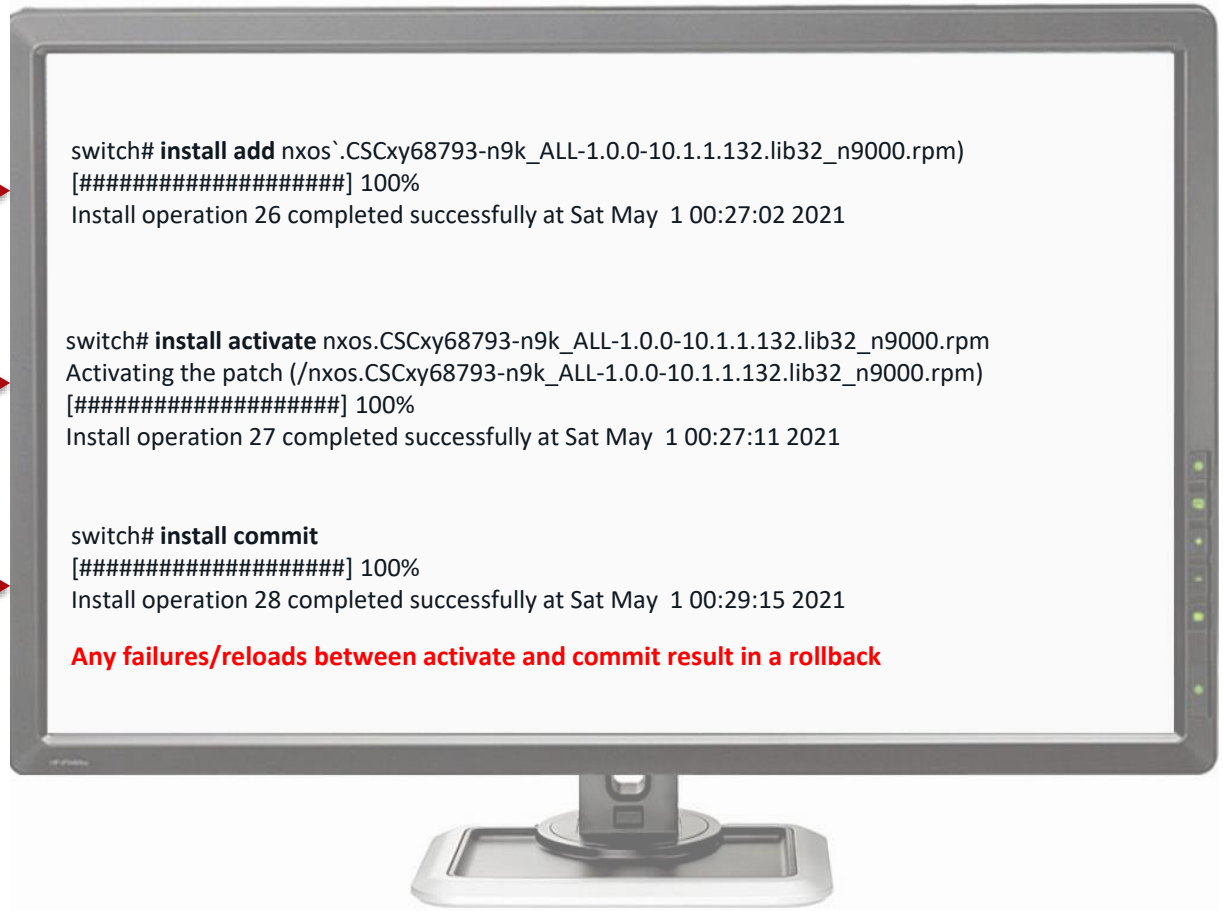
SMU Impact

Nexus SMU install commands

Adding SMU

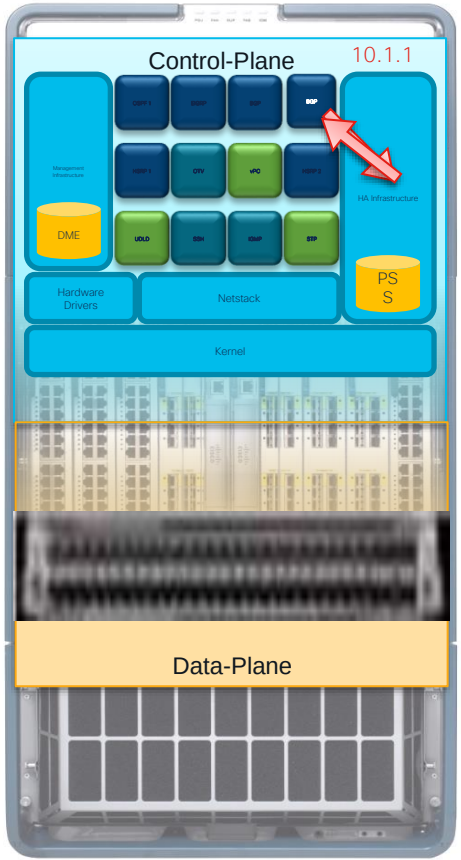
Activating SMU

Committing SMU



Restart SMU update on Nexus 9000

- Services Checkpoints their state in PSS
- Installer asks SysMgr to stop the process
- Installer updates File System with files from SMU
- Installer asks SysMgr to restart the process
- No impact on data plane
- State is recovered, operation resumes
- Total Recovery Time ~10ms



NXOS ISSU

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Running Manual Switch Checks (Upgrades)

- First step is downloading the image to switch

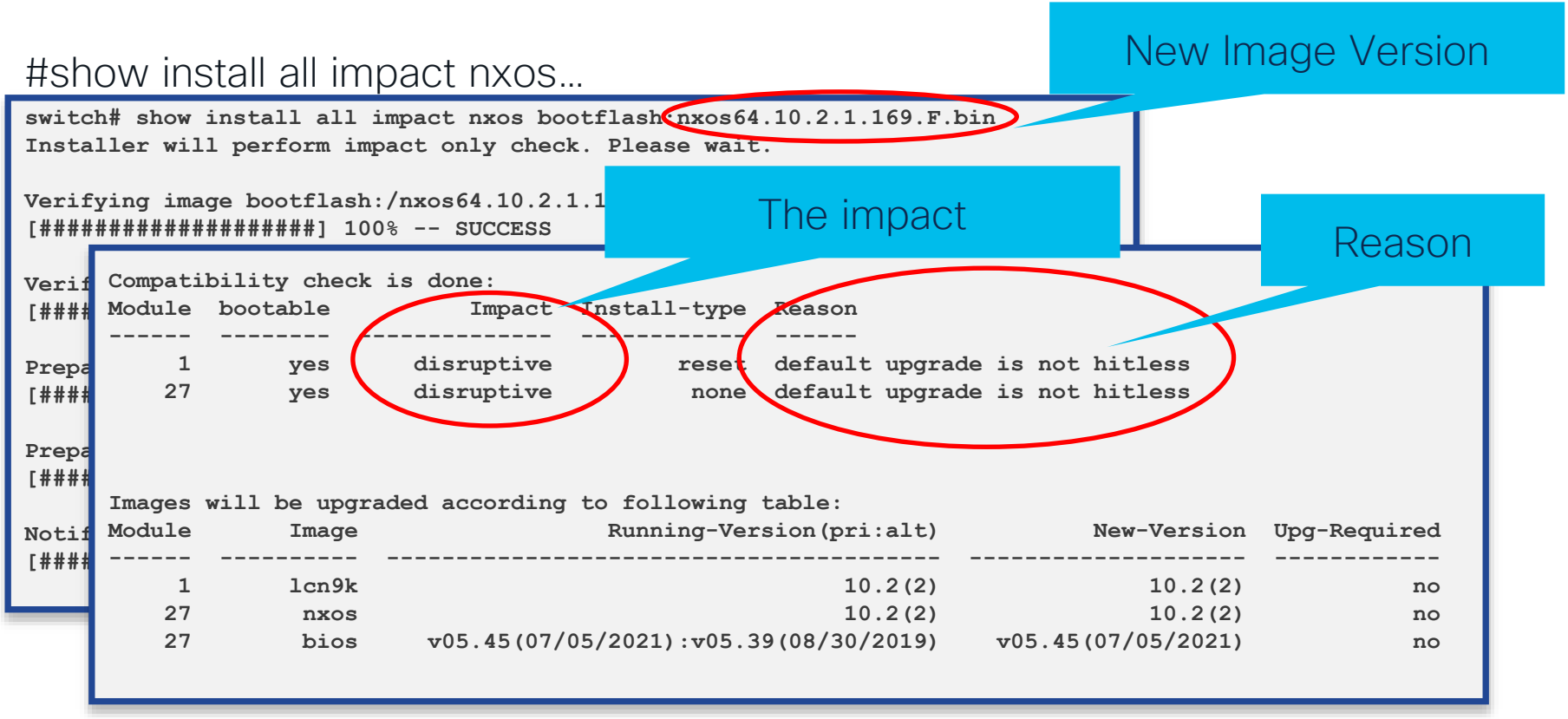
#show install all impact nxos…

New Image Version

```
switch# show install all impact nxos bootflash:nxos64.10.2.1.169.F.bin
Installer will perform impact only check. Please wait.

Verifying image bootflash:/nxos64.10.2.1.169.F.bin for boot variable "nxos".
[####################] 100% -- SUCCESS

Verifying image type.
[####################] 100% -- SUCCESS

Preparing "nxos" version info using image bootflash:/nxos64.10.2.1.169.F.bin.
[####################] 100% -- SUCCESS

Preparing "bios" version info using image bootflash:/nxos64.10.2.1.169.F.bin.
[####################] 100% -- SUCCESS

Notifying services about system upgrade.
[####################] 100% -- SUCCESS
```

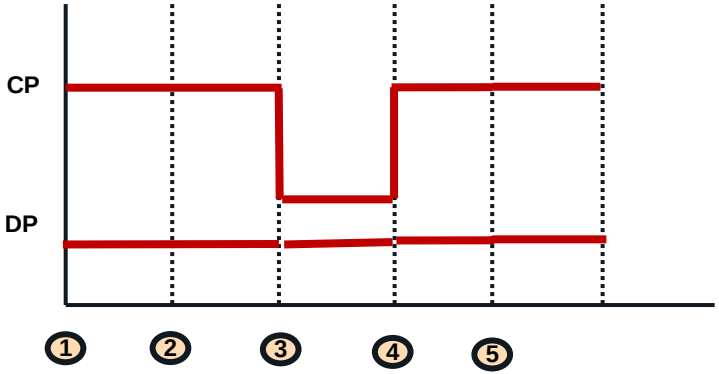
Running Manual Switch Checks (Upgrades)

#show install all impact nxos…

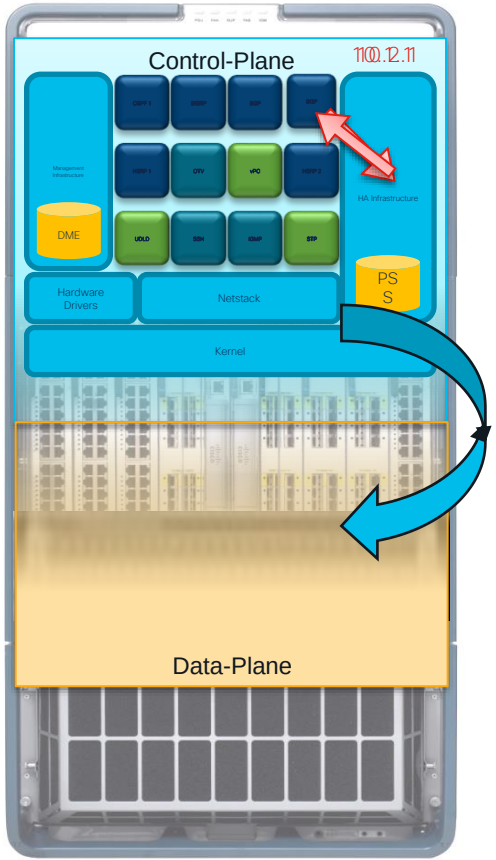


Hitless ISSU on the Nexus TOR N9K

- Single supervisor
- Hitless Upgrade
  - Control plane is inactive during reload while Data plane is forwarding



1. Pre Upgrade Check
   - Config Locked
   - Stable Network
2. Save State
3. kexec to new Image
4. Restore control plane from saved State
5. Reconcile with Data Plane



Enhanced ISSU

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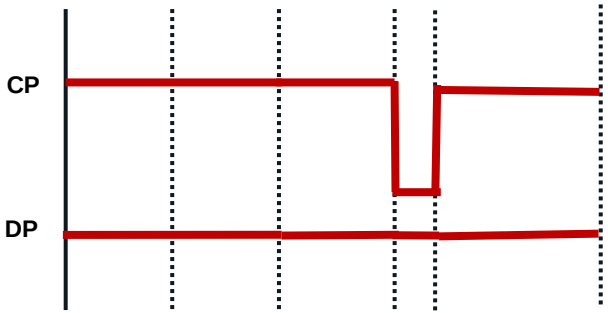
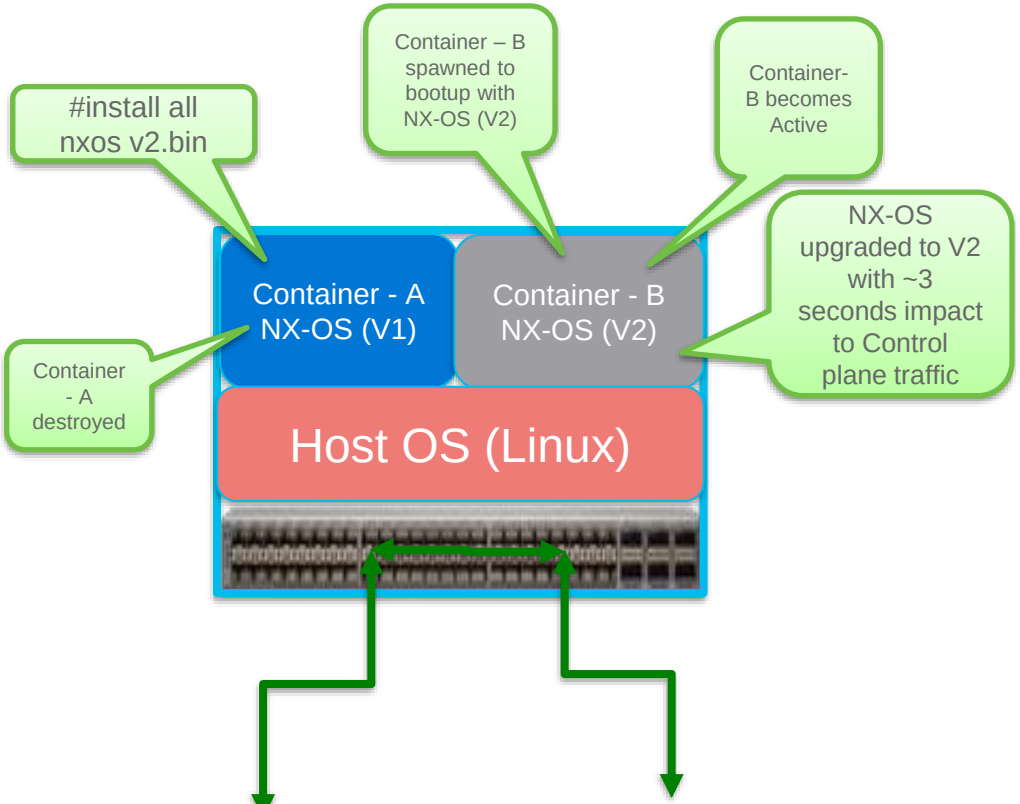
Enhanced ISSU on the Nexus TOR N9K

- Dual Container
- Control plane is only down for ~3 sec during switchover

If Kernel uprev is detected, we auto-revert to normal ISSU

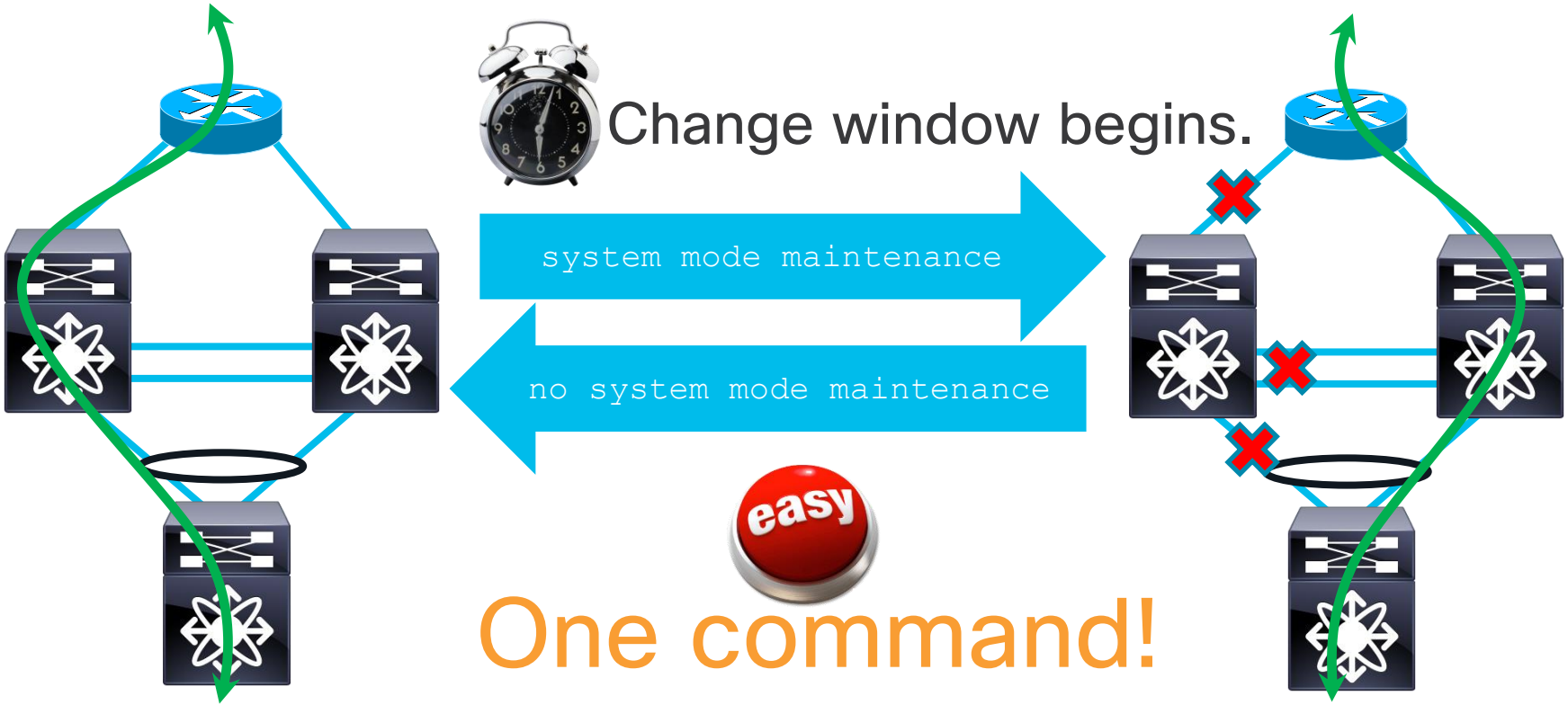




GIR

Graceful Insertion and Removal for NXOS

Planned Outage – Isolation & reintroduction of Switch



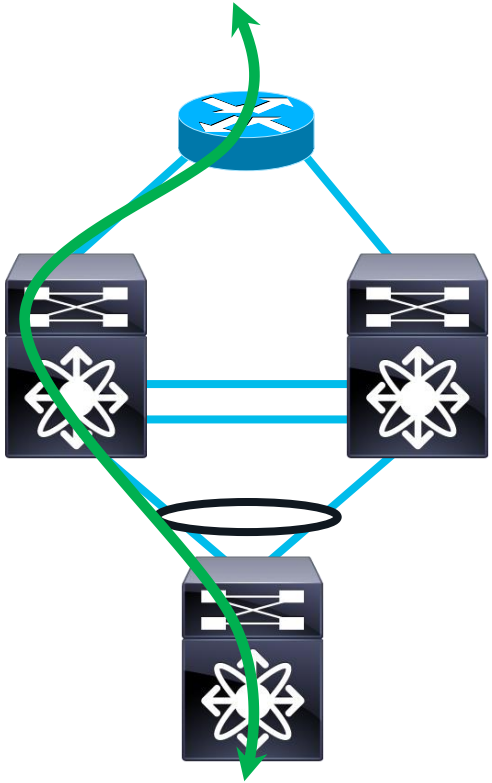
One command!

Pre-change System Snapshot

Graceful Insertion and Removal

Isolation of Switch from network

- Isolate a switch from the network in order to perform debugging or an upgrade.
- Shutdown Vs. Isolate Mode
  - Shutdown: All protocols are gracefully brought down and all physical ports are shut down. (7.2.1)
  - Isolate: All protocols are gracefully brought down but is not shutdown. (7.3.0)



NDFC Switch Image Upgrades

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NDFC Packages Upgrade Pre-requisites

Uploading the package(s) to controller

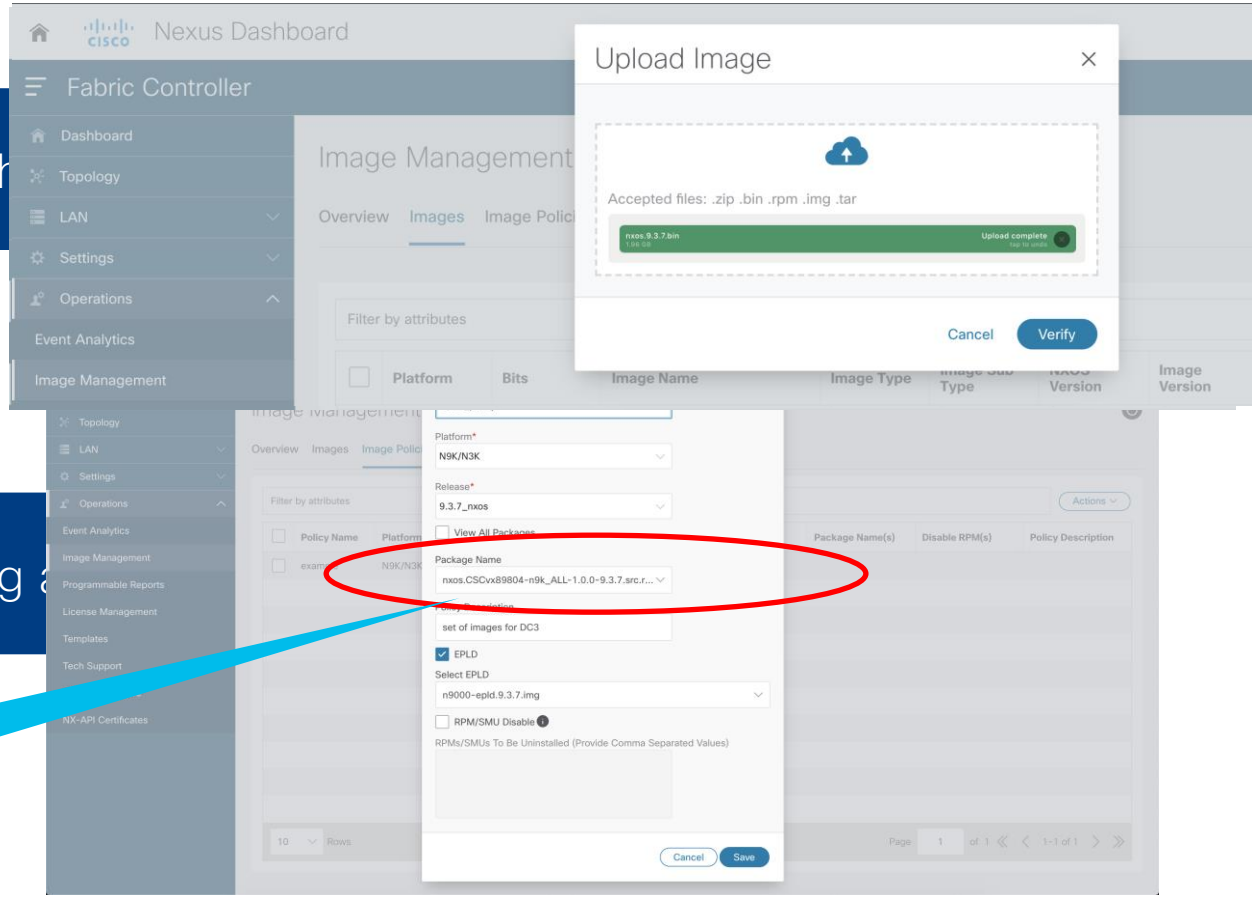
Creating a switch policy

NDFC Package Upgrade Pre-requisites

Uploading th

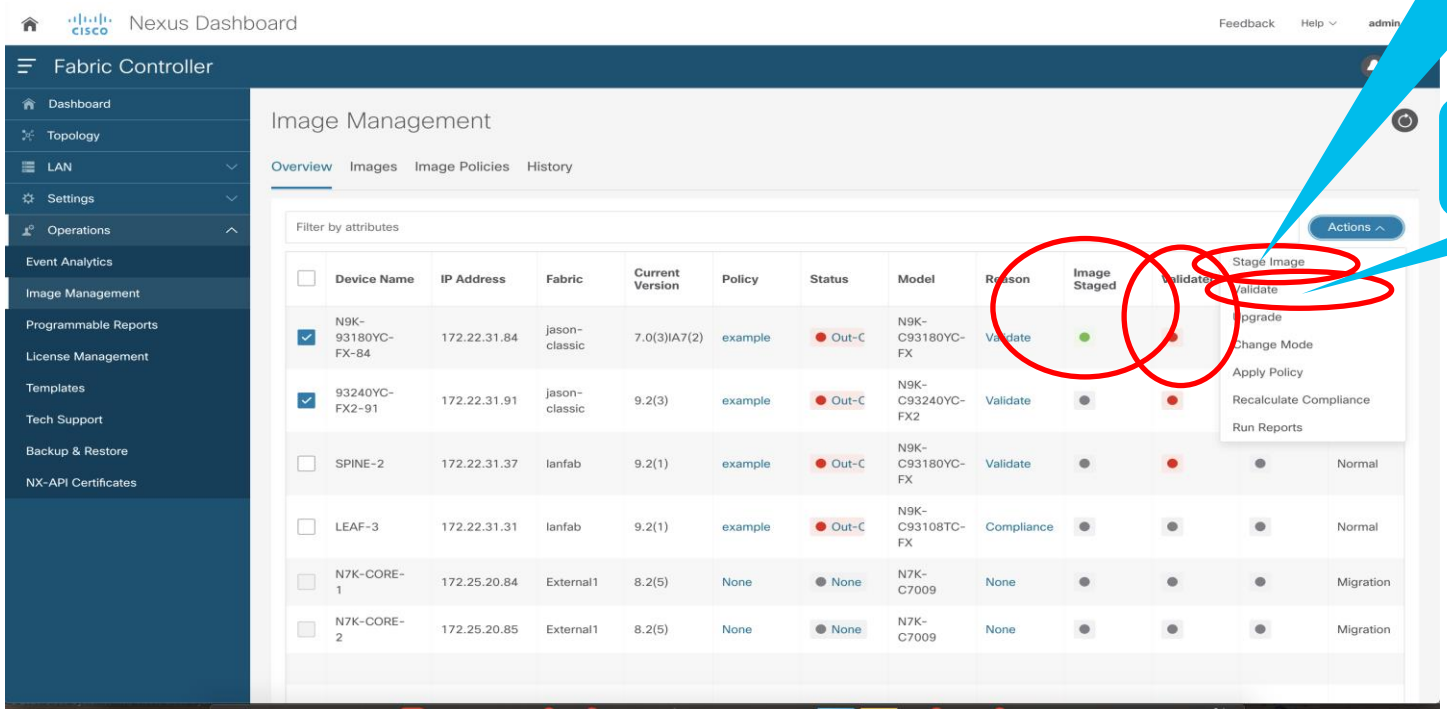
Creating a

This is where you put the image name or SMU



Staging and Validation

Recommended: Outside of the install window

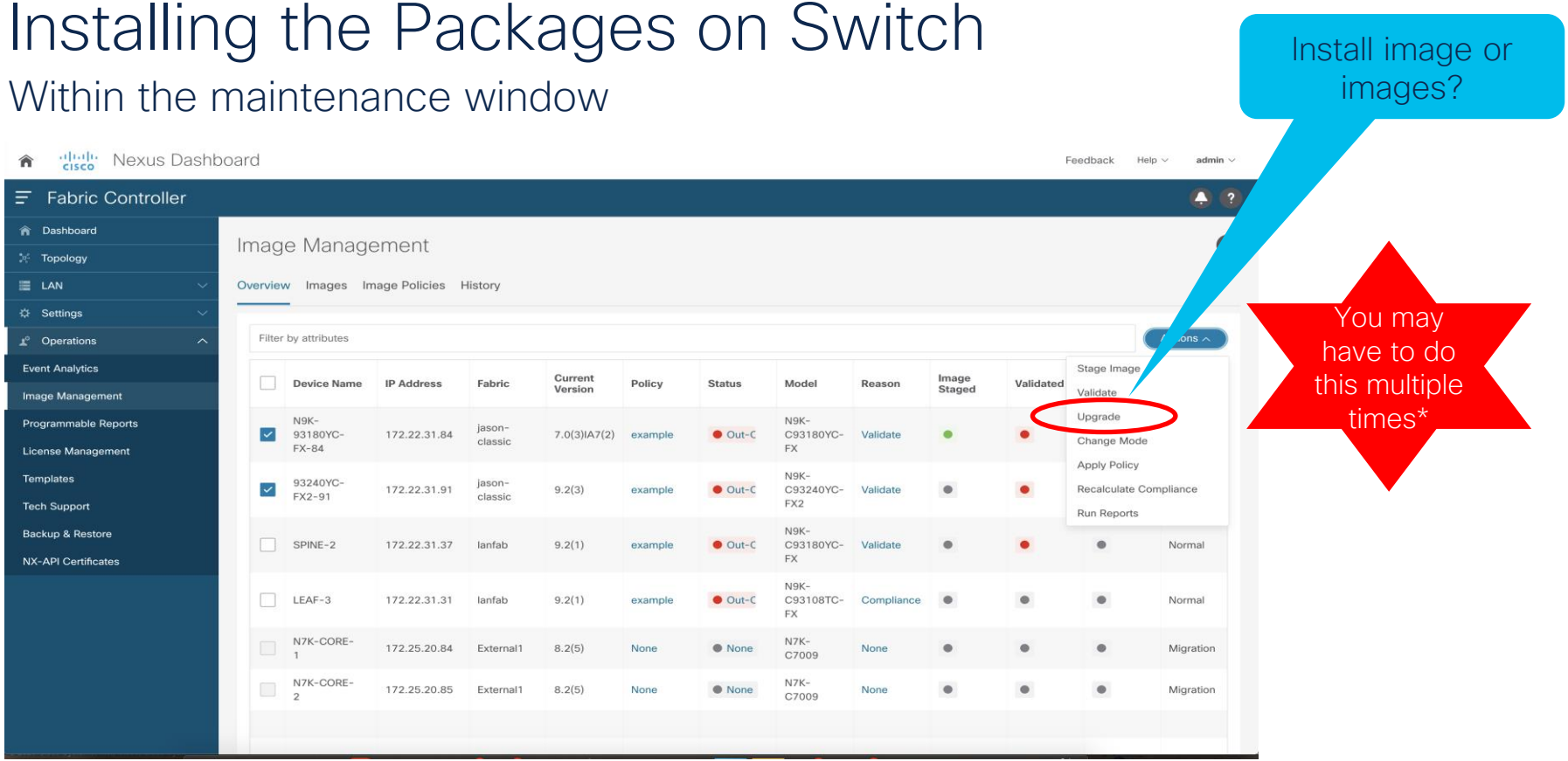


Load Image onto switches

Non-disruptive Upgrade ?

Installing the Packages on Switch

Within the maintenance window



*10.2.1/9.3.8 support image and EPLD upgrade at the same time

Simplifying Upgrade Process

Non-Disruptive NXOS upgrade

Reducing Number of reloads required during upgrade

Prevent downtime for Kernel Patch

Defaulting all ND ISSU to enhanced ISSU on GX2A and GX2B platforms

Combining NXOS and EPLD upgrade avoids additional reload in case of EPLD – 9.3(8) and 10.1(2)

Apply SMU with NXOS and EPLD upgrades – 10.2(1)

Providing the ability to perform Kernel patch without reload 10.2(2)

Best Practices for Nexus Upgrades

Check Upgrade Path
https://www.cisco.com/c/dam/en/us/td/docs/Website/datacenter/ISSUmatrix/index.html

Download Upgrade/Patch Images prior to maintenance window

Do not make Configuration Changes during upgrades

Run Pre-Upgrade Validation Checks

Agenda

- NXOS SW Architecture
- Upgrades on the Nexus Switches
- Upgrades on ACI Switches
  - Upgrade from APIC
  - Best Practices
- Bonus: Modular Software Operations

Upgrades on ACI Switches

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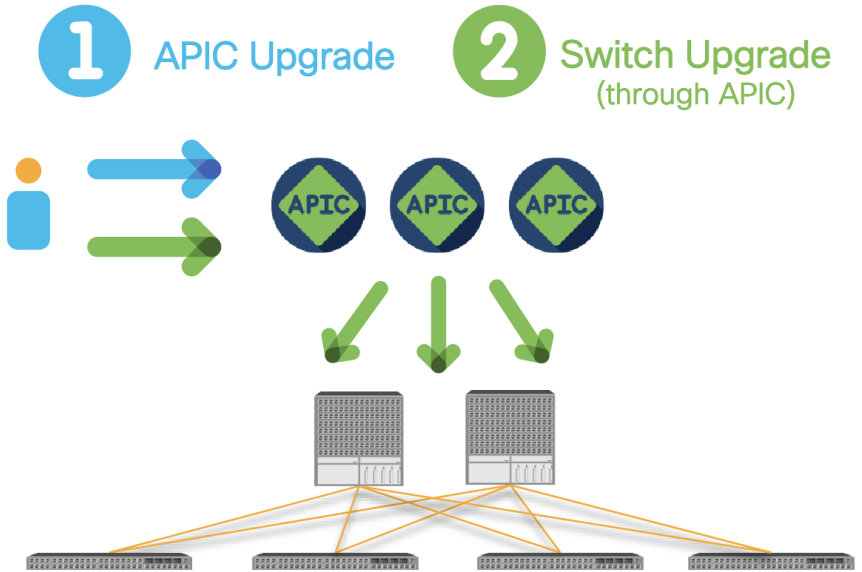
ACI Firmware Upgrade Types

ACI Firmware Upgrade Types (Regular)

- Regular Upgrade
- Software Maintenance Upgrade (SMU)
- EPLD/FPGA Upgrade (Only Switches)

Base OS firmware upgrade

In principle, all APICs and switches should be on the same version



ACI Firmware Upgrade Types (SMU)

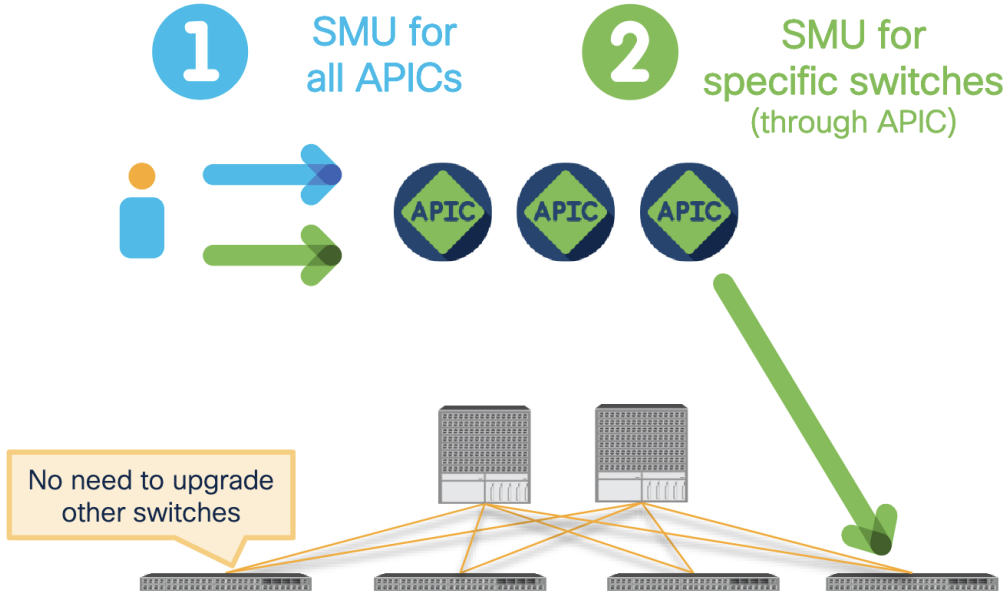
Regular Upgrade

Software Maintenance Upgrade (SMU)

EPLD/FPGA Upgrade (Only Switches)

A patch for a specific defect

No need to upgrade the entire fabric. You can apply it only to APICs or affected switch nodes



ACI Firmware Upgrade Types (EPLD/FPGA)

Regular Upgrade

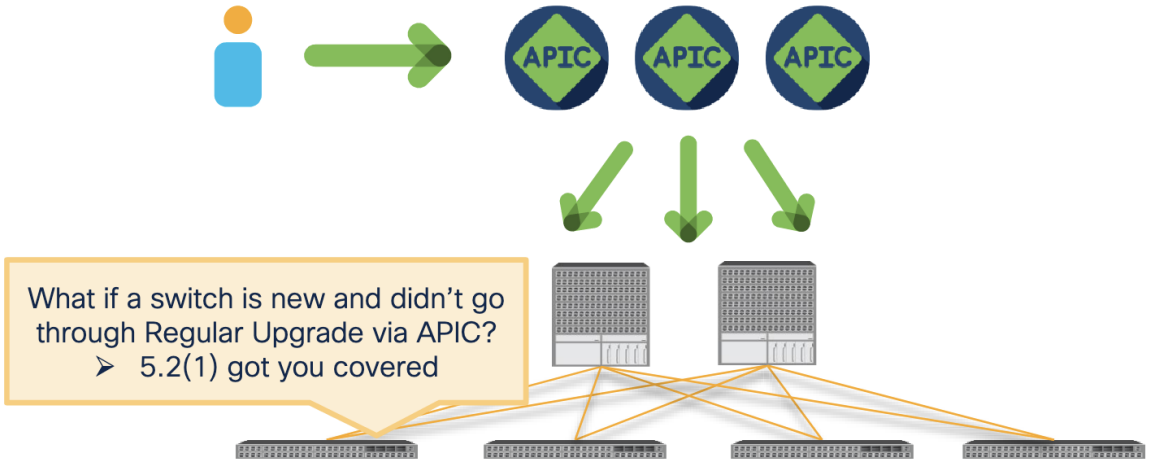
Software Maintenance Upgrade (SMU)

EPLD/FPGA Upgrade (Only Switches)

Hardware related firmware

Each ACI switch version has the desired EPLD/FPGA version.
Automatically upgraded via Regular Upgrade through APIC.

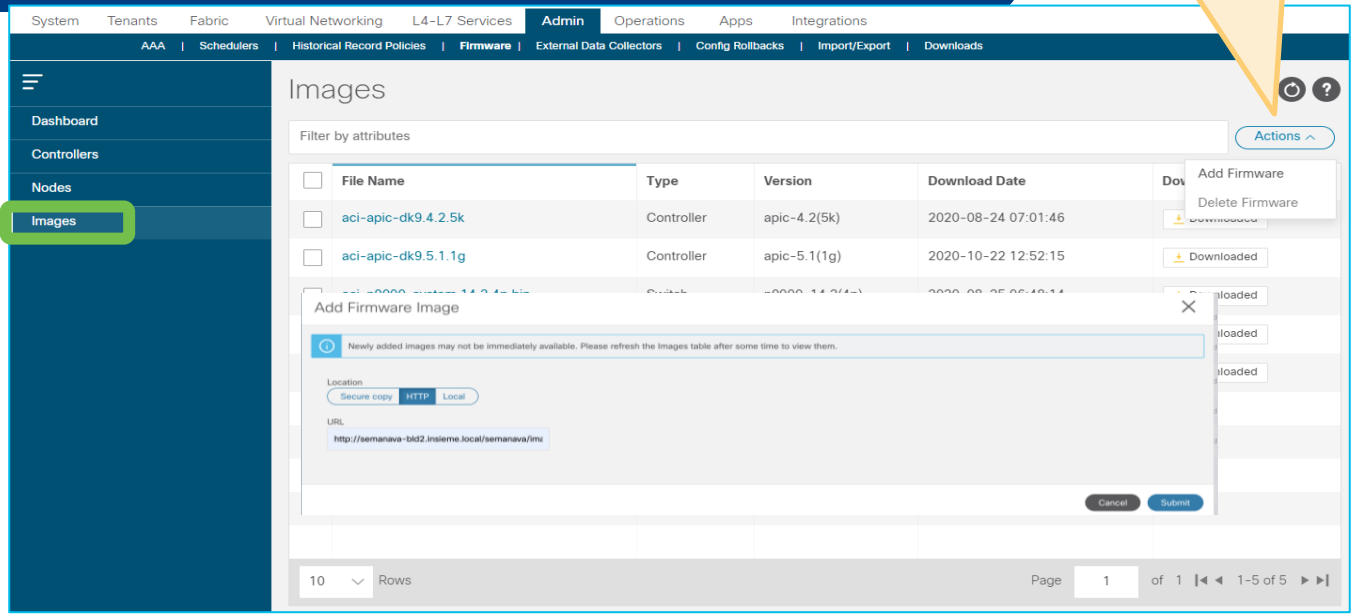
- No user configurations



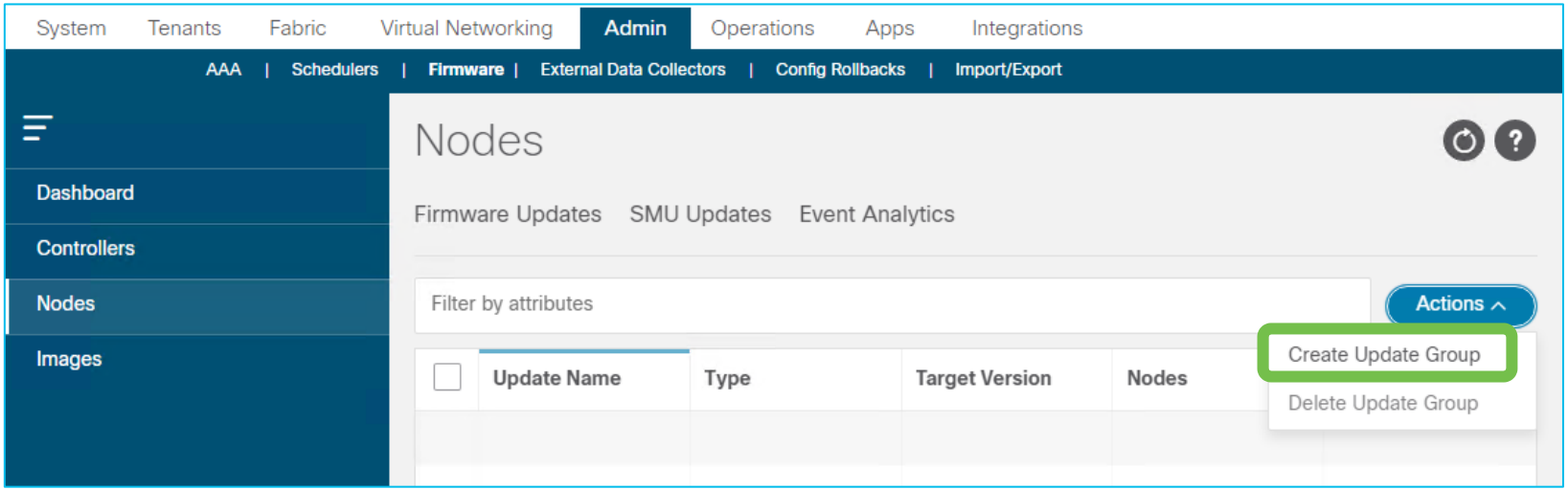
ACI Package Upgrade Pre-requisites

Uploading the package(s) to APIC controller

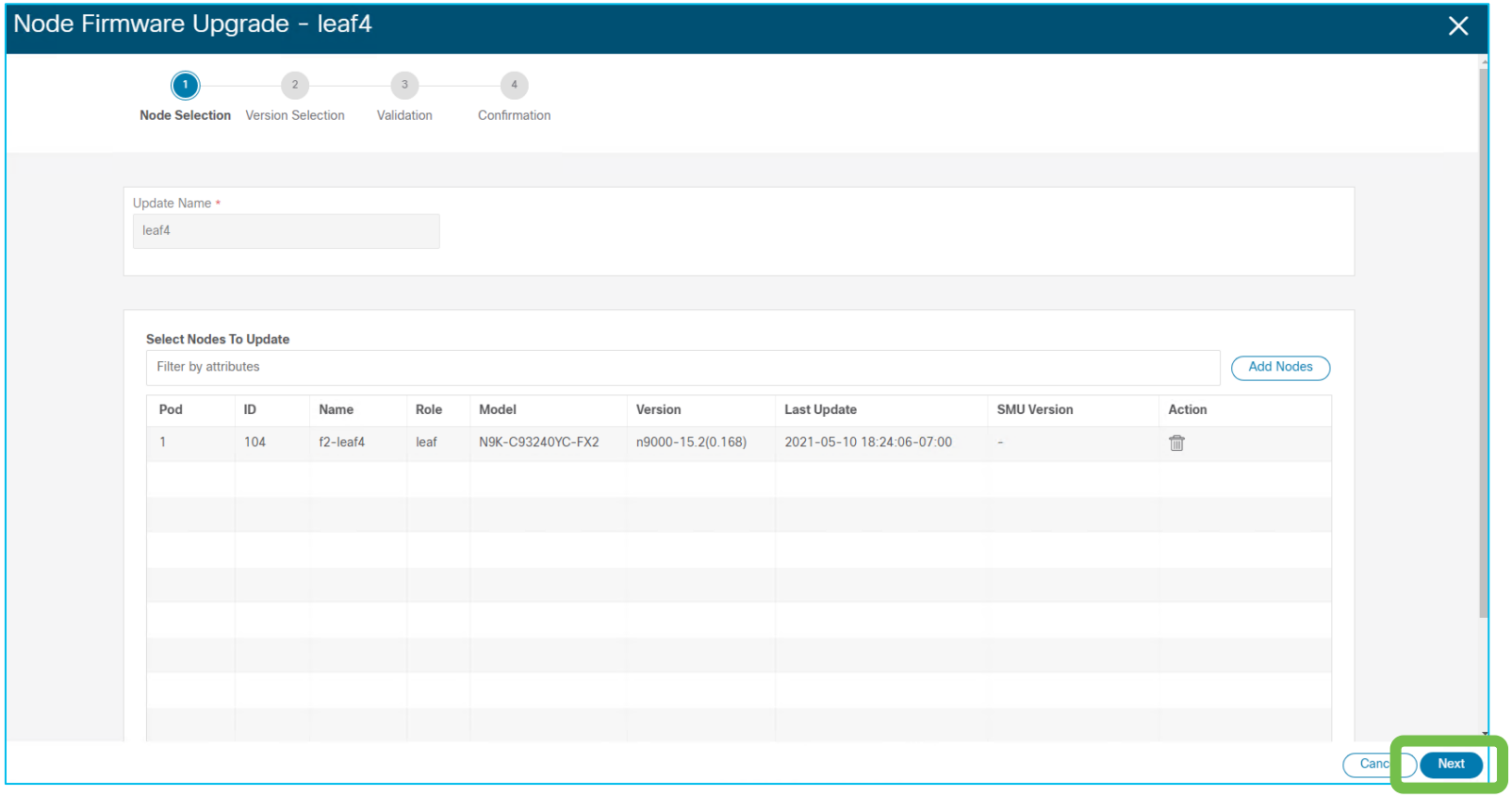
Add Firmware to download a new firmware image



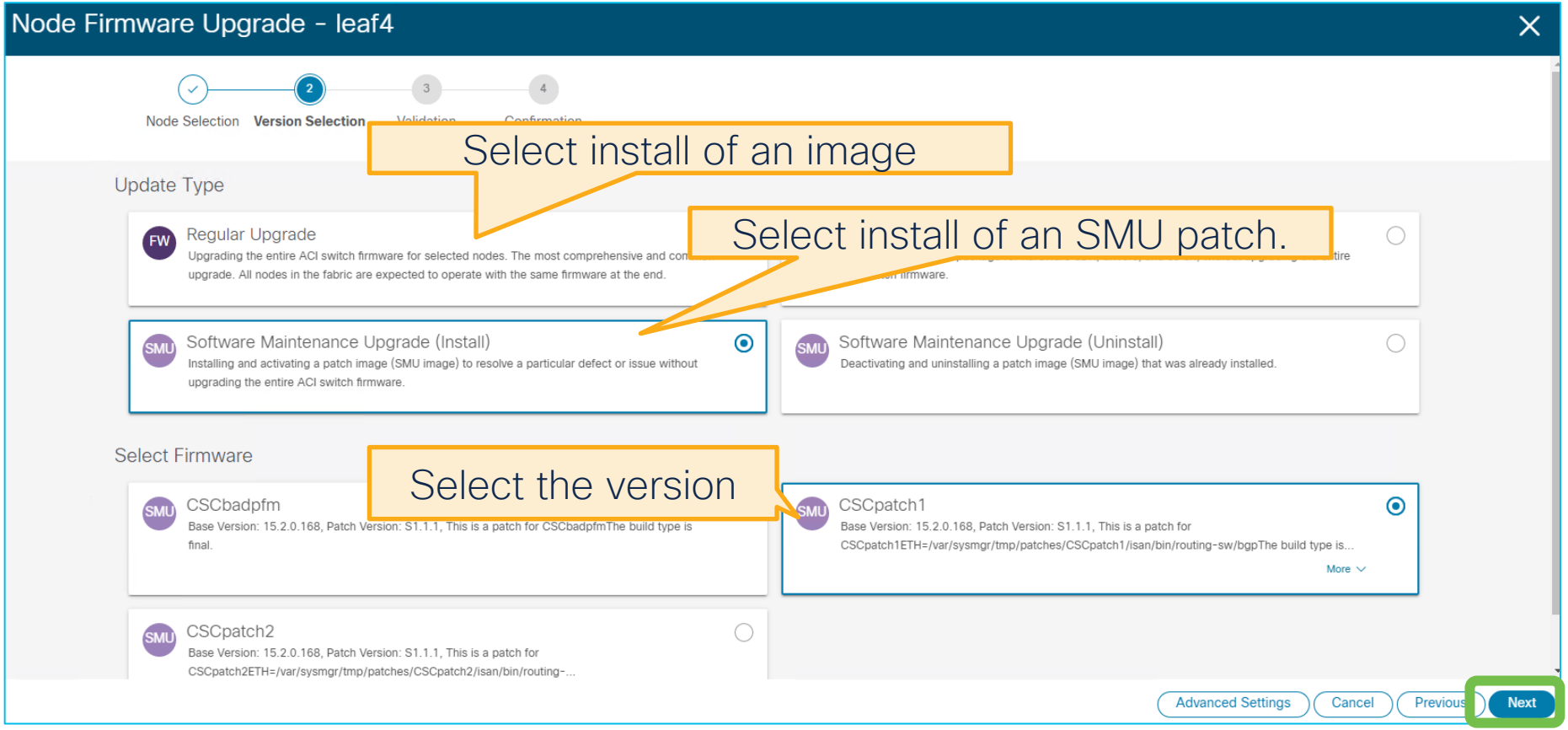
Creating an ACI update group



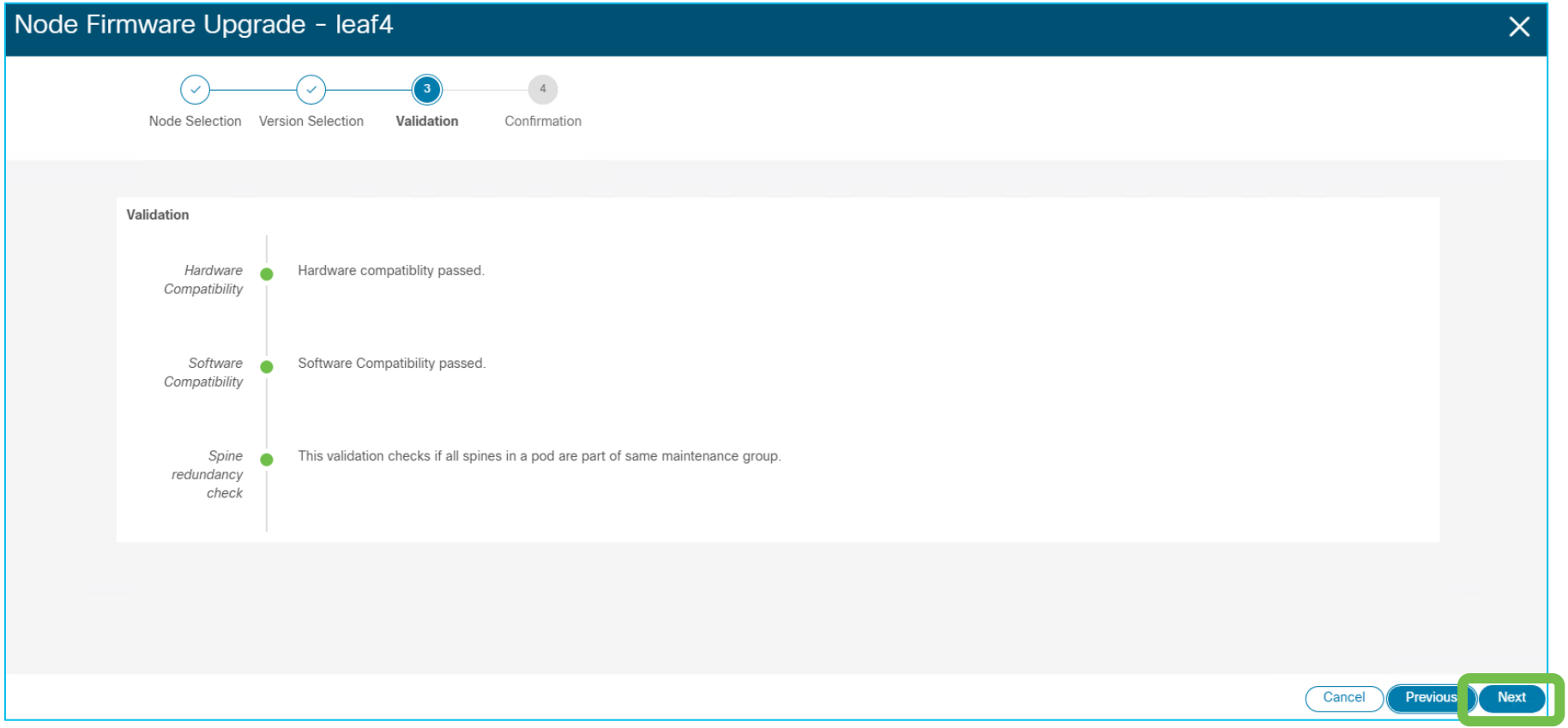
Node Selection



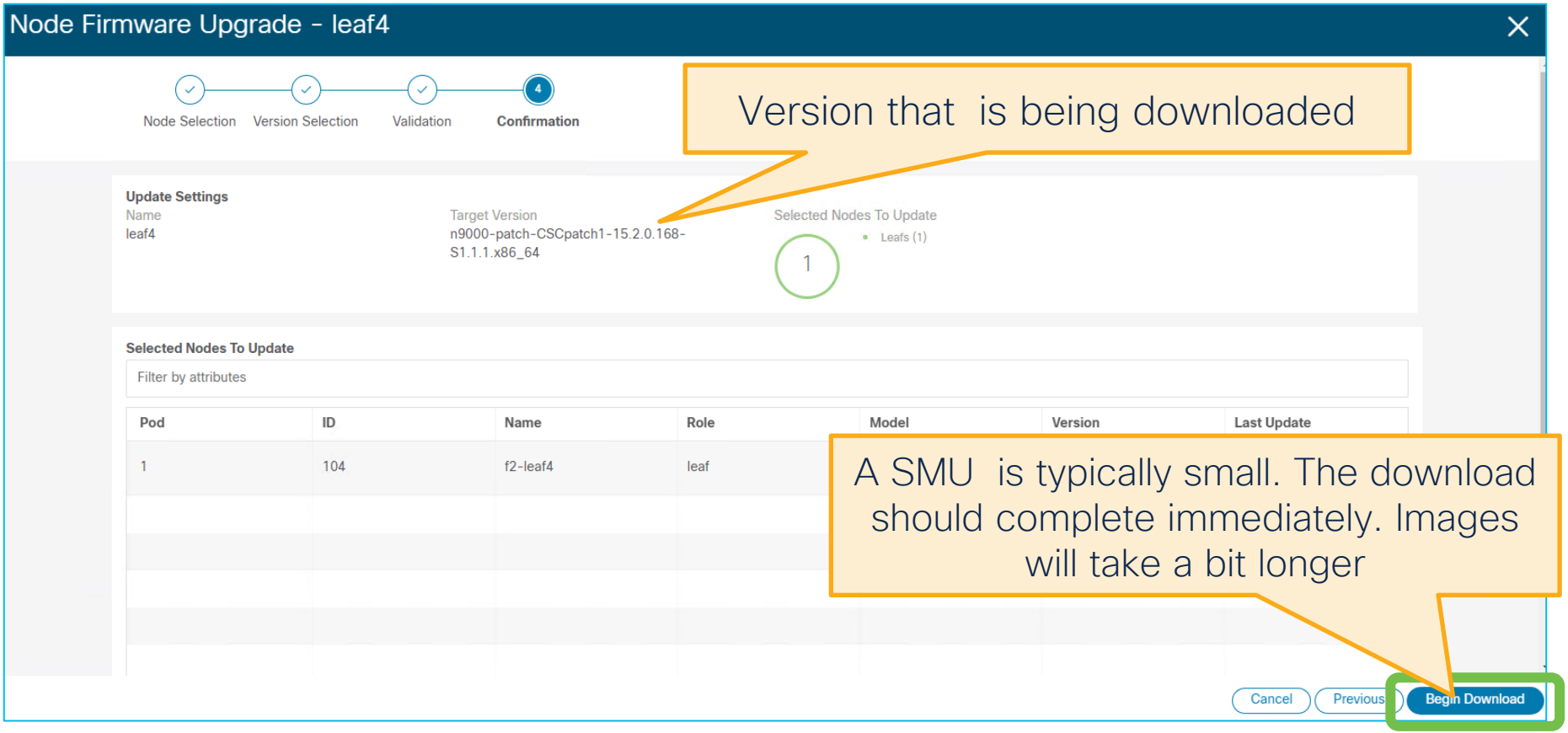
Version Selection for either image/SMU



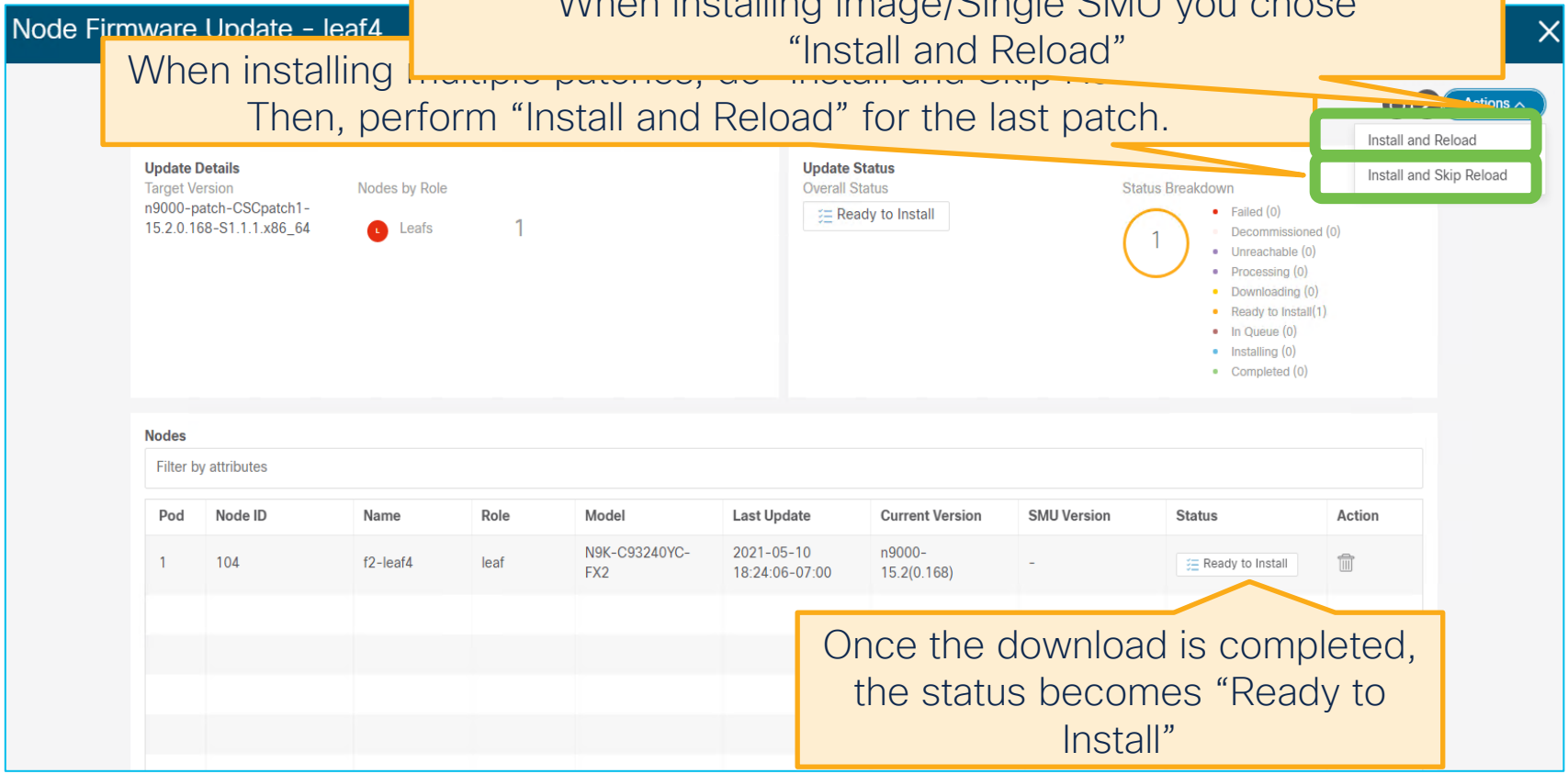
PRE Upgrade validation



Staging of the packages



Installing of Package(s)



Best Practices for ACI switch upgrades

Confirm Supported Upgrade Path
ACI Upgrade/Downgrade Support Matrix

Clear All Faults

Check APIC Cluster is Fully Fit

Run Pre-Upgrade Validation Checks

Compare state Before and After Upgrades

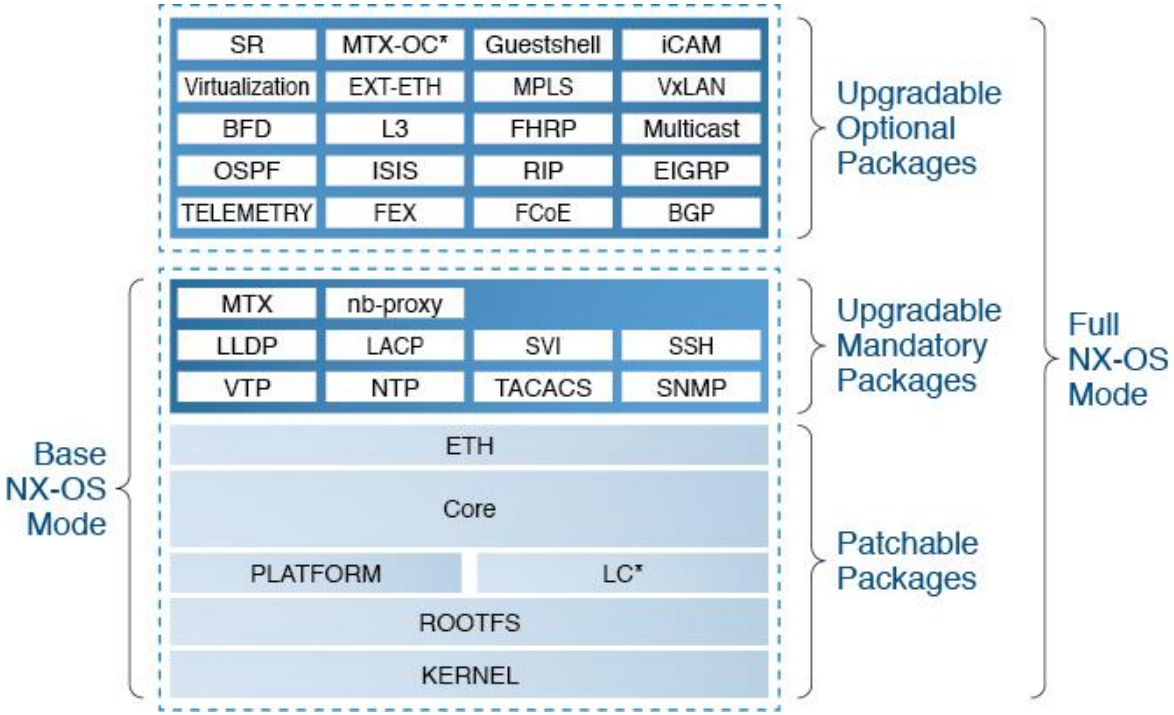
Using NAE

3rd party Apps

Agenda

- Introduction
- Upgrades on the Nexus Switches
- Upgrades on ACI Switches
- Bonus: Modular Software Operations
  - RPM Architecture
  - Switch Boot modes

Nexus RPM Architecture

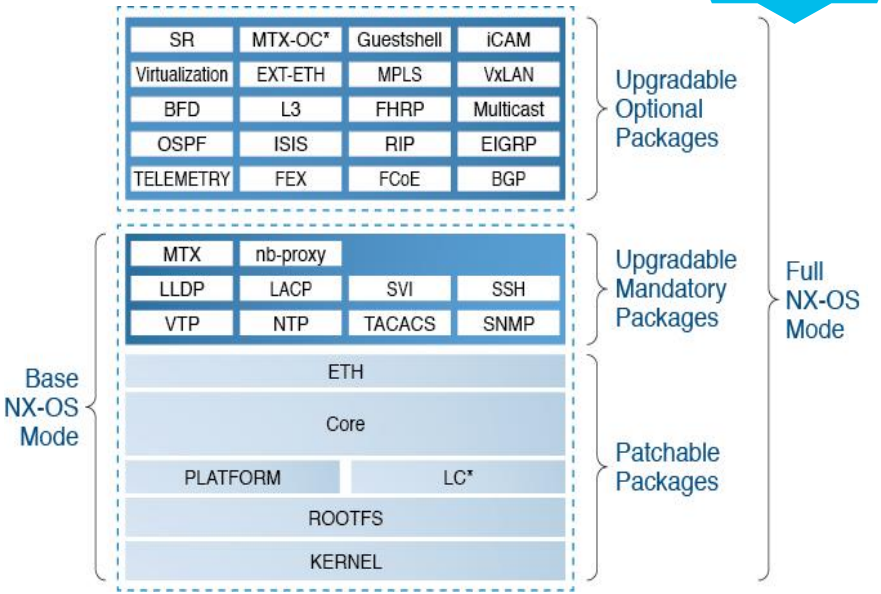


Nexus Boot Modes

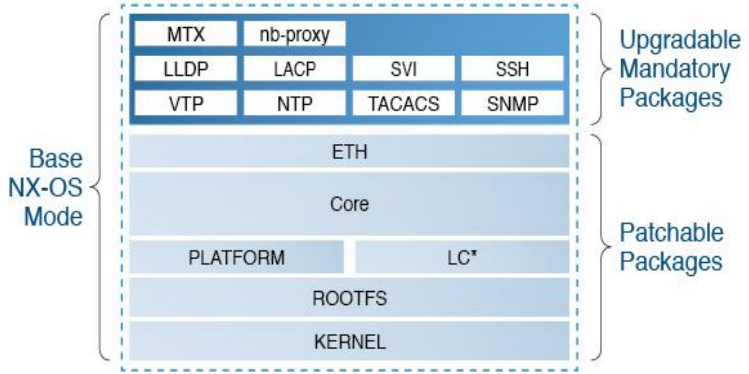
Nexus Supports two Boot Modes

```
#install reset nxos full
```

Default




```
#install reset nxos base
```



Learning Maps

https://www.ciscolive.com/emea/learn/technical-education/learning-maps.html

Data Center

ACI Technologies

Take a deep dive into ACI technologies, architecture and troubleshooting.

START

Feb 6 | 08:30
TECDCN-2840
Next Generation ACI Data Center Architecture, Deployment and Operations

Feb 7 | 08:30
BRKDCN-1601
Introduction to ACI

Feb 7 | 11:30
BRKDCN-2906
Introduction to Infrastructure as Code for ACI with Ansible and Terraform

Feb 7 | 14:00
BRKDCN-1688
How to operate your Nexus and ACI networks from the Cloud with Nexus Cloud

Feb 7 | 17:00
BRKDCN-2910
Why You Shouldn't Fear Upgrading Your ACI Fabric - The Handbook!

Feb 8 | 10:30
BRKDCN-2673
Nexus-as-Code - Kickstart your automation with ACI

Feb 8 | 12:00
BRKDCN-2949
Cisco ACI Multi-Pod Design and Deployment

Feb 8 | 14:30
BRKDCN-2980
ACI Multi-Site Architecture and Deployment

Feb 9 | 08:30
BRKDCN-2950
Nexus Cloud: How to manage your Nexus Data Center from the cloud

Feb 9 | 10:45
BRKDCN-3900
A Network Engineer's Blueprint for ACI Forwarding

Feb 9 | 13:45
BRKDCN-3982
ACI L4-L7 Policy-Based Redirect (PBR) Deep Dive and Tips

Feb 9 | 15:45
BRKDCN-3612
Secure Firewall in ACI

Feb 10 | 11:00
FINISH
BRKDCN-2969
Managing your data center network with ServiceNow

If you are unable to attend a live session, you can watch it On Demand after the event

Complete your Session Survey

- Please complete your session survey after each session. Your feedback is important.
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