Designing Highly Available Networks Using Catalyst 9000 Switches

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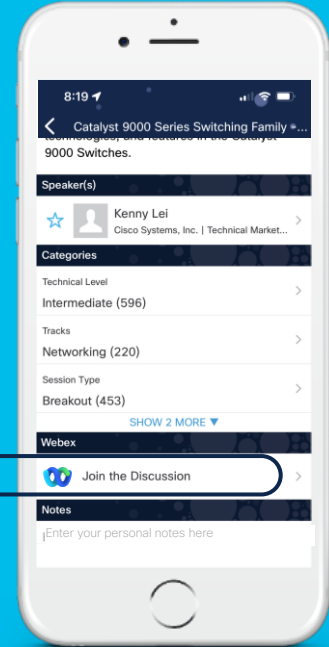
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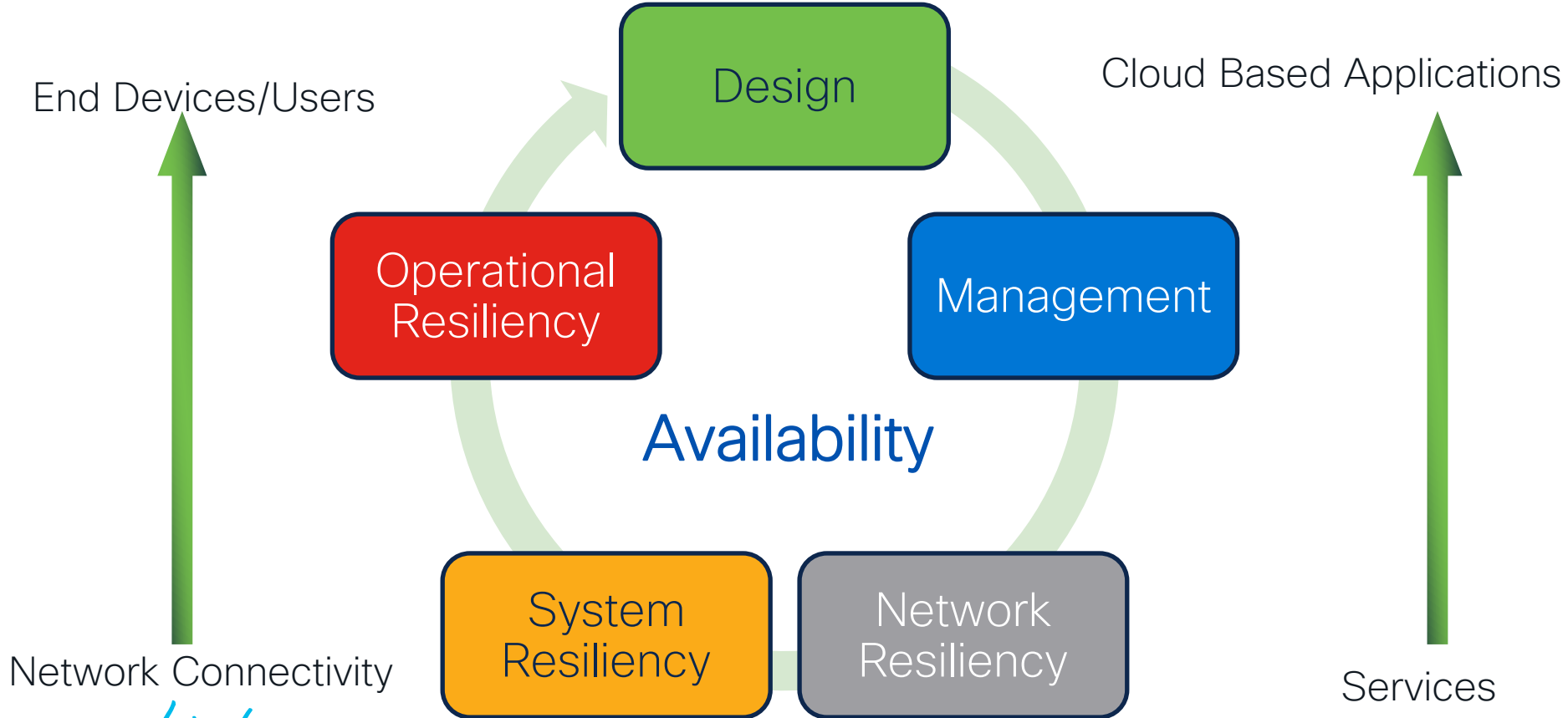
Session Overview and Objectives

High Availability has become part of the Cisco DNA and is being deployed on all levels of products

In this session, Our focus will be to learn about the existing and new High Availability features present on the Catalyst 9k Switches. We will also categorize features based on access and Distribution layer in the Enterprise Network. In the end we will see how these features can be leveraged effectively to achieve highly available network. We will also show good design practices across all the features that will help us achieve better service availability.
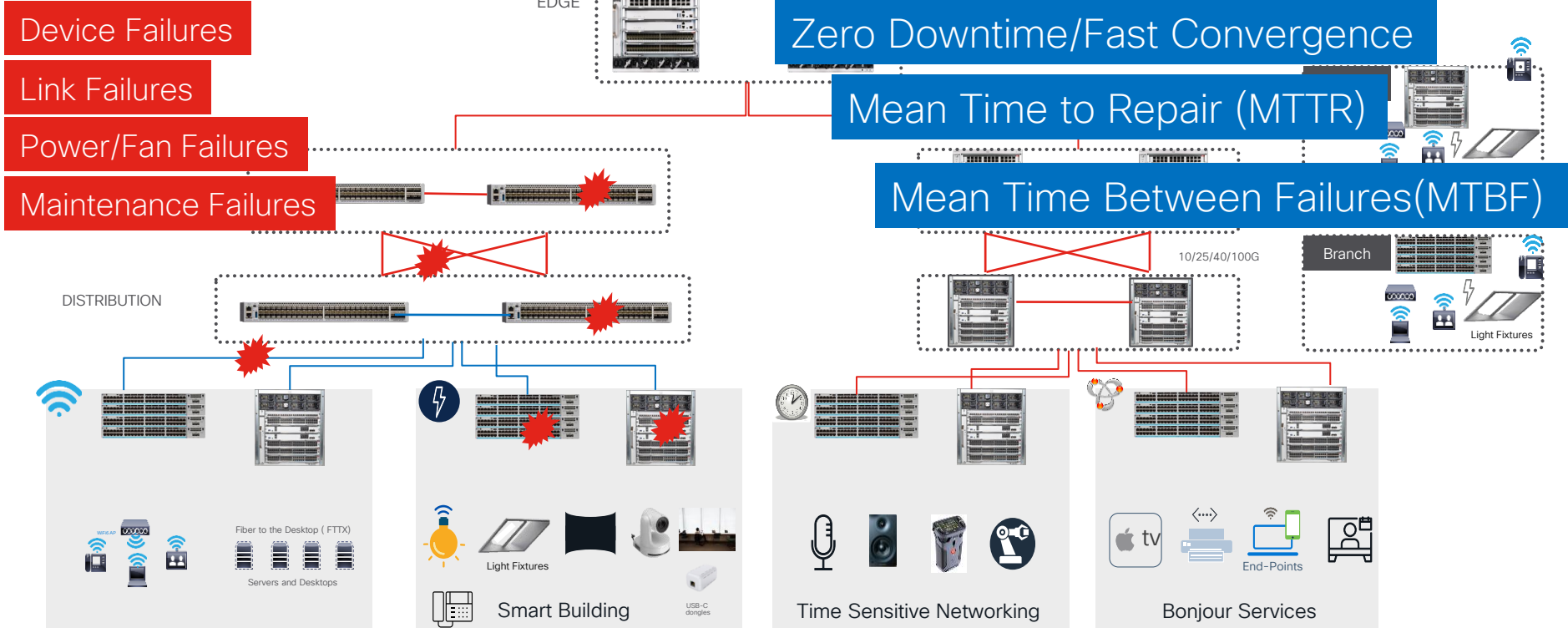
Agenda

- High Availability Overview and Evolution

- High Availability Architecture and Designs

- High Availability Solution on the Campus Access
  - Stackable High Availability Solution
  - Modular High Availability Solution

- High Availability Solution on the Campus Distribution/Core
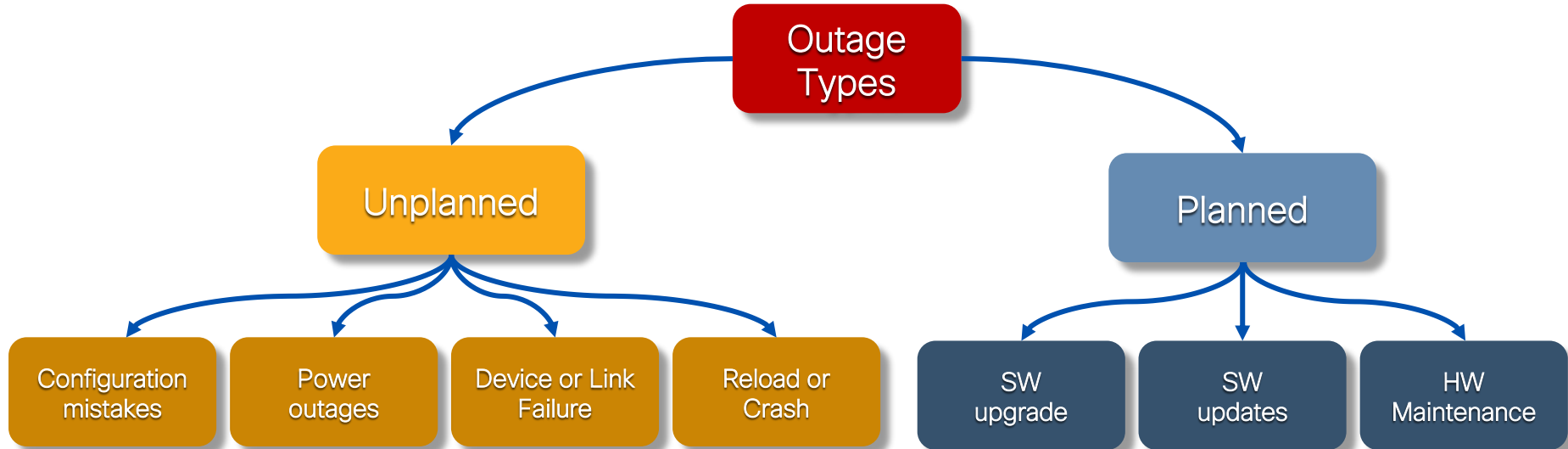
- Summary/Q&A

High Availability Strategic Circle

End Devices/Users

Cloud Based Applications

Design

Operational Resiliency

Management

Availability

System Resiliency

Network Resiliency

Network Connectivity

Services

Typical Campus Network Architecture

Device Failures

Link Failures

Power/Fan Failures

Maintenance Failures

Zero Downtime/Fast Convergence

Mean Time to Repair (MTTR)

Mean Time Between Failures(MTBF)

EDGE

DISTRIBUTION

10/25/40/100G

Branch

Light Fixtures

WiFi6 AP

Fiber to the Desktop (FTTX)

Servers and Desktops

Light Fixtures

Smart Building

USB-C dongles

Time Sensitive Networking

End-Points

Bonjour Services

Planned vs. Unplanned Outages

```
                          ┌──────────────┐
                          │   Outage     │
                          │   Types      │
                          └──────────────┘
                ┌─────────────────┐   ┌─────────────────┐
                │   Unplanned     │   │    Planned      │
                └─────────────────┘   └─────────────────┘
```

| Configuration mistakes | Power outages | Device or Link Failure | Reload or Crash | | SW upgrade | SW updates | HW Maintenance |

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

Typical Campus Network Architecture

- Add more links
- Add more devices
- Leverage FHRP like HSRP and VRRP
- Change the timers
- Tune the application performance
- Etc...

Zero Downtime/Fast Convergence

Mean Time to Repair (MTTR)

Mean Time Between Failures(MTBF)

Device Failure

Link Failure

Operational Maintenance

Power/Fan Failure

Convergence Time?
Failover Detection?

What is the best way ?

DISTRIBUTION

10/25/40/100G

Branch

Light Fixtures

Fiber to the Desktop (FTTX)

Servers and Desktops

Light Fixtures

Smart Building

USB-C
dongles

Time Sensitive Networking

End-Points

Bonjour Services

Cisco Catalyst 9000 Switching Portfolio

Adding the "X factor" to the industry's leading switching family

Catalyst 9200CX Compact

Catalyst 9200 Series

Catalyst 2960-X/XR

Catalyst 9300X

Catalyst 9300 Series

Catalyst 3650/3850

Catalyst 9400X

Catalyst 9400 Series

Catalyst 4500-E Series

Catalyst 9000 Switching Platform

Cisco ASIC

Open IOS XE

Catalyst 9500X

Catalyst 9500 Series

Catalyst 3850-XS/4500-X

Catalyst 6840-X/6880-X

Catalyst 9600X

Catalyst 9600 Series

Catalyst 6500-E/6807-XL

Access Switching

Core Switching

Catalyst 9000: Pinnacle of Resiliency

Platform/System Resiliency

- **Redundant Switches and Supervisors** for Standalone and Modular Switches with Non-Stop Forwarding and Routing (NSF/NSR)

- **Redundant Fan & Power** Supply in case of any hardware failure

Network Resiliency

- **StackWise Virtual:** Redundant System for high availability, simplified design and configuration

- **GIR:** No downtime when device removed for maintenance
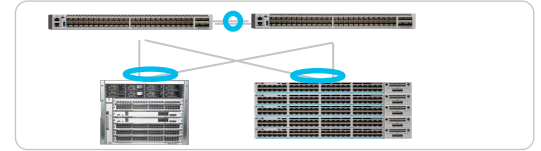
Operational Resiliency

- **ISSU:** Upgrade software with minimal to no traffic loss

- **xFSU :** Upgrade or Reload the Catalyst 9300 with very minimal traffic loss

- **Hot Patching:** No downtime for bug fixes (no reboot)

Eliminate downtime with High Availability designed at every level

Highly Available Architecture with Catalyst 9000 Switches

EDGE

Dual Supervisors

C9600

CORE

StackWise Virtual (SVL)

C9500

DISTRIBUTION

StackWise Virtual (SVL)

Dual Supervisors

C9400

C9300

StackWise

Dual Supervisors

Wi-Fi AP

Fiber to the Desktop (FTTX)

Servers and Desktops

StackWise

Dual Supervisors

Light Fixtures

USB-C dongles

Smart Building

StackWise

Dual Supervisors

Time Sensitive Networking

StackWise

Dual Supervisors

tv

End-Points

Bonjour Services

Branch

Dual Supervisors

Light Fixtures

Branch

StackWise

Light Fixtures

Routing Protocol Redundancy With NSF

Active Supervisor/Switch

EIGRP RIB	
Prefix	Next Hop
10.0.0.0	10.1.1.1
10.1.0.0	10.1.1.1
10.20.0.0	10.1.1.1

OSPF RIB	
Prefix	Next Hop
192.168.0	192.168.0.1
192.168.55..0	192.168.55.1
192.168.32.0	192.168.32.1

ARP Table	
IP	MAC
10.1.1.1	aabbcc:ddee32
10.1.1.2	adbb32:d34e43
10.20.1.1	aa25cc:ddeee8

FIB Table	
Prefix	Next HOP
10.1.1.1	aabbcc:ddee32
10.1.1.2	adbb32:d34e43
192.168.0.0	aa25cc:ddeee8

Standby Supervisor/Switch

EIGRP RIB	
Prefix	Next Hop
-	-
-	-
-	-

OSPF RIB	
Prefix	Next Hop
-	-
-	-
-	-

ARP Table	
IP	MAC
-	-
-	-
-	-

FIB Table	
Prefix	Next HOP
10.1.1.1	aabbcc:ddee32
10.1.1.2	adbb32:d34e43
192.168.0.0	aa25cc:ddeee8

SSO

Redundancy Facility

Checkpoint Facility

CISCO Live!

Routing Protocol Redundancy With NSF

Routing Protocol Redundancy With NSF

L3 Neighbor Switch

EIGRP RIB

Prefix	Next Hop
1-0.0.0.0	-10.1.1.1
-10.1.0.0	-10.1.1.1
-10.20.0.0	1-0.1.1.1

OSPF RIB

Prefix	Next Hop
192.168.0	192.168.0.1
192.168.55..0	192.168.55.1
192.168.32.0	192.168.32.1

ARP Table

IP	MAC
-10.1.1.1	a-abbcc:ddee32
-10.1.1.2	-adbb32:d34e43
-10.20.1.1	-aa25cc:ddeee8

Standby Supervisor/Switch

EIGRP RIB

Prefix	Next Hop
1-0.0.0.0	-10.1.1.1
-10.1.0.0	-10.1.1.1
-10.20.0.0	1-0.1.1.1

OSPF RIB

Prefix	Next Hop
192.168.0	192.168.0.1
192.168.55..0	192.168.55.1
192.168.32.0	192.168.32.1

ARP Table

IP	MAC
-10.1.1.1	a-abbcc:ddee32
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FIB Table

Prefix	Next HOP
10.1.1.1	aabbcc:ddee32
10.1.1.2	adbb32:d34e43
192.168.0.0	aa25cc:ddeee8

NSF

GR/NSF Signaling per protocol

Synchronization per protocol

Configuration

- OSPF

```
router ospf 1
  nsf [cisco|ieft]
```

- ISIS

```
router isis 1
  nsf [cisco|ieft]
```

- BGP

```
router bgp 1
  bgp graceful-restart
```

High Availability Components in Catalyst 9000

Stateful Switchover (SSO)

SSO Aware Applications

Forwarding Information Base
IEEE 802.1x
PAgP / LACP
...and more

SSO Compliant Applications
Routing Protocols, Netflow, etc

Non Stop Forwarding(NSF) or Graceful Restart

OSPF,BGP,LDP, etc

EDGE

SSO   NSF

NSF Aware

NSF Capable

CORE

StackWise Virtual (SVL)

SSO   NSF

10/25/40/100G

DISTRIBUTION

StackWise Virtual (SVL)

SSO

SSO

SSO

StackWise

Dual Supervisors

StackWise

Dual Supervisors

WiFi AP

Fiber to the Desktop (FTTX)

Servers and Desktops

Light Fixtures

USB-C dongles

BRKENS-2095

Catalyst 9000: Platform Resiliency

C9300 Fixed Platform

- **StackWise: Redundant System for high availability** with NSF/SSO
- **StackPower**: Redundant Power Supplies providing 1+ N redundancy
- **Redundant Fan & Power** Supply in case of any hardware failure

C9400/C9600 Modular Chassis

- **Redundant Supervisor:** Redundant System for high availability, simplified configuration

- **Redundant Fan & Power** Supply in case of any hardware failure

C9500 Fixed Platform

- **StackWise Virtual:** Redundant System for high availability with NSF/SSO

- **Redundant Fan & Power** Supply in case of any hardware failure

Sub-second Traffic impact during failures across C9k Family

Device Redundancy with StackWise

Stackwise-160/320480/1T

Stateful Switchover (SSO)

SSO Aware Applications

Forwarding Information Base
IEEE 802.1x
PAgP / LACP
...and more

SSO Compliant Applications
Routing Protocols, Netflow, etc

Non Stop Forwarding(NSF) or Graceful Restart

OSPF,BGP,LDP, etc

Up to 8 Members

SSO

SSO

A

S

M

M

M

M

M
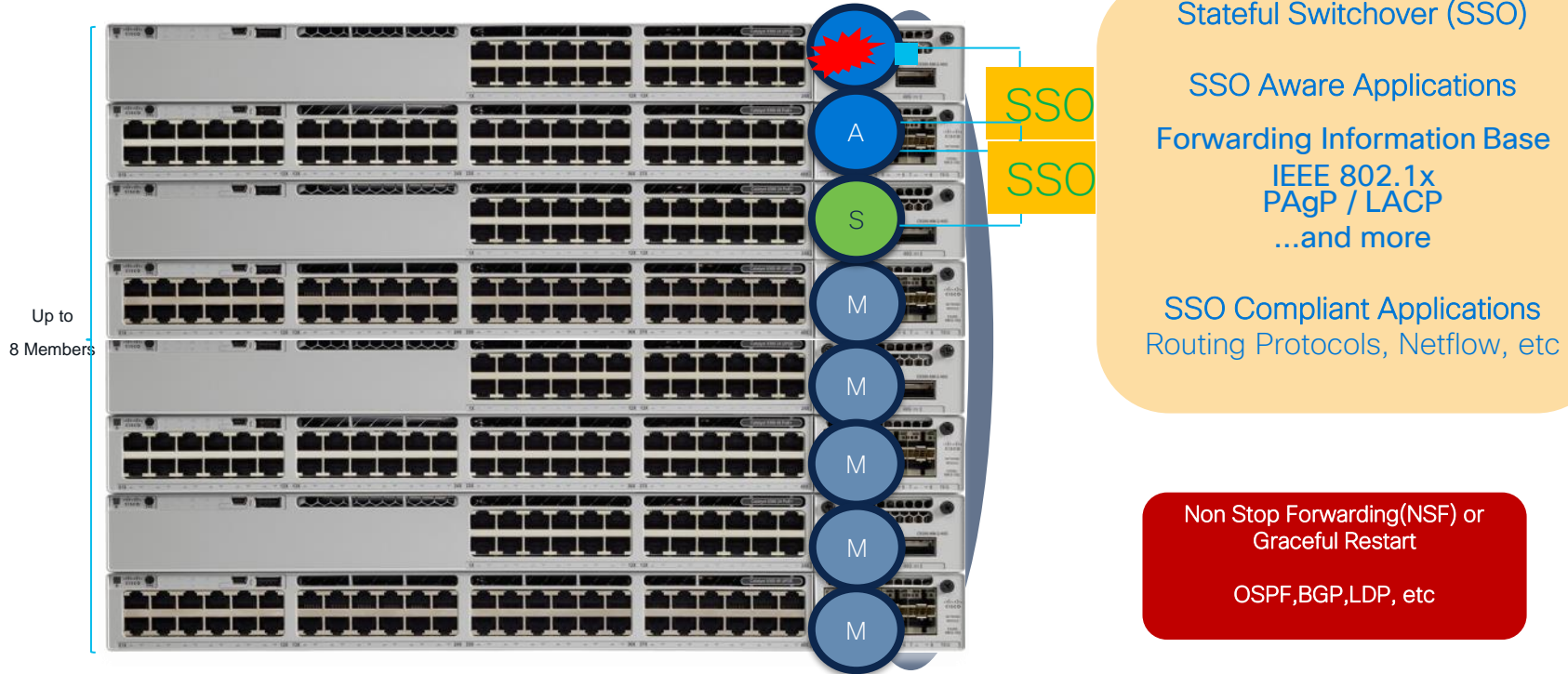
Catalyst 9300 Platform Resiliency for Power Supplies

Normal

PS failure

Combined (default)

Load sharing on all PSs

Load on Single PS

Redundant

System and PoE Load sharing on active PS
Standby PS shares the load of a system only

Standby PS becomes active
System enters alarm state

Failed PS   Active   Standby

Power Redundancy with Stacking Power Supplies

StackPower

StackPower cables

4 member

Stack Power

4 member

One shared PS pool for 4 switches

X watts

Second shared PS pool for 4 switches

X watts
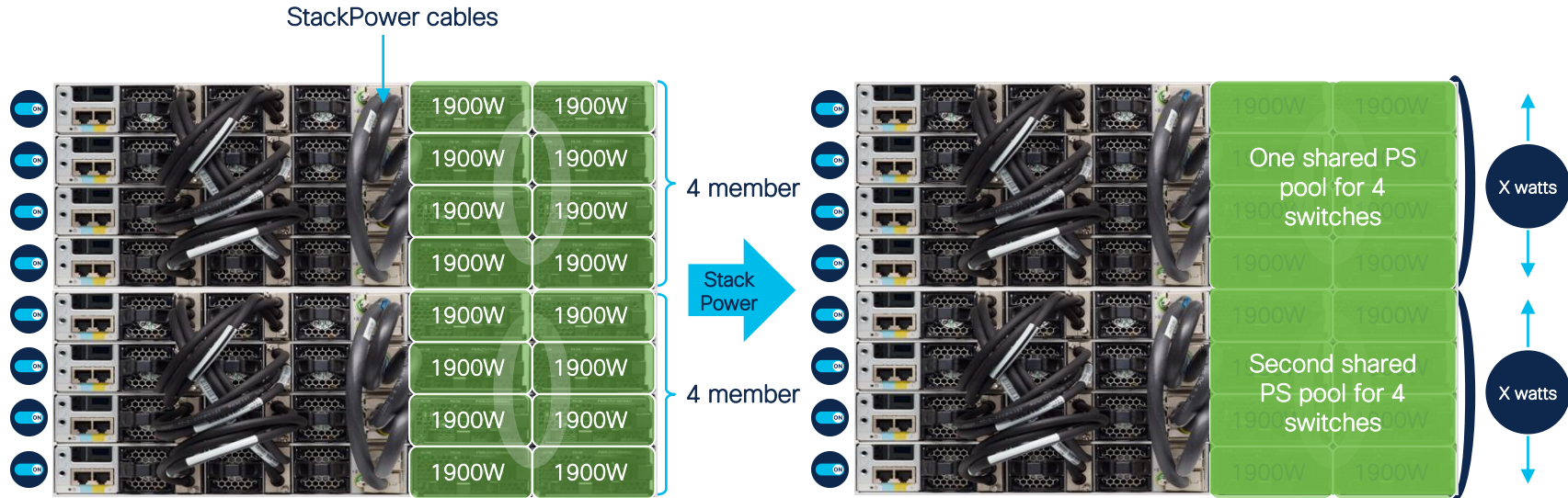
- Pools power from all Power Supplies (PS)
- All switches in StackPower share the available power in the pool
- Each switch is given its minimum power budget

- 1+N Redundancy with inline power
- Up to 4 switches in one StackPower Ring
- Multiple Power stacks possible in one data stack

Power stack modes

Combined mode
(default mode)

Power stack

12,960W

Redundant mode
(user configurable)

Backup

Power stack

11,060W
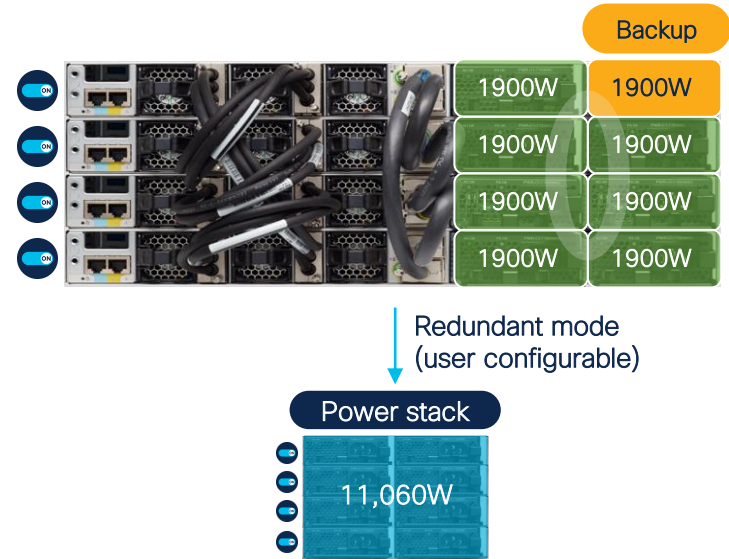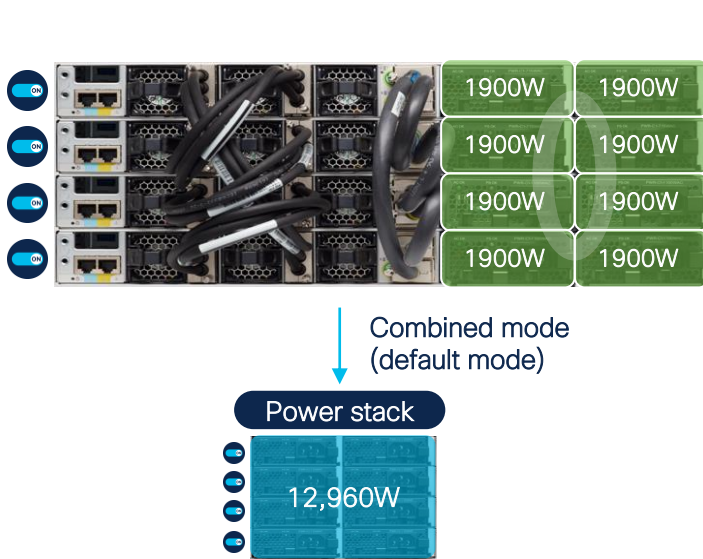
- All power supplies contribute to common output power budget

- One of the highest valued power supplies is not used in the power budget calculation

PoE Redundancy at Port Level

2-event classification	Perpetual PoE	Fast PoE
• Fast power negotiation without Link Layer Discovery Protocol (LLDP) • Physical layer negotiation < 1 second	• Uninterrupted PoE power during control plane reboot	• Bypasses Cisco IOS® control plane boot • Restores power to Powered Device (PD) within 30 seconds of power resumption
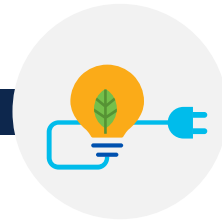
Power priority
Load shedding

Standalone mode

Low priority

High priority

Stack mode

Low priority

High priority
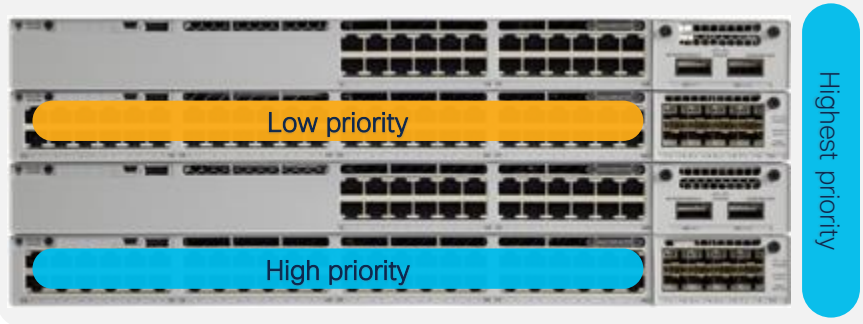
Highest priority

Load shedding based on configured priority

1. Low-priority ports
2. High-priority ports
3. Switch priority – **Highest priority**


```
9300-GIR-Access-144#show stack-power load-shedding switch 1
Power Stack          Stack   Stack    Total  Rsvd    Alloc   Unused  Num Num
Name                 Mode    Topolgy  Pwr(W) Pwr(W)  Pwr(W)  Pwr(W)  SW  PS
-------------------  ------  -------  ------ ------  ------  ------  --- ---
Powerstack-1         SP-PS   Stndaln  1100   30      240     830     1   1

      Power Stack            Priority Consumd Consumd Consumd Alloc Alloc
SW    Name                   Sw-Hi-Lo Sw(W)   Hi(W)   Lo(W)   Hi(W) Lo(W)
--  -------------------      -------- ------- ------- ------- ----- -----
1     Powerstack-1           4-13-22  153     0       0       0     0

Switch 1 High Priority Active (powered) Ports:

Switch 1 High Priority Inactive (unused) Ports:

Switch 1 Low Priority Active (powered) Ports:

Switch 1 Low Priority Inactive (unused) Ports:
    Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4, Gi1/0/5, Gi1/0/6,
    Gi1/0/7, Gi1/0/8, Gi1/0/9, Gi1/0/10, Gi1/0/11, Gi1/0/12,
    Gi1/0/13, Gi1/0/14, Gi1/0/15, Gi1/0/16, Gi1/0/17, Gi1/0/18,
    Gi1/0/19, Gi1/0/20, Gi1/0/21, Gi1/0/22, Gi1/0/23, Gi1/0/24,
```

Operational Resiliency with Extended Fast Software Upgrade

C9300- 17.3.2

C9300X- 17.7.1

Catalyst® 9300/9300X standalone

#Install add file image activate reloadfast commit

Control plane

Data plane

< 30 seconds of traffic impact

Catalyst 9300/9300X stack

#Install add file image activate reloadfast commit

Active control plane

Data plane

A
S
M

< 30 seconds of traffic impact for all ports in the stack

Catalyst 9000: Platform Resiliency

C9300 Fixed Platform

- **StackWise: Redundant System for high availability** with NSF/SSO
- **StackPower**: Redundant Power Supplies providing 1+ N redundancy
- **Redundant Fan & Power** Supply in case of any hardware failure

C9400/C9600 Modular Chassis

- **Redundant Supervisor:** Redundant System for high availability, simplified configuration
- **Redundant Fan & Power** Supply in case of any hardware failure

C9500 Fixed Platform

- **StackWise Virtual:** Redundant System for high availability with NSF/SSO
- **Redundant Fan & Power** Supply in case of any hardware failure

Sub-second Traffic impact during failures across C9k Family

Catalyst 9400/9600 Platform – Supervisor Redundancy

Non Stop Forwarding(NSF) or Graceful Restart

OSPF,BGP,LDP, etc

NSF Capable
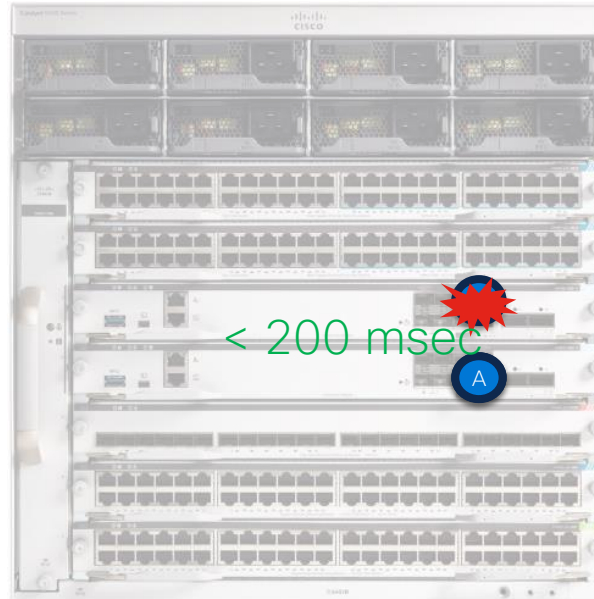
< 200 msec

A

SSO

Stateful Switchover (SSO)

SSO Aware Applications

Forwarding Information Base
IEEE 802.1x
PAgP / LACP
...and more

SSO Compliant Applications
Routing Protocols, Netflow, etc

Dual Supervisors Required to provide both Control and Data Plane Redundancy

Catalyst 9400 Power Redundancy
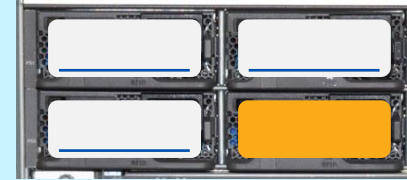
	Normal	PS failure
Combined (default)	Load sharing on all PSs	Load sharing on functional PSs
Redundant	Load sharing on active PSs Standby PS in output disabled	Standby PS becomes active System enters alarm state

Failed PS   Active   Standby

Power redundancy: N+1 and N+N

- Default active is PS1 through 4, and standby is PS5 through 8
- Standby power slots are configurable


```
SW(config)#power redundancy-mode redundant ?
  N+N   Redundant N+N (N is active, N is standby)
  N+1   Redundant N+N (N is active, 1 is standby)
SW(config)#power redundancy-mode redundant N+1 ?
  <1-8>  standby slot in N+N mode
SWR(config)#
```

- Default active is PS1 through 7, and standby is PS8
- Standby power slot is configurable


```
SW(config)#power redundancy-mode redundant ?
  N+N   Redundant N+N (N is active, N is standby)
  N+1   Redundant N+N (N is active, 1 is standby)
SW(config)#power redundancy-mode redundant N+1 ?
  <1-8>  standby slot in N+1 mode
SWR(config)#
```

| Active | Standby |

Operational Resiliency with ISSU

Dual Supervisors

Start ISSU

Uplinks

SSO

ASIC

Active Supervisor

Standby Supervisor

Line Cards

Catalyst 9400
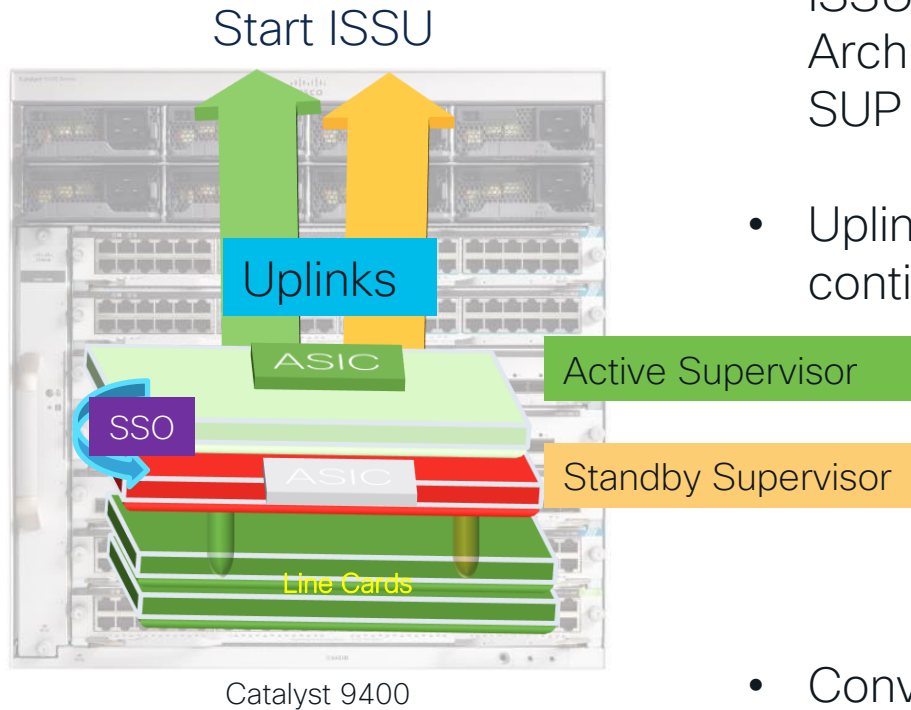
- ISSU Process leverages SSO/NSF Architecture with upgrading the Standby SUP first and then the Active SUP

- Uplinks on both active and standby SUP continue to forward traffic on C9400

- Convergence is less than 200 msec

Campus Network Architecture – Operational Resiliency

ISSU Software Upgrades via DNAC

Supervisors

Scheduling Software Activation

High Availability Architecture for Design Resiliency

FHRP – HSRP/VRRP

L2 + Spanning-Tree

SSO

SSO

Spanning-Tree

SSO

SSO

High Availability Architecture

FHRP – HSRP/VRRP

L2 + Spanning-Tree

Spanning-Tree

A

S
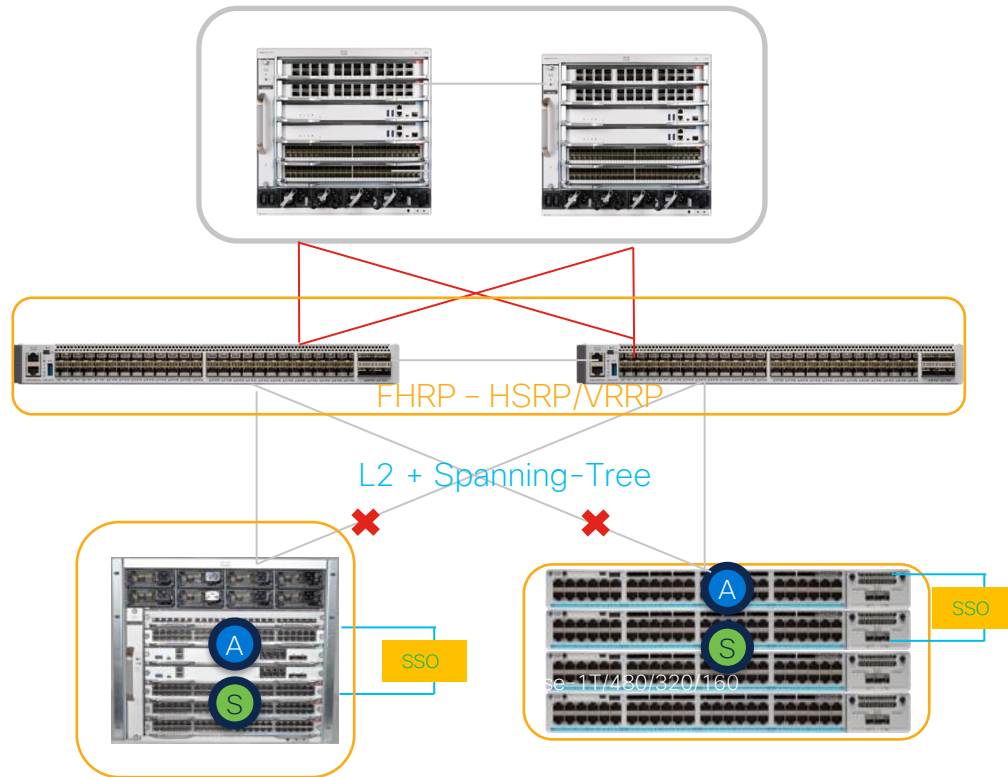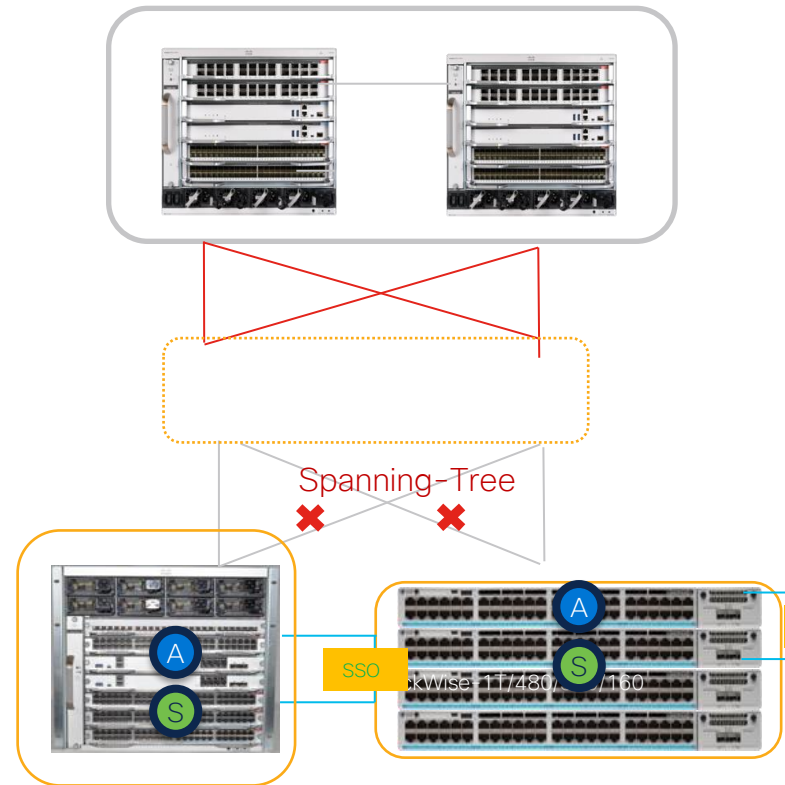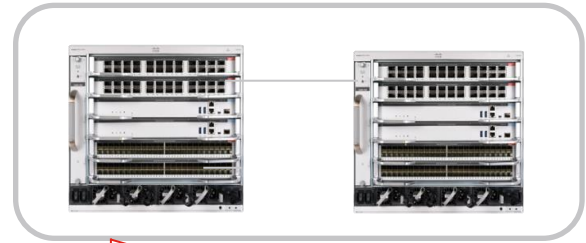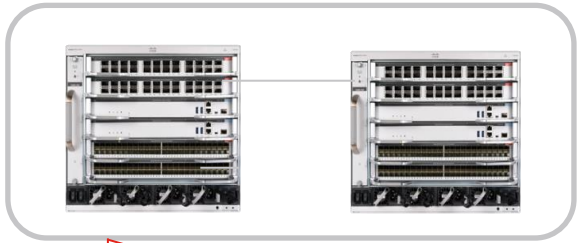
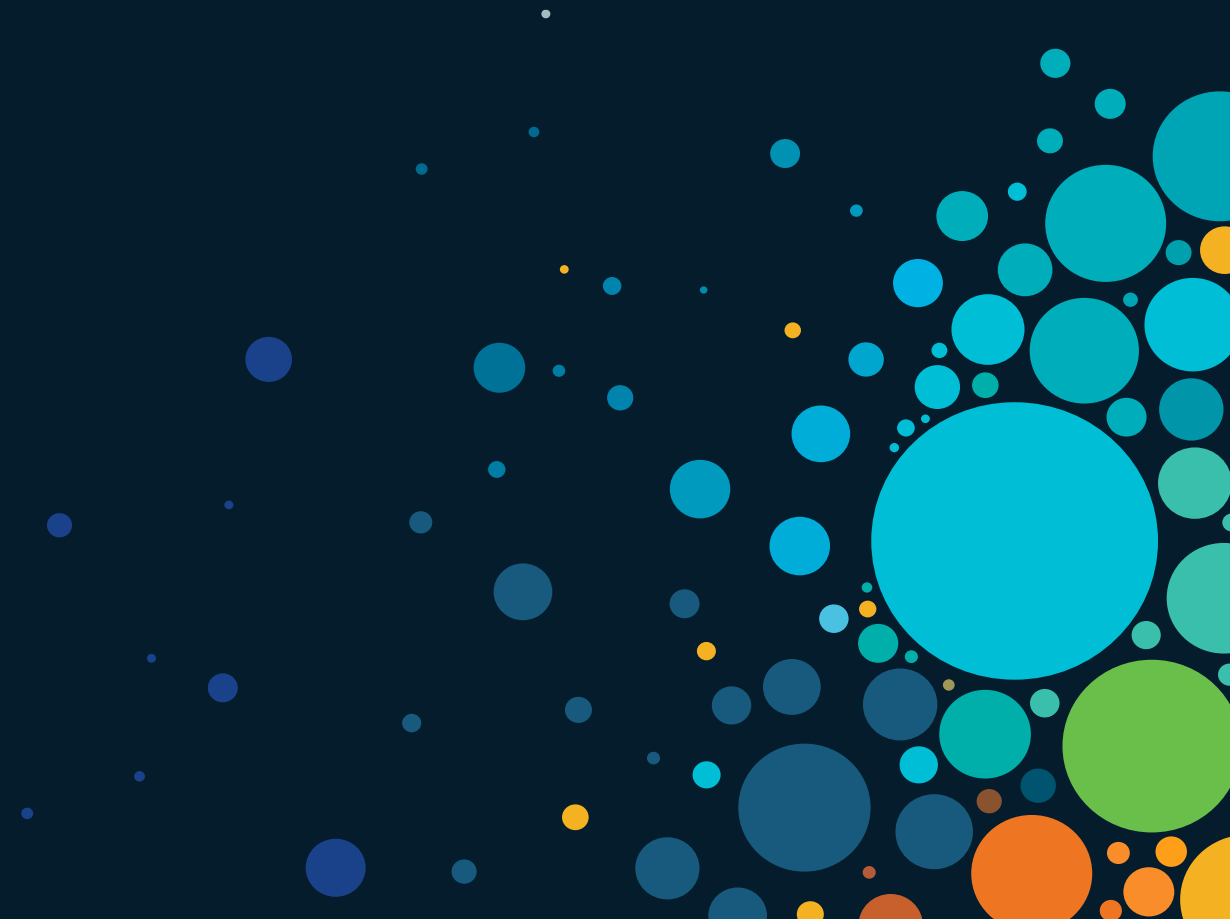## Benefits of Stackwise Virtual

Simplify Operations by Eliminating STP, FHRP and Multiple Touch-Points

Double Bandwidth & Reduce Latency with Active-Active Multi-chassis EtherChannel (MEC)

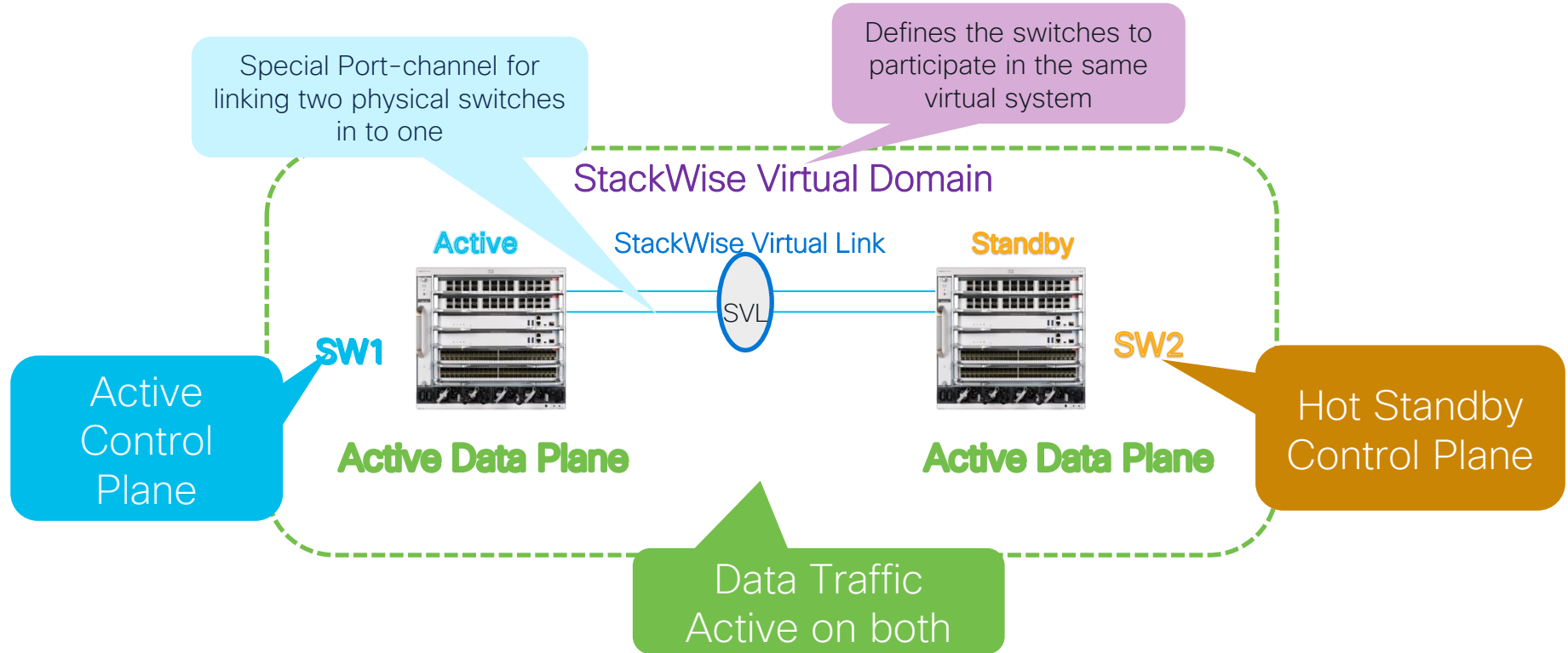Minimizes Convergence with Sub-second Stateful and Graceful Recovery (SSO/NSF)

StackWise-1T/480/320/160

StackWise Virtual

StackWise Virtual – Key Concepts

Special Port-channel for linking two physical switches in to one

Defines the switches to participate in the same virtual system

StackWise Virtual Domain

Active

StackWise Virtual Link

Standby

SVL

SW1

SW2

Active Control Plane

Hot Standby Control Plane

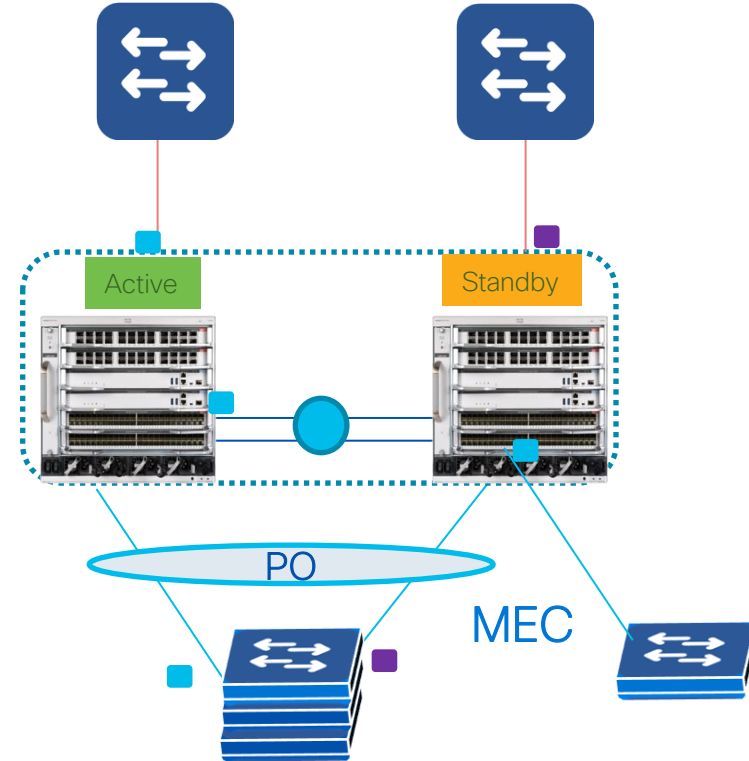Active Data Plane

Active Data Plane

Data Traffic Active on both

StackWise Virtual Architecture

Active/Active Data Plane and Multi-Chassis EtherChannel

Dual-Homed Connections - Recommended
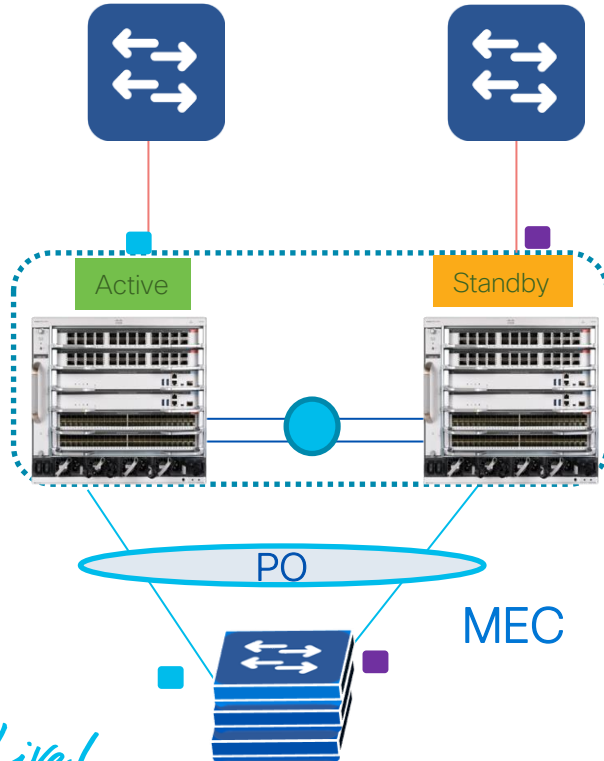
Single-Homed Connections

Active

Standby

Active

Standby

PO

MEC

PO

MEC

StackWise Virtual – Multi-Chassis EtherChannel

- Multi-Chassis EtherChannel (MEC) in StackWise Virtual enables cross stack-member link bundling into single logical L2/L3 Interface

- MECs can be deployed in three modes –

   Cisco PAgP, LACP and Static (ON)

- StackWise Virtual EtherChannel Support
  - C9400: Support 252 port-channel with IOS-XE 16.12 or later
    - Port channel ID 127 and 128 are reserved for SVL
    - Port channel ID 1-126 and 129-252 are available for L2/L3 network configuration
  - All other C9K platforms: Support 128 port-channel
    - Port channel ID 128 is reserved for SVL
    - Port channel ID 1-127 are available for L2/L3 network configurations

SVL
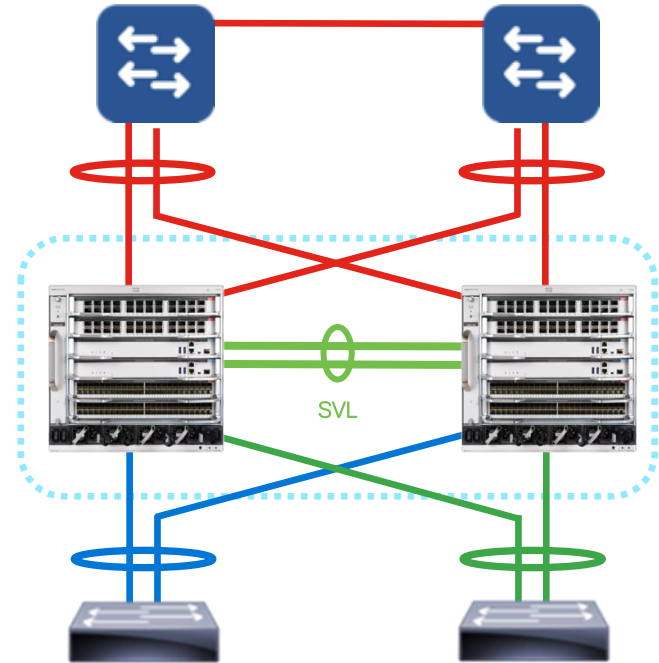
StackWise Virtual Failure and Recovery
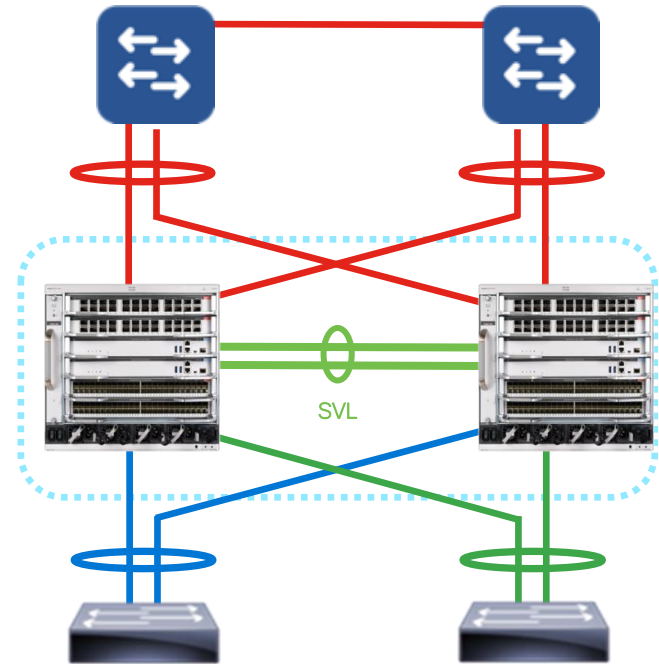
High Availability
Failure Scenario's

In a SVL Domain, one switch is elected as Active and the other as Standby

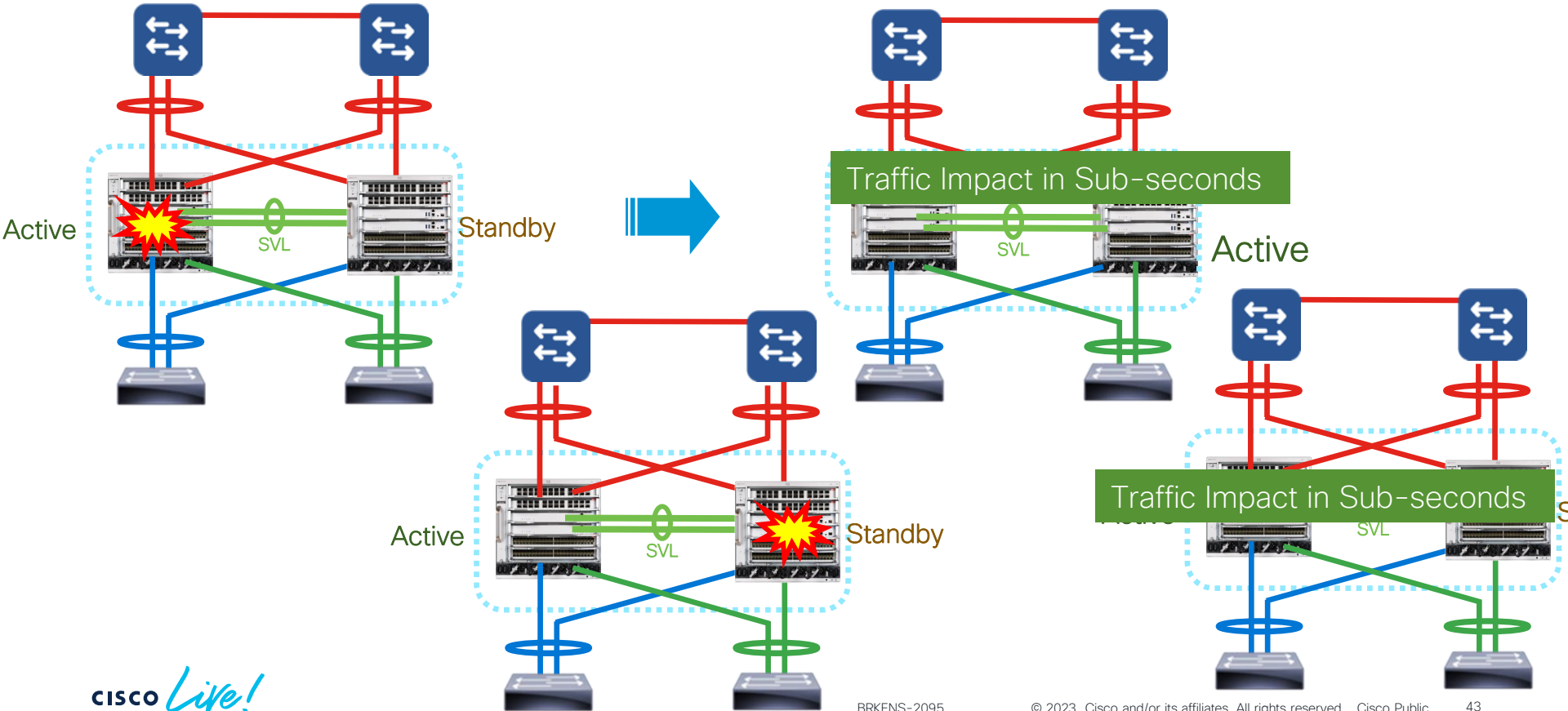All Neighbors view SVL as a single Entity, single MAC, single IP

Since the SVL is always configured as a Port Channel, the chance of the entire SVL going down is remote...

However... IT IS POSSIBLE! ☹

SVL

Recommend to deploy the SVL with **2 or more** links, distributed across entities for highest redundancy

StackWise Virtual – Inter Chassis SSO/NSF

Active

SVL

Standby

Traffic Impact in Sub-seconds

SVL

Active

Active

SVL

Standby

Traffic Impact in Sub-seconds

SVL

High Availability

Dual-Active Detection

If the entire SWV bundle fails, the SWV Domain will enter into a "Dual Active" scenario without DAD

Both switches transition to SSO Active state, and share the same network configuration

- IP addresses, MAC address, Router IDs, etc.

This can cause communication problems in the network!

3 Step Process

1 **Dual-Active Detection** – using any detection method enabled in the system.

2 Previous SWV Active shuts down ALL interfaces, and enters "Recovery Mode"… preventing further network disruption

3 **Dual-Active Recovery** – when the SWV recovers, the switch in Recovery Mode will reload to boot into a preferred standby state

Recovery Mode
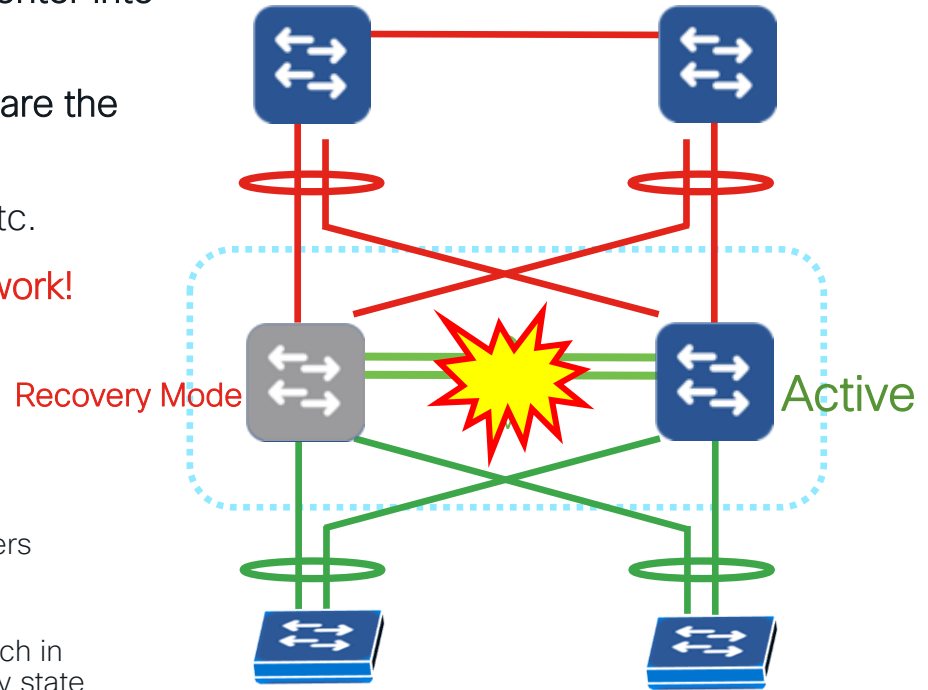
Active

High Availability
Dual-Active Protocols

Fast Hello
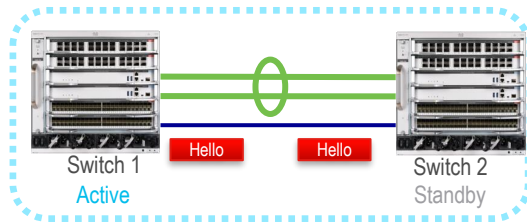
Enhanced PAGP

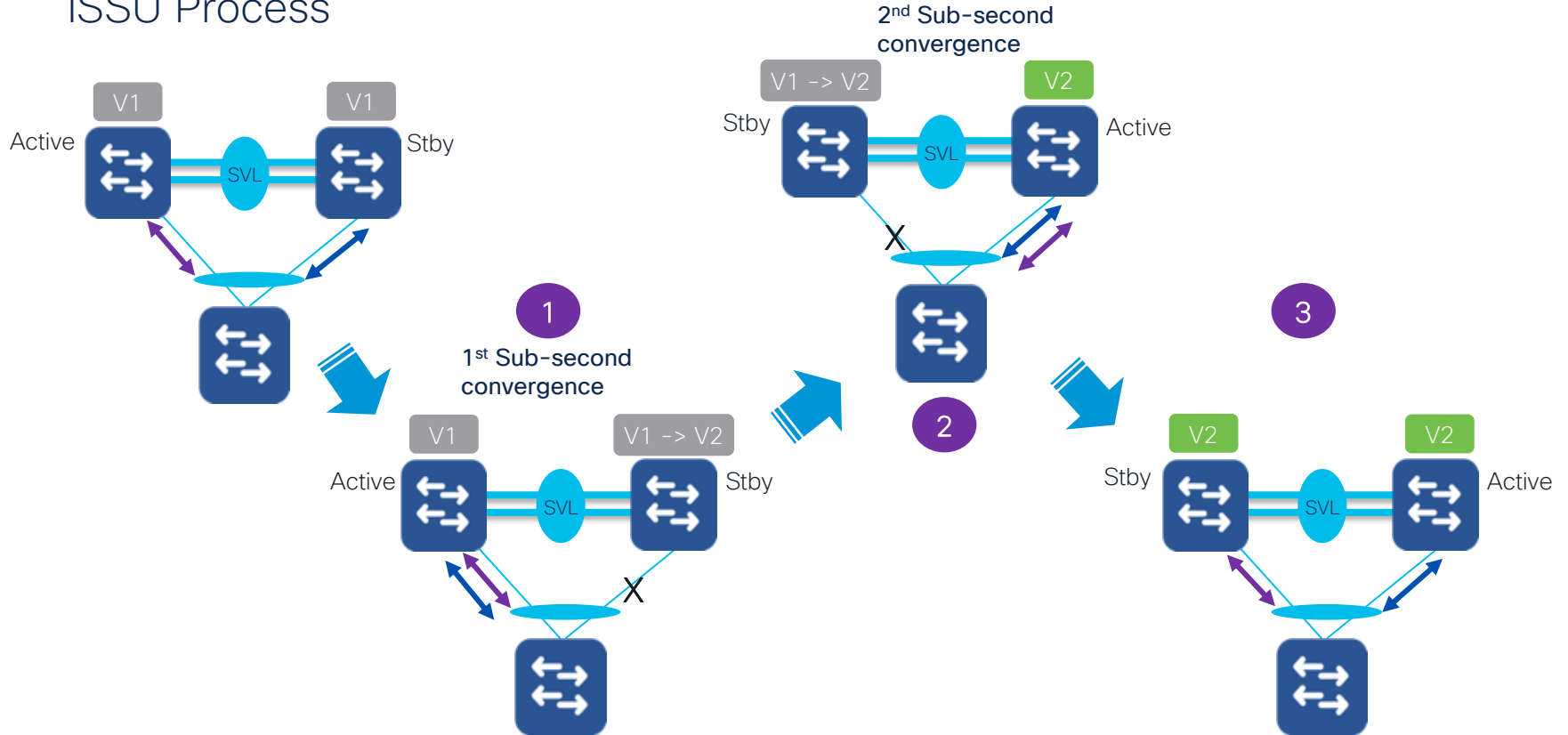❖ Direct L2 Point-to-Point Connection

❖ Sub-Second Convergence
    ❖ Typically ~50-100ms
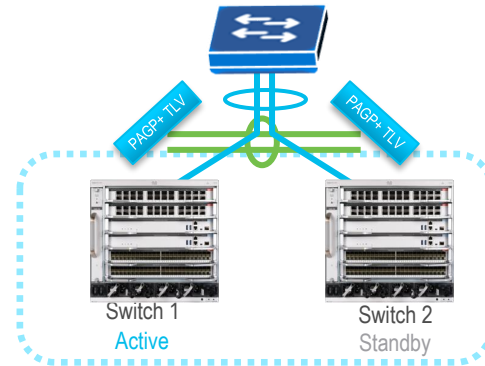
❖ Requires ePAGP capable neighbor:

❖ Sub-Second Convergence
    ❖ Typically ~200-250ms

Stackwise Virtual ISSU
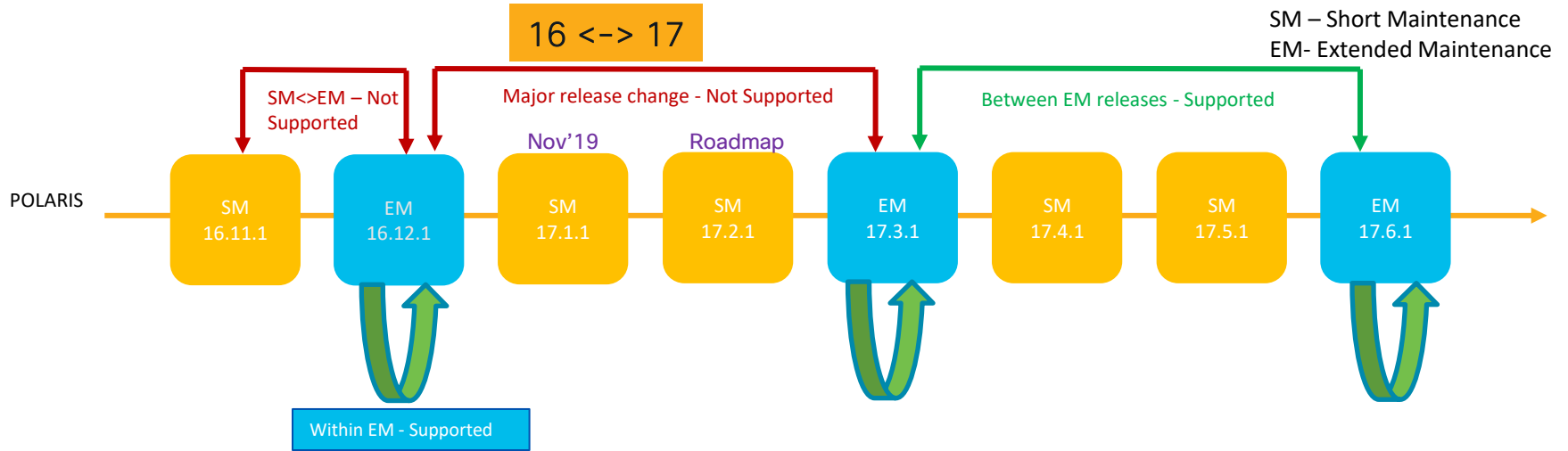
ISSU Process

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ISSU Release Guidelines

16 <-> 17

SM – Short Maintenance
EM- Extended Maintenance

SM<>EM – Not Supported

Major release change - Not Supported

Between EM releases - Supported

Nov'19   Roadmap

POLARIS

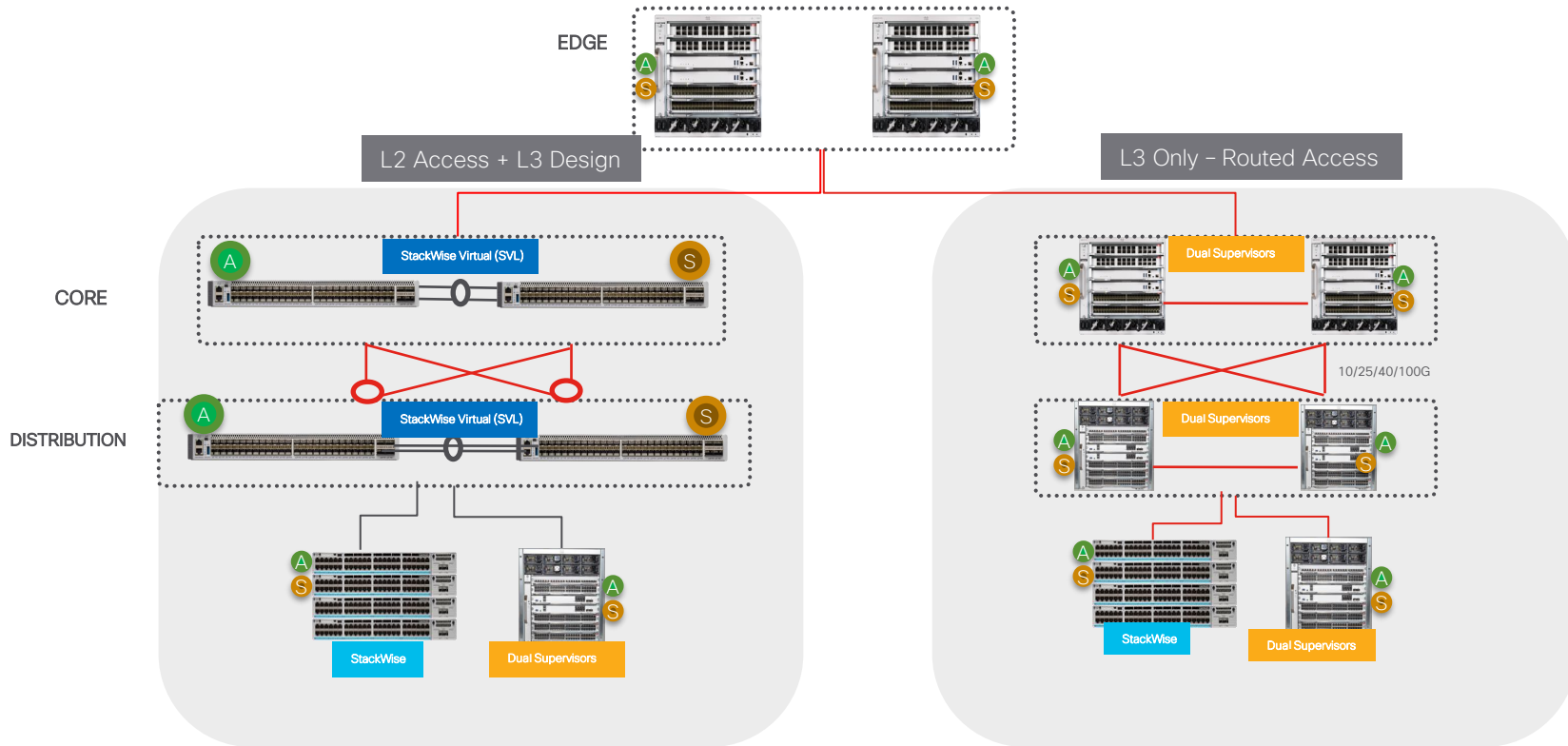| SM 16.11.1 | EM 16.12.1 | SM 17.1.1 | SM 17.2.1 | EM 17.3.1 | SM 17.4.1 | SM 17.5.1 | EM 17.6.1 |

Within EM - Supported

Supported

- Within EM Release - Any to Any within the EM Release (16.12.X <>16.12.X)
- Between EM Releases but within major releases [within +/- 2 EM releases]
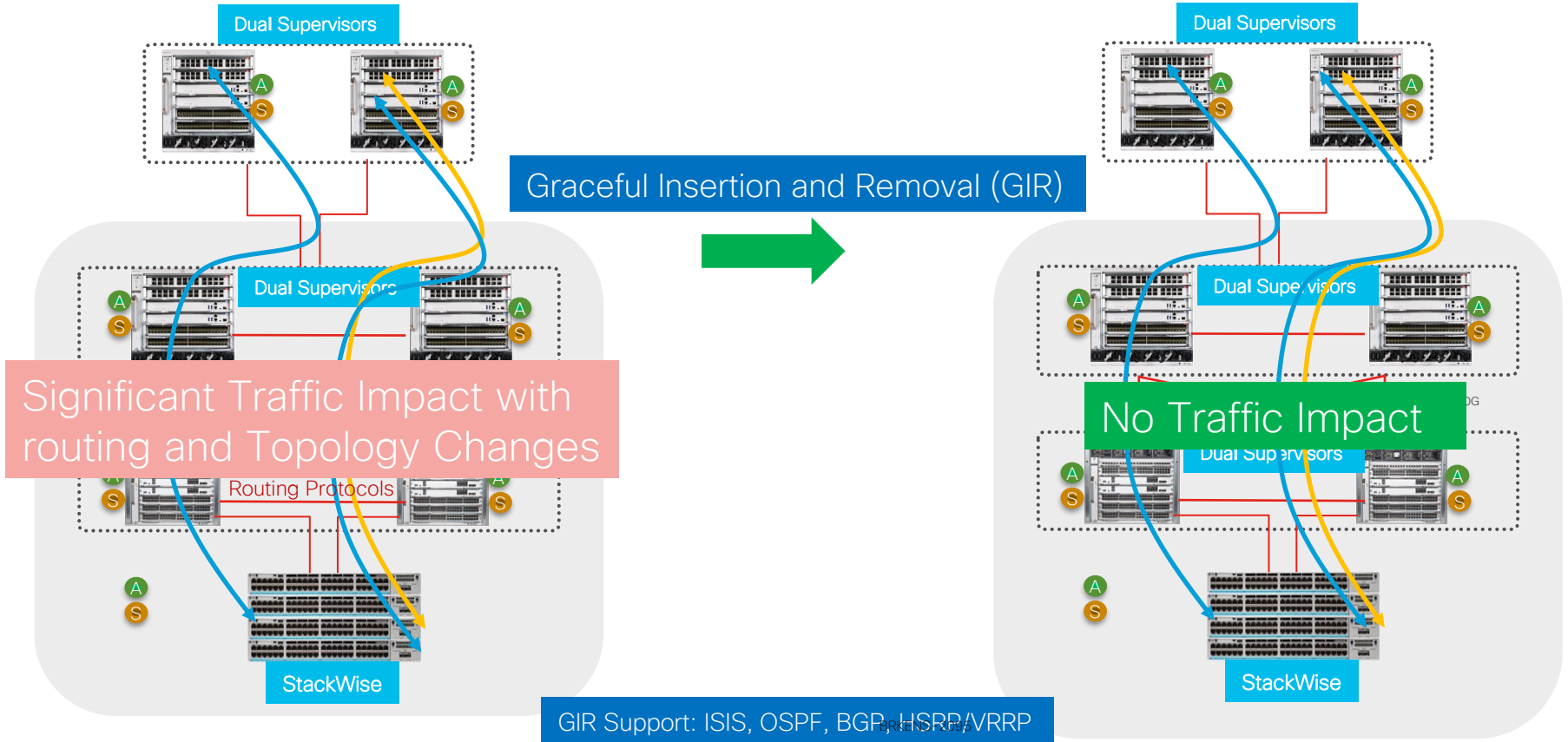
Not Supported

- SM to EM or EM to SM.(16.11.X <>16.12.x)
- Within SM Release - (16.11.1<>16.11.2)
- Beyond the +/- 2 EM Releases.
- When there is a major release change.
  - For example 16.x.x to 17.x.x

* Downgrade is not supported via ISSU method

Typical Campus Network Architecture – Design Resiliency

EDGE

L2 Access + L3 Design

L3 Only – Routed Access

CORE

StackWise Virtual (SVL)

Dual Supervisors

DISTRIBUTION

StackWise Virtual (SVL)

Dual Supervisors

10/25/40/100G

StackWise

Dual Supervisors

StackWise

Dual Supervisors

BRKENS-2095

Typical Campus Network Architecture – Design Resiliency
Routed Access Designs

Dual Supervisors

Dual Supervisors

Dual Supervisors

Dual Supervisors

Dual Supervisors

Graceful Insertion and Removal (GIR)

Significant Traffic Impact with routing and Topology Changes

No Traffic Impact

Routing Protocols

StackWise

StackWise

GIR Support: ISIS, OSPF, BGP, HSRP/VRRP

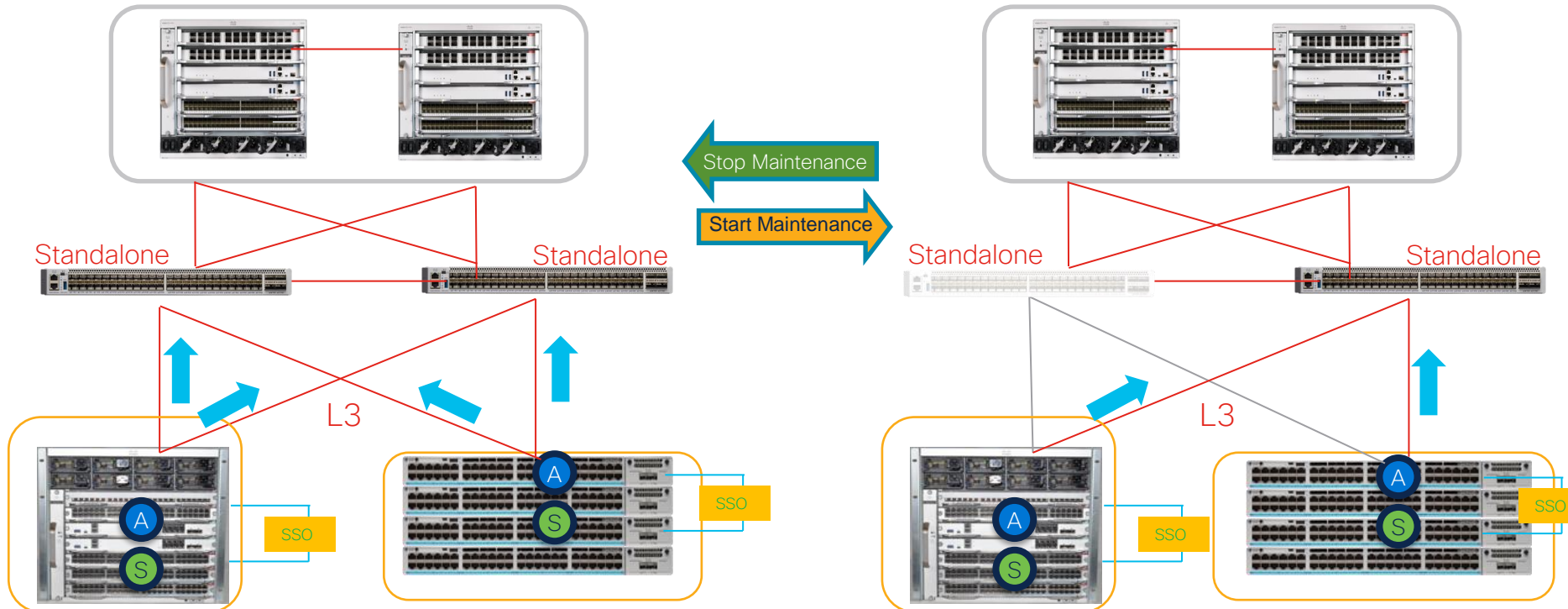# Graceful Insertion and Removal (GIR)

High Availability Architecture
Routed Access Multi-Tier Architecture

Stop Maintenance

Start Maintenance

Standalone

Standalone

Standalone

Standalone

L3

L3

A

S

SSO

A

S

SSO

A

S

SSO

A

S

SSO

L2 and L3 Topology with GIR Isolation


```
9300#start maintenance
Template default will be applied.
Do you want to continue?[confirm]
*Mar 25 17:43:20.162: %MMODE-6-
MMODE_CLIENT_TRANSITION_START: Maintenance Isolate
start  for router isis 1
*Mar 25 17:43:50.213: %MMODE-6-
MMODE_CLIENT_TRANSITION_COMPLETE: Maintenance Isolate
complete  for router isis 1
*Mar 25 17:43:50.213: MMODE-6-
MMODE_CLIENT_TRANSITION%_START: Maintenance Isolate
start  for shutdown l2
*Mar 25 17:44:20.214: %MMODE-6-
MMODE_CLIENT_TRANSITION_COMPLETE: Maintenance Isolate
complete  for shutdown l2
*Mar 25 17:44:20.214: %MMODE-6-MMODE_ISOLATED: System
is in Maintenance
```

Order for Maintenance:

BGP -> IGPs in parallel (ISIS) -> L2
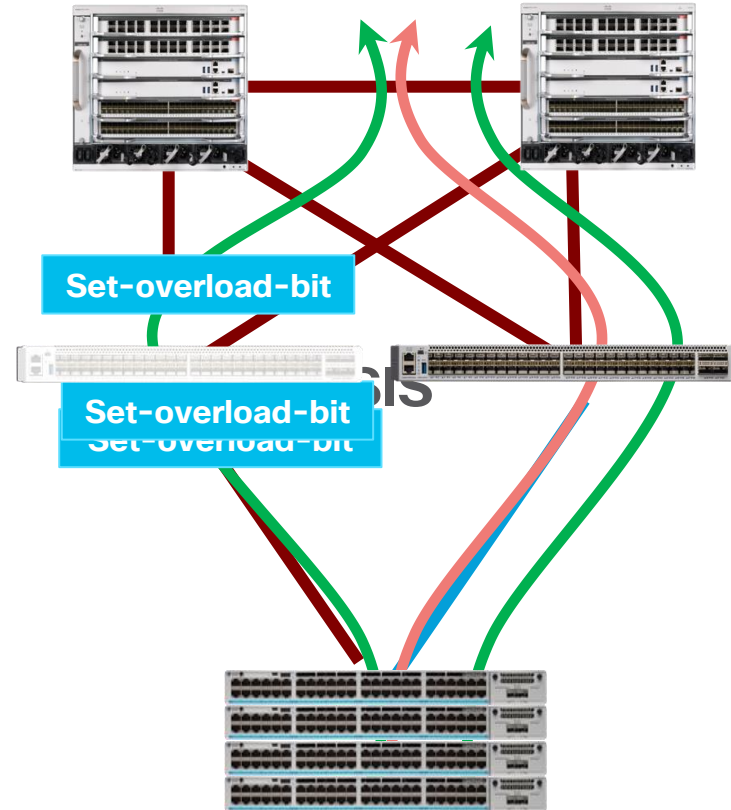
L2 and L3 Topology with GIR Isolation

```
9300#stop maintenance
*Mar 25 19:15:40.235: %MMODE-6-
MMODE_CLIENT_TRANSITION_START: Maintenance
Insert start  for shutdown l2
*Mar 25 19:16:10.237: %MMODE-6-
MMODE_CLIENT_TRANSITION_COMPLETE: Maintenance
Insert complete  for shutdown l2
*Mar 25 19:16:10.237: %MMODE-6-
MMODE_CLIENT_TRANSITION_START: Maintenance
Insert start  for router isis 1
*Mar 25 19:16:40.288: %MMODE-6-
MMODE_CLIENT_TRANSITION_COMPLETE: Maintenance
Insert complete  for router isis 1
*Mar 25 19:16:40.612: %MMODE-6-MMODE_INSERTED:
System is in Normal Mode
```


No set-overload-bit
No set-overload-bit

ISIS

Order for Maintenance:

L2 → IGPs in parallel (ISIS) -> BGP
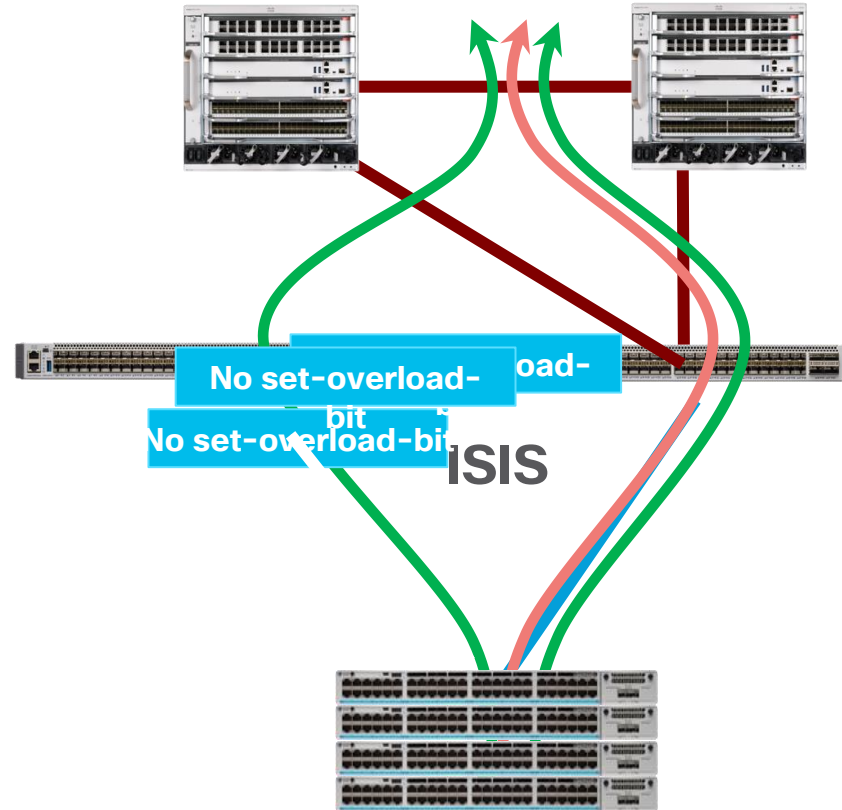
Open IOS-XE Patchability

Ready for Software Patching

SMU is an emergency point fix positioned for expedited delivery to a customer in case of a network down or revenue affecting scenario.

Cold Patching: Install of a SMU will require a system reload in the first release. It is traffic impacting.

Hot Patching: Install of a SMU does not require a reload.

Install Add → Install Activate → Install Commit

Catalyst 9000: Platform Resiliency

C9300 Fixed Platform

- **StackWise: Redundant System for high availability** with NSF/SSO
- **StackPower**: Redundant Power Supplies providing 1+ N redundancy
- Redundant Fan & Power Supply in case of any hardware failure

C9400/C9600 Modular Chassis

- **Redundant Supervisor:** Redundant System for high availability, simplified configuration
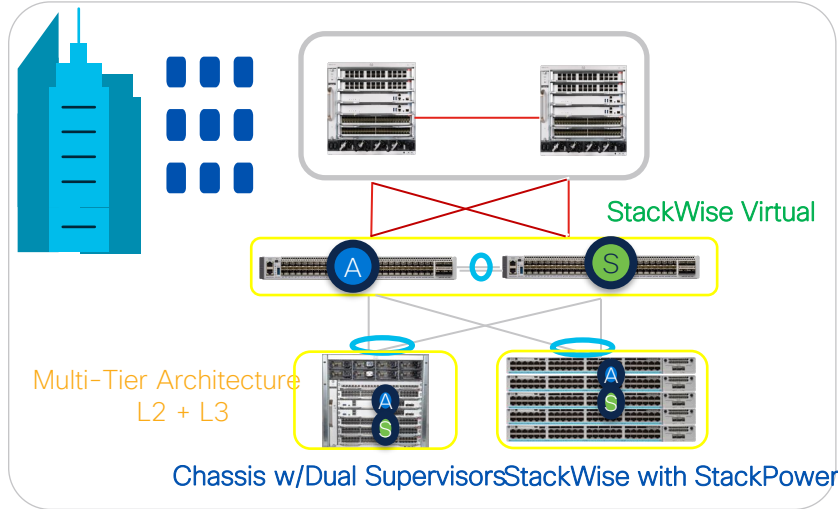- **Redundant Fan & Power** Supply in case of any hardware failure

C9500 Fixed Platform

- **StackWise Virtual:** Redundant System for high availability with NSF/SSO
- **Redundant Fan & Power** Supply in case of any hardware failure

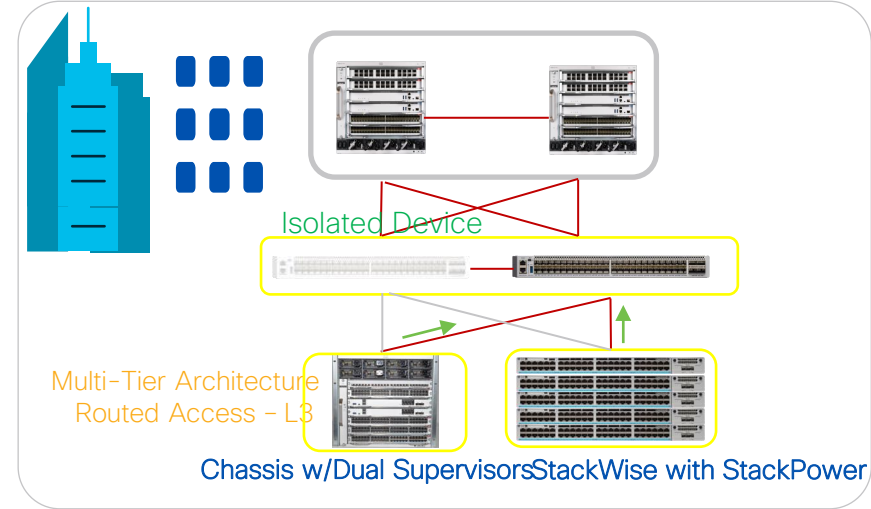## Sub-second Traffic impact during failures across C9k Family

Catalyst 9000: Features for Design Resiliency

StackWise Virtual with Backward StackWise

StackWise Virtual

Multi-Tier Architecture
L2 + L3

Chassis w/Dual Supervisors StackWise with StackPower

Device Resiliency with Simplified Design

Graceful Insertion and Removal (GIR)

Isolated Device

Multi-Tier Architecture
Routed Access – L3

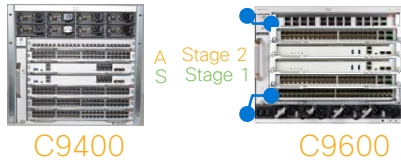Chassis w/Dual Supervisors StackWise with StackPower

Device Isolation without Traffic Impact

Device Resiliency and Sub-second failover for Every Design

Catalyst 9000: Operational Resiliency

C9400/C9600 Modular Chassis

Standalone Mode

C9400   C9600

In-Chassis Dual Supervisor ISSU

< 200 msec Traffic Impact

Requires Dual Supervisor

C9400/C9500/C9600 Platform

StackWise Virtual Mode

A   S

StackWise Virtual ISSU

< 1 sec Traffic Impact

C9300/C9300L/C9300X

Standalone and StackWise Mode

A } Stage 2

Extended Fast Software Upgrade (xFS)

< 30 sec Traffic Impact

Hot and Cold Patching for IOS Resiliency

Sub-second Traffic impact during software upgrades across C9k Family

Platform/Solution Support

Features	C9200	C9300/X	C9400/X	C9500	C9500X	C9600	C9600X
StackWise	✅	✅	NA	NA	NA	NA	NA
StackWise Virtual (SVL)	NA	NA	✅	✅	✅	✅	✅
SVL ISSU	NA	NA	✅	✅	✅	✅	Roadmap
Dual Supervisor ISSU	NA	NA (xFSU with stacking)	✅	NA	NA	✅	
Cold/Hot Patching	Cold Patching	✅	✅	✅	✅	✅	✅
GIR	NA	✅	✅	✅	✅	✅	✅
Power Redundancy	✅	✅	✅	✅	✅	✅	✅

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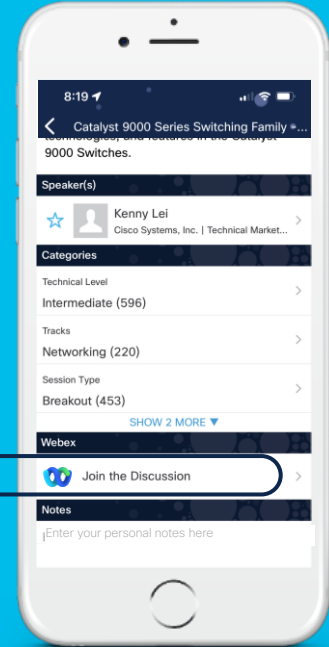Visit the On-Demand Library for more sessions at ciscolive.com/on-demand.

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