
TECHNICAL DECISION MAKER PRESENTATION

Cisco Catalyst 9400 Series

Prepared as a convenient PDF reference for network planning, platform evaluation, and procurement discussions.

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The bridge to possible

Cisco Catalyst 9400 Series

Technical Decision Maker Presentation

Agenda

1. Overview
2. Hardware
3. Architecture
4. Power
5. TCAM resources
6. Packet walks
7. Software features
8. Performance and scales
9. Product comparison
10. Optics support
11. Cheat sheets

Overview

Cisco Catalyst 9400 Series

Industry Leading Modular Access



IEEE 802.3bt
90W PoE
compliant

4-slot



Redundancy
is now
table stakes

7-slot



480G BW
per slot with
Sup2XL

10-slot

Supervisors

- Sup-1: Access
- Sup-1XL: Access
- SUP-1XL-Y: Access
- SUP-2: Access/Distribution
- SUP-2XL: Access/Distribution

Copper Line Cards

- 48x 10G mGig UPOE+
- 48x 5G mGig UPOE+
- 24x mGig + 24x UPOE
- 48x 10G mGig Data
- 48x 10/100/1000 UPOE+
- 48x 10/100/1000 UPOE
- 48x 10/100/1000 POE+
- 48x 10/100/1000 Data

Fiber Line Cards

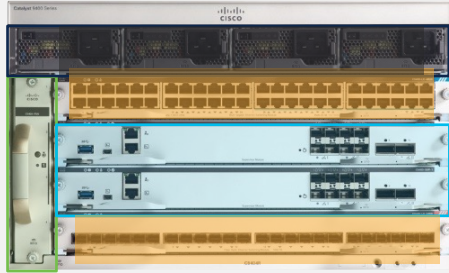
- 48x 10G SFP+
- 24x 10G SFP+
- 48x 1G SFP
- 24x 1G SFP
- 20x 25G SFP28 + 4x10G(SFP+)
- 12x40G QSFP+ or 4x100G QSFP28 + 4x40G QSFP+

Power Supplies

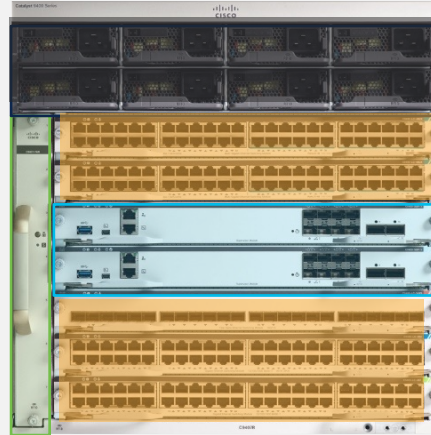
- 3200W AC
- 2100W AC
- 3200W DC

Hardware

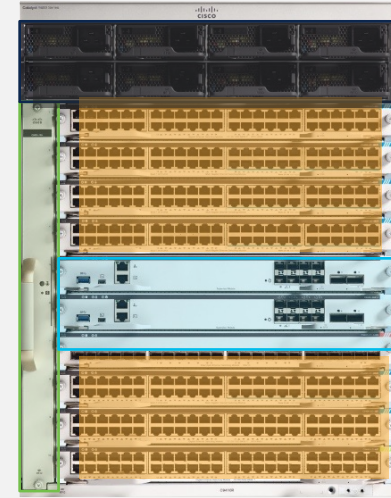
Cisco Catalyst 9400 Series chassis



4-slot



7-slot



10-slot



Power supplies



Fan tray



Supervisors



Line cards

Cisco Catalyst 9400 Series

Chassis Options



		4-slot	7-slot	10-slot
Supervisor		2 (redundant)		
Line Cards		2	5	8
Max LC ports by speed	10/100/100M	96	240	384
	1/2/5/10G	96	240	384
	1/10G SFP	96	240	384
	25G SFP	40	100	160
	40G QSFP+	24	60	96
	100G QSFP28	8	20	32
Max SUP ports by speed	10G SFP	8 (SUP1) — 4 (SUP2)		
	25G SFP	2 (SUP1-XL) — 4 (SUP2)		
	40G QSFP	2 (SUP1-XL) — 4 (SUP2)		
	100G QSFP	4 (SUP2)		
BW per LC slot (SUP1/1XL/2/2XL)		80/240/240/480G	80/120/240/480G	80/80/240/480G
Dimensions (W/D/H)		W:17.5 in. / D:16.25 in. / H: 6RU	W:17.5 in. / D:16.25 in. / H: 10RU	W: 17.5 in. / D:16.25 in. / H: 13RU
Power supply		4 PS (N+1 and N+N)	8 PS (N+1 and N+N)	8 PS (N+1 and N+N)
PoE per slot		4800W		
Cooling		Side to Side (Front to Back for PS)		

Cisco Catalyst 9400X

New Supervisor 2/2XL powered by Cisco UADP 3.0sec ASIC





Up to 240G
bandwidth



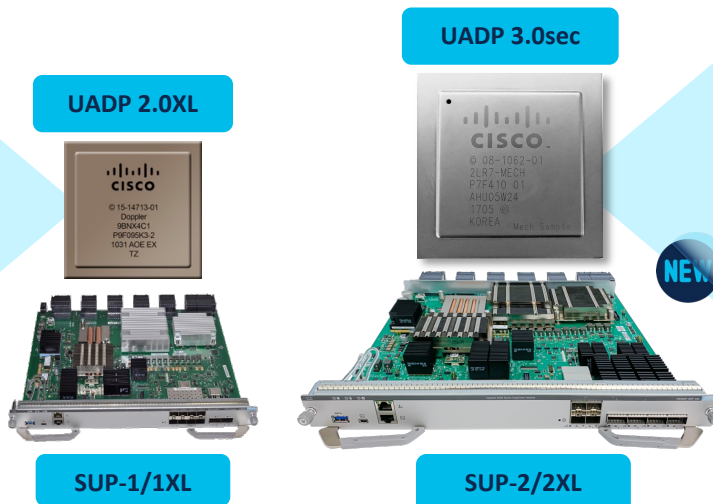
1/2.5/5/10/25/40G
Supports different speeds



**Forwarding +
ACL scale**
Up to **96,000 MACs**
Up to **64,000 routes**



Up to 32 MB
(2x 16 MB) packet buffer



240/120/80G per slot with SUP-1XL (4-, 7-, or 10-slot chassis)
80G per slot with SUP-1 (all chassis)

480G per slot with SUP-2XL
240G per slot with SUP-2



Up to 1.6T
bandwidth



1/2.5/5/10/25/40/100G
Supports different speeds



Increased
Forwarding + ACL scale
Up to **128,000 MACs***
Up to **256,000 routes***



Up to 36 MB
unified packet buffer



Up to 100G
Encryption
IPsec, WAN MACsec*



Customizable
templates for
higher scale*

* Hardware capable, Software support in future release.

Unmatched flexibility

Maximum investment protection

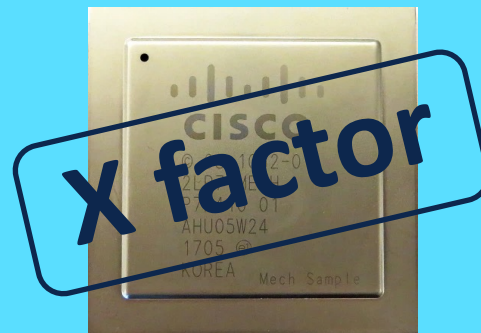
100G leadership in access

Same series, chassis options – New supervisors and line cards

Cisco UADP 3.0sec

Key highlights

- **Performance**
 - **1.6 Tbps** full duplex per ASIC
 - **36-MB** unified buffer per ASIC
 - Built-in **encryption-engine*** capable of up to 100 Gbps
- **Scalability**
 - Up to **256,000 IPv4 or IPv6 routes**, with double-wide tables
 - Up to **27,000 ingress + 20,000 egress security ACLs**
 - **Unified buffers** with dynamic threshold scheduling
- **Flexibility**
 - Programmable ASIC lookup stages
 - Support for MPLS, SD-Access, and BGP EVPN
 - Support for custom Switching Database Manager (SDM) templates*



UADP 3.0sec

Brings **line-rate 10G (480G per slot)**
performance to the Catalyst 9400 Series
with SUP-2XL

*Hardware capable. Software support in FCS+.

C9400X-SUP-2/2XL with UADP 3.0sec

C9400X-SUP-2/2XL

Gen 2 supervisor modules with UADP 3.0sec

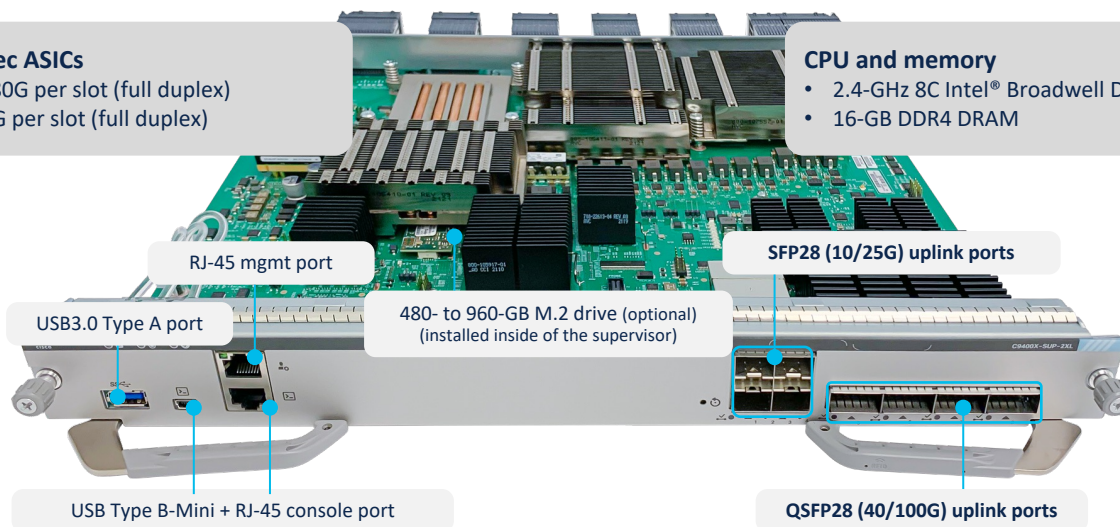
4.8 Tbps Sup2XL/
2.4 Tbps Sup2
(full duplex)

3x UADP 3.0sec ASICs

- SUP-2XL – 480G per slot (full duplex)
- SUP-2 – 240G per slot (full duplex)

CPU and memory

- 2.4-GHz 8C Intel® Broadwell DE-NS CPU
- 16-GB DDR4 DRAM



C9400X-SUP-2XL

IOS-XE 17.7.1

Cisco UADP
3.0sec

Multicore
X86 CPU

Cisco IOS® XE



X86

4.8 Tbps full duplex
(line cards and uplinks)

3x UADP 3.0sec ASICs

M.2 SATA SSD
(optional: up to 1TB)

USB 3.0

MACsec-256 / IPsec

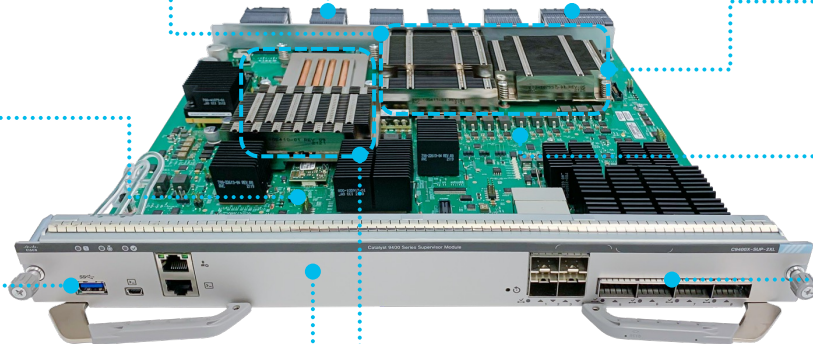
Line card slot bandwidth:
480Gb/slot with Sup2XL

SDM Templates:
Customizable in 17.11

16-GB DRAM and
16-GB flash

Uplinks:
4x25/10G/1G* 4x100/40G

2.4-GHz 8-core x86 CPU
QAT (20G HW crypto)



* With supported transceiver SFP-1G-LH & SFP-1G-SX (17.9.6, 17.12.4 & 17.15.1)

Catalyst 9400 Series – Sup2

Overview

IOS-XE 17.7.1

Cisco UADP
3.0sec

Multicore
X86 CPU

Cisco IOS® XE



2.4 Tbps full duplex
(line cards and uplinks)

3x UADP 3.0sec ASICs

M.2 SATA SSD
(optional: up to 1TB)

USB 3.0

MACsec-256 / IPsec

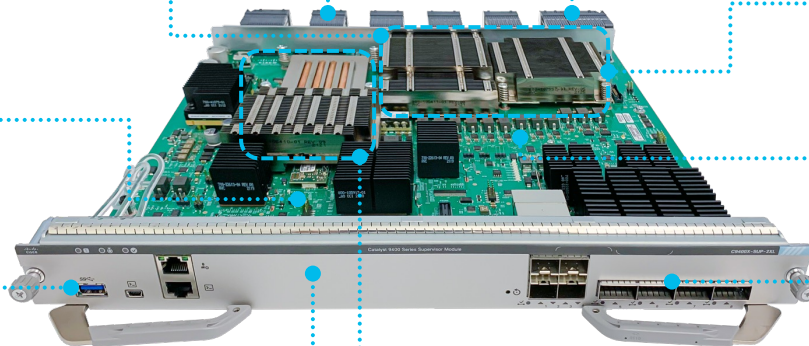
Line card slot bandwidth:
240Gb/slot

SDM Templates:
Access (default)
Border, Distribution,
Core (future)

**16-GB DRAM and
16-GB flash**

Uplinks:
4x25/10G/1G*, 4x100/40G

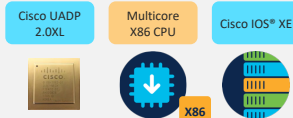
2.4-GHz 8-core x86 CPU
QAT (20G HW crypto)



* With supported transceiver SFP-1G-LH & SFP-1G-SX (17.9.6, 17.12.4 & 17.15.1)

Catalyst 9400 Series – Sup-1XL-Y

Overview



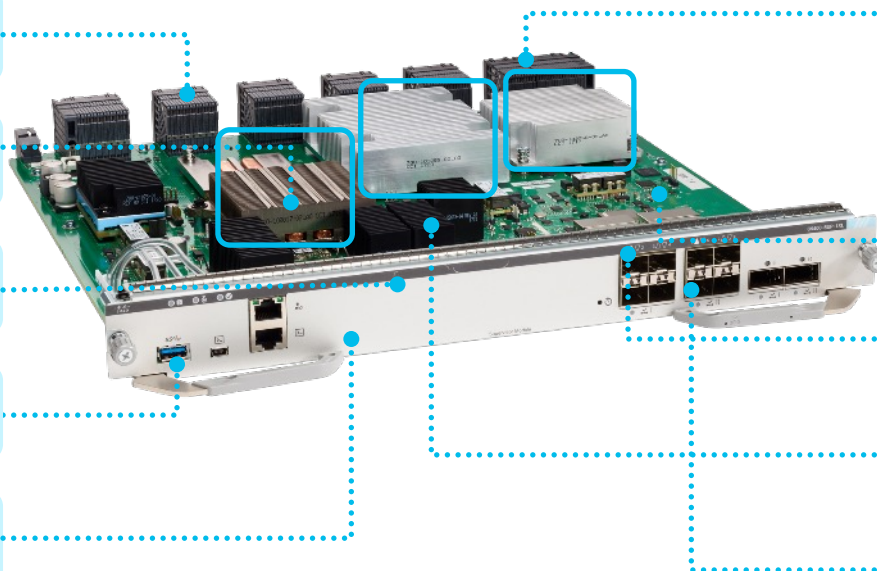
720G line cards, uplinks

UADP 2.0 XL ASICs

M.2 SATA SSD (optional; up to 1 TB)

USB 2.0/3.0

MACsec-256



Line card slot bandwidth:
4-slot: **240G** (>150 bytes)
7-slot: **120G** (>150 bytes)
10-slot: **80G** (> 150 bytes)

Templates: Distribution,
Core, SD Border

16G DRAM and 16G flash

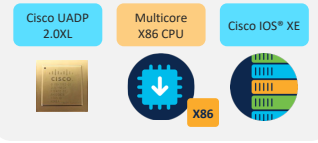
2.4-GHz quad-core x86 CPU

Uplinks:
2x 25G, 8x 10G, 2x 40G

*MACsec is not supported on 25G ports of Sup-1XL-Y

Cisco Catalyst 9400 Series – Sup-1

Overview



720G line cards, uplinks

UADP 2.0 XL ASICs

M.2 SATA SSD (optional; up to 1 TB)

USB 2.0/3.0

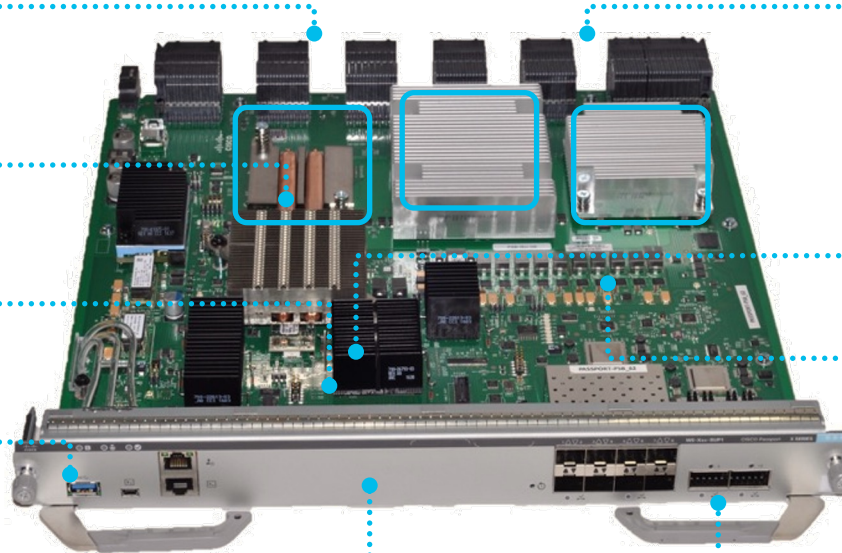
MACsec-256

Line card slot bandwidth:
4-slot: **80G** (>150 bytes)
7-slot: **80G** (>150 bytes)
10-slot: **80G** (>150 bytes)

2.4-GHz quad-core x86 CPU

16G DRAM and 16G flash

Uplinks:
8x 10G, 2x 40G



MACsec is not supported on 1G speed on uplinks

New Line Cards for Sup2/2XL – Gen 2 Line Cards



C9400X-SUP-2XL

IOS XE 17.7.1

C9400X-SUP-2

IOS XE 17.7.1

C9400-LC-48HX

IOS XE 17.8.1

C9400-LC-48XS

IOS XE 17.8.1

C9400-LC-12QC

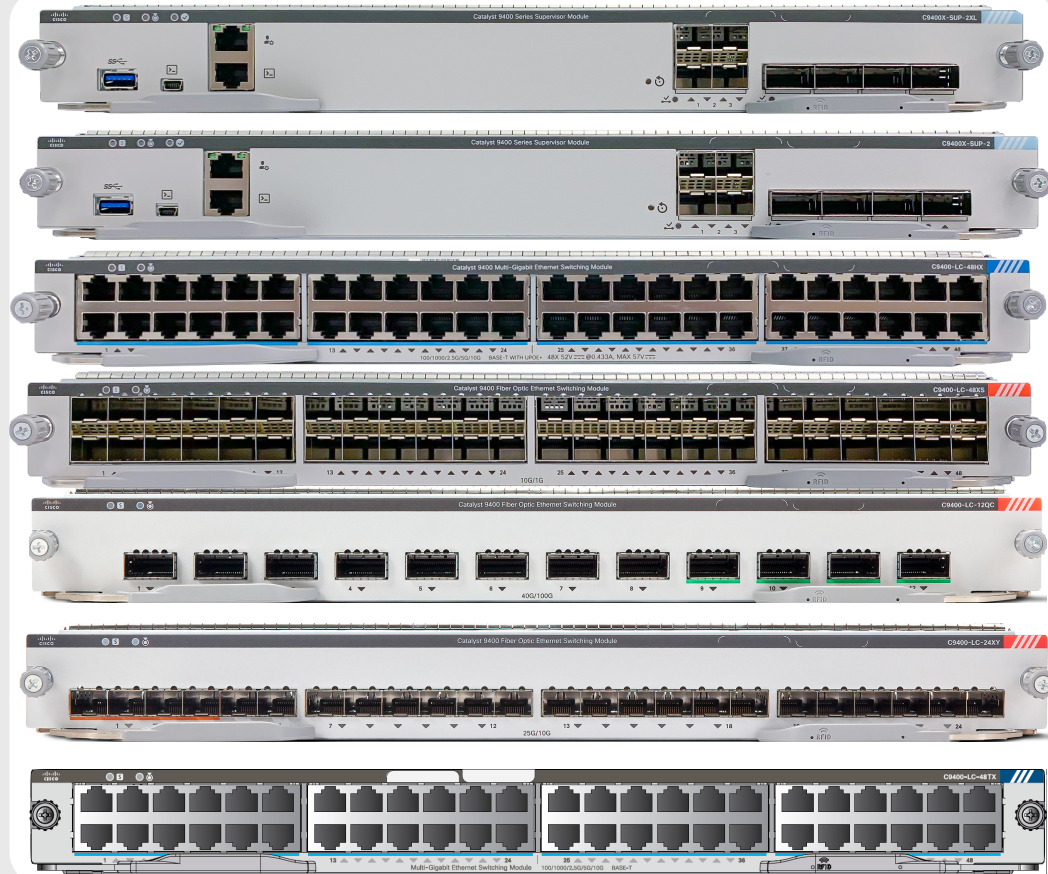
IOS XE 17.12.1

C9400-LC-24XY

IOS XE 17.12.1

C9400-LC-48TX

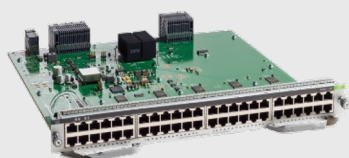
IOS XE 17.13.1



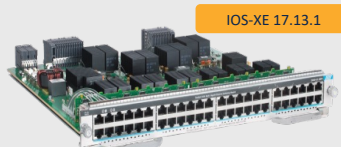
Line cards - RJ-45

TrustSec and MacSec-256 supported on all

DATA



C9400-LC-48T
48x 10/100/1000M

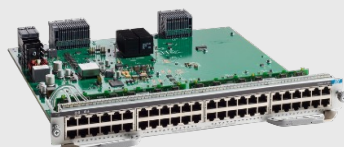


C9400-LC-48TX
48x 100M/1G/2.5G/5G/10G
PoE+/UPOE+
up to 90W

POE+/UPOE

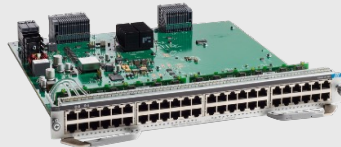


C9400-LC-48P
48x 10/100/1000M PoE+



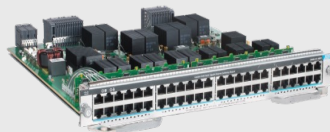
C9400-LC-48U
48x 10/100/1000M UPOE®

UPOE +



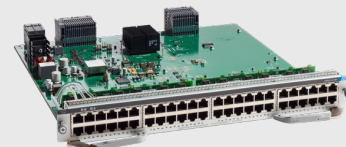
C9400-LC-48H
48x 10/100/1000M

UPOE+/802.3bt

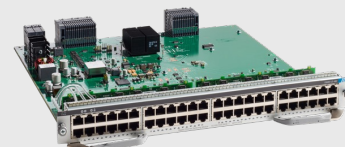


C9400-LC-48HX
48x 100M/1G/2.5G/5G/10G
PoE+/UPOE+
up to 90W

MultiGigabit



C9400-LC-48UX
24x Multigigabit + 24 10/100/1000



C9400-LC-48HN
48x 100M/1G/2.5G/5G
PoE+/UPOE+
up to 90W

Line cards – SFP/SFP+

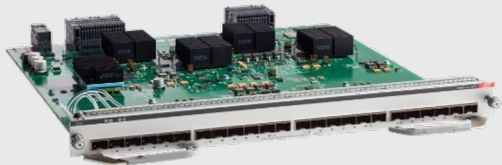
TrustSec and MACsec-256

1/10Gb SFP/SFP+



IOS-XE 17.8.1

C9400-LC-48XS
48x 1/10Gb SFP/SFP+



C9400-LC-24XS
24x1/10Gb SFP/SFP+

1 Gb SFP



C9400-LC-24S
24x 1Gb SFP

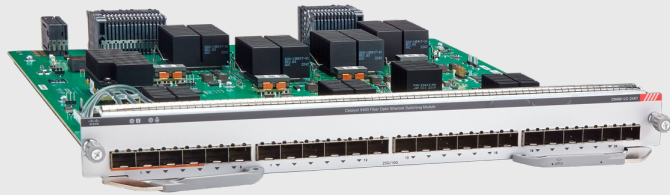


C9400-LC-48S
48x1Gb SFP

Line cards – SFP28/QSFP28

10/25G SFP28

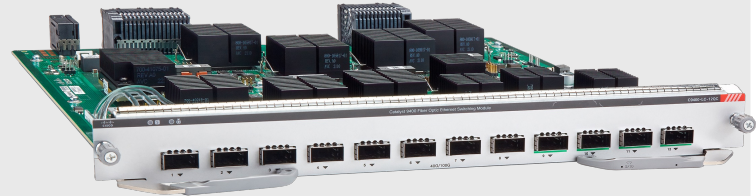
IOS-XE 17.12.1



C9400-LC-24XY
20x25Gb + 4x10Gbps

40/100Gbps QSFP28

IOS-XE 17.12.1



C9400-LC-12QC
12x40Gbps /
4x100Gbps + 4x40Gbps

Bandwidth boost with Gen 2 supervisors



Catalyst® 9400 SUP-1/1XL

Catalyst 9400X SUP-2

Catalyst 9400X SUP-2XL

NEW

NEW

	Type	9404R	9407R	9410R	9404R/9407R/9410R	9404R/9407R/9410R
C9400-LC-48TX	Copper (Data Only)	Not supported			240	480
C9400-LC-24XY	Fiber				240	480
C9400-LC-12QC	Fiber				240	480
C9400-LC-48HX	UPOE+	Not supported			240	480
C9400-LC-48XS	Fiber				240	480
C9400-LC-48UX	UPOE	80/240	80/120	80	240/240/120	240/240/120
C9400-LC-24XS	Fiber	80/240	80/120	80	240/240/120	240/240/120
C9400-LC-48HN	UPOE+	80/120	80/120	80	240	240

Upto 1.5x bandwidth uplift for Gen 1 line cards (**80G -> 120G**) on **10-slot chassis with SUP-2XL**

Up to 2x bandwidth uplift for Gen 1 line cards (**120G -> 240G**) on **7-slot chassis with SUP-2XL**

Bold indicates line rate

SUP-2XL supported line cards

	Supervisor 2XL						Bandwidth per slot (Gbps)		
	Generation	Data only	PoE	Cisco UPOE®	IEEE 802.3bt / UPOE+	Fiber	9404R	9407R	9410R
C9400-LC-12QC	2	X				X	480	480	480
C9400-LC-24XY	2	X				X	480	480	480
C9400-LC-48HX	2		X	X	X		480	480	480
C9400-LC-48XS	2	X				X	480	480	480
C9400-LC-48TX	2	X					480	480	480
C9400-LC-48HN	1.5		X	X	X		240	240	240
C9400-LC-48H	1		X	X	X		48	48	48
C9400-LC-48UX	1		X	X			240	240	120
C9400-LC-48U	1		X	X			48	48	48
C9400-LC-48T	1	X					48	48	48
C9400-LC-48P	1		X				48	48	48
C9400-LC-24/48S	1	X				X	48	48	48
C9400-LC-24XS	1	X				X	240	240	120

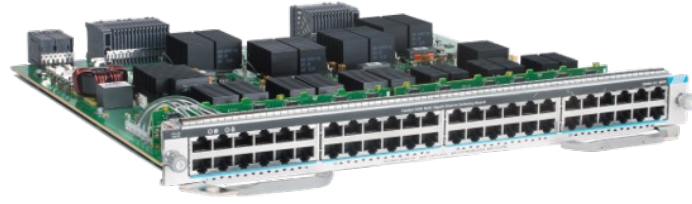
SUP-2 supported line cards

	Supervisor 2XL						Bandwidth per slot (Gbps)		
	Generation	Data only	PoE	Cisco UPOE®	IEEE 802.3bt / UPOE+	Fiber	9404R	9407R	9410R
C9400-LC-12QC	2	X				X	240	240	240
C9400-LC-24XY	2	X				X	240	240	240
C9400-LC-48HX	2		X	X	X		240	240	240
C9400-LC-48XS	2	X				X	240	240	240
C9400-LC-48TX	2	X					240	240	240
C9400-LC-48HN	1.5		X	X	X		240	240	240
C9400-LC-48H	1		X	X	X		48	48	48
C9400-LC-48UX	1		X	X			240	240	120
C9400-LC-48U	1		X	X			48	48	48
C9400-LC-48T	1	X					48	48	48
C9400-LC-48P	1		X				48	48	48
C9400-LC-24/48S	1	X				X	48	48	48
C9400-LC-24XS	1	X				X	240	240	120

SUP-1, SUP-1XL, SUP-1XL-Y supported line cards

	Supervisor 1, 1XL, 1XL-Y						Bandwidth per slot (Gbps)		
	Generation	Data only	PoE	Cisco UPOE®	IEEE 802.3bt / UPOE+	Fiber	9404R	9407R	9410R
C9400-LC-12QC	Not supported								
C9400-LC-24XY	Not supported								
C9400-LC-48HX	Not supported								
C9400-LC-48XS	Not supported								
C9400-LC-48TX	Not supported								
C9400-LC-48HN	1.5		X	X	X		120 ^(Sup1XL/-Y) 80 ^(Sup1)	120 ^(Sup1XL/-Y) 80 ^(Sup1)	80
C9400-LC-48H	1		X	X	X		48	48	48
C9400-LC-48UX	1		X	X			240 ^(Sup1XL/-Y) 80 ^(Sup1)	120 ^(Sup1XL/-Y) 80 ^(Sup1)	80
C9400-LC-48U	1		X	X			48	48	48
C9400-LC-48T	1	X					48	48	48
C9400-LC-48P	1		X				48	48	48
C9400-LC-24/48S	1	X				X	48	48	48
C9400-LC-24XS	1	X				X	240 ^(Sup1XL/-Y) 80 ^(Sup1)	120 ^(Sup1XL/-Y) 80 ^(Sup1)	80

48-port 90W 802.3bt UPOE+ mGIG line card



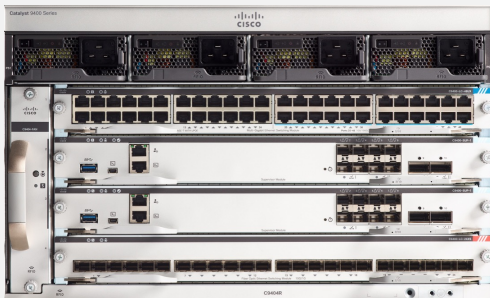
C9400-LC-48HX

- Support for **Type 4 PSE (up to 90W per port or Class 8)**
- By default, compliant with IEEE 802.3bt standard
- Compatible with previous IEEE 802.3af and IEEE 802.3at standard
- Up to 10G line rate on all 48 ports
- Supported speeds: 100M, 1G, 2.5G, 5G, 10G
- Up to 48 concurrent ports per line card

UPOE+ port density with C9400-LC-48HX

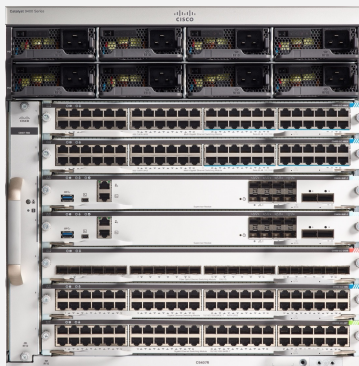
With **3200W** power supply in combined mode (fully loaded PSUs)

C9404R



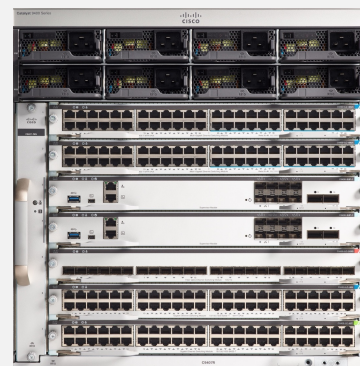
96 ports
(fully loaded chassis)

C9407R



226 ports (up to 4 fully loaded
line cards + 34 ports)

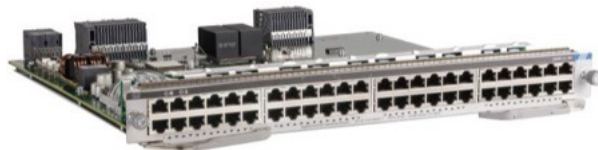
C9410R



224 ports (up to 4 fully loaded
line cards + 32 ports)

Supported with SUP-2/2XL only

48-port 90W 802.3bt UPOE+ mGIG (5G) line card



From 17.5.1

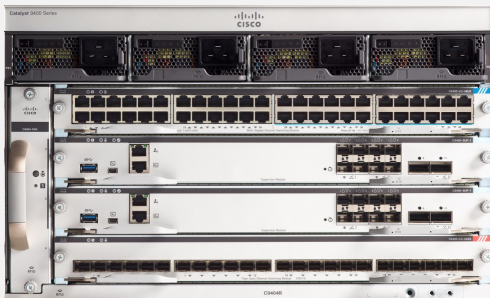
C9400-LC-48HN

- Support for **Type 4 PSE (up to 90W per port or Class 8)**
- By default, compliant with IEEE 802.3bt standard
- Compatible with previous IEEE 802.3af and IEEE 802.3at standards
- Up to 5G line rate on all 48 ports
- Supported speeds: 100M, 1G, 2.5G, 5G
- Up to 48 concurrent ports per line card

UPOE+ port density with C9400-LC-48HN

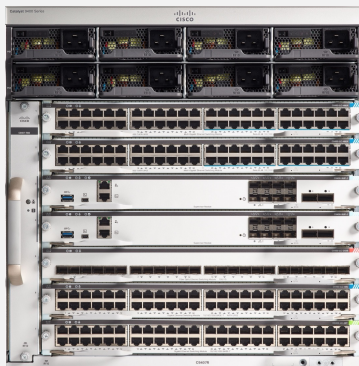
With **3200W** power supply in combined mode (fully loaded PSUs)

C9404R



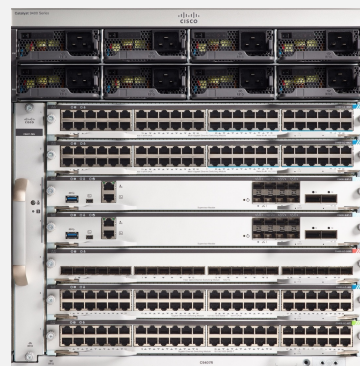
96 ports
(fully loaded chassis)

C9407R



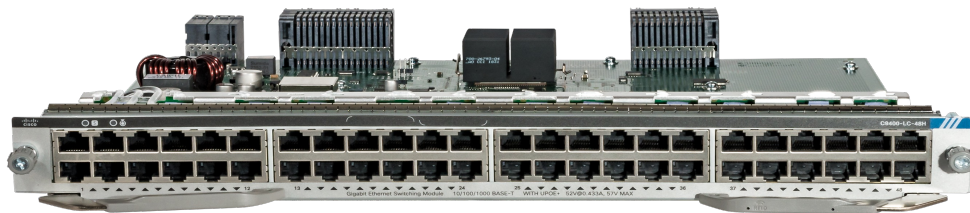
237 ports (sup-1)
233 ports (sup-2)
(fully loaded chassis)

C9410R



235 ports (sup-1)
231 ports (sup-2)
(up to 5 fully loaded line cards)

48-port 90W 802.3bt UPOE+ line card



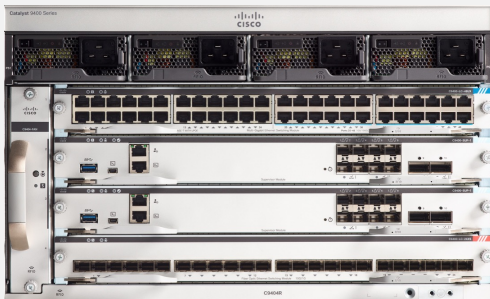
C9400-LC-48H

- Support for **Type 4 PSE (up to 90W per port or Class 8)**
- By default, compliant with IEEE 802.3bt standard
- Compatible with previous IEEE 802.3af and IEEE 802.3at standards
- Up to 1G line rate on all 48 ports
- Supported speeds: 100M, 1G, 2.5G, 5G
- Up to 48 concurrent ports per line card

UPOE+ port density with C9400-LC-48H

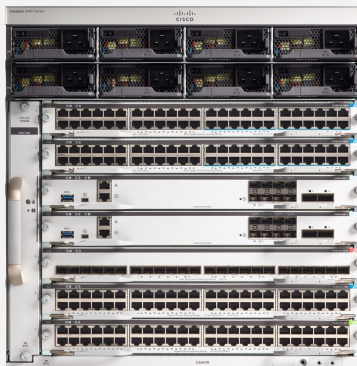
With **3200W** power supply in combined mode (fully loaded PSUs)

C9404R



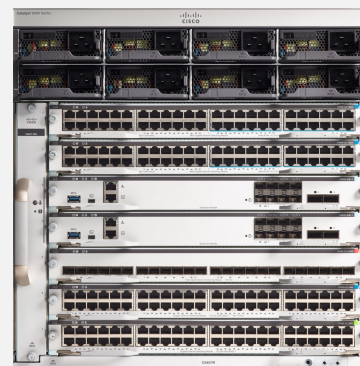
96 ports
(fully loaded chassis)

C9407R



240 ports (sup-1)
239 ports (sup-2)
(fully loaded chassis)

C9410R

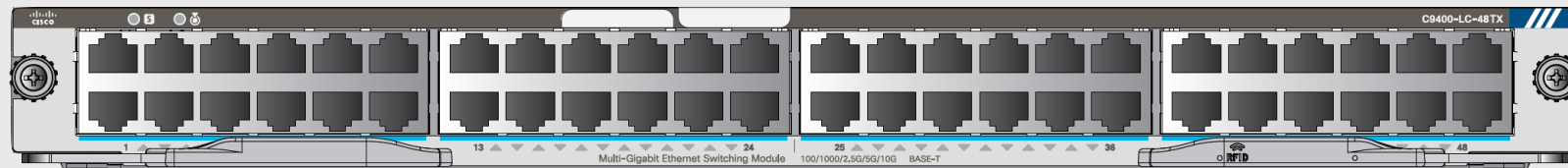


241 ports (sup-1)
237 ports (sup-2)
(fully loaded chassis)

48-port Multigigabit line card - C9400-LC-48TX

Data Only Multigigabit Line card

2nd Gen



C9400-LC-48TX (48x 10G Multigigabit Data Only)



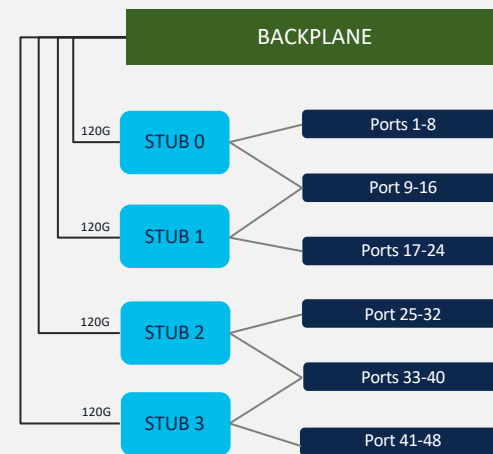
Catalyst® 9400X SUP-2/XL

48 ports of Copper

Up to 10G line rate on all 48 ports with SUP-2XL

Supported speeds: 100M, 1G, 2.5G, 5G, 10G

2:1 oversubscription with SUP-2, Line rate with SUP-2XL



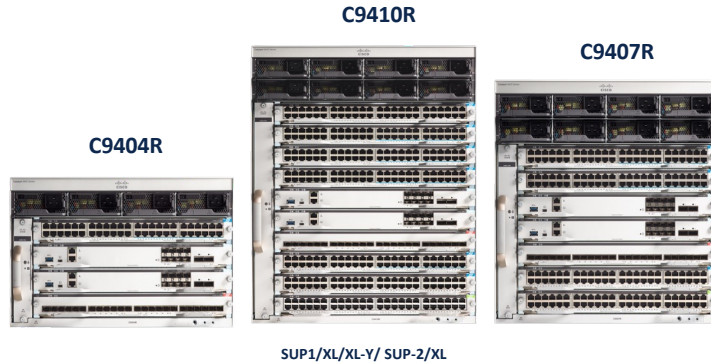
Power supplies

- **Modular design:** 4 PS for 4-slot chassis, 8 PS for 7- and 10-slot chassis
- **Shared:** Power for both data and inline power
- **Slot priority:** Lower-number slots have higher power priority (configurable in future software)
- **Platinum-rated PS:** 90%+ efficiency
- **Output:**
 - 3200W AC PS with 240V input (1570W with 120V input, 16A input)
 - 2100W AC PS with 240V input (940W with 120V input, 10.4A input)
 - 3200W DC PS with -48 to -60 VDC input (55V at 58.0A, 3.3V at 3.0A)

Cisco Catalyst™ 9400 Series supports mixed-voltage input and same-capacity power supplies for combined mode. Redundant mode can use power supplies of mixed capacity. Higher capacity power supplies will be redundant.



C9400: Titanium Rated Power Supply



New Titanium Rated

sustainable & low operating cost for customers



PSU Load	Certification						
	Unrated	80 PLUS	80 PLUS BRONZE	80 PLUS SILVER	80 PLUS GOLD	80 PLUS PLATINUM	80 PLUS TITANIUM
20%	Efficiency: 70%	Efficiency: 80%	Efficiency: 82%	Efficiency: 85%	Efficiency: 87%	Efficiency: 90%	Efficiency: 92%
50%	Efficiency: 70%	Efficiency: 80%	Efficiency: 85%	Efficiency: 88%	Efficiency: 90%	Efficiency: 92%	Efficiency: 94%
100%	Efficiency: 70%	Efficiency: 80%	Efficiency: 82%	Efficiency: 85%	Efficiency: 87%	Efficiency: 89%	Efficiency: 90%

Q1CY24

Titanium is the highest efficiency rating in the market, with a +5% gain above Platinum at 100% load

Fan tray

- **Redundant:** N+1 fan
- **Flexible service:** Fan tray can be replaced from the port side or the back
- **Efficient:** Variable speed per fan depends on the load, temperature, and altitudes
- **Airflow:** Side to side



Blue beacon

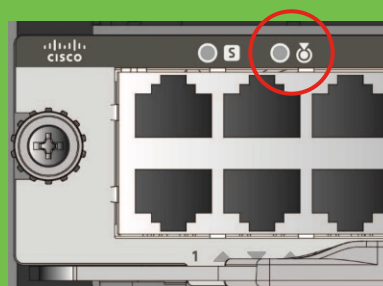
- Chassis/fan tray, supervisor, line cards, and power supply have a beacon
- Identifies the hardware during configuration and troubleshooting
- Turns on and off via software control (no button except on the fan tray)



Chassis/fan tray



Supervisor



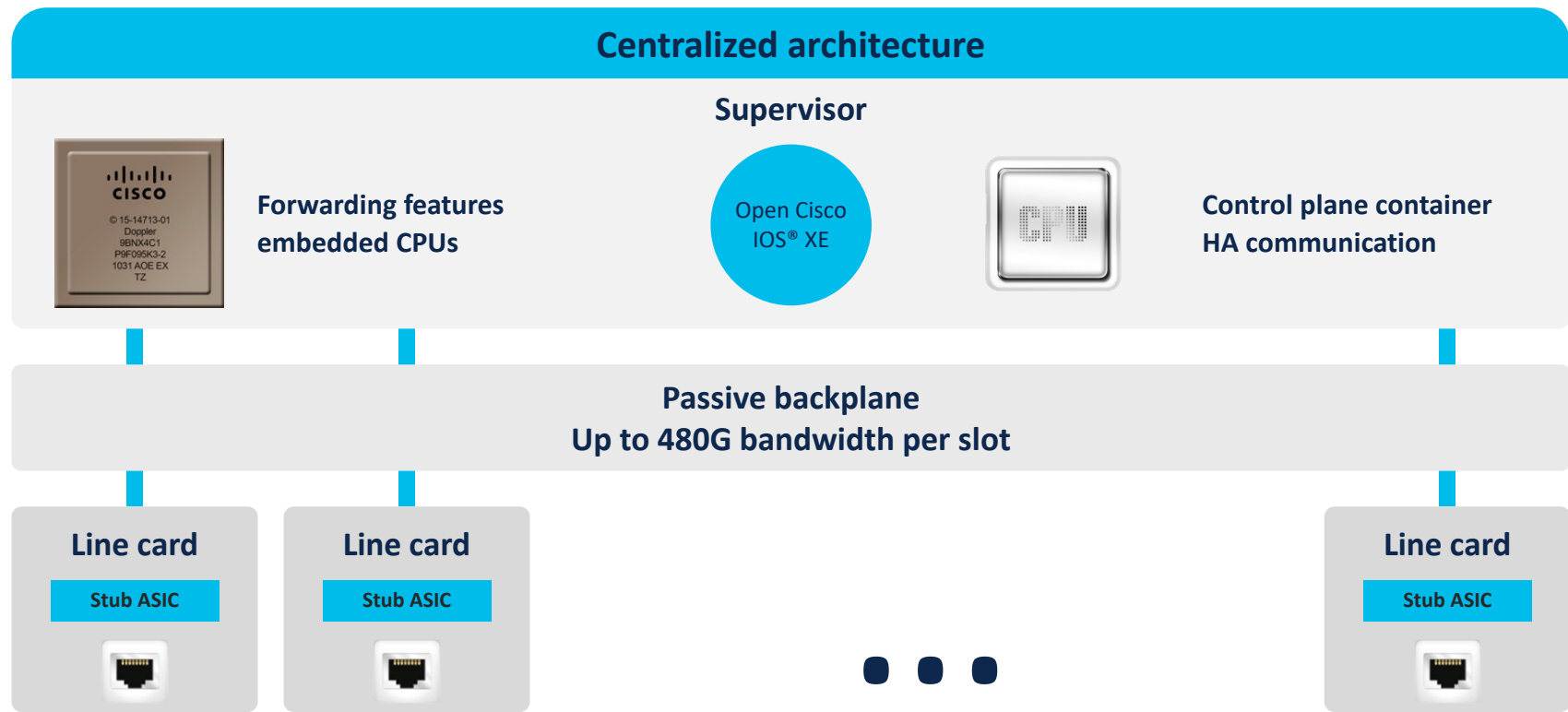
Line card



Power supply

Architecture

Architecture



UADP 2.0 XL – ASIC innovation



Investment protection
Flexible pipeline



Universal deployments
Adaptable tables



Shared TCAM lookup
Multicore resource share

1 2 3

384,000 flex
counters



Shared
lookup



Up to 240G
bandwidth



Up to 2x to 4x
forwarding + TCAM



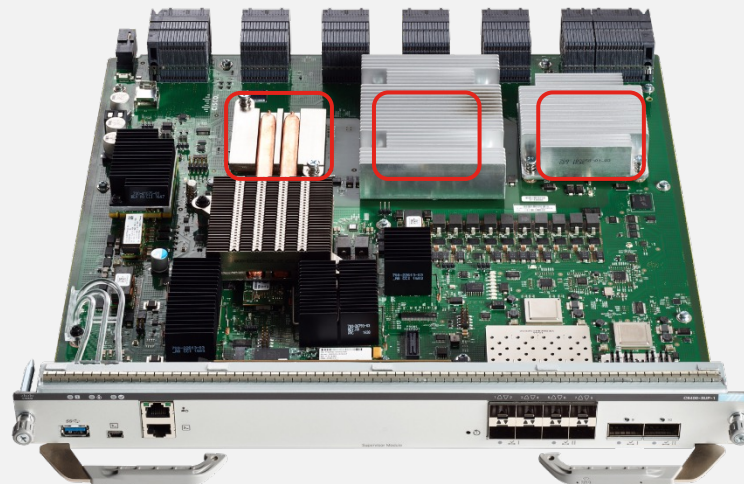
Embedded CPUs



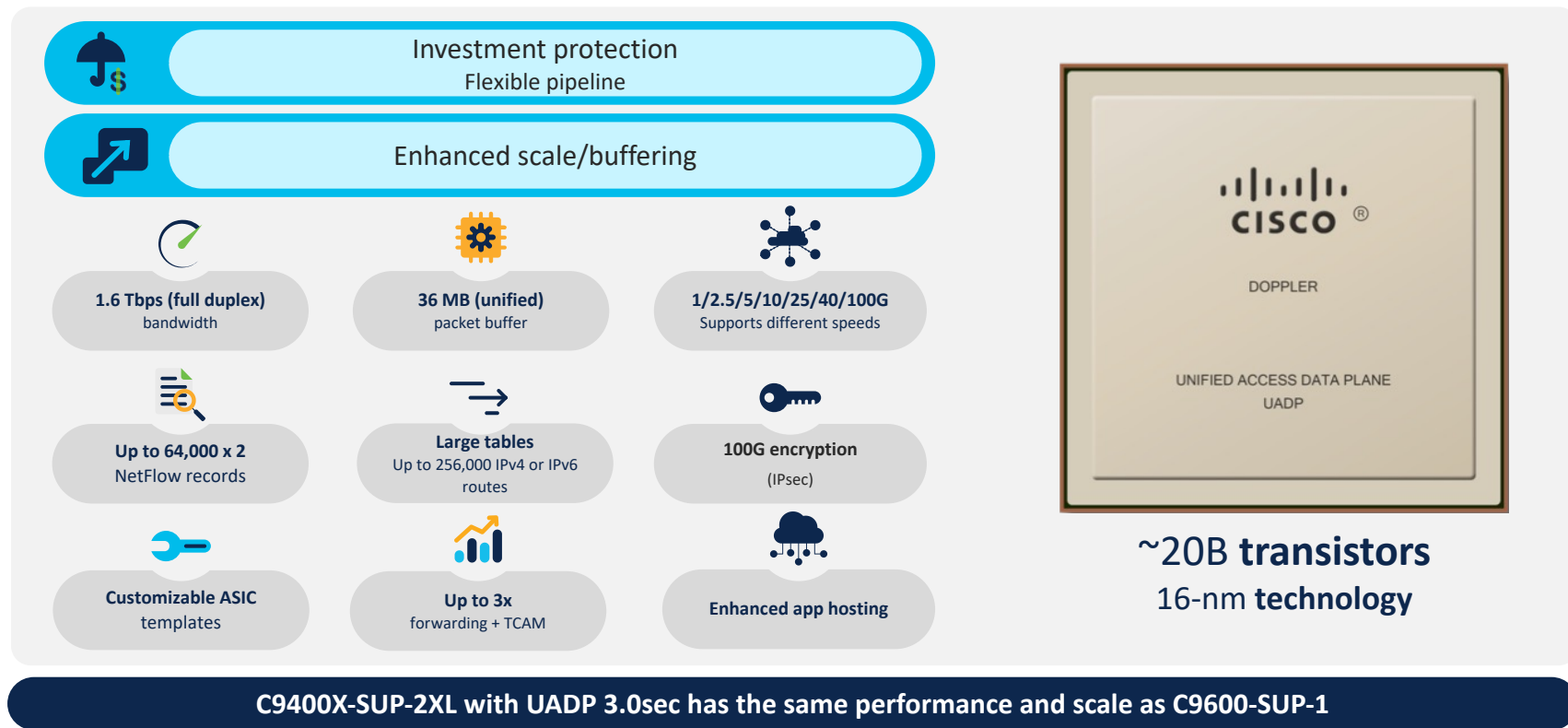
Up to 32 MB
packet buffer



Up to 64,000 x 2
NetFlow records

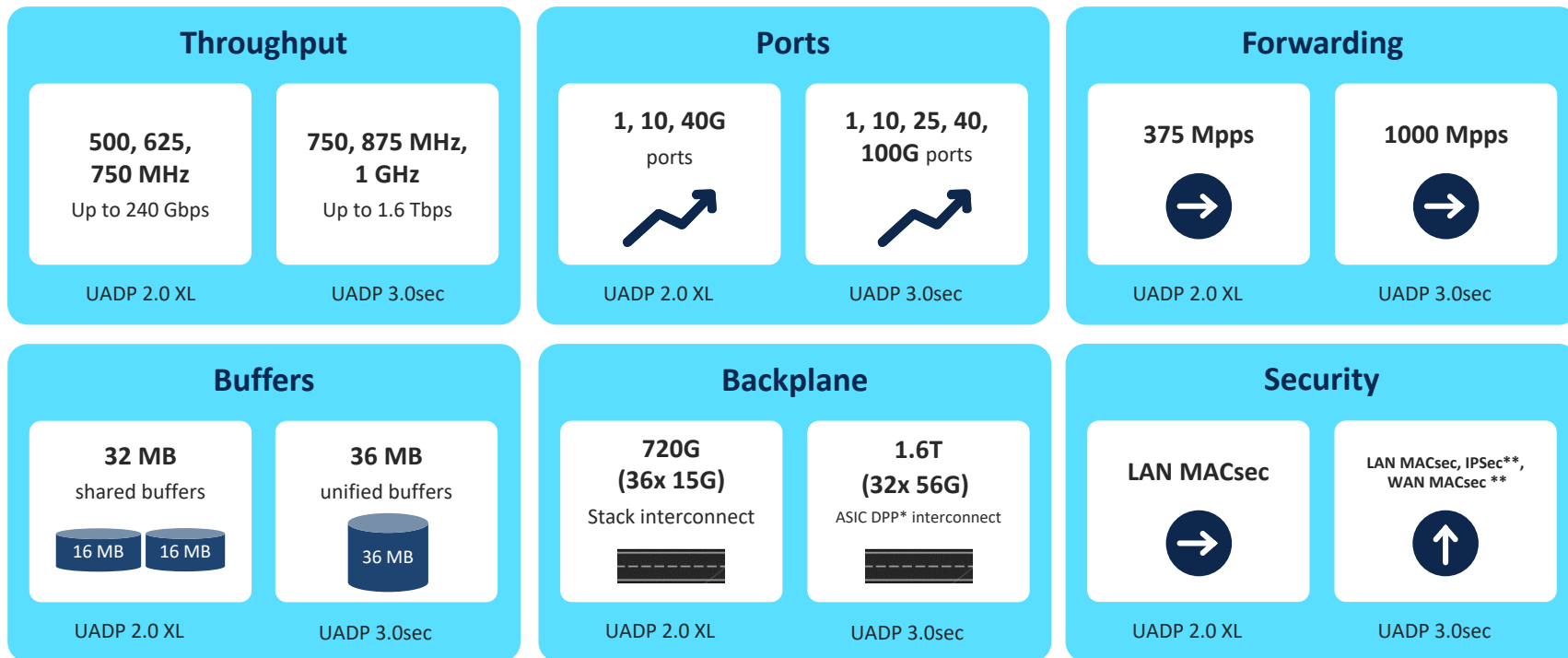


UADP 3.0sec – Next generation of ASIC innovation



UADP evolution

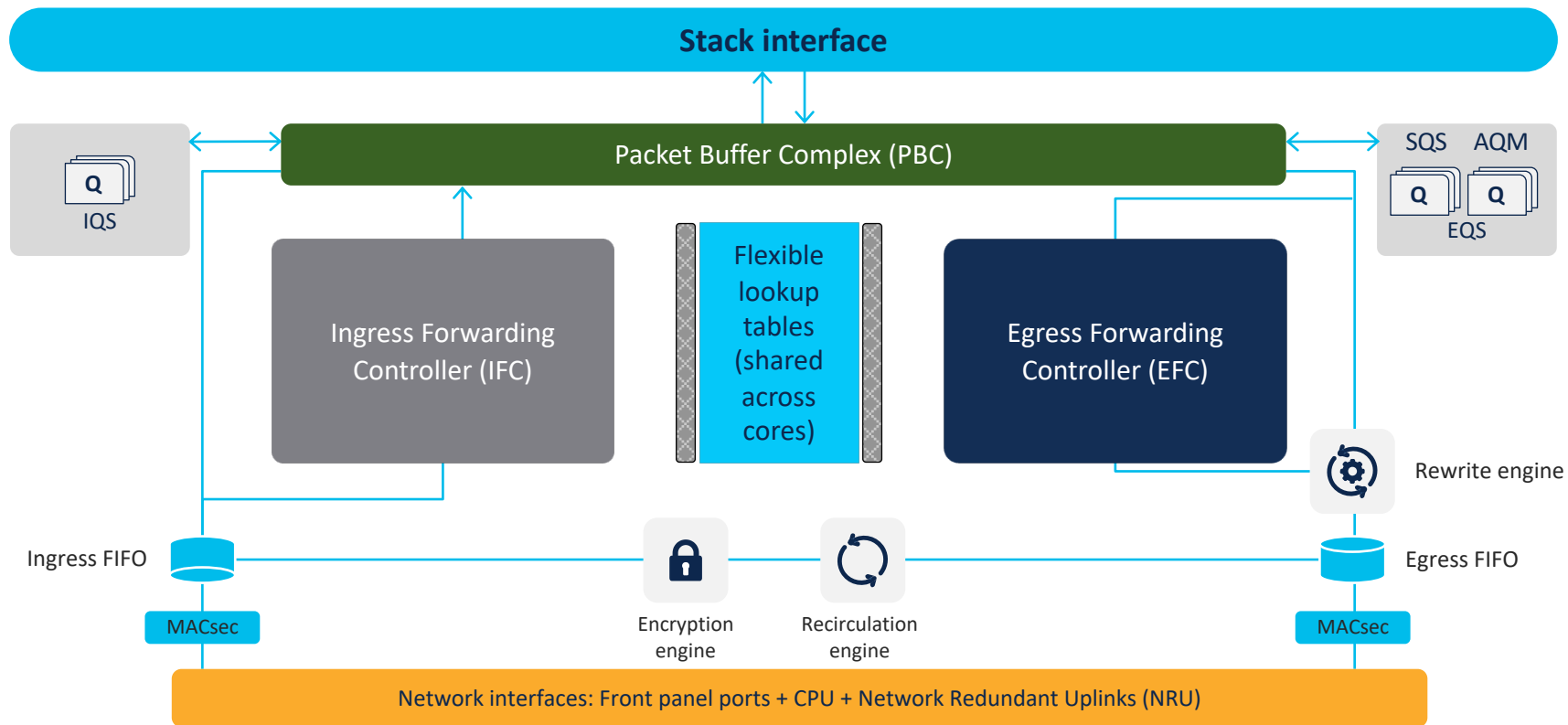
UADP 2.0 XL vs. 3.0sec per-ASIC capabilities



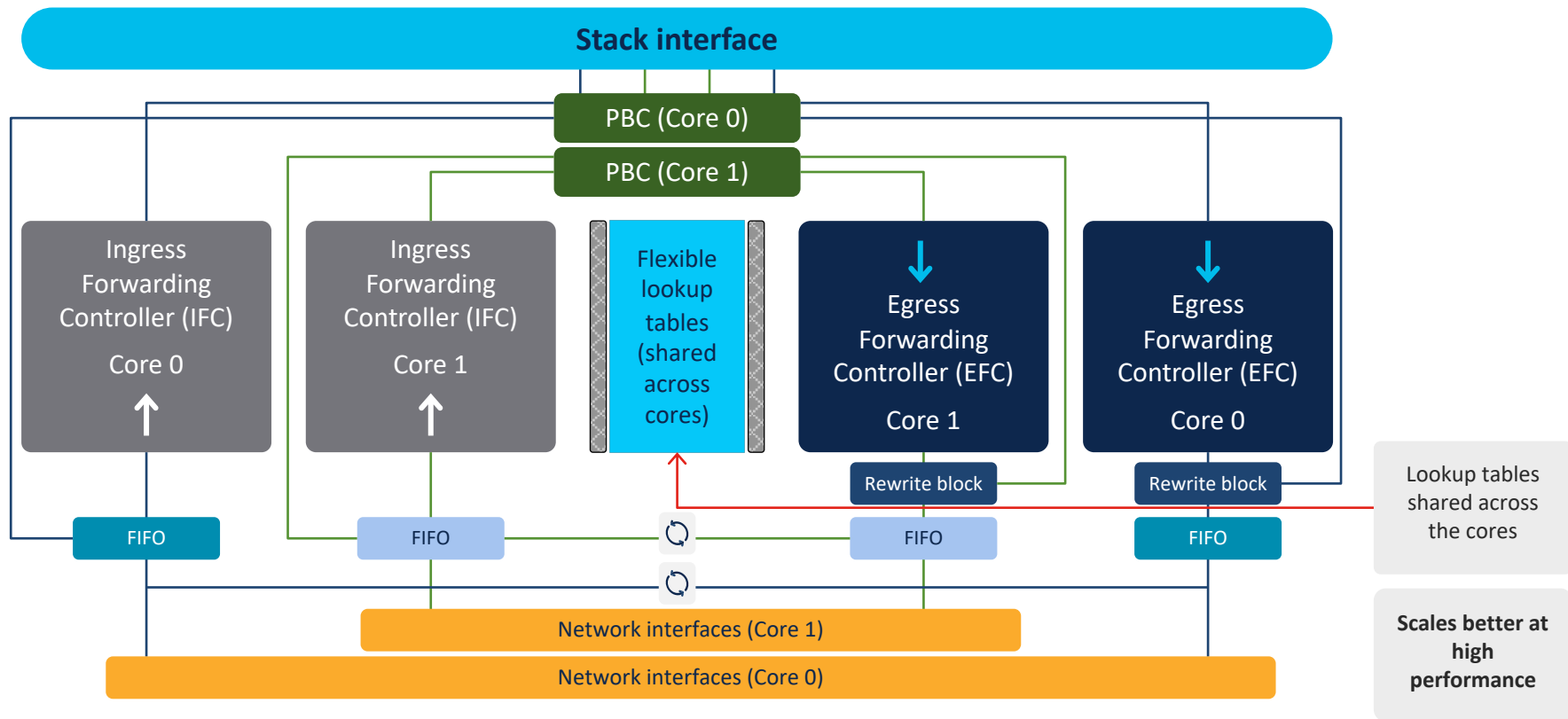
*DPP – Direct point to point.

** – Roadmap

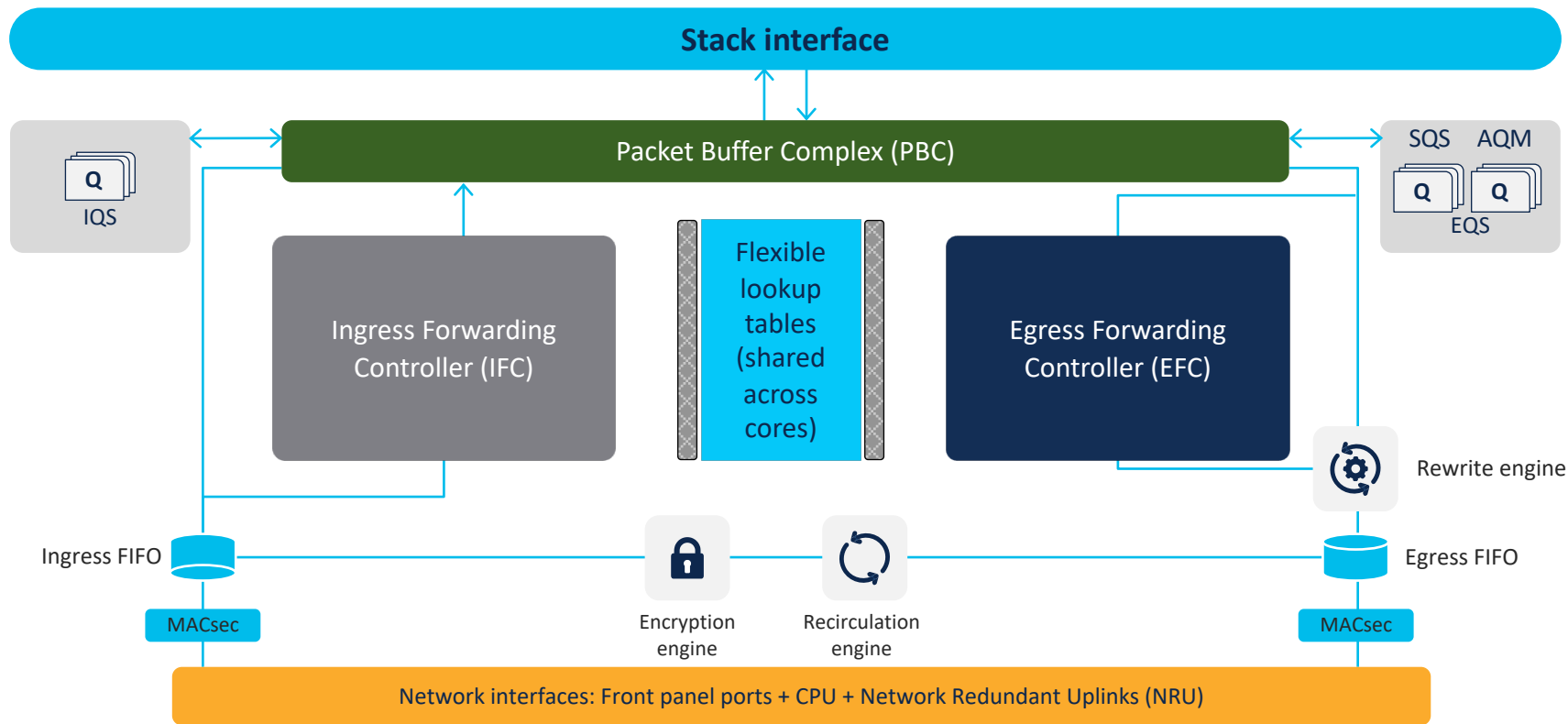
UADP 2.0 XL/3.0sec – Two cores



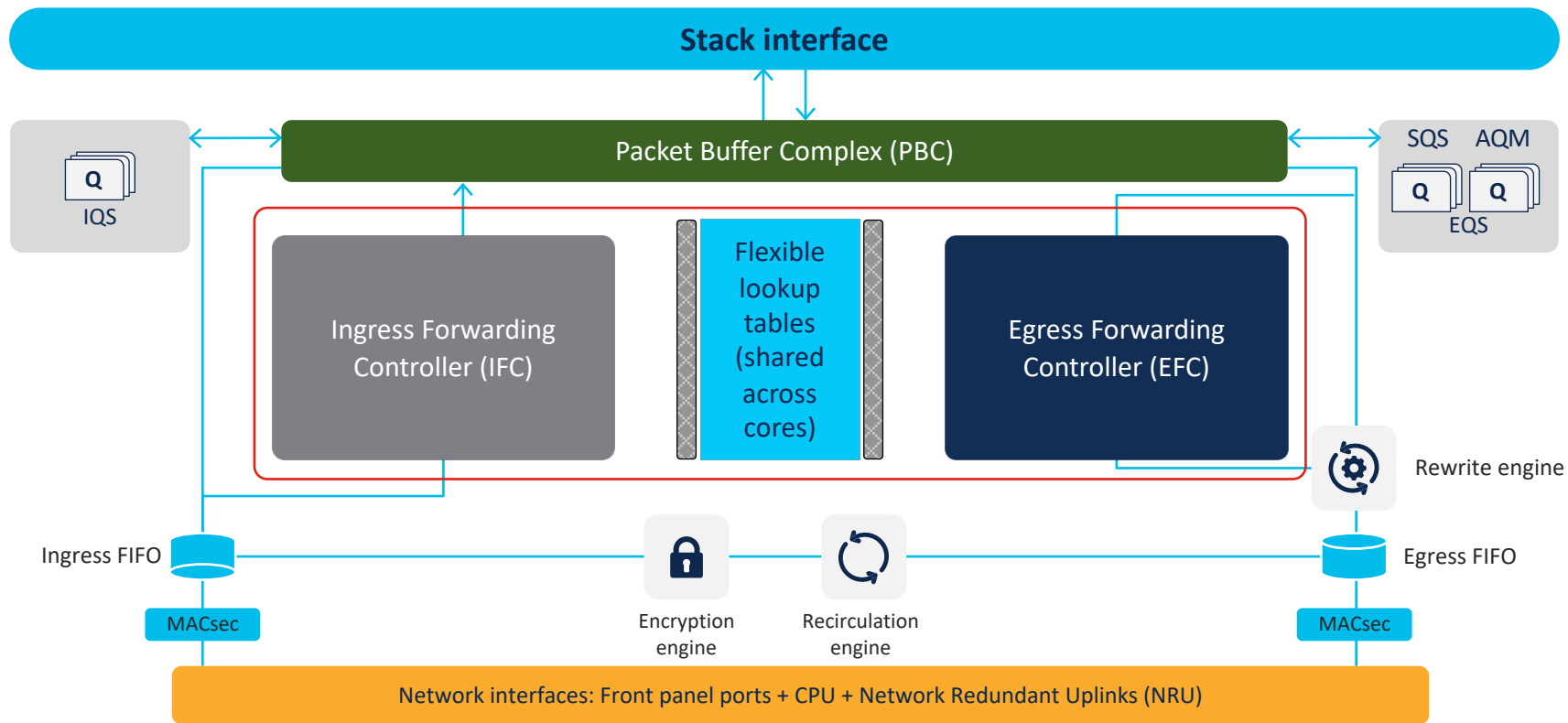
Shared lookup tables



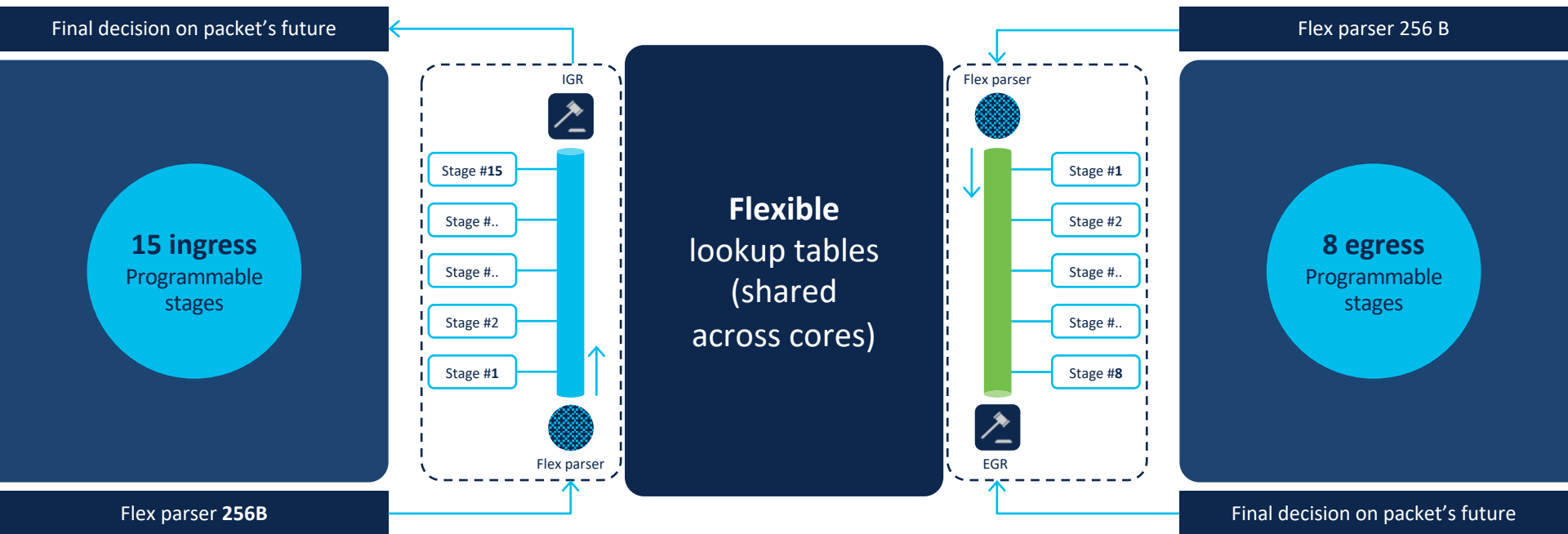
UADP 2.0 XL/3.0sec – Core architecture



UADP 2.0 XL/3.0sec – Forwarding pipelines

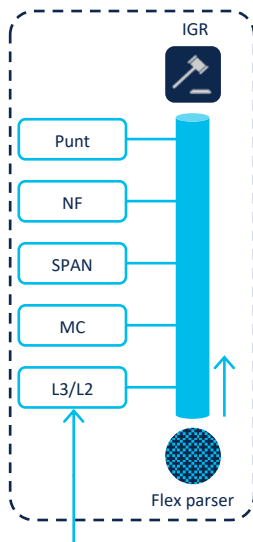


Forwarding – Under the covers



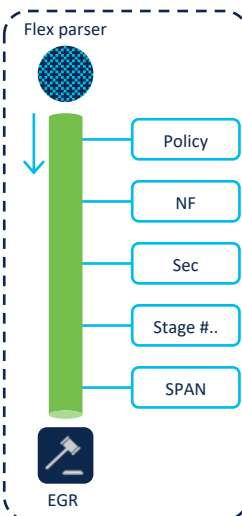
UADP 2.0 XL/3.0sec – Sample stages

15 ingress
Programmable
stages



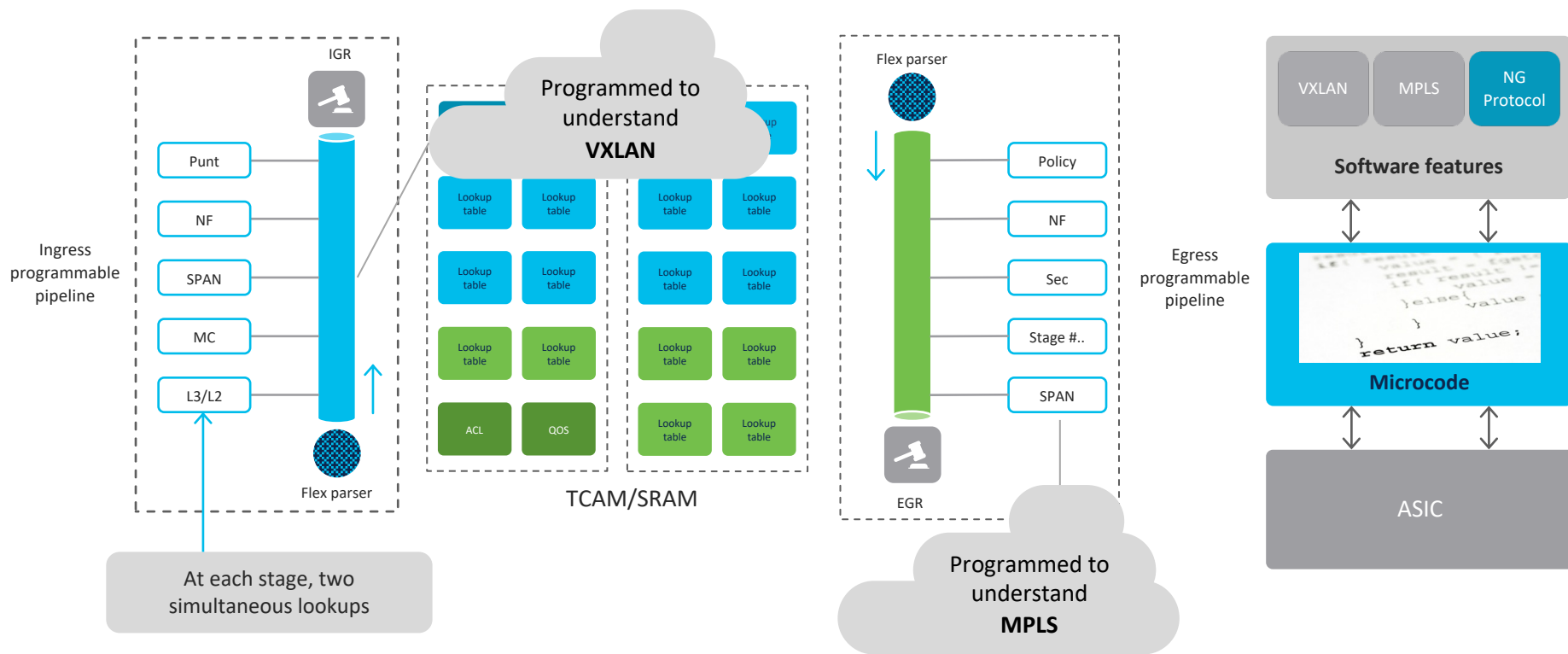
At each stage, two
simultaneous lookups

Flexible
lookup tables
(shared
across cores)

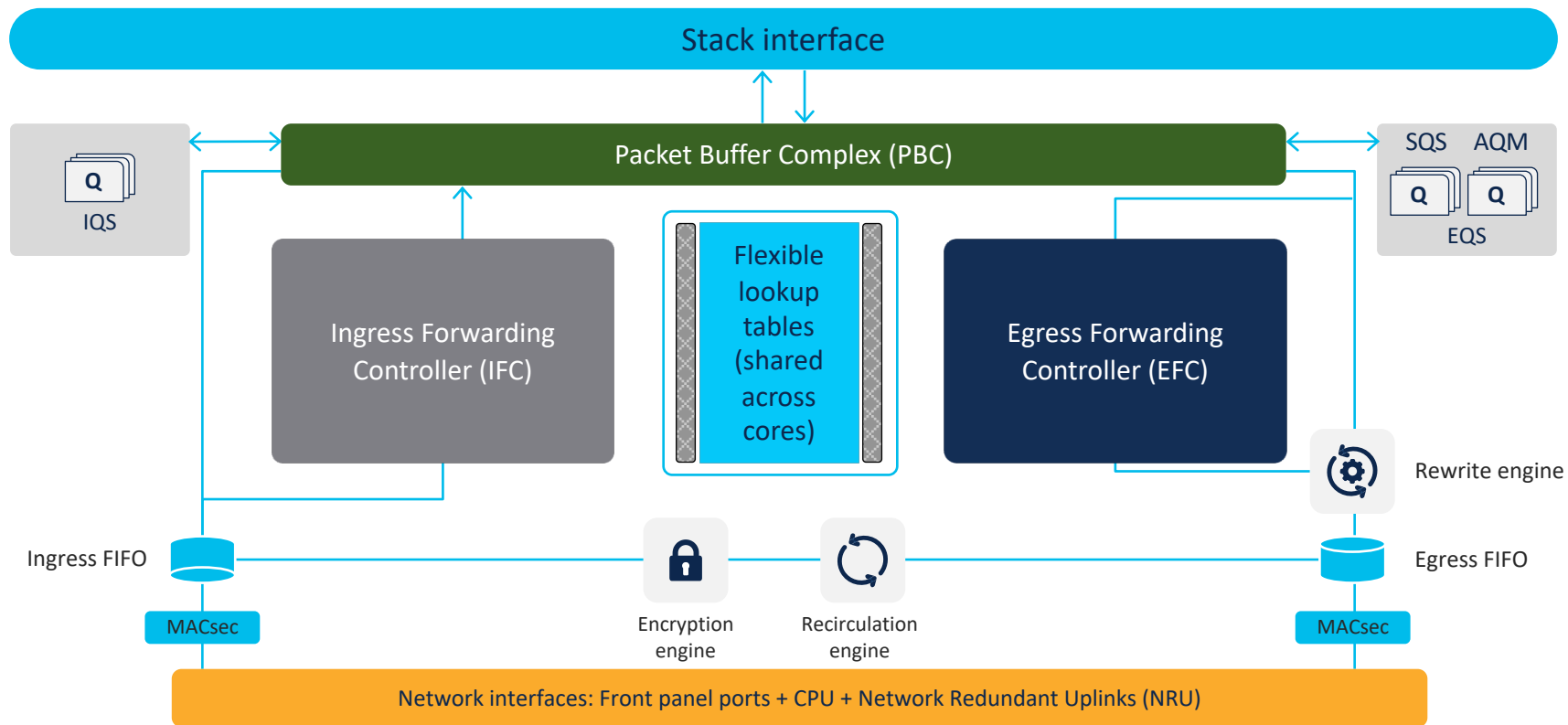


8 egress
Programmable
stages

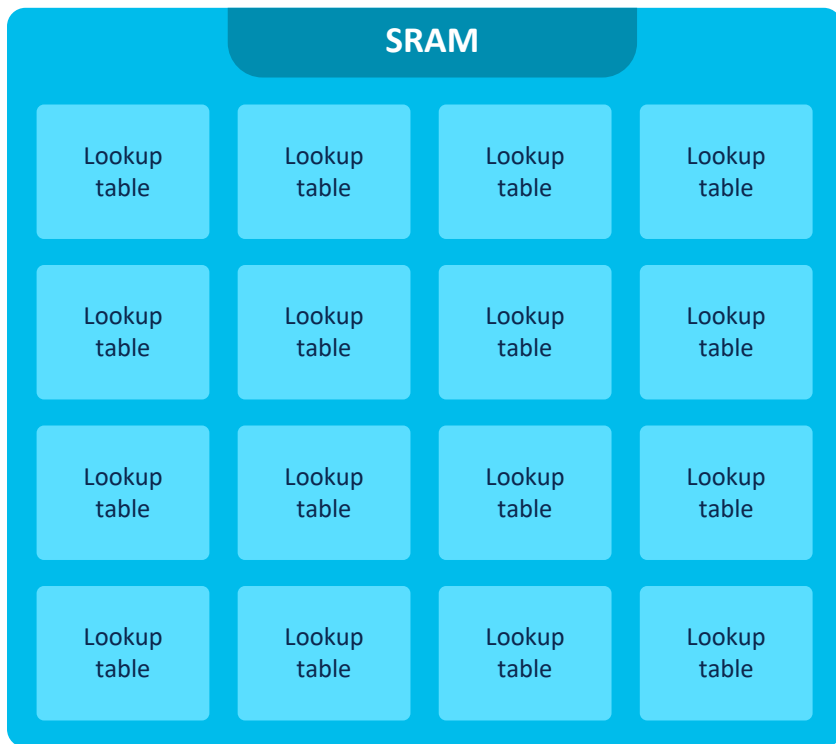
Microcode programs – UADP 2.0 XL/3.0sec



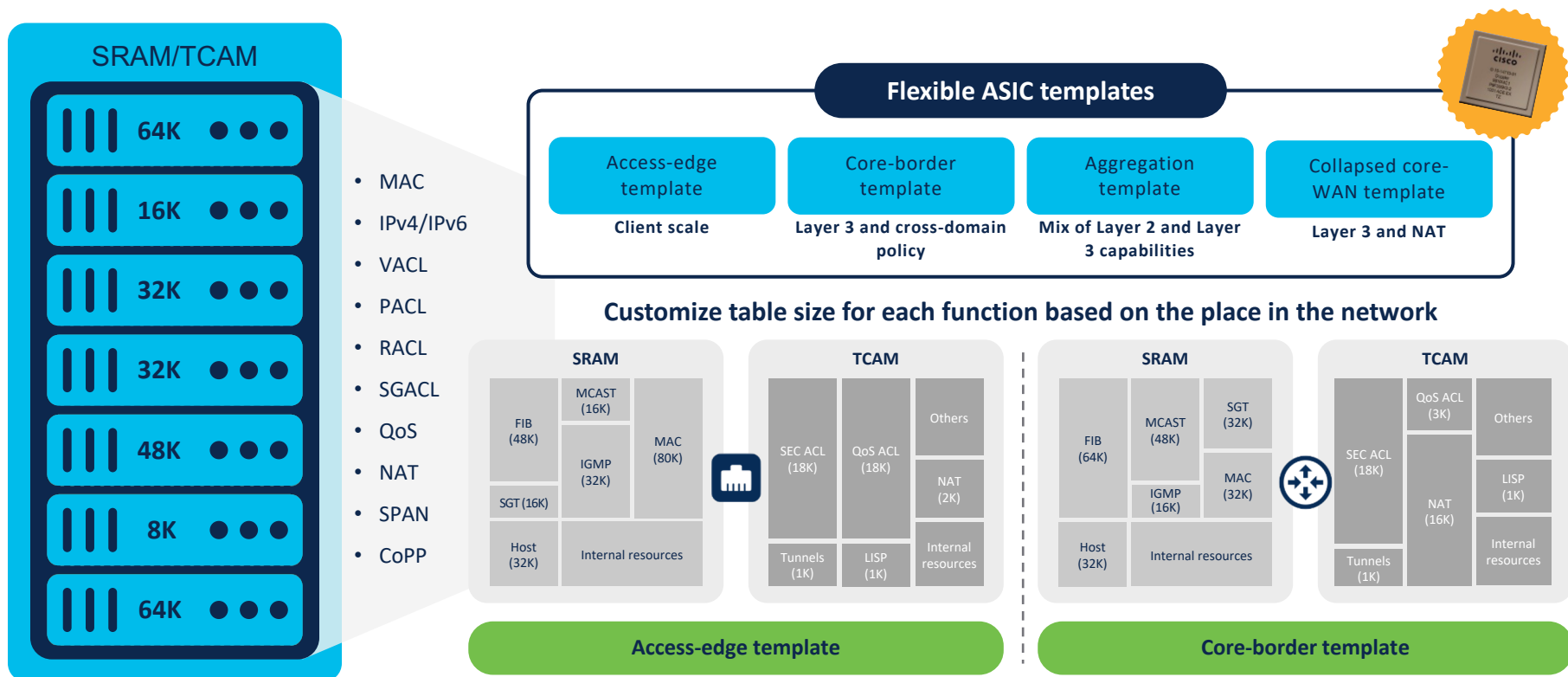
UADP 2.0 XL/3.0sec – Lookup tables



Flex tables



Custom ASIC templates for universal deployment



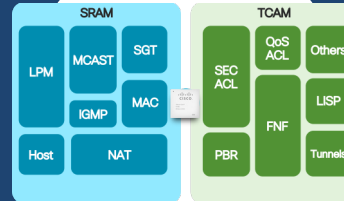
Default SDM

Access Template

Maximizes ASIC resources for **Layer 2 MACs, Hosts, L2 Unicast/Multicast, L2VPN** and **Flexible NetFlow**

Only option on 9400X prior to 17.11

User-Customizable ASIC Resources



Cisco Catalyst®
9400X

FIB Customization

Flexibly reallocate the Central Exact Match (CEM) table between MAC, Hosts, Multicast, NAT, MPLS and ACL Labels

ACL Customization

Allocate TCAM space between Security ACL, QoS, PBR and Flexible Netflow

Custom SDM

Catalyst 9400X – Custom SDM Templates

SDM templates and scale numbers

Feature (ACL) TCAM

Forwarding (FIB) Hash

IOS-XE 17.11.1

NEW

FIB

Double width fields ensures IPv4 and IPv6 have the same scale

L2 and L3 Multicast can have a total of 48K FIB Resources

Space for Some features can be disabled completely by setting scale to 0

ACL ingress and egress are split between two cores

Due to space reserved for IPsec SA table, max ACL on core 1 is 25K

Maximum Security ACL size possible is $25 + 27 = 52K$

All features need dedicated space. 0 setting is not allowed

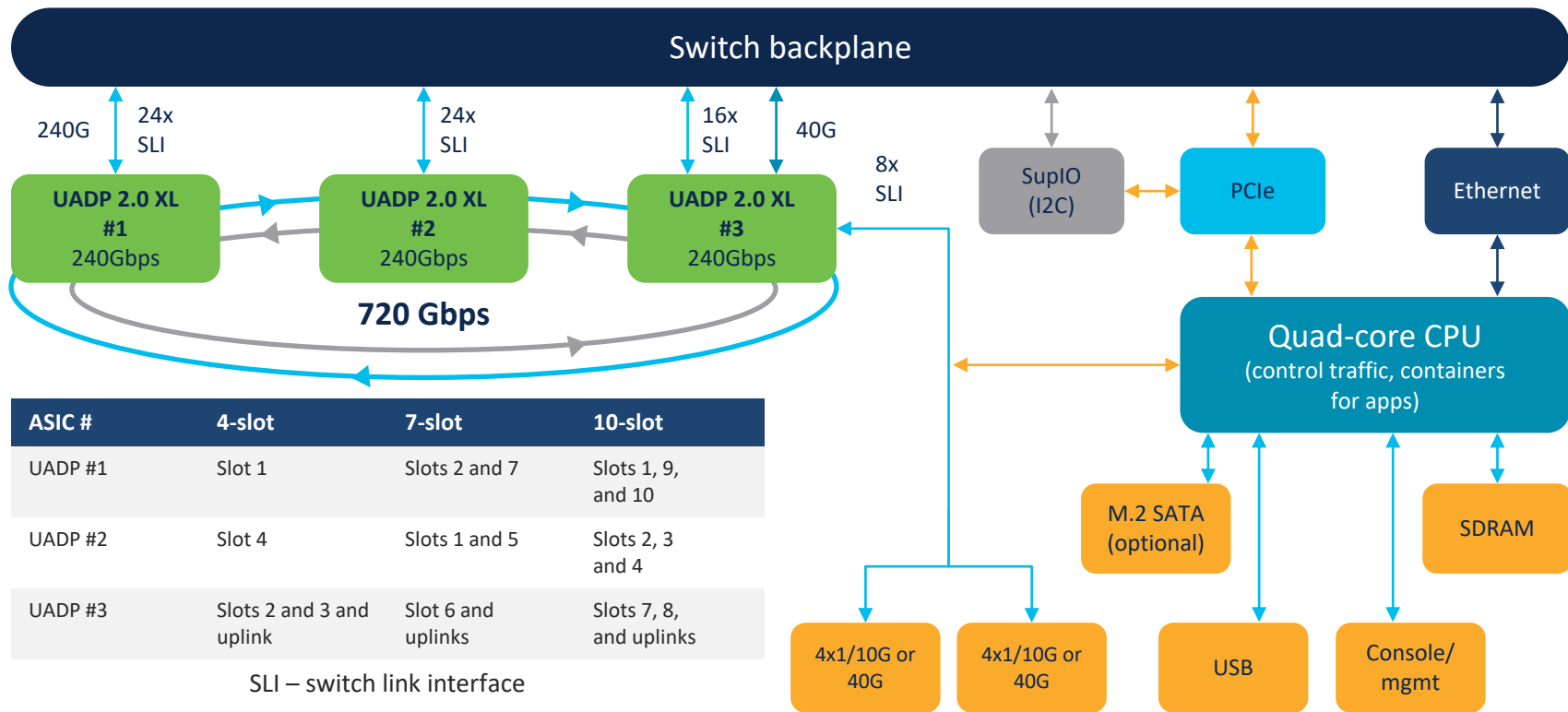
ACL TCAM

Features			Range	Access (default)	Step-Size	
Unicast routes (LPM & Host, IPv4/IPv6)			✂	64K-256K	112K	16K
MAC address entries			✂	32K-128K	64K	16K
L2 Multicast groups			✂	0-32K	16K	16K
L3 Multicast routes (IPv4/IPv6)			✂	0-32K	16K	16K
Flexible NetFlow	Ingress	✂	0-64K	32K	32K	
	Egress	✂	0-64K	0	32K	
SGT, MPLS			✂	0-64K total	32K SGT, 16K MPLS	32K
Total FIB Resources - 416K						
Security ACL	Ingress	✂	4K-27K	10K	2K	
	Egress	✂	4K-27K	16K	2K	
NetFlow ACL	Ingress	✂	1K-2K	1K	1K	
	Egress	✂	1K-2K	1K	1K	
LISP			✂	1K-2K	2K	1K
PBR/NAT (per direction)			✂	1K, 2K-16K	2K	2K
Tunnels (Termination)			✂	1K-3K	1K	1K
SPAN	Ingress		0.5K		Not Customizable	
	Egress		0.5K		Not Customizable	
CPP			0.5K		Not Customizable	
IPsec			1K		Not Customizable	
MACsec SPD			0.25K		Not Customizable	
Total ACL Resources - 54K						

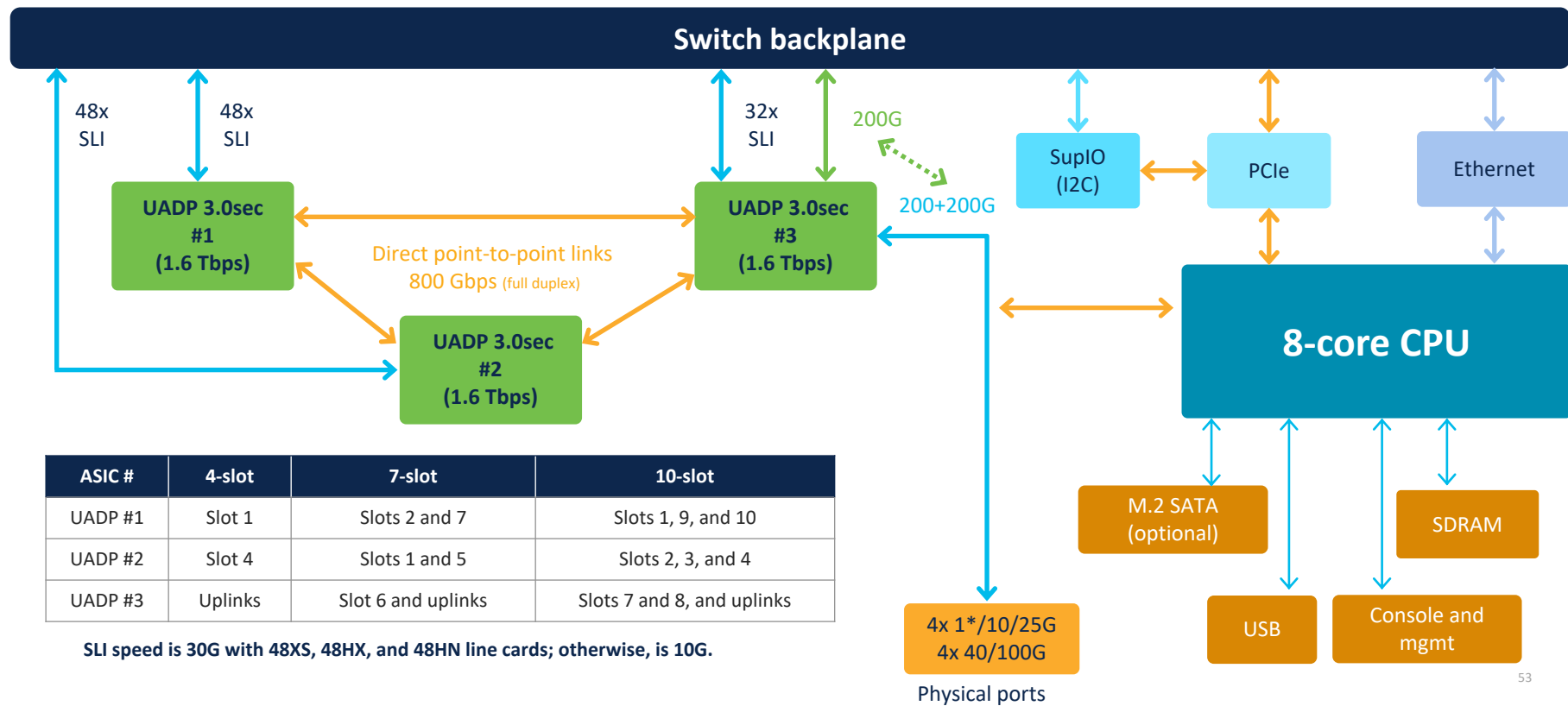


Customizable Resources

Catalyst 9400 Sup-1/1XL/1XL-Y block diagram



SUP-2/2XL block diagram



* With supported transceiver SFP-1G-LH & SFP-1G-SX (17.9.6, 17.12.4 & 17.15.1)

Port-to-ASIC mapping

```
switch# show platform software fed active ifm mappings lpn
```

Mappings Table

LPN	ASIC	Port	Interface	IF_ID	Active
1	1	0	GigabitEthernet1/0/1	0x000000c6	Y
<SNIP>					
48	1	47	GigabitEthernet1/0/48	0x00000036	Y
1	0	0	GigabitEthernet2/0/1	0x00000037	Y
<SNIP>					
48	0	47	GigabitEthernet2/0/48	0x000000c5	Y
1	2	17	TenGigabitEthernet3/0/1	0x00000067	Y
<SNIP>					
8	2	10	TenGigabitEthernet3/0/8	0x0000006e	Y
9	2	18	FortyGigabitEthernet3/0/9	0x0000006f	Y
10	2	19	FortyGigabitEthernet3/0/10	0x00000070	Y
1	2	3	TenGigabitEthernet4/0/1	0x00000071	Y
<SNIP>					
8	2	4	TenGigabitEthernet4/0/8	0x00000078	Y
9	2	8	FortyGigabitEthernet4/0/9	0x00000079	Y
10	2	9	FortyGigabitEthernet4/0/10	0x0000007a	Y
1	1	0	TenGigabitEthernet5/0/1	0x0000007b	Y
<SNIP>					
24	1	23	TenGigabitEthernet5/0/24	0x00000092	Y
1	2	24	GigabitEthernet6/0/1	0x00000093	Y
<SNIP>					
24	2	69	GigabitEthernet6/0/24	0x000000aa	Y
25	2	30	TenGigabitEthernet6/0/25	0x000000ab	Y
<SNIP>					
48	2	63	TenGigabitEthernet6/0/48	0x000000c2	Y

switch#

Cisco® Catalyst® 9407R

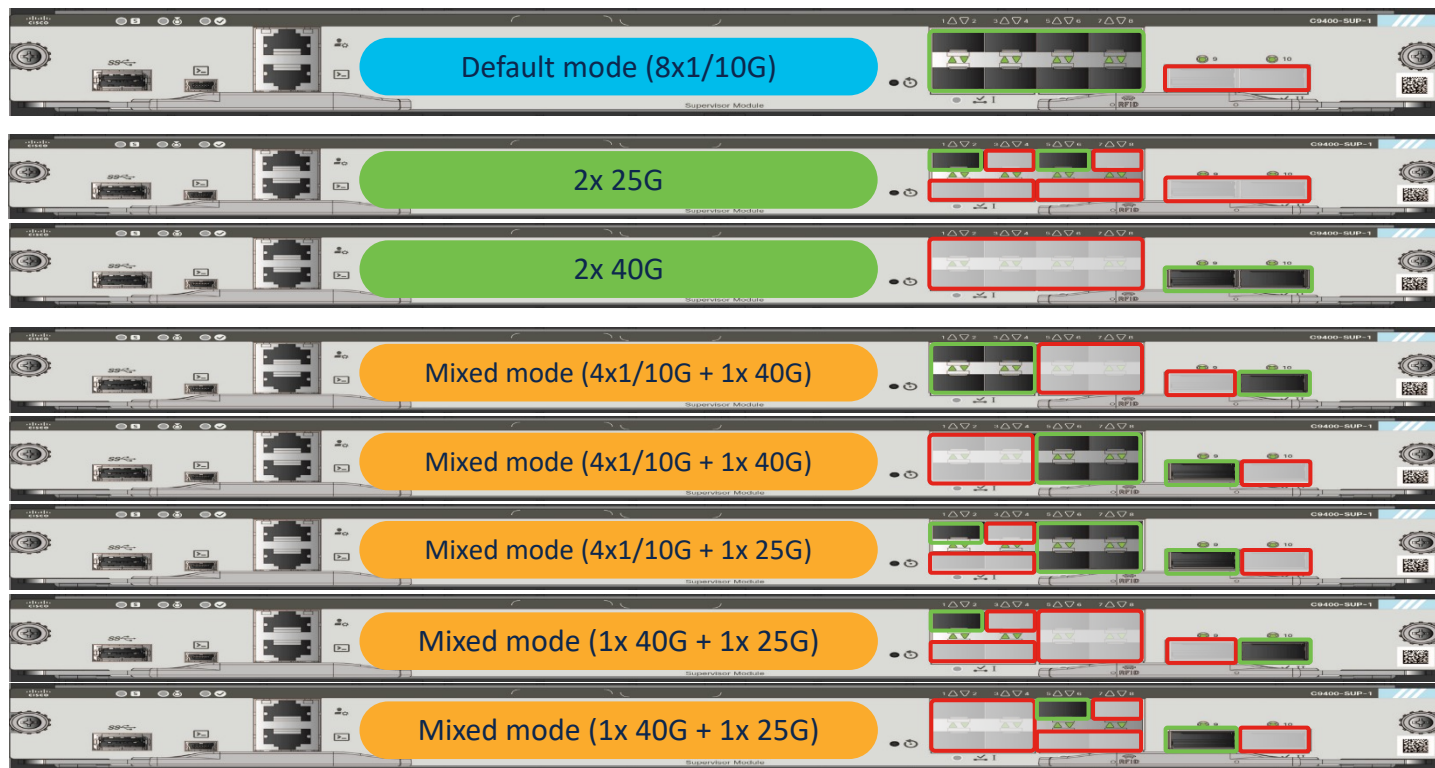
Mod Card type

-
- 1 48-port UPOE 10/100/1000 (RJ-45)
 - 2 48-port 10/100/1000 (RJ-45)
 - 3 Supervisor 1 module
 - 4 Supervisor 1 module
 - 5 24-port 10 Gigabit Ethernet (SFP+)
 - 6 48-port UPOE w/24p Multigigabit 24p RJ-45

SUP-1, SUP-1XL and 1XL-Y Uplinks

Single Supervisor – Port Combinations

Max Uplink
Bandwidth
80Gbps

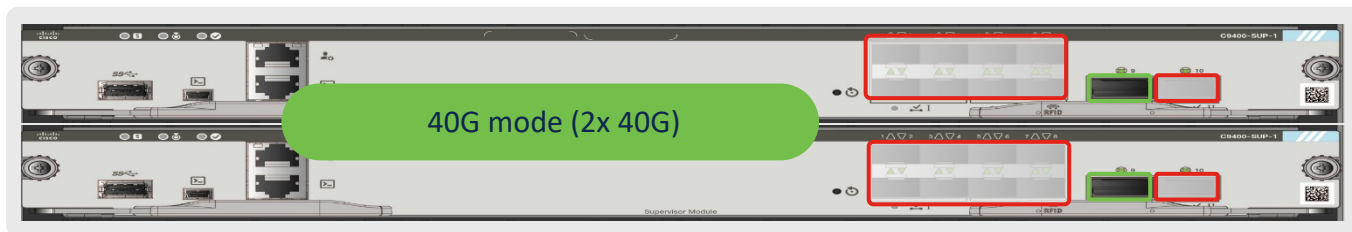
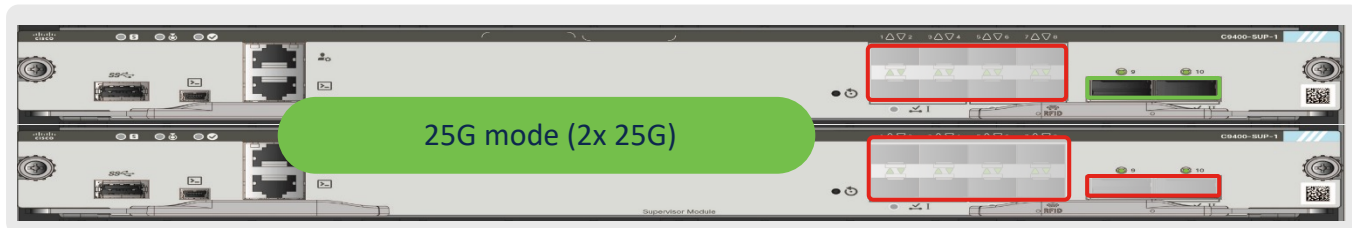
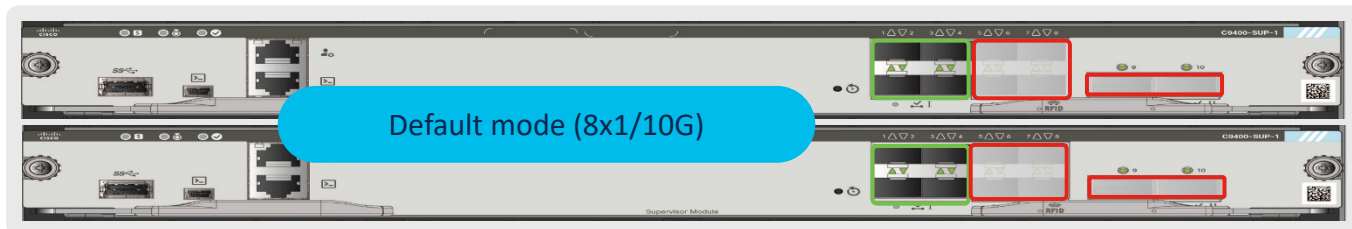


□ Active □ Disabled

SUP-1, SUP-1XL and 1XL-Y Uplinks

Dual Supervisors – Port Combinations (Symmetric)

Max Uplink
Bandwidth
80Gbps



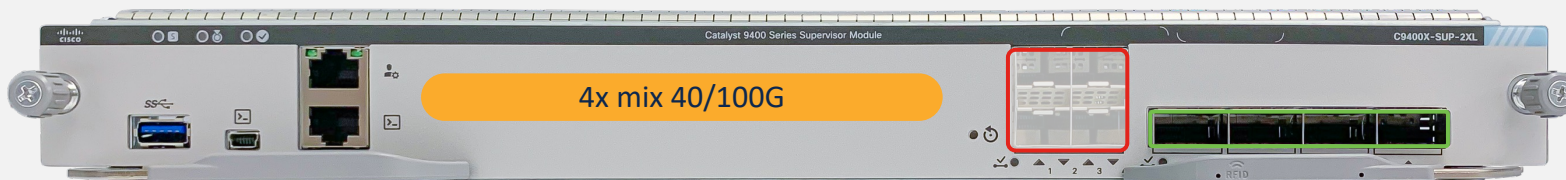
□ Active □ Disabled

SUP-2 and SUP-2XL Uplinks

Single Supervisor – Port Combinations

Max Uplink
Bandwidth
400Gbps

Allows different port speed combinations

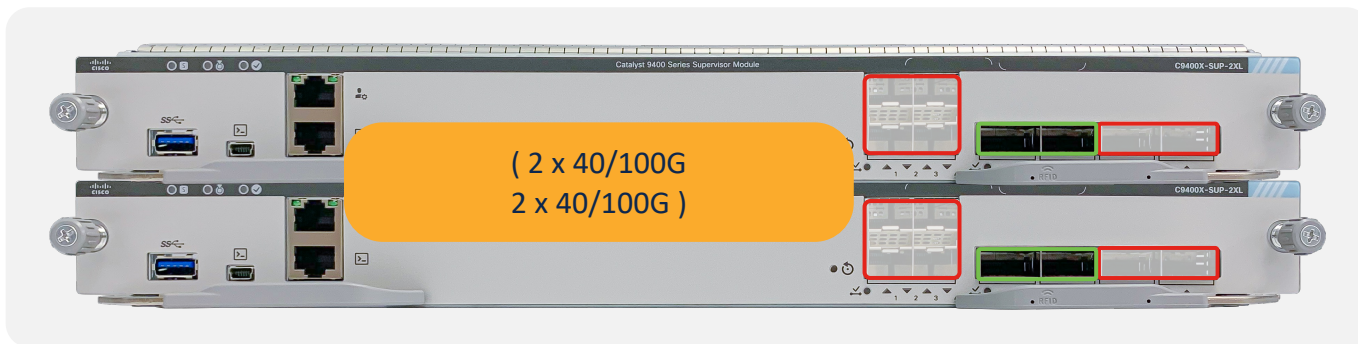
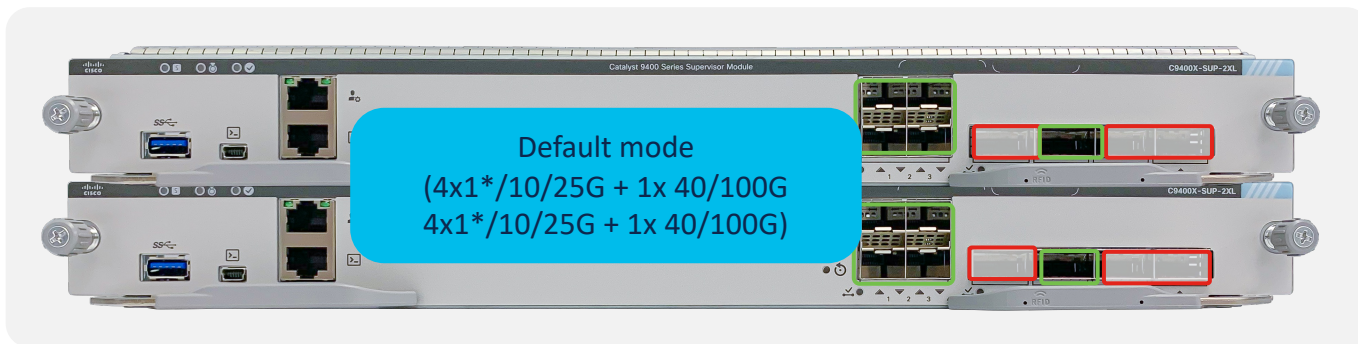


☒ Active ☐ Disabled

SUP-2 and SUP-2XL Uplinks

Dual Supervisors – Port Combinations (Symmetric)

Max Uplink
Bandwidth
400Gbps



□ Active □ Disabled

* With supported transceiver SFP-1G-LH & SFP-1G-SX (17.9.6, 17.12.4 & 17.15.1)

C9400X-SUP-2/2XL -1G support with transceivers

1G support for SUP2/2XL Uplinks

NEW

General Availability: 17.15.1/17.12.4



C9400X-SUP-2



C9400X-SUP-2XL



SFP-1G-LH



SFP-1G-SX

Works in 10/25 ports only
Interoperates with 1G only
(Available in CCW now)

[Cisco 1G Optics Data Sheet](#)

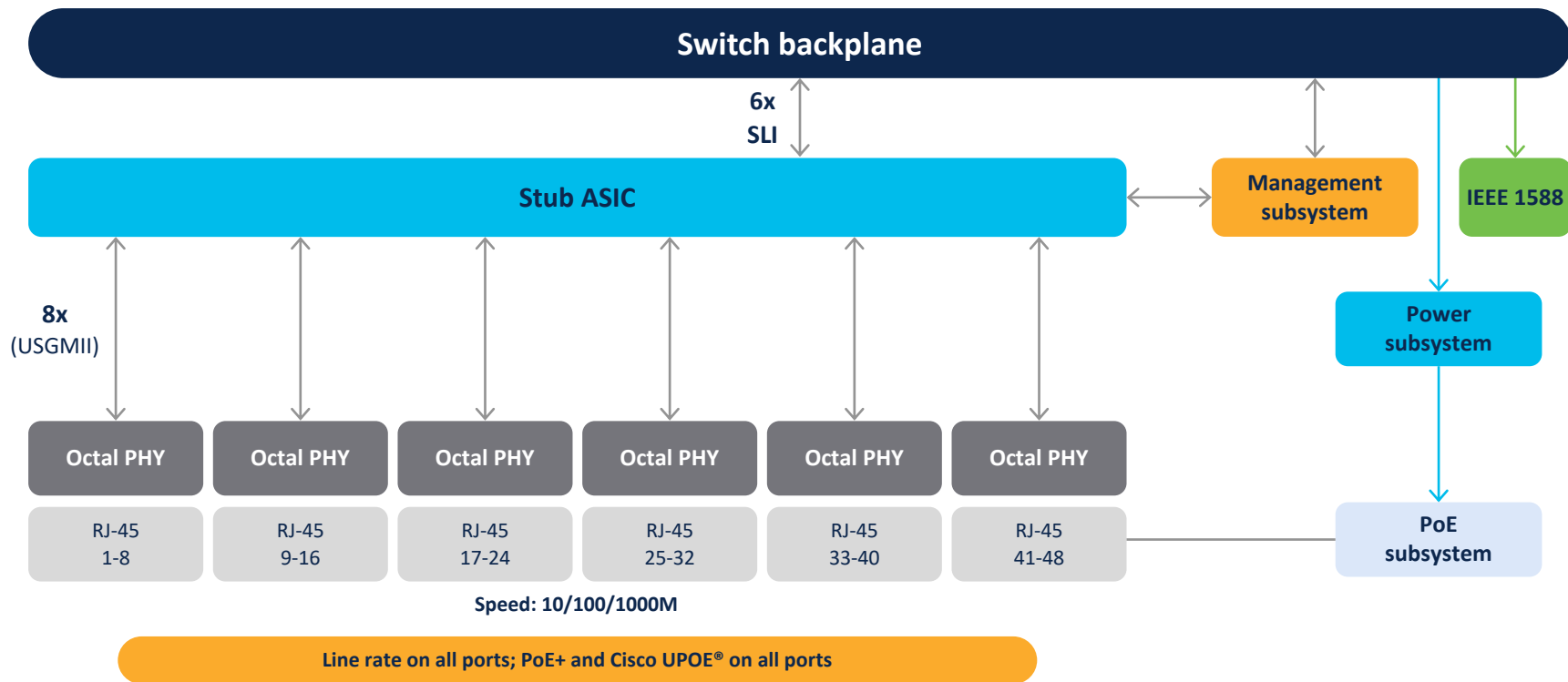
Built-in PHY in special SFP converts 10G -> 1G



Existing GLC/SFP 1G will NOT work with SUP-2/2XL Uplink ports

Only supported on native SFP 10/25 ports. Not supported on QSFP ports using QSA/breakout

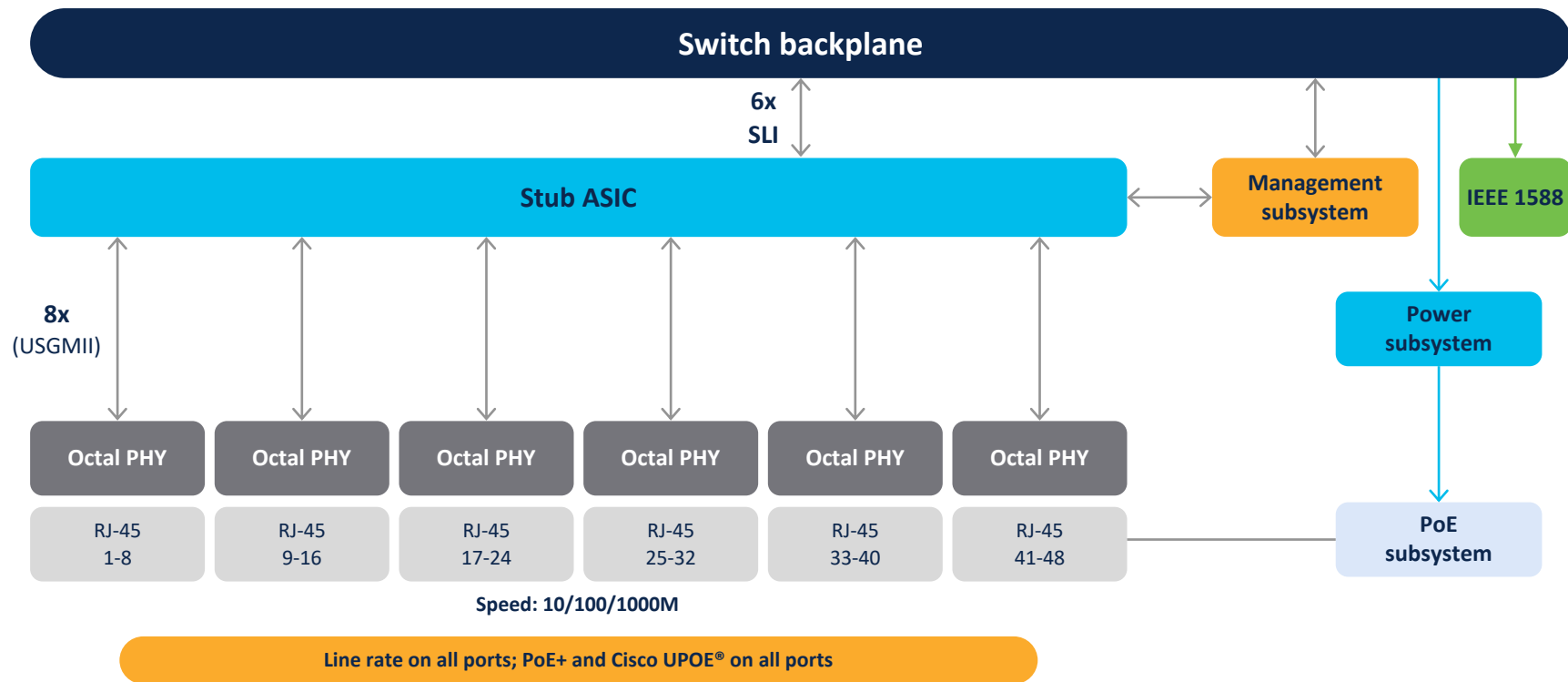
SUP-1/1XL – 48x 1G C9400-LC-48/U/H (PoE+, Cisco UPOE, UPOE+/802.3bt)



SLI – Switch Link Interfaces ~ 10 Gbps

SUP-2/2XL – 48x 1G C9400-LC-48/U/H

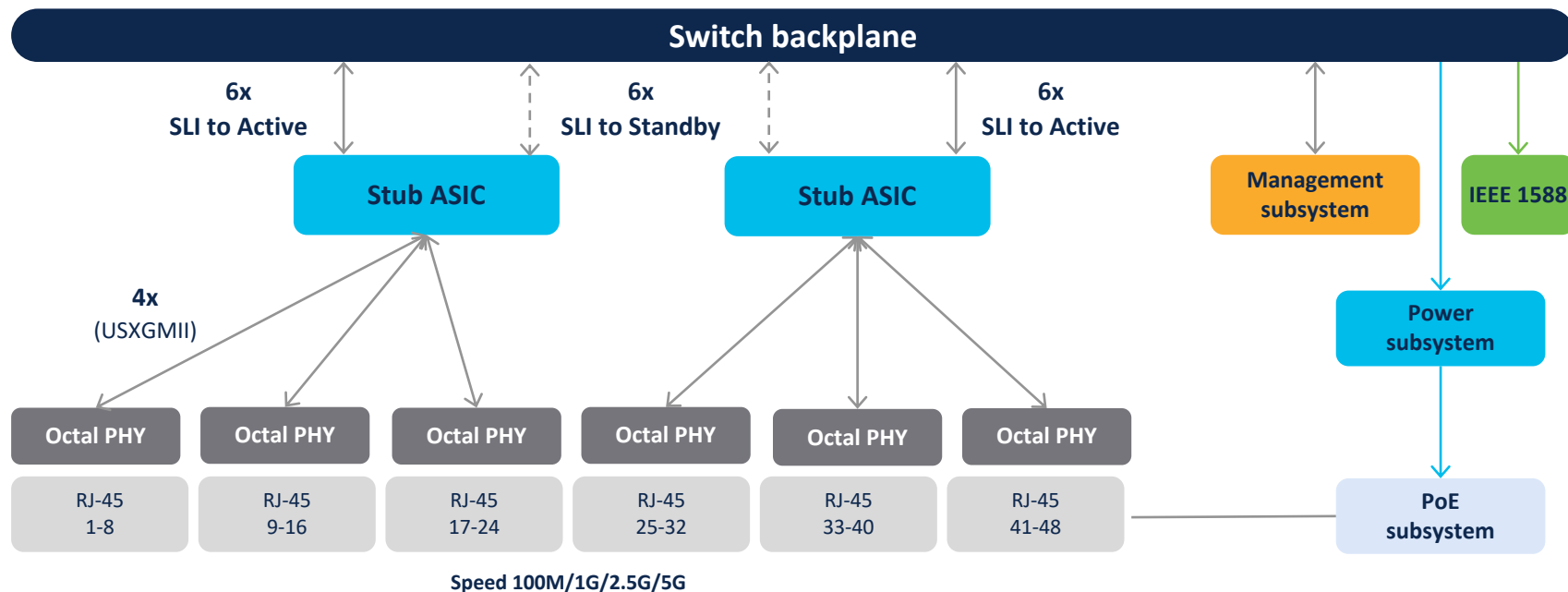
PoE+, Cisco UPOE, UPOE+/802.3bt



SLI – Switch Link Interfaces ~ 10 Gbps

SUP-1/1XL – 48x 5G C9400-LC-48HN

PoE+, Cisco UPOE, UPOE+/802.3bt



SUP-1: 8 SLIs are active with 9410R, 9407R, and 9404R (80G per slot)
SUP-1XL: 8 SLIs are active with 9410R (80G per slot); 12 SLIs are active with 9407R and 9404R (120G per slot)

SLI – Switch Link Interfaces ~ 10 Gbps

SUP-1/1XL – C9400-LC-48HN port groups – 7-slot chassis

```
C9407R#show platform hardware iomd 6/0 portgroups
```

Port Group	Interface	Status	Interface Bandwidth	Group Max
1	FiveGigabitEthernet6/0/1	up	5G	10G
1	FiveGigabitEthernet6/0/2	up	5G	
1	FiveGigabitEthernet6/0/3	up	5G	
1	FiveGigabitEthernet6/0/4	up	5G	
2	FiveGigabitEthernet6/0/5	up	5G	10G
2	FiveGigabitEthernet6/0/6	up	5G	
2	FiveGigabitEthernet2/0/7	up	5G	
2	FiveGigabitEthernet2/0/8	up	5G	
3	FiveGigabitEthernet2/0/9	up	5G	10G
3	FiveGigabitEthernet2/0/10	up	5G	
3	FiveGigabitEthernet2/0/11	up	5G	
3	FiveGigabitEthernet2/0/12	up	5G	

<SNIP>

- 10G bandwidth shared within port group
- 12 port groups in the 4- and 7-slot chassis
- Performance mode is not supported

SUP-1/1XL – C9400-LC-48HN port groups – 10-slot chassis

```
C9410R#show platform hardware iomd 2/0 portgroups
```

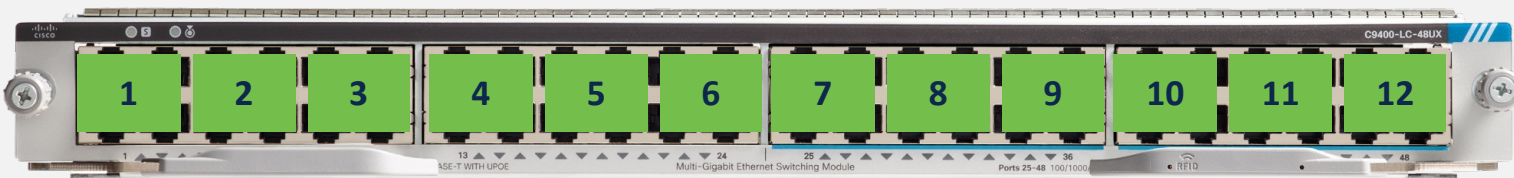
Port Group	Interface	Status	Interface Bandwidth	Group Max Bandwidth
1	FiveGigabitEthernet2/0/1	up	5G	
1	FiveGigabitEthernet2/0/2	up	5G	
1	FiveGigabitEthernet2/0/3	up	5G	
1	FiveGigabitEthernet2/0/4	up	5G	10G
1	FiveGigabitEthernet2/0/5	up	5G	
1	FiveGigabitEthernet2/0/6	up	5G	
2	FiveGigabitEthernet2/0/7	up	5G	
2	FiveGigabitEthernet2/0/8	up	5G	
2	FiveGigabitEthernet2/0/9	up	5G	
2	FiveGigabitEthernet2/0/10	up	5G	10G
2	FiveGigabitEthernet2/0/11	up	5G	
2	FiveGigabitEthernet2/0/12	up	5G	

<SNIP>

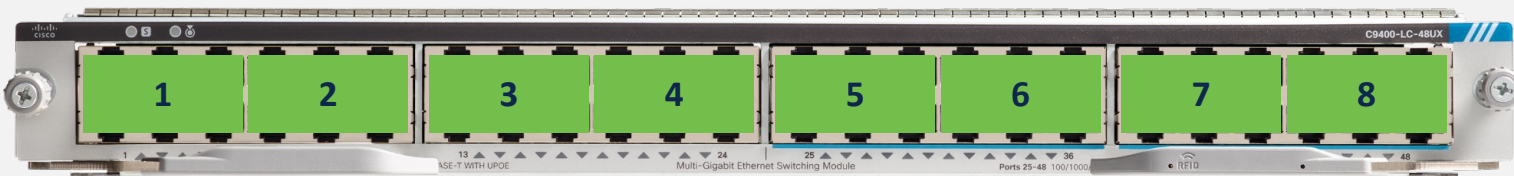
- 10G bandwidth shared within port group
- 8 port groups in the 10-slot chassis
- Performance mode is not supported

SUP-1/1XL – C9400-LC-48HN port groups

4- and 7-slot chassis: 12 port groups

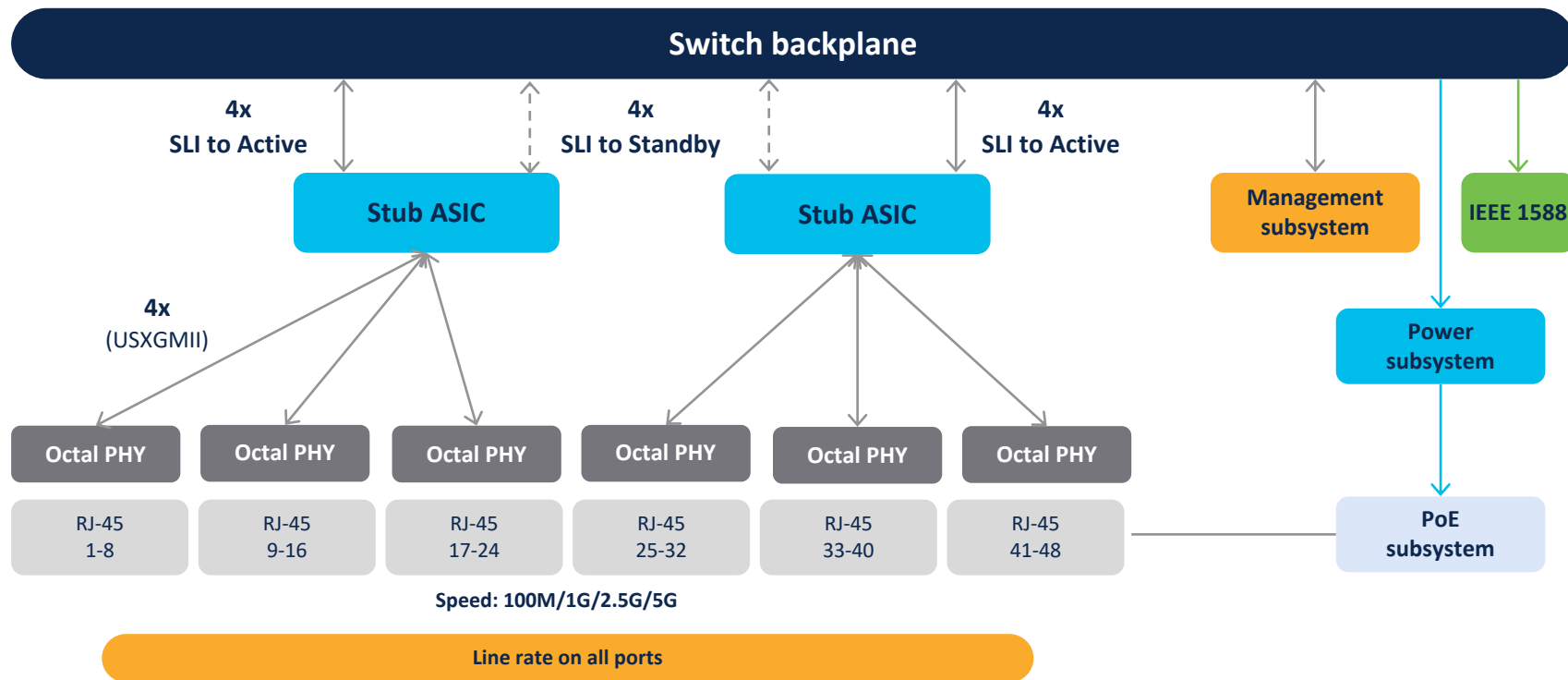


10-slot chassis: 8 port groups



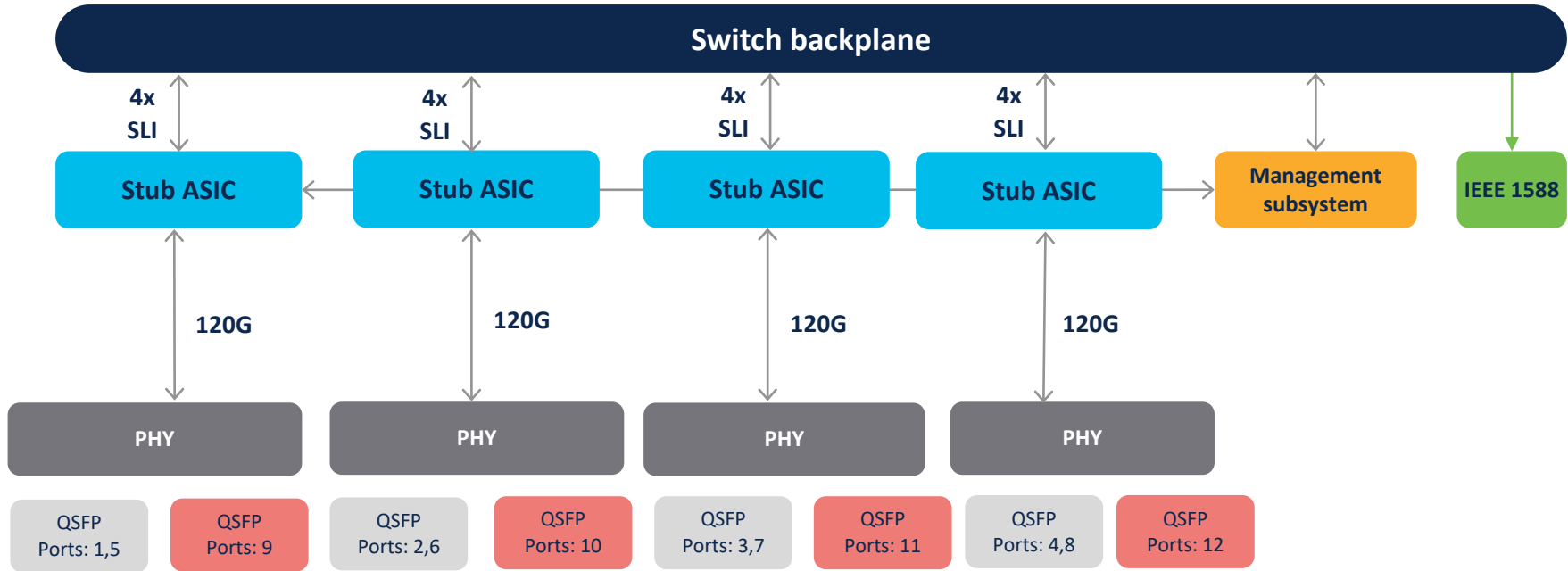
SUP-2/2XL – 48x 5G C9400-LC-48HN

PoE+, Cisco UPOE, UPOE+/802.3bt



SLI – Switch Link Interface ~ 30 Gbps

SUP-2/2XL – 12 Port 40G/100G – 9400-LC-12QC

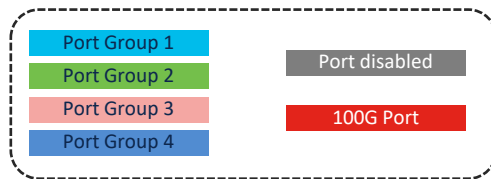


- Oversubscribed (2:1) if all ports active with SUP2 (default mode)

SLI – Switch Link Interfaces ~ 30 Gbps

C9400-LC-12QC

12-port 40G/100G Gen2 Line Card – Port-Groups & Modes



Default Mode – 12 x40G

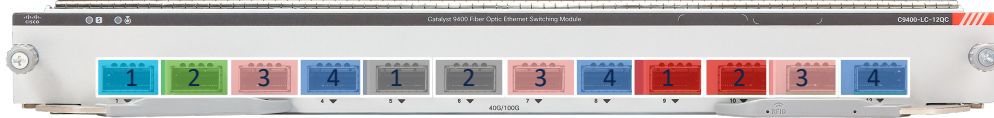


12x40G - all port groups active

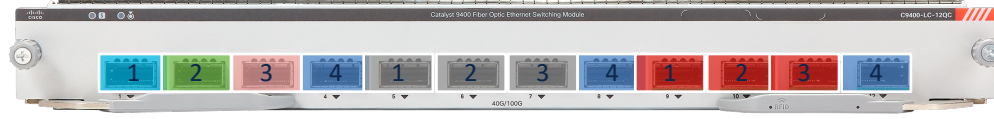
Configurable Mode – 100G+40G



1 port active at 100G, 40G port in group 1 disabled

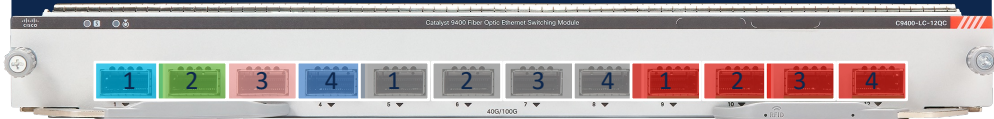


2 ports active at 100G, 2 40G ports disabled



3 ports active at 100G, 3 40G ports disabled

Configurable Mode with 4x100G + 4x40G (Oversubscribed):



Default 100G mode: All active ports oversubscribed fairly

C9400-LC-12QC

12-port 40G/100G Gen2 Line Card

- **12 x QSFP28 ports**

- 12 x 40Gbps (default)
- Up to 4 x 100Gbps + 4 x 40Gbps
- Use CLI **"enable mode 100G"** on ports 9-12

- **480Gbps with SUP2XL - 240Gbps with SUP2**

- Oversubscribed (2:1) if all ports active (SUP2) (default)

- **100G Performance Mode (SUP2XL Only) :**

- CLI Config for Line Rate 100G*
- Or disable 40G ports, when using 100G

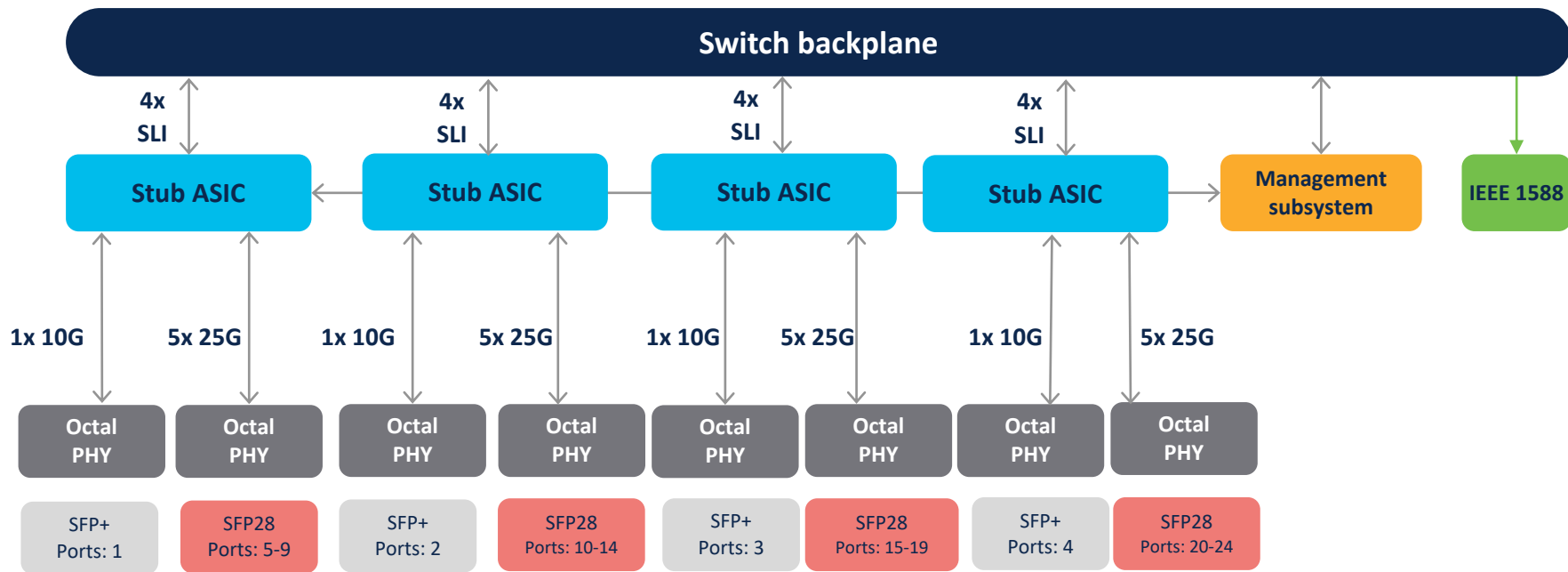
- **Operating Modes:**

- 12x 40G (Default)
- 4x 100G + 4x 40G (1.16:1 oversubscription)



* Roadmap

SUP-2/2XL – 10G/25G Fiber -9400-LC-24XY



- Oversubscribed (1.125:1) if all ports active with SUP2XL
- Oversubscribed (2.25 :1) if all ports active with SUP2

SLI – Switch Link Interfaces ~ 30 Gbps

C9400-LC-24XY

20x 25G + 4x 10G Gen2 Line Card – Port-Groups & Modes

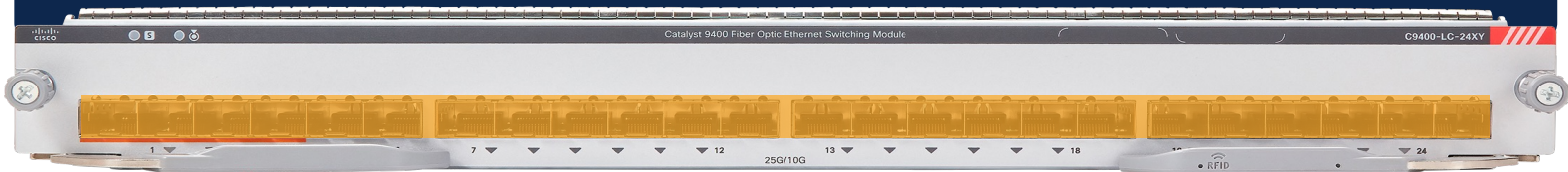
- Port Group 1
- Port Group 2
- Port Group 3
- Port Group 4

Port disabled

10G Port

* Any 2 or 4 ports

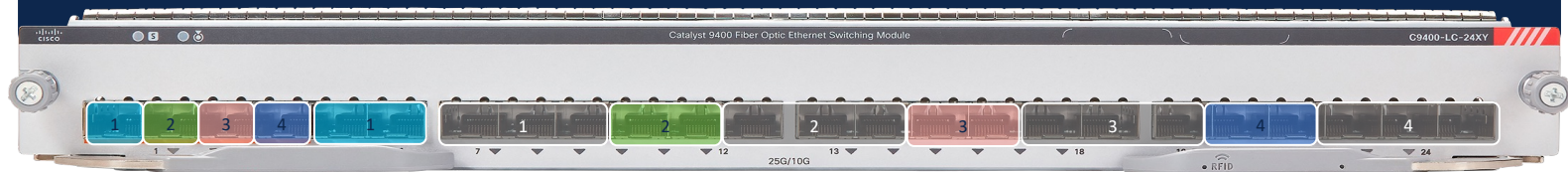
Default Mode – 24x 10G Line Rate



SUP 2 (240G/slot)- 1x 10G + 2x25 Gig from each port group *

4x 10G + 8x 25G Ports Line Rate

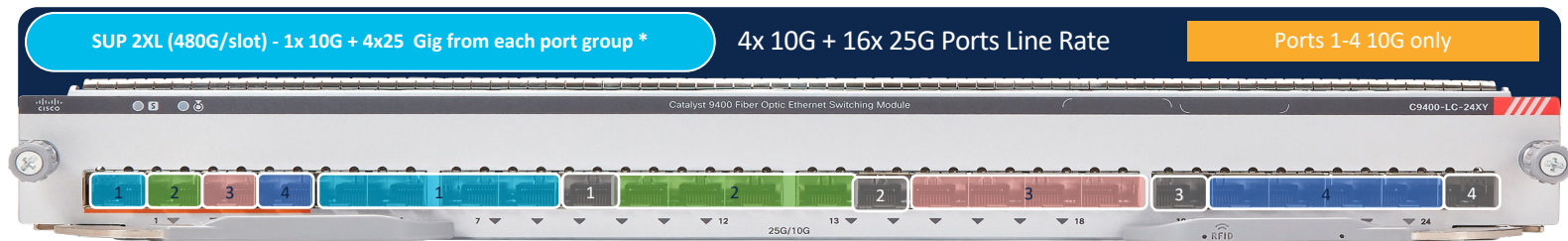
Ports 1-4 10G only



SUP 2XL (480G/slot) - 1x 10G + 4x25 Gig from each port group *

4x 10G + 16x 25G Ports Line Rate

Ports 1-4 10G only



C9400-LC-24XY

20x 25G + 4x 10G Gen2 Line Card

- **24 x SFP28 ports**

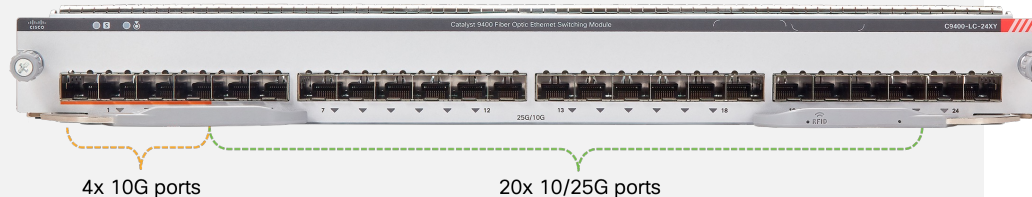
- 20 x 25Gbps + 4 x 10Gbps
- Optics: SFP, SFP+, SFP28
- 6 Ports (5x 25G + 1x 10G) per Stub ASIC

- **480Gbps with SUP2XL - 240Gbps with SUP2**

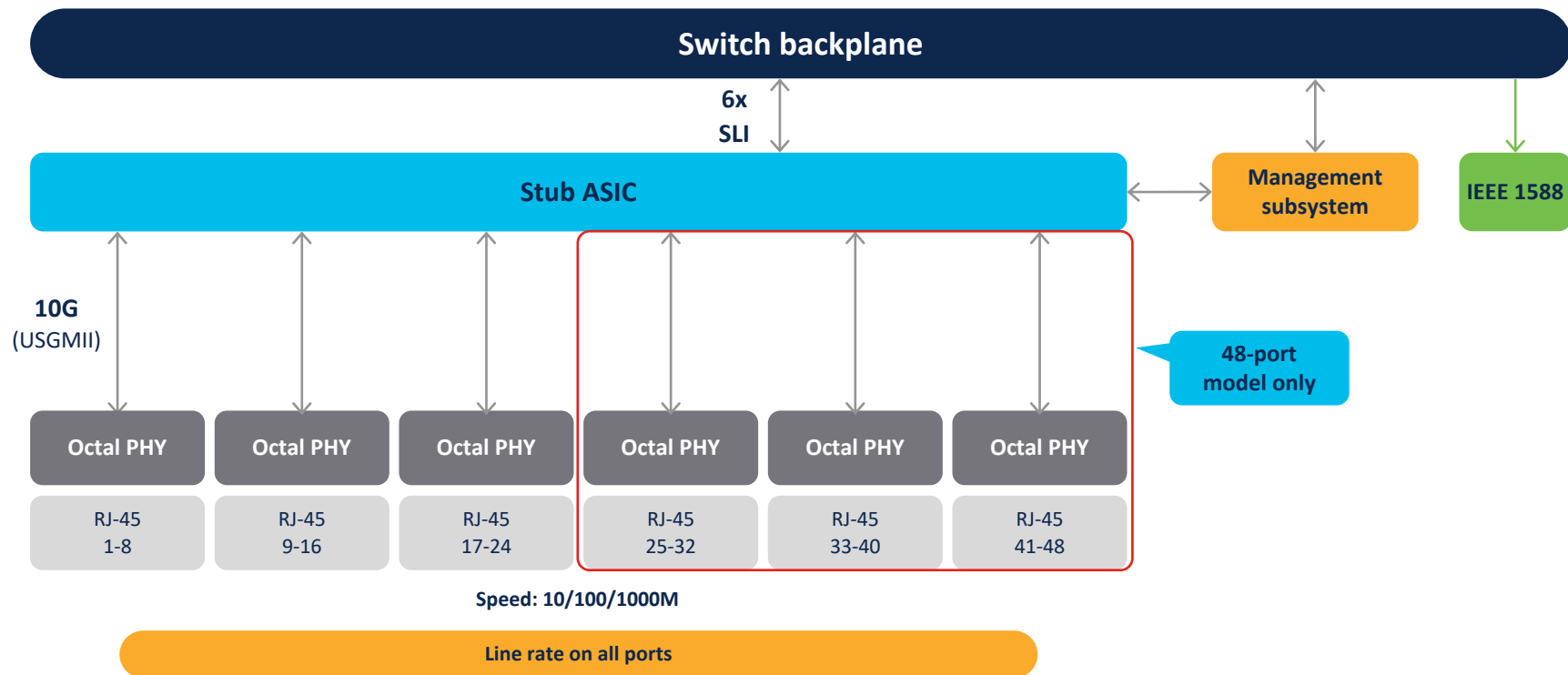
- Oversubscribed (1.125:1) if all ports active (SUP2XL)
- Oversubscribed (2.25 :1) if all ports active (SUP2)
- No performance mode

- **Operating Modes for Line Rate:**

- 24 x 10G Line rate
- SUP2XL - any 4x 25G + 1x 10G ports per Stub ASIC
- SUP2 - any 2x 25G + 1x 10G ports per Stub ASIC

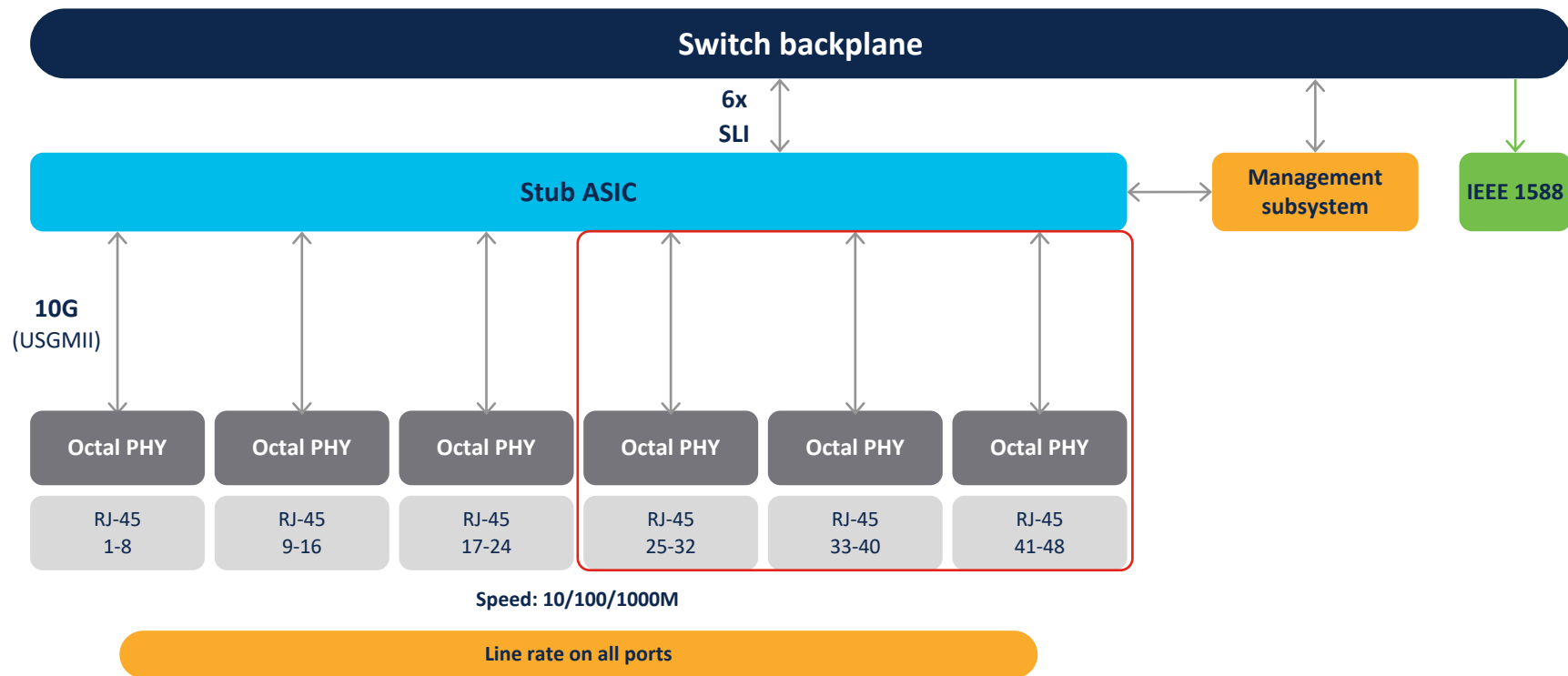


Sup 1/1XL – 24/48x 1G C9400-LC-24S/48S/48T



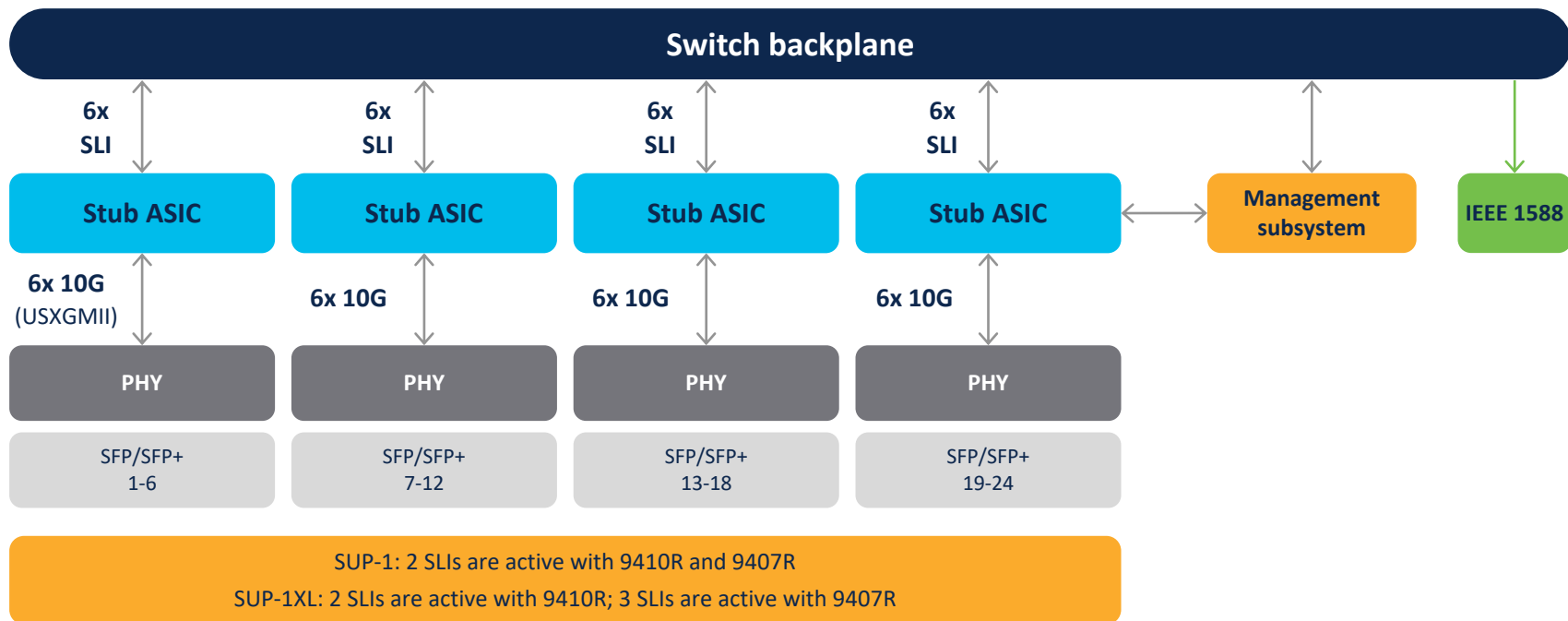
SLI – Switch Link Interface ~ 10 Gbps

SUP-2/2XL – 24/48x 1G C9400-LC-24S/48S/48T



SLI – Switch Link Interface ~ 10 Gbps

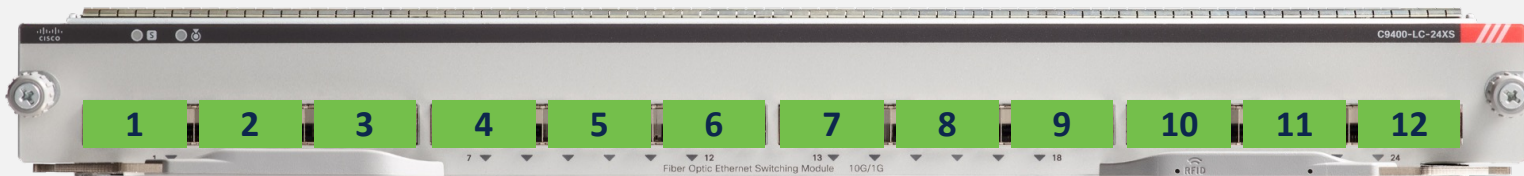
SUP-1/1XL – 24x 1/10G SFP/SFP+ C9400-LC-24XS



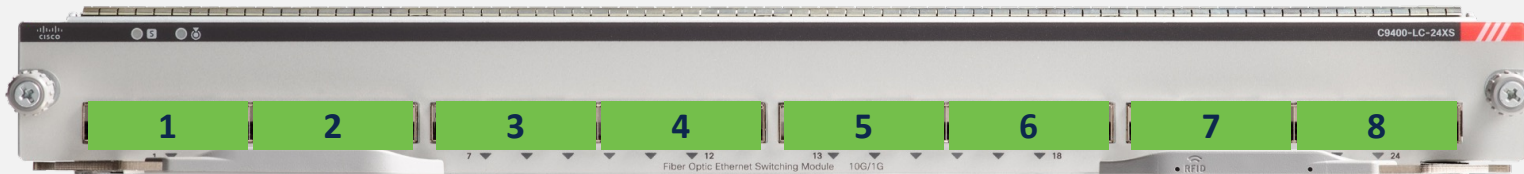
SLI – Switch Link Interface ~ 10 Gbps

SUP-1/1XL – C9400-LC-24XS port groups

7-slot chassis: 12 port groups



10-slot chassis: 8 port groups



SUP-1/1XL – C9400-LC-24XS port groups

7-slot chassis

```
R4-C94-2041#show platform hardware iomd 5/0 portgroups
Port      Interface      Status  Interface Group
Max
Group                                           Bandwidth  Bandwidth
1         TenGigabitEthernet5/0/1 up        10G
1         TenGigabitEthernet5/0/2 down      10G      10G
2         TenGigabitEthernet5/0/3 up        10G
2         TenGigabitEthernet5/0/4 down      10G      10G
3         TenGigabitEthernet5/0/5 up        10G
3         TenGigabitEthernet5/0/6 down      10G      10G
4         TenGigabitEthernet5/0/7 up        10G
4         TenGigabitEthernet5/0/8 down      10G      10G
<SNIP>
11        TenGigabitEthernet5/0/21      up        10G
11        TenGigabitEthernet5/0/22      down      10G      10G
12        TenGigabitEthernet5/0/23      up        10G
12        TenGigabitEthernet5/0/24      down      10G      10G
R4-C94-2041#show
```

- Bandwidth shared within port group
- 12 port groups in the 7-slot chassis
- For 10G line rate performance:
 - Configure: “hw-module subslot <slot#/0> mode performance”
 - 8 ports (1, 3, 5, 7, 9, 11, 13, 15)

SUP-1/1XL – C9400-LC-24XS port groups

10-slot chassis

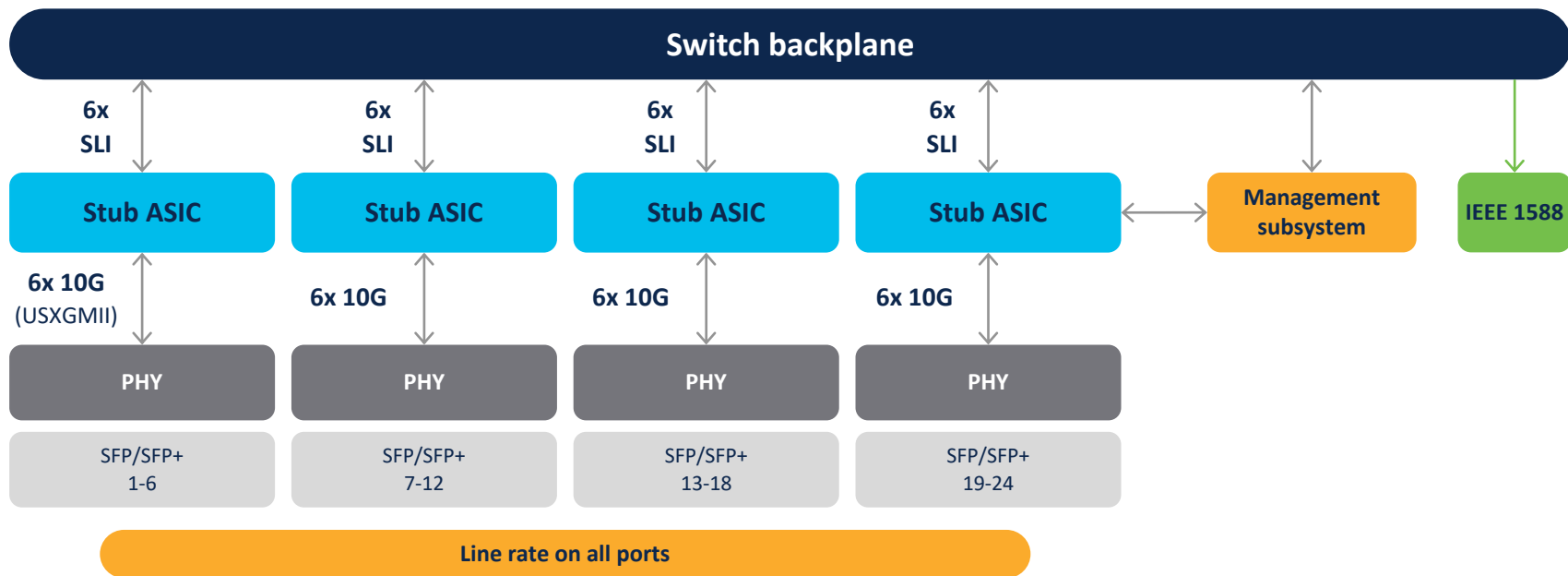
```
mac1#show platform hardware iomd 10/0 portgroups
```

Port Group	Interface	Status	Interface Bandwidth	Group Max Bandwidth
1	TenGigabitEthernet10/0/1	admindown	10G	
1	TenGigabitEthernet10/0/2	admindown	10G	
1	TenGigabitEthernet10/0/3	admindown	10G	10G
2	TenGigabitEthernet10/0/4	admindown	10G	
2	TenGigabitEthernet10/0/5	admindown	10G	
2	TenGigabitEthernet10/0/6	admindown	10G	10G
3	TenGigabitEthernet10/0/7	admindown	10G	
3	TenGigabitEthernet10/0/8	admindown	10G	
3	TenGigabitEthernet10/0/9	admindown	10G	10G
<SNIP>				
7	TenGigabitEthernet10/0/19	admindown	10G	
7	TenGigabitEthernet10/0/20	admindown	10G	
7	TenGigabitEthernet10/0/21	admindown	10G	10G
8	TenGigabitEthernet10/0/22	admindown	10G	
8	TenGigabitEthernet10/0/23	down	10G	
8	TenGigabitEthernet10/0/24	admindown	10G	10G

```
mac1#
```

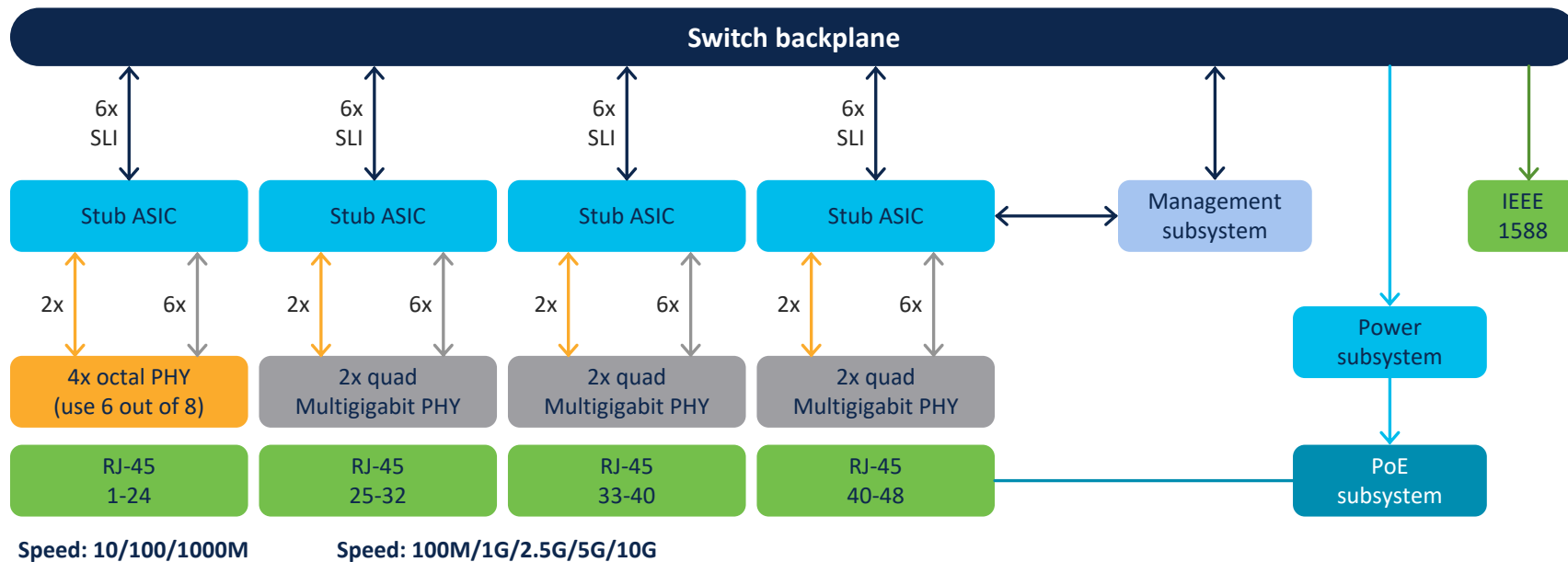
- Bandwidth shared within port group
- 8 port groups in the 10-slot chassis
- For 10G line rate performance:
 - Configure: “hw-module subslot <slot#/0> mode performance”
 - 5 ports (1, 4, 7, 10, 13)

SUP-2/2XL – 24x 1/10G SFP/SFP+ C9400-LC-24XS



SLI – Switch Link Interface ~ 10 Gbps

SUP-1/1XL – Multigigabit RJ-45 C9400-LC-48UX



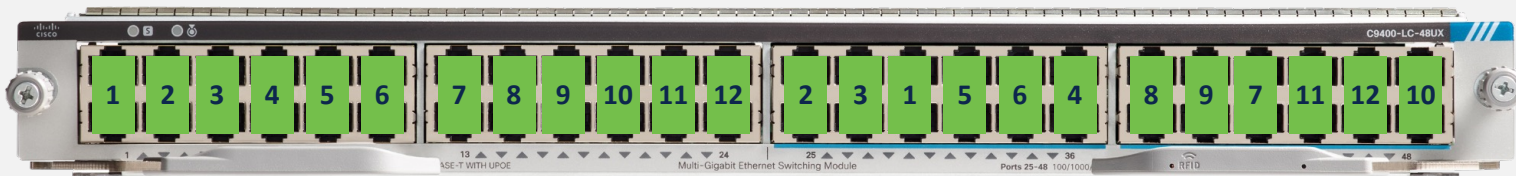
SUP-1: 2 SLIs are active with 9410R and 9407R
SUP-1XL: 2 SLIs are active with 9410R; 3 SLIs are active with 9407R

SLI – Switch Link Interface ~ 10 Gbps

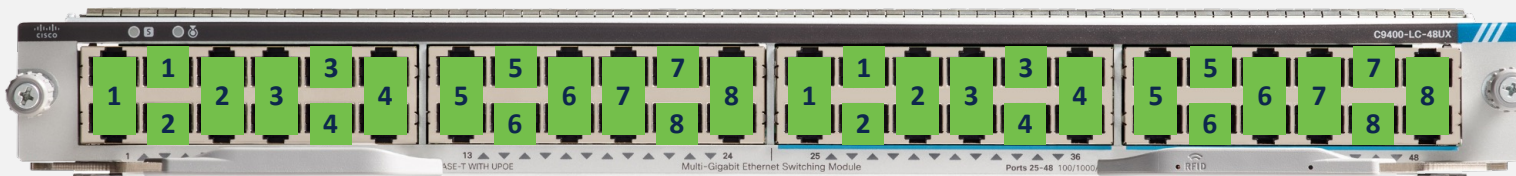
SUP-1/1XL

C9400-LC-48UX port groups

7-slot chassis: 12 port groups



10-slot chassis: 8 port groups



SUP-1/1XL – C9400-LC-48UX port groups

7-slot chassis

```
R4-C94-2041#show platform hardware iomd 6/0 portgroups
```

Port Group	Interface	Status	Interface Bandwidth	Group Max Bandwidth
1	GigabitEthernet6/0/1	up	1G	
1	GigabitEthernet6/0/2	up	1G	
1	TenGigabitEthernet6/0/29	up	10G	
1	TenGigabitEthernet6/0/30	up	10G	10G
2	GigabitEthernet6/0/3	up	1G	
2	GigabitEthernet6/0/4	up	1G	
2	TenGigabitEthernet6/0/25	up	10G	
2	TenGigabitEthernet6/0/26	up	10G	10G
<SNIP>				
11	GigabitEthernet6/0/21	down	1G	
11	GigabitEthernet6/0/22	down	1G	
11	TenGigabitEthernet6/0/43	up	10G	
11	TenGigabitEthernet6/0/44	up	10G	10G
12	GigabitEthernet6/0/23	down	1G	
12	GigabitEthernet6/0/24	down	1G	
12	TenGigabitEthernet6/0/45	up	10G	
12	TenGigabitEthernet6/0/46	up	10G	10G

```
R4-C94-2041#
```

- Bandwidth shared within port group
- 12 port groups in the 7-slot chassis
- For 10G line-rate performance:
 - Configure: “hw-module subslot <slot#/0> mode performance”
 - 8 ports (25, 27, 29, 31, 33, 35, 37, 39)

SUP-1/1XL – C9400-LC-48UX port groups

10-slot chassis

```
mac1#show platform hardware iomd 9/0 portgroups
```

Port Group	Interface	Status	Interface Bandwidth	Group Max Bandwidth
1	GigabitEthernet9/0/1	admindown	1G	
1	GigabitEthernet9/0/2	admindown	1G	
1	GigabitEthernet9/0/3	admindown	1G	
1	TenGigabitEthernet9/0/25	admindown	10G	
1	TenGigabitEthernet9/0/26	admindown	10G	
1	TenGigabitEthernet9/0/27	admindown	10G	10G
2	GigabitEthernet9/0/4	admindown	1G	
2	GigabitEthernet9/0/5	admindown	1G	
2	GigabitEthernet9/0/6	admindown	1G	
2	TenGigabitEthernet9/0/28	admindown	10G	
2	TenGigabitEthernet9/0/29	admindown	10G	
2	TenGigabitEthernet9/0/30	admindown	10G	10G
<SNIP>				
8	GigabitEthernet9/0/22	admindown	1G	
8	GigabitEthernet9/0/23	admindown	1G	
8	GigabitEthernet9/0/24	admindown	1G	
8	TenGigabitEthernet9/0/46	admindown	10G	
8	TenGigabitEthernet9/0/47	admindown	10G	
8	TenGigabitEthernet9/0/48	admindown	10G	10G

```
mac1#
```

- Bandwidth shared within port group
- 8 port groups in the 10-slot chassis
- For 10G line rate performance:
 - **Configure:** “hw-module subslot <slot#/0> mode performance”
 - **5 ports** (25, 28, 31, 34, 37)

Multigigabit ports naming convention

```
Command Prompt
SW # show ip int br | i up
TenGigabitEthernet2/1 unassigned YES unset up up
TenGigabitEthernet2/2 unassigned YES unset up up

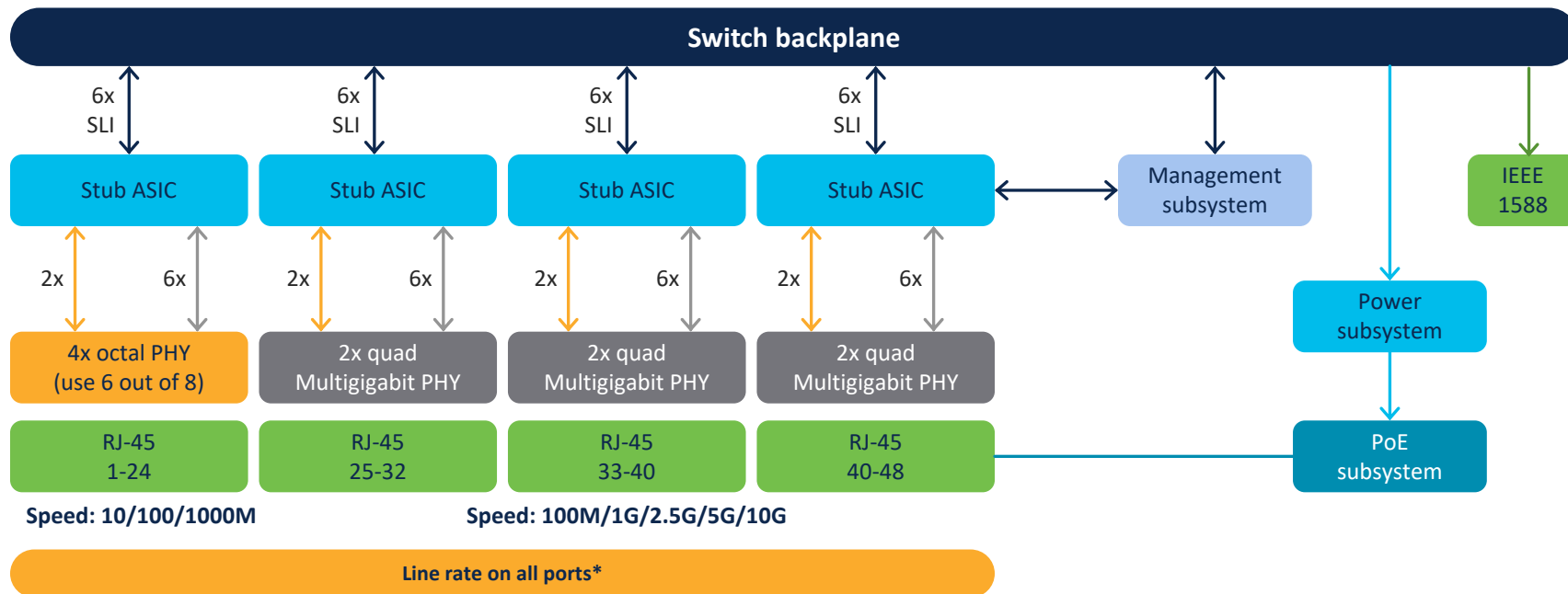
SW # show int TenGigabitEthernet 2/1
TenGigabitEthernet2/1 is up, line protocol is up
(connection)
Hardware is Ten Gigabit Ethernet Port, address is
18e7.28d8.55e0 (bia 18e7.28d8.55e0)
MTU 1500 bytes, BW 10000000 Kbit/sec, DLY 10
usec, reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Full-duplex, 10Gb/s, link type is auto, media type is
100/1000/2.5G/5G/10GBaseTx
```

Multigigabit ports have names beginning with TenGigabitEthernet, indicating their highest possible speed

Multigigabit port speeds:
100M/1G/2.5G/5G/10G

The non-Multigigabit ports are the same as in previous line cards and products – support 10M/100M/1G speeds

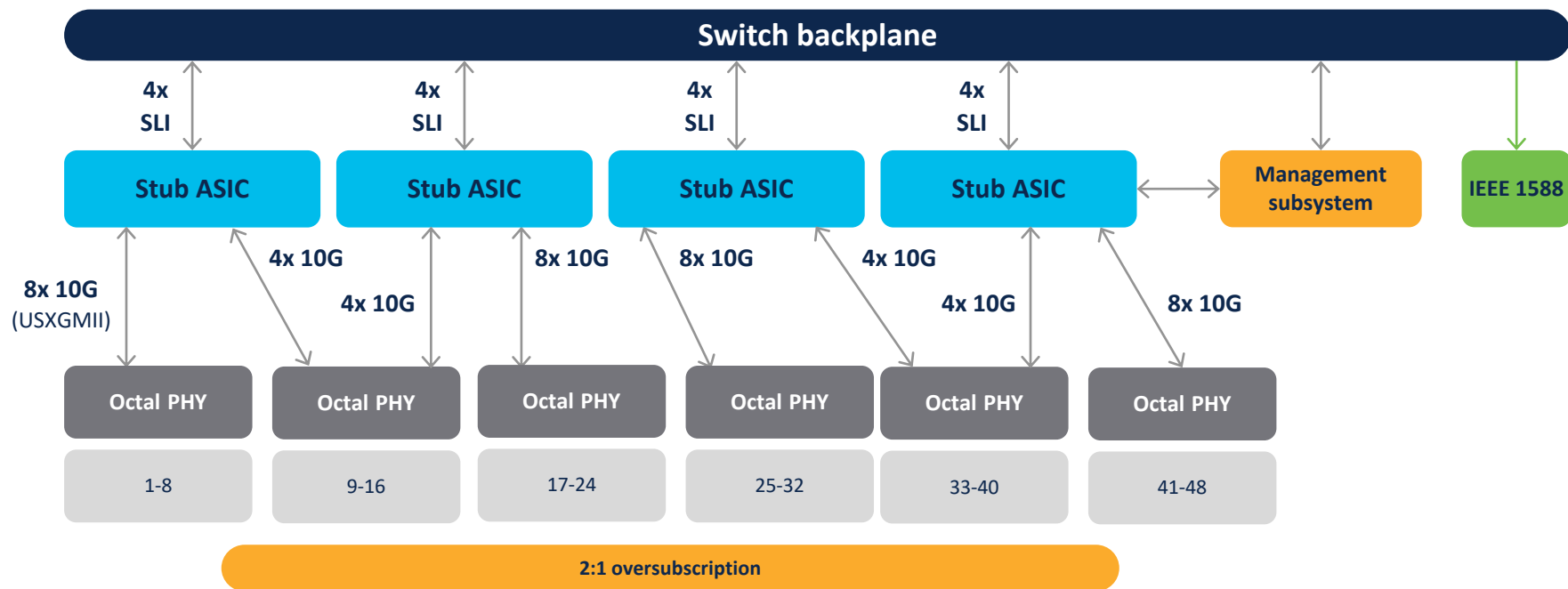
SUP-2/2XL – Multigigabit RJ-45 C9400-LC-48UX



* The line card will get 240G bandwidth on the slot, where 264G is the max bandwidth needed, but in a real production environment 240G will be enough to make line rate on all ports.

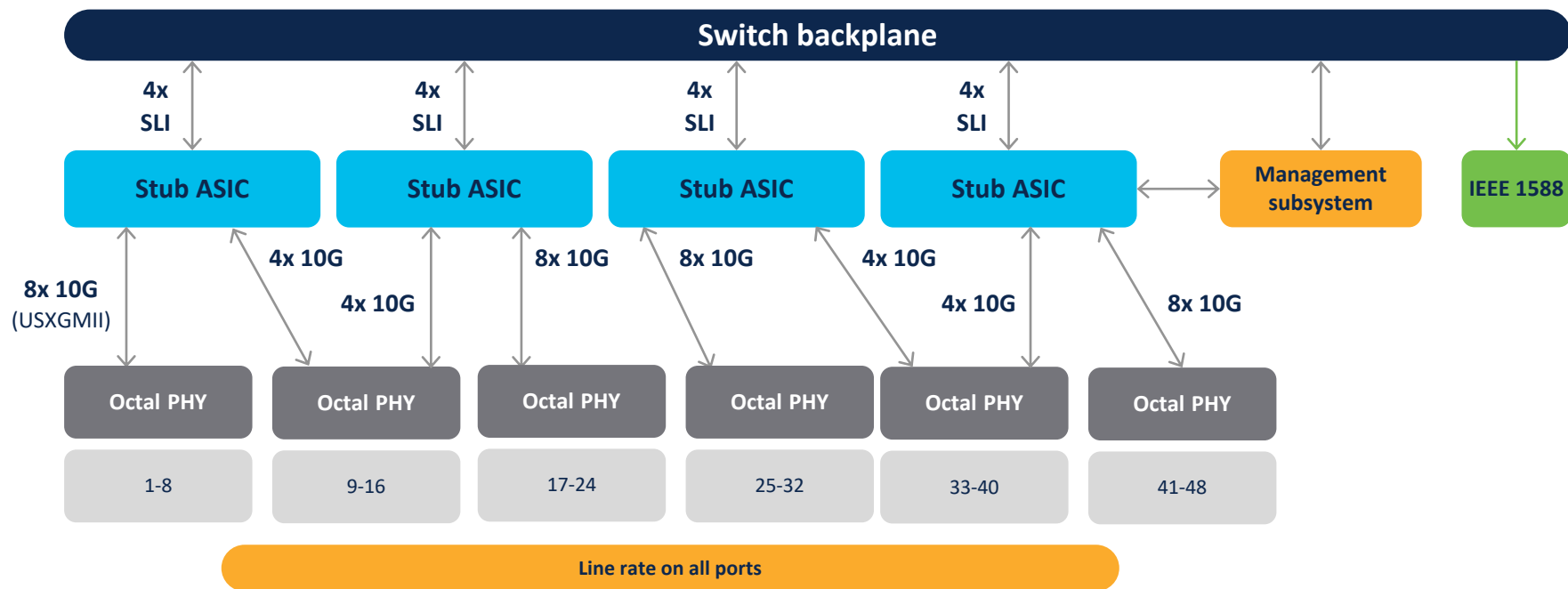
SLI – Switch Link Interface ~ 10 Gbps

SUP-2 – 48x 10G fiber C9400-LC-48XS



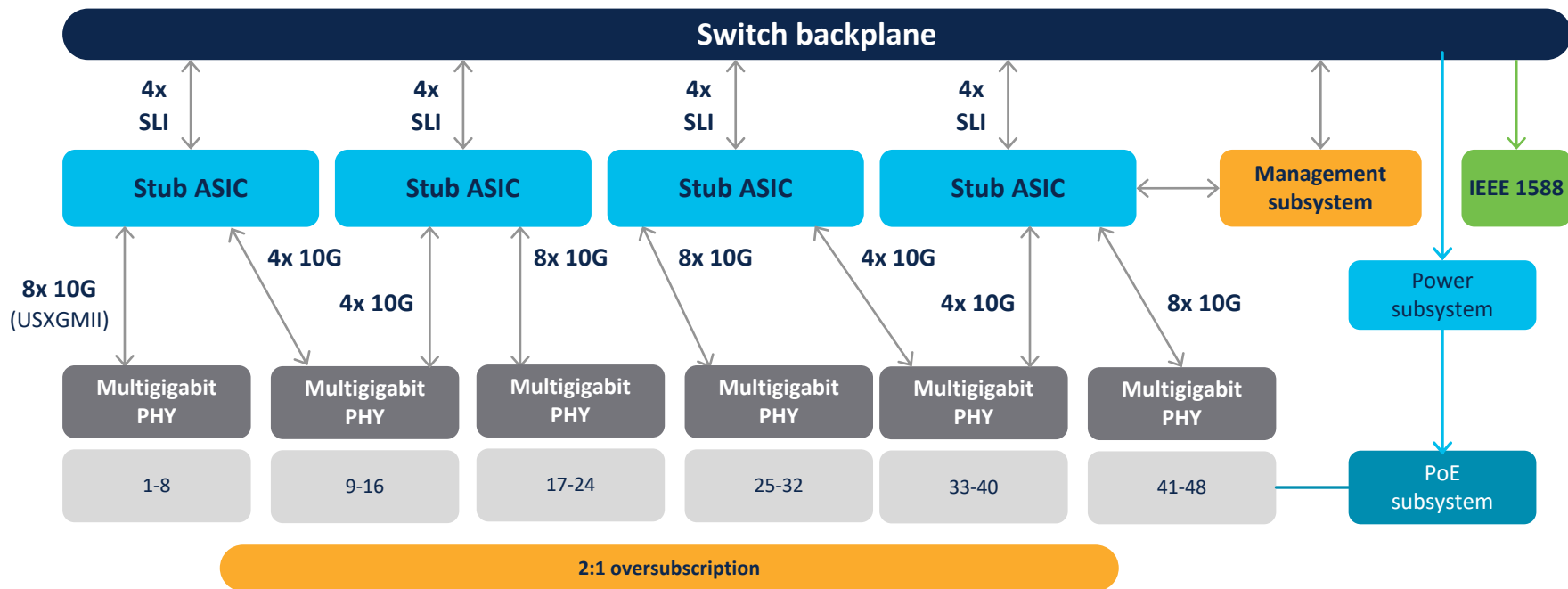
SLI – Switch Link Interface ~ 30 Gbps

SUP-2XL – 48x 10G fiber C9400-LC-48XS



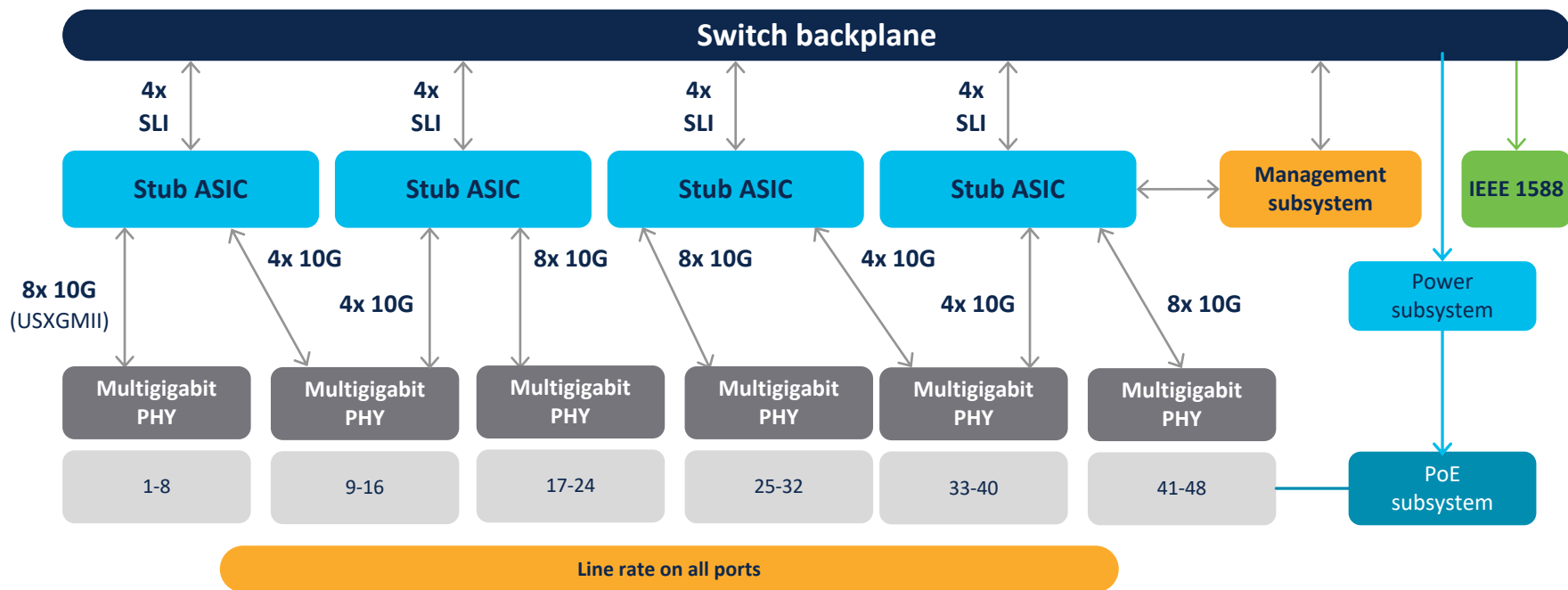
SLI – Switch Link Interface ~ 30 Gbps

SUP-2 – 48x 1/2.5/5/10G Multigigabit C9400-LC-48HX



SLI – Switch Link Interface ~ 30 Gbps

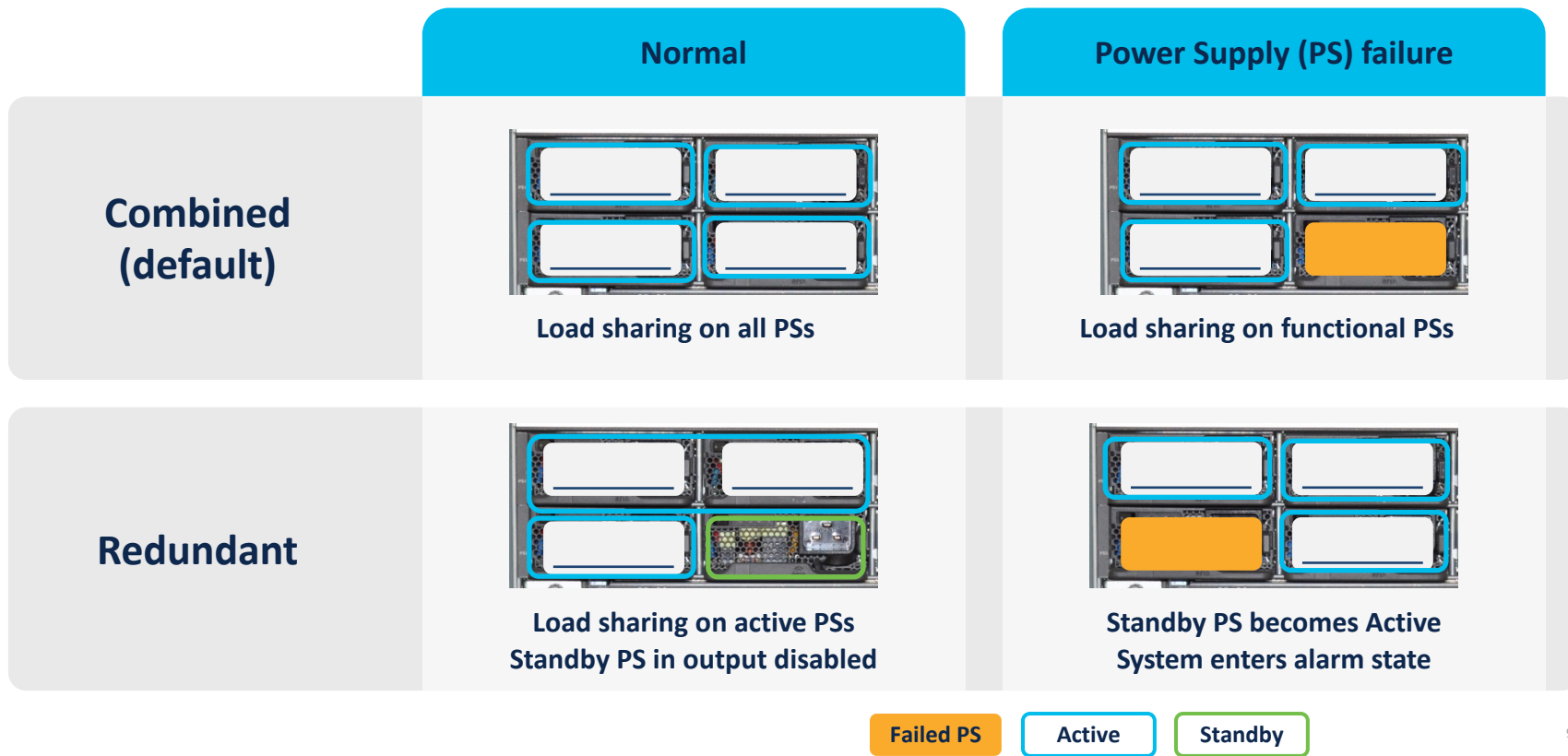
SUP-2XL – 48x 1/2.5/5/10G Multigigabit C9400-LC-48HX



SLI – Switch Link Interface ~ 30 Gbps

Power

Power redundancy



Power redundancy: N+1 and N+N

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



- 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+N ?  
<1-8> standby slot in N+N mode  
SWR(config)#
```

```
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

Power redundancy – Power

Budgeted power

Total power required for the components (supervisors, line cards, and fan tray)

Active power

Active

Total power in the Active power supply slots

Standby power

Standby

Total power in the Standby power supply slots

Aggregated power

Total power in both Active and Standby power supply slots

Active

Standby

Show power detail output 1/2

```
switch#sho power detail
```

Power					Fan States			
Supply	Model No	Type	Capacity	Status	1	2	3	4
PS1	C9400-PWR-3200AC	AC	n.a.	faulty	n.a.	n.a.	n.a.	n.a.
PS2	C9400-PWR-3200AC	AC	n.a.	faulty	n.a.	n.a.	n.a.	n.a.
PS3	C9400-PWR-3200AC	AC	3200 W	standby	n.a.	n.a.	n.a.	n.a.
PS4	C9400-PWR-3200AC	AC	3200 W	standby	n.a.	n.a.	n.a.	n.a.
PS5	C9400-PWR-3200AC	AC	n.a.	faulty	n.a.	n.a.	n.a.	n.a.
PS6	C9400-PWR-3200AC	AC	n.a.	faulty	n.a.	n.a.	n.a.	n.a.
PS7	C9400-PWR-3200AC	AC	3200 W	active	good	good	good	good
PS8	C9400-PWR-3200AC	AC	3200 W	active	good	good	good	good

PS Current Configuration Mode : N+N redundant
 PS Current Operating State : Full protected

Power supplies currently active : 2
 Power supplies currently available : 4

Operating
state

Power Summary (in Watts)		Maximum
	Used	Available
System Power	1720	1720
Inline Power	2880	4680
Total	4600	6400

Budgeted
power

Active

Standby

Show power detail output 2/2

Automatic Linecard Shutdown : Enabled
Power Budget Mode : Dual Sup

Mod	Model No	autoLC Priority	Power State	Budget	Instantaneous	Peak	Out of Reset	In Reset
1	C9400-LC-48U	0	accepted	65	34	41	65	5
2	C9400-LC-48T	1	accepted	65	34	46	65	5
3	C9400-SUP-1	0	accepted	400	245	263	400	130
4	C9400-SUP-1	0	accepted	400	245	263	400	130
5	C9400-LC-24XS	2	accepted	200	112	116	200	10
6	C9400-LC-48UX	3	accepted	240	144	167	240	15
--	Fan Tray	0	accepted	350	--	--	350	--
Total1720								

Power budget

Release 16.6.1

The system automatically budgets power for redundant supervisors

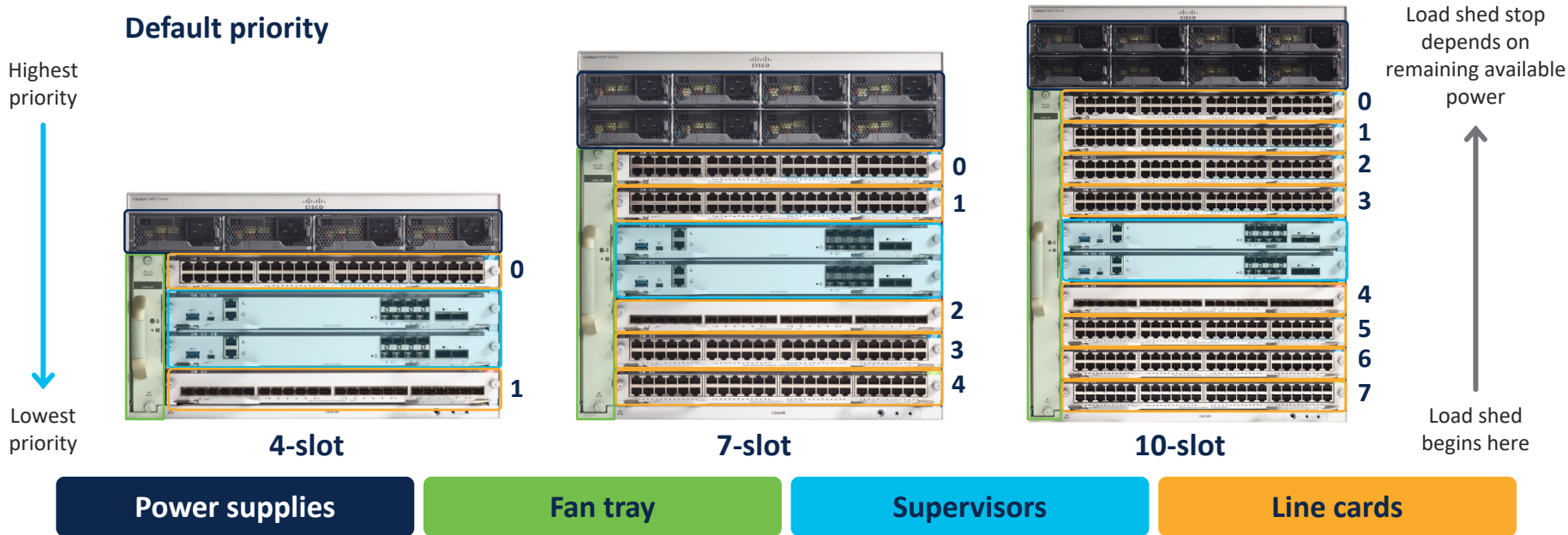
Release 16.6.2 and later

- Added ability to budget power for single supervisor with Command-Line Interface (CLI)
- `"power budget mode single-sup"`

Catalyst 9400 Series power management

Automatic line card shutdown and PoE port priority in case of power load shedding

8 priority levels, 0 to 7, with 0 having the highest and 7 the lowest priority



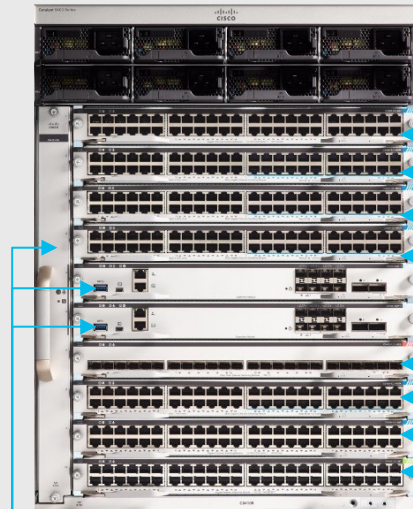
Supervisors and fan tray have the highest priority and will shut down last

Power priority

- All components in the system are assigned a power priority level
- Supervisors and fan tray have the same highest priority level
- Line cards with lower slot numbers have the higher power priority level by default if "power supply autoLC shutdown" is configured
- Software allows user-configurable power priority for line card slots

```
C94(config)#power supply autoLC priority ?  
<1-7>  Physical slot number  
<cr>
```

```
C94(config)#power supply autoLC priority
```



Highest priority

User-configurable priority

User-configured PoE port priority

For example, user configures:

- Priority 0 (highest priority) on last 24 ports of line card slots 8, 9, and 10

In case of PS failure, if the system doesn't meet the required threshold:

First 24 ports of slot 10, line cards will be denied power

If the system still doesn't have enough power to meet the PoE threshold:

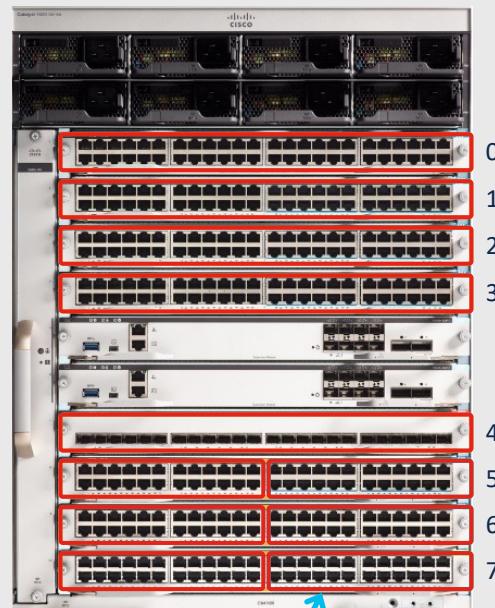
- First 24 ports of slot 9, line cards will be denied power
- Then first 24 ports of slot 8, line cards will be denied power
- Then all ports of slot 7, line cards will be denied power
- Then all ports of slot 4, line cards will be denied power
- Then all ports of slot 3, line cards will be denied power
- Then all ports of slot 2, line cards will be denied power

Now if the system still doesn't have enough power to meet the PoE threshold:

- Last 24 ports of slot 10, line cards will be denied power
- Then last 24 ports of slot 9, line cards will be denied power
- Then last 24 ports of slot 8, line cards will be denied power

Finally:

- All ports of slot 1, line cards will be denied power



Note: Switch will deny power only to these ports and won't affect the data, until the line card is shut down.

Minimum supervisor FPGA image version needed to support the feature is **19082605**.

Configuration steps

Global command to enable power-limiting feature (enabled by default):

```
Switch(config)# power inline auto-shutdown
```

Default

```
Switch# show power inline priority
Power inline auto shutdown: Enabled
```

Interface	Admin	Oper	Admin	Oper
State	State	State	Priority	Priority
-----	-----	-----	-----	-----
Gi1/0/1	auto	off	n/a	0
Gi1/0/2	auto	off	n/a	0
Gi1/0/3	auto	off	n/a	0
Gi1/0/4	auto	off	n/a	0
<snip>				
Gi2/0/1	auto	on	n/a	1
Gi2/0/2	auto	off	n/a	1
Gi2/0/3	auto	off	n/a	1
Gi2/0/4	auto	off	n/a	1
<snip>				

Interface configuration command to change the default priority per port (user configurable):

```
Switch(config)# interface gigabitEthernet 1/0/1
Switch(config-if)# power inline port priority
<0-7> 0 (Highest priority), 7
(Lowest priority)
```

After configuring port 1/0/1 with priority 1

```
Switch(config)#interface gigabitEthernet 1/0/1
Switch(config-if)#power inline port priority 1
Switch# show power inline priority

Power inline auto shutdown: Enabled
Interface Admin Oper Admin Oper
State State State Priority Priority
-----
```

Gi1/0/1	auto	off	1	1
Gi1/0/2	auto	off	n/a	0
Gi1/0/3	auto	off	n/a	0
Gi1/0/4	auto	off	n/a	0

```
<snip>
```


Power redundancy – Combined mode

- Default operating mode
- All power supplies are active
- Equal sharing between power supplies
- If budgeted power is greater than active power
 - Default: System will shut down
 - If automatic line card shutdown is enabled: Components are shut down according to the power priority

Power redundancy – N+1/N+N mode

- Initial configuration (from default combined mode)
 - Active power > Budgeted power
 - Standby power $\geq$ Active power: Fully protected
 - Standby power < Active power &&
 - Standby power $\geq$ Max capacity PS in active group:* Normal protected
 - No PS in the standby slot: Configuration rejected. Operated in combined mode
 - Active power < budgeted power: Configuration rejected. Operated in combined mode

* When mixing power supplies with different capacities.

Power redundancy – N+1/N+N mode

- System bootup with N+1/N+N mode configured
 - Active power > Budgeted power
 - Standby power $\geq$ Active power: Fully protected
 - Standby power < Active power &&
 - Standby power $\geq$ Max capacity PS in active group:* Normal protected
 - No PS in the standby slot: Operated in combined mode (no change to the existing configuration)
 - Active power < budgeted power
 - Aggregated power > budgeted power: Operated in combined mode (no change to the existing configuration)
 - Aggregated power < budgeted power:
 - Default (automatic line card shutdown is disabled): System will shut down
 - If automatic line card shutdown is enabled: Components are shut down according to the power priority

* When mixing power supplies with different capacities.

Power redundancy – FAQ

- When does Standby becomes Active?
 - When there is a failure in the active group. Additional power requirements (adding line cards or PoE devices) don't cause Standby to become Active.
- Use redundant mode (N+1 or N+N).



Power redundancy – Best practice

- Cisco Catalyst™ 9400 Series supports mixed-voltage input and same-capacity power supplies. Combined mode is the default, redundant mode is configurable.
- Use redundant mode (N+1 or N+N).

3.2 kW power supply



	@120V	@240V
Input current	16A	16A
Output power	1560W	3190W
Output current	55V, 28.36A 3.3V, 3A	55V, 58A 3.3V, 3A
Heat dissipation	950 Btu/hr	950 Btu/hr

Voltage	Max PoE (15W) devices	Max PoE+ (30W) devices	Max Cisco UPOE® (60W) devices
120V	104	52	26
240V	213	106	53

2.1 kW power supply



	@120V	@240V
Input current	10.4A	10.4A
Output power	940W	2,102W
Output current	55V, 17.09A 3.3V, 3A	55V, 38.21A 3.3V, 3A
Heat dissipation	460 Btu/hr	460 Btu/hr

Voltage	Max PoE (15W) devices	Max PoE+ (30W) devices	Max Cisco UPOE® (60W) devices
120V	104	52	26
240V	213	106	53

3.2 kW DC power supply



Operating modes:

1. Auto-on (default mode)

- PS auto-starts or restarts on application or restoration

2. Protected

- Press Power button for 2 seconds to restore operation if output voltage is zero or drops for more than 3 seconds

- **Input voltage:** -40V to -72V DC
- **Input current:** 36A per DC input (72A total) at -48V to -60V DC

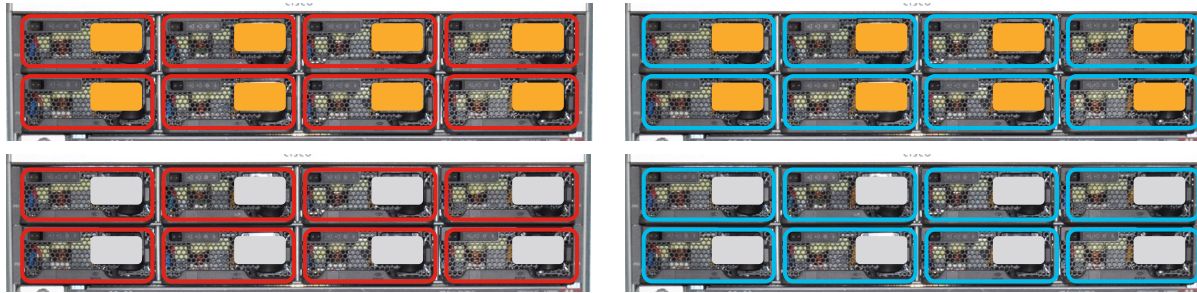
- **Output voltage:** 55V
- **Inrush current:** 50A (cold start – off for more than 1 hour) | 70A (hot start – on for more than 1 hour)

Max PoE (15W) devices	Max PoE+ (30W) devices	Max Cisco UPOE® (60W) devices
213	106	53

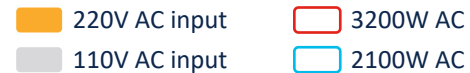
Power redundancy – Best practice

Mix and match combinations

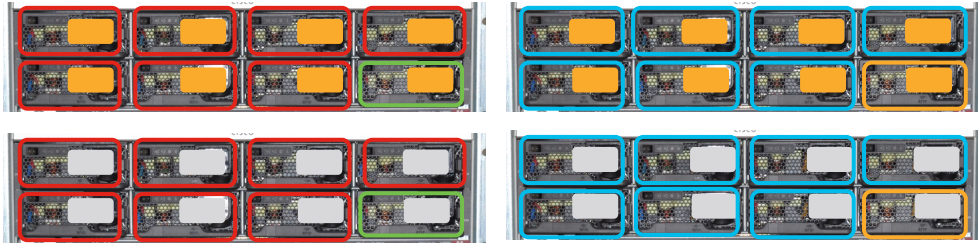
Combined mode AC input only



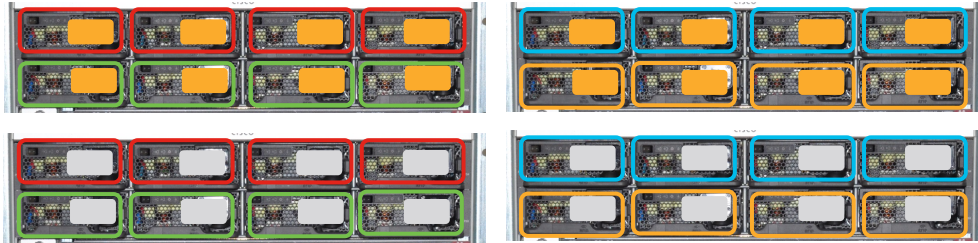
- All installed PS must be of the same capacity.
Example: All PS 3200W AC or 2100W AC
- All installed PS must have the same AC input voltage level.
Example: 220V AC or 110V AC



N+1 mode AC input only



N+N mode AC input only



- All installed PS must be of the same capacity.
Example: All PS 3200W AC or 2100W AC
- All installed PS must have the same AC input voltage level.
Example: 220V AC or 110V AC

220V AC input

110V AC input

Active

3200W AC

Stdby

3200W AC

Active

2100W AC

Stdby

2100W AC

AC and DC combined mode



- All installed PS must be of the same capacity.
Example: Either 3200W AC input or 3200W DC
- All installed 3200W AC PS must have an AC input voltage of 220V AC.
Cannot mix or use 120V AC input.

AC and DC N+1 mode



- All installed PS must be of the same capacity.
Example: Either 3200W AC input or 3200W DC
- All installed 3200W AC PS must have an AC input voltage of 220V AC
Cannot mix or use 120V AC input.



220V AC input

Active

3200W AC

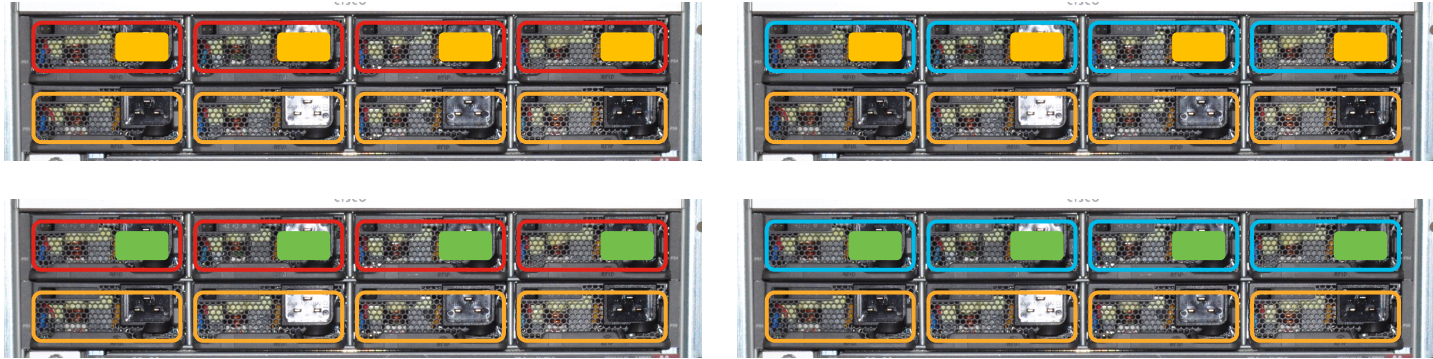
Active

2100W AC

Active

3200W DC

AC and DC N+N mode



- All Active AC or Standby PS modules must be of same type or vice versa. (Type is AC or DC.)
Example: All 2100W AC or all 3200W AC as Active and all 3200W DC as Standby.
- All AC input PS must be of the same capacity and have the same input voltage level.
Example: All 2100W AC or all 3200W AC input PS with input voltage of 110V AC or all inputs 220V AC.

Note: All installed DC-input power supply modules must be configured as standby in N+N mode, and higher-capacity modules must be configured as standby.

220V AC input

110V AC input

Active

3200W AC

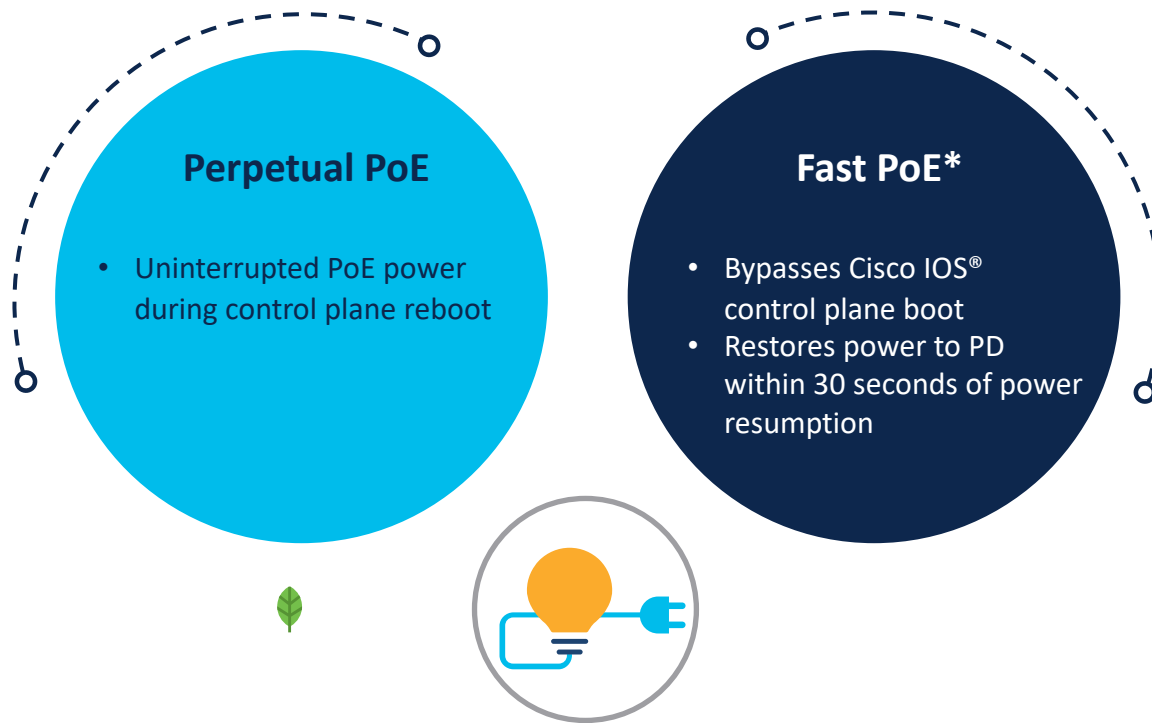
Stdby

3200W DC

Active

2100W AC

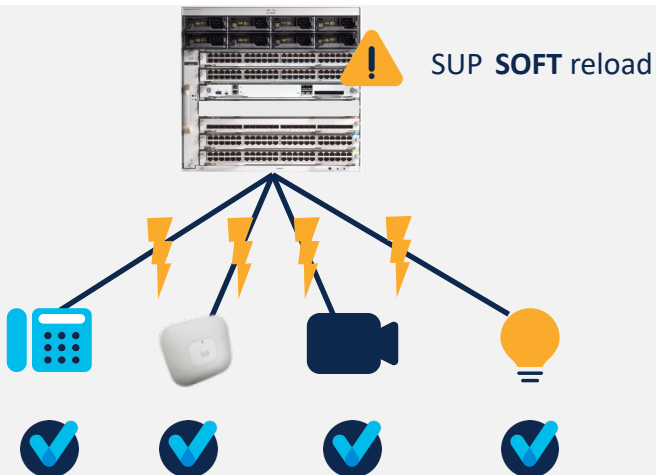
PoE innovations on C9400X-SUP-2/2XL



* roadmap

Perpetual PoE with C9400X

PoE devices connected to switch stay powered even on Single SUP reload



```
Switch> enable
```

```
Switch# configure terminal
```

```
Switch(config)# interface gigabitethernet2/0/1
```

```
Switch(config-if)#
```

```
power inline port perpetual-poe-ha
```

```
Switch(config-if)# end
```

- PoE devices continue to get **last negotiated power**
- Applicable to “soft” reload – Image upgrade, software crash, manual reboot
- PPOE is now supported with single SUP configuration
- Not applicable during power outage to switch

TCAM resources

Forwarding and feature tables – Sup1/Sup1XL

Forwarding resources (Hash)

- Media Access Control (MAC) entries
- IP Connected (Host) routes
- IP Longest Prefix Match (LPM) routes
- IP Multicast (PIM) routes
- Internet Group Management Protocol (IGMP) groups
- Multi Protocol Label Switching (MPLS) labels
- Scalable Group Tags (SGTs)

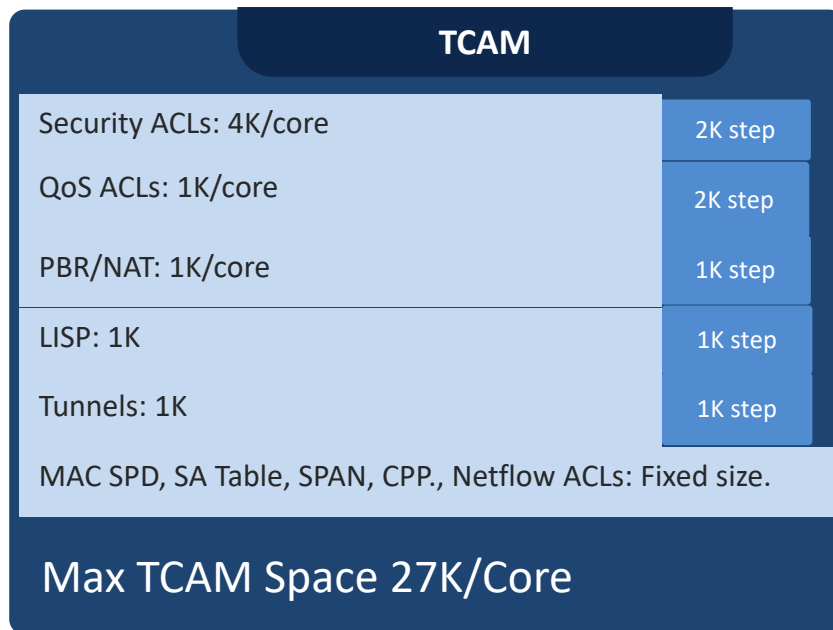
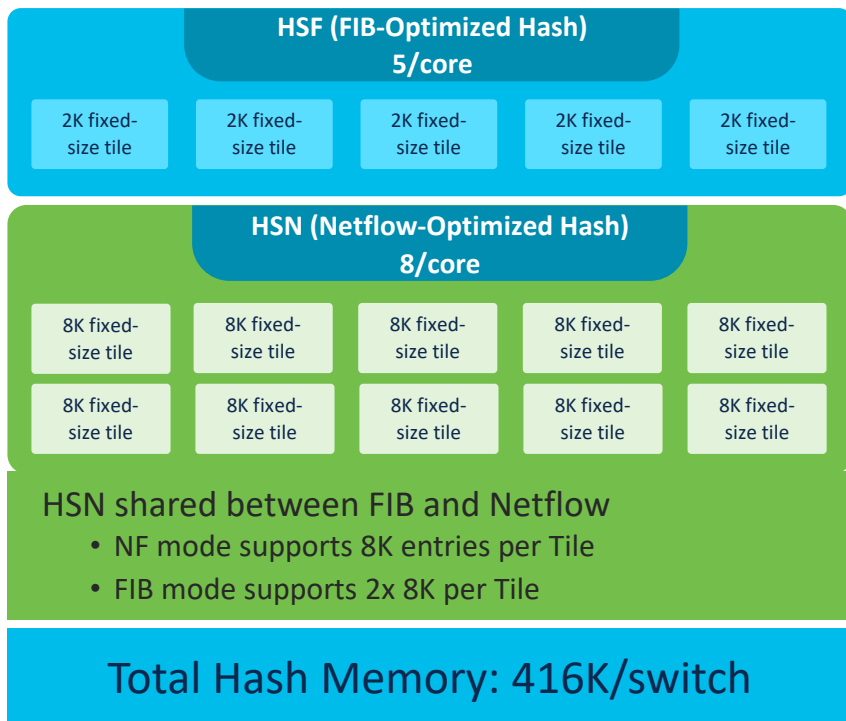
Feature resources (TCAM)

- Security Access Control Lists (ACLs)
- Quality of Service (QoS) ACLs
- Service ACLs
 - PBR/NAT
 - NetFlow ACL
 - SPAN
 - MACsec
 - CoPP
 - Tunnel
 - LISP

NetFlow (Hash)

- Ingress FNF entries
- Egress FNF entries

Forwarding and Feature Tables (UADP 3.0) – Sup2/2XL



SUP-1/1XL/1XL-Y flex tables (default template)

Forwarding resources

- MAC: 64,000
- Host routes: 48,000 to 112,000
- IGMP groups: 16,000
- LPM routes: 64,000
- Multicast routes: 16,000
- SGTs: 16,000

Feature resources

- Security ACLs: 18,000
- QoS ACLs: 18,000
- Service ACLs: 18,000
 - PBR/NAT
 - NetFlow ACL
 - SPAN
 - MACsec
 - CoPP
 - Tunnel
 - LISP

NetFlow

NetFlow entries: 128,000 per ASIC

Cisco Catalyst 9400 templates (for SUP-1XL/1XL-Y)

	16.6 to 16.8	16.9 and beyond		
	Access	Access	Core	SD-Access
Longest prefix match (LPM)	64,000	64,000	64,000	64,000
Host	48,000	48,000	32,000	80,000
Layer 2 multicast	16,000	16,000	16,000	16,000
Layer 3 multicast	16,000	16,000	32,000	16,000
MAC addresses	64,000	64,000	16,000	16,000
SGTs	8000	8000	8000	8000
Flexible NetFlow entries	128,000 per ASIC	128,000 per ASIC	128,000 per ASIC	128,000 per ASIC
Security ACLs	18,000	18,000	18,000	18,000
QoS ACLs	18,000	18,000	18,000	18,000
PBR/NAT	2000	2000	2000	2000
Tunnels	1000	1000	1000	1000
LISP	1000	1000	1000	1000
MPLS L3VPN VRFs	256	256	256	N/A
MPLS labels	8000	16,000	24,000	
MPLS L3VPN routes VRF	16,000	32,000	32,000	
MPLS L3VPN routes prefix	4000	4000	4000	
MVPN MDT tunnels	256	1000	1000	
L2VPN EoMPLS attachments	256	1000	1000	

SUP-2/2XL flex tables (default template)

Forwarding resources

- MAC: 64,000
- Host routes: Up to 112,000 IPv4/IPv6 (double wide)
- IGMP groups: 16,000
- LPM routes: 112,000
- Multicast routes: 16,000
- SGTs: 32,000

Feature resources

- Security ACLs: 10,000 (in), 16,000 (out)
- QoS ACLs: 8,000 (in), 8,000 (out)
- Service ACLs: 18,000
 - PBR/NAT
 - NetFlow ACL
 - SPAN
 - MACsec
 - CoPP
 - Tunnel
 - LISP

NetFlow

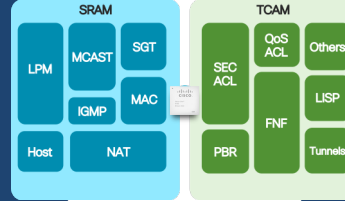
NetFlow entries: 96,000 per ASIC

Default SDM

Access Template
Maximizes ASIC resources
for **Layer 2 MACs, Hosts,
L2 Unicast/Multicast, L2VPN**
and **Flexible NetFlow**

Only option on 9400X prior
to 17.11

User-Customizable ASIC Resources



**Cisco Catalyst®
9400X**

FIB Customization
Flexibly reallocate the
Central Exact Match (CEM) table
between MAC, Hosts, Multicast,
NAT, MPLS and ACL Labels

ACL Customization
Allocate TCAM space between
Security ACL, QoS,
PBR and Flexible Netflow

Custom SDM

Catalyst 9400X-SUP-2/2XL SDM template

	17.7
	Access
Longest prefix match (LPM)	112,000
Layer 2 multicast	16,000
Layer 3 multicast	16,000
MAC addresses	64,000
SGTs	32,000
Input Flexible NetFlow entries	49,000 per ASIC
Output Flexible NetFlow entries	49,000 per ASIC
Input security ACLs	10,000
Output security ACLs	16,000
Input QoS ACLs	8,000
Output QoS ACLs	8,000
MPLS L3VPN VRFs	256
MPLS labels	16,000
MPLS L3VPN routes VRF	112,000
MPLS L3VPN routes prefix	32,000
MVPN MDT tunnels	1,024
L2VPN EoMPLS attachments	1,024

	17.7
	Access
VRF	1,024
Input flow SPAN ACEs	512
Output flow SPAN ACEs	512
Control plane entries	512
PBR/NAT	2,000
Tunnels	1,000
LISP	2,000

Catalyst 9400X – Custom SDM Templates

SDM templates and scale numbers

Feature (ACL) TCAM

Forwarding (FIB) Hash

IOS-XE 17.11.1

NEW

FIB

Double width fields ensures IPv4 and IPv6 have the same scale

L2 and L3 Multicast can have a total of 48K FIB Resources

Space for Some features can be disabled completely by setting scale to 0

ACL ingress and egress are split between two cores

Due to space reserved for IPsec SA table, max ACL on core 1 is 25K

Maximum Security ACL size possible is $25 + 27 = 52K$

All features need dedicated space. 0 setting is not allowed

ACL TCAM

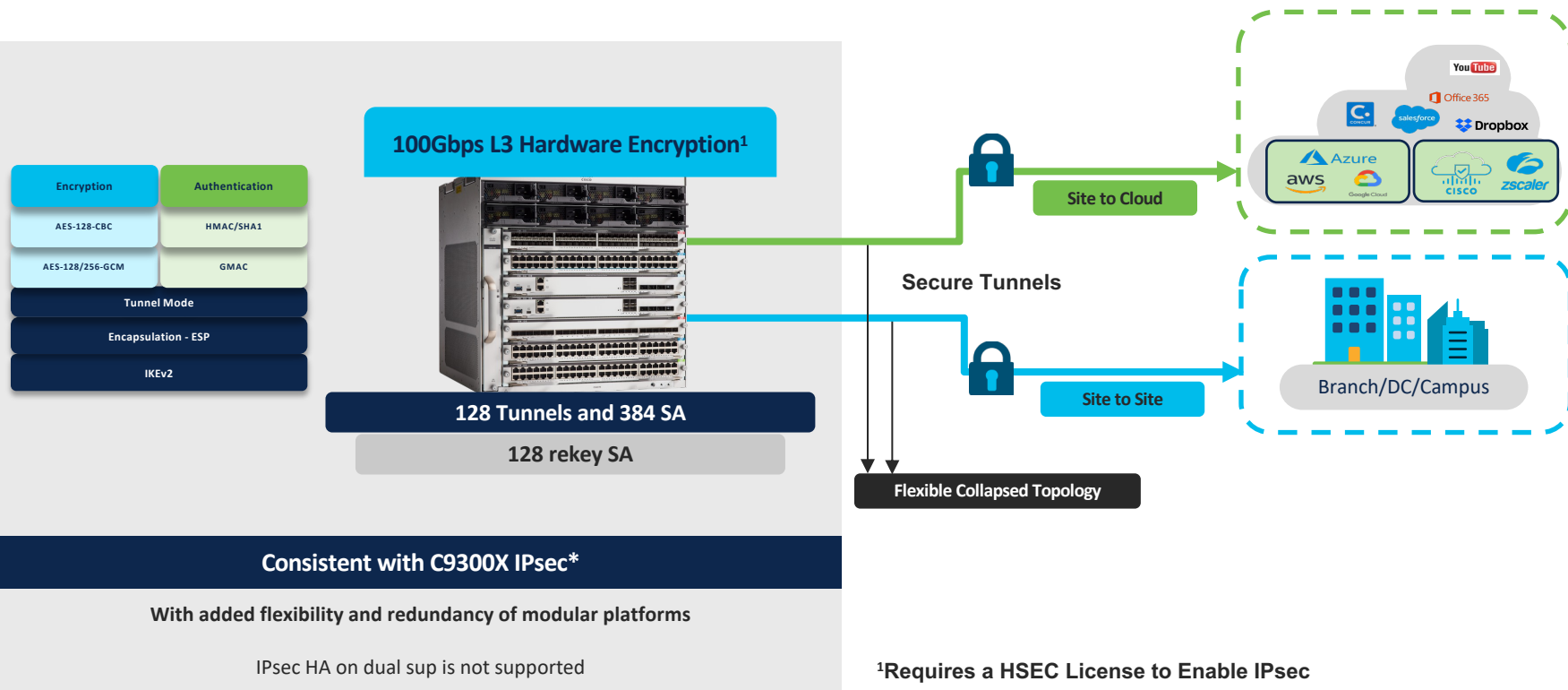
Features			Range	Access (default)	Step-Size	
Unicast routes (LPM & Host, IPv4/IPv6)			✂	64K-256K	112K	16K
MAC address entries			✂	32K-128K	64K	16K
L2 Multicast groups			✂	0-32K	16K	16K
L3 Multicast routes (IPv4/IPv6)			✂	0-32K	16K	16K
Flexible NetFlow	Ingress	✂	0-64K	32K	32K	
	Egress	✂	0-64K	0	32K	
SGT, MPLS			✂	0-64K total	32K SGT, 16K MPLS	32K
Total FIB Resources - 416K						
Security ACL	Ingress	✂	4K-27K	10K	2K	
	Egress	✂	4K-27K	16K	2K	
NetFlow ACL	Ingress	✂	1K-2K	1K	1K	
	Egress	✂	1K-2K	1K	1K	
LISP			✂	1K-2K	2K	1K
PBR/NAT (per direction)			✂	1K, 2K-16K	2K	2K
Tunnels (Termination)			✂	1K-3K	1K	1K
SPAN	Ingress		0.5K		Not Customizable	
	Egress		0.5K		Not Customizable	
CPP			0.5K		Not Customizable	
IPsec			1K		Not Customizable	
MACsec SPD			0.25K		Not Customizable	
Total ACL Resources - 54K						



Customizable Resources

Catalyst 9400X – Modular Collapsed Edge/Distribution

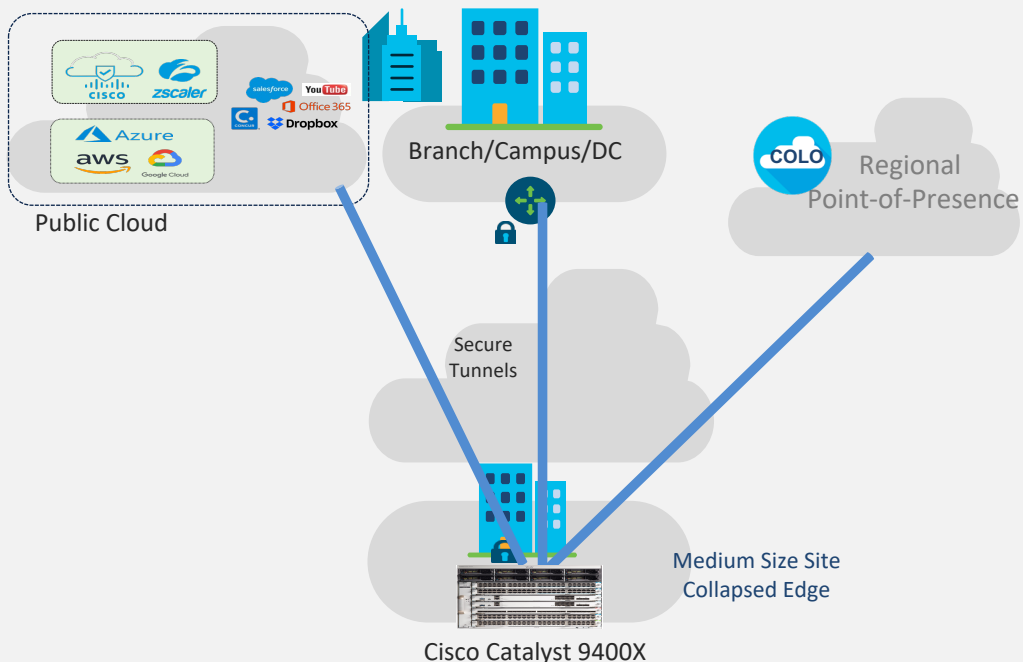
Now with NAT Traversal in 17.11.1



Catalyst 9400X IPSEC Support – Now with NAT-T in 17.11

Modular Advantage – New Collapsed Edge Use Case

- Site-to-Site VPN with Static VTI
- SA negotiation done by Control Plane
- Encryption done in Hardware
- NAT traversal on Roadmap for 17.11
- 128 Tunnels supported in software



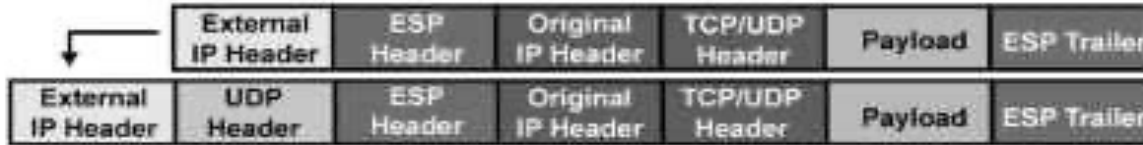
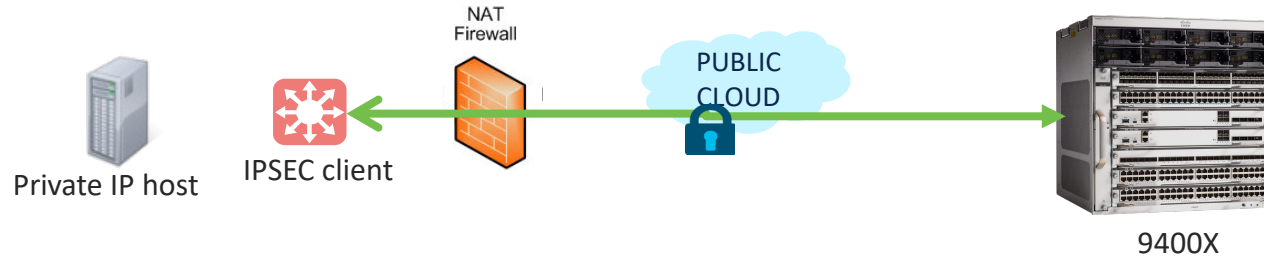
Site-to-Site and Site-to-Cloud

*100G Line-rate IPsec encryption with
low latency forwarding*

* Roadmap

NAT Traversal

Encapsulates ESP with UDP port 4500 to allow IPSEC to traverse NAT/PAT device



Configuration :IPSEC NAT-T

Switch 1 (9400X) :

```
conf t
interface Loopback30
ip address 21.21.21.22 255.255.255.255
end
```

```
conf t
interface Tunnel30
ip address 10.12.12.14 255.255.255.0
tunnel source Loopback30
tunnel mode ipsec ipv4
tunnel destination 10.10.10.11
tunnel protection ipsec profile nil_ips
end
```

**By default, NAT-T is enabled
To disable:**

```
conf t
no crypto ipsec nat-transparency udp-
encapsulation
```

NAT Device:

```
conf t

ip nat inside source static udp 21.21.21.22 500
21.21.21.22 12121

ip nat inside source static udp 21.21.21.22 4500
21.21.21.22 6500
```

Switch 2 (9400X) :

```
conf t
interface Loopback30
ip address 10.10.10.11 255.255.255.255
end
```

```
conf t
interface Tunnel30
ip address 10.12.12.13 255.255.255.0
tunnel source Loopback30
tunnel mode ipsec ipv4
tunnel destination 21.21.21.22
tunnel protection ipsec profile nil_ips
end
```

Configuration – Site to Site with AAA

Set up AAA and Radius keys



Site A

Create Trustpoint

```
aaa new-model
aaa authentication login ISE group ISE
aaa authorization network ISE group ISE
aaa accounting network ISE start-stop group ISE
```

```
aaa group server radius ISE
server-private 192.168.104.101
key CISCO
```

```
aaa server radius dynamic-author
client 192.168.104.101
server-key CISCO
auth-type all!
```

IKEv2 Peer Profile

```
crypto ikev2 profile auth_Hun
match identity remote address 172.16.0.24 255.255.255.255
identity local address 172.16.0.12
authentication remote eap query-identity
authentication local rsa-sig
aaa authentication eap default
aaa authorization user eap cached
no config-exchange request
```

Site B

Create Trustpoint

```
aaa new-model
aaa authentication login ISE group ISE
aaa authorization network ISE group ISE
aaa accounting network ISE start-stop group ISE
```

```
aaa group server radius ISE
server-private 192.168.104.101
key CISCO
```

```
aaa server radius dynamic-author
client 192.168.104.101
server-key CISCO
auth-type all!
```

IKEv2 Peer Profile

```
crypto ikev2 profile auth_Hun
match identity remote address 172.16.0.24 255.255.255.255
identity local address 172.16.0.12
authentication remote eap query-identity
authentication local rsa-sig
aaa authentication eap default
aaa authorization user eap cached
no config-exchange request
```

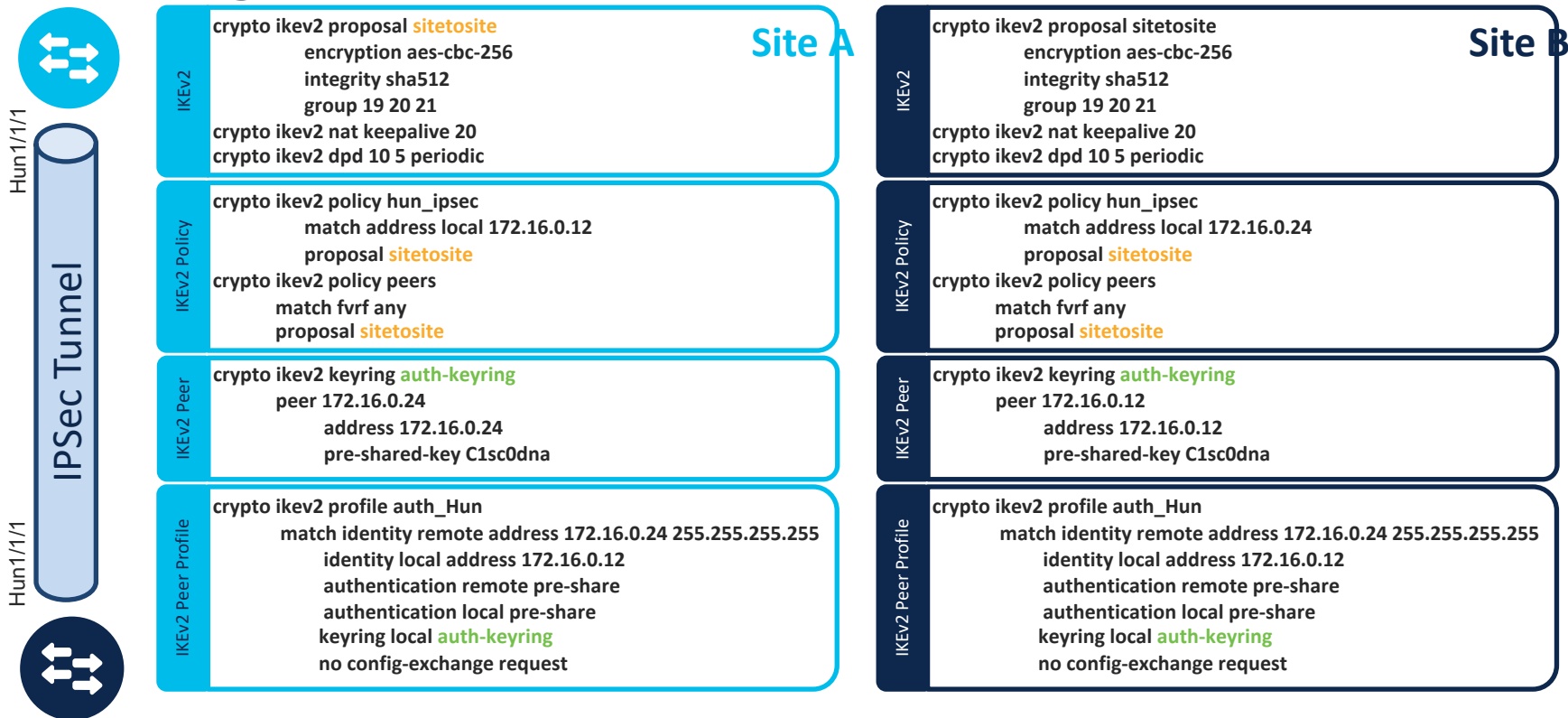
Step:

3

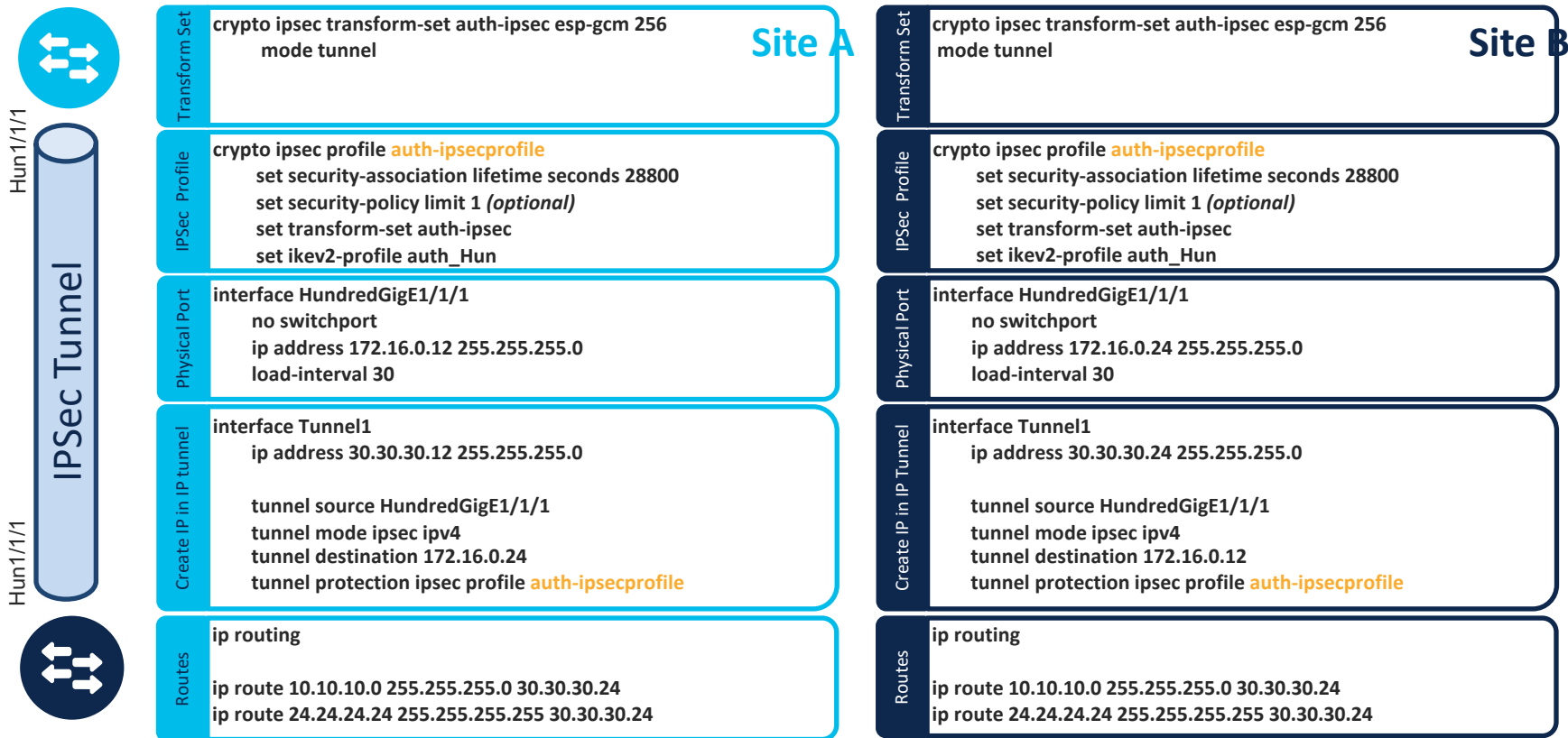
4

* Reference: <https://www.ciscolive.com/c/dam/r/ciscolive/us/docs/2015/pdf/TECSEC-3725.pdf>

Configure IKEv2

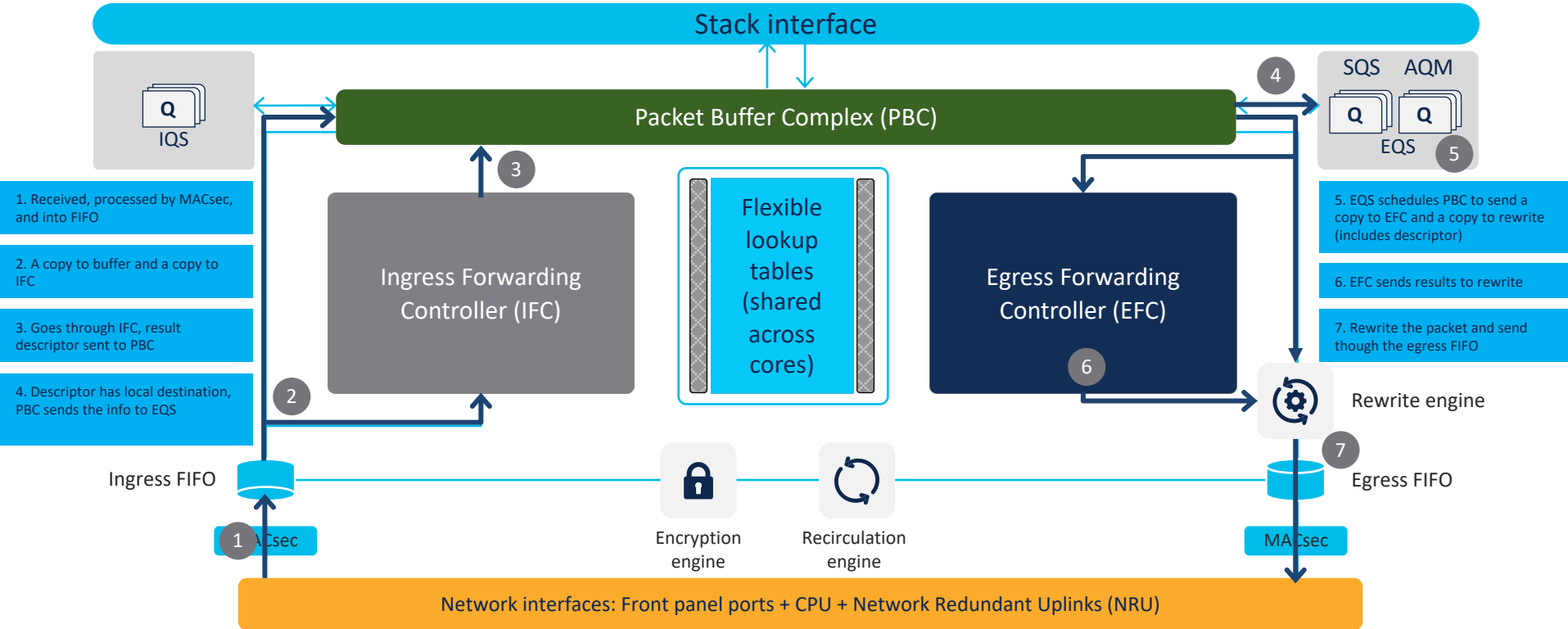


Transform-set and Tunnel Interface

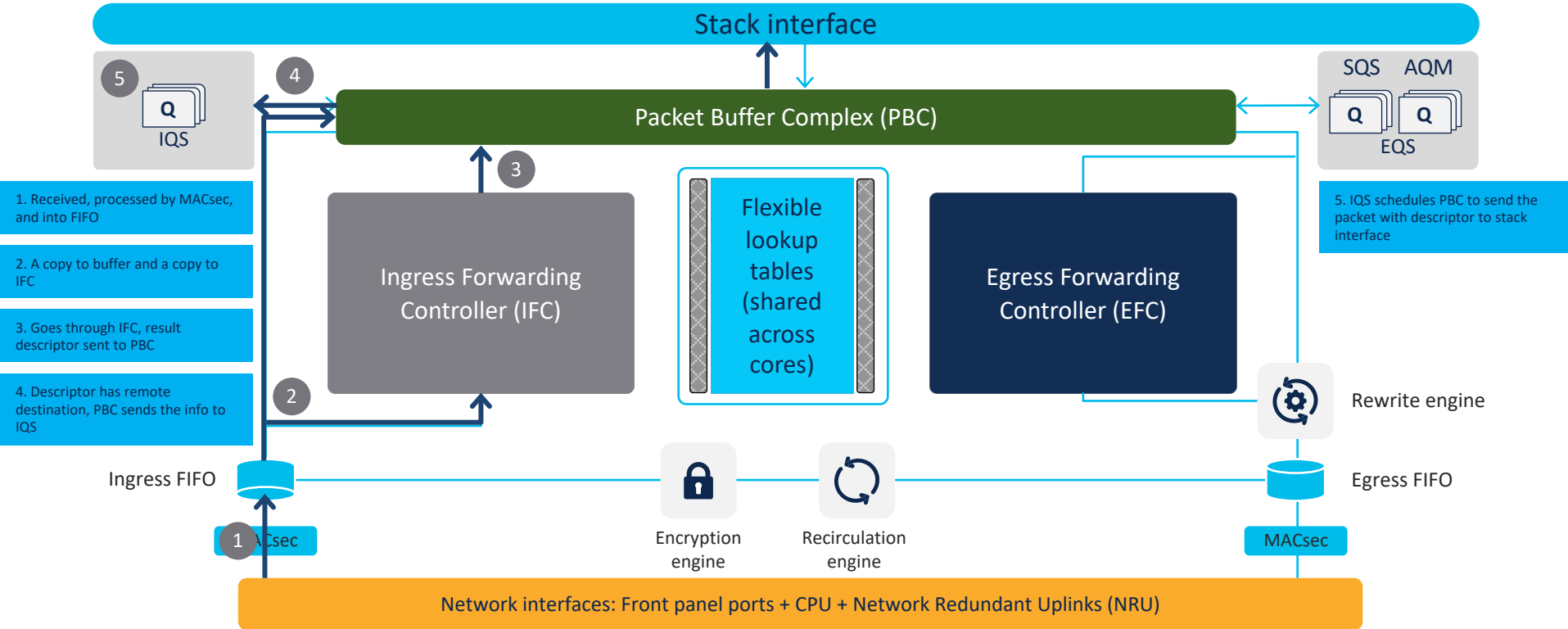


Packet walks

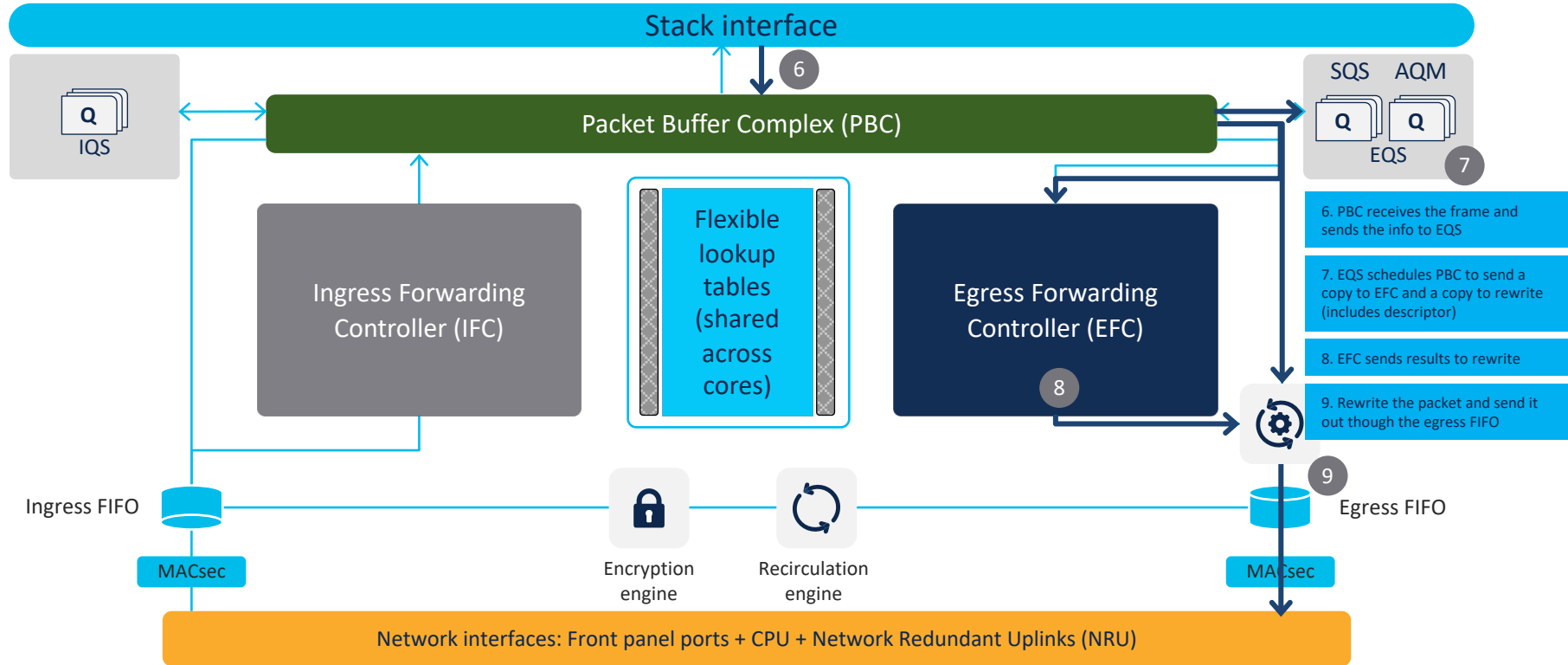
Unicast – Within ASIC



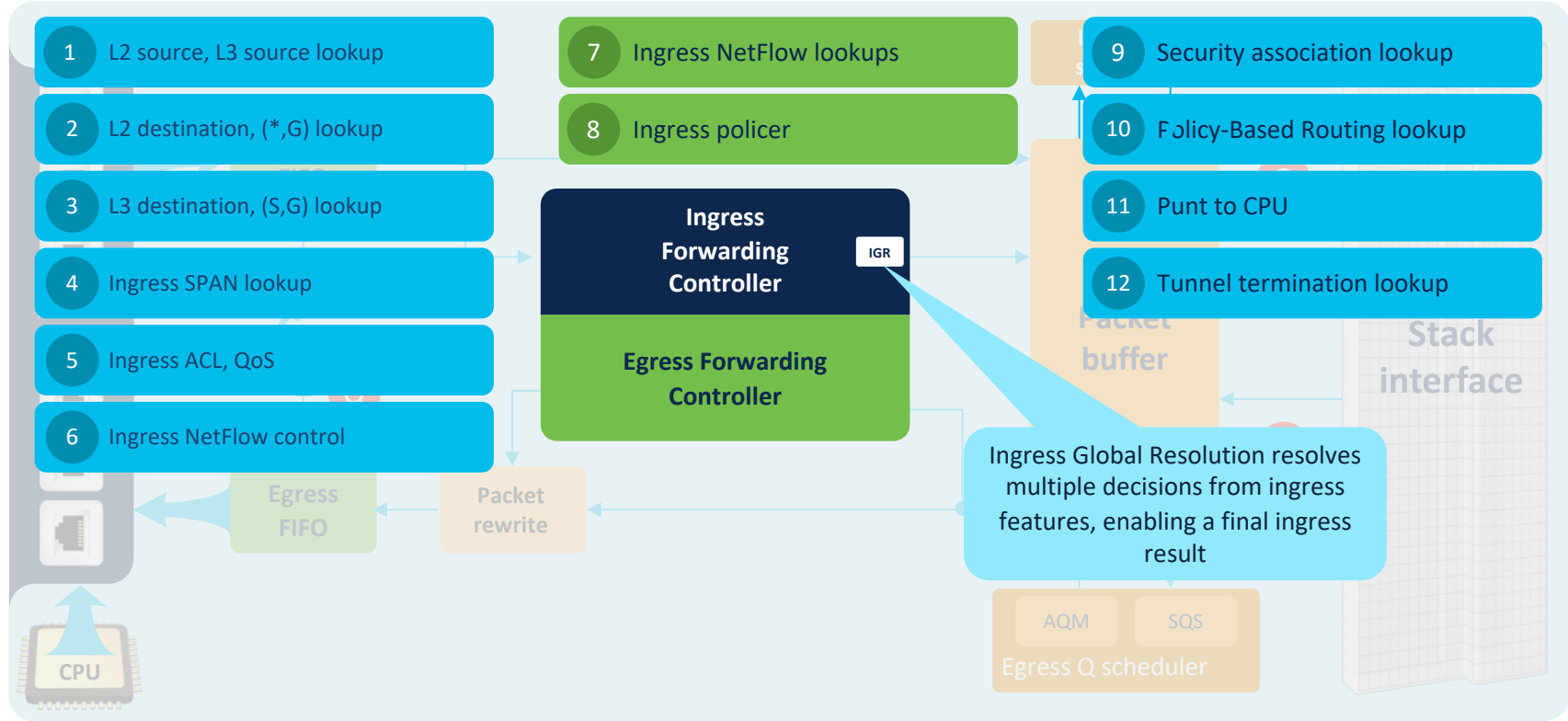
Unicast – Across ASICs on input



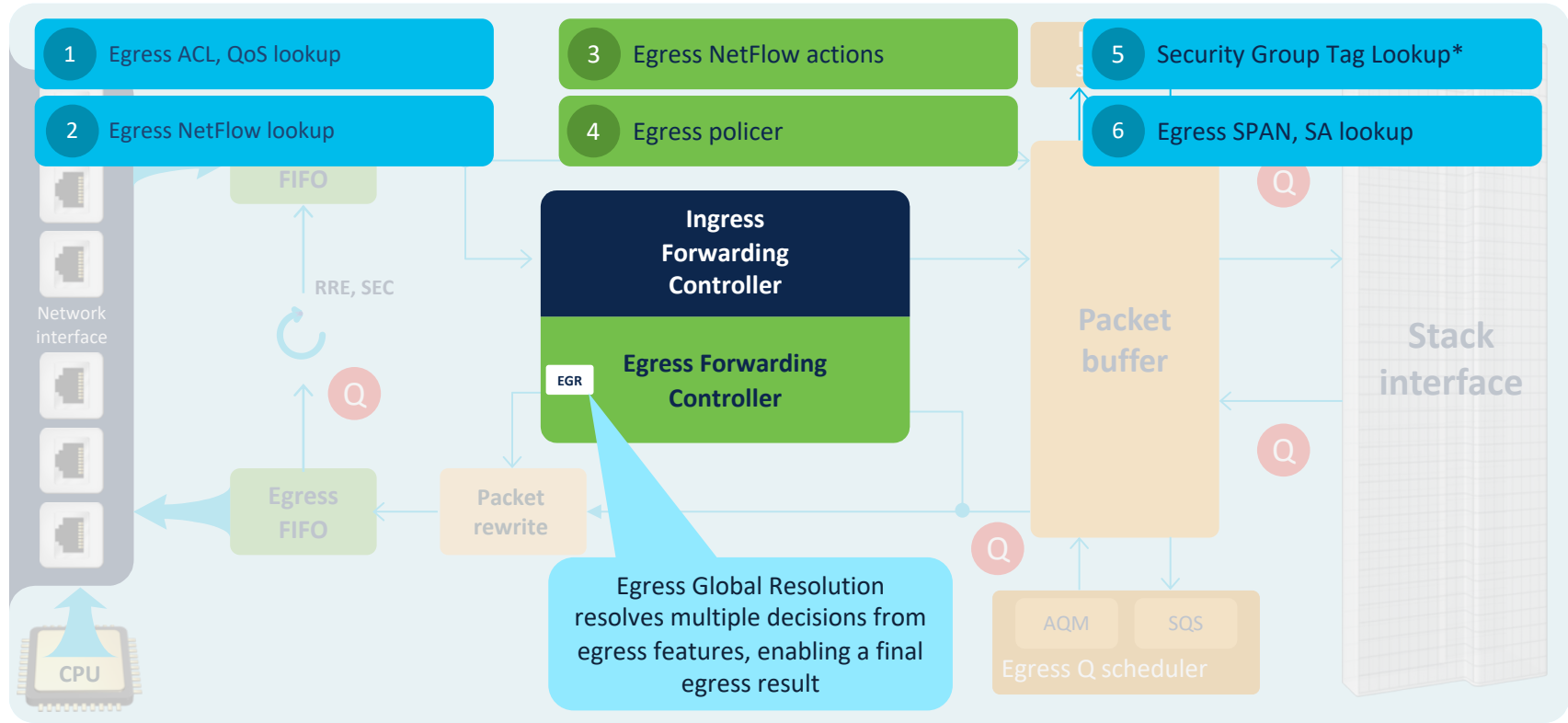
Unicast – Across ASICs on input



Ingress lookup sequence



Egress lookup sequence



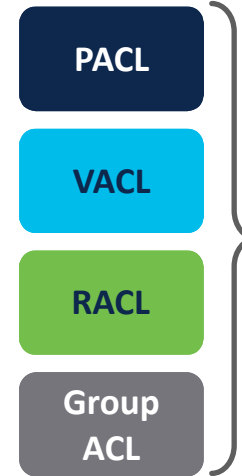
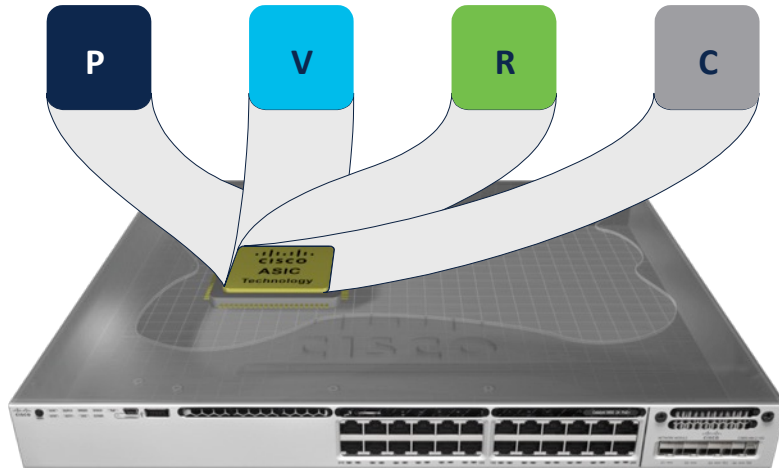
Access Control Lists (ACLs)

ACL types and features

- Security ACL (MAC, IPv4, and IPv6)
 - Port ACL (PACL): Enabled under Layer 2 interface
 - VLAN ACL (VACL): Enabled for Layer 2 VLAN traffic
 - Router ACL (RACL): Enabled for routed traffic
 - Group ACL (GACL): ACL for clients group
 - Security group ACL (SGACL): ACL for Cisco TrustSec® and SGTs
 - Web Cache Communication Protocol (WCCP)-Egress
- ACL for QoS classification and policing (including Control Plane Policing [CoPP])
- Service ACL policy
 - PBR, NAT, WCCP-Ingress
 - NetFlow ACL
 - SPAN
 - MACsec
 - User ACL to redirect traffic (CoPP)
 - Tunnel
 - LISP



Security ACL types



How would you scale
for wireless clients
that have features
like ACL and QoS
associated with them?

Security ACLs

```
interface gigabitethernet1/1
```

```
  ip access-group PACL-1 in
  ip access-group PACL-2 out
```

PACL: Direction indicated in CLI

```
  switchport access vlan 100
```

```
  vlan access-map VACL-map
  match ip address VACL-1
  action forward
```

```
  vlan filter VACL-map vlan-list 100
```

VACL: VLAN ACL for both ingress and egress; apply to pre- and post-routed traffic

```
  interface Vlan100
  no shutdown
```

```
  ip access-group RACL-1 in
  ip access-group RACL-2 out
```

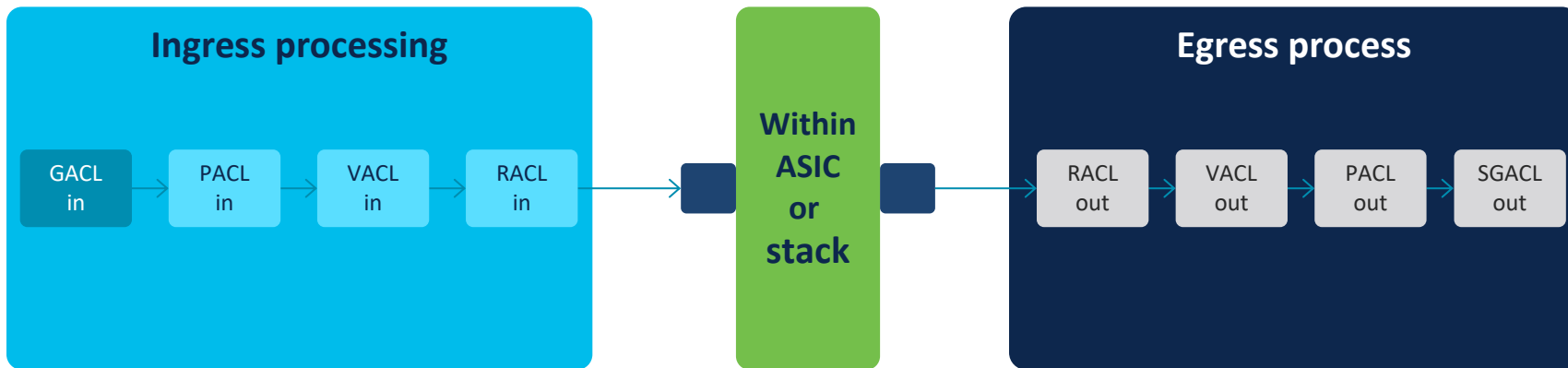
RACL: Routed ACL; apply only to traffic that requires routing; direction indicated in the CLI

```
  ip address 100.1.1.1/24
```

ACL type	Attach point	Direction
PACL	Layer 2 interface	In or out
VACL	VLAN	Always in and out
RACL	Layer 3 interface, Layer 3 port channel, subinterface SVI	In or out

Security ACL processing order and priority

- The following is a conceptual illustration. In the ASIC, the lookup for different types of ACLs takes place concurrently.
- A packet is dropped if it hits the deny rule in any of these types of ACLs.
- RACL is applied only to traffic that is Layer 3 forwarded.



Sharing Access Control Entries (ACEs)

- Each ACL policy is reference by a label.
- Same ACL policy (security ACL such as GACL, PACL, VACL, RACL, and QoS ACL) is applied to multiple interfaces or VLAN; it uses the same label.
- Label sharing is within the core.
- Ingress and egress use different labels.

```
ip access-list extended ip-list-1
deny ip 100.1.1.0 0.0.0.255 200.1.1.0 0.0.0.255
deny ip 100.1.2.0 0.0.0.255 200.1.2.0 0.0.0.255
deny ip 100.1.3.0 0.0.0.255 200.1.3.0 0.0.0.255
permit ip any any

interface GigabitEthernet1/0/1
 ip access-group ip-lists-1 in
interface GigabitEthernet1/0/2
 ip access-group ip-lists-1 in
interface GigabitEthernet1/0/3
 ip access-group ip-lists-1 in
```

Label

101

Gi1/0/1

101

Gi1/0/2

101

Gi1/0/3

101

IPv4 ACL ip-list-1 in

SUP-1/1XL

ACL allocation

ACL type	Default template
Security ACLs	18,000
QoS ACLs	18,000
Service ACLs – PBR/NAT	2000
Service ACLs – tunnel	1000
Service ACLs – CoPP	1000
Service ACLs – MACsec	1000
Service ACLs – SPAN	1000
Service ACLs – NetFlow	1000 ingress, 2000 egress
Service ACLs – LISP	1000
Service ACL - client_LE	4000
Service ACL – input_group_LE	1000
Service ACL – output_group_LE	1000

SUP-2/2XL ACL allocation

ACL type	Default template
Security ACLs (in + out)	10,000 + 16,000
QoS ACLs (in + out)	8,000 + 8,000
Service ACLs – PBR/NAT	2,048
Service ACLs – tunnel	1,024
Service ACLs – CoPP	512
Service ACLs – MACsec	1024
Service ACLs – SPAN	1024
Service ACLs – NetFlow	1,024 ingress, 1,024 egress
Service ACLs – LISP	2,048
Service ACL - client_LE	4,000
Service ACL – input_group_LE	1,000
Service ACL – output_group_LE	1,000

SUP-1XL – Resource utilization

```
C9400#show platform hardware fed active fwd-asic resource tcam utilization
CAM Utilization for ASIC Instance [0] Table           Max Values           Used Values
-----
Unicast MAC addresses                               65536/512             17/21
IGMP and Multicast groups                           8192/512              0/0
L2 Multicast groups                                 8192/512              0/0
Directly or indirectly connected routes             16384/65024           0/14
NAT/PAT SA address and Port                         0                     0
QoS Access Control Entries                          18432                  0
Security Access Control Entries                     18432                  114
Ingress Netflow ACEs                               1024                   8
Policy Based Routing ACEs                           2048                   0
Egress Netflow ACEs                                 2048                   0
Input Microflow policer ACEs                         512                   0
Output Microflow policer ACEs                       1024                   7
Flow SPAN ACEs                                       1024                   0
Control Plane Entries                               1024                  200
Tunnels                                               1024                   17
Lisp Instance Mapping Entries                       1024                   3
Input Security Associations                          512                   0
Output Security Associations and Policies            512                   5
SGT_DGT                                              8192/512              0/0
CLIENT_LE                                           4096/256              0/0
INPUT_GROUP_LE                                       1024                   0
OUTPUT_GROUP_LE                                      1024                   0
Macsec SPD                                           256                   2
```

Example output from
Cisco Catalyst™ 9400 Series

SUP-2XL – Resource utilization

C9400X#show platform hardware fed active fwd-asic resource tcam utilization

Codes: EM - Exact_Match, I - Input, O - Output, IO - Input & Output, NA - Not Applicable

CAM Utilization for ASIC [0]

Table	Subtype	Dir	Max	Used	%Used	V4	V6	MPLS	Other
Mac Address Table	EM	I	65536	42	0.06%	0	0	0	42
Mac Address Table	TCAM	I	1536	22	1.43%	0	0	0	22
L3 Multicast	EM	I	16384	0	0.00%	0	0	0	0
L3 Multicast	TCAM	I	768	6	0.78%	3	3	0	0
L2 Multicast	EM	I	16384	0	0.00%	0	0	0	0
L2 Multicast	TCAM	I	768	7	0.91%	3	4	0	0
IP Route Table	EM/LPM	I	114688	9	0.01%	8	0	1	0
IP Route Table	TCAM	I	2304	11	0.48%	6	3	2	0
QOS ACL	TCAM	I	8192	45	0.55%	15	20	0	10
QOS ACL	TCAM	O	8192	40	0.49%	13	18	0	9
Security ACL	TCAM	I	10240	88	0.86%	12	36	0	40
Security ACL	TCAM	O	16384	43	0.26%	14	24	0	5
Netflow ACL	TCAM	I	1024	6	0.59%	2	2	0	2
PBR ACL	TCAM	I	2048	22	1.07%	16	6	0	0
Netflow ACL	TCAM	O	1024	6	0.59%	2	2	0	2
Flow SPAN ACL	TCAM	I	512	4	0.78%	1	2	0	1
Flow SPAN ACL	TCAM	O	512	4	0.78%	1	2	0	1
Control Plane	TCAM	I	512	281	54.88%	130	106	0	45
Tunnel Termination	TCAM	I	1024	24	2.34%	9	14	0	1
Lisp Inst Mapping	TCAM	I	2048	1	0.05%	0	0	0	1
Security Association	TCAM	I	512	4	0.78%	2	2	0	0
CTS Cell Matrix/VPN Label	EM	O	32768	0	0.00%	0	0	0	0
CTS Cell Matrix/VPN Label	TCAM	O	768	1	0.13%	0	0	0	1
Client Table	EM	I	8192	0	0.00%	0	0	0	0
Client Table	TCAM	I	512	0	0.00%	0	0	0	0
Input Group LE	TCAM	I	1024	0	0.00%	0	0	0	0
Output Group LE	TCAM	O	1024	0	0.00%	0	0	0	0
Macsec SPD	TCAM	I	1024	2	0.20%	0	0	0	2

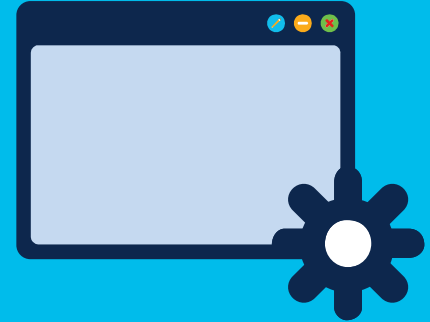
Example output from
Cisco Catalyst™ 9400X Series

Resource output

Resource	Resource explained
Unicast MAC addresses	Unicast MAC addresses
IGMP and multicast groups	Internet Group Management Protocol (IGMP) and multicast groups
Layer 2 multicast groups	IGMP snooping entries
Directly connected routes	Directly connected hosts (host routes or /32 routes)
Indirect routes	Indirect routes, or longest prefix match (LPM)
Security ACEs	Security access control entries (ACEs) (PACL, VACL, RACL, GACL, SGACL, WCCP-Egress)
QoS ACEs	ACEs for QoS
Policy-based routing ACEs	ACEs for PBR, NAT, and WCCP-Ingress
Egress NetFlow ACEs	ACEs for NetFlow
Input microflow policer ACEs	Used for wireless client policer
Output microflow policer ACEs	Used for wireless client policer
Flow SPAN ACEs	ACEs for Switched Port Analyzer (SPAN)
Tunnels	ACEs for Control and Provisioning of Wireless Access Points (CAPWAP) tunnels
LISP instance mapping entries	ACEs for LISP
Input security associations	Used with MACsec
Output security association and policies	Used with Cisco TrustSec®
SGT-DGT	Scalable group tag to destination group tag mapping
CLIENT_LE	ACEs for clients (for 802.1X wire client)
INPUT_GROUP_LE	ACEs for input group (for 802.1X wire client)
OUTPUT_GROUP_LE	ACEs for output group (for 802.1X wire client)
MACsec SPD	Security Policy Database, used with MACsec

ACL programming scope

- RACL, VACL, SGACL: On all cores and ASICs.
- VACL: Programmed for both ingress and egress (IPv6 VACL takes four entries – Two for ingress and two for egress).
- PACL and GACL: Programmed only on the core that has the port. (If L4OP is part of the PACL/GACL, it will be programmed in both cores.)



ACL Layer 4 operators (L4OPs)

- Eight L4OPs
- First use the L4OPs
- When additional L4OPs are needed, software will optimize and use ACE expansion for the L4OPs that use the fewest ACEs

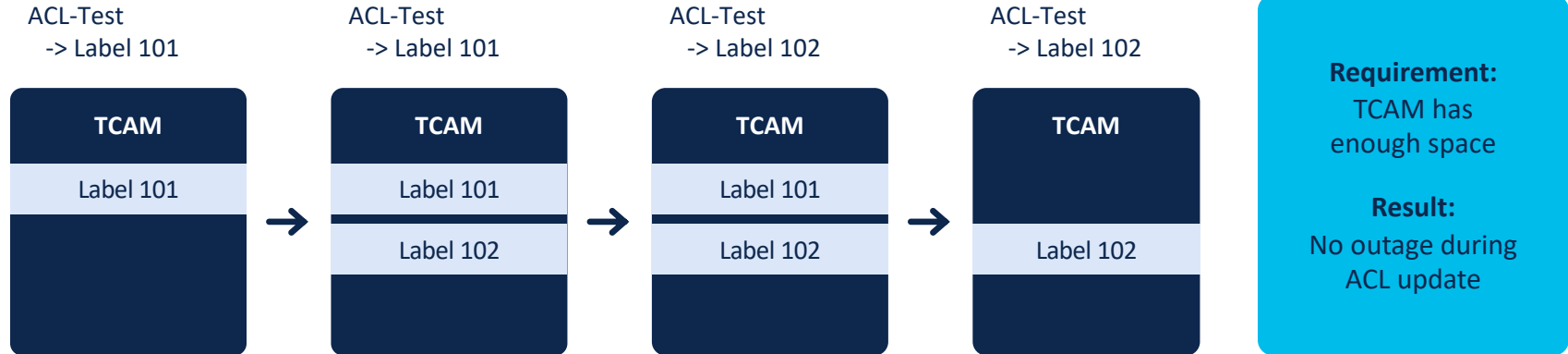
Two L4OPS

```
ip access-list extended test
  permit tcp 10.0.0.0 0.0.0.255 any range 1000 2000
  permit udp 30.0.0.0 0.0.0.255 any range 2000 4000
  permit tcp 50.0.0.0 0.0.0.255 any rst
```

Hitless (atomic) ACL update

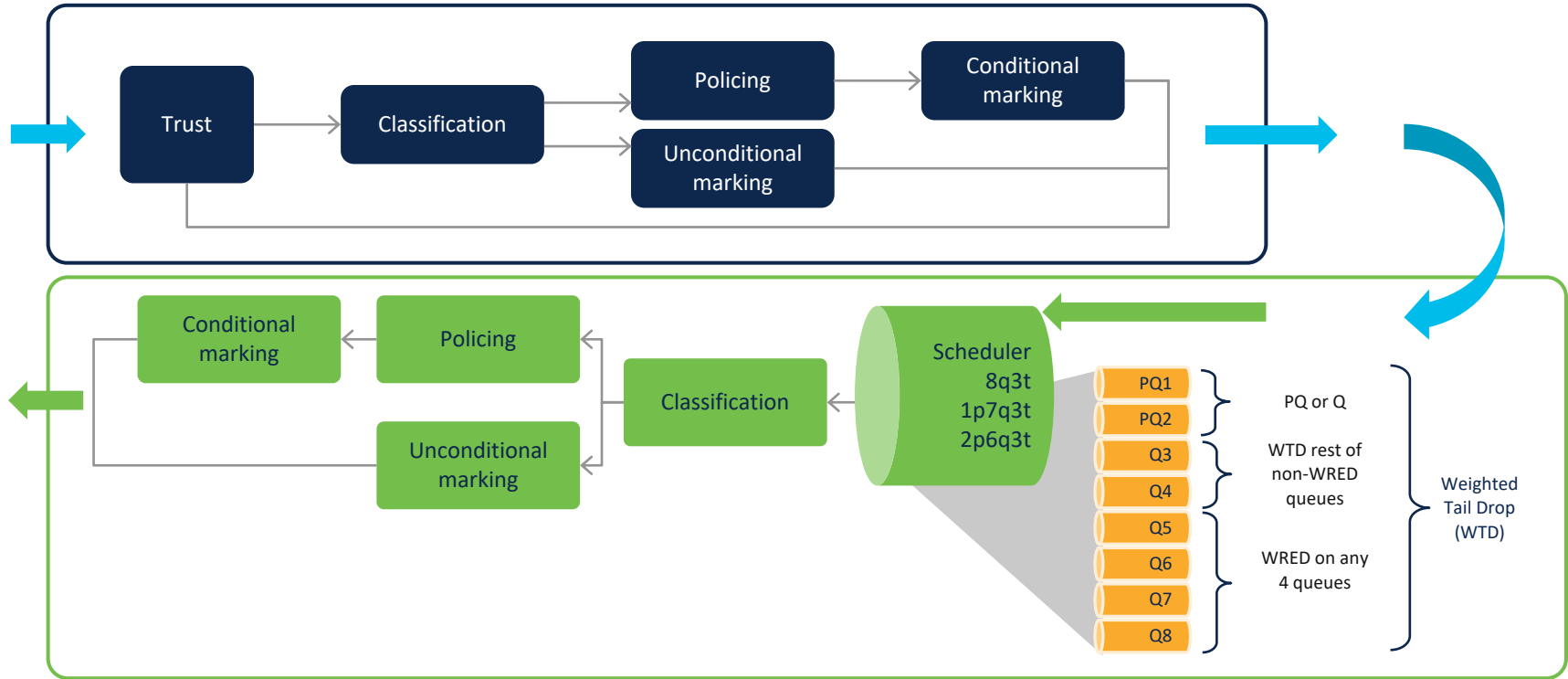
Modified ACL-Test

```
SW(config)#ip access-list extended ACL-Test
SW(config-ext-nacl)#105 permit ip host 10.1.1.1 host 20.1.1.1
SW(config-ext-nacl)#
```

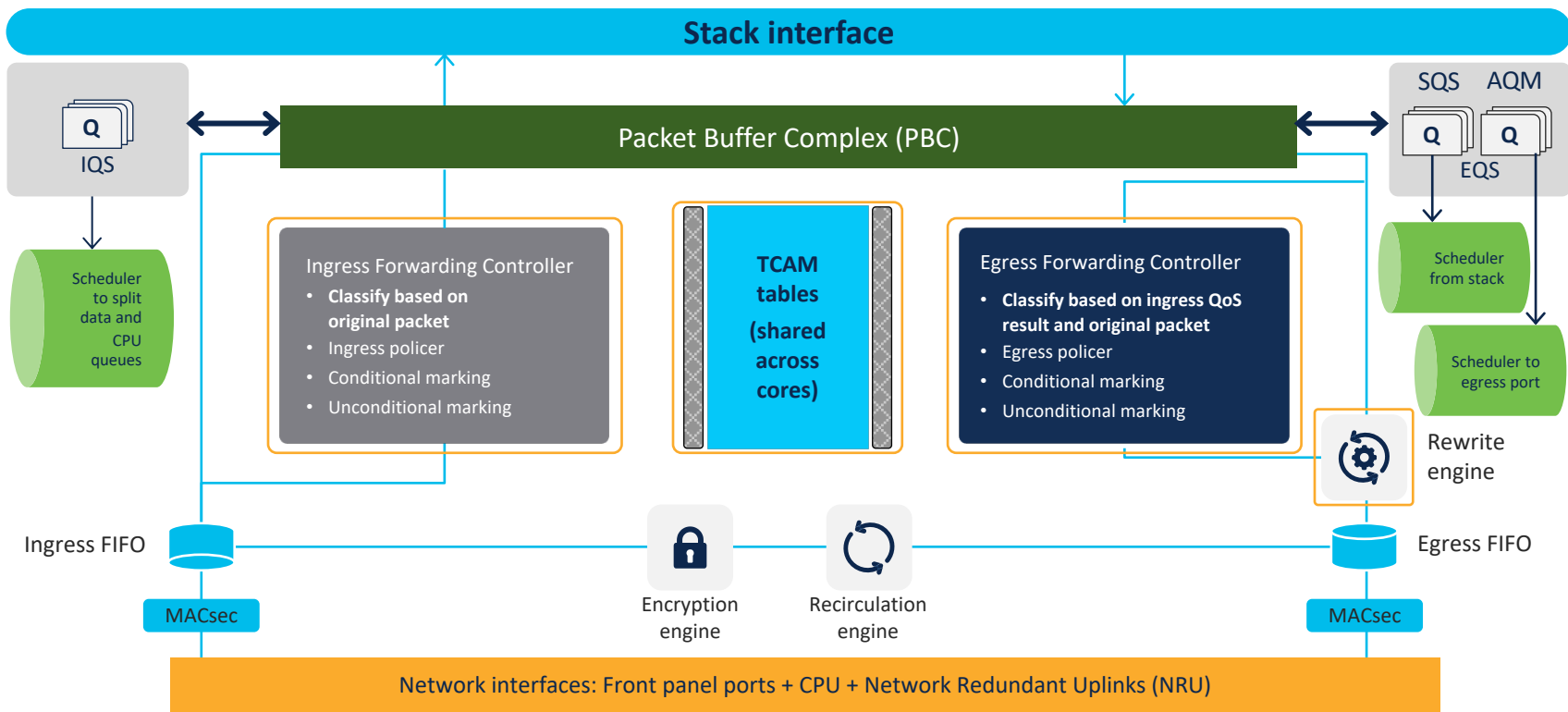


Quality of Service (QoS)

QoS fundamental actions



UADP 2.0/3.0sec – QoS packet processing



Traffic classification

- A class map can be defined as a logical OR only, that is, “match-any”
- “match-all” is also supported on the Cisco Catalyst™ 9000 family (default)

```
switch(config-cmap)# class-map match-any VOICE
switch(config-cmap)#match ?
  access-group      Access group
  any                Any packets
  class-map         Class map
  cos               IEEE 802.1Q/ISL class of service/user priority values
  dscp              Match DSCP in IPv4 and IPv6 packets
  group-object      Match object-group
  ip                IP specific values
  mpls              Multi Protocol Label Switching specific values
  non-client-nrt    Match non-client NRT
  precedence        Match Precedence in IPv4 and IPv6 packets
  protocol          Protocol
  qos-group         Qos-group
  vlan              VLANs to match
  wlan              802.11-specific values
```

Marking

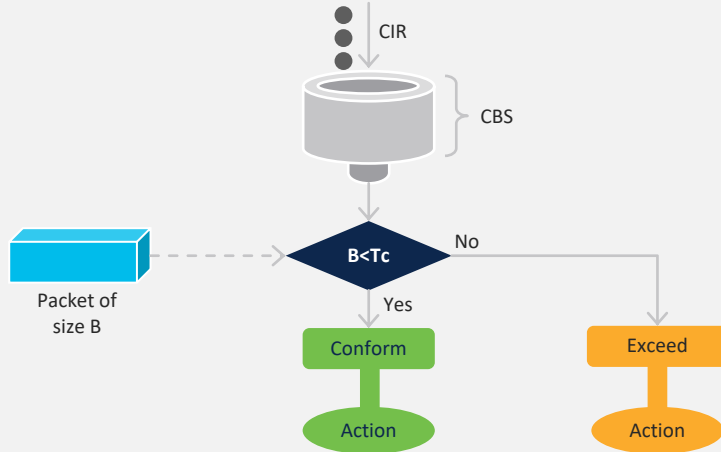
- Three types of marking policies:
 - Conditional policer-based marking
 - Unconditional explicit marking
 - Table map-based marking
- Marking with “set”
- Marking with table maps
- Table maps can be applied only on class default

```
[class-maps omitted for brevity]
policy-map MARKING-POLICY
  class VOIP
    set dscp ef
  class MULTIMEDIA-CONFERENCING
    set dscp af41
  class SIGNALING
    set dscp cs3
  class TRANSACTIONAL-DATA
    set dscp af21
  class BULK-DATA
    set dscp af11
  class SCAVENGER
    set dscp cs1
  class default
    set dscp dscp table COS2DSCP
```

```
table-map COS2DSCP
  map from 5 to 46
  default copy
```

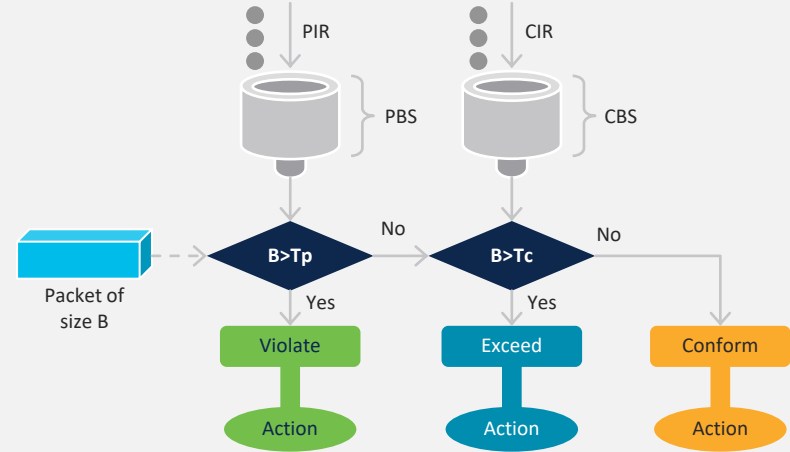

Policing

One rate, two colors



```
police cir 100000000 bc 3125000 conform-action  
set-dscp-transmit af41 exceed-action drop
```

Two rates, three colors



```
police cir percent 10 pir percent 50 conform-  
action transmit exceed-action set-dscp-transmit  
af11 violate-action drop
```

Packet buffers

Types:

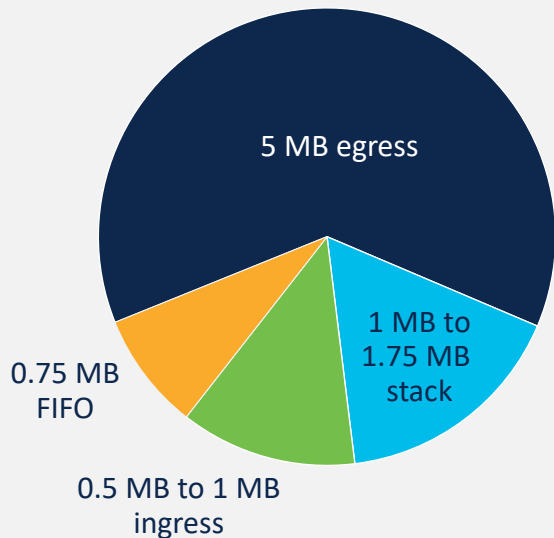
- Ingress buffers: For Ingress Queues and Scheduler (IQS) (dedicated and shared)
- Egress stack buffers: For egress Stack Queues and Scheduler (SQS) (dedicated and shared)
- Egress port buffers: For egress port queues (AQM)
- Temporary buffers: For packets from the stack or CPU

Allocation:

- Use dedicated first, then shared

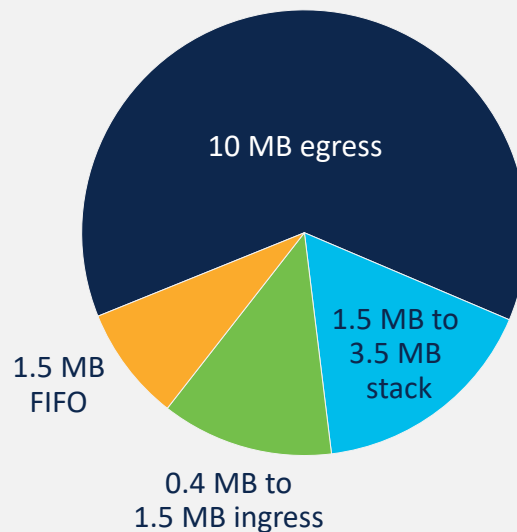
Buffer size comparison: Catalyst 9300 and 9400/9500 Series

Catalyst® 9300 Series (per Core)



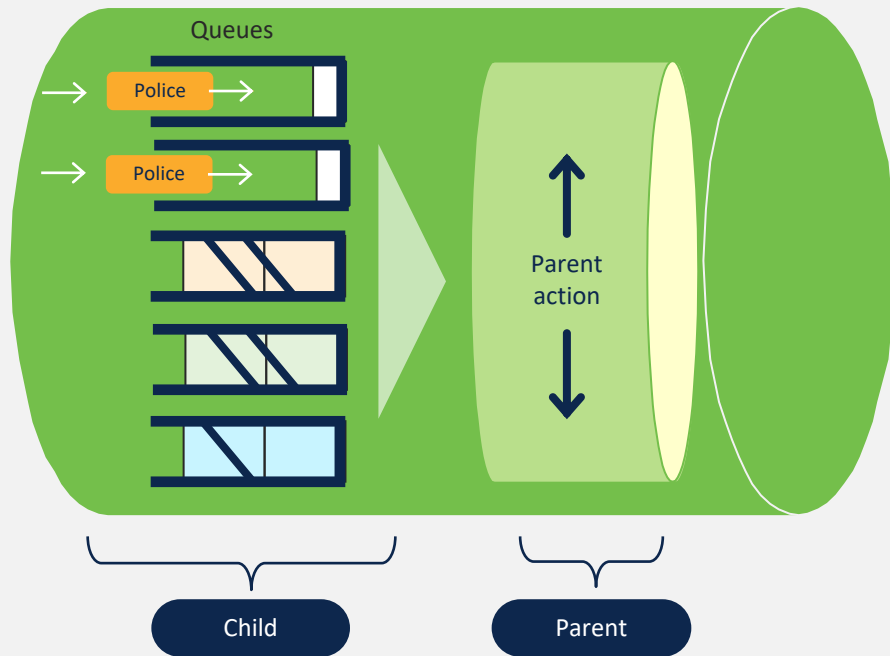
Per core: 8 MB | Per ASIC: 8+8 MB

Catalyst 9400 and 9500 Series (per Core)



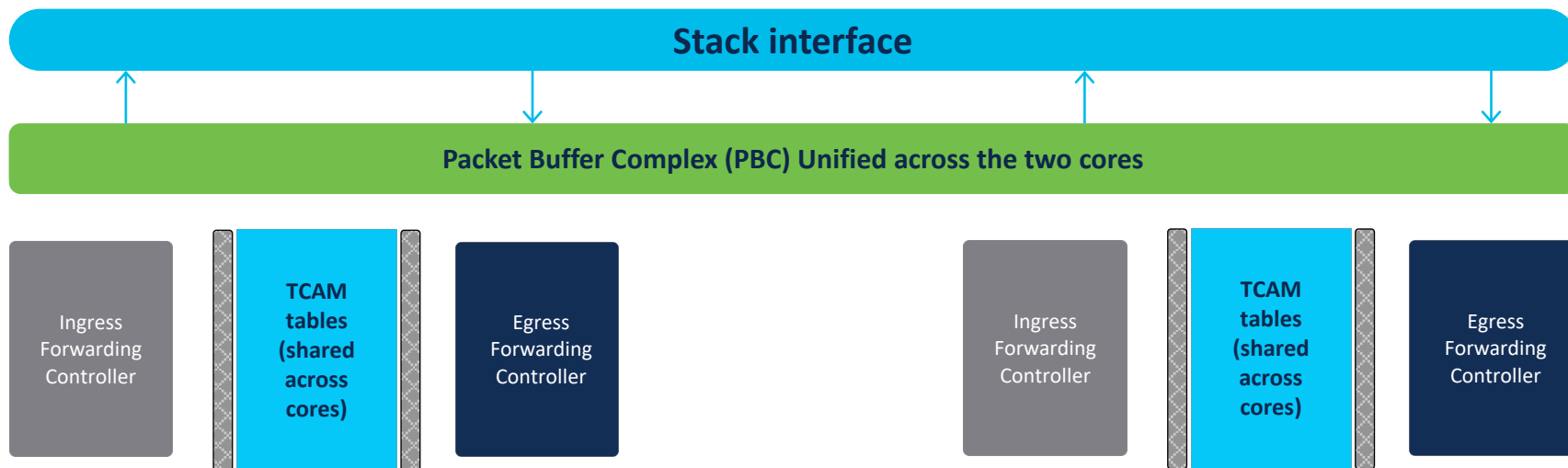
Per core: 16 MB | Per ASIC: 16+16 MB

2-level hierarchical QoS (HQoS)



Child	Parent
Bandwidth, policing	Shape
Marking	Policing
Policing	Marking

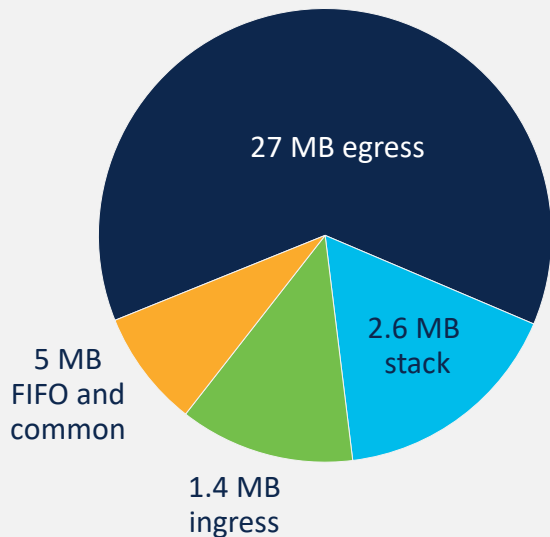
UADP 3.0sec – QoS unified buffer vs. Per core



```
C9400X(config)# qos shared-buffer
C9400X(config)# qos queue-softmax-multiplier ?
    <100-1200> multiplier(%) (Per Core Mode)
    <100-4800> multiplier(%) (Unified Buffer)
```

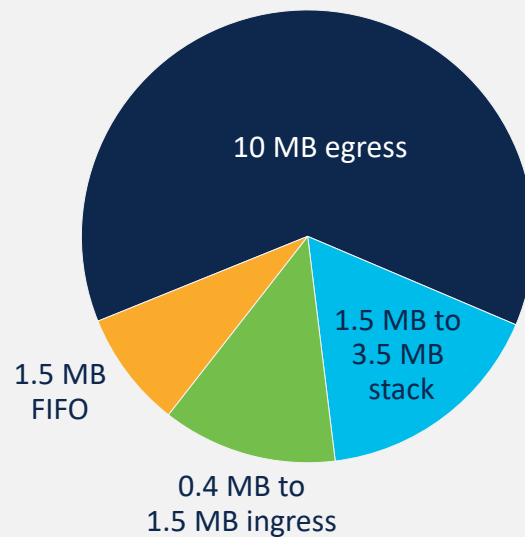
Buffer size comparison: Catalyst 9400X and 9400 models

Catalyst® 9400X models (per ASIC)



Per core: 18 MB | Per ASIC: 18+18 MB

Catalyst 9400 models (per Core)

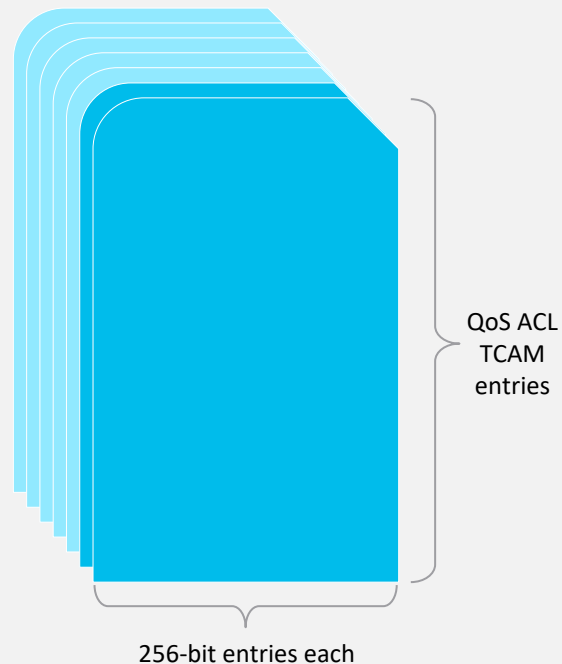


Per core: 16 MB | Per ASIC: 16+16 MB

Cisco Catalyst 9400 Series – QoS scalability

SUP-1/1XL

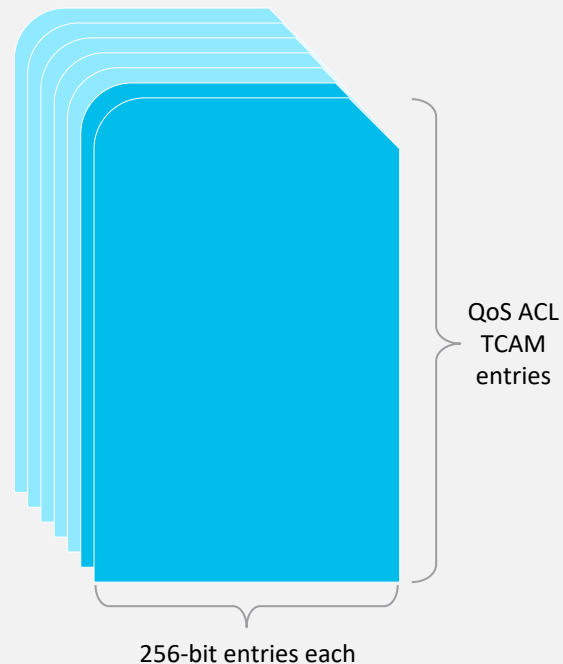
QoS scale numbers	
QoS ACL (IPv4) entries	8000 ingress + 8000 egress
QoS ACL (IPv6) entries	8000 ingress + 8000 egress
Class maps (ingress)	1024
Class maps (egress)	512
Table maps (ingress)	256
Table maps (egress)	256
Aggregate policers	Per ASIC: 8000 (1R2C), 4000 (2R3C)
Wired queues per port	8 queues (2 can be priority)
Default queue per port	2 queues (1 critical, 1 standard)
Buffer per ASIC	32 MB



Cisco Catalyst 9400 Series – QoS scalability

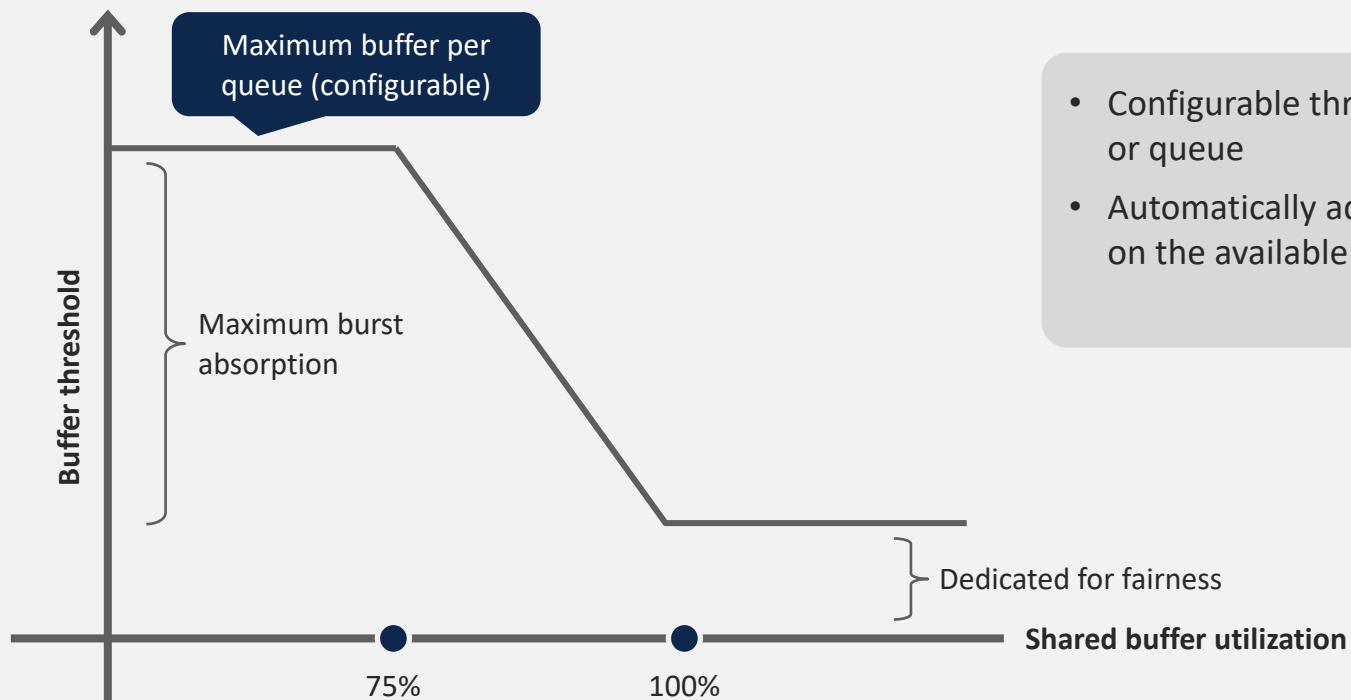
SUP-2/2XL

QoS scale numbers	
QoS ACL (IPv4) entries	8000 ingress + 8000 egress*
QoS ACL (IPv6) entries	8000 ingress + 8000 egress*
Class maps (ingress)	1024
Class maps (egress)	512
Table maps (ingress)	256
Table maps (egress)	256
Aggregate policers	16,000 total, 63 policers per port per direction
Wired queues per port	8 queues (2 can be priority)
Default queue per port	2 queues (1 critical, 1 standard)
Buffer per ASIC	36 MB (unified or per core mode)



* With default SDM template.

Dynamic fair buffer sharing



- Configurable threshold per port or queue
- Automatically adjusted; depends on the available shared pool

Cisco Catalyst 9400 and 4500E Series

	Catalyst 9400 SUP-2/2XL	Catalyst 9400 SUP-1/1XL	Catalyst 4500E Series
Buffer	108 MB per system (36 MB per ASIC unified)	96 MB per system (32 MB per ASIC)	32 MB
HQoS (2 levels)	Yes	Yes	No
Dynamic Buffer Limiting (DBL)	No	No	Yes
Dynamic Threshold and Scaling (DTS)	Yes	Yes	No
Weighted Random Early Detection (WRED)	Yes	Yes	No
Control Plane Policing (CoPP)	Yes (system predefined class)	Yes (system predefined class)	Yes (system predefined class and user-defined class)

Control Plane Policer (CoPP)

	Catalyst® 9400 and 9400X models	Catalyst 4500E Series
Queues	32 queues (17 used)	64 queues (not all queues are used)
CoPP class	AQM for system-defined; user-defined is using ACL	User can define class plus system-defined ACL
Policer	Queues will have to share the policers	Shared with the system's policer
Policer rate	User can change the rate	User can change the rate
Policing	User-defined is bits per second System-defined is packets per second	Both are packets per second
Default	Enabled	Disabled

Multicast

Cisco Catalyst 9000 family multicast

Performance

- High Layer 2 and Layer 3 multicast throughput
- Low latency

Flexible scalability

- Different Switching Database Manager (SDM) templates provide different IGMP snooping groups and multicast routes (mroutes)

Optimized replication

- Replication is done at egress
- A single copy is in the buffer memory during replication

Enhanced features

- IP-based forwarding for IGMP snooping
- IGMP snooping explicit tracking (for IGMP v3)

Multicast features

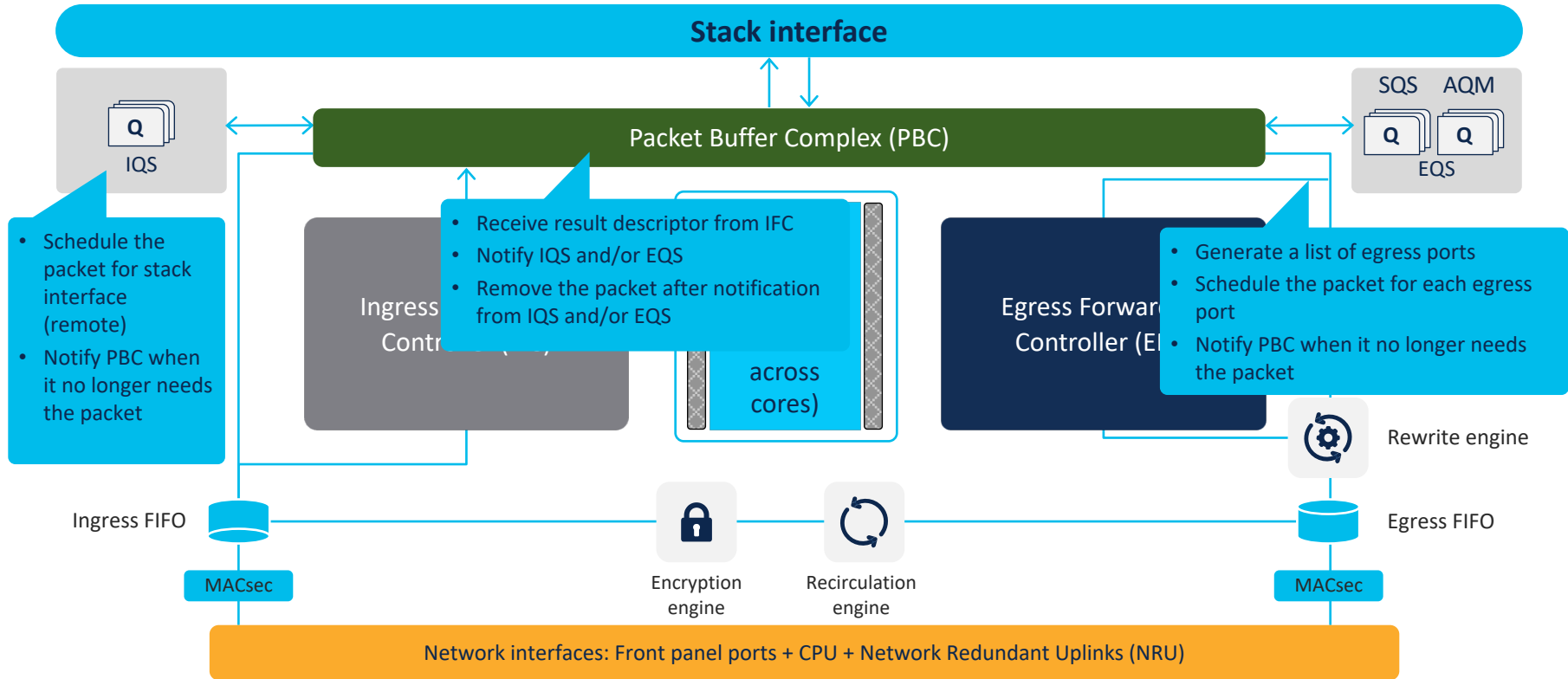
Features	Catalyst® 9000 family
IGMP v1, v2, v3	Yes
IGMP snooping	Yes
MLD (Multicast Listener Discovery) v1, v2	Yes
MLD snooping (v1, v2)	Yes
PIM (Protocol Independent Multicast) SM (Sparse Mode)	Yes
PIM Dense Mode	Yes
PIM SSM (Source-Specific Mode)	Yes
PIM Bi-Dir	Yes

IP-based forwarding for IGMP snooping

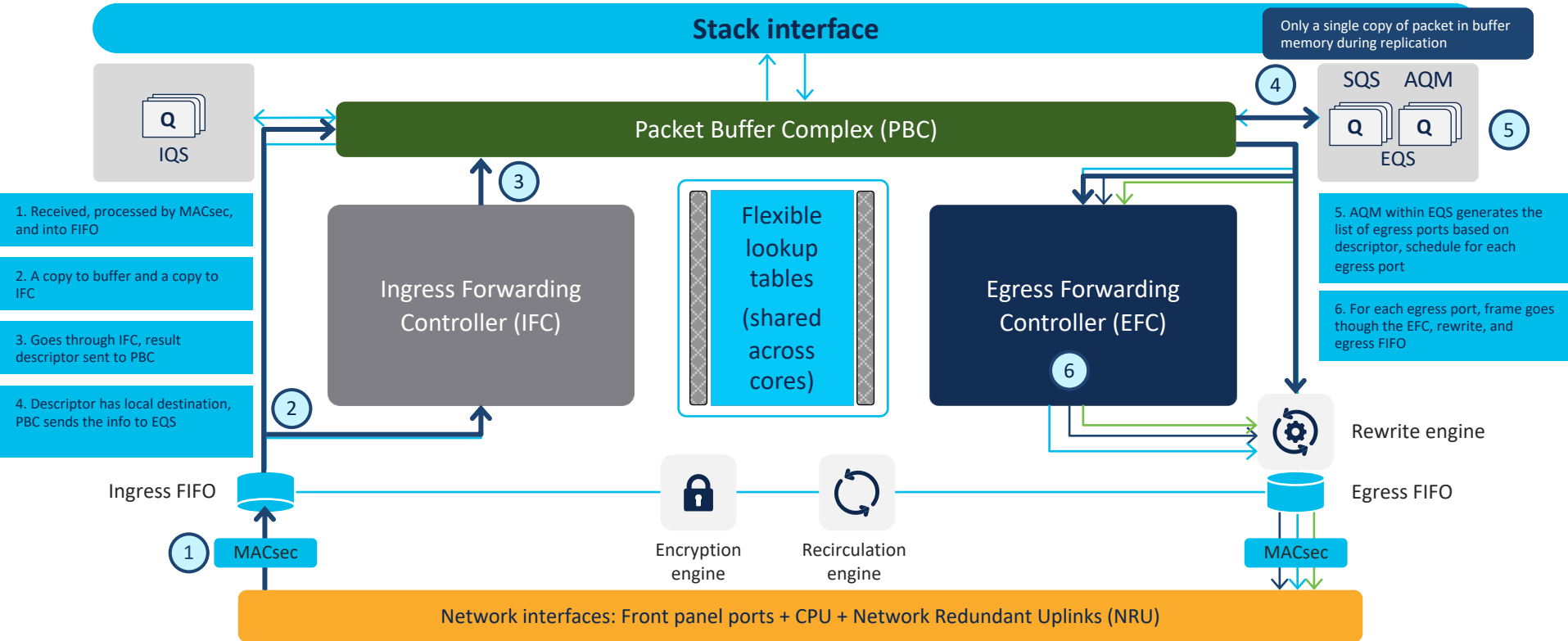
- Source IP and group address-based forwarding for IGMP v3 snooping even when the device is a Layer 2 switch
- Can filter traffic based on source IP
- No concern for overlapping multicast MAC addresses



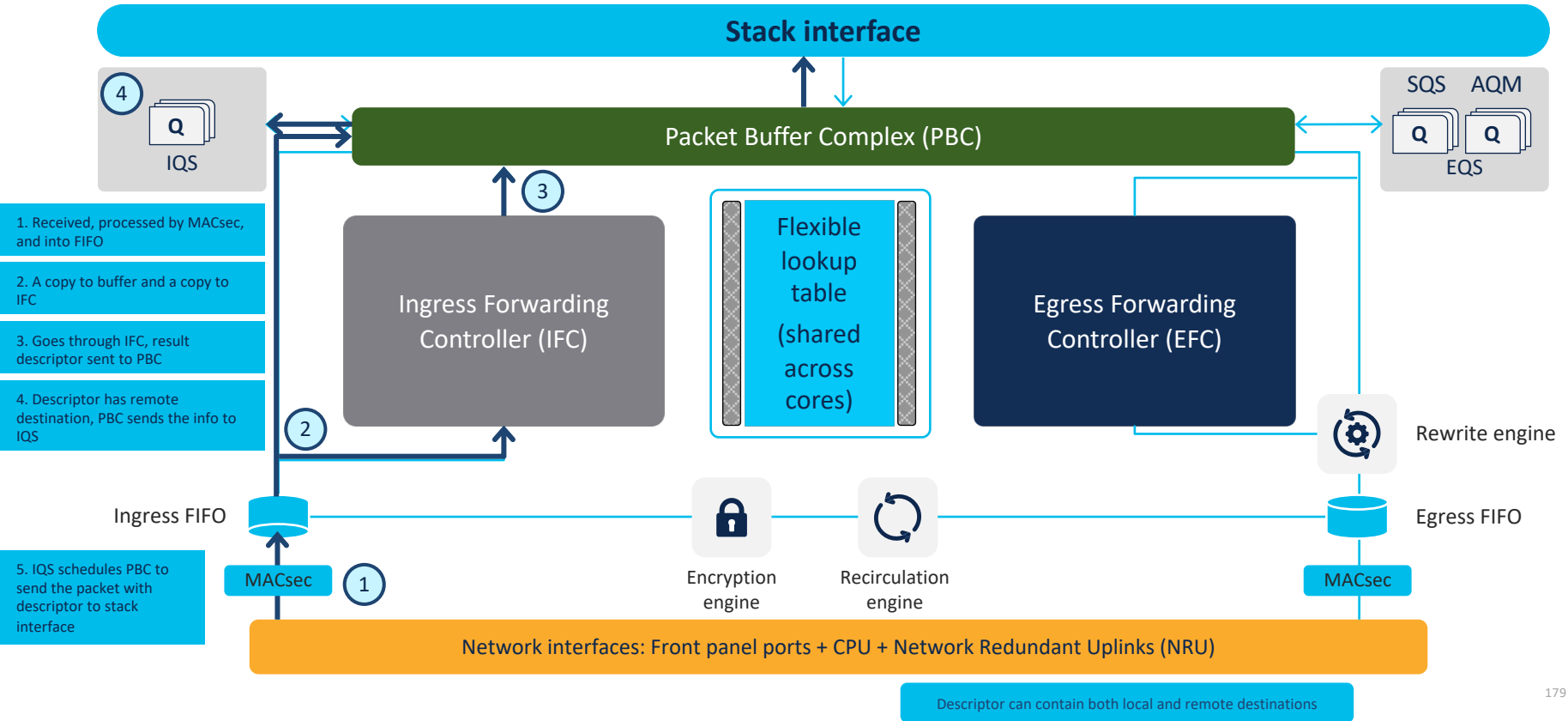
Multicast key components



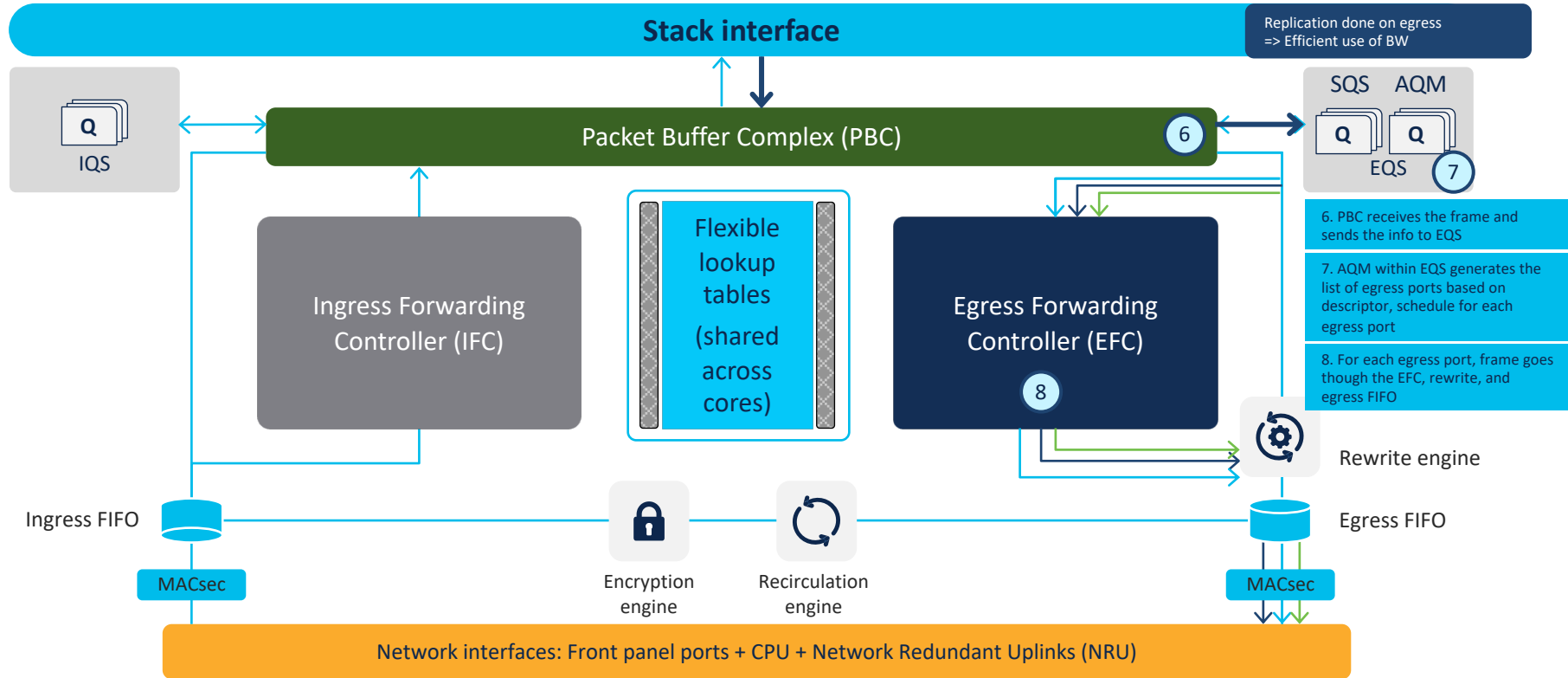
Multicast – Egress local



Multicast – Egress remote on input

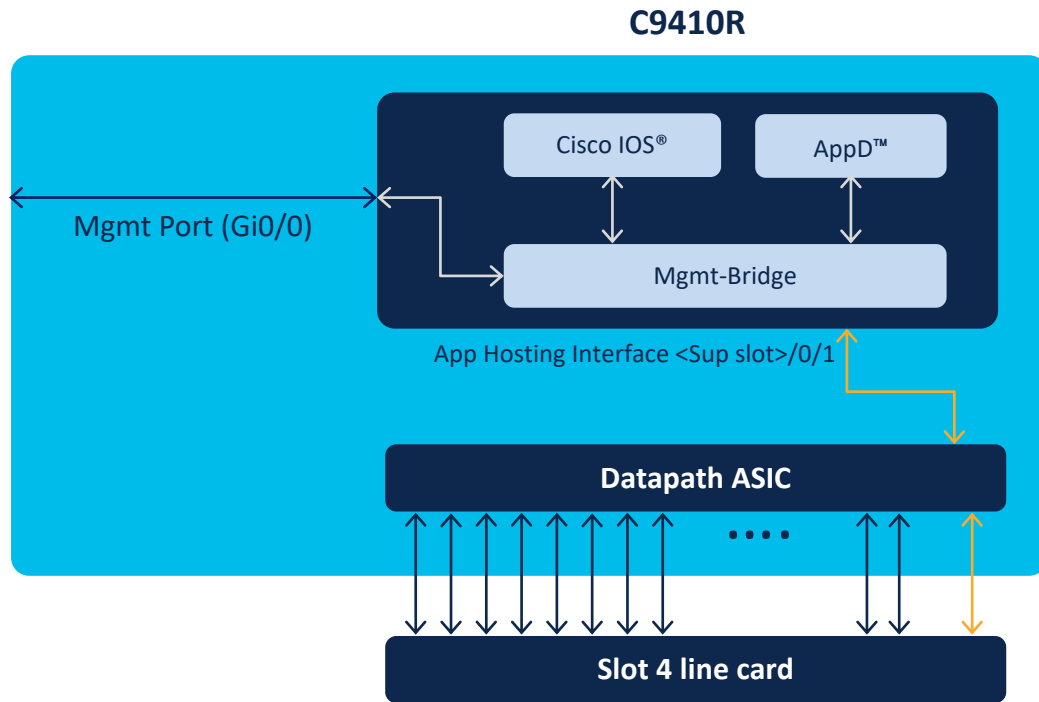


Multicast – Egress remote output



App hosting

App hosting support on Catalyst 9410R chassis



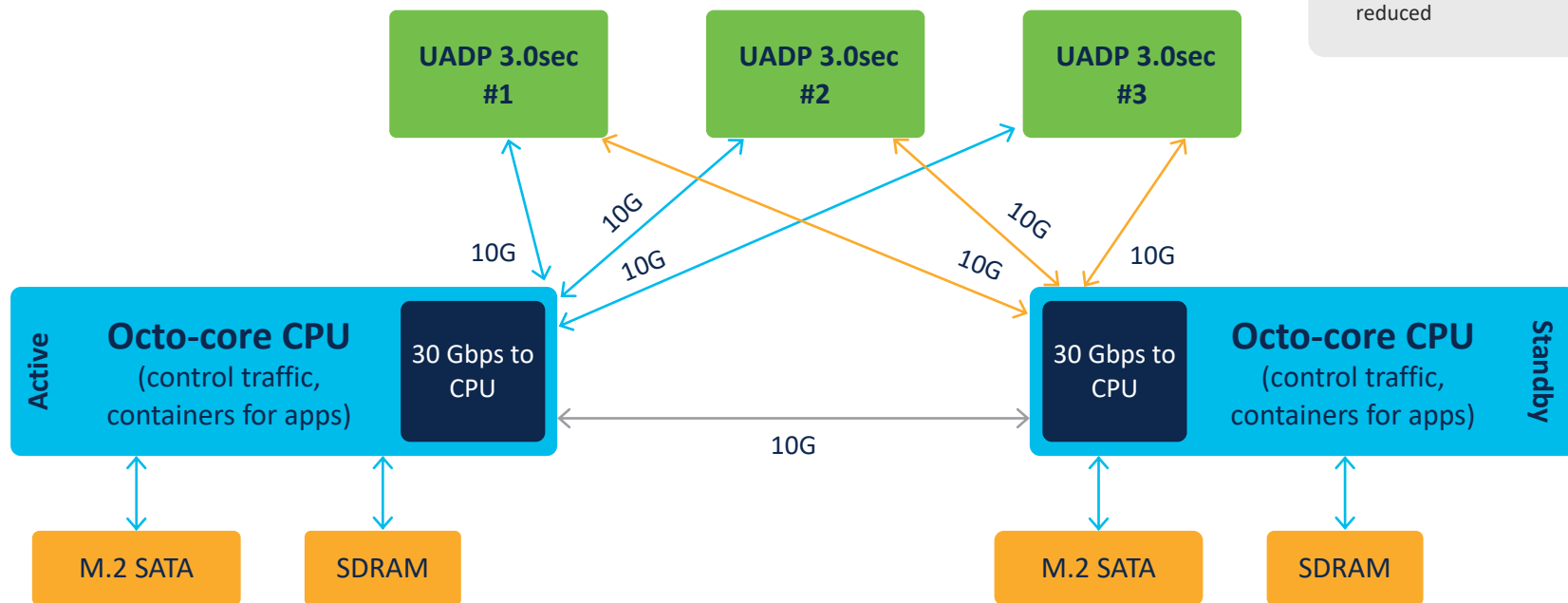
C9410R chassis

- Enable AppGig port by disabling **slot 4 port 48**
- User manually disables if slot 4 port 48 is active
- 24-port line card in slot 4 don't require disabling port

App hosting on C9400-SUP-2/2XL

C9410R chassis

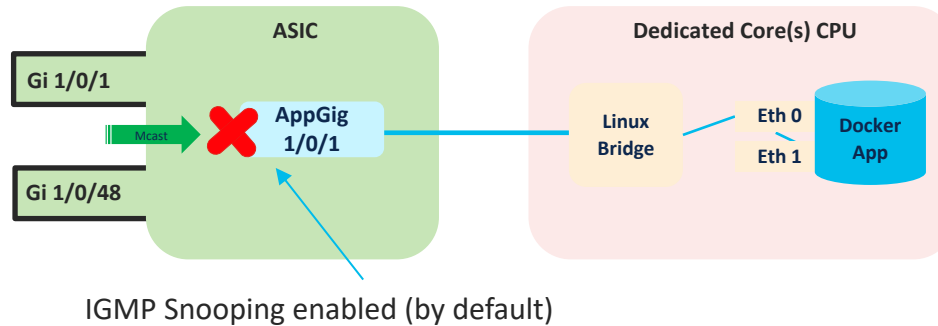
- Enable 2x app hosting ports – the bandwidth per slot is not reduced



Multicast support in AppGig interface (new in 17.11)

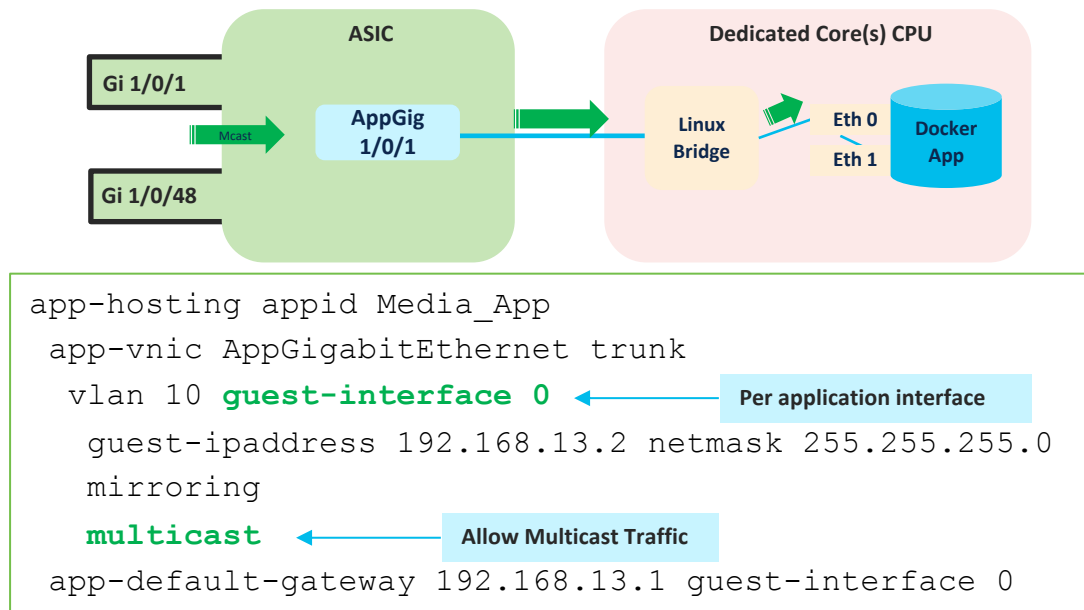
By Default, C9K switch don't allow the multicast packets to be forwarded on AppGig Port.

Avoiding unnecessary traffic to be forwarded to the application.



App Hosting Configuration for Multicast

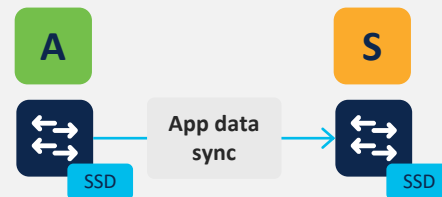
Various applications require to receive the multicast traffic for their functionality.



Allowing multicast traffic to an application based on application's configuration

SUP-1/1XL – App hosting high availability with auto-restart

- Provides cold restart option for application and the underlying app hosting framework
- Retains the last configured operational state of an app in the event of system switchover or restart
- 1+1 switch redundancy
- Same storage type (flash* or SSD) required on both Active and Standby
- Enabled by default



Supported platforms	Release
C9300/L StackWise® 480 (1+1 mode only)	17.2.1
9400 dual supervisors (single chassis and StackWise Virtual)	17.5.1
9500/H StackWise Virtual	17.5.1
9600 dual supervisors (single chassis and StackWise Virtual)	17.5.1

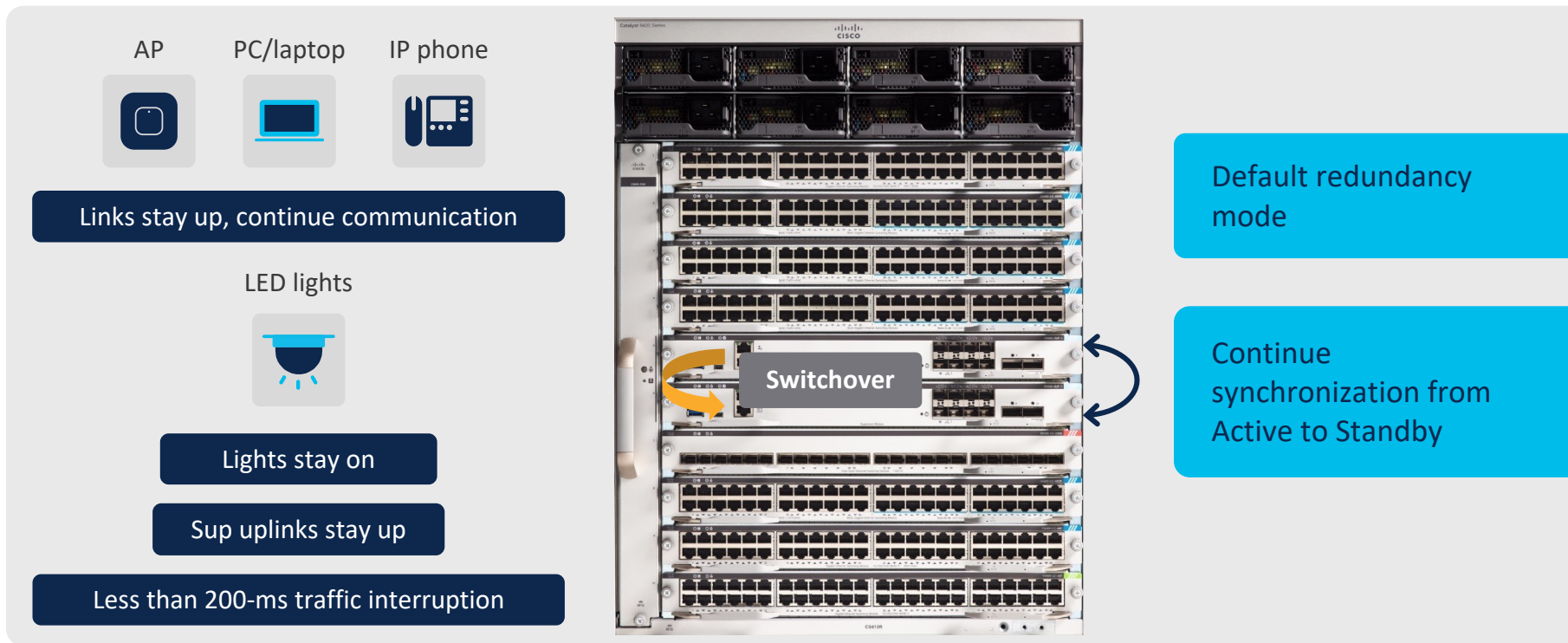
* Flash is only for Cisco signed apps.

High availability

Stateful Switchover (SSO)

Release 16.6.2 or later

Stateful Switchover (SSO)



SUP-1 uplink redundancy – Dual supervisors

Default mode (8x 10G)

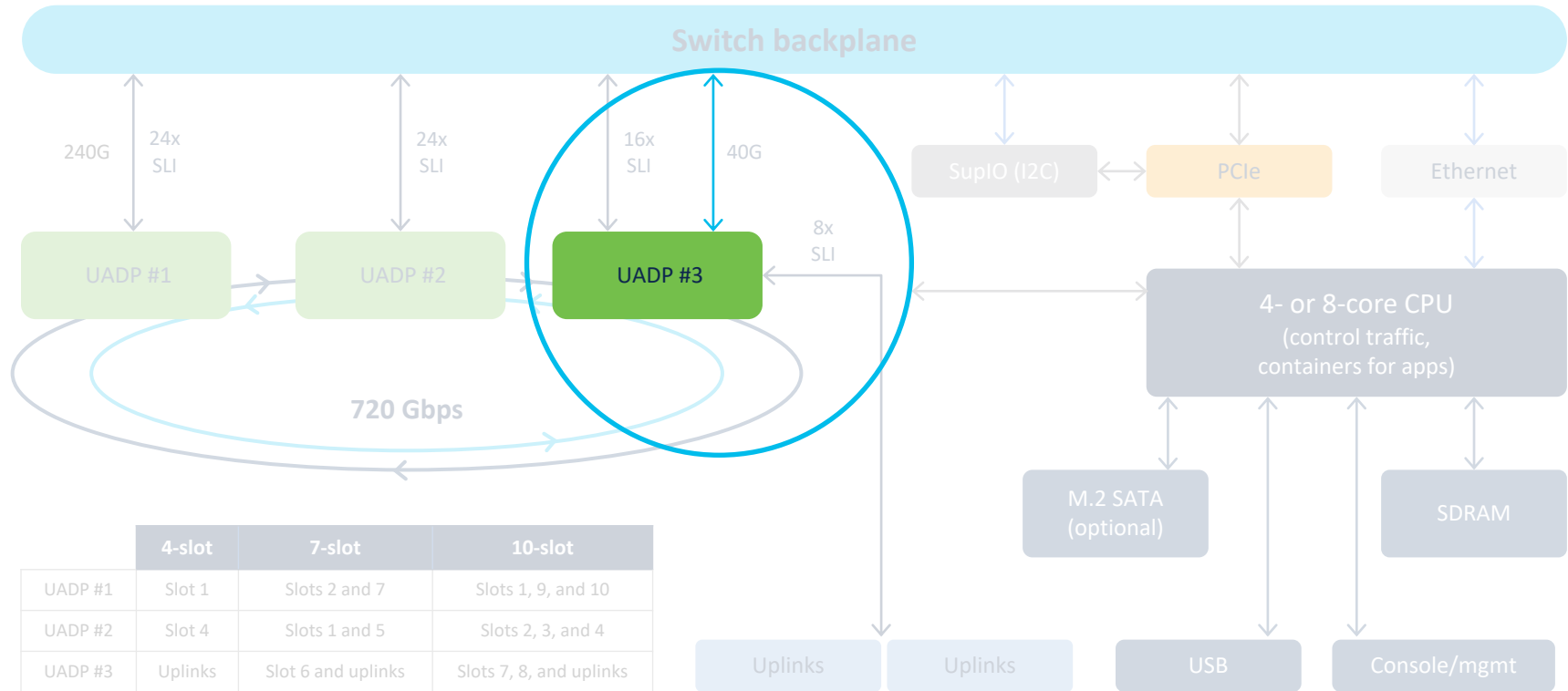


40G uplink mode

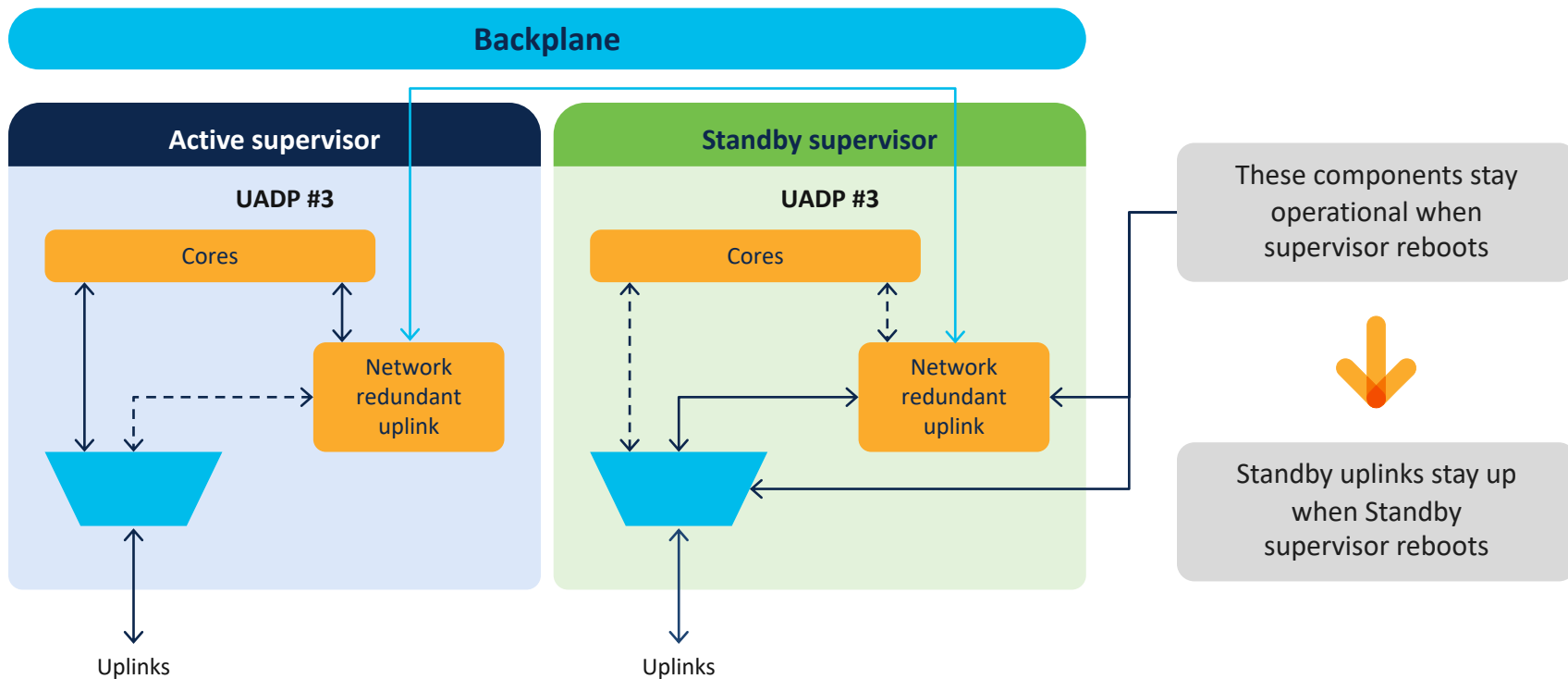
Interface
FortyGigabitEthernet
<slot>/0/9 enable



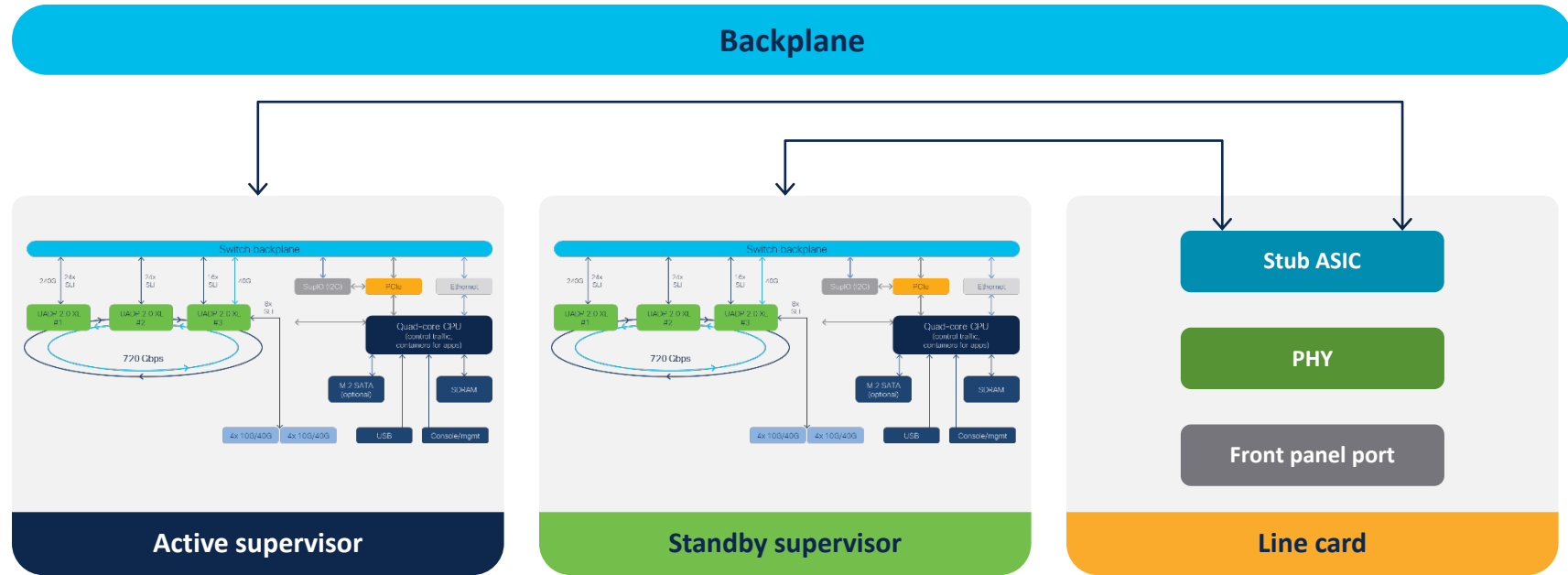
Redundant uplinks



Redundant uplinks



Supervisor and line card connection



Redundancy status – SSO

```
R4-C94-2041#sho module
```

```
Chassis Type: WS-XC7R
```

Mod	Card Type	Model	Serial No.
1	48-Port UPOE 10/100/1000 (RJ-45)	WS-XL48U	JAE204505N6
2	48-Port 10/100/1000 (RJ-45)	WS-XL48D	JAE204700NV
3	Supervisor 1 Module	WS-XSUP	JAE21020499
4	Supervisor 1 Module	WS-XSUP	JAE21020499
5	24-Port 10 Gigabit Ethernet (SFP+)	WS-XL24SFP+	JAE204605WQ
6	48-Port UPOE w/ 24p mGig 24p RJ-45	WS-XL24X48U	JAE204603H2

Mod	MAC addresses	Hw	Fw	Sw	Status
<SNIP>					

Mod	Redundancy Role	Operating Redundancy Mode	Configured Redundancy Mode
3	Standby	sso	sso
4	Active	sso	sso

```
R4-C94-2041#
```

Redundancy status – SSO

```
R4-C94-2041#show redundancy states
    my state = 13 -ACTIVE
    peer state = 8  -STANDBY HOT
        Mode = Duplex
        Unit = Secondary
        Unit ID = 49
    Redundancy Mode (Operational) = sso
    Redundancy Mode (Configured)  = sso
    Redundancy State                = sso
        Maintenance Mode = Disabled
        Manual Swact = enabled
    Communications = Up
        client count = 100
    client_notification
    _TMR = 30000 milliseconds
        RF debug mask = 0x0
R4-C94-2041#
```

Auto Negotiation on C9400X Uplinks (25G+ speeds)

- This feature allows the two connected ports to exchange their capabilities to bring the link up automatically. From 17.9.1 we are enabling this feature on SUP-2/SUP-2XL uplinks only.
- This is applicable for speeds of 25G and above.
- The FEC mode are part of this feature and is set to auto, but the FEC mode can be changed at user discretion.
- This is configurable change and can be disabled with "speed no negotiate" cli on passive copper transceiver only
- This eases the interop operations.
- This feature is not supported on Gen 1 Supervisor Uplinks.

Software Maintenance Upgrade (SMU)

SMU

- In 16.6.1, SMU is supported with system reload only
 - Use “install add <smu> activate”
 - Both Active and Standby are upgraded with the patch but not activated yet
 - Both Active and Standby reload to run the new image
- Post 16.6.1, SMU will be supported with an In-Service Software Upgrade (ISSU) option
 - Use “install add <smu> activate issu”
 - Standby is upgraded with the patch
 - System switchover and the new Active is now running the image plus the patch
 - The new Standby is upgraded with the patch

SMU support at FCS

- SMU support at first customer shipment (FCS) will be at parity with 16.5
 - Routing protocols (IS-IS, BGP, ...)
 - Multicast
 - Security

SMU support post-FCS

- In 16.6, additional components will be added:
 - Cisco TrustSec®
 - Authentication, Authorization, and Accounting (AAA)
 - Dynamic Host Configuration Protocol (DHCP)
 - QoS
 - Cisco® Configuration Assistant
 - Simple Network Management Protocol (SNMP)
 - Address Resolution Protocol (ARP)
 - Cisco Discovery Protocol
 - ACLs
 - Secure Shell Protocol (SSH)
 - IPv6
 - Device sensor
 - Locator/ID Separation Protocol (LISP)

In-Service Software Upgrade (ISSU)

(16.9.1 and later)

Dual-supervisor ISSU

In-Service Software Upgrade (ISSU) overview

- ISSU provides a mechanism to perform software upgrades and downgrades (major or minor release) without taking the **complete switch** out of service
- Leverages the capabilities of Nonstop Forwarding (NSF) and SSO to always allow one of the supervisors in the chassis to keep forwarding traffic during a Cisco IOS® Software upgrade (or downgrade)
- ISSU supports upgrades, downgrades, and rollbacks



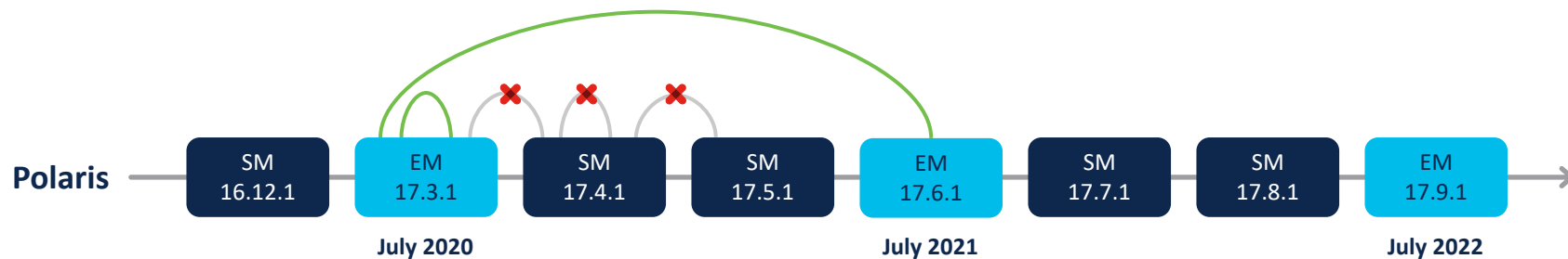
Catalyst® 9400 Series

Dual-supervisor ISSU prerequisites

Prerequisites

- Ensure that both Active and Standby supervisors are configured in SSO mode
- System must be booted with packages/install mode
- Auto boot must be enabled
- NSF should be configured if a supported routing protocol is enabled on the chassis

ISSU release upgrade/downgrade rules



Supported (upgrades and downgrades both)

- EM release: Any-to-any within the EM release (17.6.X <> 17.6.X)
- EM release <> EM release (17.3.X <> 17.6.X, 17.6.X <> 17.9)

Not supported

- SM to EM or EM to SM (16.12.X <> 17.X)
- SM release (within 17.6.1 <> 17.7.1)
- Beyond the +/- 2 EMR ISSU releases
- ISSU breaks when there is a major release change
 - For example, 16.x.x to 17.x.x

“Install” command-line key features

- Simple and consistent CLIs for switching and routing platforms for installation, ISSU, and SMU.
- SMUs (point fixes) can be installed using ISSU workflows.
- Customer need not provide the package names or file names.
- Auto-abort timer is started when activation is done. If a commit is not done within the abort time window, the system will roll back to the state before the start of the ISSU.
- The ISSU operation can be aborted any time by using the **“install abort issu”** keyword.
- Each step should be executed in the same sequence, as per the provided workflow (the system will error out if an incorrect sequence is followed).
- Selective upgrade of subpackages is not allowed.
- If there is an unsaved configuration during the ISSU operation, the CLI asks for user input before proceeding.

ISSU upgrade steps

3-step process

- 1 Install add file <tftp/ftp/flash/disk:*.bin>
- 2 Install activate ISSU
- 3 Install commit

Granular control over the upgrade process with the ability to roll back

1-step process

Install add file
<tftp/ftp/flash/disk:*.bin>activate
ISSU commit

Single command to perform complete ISSU

Install commands

Step-by-step workflow:

Install add <ftp://cisco.com/image.bin>

Install activate issu



Workflow step details:

- “**Install add**” command will download the image from the Cisco.com posted location.
- “**Install activate**” command upgrades the chassis to the new software version.
- “**Install commit**” command makes the changes permanent and deletes the older version of the software from the chassis.
- “**Install abort issu**” customer can issue the abort command to revert the software back to the original state.

Install commands (continued)

One-shot ISSU:

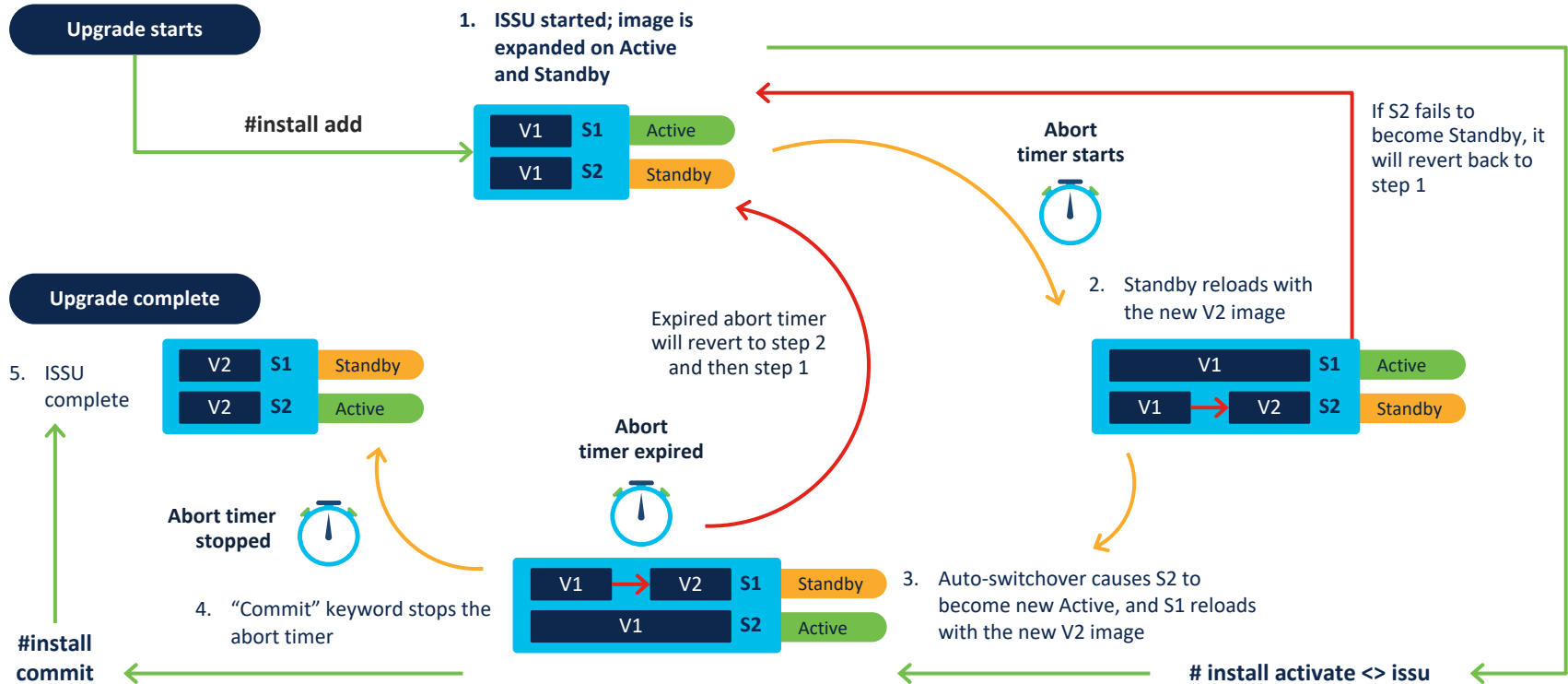
```
# install add <tftp://cisco.com/.bin> activate issu commit
```

A single command will:

- Download the image from the Cisco.com posted location
- Upgrade the chassis and commit the software version
- Delete the older version of software from the chassis

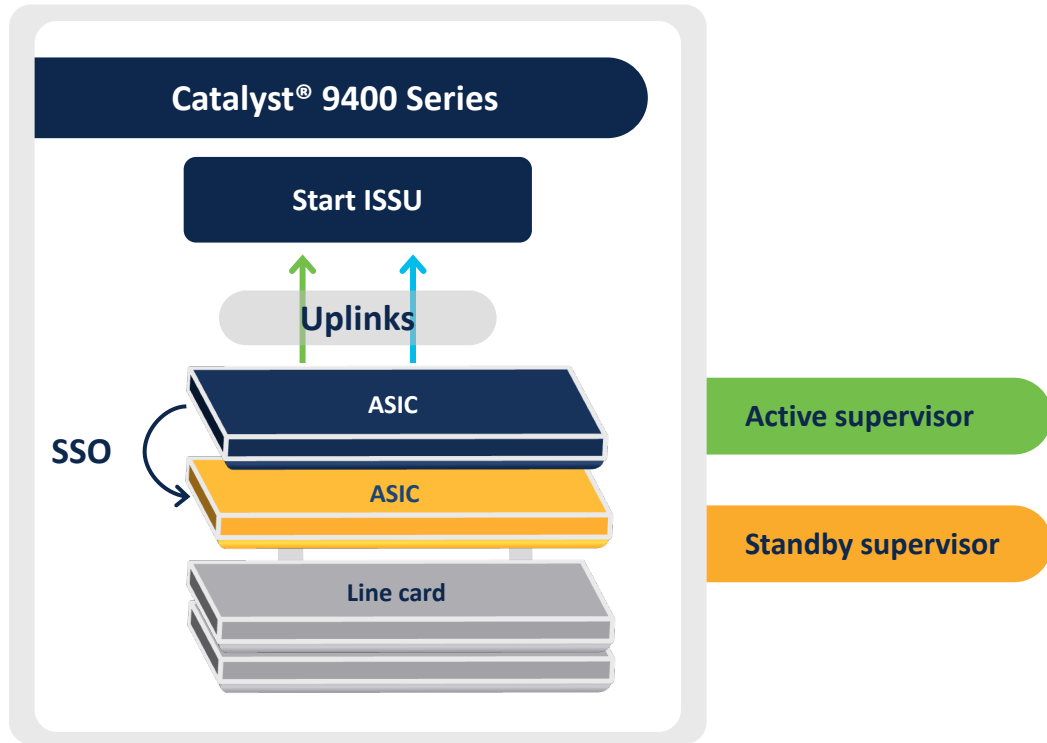
However, the system has the capability to roll back to older images in case of single fault scenarios (such as a crash, etc.) during the upgrade process. In this workflow no manual rollback is allowed.

Cisco Catalyst 9000 family ISSU workflow



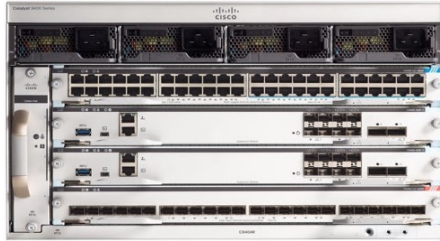
ISSU process

Dual supervisors

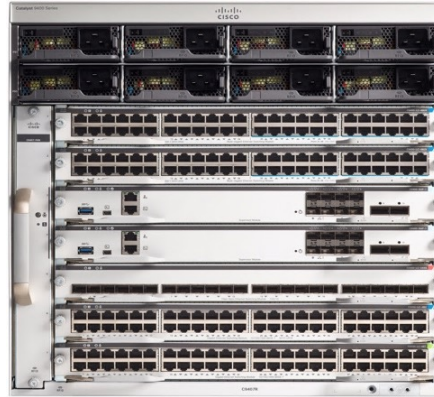


- Uplinks on both Active and Standby supervisors are forwarding traffic
- Convergence takes less than 200 ms during the switchover

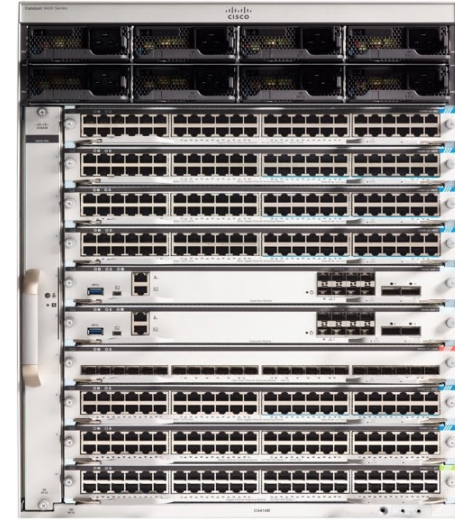
Dual-supervisor ISSU – Supported platforms



Catalyst® 9404R



Catalyst 9407R



Catalyst 9410R

**ISSU supported on all standalone Catalyst
9400 Series SKUs with dual supervisors in a single chassis**

Dual-supervisor ISSU restrictions

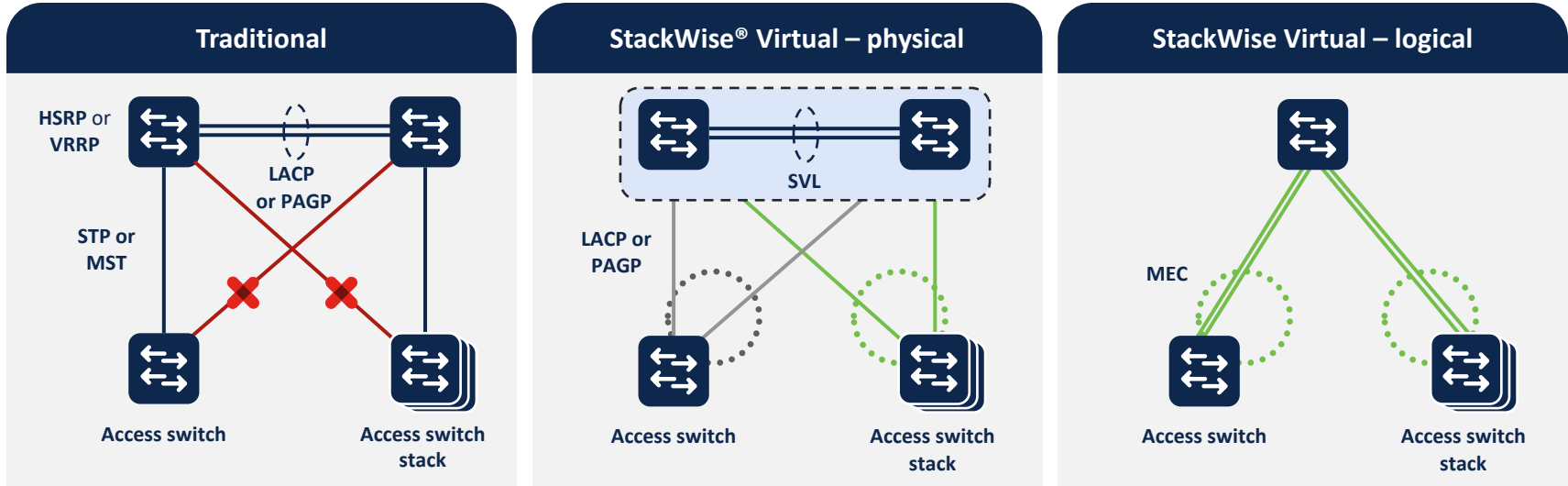
Restrictions

- Even with ISSU, it is recommended that upgrades be performed during a maintenance window.
- The new features should **not** be enabled (if they require change of configuration) during the ISSU process.
- In a downgrade scenario, if any feature is not available in the downgrade revision Cisco IOS® software image, that feature should be disabled before the ISSU process is initiated.
- ISSUs must be attempted within the supported ISSU release range.

StackWise Virtual

StackWise Virtual

Topology comparisons



Benefits of StackWise Virtual

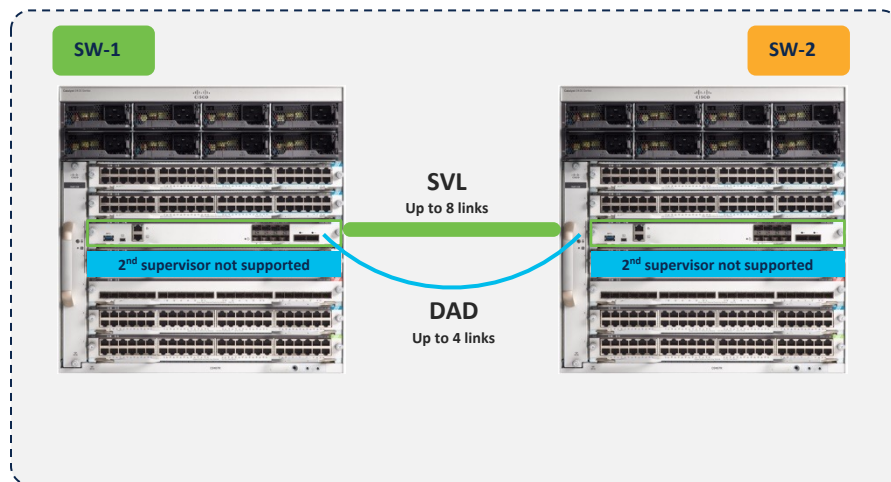
Simplify operations by eliminating Spanning Tree Protocol (STP), First Hop Redundancy Protocol (FHRP), and multiple touchpoints
Double bandwidth and reduce latency with Active-Active Multichassis EtherChannel (MEC)
Minimize convergence with subsecond stateful and graceful recovery (SSO/NSF)

StackWise Virtual – Catalyst 9400 Series

Stacking and cables



StackWise® Virtual



- StackWise Virtual Link (SVL)
 - 10G or higher speed
 - Up to 8 ports
 - Must all be the same speed
- Dual Active Detection (DAD)
 - 1G or higher speed
 - Up to 4 links
- In SVL mode, **second supervisor** is not supported in the chassis
- **SVL is supported only between the same 9400 Series models with the same supervisors in the same slots**

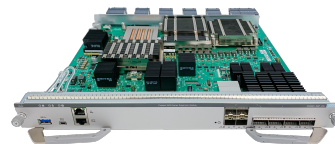
- StackWise Virtual is a distribution layer technology, allowing stacking of **only** two switches using fixed front panel ports.
- StackWise Virtual supports flexible distances with support for all supported cables and optics.

Catalyst 9400 StackWise Virtual Support Matrix

C9400-Sup-1
C9400-Sup-1XL
C9400-Sup-1XL-Y



C9400X-Sup-2
C9400X-SUP-2XL



Minimum SW

IOSXE 16.9.1

IOSXE 17.9.1

SVL

Any 10G or higher speed ports
(IOSXE 16.12.1 or later)

10G or higher speed ports on Sup and the following LC
(IOSXE17.9.1):

Cat9400-LC-48X
Cat9400-LC-48HX
Cat9400-LC-24XS
Cat9400-LC-48UX

DAD

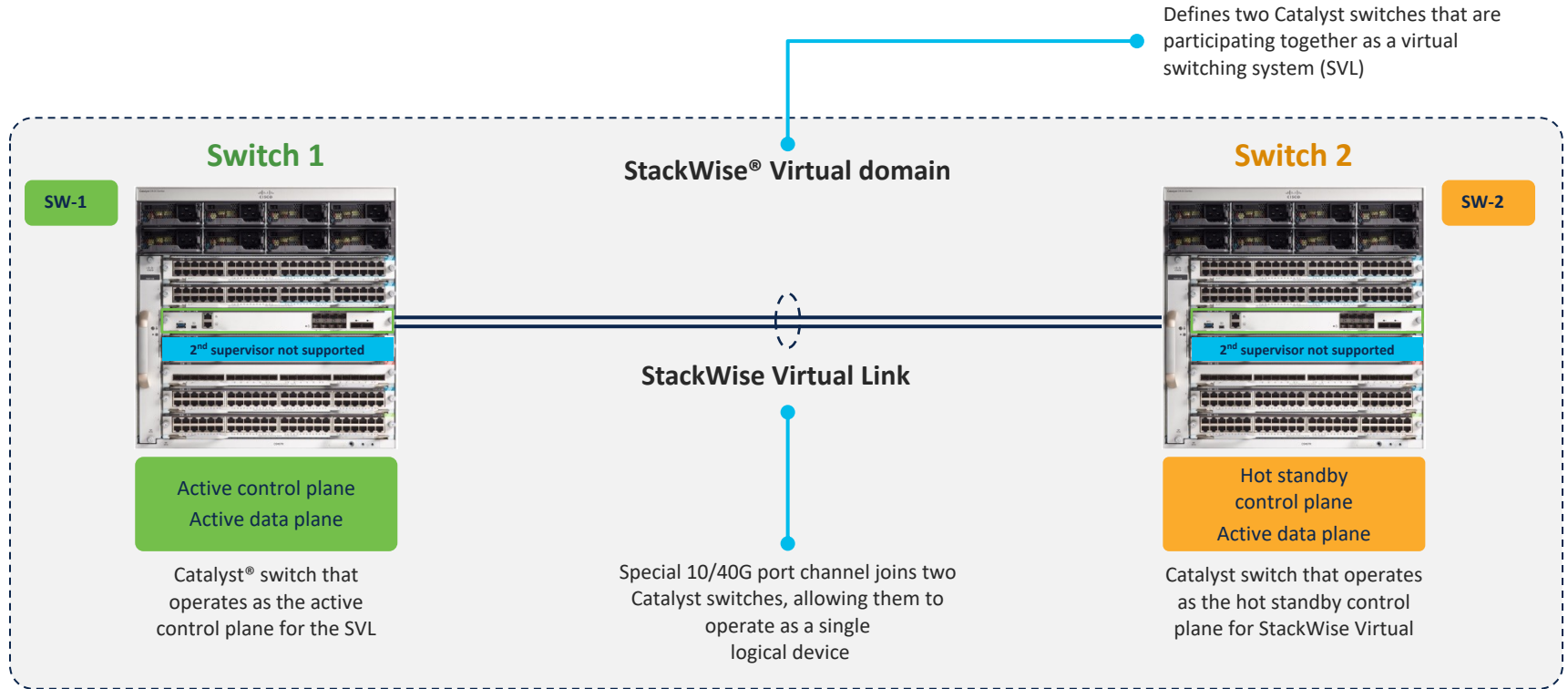
Any 1G or higher speed ports
(IOSXE 16.12.1 or later)

10G or higher speed ports on Sup and the following LC
(IOSXE17.9.1):

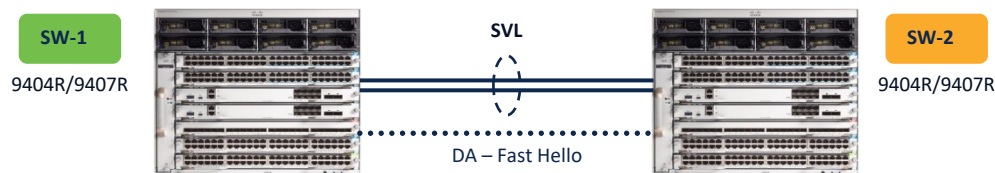
Cat9400-LC-48X
Cat9400-LC-48HX
Cat9400-LC-24XS
Cat9400-LC-48UX

StackWise Virtual architecture

Key concepts



StackWise Virtual configuration



Step 1: StackWise® Virtual domain

- Enable StackWise Virtual
- Configure StackWise Domain-ID. Range 1-255. Default = 1. Optional.

SW-1	SW-2
9407-1(config)# stackwise-virtual	9407-2(config)# stackwise-virtual
9407-1(config)# domain <1-255>	9407-2(config)# domain <1-255>

Step 2: StackWise Virtual Link

- Configure StackWise Virtual Links
- 10G or 40G SVL interface, auto EtherChannel
- Max 8 SVL member links

SW-1	SW-2
9407-1(config)# interface range FortyG x/y/z	9407-2(config)# interface range FortyG x/y/z
9407-1(config-if)# stackwise-virtual link <1 255>	9407-2(config-if)# stackwise-virtual link <1 255>

Step 3: Dual-Active detection

- Configure StackWise Virtual links
- 10G or 40G dual-Active support
- Max 4 dual Active Fast Hello links

SW-1	SW-2
9407-1(config)# interface range TenG x/y/z	9407-2(config)# interface range TenG x/y/z
9407-1(config-if)# stackwise-virtual dual-active-detection	9407-2(config-if)# stackwise-virtual dual-active-detection

Step 4: Save and reload to convert

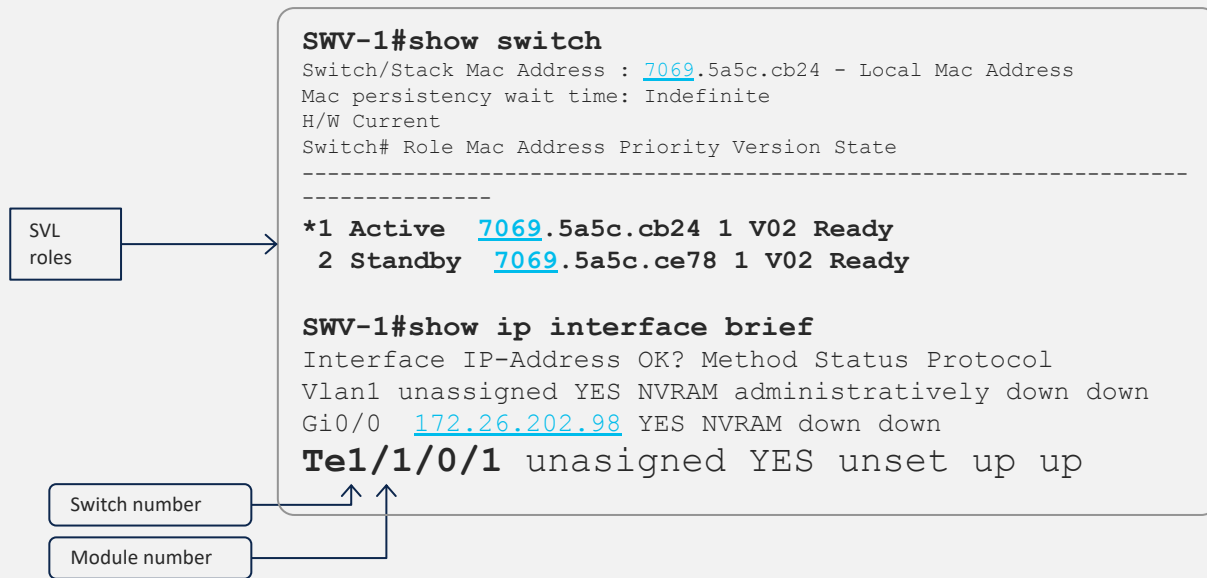
- Copy configuration on startup and storage
- Reload both systems to enable StackWise Virtual in the network

SW-1	SW-2
9407-1# copy run start	9407-2# copy run start
9407-1# reload	9407-2# reload

StackWise Virtual configuration – Post-conversion changes on Catalyst 9400 Series

Interface numbers

- After converting to StackWise® Virtual mode, interface numbers change from 3-tuple to 4-tuple



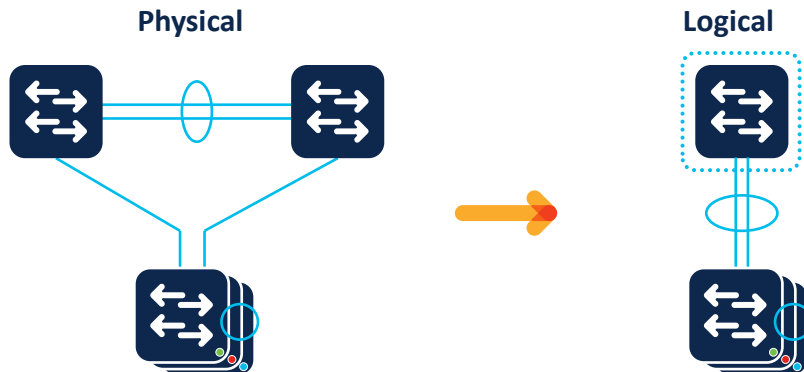
StackWise Virtual restrictions

Platform	SVL limitations	DAD limitations
Catalyst® 9400 Series (16.9.1)	- SVL configuration is supported only on supervisor ports - SVL configuration is not supported with quad supervisors	DAD support only on the supervisor ports
Catalyst 9400 Series (16.11.1)	- SVL configuration is supported on supervisor ports and 10G line card ports with controlled availability - SVL configuration is not supported with quad supervisors	DAD configuration is supported on supervisor ports and all line card ports with controlled availability
Catalyst 9400X models (C9400-SUP-2/2XL)	Supported starting 17.9.1	

New hardware for StackWise Virtual

2-node StackWise Virtual

StackWise® Virtual



Layer	Platform	Supervisor support	Version
Distribution	Catalyst® 9404R or 9407R	SUP-1* SUP-1XL SUP-1XL-Y**	16.9.1
	Catalyst 9410R	SUP-1* SUP-1XL SUP-1XL-Y**	16.11.1

*Add-on license required.

** StackWise Virtual support on SUP-1XL-Y is supported starting with Release 16.11.1.

Catalyst 9400 – Increased system MTU 9216

Layer 2 MTU

- System MTU
 - Default MTU is 1500

Switch (config)#system mtu 9216
- Interface MTU
 - Optional
 - Has higher precedence over system MTU

Switch (config-if)#mtu 9216

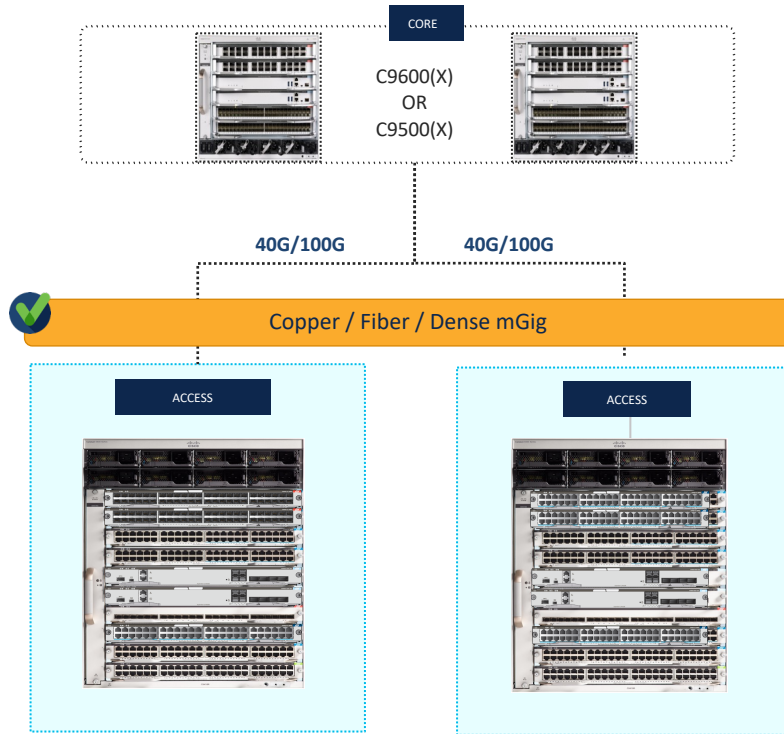
Layer 3 MTU

- System MTU
 - Not applicable
- Interface MTU
 - Optional
 - Should be equal to or lower than the Layer 2 MTU

Switch (config-if)#ip mtu 9216

Max system MTU is 9198 in all releases prior to 17.2.1

Catalyst 9400 – Flexible Access Deployment



Uplinks:

Speed: 100G, 40G or 10G

Uplink redundancy:

ECMP and/or port channel

Power redundancy:

Combine, N+1, N+N

Access line cards:

Speed: 10M/100M/1000M/2.5G/5G/10G

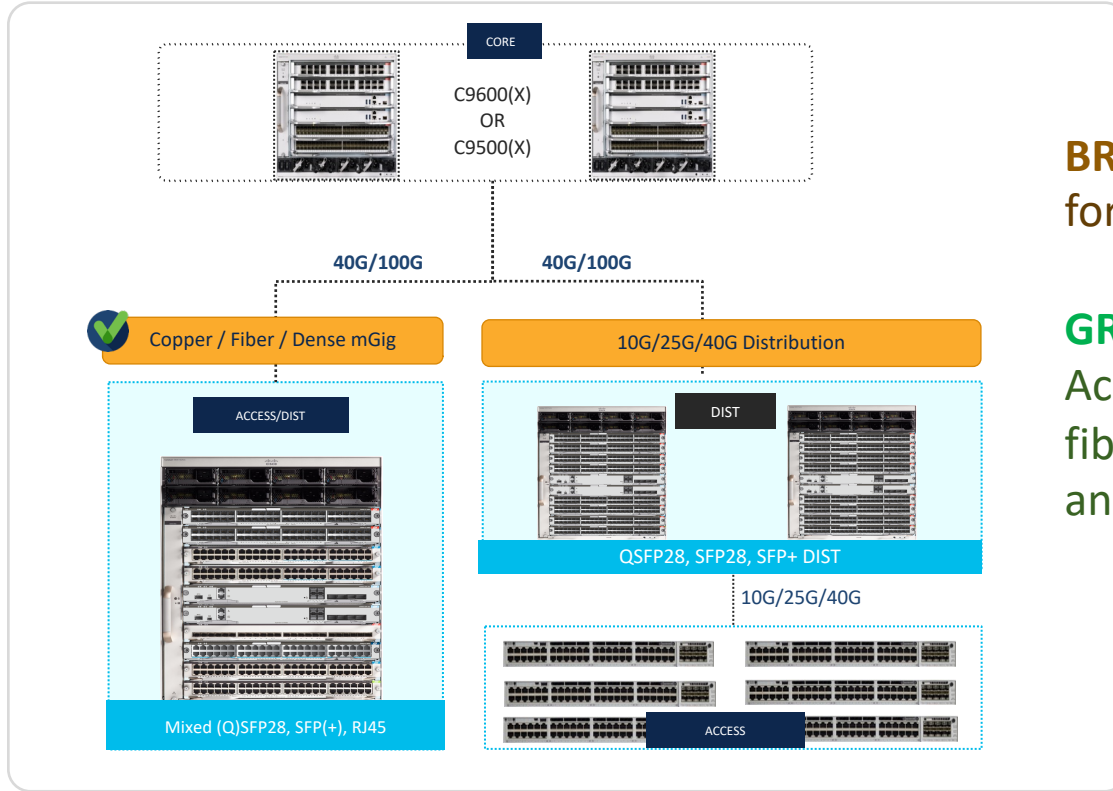
LC Type: Copper / Fiber

Inline power:

PoE, PoE+, and Cisco UPOE/UPOE+

Fast PoE, Perpetual PoE, PoE Port Priority

Catalyst 9400 – Flexible Distribution Deployment



BROWNFIELD: 10G to 25G transition for existing distribution deployments

GREENFIELD: Collapsed Distribution-Access deployment with 25G & 40G fiber mixed with multigigabit ethernet and PoE/UPOE(+)

Product comparison

Catalyst 9400X vs. 9400 models – Physical

	 Catalyst® 9400X (UADP 3.0sec)				 Catalyst 9400 (UADP 2.0XL)			
	LC-24XY	LC-12QC	LC-48HX	LC-48XS	LC-48HN	LC-48UX	LC-24XS	LC-48S
CPU (number)	2.4-GHz Intel® 8C (BDW D-1564N)				2.4-GHz Intel 4C (BDW D-1530)			
DRAM (type)	16 GB ^{DDR4}				16 GB ^{DDR3}			
ASIC (number)	UADP3.0sec ^{x3}				UADP 2.0XL ^{x3}			
Capacity (chassis)	4.8 Tbps (full duplex)				960G (full duplex)			
Capacity (per slot)	480G (all chassis)				240G ^(9404R) /120G ^(9407R) /80G ^(9410R)			
1G ^{max}	96/240/384	96/240/384	96/240/384	96/240/384	96/192/384	96/192/384	48/96/192	96/192/384
5G ^{max}	96/240/384	—	96/240/384	—	96/192/384	48/96/192	—	—
10G ^{max}	96/240/384	96/240/384	96/240/384	96/240/384	48/96/192	48/96/192	48/96/192	—
25G ^{max}	40/100/160 + 4 ^(sup)	40/100/160 + 4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)
40G ^{max}	24/60/96 + 4 ^(sup)	24/60/96 + 4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)	4 ^(sup)
100G ^{max}	8/2/32 + 4 ^(sup)	—	4 ^(sup)	4 ^(sup)	—	—	—	—

Catalyst 9400X vs. 9400 models – Features

	 Catalyst® 9400X (UADP 3.0sec)		 Catalyst 9400 (UADP 2.0XL)	
	Default (access)	Maximum (custom)*	Default (access)	Maximum (core)
MAC addresses	64,000	128,000	96,000	16,000
IP host routes	112,000 (LPM+host)	256,999 (LPM+host)	48,000	32,000
Multicast L2 groups	16,000	32,000	16,000	16,000
Multicast L3 routes	16,000	32,000	16,000	16,000
IP LPM routes	112,000 (LPM+host)	256,000 (LPM+host)	64,000	64,000
MPLS labels	16,000	64,000	12,000	16,000
SGT/OG labels	32,000	64,000	8000	8000
NAT sessions	2,000	16,000	2000	2000
Sec ACL entries	10,000 (input) + 16,000 (output)	27,000 (input) + 18,000 (output)	18,000 (shared)	18,000 (shared)
QoS ACL entries	8,000 (input) + 8,000 (output)	16,000 (input) + 16,000 (output)	18,000 (shared)	18,000 (shared)
PBR ACL entries	2,000	16,000	2000	2000

* Software roadmap (FCS+).

Catalyst 9400 Series hardware differentiators

		Catalyst 9400X models	Catalyst 9400 models	Catalyst 4500E Series
Foundational hardware	CPU	Intel® X86 8-core 2.4 GHz	Intel X86 4-core 2.4 GHz	Freescall quad core 2 GHz
	ASIC	UADP 3.0sec (Doppler ES)	UADP 2.0 XL (Doppler D)	K5/K10
	Memory	16 GB DDR4	16 GB DDR4	4 GB DDR3
	Flash	16 GB	16 GB	2 GB
	SSD storage (USB 3.0) – Removable	✓	✓	✗
Uplinks	Support 25G uplinks	✓	✓ (16.9.1)	✗
	Support Multigigabit uplinks	✓	✓ (16.6.2)	✗
	8x 10G, 2x 40G uplinks	✗	✓	SUP-9E with 2x 40G
	4x 1/10/25G, 4x 40/100G uplinks	✓	✗	✗
Wireless density	Number of access points	✗	✗	100
	Number of wireless clients	✗	✗	2000
Power supplies	Platinum-rated power supplies	✓	✓	Gold
	N+1, N+N	✓	✓	✗
Enabler for	NG stacking – StackWise® Virtual	✓	✓ (16.9.1)	VSS
	256-bit MACsec	✓	✓	✗
	Audio Video Bridging (AVB)	✗	✗	✗
	Containers, app hosting	✓	✓	✗

* Hardware Capable.

Catalyst 9400 Series software differentiators

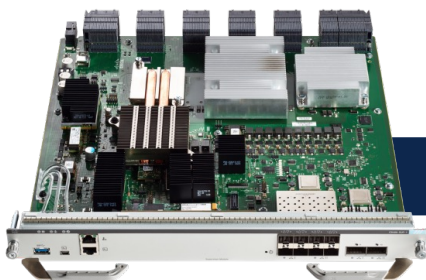
		Catalyst 9400X models	Catalyst 9400 models	Catalyst 4500E Series
Modern OS	Containers, app hosting	✓	✓	✗
	Graceful Insertion and Removal (GIR)	✓	✓	✗
	Patching	✓	✓	✗
	Fast software upgrade	✓	✓	✗
	StackWise® Virtual	✗ *	✓	VSS
SD-Access	Wireless controller (eWLC) hosting on switch	✗	✗	✓
	Fabric-enabled wireless	✗	✗	✓
	Subtended node support	✓ *	✓ *	✗
Security	Encrypted Traffic Analytics (ETA)	✗	✓	✗
	Predictive threat analysis (SLN)	✓	✓	✗
	Fabric sec encryption	✗	✗	✗
Visibility	FabricFlow	✗	✗	✗
	Application Visibility and Control (AVC)	✗	✓	✗

* Hardware Capable.

Catalyst 9400 Series SUP-2/2XL, SUP-1, and 4500 Series SUP8-E comparison

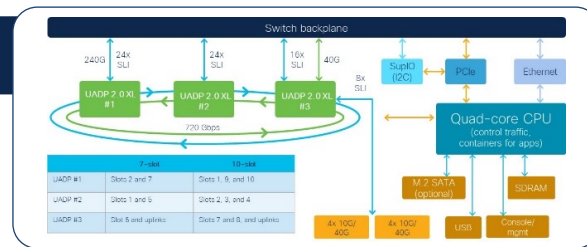
Features	SUP-2/2XL	SUP-1/1XL	SUP8-E
Bandwidth	4.8 Tbps	1.44 Tbps	928 Gbps
Throughput	3 Bpps IPv4/v6	900 Mpps IPv4/v6	250 Mpps v4 (125 Mpps IPv6)
Native wireless controller support	No	No	Yes
Uplinks	4x 1/10/25G + 3x 40/100G 4x 40/100G	2x 40G or 8x 10G	8x 10G
DRAM	16 GB	16 GB	4 GB
Flash	16 GB	16 GB	2 GB
Buffers	108 MB (36 MB per ASIC)	96 MB (32 MB per ASIC)	32 MB
Multicore CPU	2.4-GHz octo core (Intel® Broadwell x86)	2.4-GHz quad core (Intel Broadwell x86)	2-GHz quad core (freescale)
Blue beacon for serviceability	Yes (all components)	Yes (all components)	Yes (supervisor and chassis)
Operating system	Open Cisco IOS® XE	Open Cisco IOS XE	Cisco IOS XE

Supervisor cheat sheets



C9400-SUP-1

Architecture



Quick facts

- PID: C9400-SUP-1
- Min ROMMON: 16.6.1r
- Min OS: 16.6.1
- Interface type: SFP/SFP+; QSFP+
- Speed: 100M/1G/10G/40G
- CPU: X86-- quad core 2.4 GHz
- Memory: 16 GB DDR4
- Flash: 16 GB
- Optional M2.SATA SSD: 240, 480, or 960 GB
- External storage: USB 2, USB 3
- 3x UADP 2.0 XL ASICs

Environmental

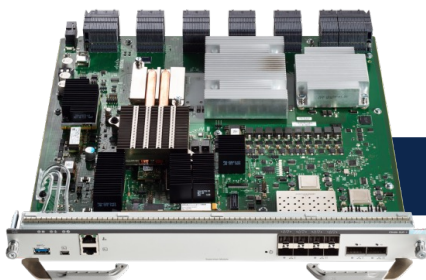
- Power: 400W
- MTBF: 302,000 hours

Performance

- Bandwidth per slot: 80G for 7 and 10 slots
- Aggregate bandwidth: 720G
- Throughput: 900 Mpps

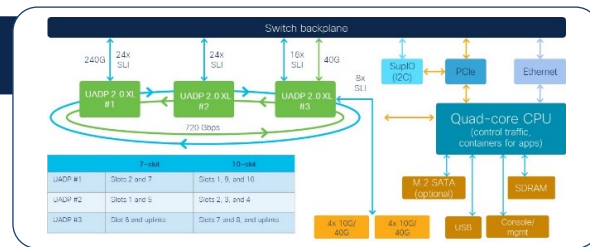
Scale (default)

- MAC: 64,000
- LPM (IPv4/v6): 64,000/32,000
- Host routes: (IPv4/v6): 48,000/24,000
- IGMP groups: 16,000
- Mroutes (IPv4/v6): 16,000/8000
- NetFlow entries: 128,000 per ASIC
- Security TCAM: 18,000
- QoS TCAM: 18,000
- Service TCAM: 18,000
- Jumbo frames: 9216
- Buffer: 32 MB per ASIC



C9400-SUP-1XL

Architecture



Quick facts

- PID: C9400-SUP-1XL
- Min ROMMON: 16.6.2r
- Min OS: 16.6.2
- Interface type: SFP/SFP+; QSFP+
- Speed: 100M/1G/10G/40G
- CPU: X86 quad core 2.4 GHz
- Memory: 16 GB DDR4
- Flash: 16 GB
- Optional M2.SATA SSD: 240, 480, or 960 GB
- External storage: USB 2, USB 3
- 3x UADP 2.0 XL ASICs

Environmental

- Power: 400W
- MTBF: 302,000 hours

Performance

- Bandwidth per slot: 120G for 7 slots and 80G for 10 slots
- Aggregate bandwidth: 720G
- Throughput: 900 Mpps

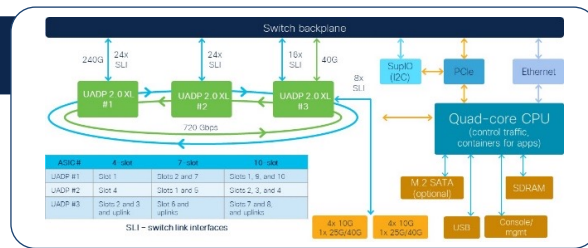
Scale (default)

- MAC: 64,000
- LPM (IPv4/v6): 64,000/32,000
- Host routes: (IPv4/v6): 48,000/24,000
- IGMP groups: 16,000
- Mroutes (IPv4/v6): 16,000/8000
- NetFlow entries: 128,000 per ASIC
- Security TCAM: 18,000
- QoS TCAM: 18,000
- Service TCAM: 18,000
- Jumbo frames: 9216
- Buffer: 32 MB per ASIC



C9400-SUP-1XL-Y

Architecture



Quick facts

- PID: C9400-SUP-1XL-Y
- Min ROMMON: 16.6.2r
- Min OS: 16.9.1
- Interface type: SFP/SFP+; SPF28; QSFP+
- Speed: 100M/1G/10G/25G/40G
- CPU: X86 quad core 2.4 GHz
- Memory: 16 GB DDR4
- Flash: 16 GB
- Optional M2.SATA SSD: 240, 480, or 960 GB
- External storage: USB 2, USB 3
- 3x UADP 2.0 XL ASICs

Environmental

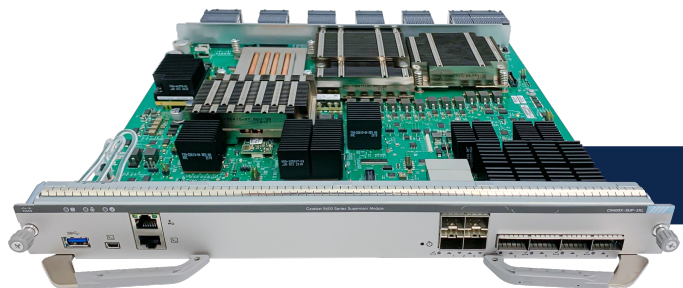
- Power: 400W
- MTBF: 302,000 hours

Performance

- Bandwidth per slot: 240G for 4 slots, 120G for 7 slots, 80G for 10 slots
- Aggregate bandwidth: 720G
- Throughput: 900 Mpps

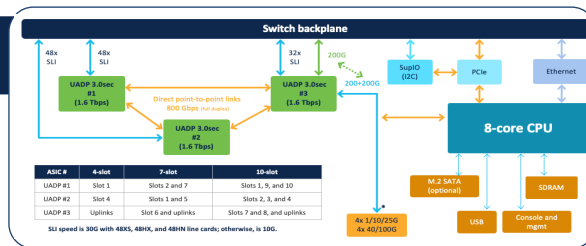
Scale (default)

- MAC: 64,000
- LPM (IPv4/v6): 64,000/32,000
- Host routes: (IPv4/v6): 48,000/24,000
- IGMP groups: 16,000
- Mroutes (IPv4/v6): 16,000/8000
- NetFlow entries: 128,000 per ASIC
- Security TCAM: 18,000
- QoS TCAM: 18,000
- Service TCAM: 18,000
- Jumbo frames: 9216
- Buffer: 32 MB per ASIC



C9400-SUP-2/2XL

Architecture



Quick facts

- PID: C9400-SUP-2/ 2XL
- Min ROMMON: 17.7.1r
- Min OS: 17.7.1
- Interface type: SFP/SFP+; SPF28; QSFP+
- Speed: 100M/1G/10G/25G/40G/100G
- CPU: X86 octo core 2.4 GHz
- Memory: 16 GB DDR4
- Flash: 16 GB
- Optional M2.SATA SSD: 240, 480, or 960 GB
- External storage: USB 3
- 3x UADP 3.0sec ASICs

Environmental

- Power: 650W/722W
- MTBF: 304,308 hours

Performance

- Bandwidth per slot (full duplex):
 - Sup2XL – 480G
 - Sup2 – 240G
- Aggregate bandwidth: 4.8 Tbps (full duplex)
- Throughput: 9 Bpps

Scale (default)

- MAC: 64,000
- LPM (IPv4/v6): 114,000
- Host routes: (IPv4/v6): 114,000
- IGMP groups: 16,000
- Mroutes (IPv4/v6): 16,000
- NetFlow entries (in/out): 50,000/ 50,000 per ASIC
- Security TCAM: 10,000 / 16,000
- QoS TCAM (in/out): 8,000 / 8,000
- Service TCAM: 8,000
- Jumbo frames: 9216
- Buffer: 36 MB per ASIC

SUP-2/2XL -1G support with transceivers

1G support for SUP2/2XL Uplinks

NEW

General Availability: 17.15.1/17.12.4



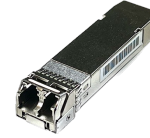
C9400X-SUP-2



C9400X-SUP-2XL



SFP-1G-LH



SFP-1G-SX

Works in 10/25 ports only
Interoperates with 1G only
(Available in CCW now)

[Cisco 1G Optics Data Sheet](#)

Built-in PHY in special SFP converts 10G -> 1G



Existing GLC/SFP 1G will NOT work with SUP-2/2XL Uplink ports

Only supported on native SFP 10/25 ports. Not supported on QSFP ports using QSA/breakout



The bridge to possible



Turn this technical overview into a purchase-ready BOM

Send the exact model or BOM and your deployment requirements. Layer23-Switch can review compatibility, availability, and quote options.

- ✓ Exact model or Cisco PID and quantity
- ✓ Port count, media type, PoE budget, and uplink speed
- ✓ Redundancy, licensing, support, and accessory needs
- ✓ Ship-to country, target date, and lead-time constraints

REQUEST A BOM REVIEW

www.layer23-switch.com



SCAN TO REQUEST A QUOTE

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