



The bridge to possible



# Aktuální WAN portfolio

a progresivní transportní technologie v roce 2024

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19. 3. 2024

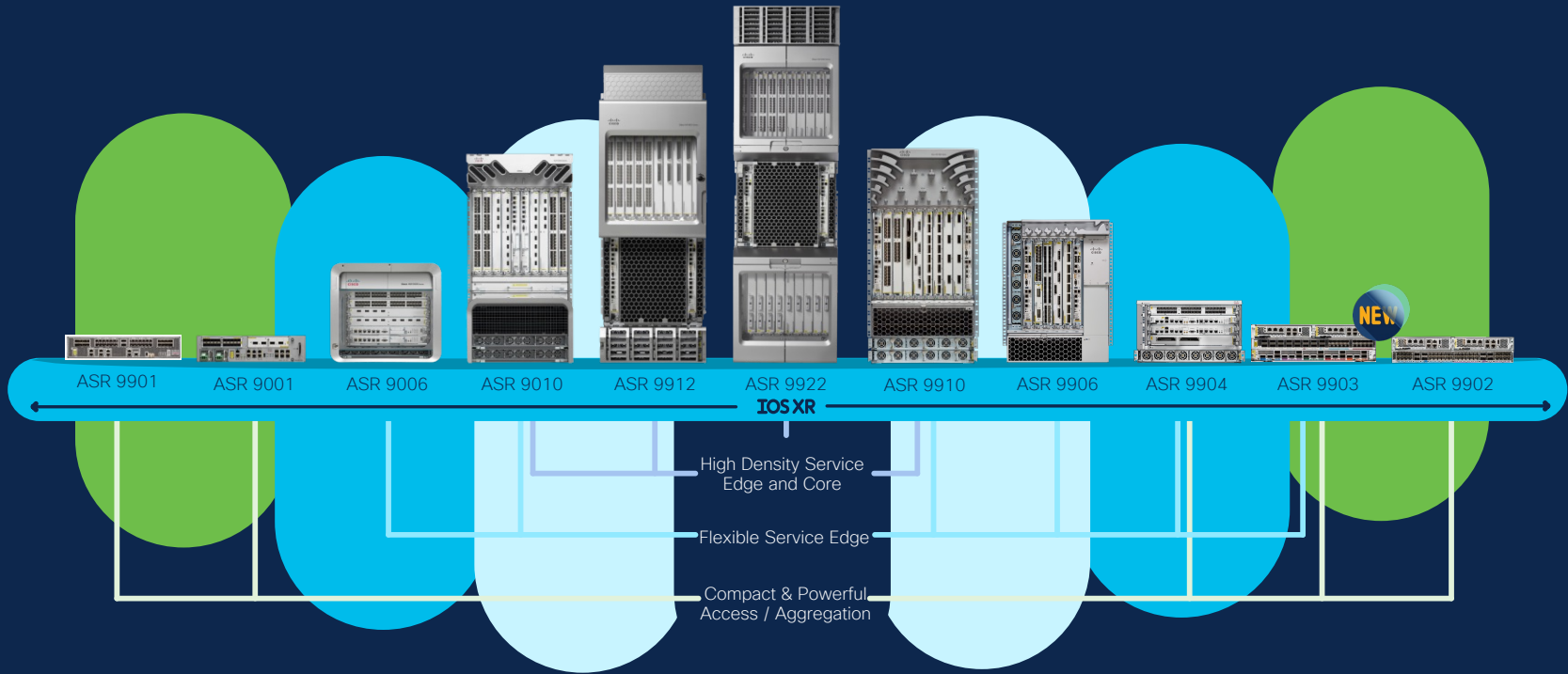
# Agenda

- WAN Portfolio
  - ASR 9000
  - Cisco 8000
  - NCS 540
  - NCS 5500/5700
- Transportne technologie
- Novinky

*A9K*

# Cisco ASR 9000 Series

## Hardware portfolio



# One Set of Commons for 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> Generation

A99-RP3-SE/TR & A9K-RSP5-SE/TR



## 4<sup>th</sup> Generation Route Processor Card

- 9006/9010 - 1.2T/slot throughput (redundant configuration)
- 8 Core Intel CPU at 2G processor
- Available in both TR (24GB)/ SE (40GB) variants

## Line Cards Supported

- 5<sup>th</sup> Generation
- 4<sup>th</sup> Generation
- 3<sup>rd</sup> Generation

## RSP5 Supported Chassis

- 9006/9010/9910/9906/9904

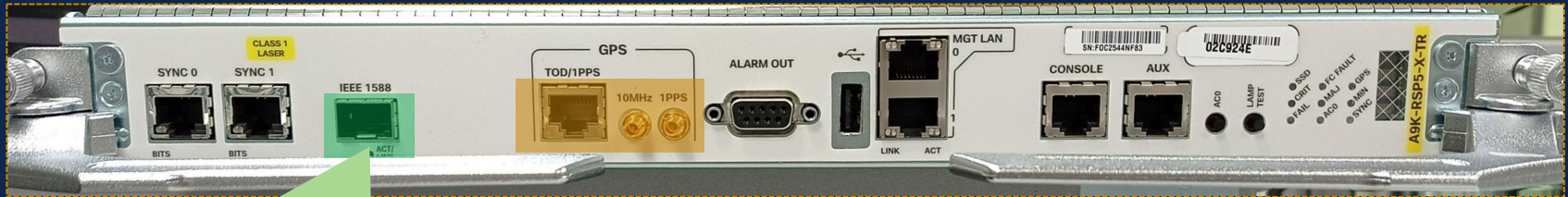
## RP3 Supported Chassis

- 9912 / 9922

# Class C Complaint RSP5-X “+ Class C”

Use Case: 5G Packet Core & Converged wireline, wireless edge services

## A9K-RSP5-X-SE/TR



1588: Changed from RJ45 (RSP5) to 10/1G optical port (RSP5-X)






ICS0/1 and CMP ports are removed from the new RSP5-X

## A9K-RSP5-SE/TR

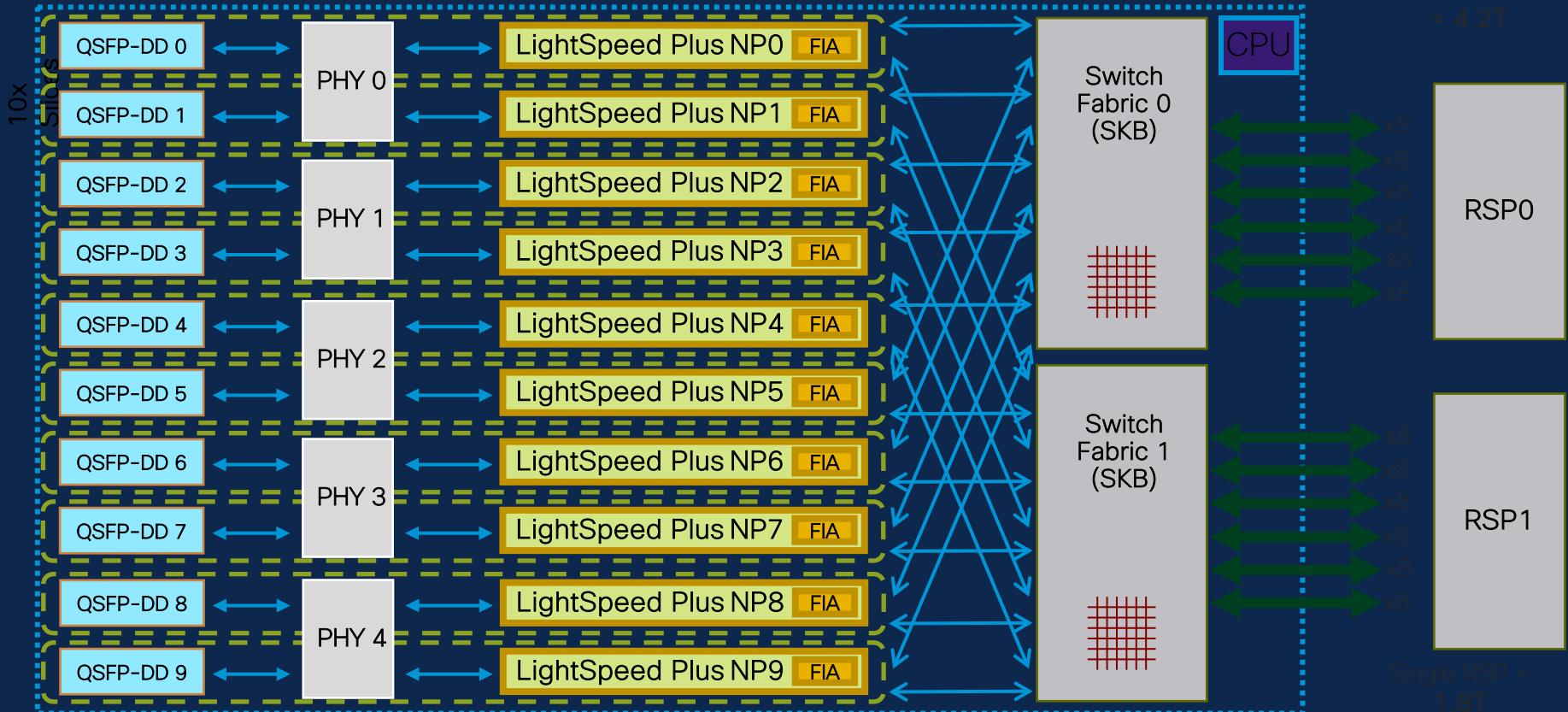


# ASR 9000 5<sup>th</sup> Generation Portfolio

400GE to 4T

	Ports	Bandwidth	Combo Ports	MACSec/ FlexE	Timing	RSP / RP
 A99-32X100GE-X	32 Ports of QSFP28	3.2 Tbps	No	No	Class B SyncE	RSP5, RP3
 A9K-20HG-FLEX	15 Ports QSFP28 5 Ports QSFP-DD	2 Tbps	Yes	MACSec + Flex-E	Class C SyncE	RSP5, RP3
 A9K-8HG-FLEX	6 Ports QSFP28 2 Ports QSFP-DD	800 Gbps	Yes	MACSec + Flex-E	Class C SyncE	RSP5, RSP880-LT, RSP880, RP3, RP2
 A99-10X400GE-X	10 Ports of QSFP-DD	4 Tbps	Yes	MACSec	Class B SyncE	RSP5, RP3
 A9K-4HG-FLEX	4 Ports QSFP28 16 Ports SFP28 24 Ports SFP+	400 Gbps	Yes	MACSec	Class C SyncE	RSP5, RSP880-LT, RSP880, RP3, RP2

# A99-10X400GE-X-SE/TR (7-fabric) LC Architecture (when used in 9904)





# ASR 9000 5th Generation Compact Chassis

Throughput	Ports	Multi-rate Ports	MACSec/OTN	Timing
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ASR-9902

800 Gbps

2 Ports QSFP-DD  
6 Ports QSFP28  
16 Ports SFP28  
24 Ports SFP+

Yes

MACSec/  
OTN

Class C



ASR-9903 (Fixed Ports)

1.6 Tbps

16 Ports QSFP28  
20 Ports SFP+

Yes

MACSec

Class C



A9903-20HG-PEC

2 Tbps

15 Ports QSFP28  
5 Ports QSFP-DD

Yes

MACSec

Class C



A9903-8HG-PEC

800 Gbps

32 Ports SFP28  
16 Ports SFP+

Yes

MACSec

Class C

# Cisco ASR 9000 Compact Routers

ASR 9901



NEW  
ASR 9903



NEW  
ASR 9902



RU Size	2 RU	3 RU	2 RU
Depth	600 mm	600 mm	483 mm
Air Flow	Front to Back	Front to Back	Front to Back
Capacity	Up to 456 Gbps	Up to 3.6 Tbps	Up to 800GE
Route Processor	Integrated RP	Redundant RP	Redundant RP
Ports/Slots	Fixed Ports: Total 42 <ul style="list-style-type: none"> <li>• 2x100GE</li> <li>• 24 x 1/10GE (Linear tunable optics)</li> <li>• 16x1GE</li> </ul>	Fixed Board: 14x100GE QSFP28 + 2x100G   20x10GE SFP+ 1 Port Expansion Card: <ul style="list-style-type: none"> <li>• 2T Port exp. card</li> <li>• 800G Port exp. Card</li> </ul>	Fixed Ports: Total 48 <ul style="list-style-type: none"> <li>• 8x 100GE</li> <li>• 16x 25G / 10GE</li> <li>• 24x 10GE w/ OTN mode ((Linear tunable optics)</li> </ul>
MACSec	Yes	Yes	Yes
Applications	Access / Aggregation / Service Edge	Service Edge	Service Edge / Aggregation / Access
OS	IOS XR (64 Bit)	IOS XR (64 Bit)	IOS XR (64 Bit)

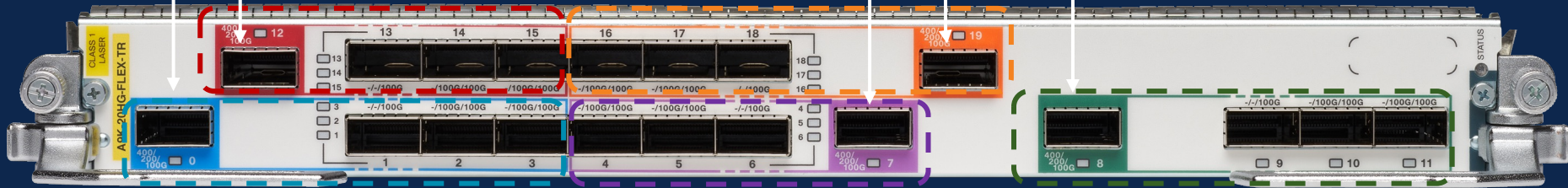
# EOS

- ASR 9901 -> ASR 9902
- <https://www.cisco.com/c/en/us/products/collateral/routers/asr-9000-series-aggregation-services-routers/asr-9901-router-eol.html>
- A9K 16x100G -> 20HG (5x400G or 20x100G)
- <https://www.cisco.com/c/en/us/products/collateral/routers/asr-9000-series-aggregation-services-routers/asr-9000-4th-gen-ethernet-lc-fam-eol.html>

# ASR 9000 5<sup>th</sup> Generation 2T Combo Card

## A9K-20HG-FLEX-SE/TR

Multi-rate Ports: 0/7/8/12/19  
Supports QSFP-DD / QSFP28 / QSFP+  
400G/200G/100G/40G



### 400G Ready

- 10G/25G/40G/100G/200G/400G Support

Each Slice Independently Configured as:

- 1x400G
- 1x200G + 2x100G or 2x40G
- 4x100G or 4x40G

Each 100G Breakout into 4x25G or 4x10G **Total 80x  
10/25GE**

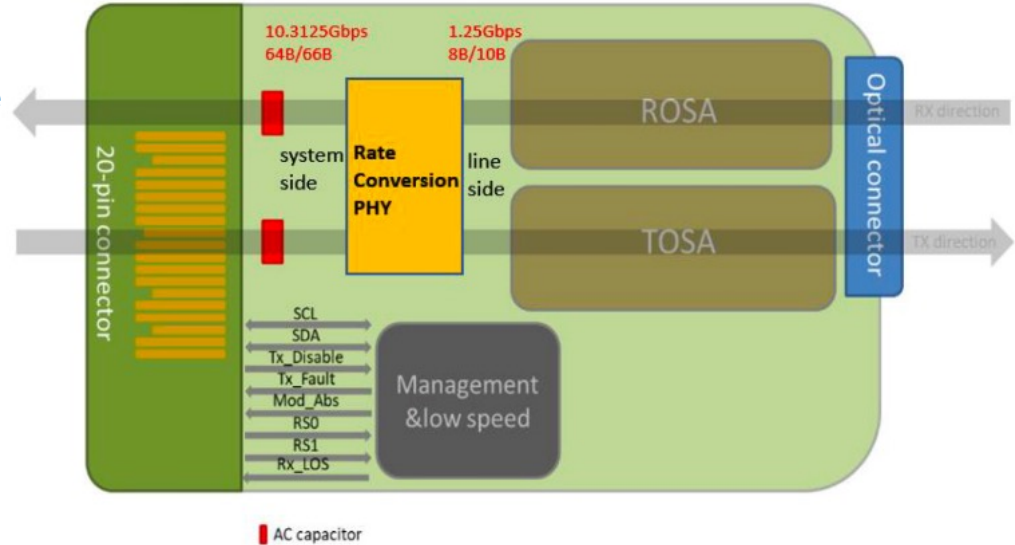
# 10G to 1GE Rate Change SFP Optics (aka Smart 1G)

2 modules:

- **SFP-1G-SX**: 1km reach over OM3/OM4
- **SFP-1G-LH**: 10km reach over single-mode fiber

1G modules can work in 10G/25G ports

- designed to allow platforms without 1G Media Access Control to link up to 1G transceivers; works on 10G/25G ports
- provides a standard 10G electrical interface on the system side
- Contains PHY to convert 10G electrical interface to 1G optical interface



- In the ingress the module converts physical coding from 8B/10B to 64B/66B encoding
- In the egress the module converts physical coding from 64B/66B to 8B/10B encoding
- Due to higher thermal of these 10G-to-1GE SFPs **odd numbered** 10G/25G ports can run this optic (the upper row of SFP+/SFP28 ports) - It means that **max 20x 1GE ports can be supported.**
- The following port combinations are available:
  - **5x1GE + 35x10GE** or **10x1GE + 30x10GE** or **15x1GE + 25x10GE** or **20x1GE + 20x10GE** or **40x1GE**

*Cisco 8000*

# 8000 Value Proposition

- 400G & 800G Optimized
- Powered by Silicon One
- Runs IOS XR and 3<sup>rd</sup> party NOS
- Fixed, Centralized, Distributed
- Power Efficient

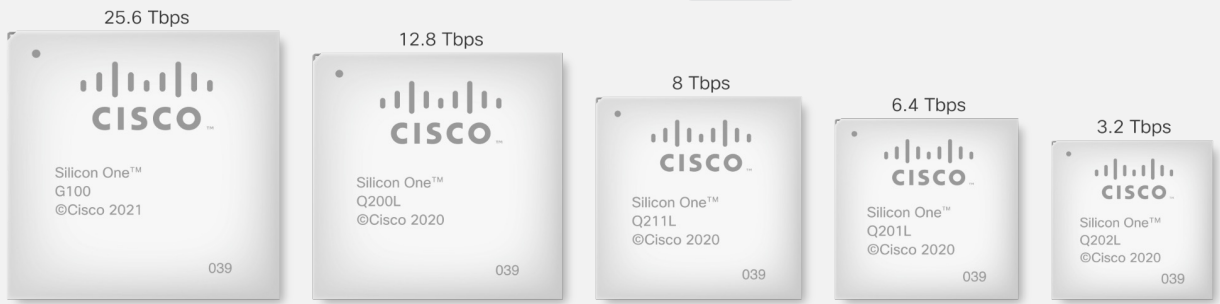


# Silicon One Device Lineup

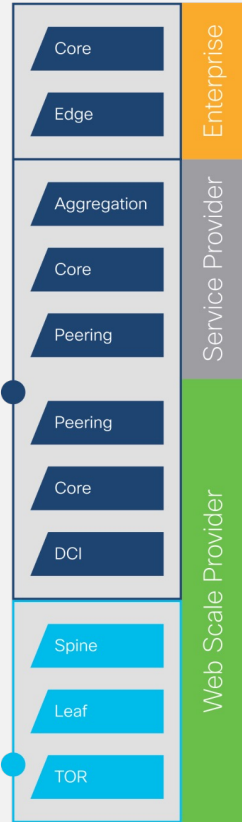
One Architecture, SDK and P4 Forwarding Code



Routing

















Web Scale Switching





# Cisco 8000 Customer Traction

Positioning	Key Customer Wins
DC/Web OTT	     
Core/LSR	  
Aggregation	  <b>PACKETFABRIC</b>
Peering	  

Customers  
> 150+

Systems  
70,000+

100GE Ports  
4,4M+

400GE Ports  
1,4M+

# 8100 vs. 8200 Introduction

- 8200 has HBM for FIB expansion and deep buffers, 8100 does not
- Traffic passing through 8100 should stay in the building/site
- 8100 is for DC fabric (leaf, spine, and small-buffer ToR)  
Medium FIB (<1M v4) scale & smaller buffers (100s of microseconds)
- 8200 is for a wide range of roles  
SP core, aggregation, and peering  
DC leaf/spine/ToR and DCI  
Large FIB (~4M v4) and deep buffers (10s of milliseconds)

# 8200 Hardware Reference

	8212-48FH-M	8201-32FH	8202-32FH-M	8201-24H8FH	8201	8202
Bandwidth	19.2 Tbps	12.8 Tbps	12.8 Tbps	5.6Tbps	10.8 Tbps	10.8 Tbps
ASIC	P100	Q200	Q200	Q200	Q100	Q100
QSFP28	0	0	0	24	12	60
QSFP56-DD (400G)	48 (MACsec)	32	32 (MACsec)	8	24	12
Depth	23.6" / 600mm	23.6" / 600mm	23.6" / 600mm	23.6" / 600mm	20.1" / 511 mm	20.1" / 511 mm
Weight	42 lb / 19 kg	31 lb / 14.1 kg	42 lb / 19kg	31 lb / 14.1 kg	24 lb / 10.9 kg	42 lbs / 19 kg
CPU / Memory	Intel Broadwell 4-core with 32 GB DRAM & 128 GB SSD					
Fans	4	6	4	6	5	3
Airflow	PSI	Either	PSI / PSE future	Either	Either	Either
Typical/Max power	TBD	288/675W	700/1550W	200/525W	415/660W	700/1150W





# Cisco Silicon One *P100*

- 19.2T routing device in 7nm
- Consistent architecture
- Highest routing performance
- SRAM and deep HBM buffers
- Lowest routing power per bit
- Increased scale vs. Q200
- 100G SerDes enable 800G



# 8800 Series Overview



	8804	8808	8812	8818
Rack Units	10 RU	16 RU	21 RU	33 RU
Line Cards	 48x100GbE (Q100, MACsec)	 36x400GbE (Q200, MACsec)	 34x100GbE & 14x400GbE (Q200, 16x 100G MACsec)	 36x 2x400GbE (P100)
Capacity (28.8T LC)	115.2 Tbps	230.4 Tbps	345.6 Tbps	518.4 Tbps
Typical System Power (Q200 14.4T LC)	4.1 KW	8.0 KW	13.8 KW	17.4kW (18 LCs) 13.9kW (12 LCs)

# Cisco 8600 Centralized Router



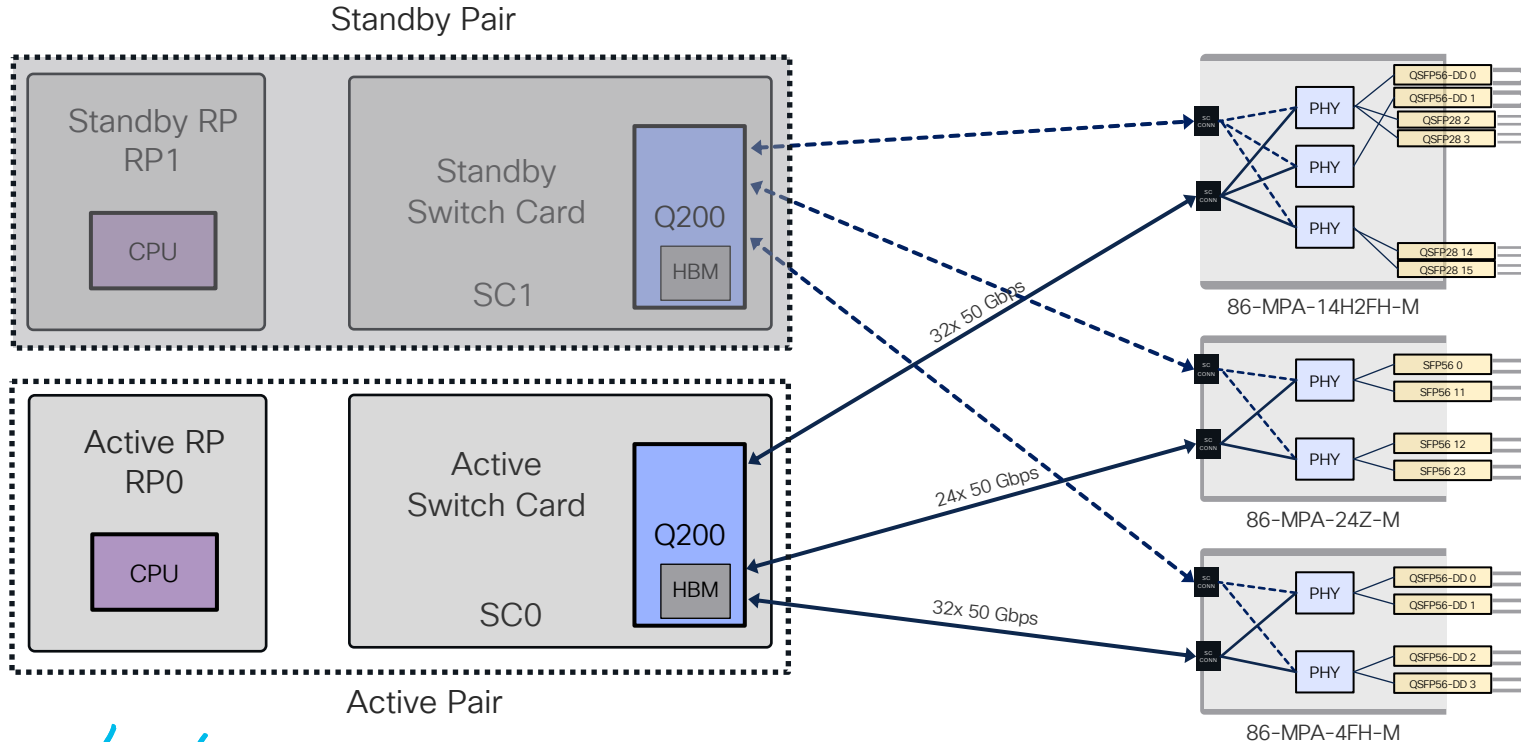
8608

ASIC	Q200
CP/DP Redundancy	Possible (Optional)
Rack Units	7RU
MACsec	Yes
MPA	
86-MPA-24Z-M	24 x 10/25/50G
86-MPA-4FH-M	4x 400GbE
86-MPA-14H2FH-M	8x 100GbE + 2x 400GbE or 16x100GbE
Total Throughput	12.8Tbps

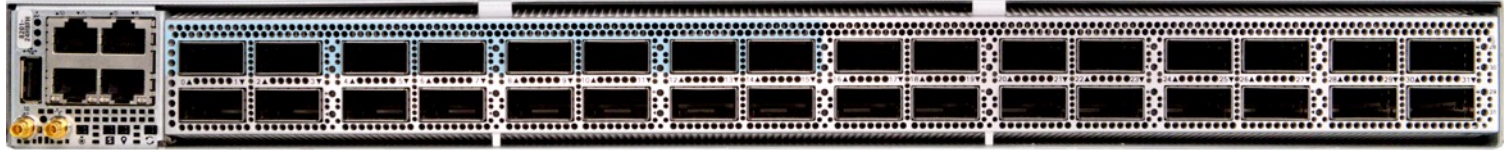


# 8608 Architecture

## Redundant Mode



# 8201-24H8FH



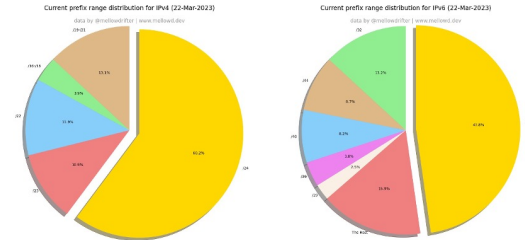
- 1 RU Fixed System, 24 x 100G QSFP28 + 8 x 400G QSFP-DD optics
- Cisco Silicon One Q200
- ZR, ZR+ & Bright ZR+ support on all 400G ports
- 6 Fan Trays (N+1), 2 Power Supplies (N+1)





# Cisco 8000 Peering role (42% in 2030)

- **Test of real conditions**



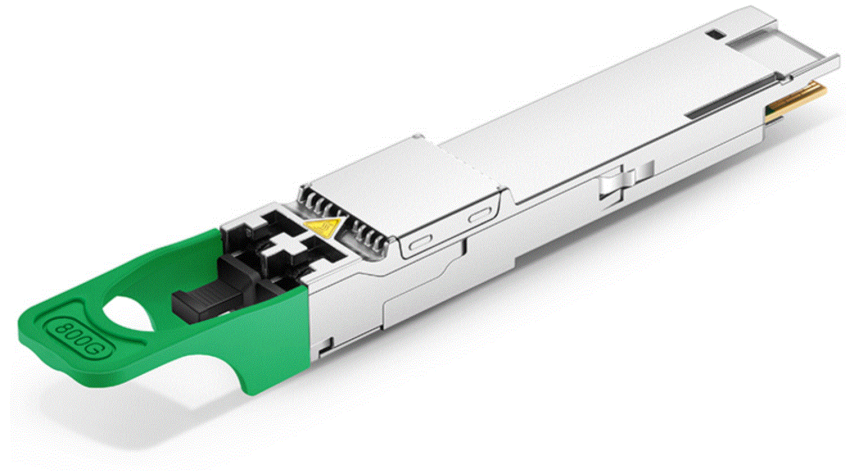
- For IPv4, data have shown future growth follows a linear model with 150 additional prefixes daily. It's expected to have ~ 1.2M IPv4 routes in 2028
- <https://xrdocs.io/8000/tutorials/cisco-8000-fib-scale/>
- <https://xrdocs.io/8000/tutorials/cisco-8000-peering-telemetry-demo/>
- The video shows live examples of telemetry collection: RPKI, FIB, Netflow, BGP, QoS, uRPF/RTBH/SRTBH and BGP Flowspec.

# 800G vs. 800 GbE vs. 2x 400 & 8x 100 GbE

- P100 and G100 introduce 100G SerDes and 800G ports
- There is no single-fiber pair 800G in FY23
- 800G ports are currently 8x 100 or 2x 400 (maybe 4x 200)
- Interoperable 800G in next generation ASICs (~2024)  
Ethernet Technology Consortium standard first, then IEEE (very similar for initial PMDs)
- Use the terms carefully
  - “800G” ports means 800G bandwidth, 8x100, 2x 400G, or proprietary 800G
  - “2x 400 GbE” or “8x 100 GbE” IEEE standards shipping in first generation
  - “800 GbE” means standardized single-channel (future – don’t use this yet)

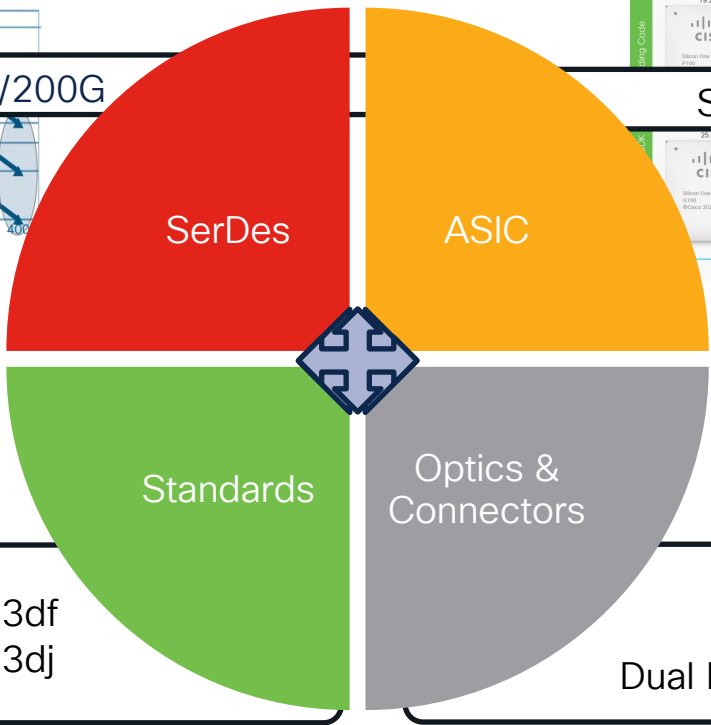
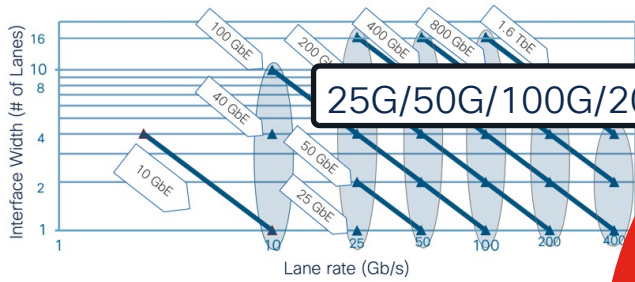
# 8000 Series 800G Ports

- First shipped in mid 2022 – 32x 800G
- Second board will be 36x 800G line card
- First-gen 800G ports are 8x 100 GbE or 2x 400 GbE
  - 2x LC connector to two 400 GbE FR4
  - MPO12 to two 400 GbE DR4
  - MPO16 to eight 100 GbE

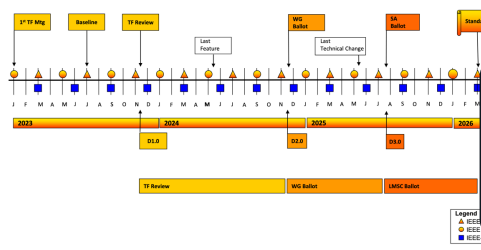


For more info: <https://blogs.cisco.com/tag/qsfp-dd800>

# Path to 800G & 800GbE



## Adopted IEEE P802.3dj Timeline (16 Jan 2023)

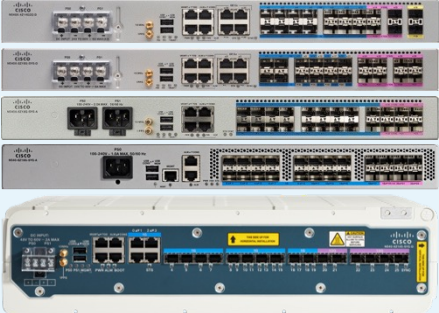
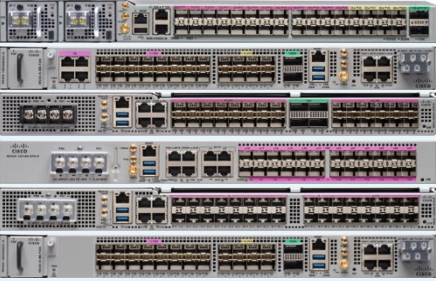




802.3df  
802.3dj

QSFP-DD800  
Dual MPO/Duplex LC

*NCS 540*

# NCS 540 Family in 2022









Small	Medium	Large	Fronthaul
<p><b>Darwin</b> Fitzroy, Galapagos, Beagle Meerkat<sup>7.5.2</sup>, Finches<sup>7.8.1</sup></p>	<p><b>Tortin &amp; Big Bend</b> Tortin 16/32, Everglades, Crater Lake, Acadia, Denali, Olympic<sup>7.5.2</sup></p>	<p><b>Arches</b></p>	<p><b>Felidae</b> Lion, Jaguar</p>
			
<p><b>64G or 104G</b> QUX-64/120 1/10/25GE (2x SFP28) PSU: Fixed AC/DC 1+1 or non-redundant I-Temp S2S or F2L Airflow, Fixed Fans Depth: 23cm C-Temp PID: Single AC/DC PSU, F2L Airflow, no timing Passive Cooling (Fanless) PID: Fixed DC PSU 1+1, 2.5RU, depth 38cm</p> <p><b>Shipping</b> 7.3.1/7.4.1/7.5.2/7.8.1</p>	<p><b>136G to 300G</b> QAX-160/300 1/10/25/40/100GE (2/4x QSFP28) PSU: FRU 1+1 AC/DC or Fixed 1+1 DC/1 AC I-Temp or C-Temp F2B or S2S Airflow, Modular or Fixed Fans GNSS Receiver MACsec Depth: 25-28cm</p> <p><b>Shipping</b> 6.3.2/6.5.2/7.0.1/7.5.2</p>	<p><b>800G</b> Q2A 1/10/25/40/50/100/200/400GE (2x QSFP56-DD, 8x SFP56) PSU: FRU 1+1 AC/DC I-Temp F2B Airflow, Modular or Fixed Fans GNSS Receiver MACsec Depth: 30cm</p> <p><b>Shipping</b> 7.4.1</p>	<p><b>300G or 900G</b> QAX-300/J+ 1/10/25/40/100GE (2/4x QSFP28) 2/24x 10/25GE TSN 802.1Qbu 12/24x CPRI 3-8 PSU: FRU 1+1 AC/DC I-Temp or C-Temp F2B Airflow, Modular or Fixed Fans GNSS Receiver MACsec* Depth: 35/55cm</p> <p><b>Shipping</b> 7.3.2</p>

# NCS 540

NCS 540				FCS	NPU	NPU Gbps	Max IO Gbps	PSUs	Fans	Airflow	Temp	Conf. Coat	Depth [cm]	GNSS	PTP Class	MACsec	CPRI	TSN	QDD56	QSFP28	SFP56	SFP28	SFP10	SFP	RJ45	
Large	Arches		N540-24Q8L2DD-SYS	7.4.1	Q2A	800	1000	M	F	F2B	I		30	Y	C	Y			2	8	24					
Medium	Tortin	Tortin 16	N540-ACC-SYS	6.5.2	QAX	300	640	M	M	F2B	I		26	Y	B	Y			2	8	24					
		Tortin CC 16	N540X-ACC-SYS	6.5.2	QAX	300	640	M	M	F2B	I	Y		26	Y	B	Y			2	8	24				
		Tortin 32	N540-24Z8Q2C-SYS	6.3.2	QAX	300	640	M	M	F2B	I			26	Y	B	Y			2	8	24				
Medium	Big Bend	Everglades	N540X-16Z4G8Q2C-D/A	7.0.1	QAX	300	564	F <sup>1</sup>	F	S2S	I	Y	28	Y	C	Y			2	8	16				4	
		Olympic	N540X-16Z8Q2C-D	7.5.2	QAX	300	560	F <sup>D</sup>	F	S2S	I	Y		28	Y	C	Y			2	8	16				
		Crater Lake	N540-28Z4C-SYS-D/A	7.0.1	QAX	300	680	F <sup>1</sup>	F	F2B	C			25		B				4			28			
		Acadia	N540X-12Z16G-SYS-D/A	7.0.1	QAX	160	136	F <sup>1</sup>	F	S2S	I	Y		25	Y	C								12	12	4
		Denali	N540-12Z20G-SYS-D/A	7.0.1	QAX	160	140	F <sup>1</sup>	F	F2B	C			25		B								12	20	
Small	Darwin	Fitzroy	N540X-4Z14G2Q-D/A	7.4.1	QUX	120	104	F <sup>2</sup>	F	S2S	I	Y	23		C							2	4	14	4 <sup>x</sup>	
		Galapagos	N540X-8Z16G-SYS-D/A	7.3.1	QUX	120	104	F <sup>2</sup>	F	S2S	I	Y		23		C							8	12+8 <sup>c</sup>	4	
		Beagle	N540X-6Z18G-SYS-D/A	7.3.1	QUX	64	78	F <sup>2</sup>	F	S2S	I	Y		23		C							6	18		
		Finches	N540-6Z18G-SYS-D/A	7.8.1	QUX	64	78	F <sup>1</sup>	F	F2L	C			23		-							6	18		
		Meerkat	N540-6Z14S-SYS-D	7.5.2	QUX	64	80	F <sup>D</sup>	-	-	I			38		C							6	10+6 <sup>c</sup>	4	
Fronthaul	Felidae	Lion	N540-FH-AGG-SYS	7.3.2	J+	900	1000	M	M	F2B	C		55	Y	C	Y <sup>R</sup>	Y	Y		4	24					
		Jaguar	N540-FH-CSR-SYS	7.3.2	QAX	300	550	M	F	F2B	I			35	Y	C	Y <sup>R</sup>	Y	Y		2	6	20			

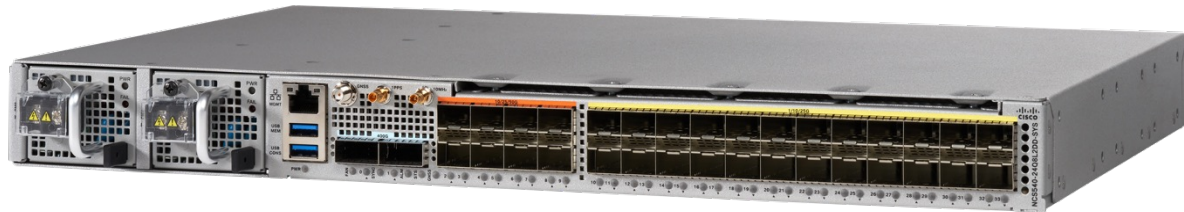
M: modular F: fixed F<sup>1</sup>: dual DC or single AC F<sup>2</sup>: dual DC or dual AC F<sup>D</sup>: dual DC R: roadmap x: combo ports c: using cSFP

# NCS 540

	Interfaces	Throughput	Timing	IOS XR FCS	DRAM	Power
<b>Tortin 32GB/16GB</b> N540-24Z8Q2C-SYS N540(X)-ACC-SYS 	2x 100/40GE 8x 25/10/1GE 24x 10/1GE	300G Max Interfaces: 640G	GNSS Class B 1pps/10MHz/ToD	32GB: 6.3.2 Apr 2018 16GB: 6.5.2 Jan 2019	32GB 16GB	Modular: 1+1 AC/DC
<b>Everglades</b> N540X-16Z4G8Q2C-D/A 	2x 100/40GE 8x 25/10/1GE 16x 10/1GE 4x 1GE Copper	300G Max Interfaces: 564G	GNSS Class C 1pps/10MHz/ToD BITS	7.0.1 LNT August 2019	8GB	Fixed: 1 AC 1+1 DC
<b>Crater Lake</b> N540-28Z4C-SYS-D/A 	4x 100/40GE 28x 10/1GE	300G Max Interfaces: 680G	Class B* 1pps/10MHz/ToD BITS	7.0.1 LNT August 2019	8GB	Fixed: 1 AC 1+1 DC
<b>Acadia</b> N540X-12Z16G-SYS-D/A 	12x 10/1GE 12x 1GE 4x 1GE Copper	160G Max Interfaces: 136G	GNSS Class C 1pps/10MHz/ToD BITS	7.0.1 LNT August 2019	8GB	Fixed: 1 AC 1+1 DC
<b>Denali</b> N540-12Z20G-SYS-D/A 	12x 10/1GE 20x 1GE	160G Max Interfaces: 140G	Class B* 1pps/10MHz/ToD BITS	7.0.1 LNT August 2019	8GB	Fixed: 1 AC 1+1 DC
<b>Fitzroy</b> N540X-4Z14G2Q-D/A 	2x 25/10/1GE 4x 10/1GE 10x 1GE 4x 1GE Combo SFP/RJ45	120G Max Interfaces: 104G	Class C 1pps/10MHz/ToD	7.4.1 LNT August 2021	8GB	Fixed: 1+1 AC 1+1 DC
<b>Galapagos</b> N540X-8Z16G-SYS-D/A 	8x 10/1GE 4x 1GE SFP 4x 1GE RJ45 8x 1GE SFP or 16x 1GE cSFP	120G Max Interfaces: 104G	Class C 1pps/10MHz/ToD	7.3.1 LNT February 2021	8GB	Fixed: 1+1 AC 1+1 DC
<b>Beagle</b> N540X-6Z18G-SYS-D/A 	6x 10/1GE 18x 1GE	64G Max Interfaces: 78G	Class C 1pps/10MHz/ToD	7.3.1 LNT February 2021	8GB	Fixed: 1+1 AC 1+1 DC



# NCS 540 Large Arches N540-24Q8L2DD-SYS

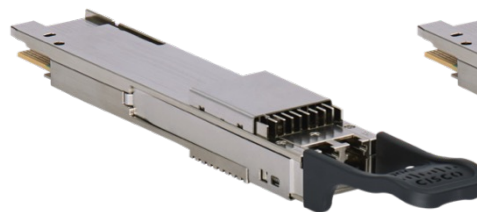


- Broadcom Qumran 2A (J2 family)
- 800Gbps/600Mpps, Max IO 1T, 2GB Packet Buffer
- CPU 4C Intel Xeon, 16GB DRAM, 64GB SATA
- 1RU, Depth 299mm
- Redundant Modular AC/DC 1+1 power supplies
- Front to Back airflow
- Fixed redundant fans
- I-Temp -40C to +65C
- G.8273.2 Class C & GNSS Receiver

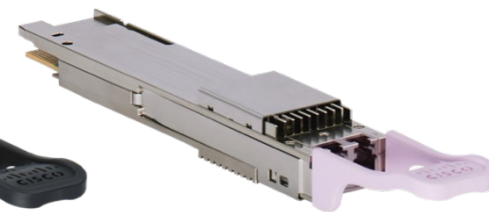
2x 400GE QSFP56-DD

8x 50GE SFP56

24x 25GE SFP28



QDD-400G-ZR-S



QDD-400G-ZRP-S

# NCS 540 Large

## N540-24Q8L2DD-SYS

Q2A 800G  
@600Mpps

Intel 4C CPU  
16GB DRAM

Power: Modular  
1+1 DC/AC

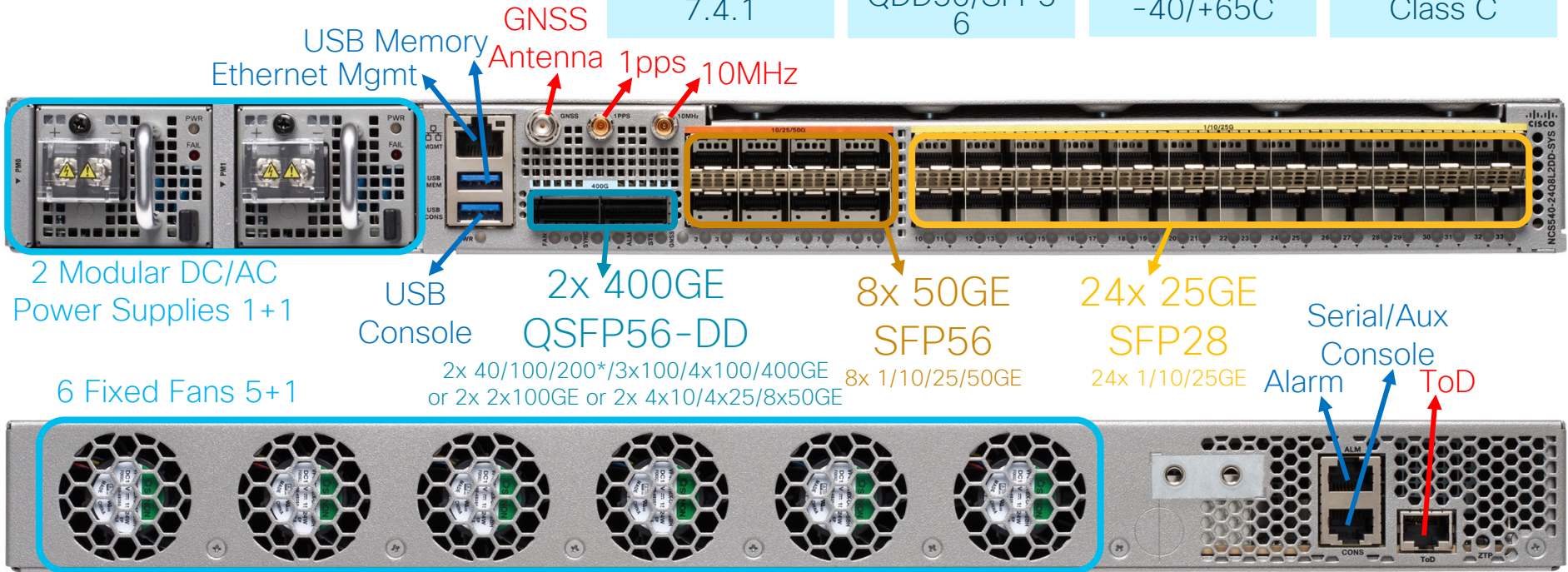
F2B Airflow  
5+1 Fans

IOS XR  
7.4.1

MACsec on  
QDD56/SFP56

I-Temp  
-40/+65C

G.8273.2  
Class C



USB Memory  
Ethernet Mgmt

GNSS  
Antenna 1ppm 10MHz

2 Modular DC/AC  
Power Supplies 1+1

USB  
Console

2x 400GE  
QSFP56-DD

2x 40/100/200\*/3x100/4x100/400GE  
or 2x 2x100GE or 2x 4x10/4x25/8x50GE

8x 50GE  
SFP56

8x 1/10/25/50GE

24x 25GE  
SFP28

24x 1/10/25GE

6 Fixed Fans 5+1

Serial/Aux  
Console  
Alarm  
ToD

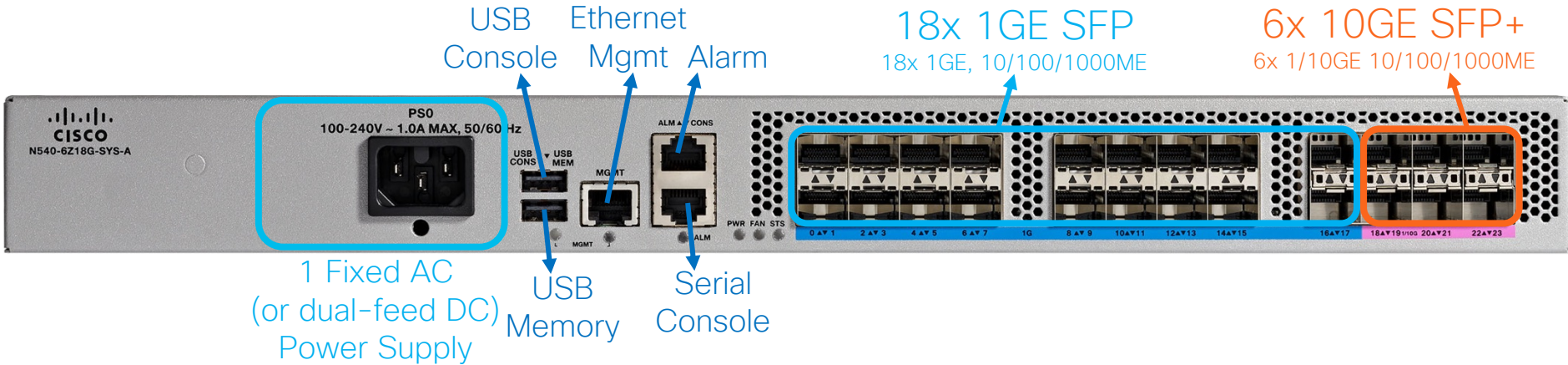
# NCS 540 Finches

## N540-6Z18G-SYS-A/D

- “Beagle light”
- The same as Beagle but:
  - Single AC PSU or single dual-feed DC PSU
  - Front to Left airflow (Front to Back with air baffle)
  - No I-Temp = C-Temp 0°C to 55°C @300m
  - No Conformal Coating
  - No timing = no SyncE, no PTP
  - No additional surge protection for DC PSU



# NCS 540 Finches N540-6Z18G-SYS-A (-D)



QUX 64G

C-Temp 0C/+55C

Power: 1x Fixed AC or 2-feed DC

8GB DRAM

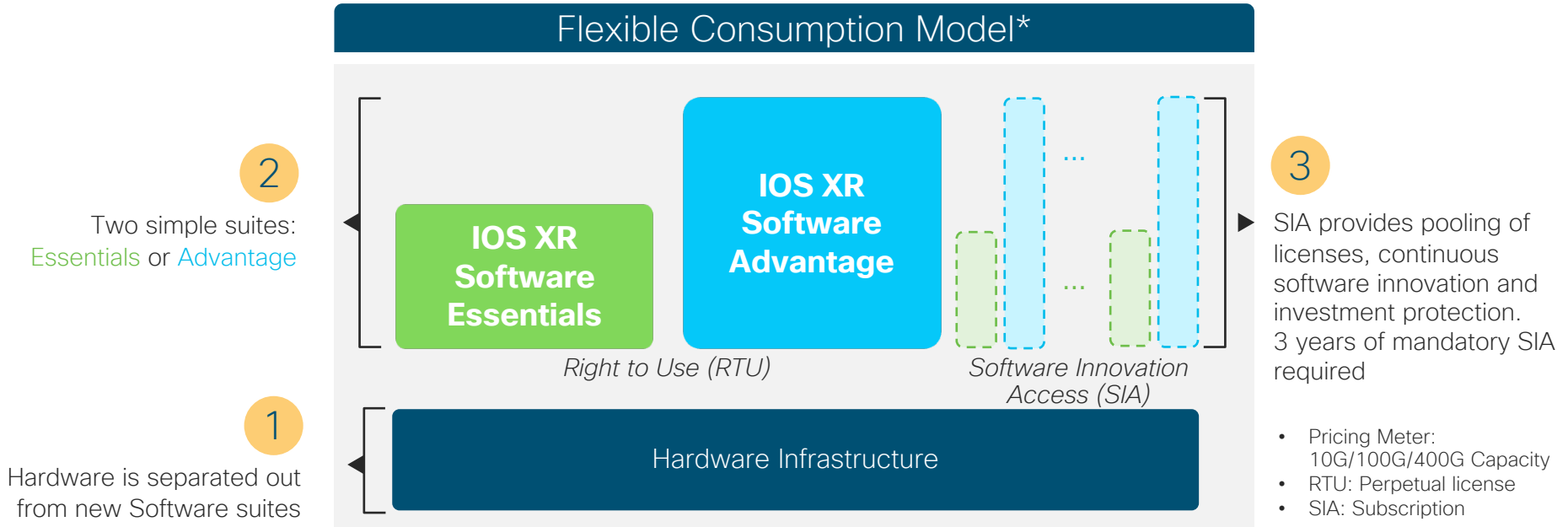
F2L Airflow

# *FCM*

Flexible Consumption Model

- licenses used per active port
- license pooled from smart account

# Flexible Consumption Model (FCM)



\* Smart Licensing registration & reporting required for FCM

# Criteria for Advantage RTU License

Advanced Feature	System or Port Level	Check	Action
L2VPN	Per Port	Check all ports that are <u>attachment circuits</u> to an L2VPN or EVPN service (PW, VPWS, VPLS, EVPN)	All ports that match require an Advantage SW license
L3VPN	Per Port	Count the Number of VRFs that are Globally Configured	If <= 8, Essentials SW license only If > 8, Advantage SW license required
		Check all ports that have parent/subinterface configured with VRFs	All ports that match require an Advantage SW license
Peering Scale	Per System	Check FIB scale limits of IPv4: 512K routes, IPv6: 50K routes	Upon match, require an Advantage SW license for all ports in system
Traffic Engineering	Per System	Check if Traffic Engineering or Flex-Algo is enabled on the system	Upon match, require an Advantage SW license for all ports in system
Security / MACsec	Per Port	Check for all ports that are configured with MACSec	All ports that match require an Advantage SW license

# NCS 540 FCM Advantage 10G RTU License

- PID: ADN-AC-10G-RTU-1 (includes Essentials) or ADV-AC-10G-RTU-1 (for upgrade from Essentials to Advantage)
- Not for actual bandwidth used but for “Up” interfaces in 10G increments
- Always maximum 1 Advantage license per 10G
- Rounding to 10G applies for 1GE or 25GE interfaces (15G→24G=2x 10G RTU, 25G→34G=3x 10G RTU, ...)

## Per-interface Advantage licenses:

- L3VPN: per access interface if router has >8 VRFs
- L2VPN: per access interface for: VPWS, VPLS, EVPN (for any interface in I2vpn before 7.4.2, 7.5.2)
- MACsec

## Per-system Advantage licenses:

### Needed for all “Up” interfaces

- Traffic Engineering: In IGP, RSVP-TE, SRTE, Flex-Algo
- Peering scale: >512k v4 or >50k v6
- BGP features: EPE, FlowSpec\*, QPBB, RPKI, BMP, Attribute Download
- Lawful Intercept, SL-API



# Supporty v SP

## Identify the right service level

Traditional Model to FCM Model Support Service Levels Translator

### Equivalent Traditional Support Service GSPs

SW Support		SP SW Support	
Service	Service Description	Service	Service Description
SAS	24/7 SW Support	SPSAS	24/7 SW Support
ECMU	24X7 SW TAC with SW downloads	SPCMU	24X7 SW TAC with SW downloads

Smart Net Total Care		SP Base, HW Support	
Service	Service Description	Service	Service Description
-	-	SP RTF Svc(*)	SPRTF
SNT	SNTC-8X5XNBD	8X5XNBD AR Svc	SPAR1
SNTE	SNTC-8X5X4	8X5X4 AR Svc	SPAR2
SNTP	SNTC-24X7X4	24X7X4 AR Svc	SPAR3
S2P	SNTC-24X7X2	24X7X2 AR Svc	SPAR4
CS	SNTC-8X5XNBDOS	8X5XNBD Onsite Svc	SPCS
C4S	SNTC-8X5X4OS	8X5X4 Onsite Svc	SPC4S
C4P	SNTC-24X7X4OS	24X7X4 Onsite Svc	SPC4P
C2P	SNTC-24X7X2OS	24X7X2 Onsite Svc	SPC2P

### FCM Support GSPs

What to Quote	
"SD"-Service	SKU format
SDSWK	SD- <u>xxxx</u>
SDSWK	SD- <u>xxxx</u>

What to Quote	
"SD"-Service	SKU format
SDRTFK(*)	SD- <u>xxxx</u>
SDAR1K	SD- <u>xxxx</u>
SDAR2K	SD- <u>xxxx</u>
<b>SDAR3K</b>	<b>SD-<u>xxxx</u></b>
SDAR4K	SD- <u>xxxx</u>
SDCSK	SD- <u>xxxx</u>
SDC4SK	SD- <u>xxxx</u>
SDC4PK	SD- <u>xxxx</u>
SDC2PK	SD- <u>xxxx</u>

SDRTF service level is restricted for SP customers only

*NCS 5500, 5700*

(BRKSPG-2397)

# NCS 5500/5700 – Fixed Portfolio

## High Scale Aggregation evolution

### NCS5500 Products (Q-MX, J, J+)

1G | 10G | 40G | 100G

NCS 5501/SE



1G | 10G | 25G | 40G | 100G

NCS 55A2-MOD-S/SE



1G | 10G | 25G | 40G | 100G

NCS-55A1-48Q6H



NCS-55A1-24Q6H-S/SS



40G | 100G

NCS 55A1-36H-S/SE



NCS 55A1-24H



NCS-57B1-6D24



- 400G ZR/ZR+/Bright ZR
- 1RU; 4.8 Tbps throughput
- 24x100G + 6x400G
- MACSEC, Timing

NCS-57B1-5DSE



- 400G ZR/ZR+/Bright ZR
- 1RU; 4.4 Tbps throughput
- 24x100G + 5x400G
- MACSEC, Timing
- External TCAM

NCS-57D2-18DD-S



- 400G ZR/ZR+/Bright ZR
- 2RU; 7.2 Tbps throughput
- Flexible 66 ports 2x400G + 16x400G/64x100G
- MACSEC, Timing

NCS-57C3-MOD-S



- 400G ZR/ZR+/Bright ZR
- 3RU; 2.4T throughput
- Fixed: 48x1/10/25G + 8x100G 3 x MPA: 2x800G + 1x 400G
- MACSEC, Timing

NCS-57C3-MOD-SE



- 400G ZR/ZR+/Bright ZR
- 3RU; 2.4T throughput
- Fixed: 48x1/10/25G + 4x100G 3 x MPA: 2x800G + 1x 400G
- MACSEC, Timing
- External TCAM

NCS-57C1-48Q6D-S

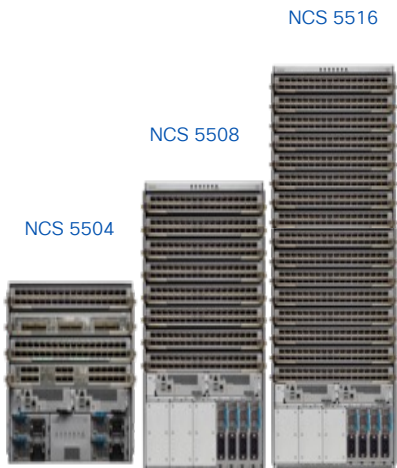


- 400G ZR/ZR+/Bright ZR
- 1RU; 2.4T throughput
- 32x1/10/25G + 16x1/10/25/50G + 6x400G
- MACSEC, Timing

● Segment Routing
 ● EVPN
 ● MACSec
 ● Timing
 ● 400G ZR/ZRP/Bright ZR

# NCS 5500/5700 – Modular Portfolio

## High Scale Aggregation evolution



### NCS5500 Products (J, J+)

**40G | 100G**

NC55-36X100G-A-SE

NC55-36X100G-A-SE-S

**1G | 10G | 25G | 40G | 50G | 100G**

NC55-MOD-A-S

NC55-MOD-A-SE-S

**1G | 10G | 25G | 40G | 100G**

NC55-32T16Q4H-A

- Segment Routing
- EVPN
- MACSec
- Timing
- 400G ZR/ZRP/Bright ZR

### NCS5700 Products (J2, J2C)

**NC57-24DD**

- 400G ZR/ZR+/Bright ZR
- 24x400G
- Through put 9.6 Tbps
- No External TCAM

---

**NC57-18DD-SE**

- 400G ZR/ZR+/Bright ZR
- 18x100G, 30x200G/100G
- Through put 7.2 Tbps
- External TCAM

---

**NC57-36H6D-S**

- 400G ZR/ZR+/Bright ZR
- 100G, 400G
- Throughput 4.8 Tbps
- Timing, MACSEC, No External TCAM

---

**NC57-36H-SE**

- 100G
- Throughput 3.6 Tbps
- External TCAM

---

**NC57-MOD-S**

- 400G ZR/ZR+/Bright ZR
- 10G, 25G, 50G, 400G
- Throughput 2.8 Tbps
- MACSEC, 800G-MPA, No External TCAM

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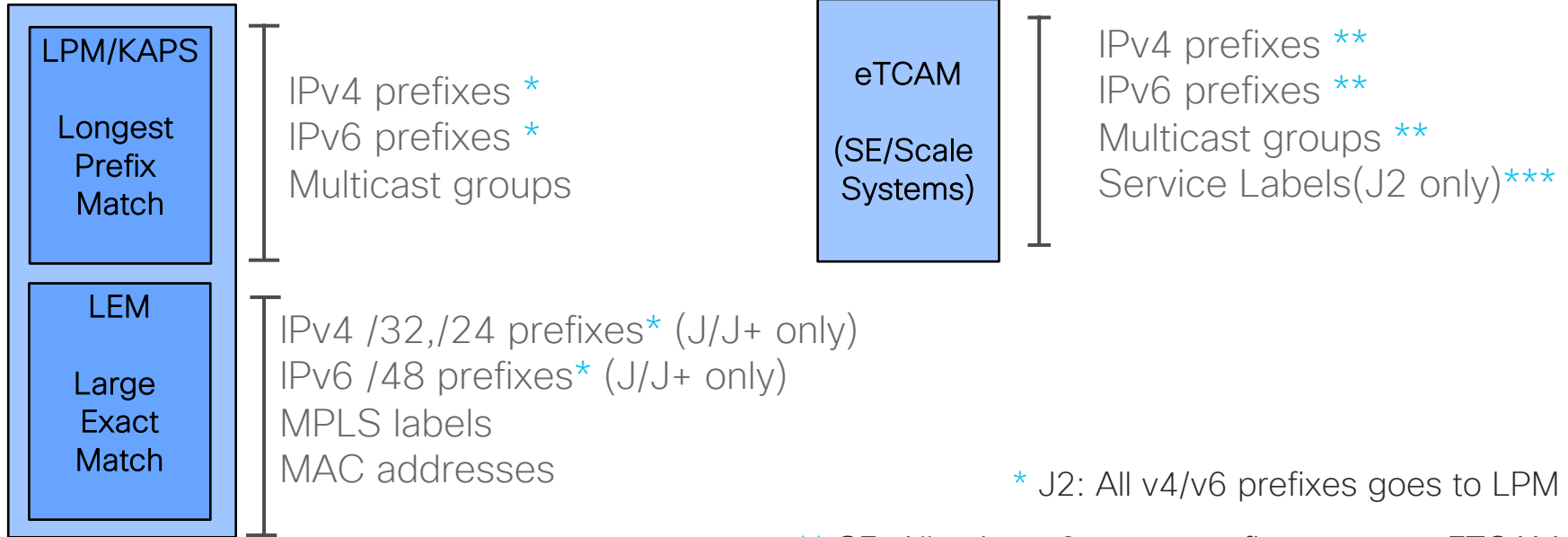
**NC57-48Q2D-S/SE**

- 400G ZR/ZR+/Bright ZR
- 1G, 10G, 25G, 50G, 100G, 400G
- Throughput 2.4 Tbps
- Timing, MACSEC, External TCAM

# NCS5500/5700 – NPU Evolution

	Jericho	Jericho +	Jericho2	Jericho2C	Jericho2C+
<b>Bandwidth</b>	720G	900G	4.8T	2.4T	7.2T
<b>Power/100G</b>	16.6W	16.6W	7.3W	5-6.7W	6.3W
<b>Performance (pps)</b>	720M	835M	2B	1B	2.83B
<b>OCB</b>	16MB	16MB	32MB	32MB	32MB
<b>Buffer</b>	4GB (GDDR)	4GB (GDDR)	8GB (HBM)	4GB (HBM)	8GB (HBM)
<b>VOQ</b>	96K	96K	64K per core	128K per core	256K per core
<b>Counters</b>	256K	256K	384K	192K	384K
<b>Network IF</b>	24x 25G+36x 12.5G	48x25G+24x12.5G	96x 50G	32x50G+96x25G	144x 50G
<b>Fabric IF</b>	36x 25G	48x 50G	112x 50G	48x 50G	192x 50G
<b>MC Groups</b>	-	128K	256K	256K	256K
<b>Timing / Encryption</b>	Class B / No	Class B / No	Class B / No	Class C / No	Class C / Yes

# Database Overview – LEM/LPM



\* J2: All v4/v6 prefixes goes to LPM

\*\* SE: All unicast & mcast prefixes goes to ETCAM

\*\*\* J2-SE: Label in ETCAM for specific scenarios

*J2*

# NCS-57B1-6D24 / NCS-57B1-5DSE

- 1RU: 24 ports QSFP + 6/5 ports QSFP-DD  
24x 40G/100G + (6 or 5)x 400G/200G
- 1x Jericho2 Forwarding ASIC (SoC) BCM88690  
2TPPS / 4,800 Gbps
- Base and Scale versions  
Base: 6x QSFP-DD / Scale: 5x QSFP-DD ports
- IOS XR 7.3.1  
XR7, Native only





# NCS-57C1-48Q6D-S

- 1RU: 32 ports SFP28 + 16 SFP56+ 6 ports QSFP-DD  
48x 1G/10G/25G + 6 x 400G
- 1x Q2C Forwarding ASIC (SoC) BCM88820  
1B PPS / 2,400 Gbps
- **Base version**
- IOS XR 7.5.2  
XR7, Native only



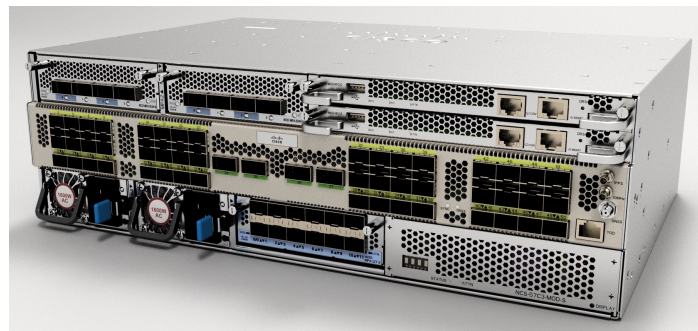
# NCS-57C3-MOD

- Code name: Eyrie
- Compact 3RU, 284mm depth, F2B air-flow, dual RP, dual PSU, 6x fan trays
- Flexible with multiple interfaces support : 1G - 400G
- Ideal for [network use cases](#) like Mobile backhaul, Core/LSR, Peering etc.
- Platform will also support RON, PLE & [cnBNG](#)
- [400G ZR/ZRP](#), [CFP2-DCO](#) support via MPA
- MPA's supported:

4x QSFP-DD	12x SFP56	1xCFP2 + 1xQSFP-DD
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PLE	8x100G QSFP28	All existing 400G MPA's
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For more information, please refer to [NCS 57C3 data sheet](#)

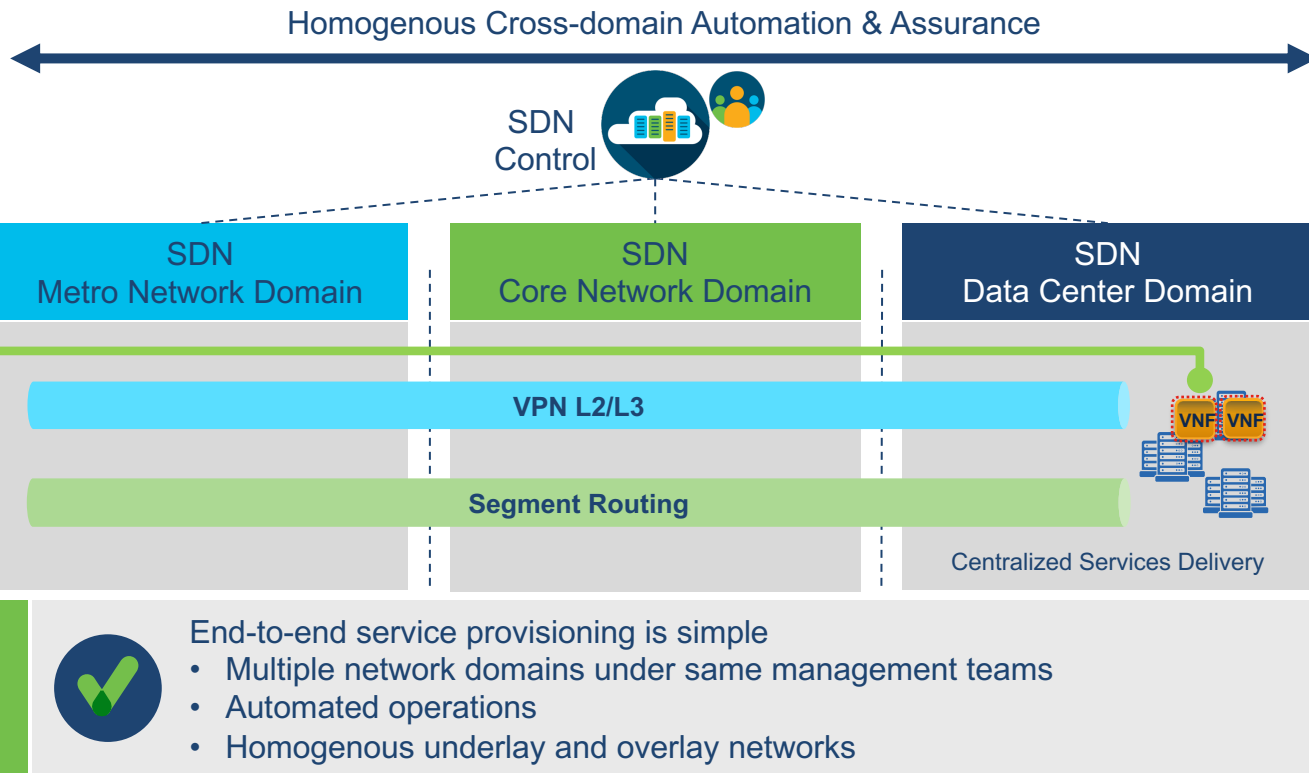
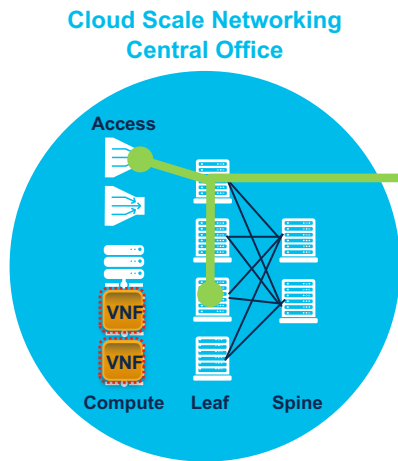


## Quick Facts

Capacity	Base: 4.0T   Scale: 3.6T (Oversubscribed)	
NPU	1x Jericho2C (2.4 T)	
Port Configuration	2x MPAs (800G) + 1x MPA (400G) + 48x SFP28 + 8/4x QSFP28	
Power	Base Typical (25°C): 445W Maximum (50°C): 675W	Scale Typical (25°C): 485W Maximum (50°C): 735W
Temperature Support (at 1800m)	0-50°C 0-45°C (with NC57-MPA-2D4H-FC & low-powered 400G optics)	
SW Release	7.4.1 (Shipping)	
Hardware capabilities	<a href="#">MACSEC</a> , <a href="#">Class C Timing</a> , Built-in GNSS, Redundant RP	

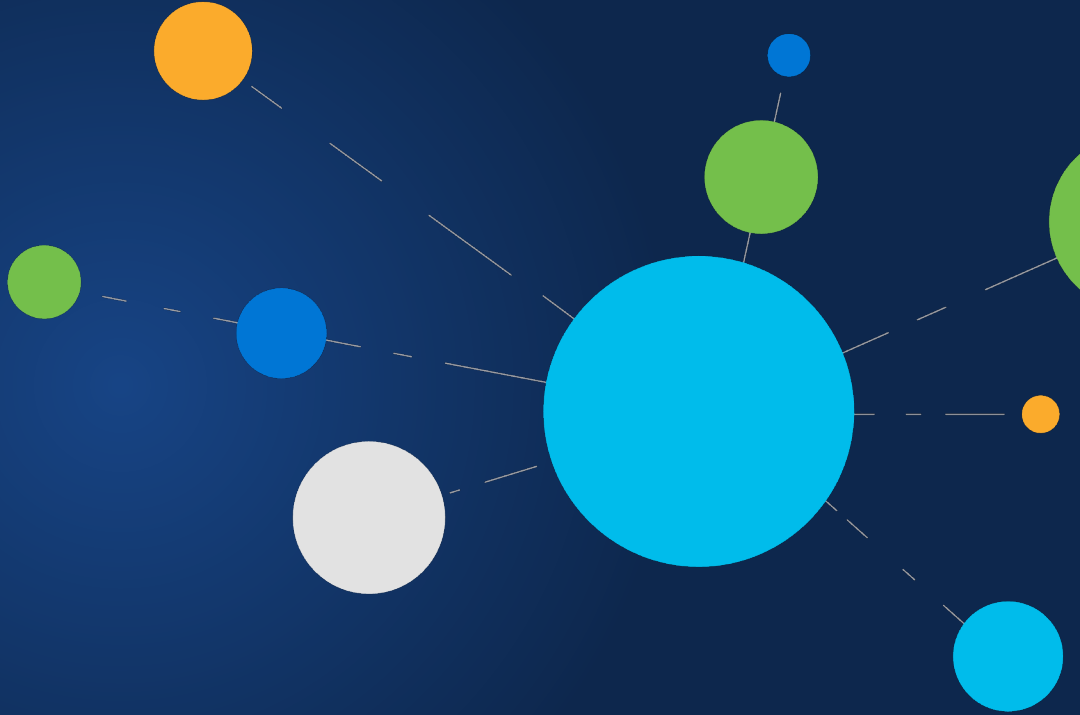
# *Segment Routing*

# SR-MPLS: SDN ready “Network as a Fabric” for Service Creation





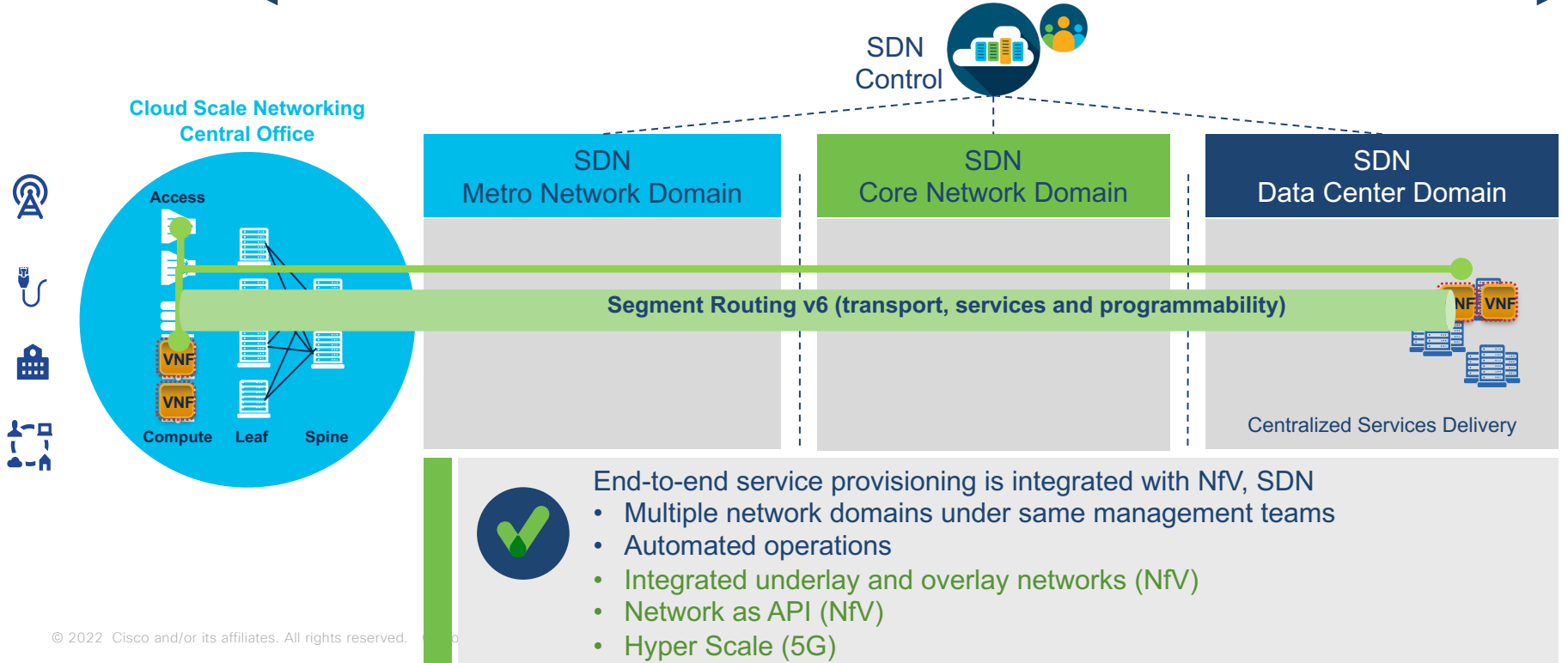
# SRv6 Path to Simplicity



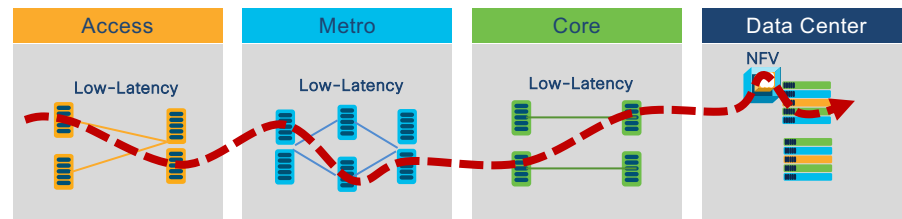
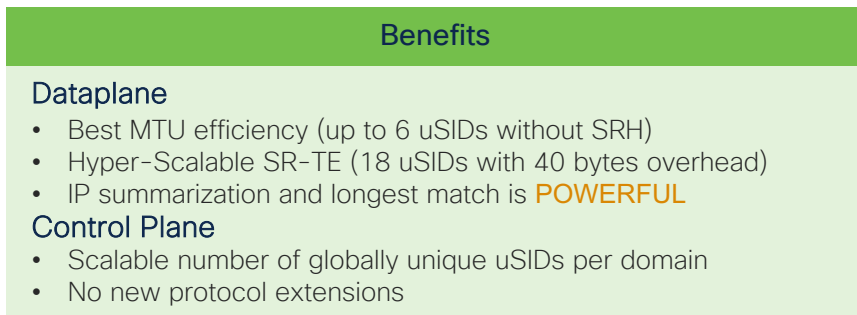
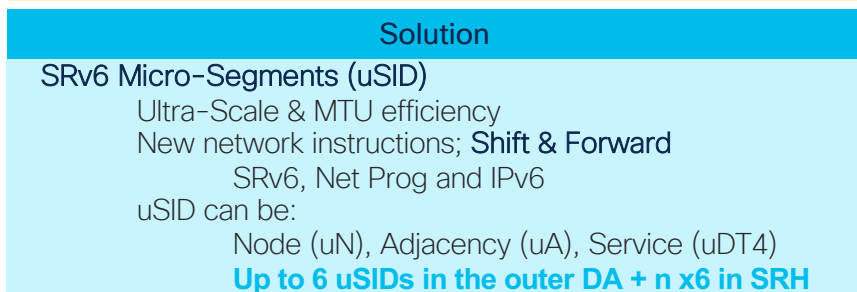
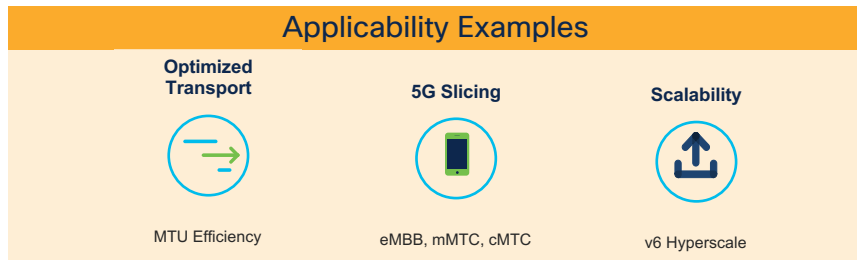
# SRv6: SDN, Nfv, 5G ready “Network as an API” for Service Creation



Homogenous Cross-domain Automation & Assurance



# SRv6 Micro-Program: Scale and MTU Efficiency



FCBB:BB00:0001:0002:0003:0004:0005:0006

uSID Block    uSID1    uSID2    uSID3    uSID4    uSID5    uSID6

e.g. Min-Cost Slice

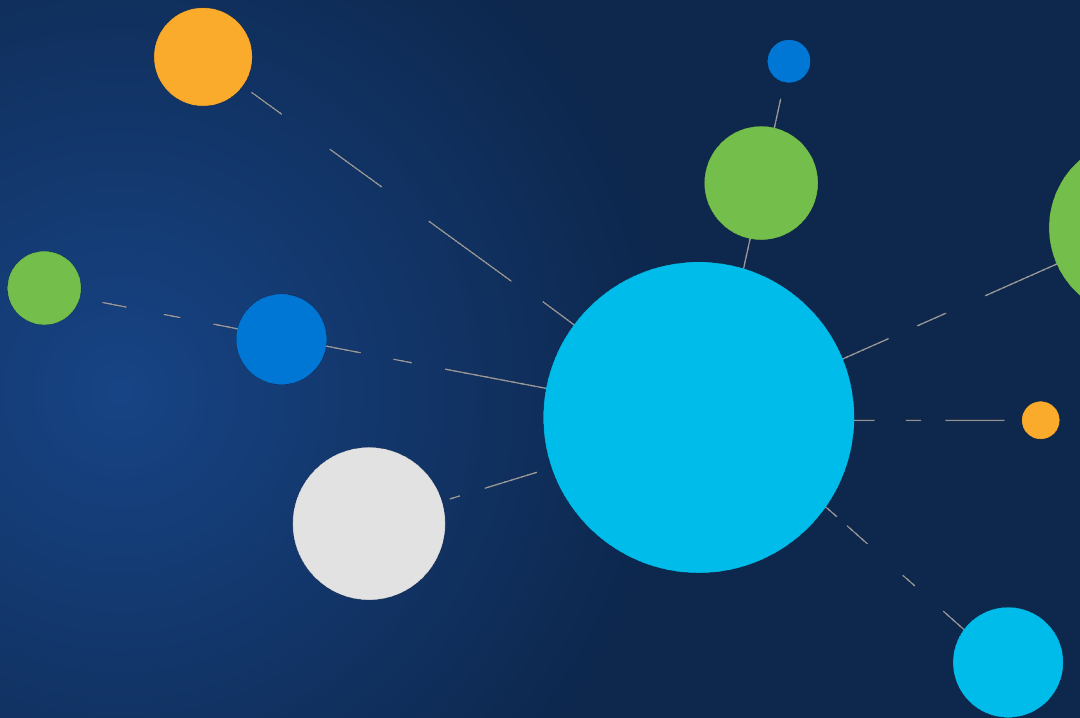
**Outer SRH:** FCBB:BB00:0007:0008:0009:0010:0011:0012

uSID7    uSID8    uSID9    uSID10    uSID11    uSID12

Scalable number of globally unique nodes in the domain  
**16-bit uSID: 65k uSIDs per domain block**  
**32-bit uSID: 4.3M uSIDs per domain block**

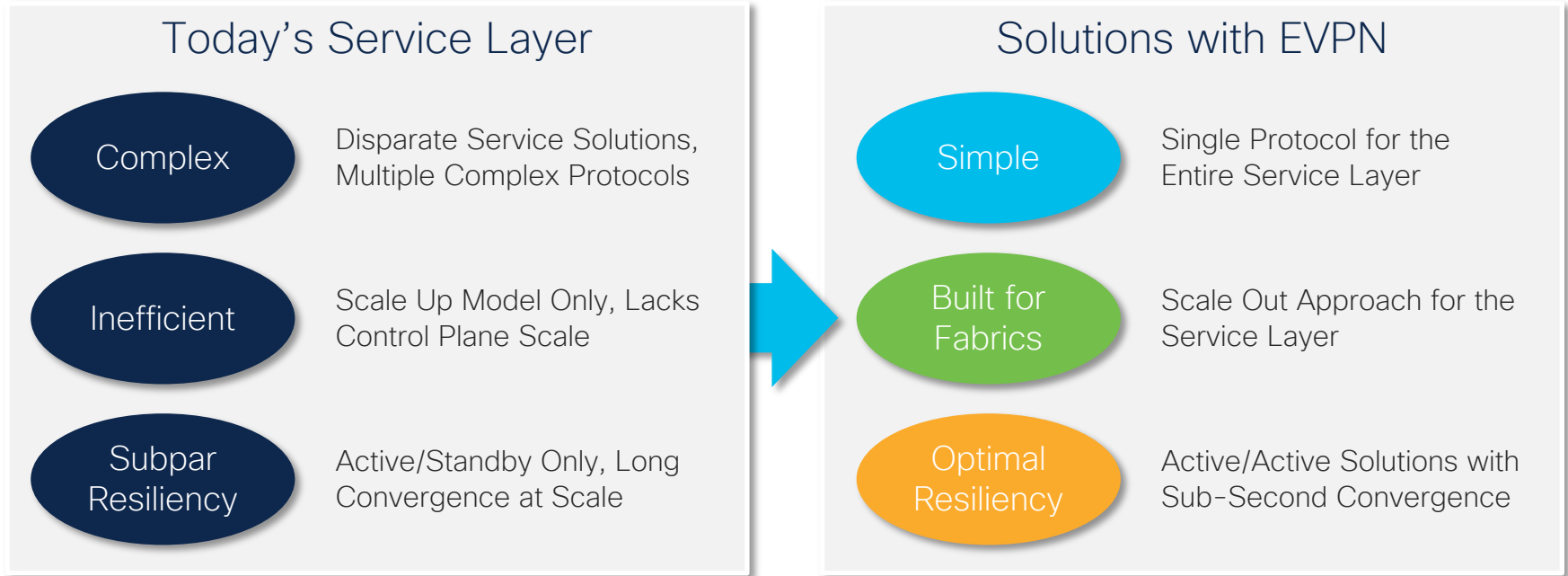


EVPN

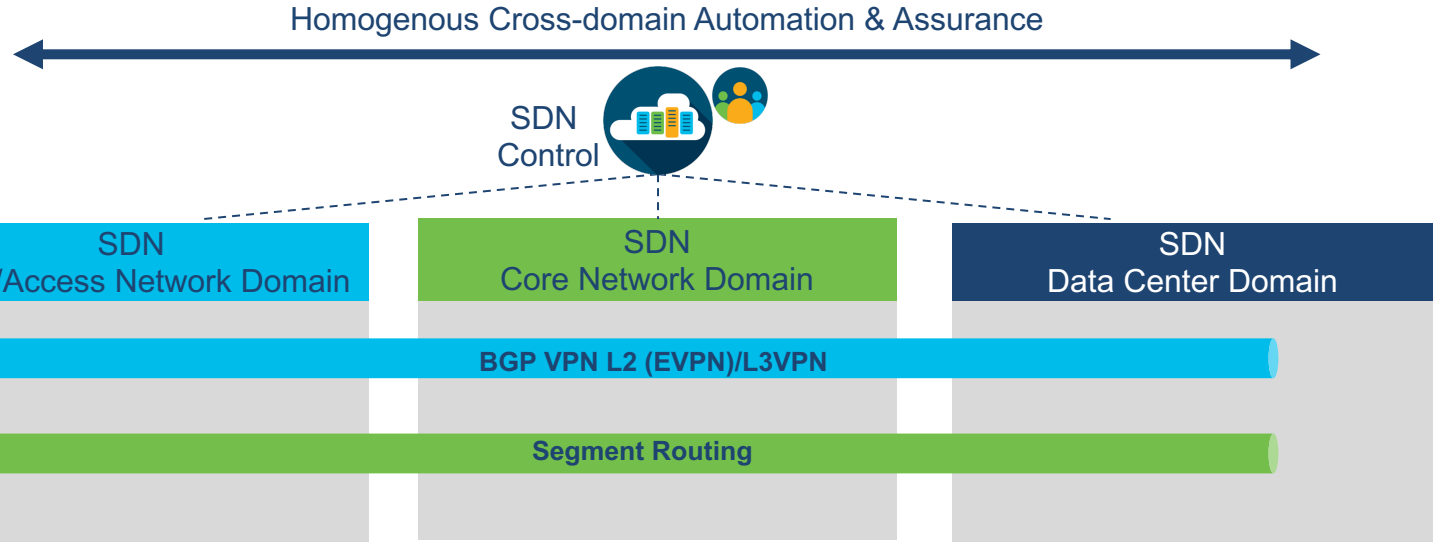




# Leadership in the Service Layer with EVPN



# Unified services vision



End-to-end service provisioning is simple and scalable

- Multiple network domains under same management teams
- Automated operations
- Homogenous underlay and overlay networks

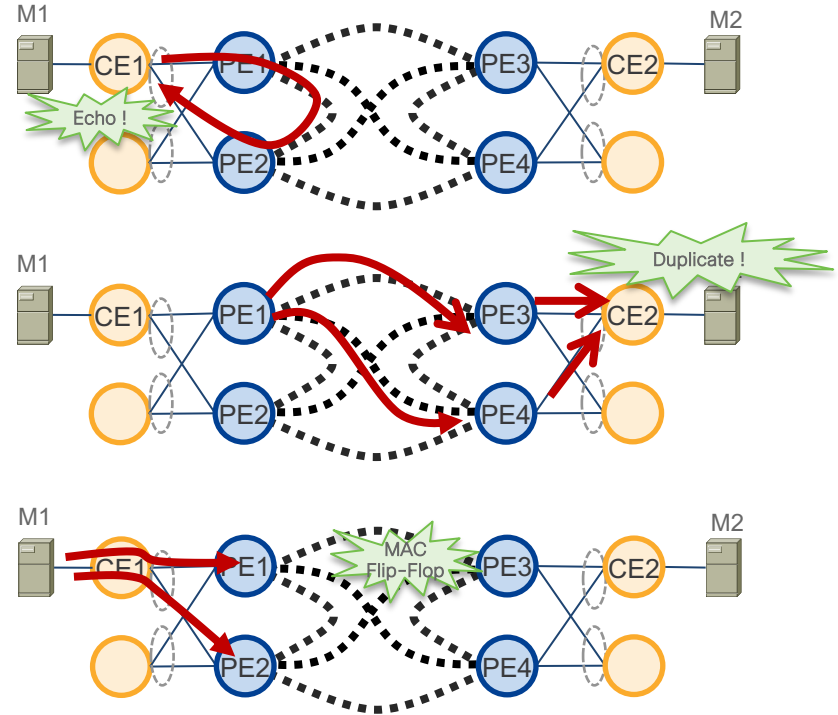


# EVPN Overview

# Next-Generation Solutions for L2VPN

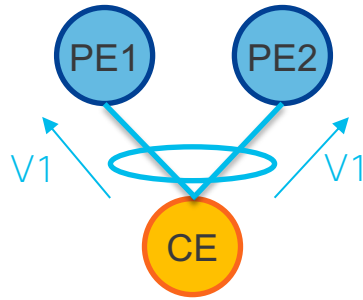
## Solving VPLS challenges for per-flow Redundancy

- Existing VPLS solutions do not offer an All-Active per-flow redundancy
- Looping of Traffic Flooded from PE
- Duplicate Frames from Floods from the Core
- MAC Flip-Flopping over Pseudowire
  - E.g. Port-Channel Load-Balancing does not produce a consistent hash-value for a frame with the same source MAC (e.g. non MAC based Hash-Schemes)



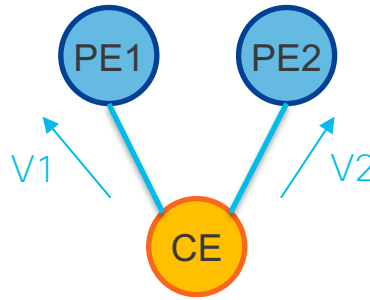
# EVPN - load-balancing modes

All-Active  
(per flow)



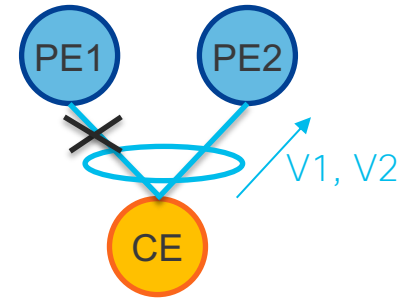
Single LAG at the CE  
VLAN goes to both PE  
Traffic hashed per flow  
**Benefits:** Bandwidth, Convergence

Single-Active  
(per VLAN)



Multiple LAGs at the CE  
VLAN active on single PE  
Traffic hashed per VLAN  
**Benefits:** Billing, Policing

Port-Active  
(per port)

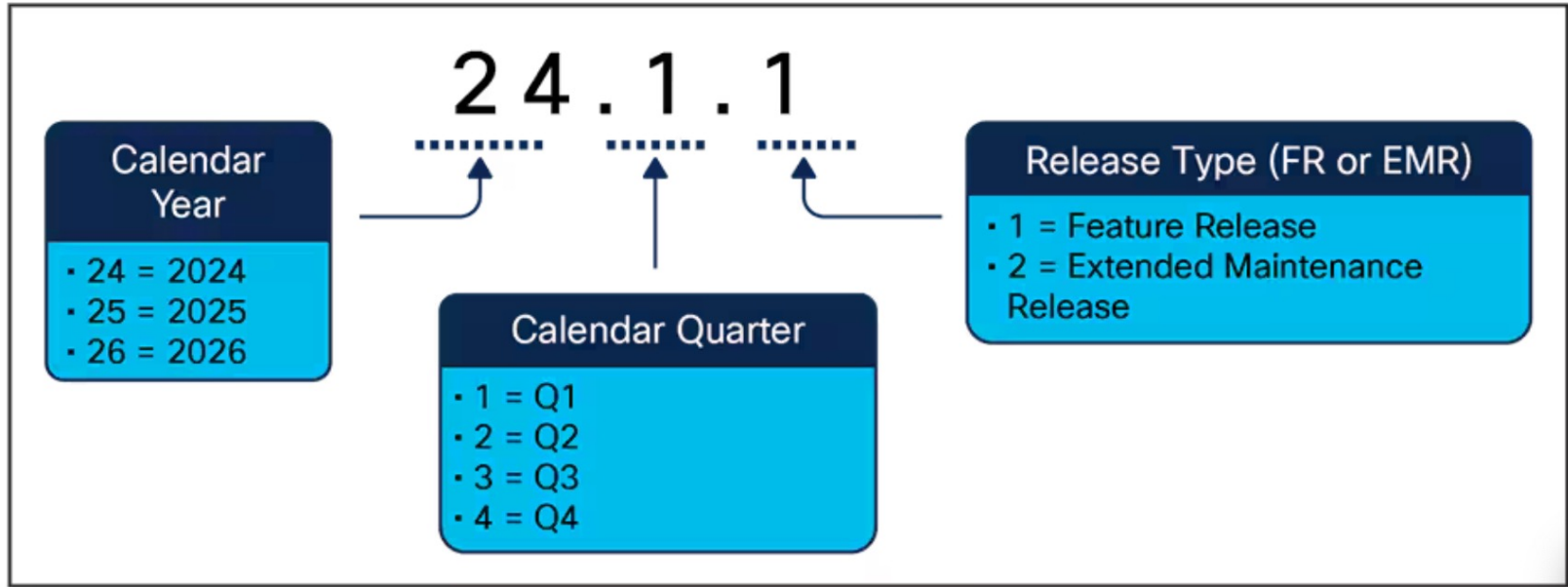


Single/Multiple LAGs at the CE  
Port active on single PE  
Traffic hashed per port  
**Benefits:** Protocol Simplification

*News*

# New IOS-XR numbering

The examples in these guidelines use the X.Y.Z format for release version numbers, for example 24.1.1 (Figure 1).

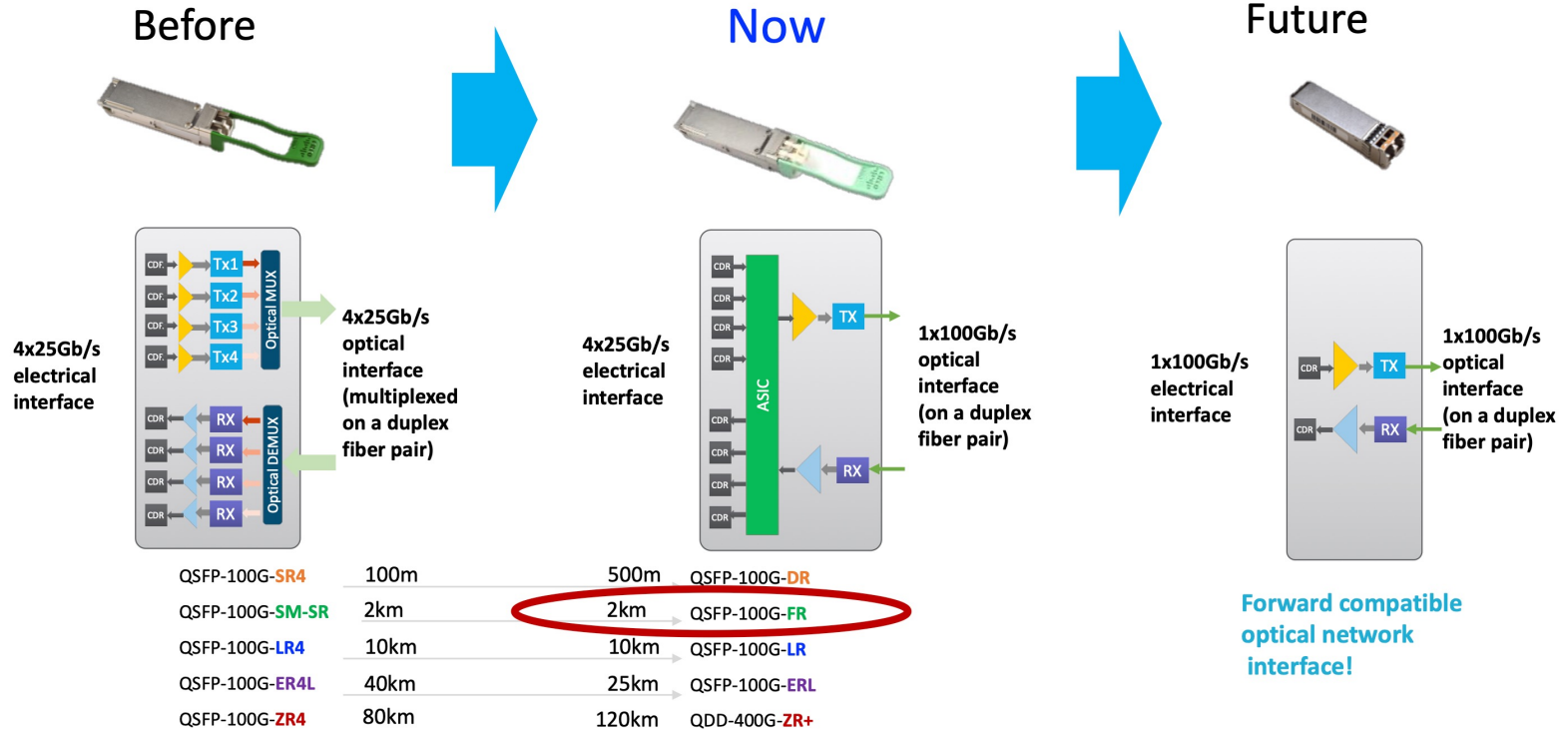


*Optics*

*DCO + RON*



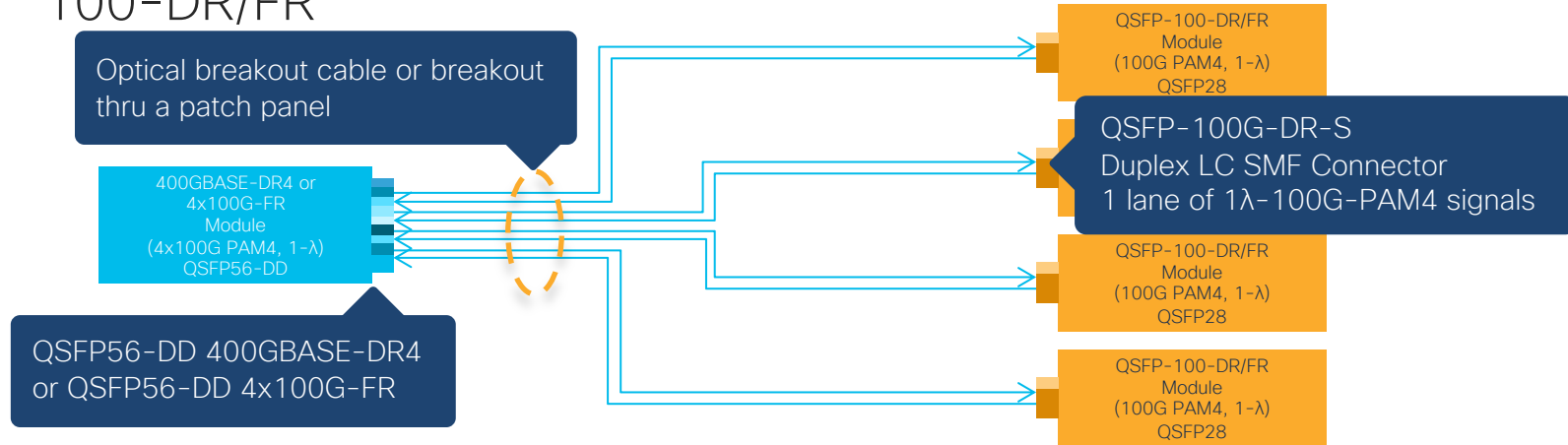
# Single lambda optics



# 400G Breakout Options

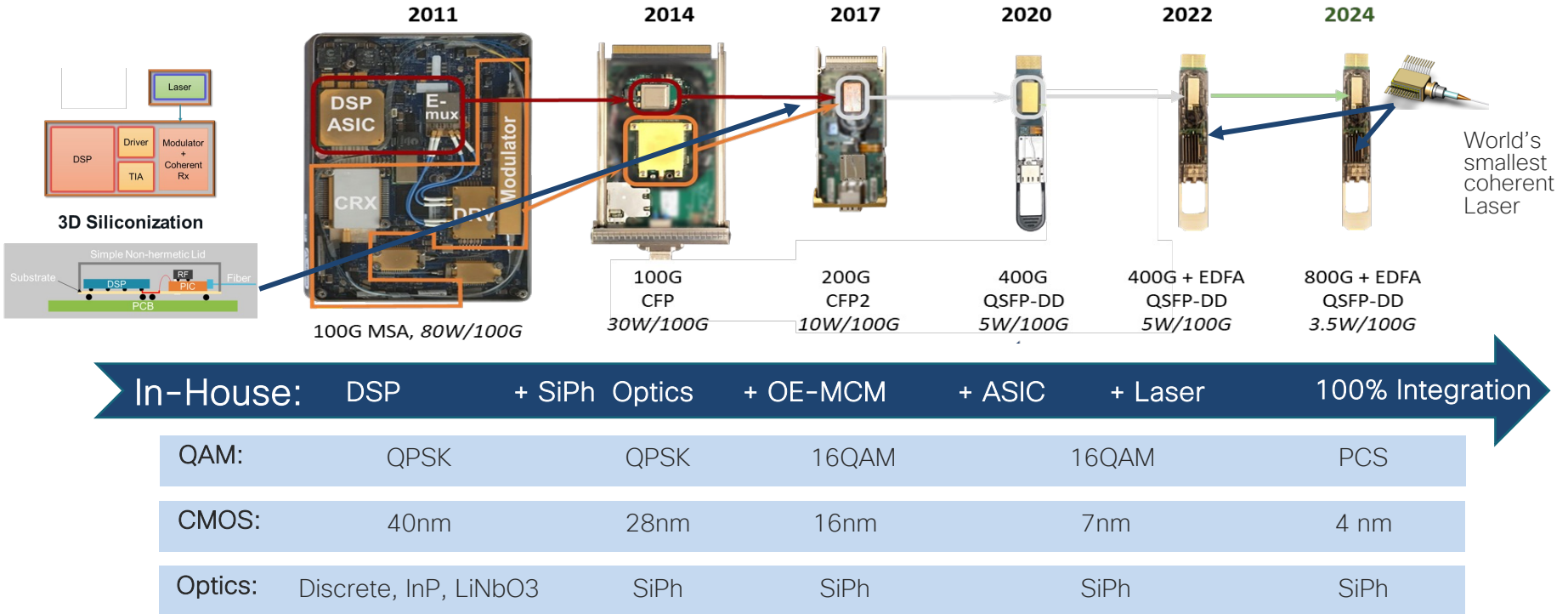
## 400GBASE-DR4 example

- Provides 4 lanes for 1 $\lambda$ -100G-PAM4 (100GBASE-DR) optical signal (up to 500m)
- Can be used for high density 100G interface with breakout QSFP-100-DR/FR



- 4x100G-FR: 4 x 1 $\lambda$ -100G-PAM4 (100G-FR) optical signal (Up to 2km)

# Innovation and Advancement in Silicon Photonics (SiPh & Digital Coherent Optics)



# 400G QSDD Digital Coherent Optics Applications

## ER1



### Point to Point

Intra-data center, campus interconnect, core-to-edge router



### Lowest Cost

Based on fixed laser with simple point-to-point connectivity



### Short Reach

Up to **45KM** for unamplified at 13dB

## ZR



### Point to Point

Web, Data Center Interconnect, Non-SP/SP router interconnect



### Low Cost

Lowest cost 400G DCO option for very simple designs



### Short Reach

Up to **120KM** for P2P amplified links

## ZR+



### Data Centric

Web Scale, DC Interconnect, Non-SP/SP Router Interconnect



### Cost Optimized

Essential power and features only to optimize for cost



### Simple Features

Designed for open line systems that balance power levels; high-performance forward error correction  
**1000Kms Reach (400G)**

## Bright ZR+



### Transport Centric

Service Providers, Routed Optical Networking



### High TX Power

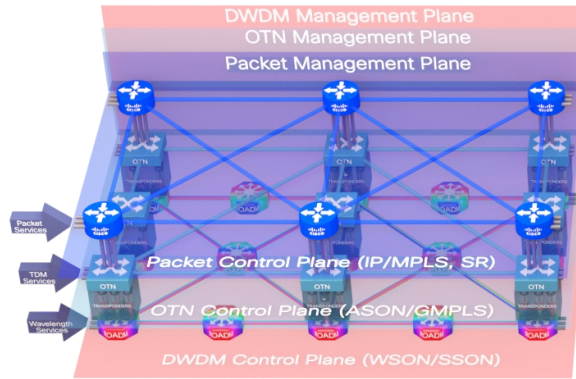
+1dbm for difficult spans; interop with brownfield transponder & legacy line systems



### Advanced Features

TOF, OTN and L1 Encryption features; integrated optical amplifier  
**1500Km reach (400G)**

# Routed Optical Networking Architecture



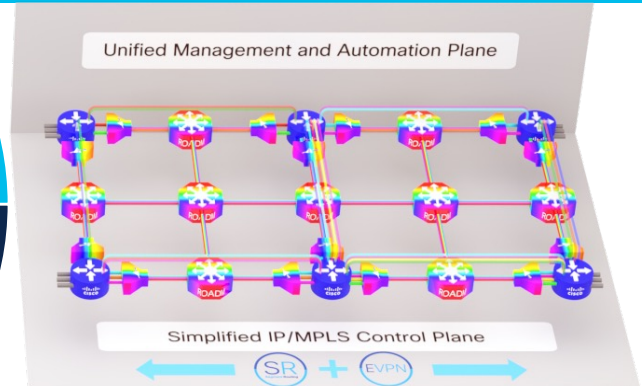
**Today's Networks**  
3-4 Layered Architecture

**Collapses 3 layers into 1**

- 1 Switching Element
- 1 Control plane
- 1 Services layer

**Single pane of glass**

## Internet for the Future Routed Optical Networking



**Route when you can and  
ROADM when you need to**

*RON is to Networking what EVs are to the Automotive industry as it redefines the way we build IP and Optical Networks by simplifying by providing a more sustainable way to build networks*

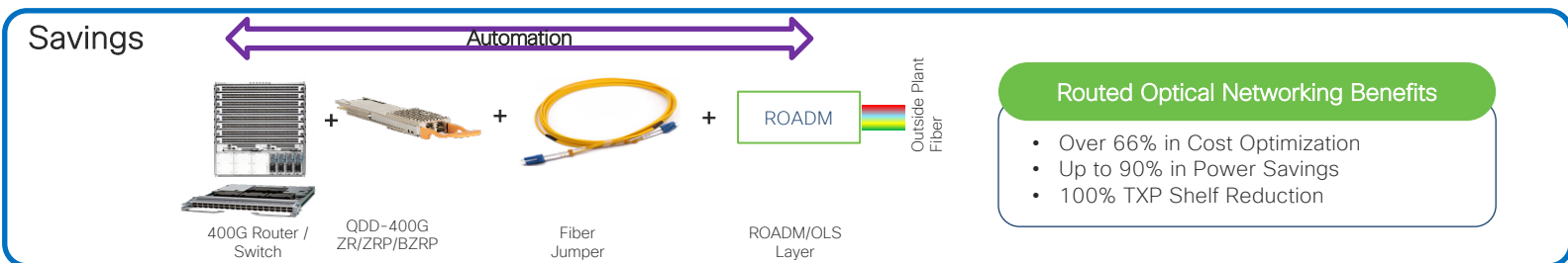
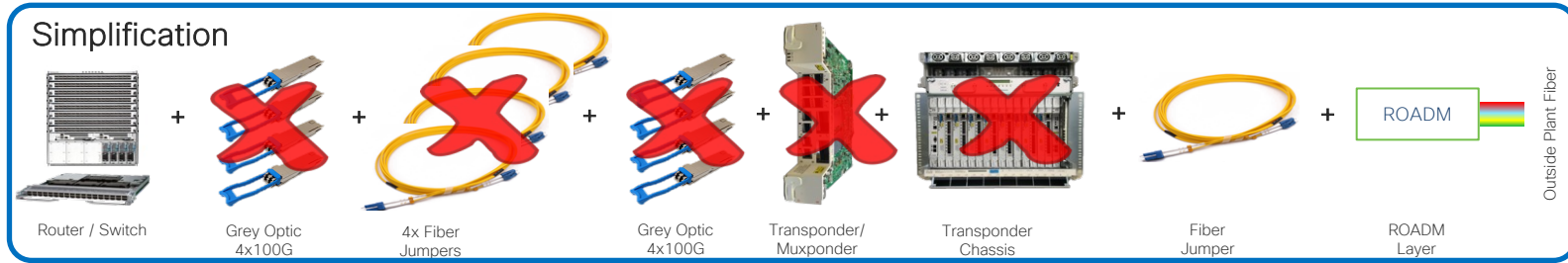
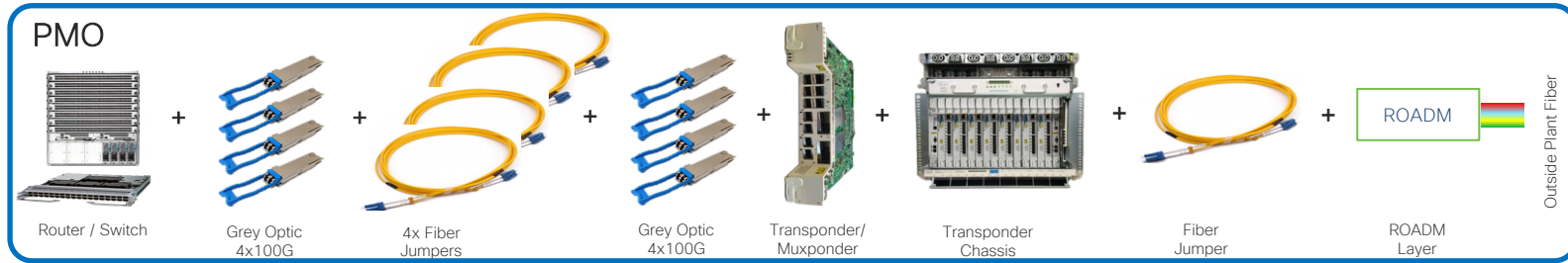
**3S' of RON :**

Simplification, Savings Sustainability

# RON TCO Benefits – Cisco on Cisco



Sustainability



# QSFP-DD Pluggable Open Line System

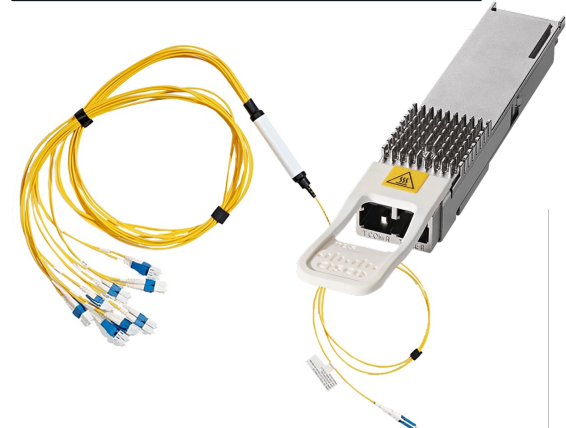
## QDD-OLS (XR 24.1.1)

- Extends
  - 400G QSFP-DD ZR/ZR+: from 40 to 130 km
  - 400G Bright QSFP-DD ZR/ZR+: from 80 to 130 km

30W, 2RU

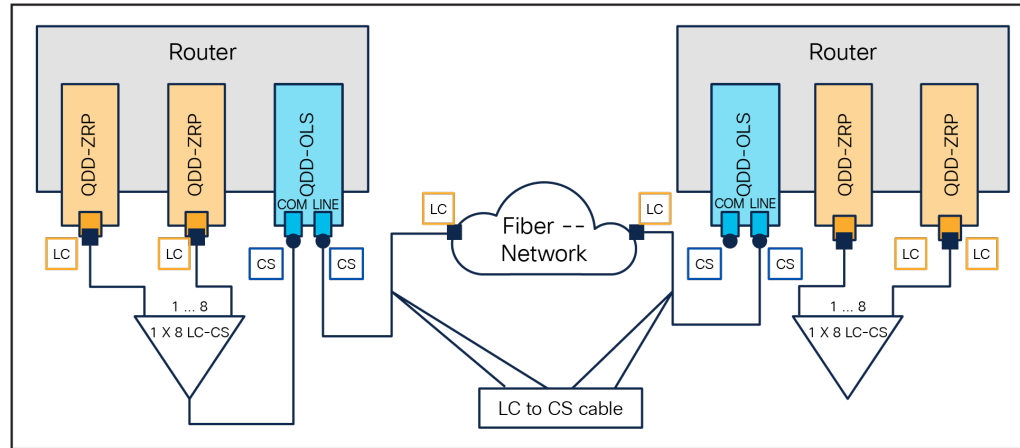


3.5W, 1xQDD cage



# QSFP-DD Pluggable Open Line System

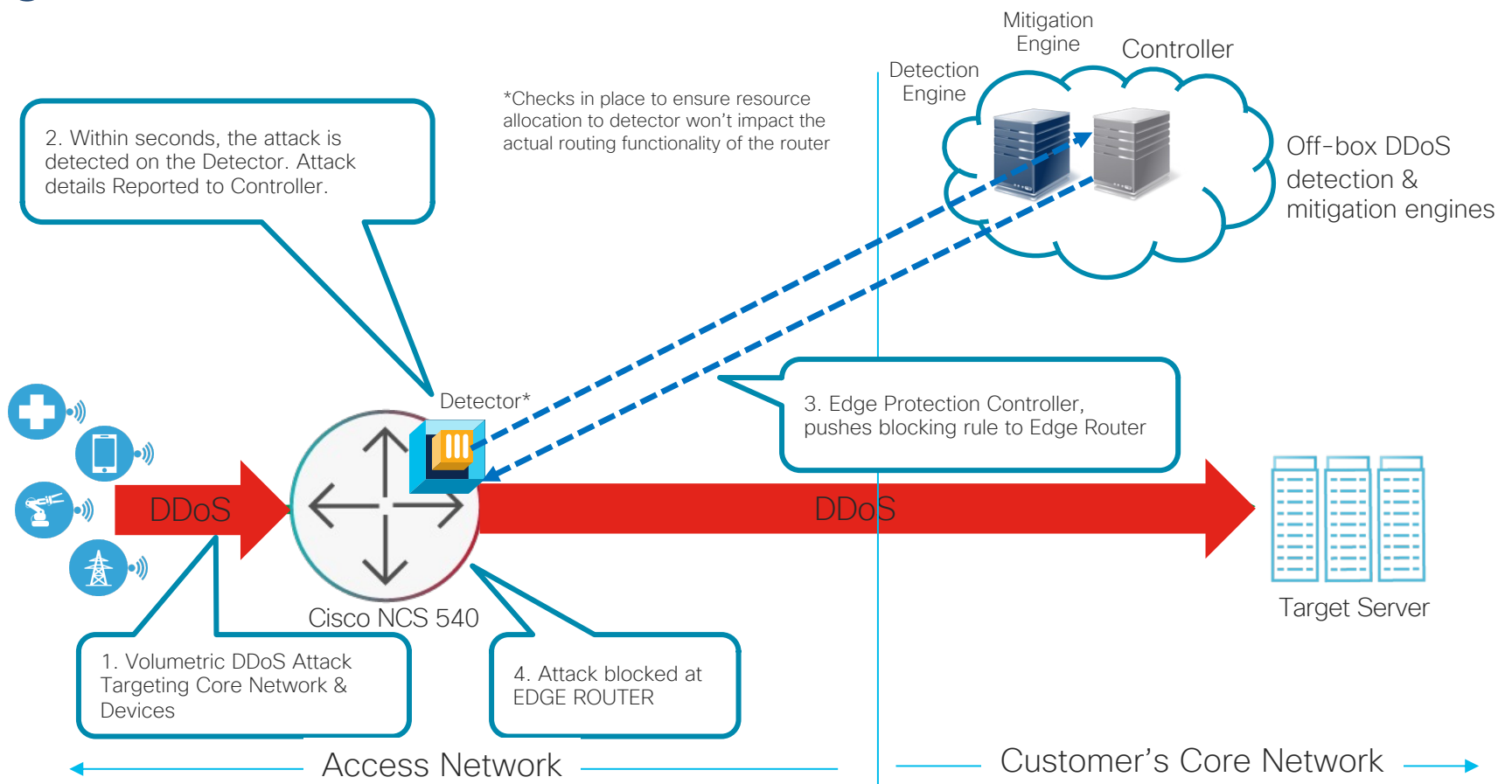
Breakout Cable + Tx EDFA + Rx EDFA





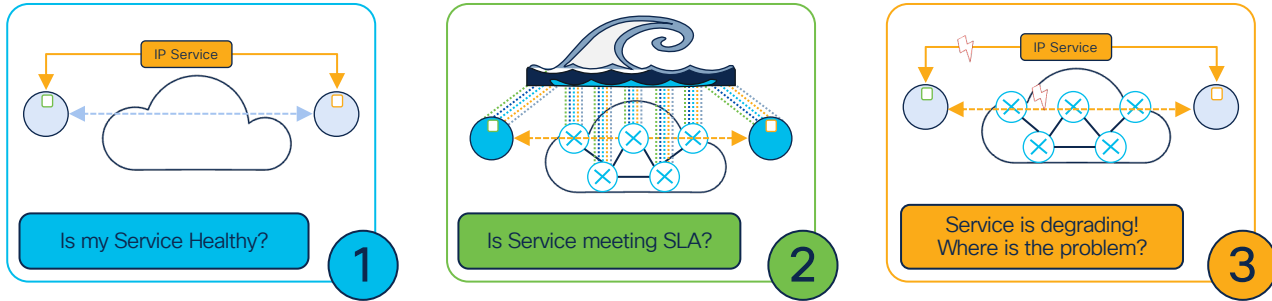
*News*

# Edge Protection Solution on NCS 540



# Accedian

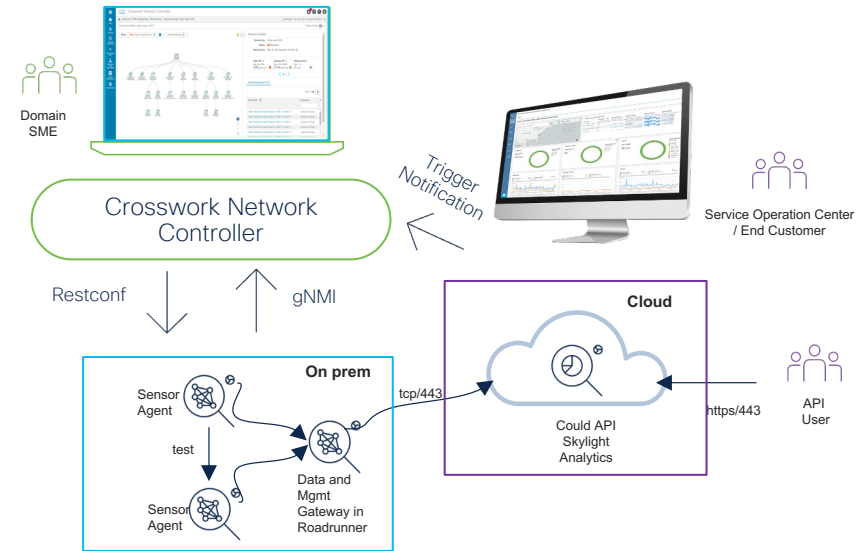
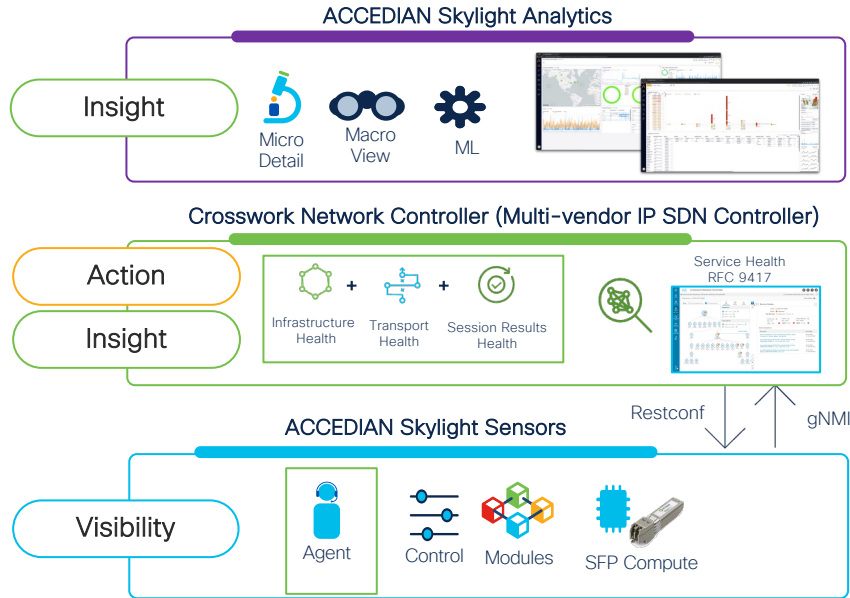
## An Intent-based Approach to Assurance



Challenge	Requirement	How
1 Visibility	End-to-end service visibility	Service centric operations
2 Insight	Bridge customer experience to network health	Dynamically tie Intent to telemetry
3 Action	Expedite MTTI/MTTK	Capture knowledge to automate troubleshooting

# Deliver Your IP Services with Confidence

## Crosswork Network Controller + Accedian Integrated Solution



- **Zero Touch Assurance:** Extend service definition (INTENT) to include TWAMP sessions with desired topology
- **Model Driven Telemetry:** Subscribe to Accedian gNMI paths path automatically for the service session initiated

# Accedian Sensors (Probes) for Measurements



Sensor Agents

Docker Container

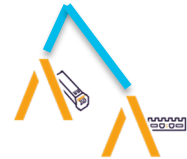
TWAMP, ICMP Echo, TCP Throughput, Traceroute, TCP, DNS + HTTPS



Sensor Control

VM with Custom OS

TWAMP, ICMP Echo



SFP Compute / Module



TWAMP, ICMP Echo, Y.1731, Flowmeter, SAT (Y.1564/RFC2544)  
MEF Service Demarcation



Performance Elements



TWAMP, Y.1731, SAT (Y.1564/RFC2544)  
MEF Service Demarcation



Sensor Capture

VM, Docker Container

Hundreds of Transaction-Based KPIs  
L3-L7

# AI Fabric

## **RoCEv2** - RDMA over Converged Ethernet

### **Lossless**

- Explicit Congestion Notification (ECN)
- Priority Flow Control (PFC)

### **Undersubscription**

<https://www.cisco.com/c/en/us/td/docs/dcn/whitepapers/cisco-data-center-networking-blueprint-for-ai-ml-applications.html>



The bridge to possible

