



Build a More Efficient and Simplified Access Network with the Versatile NCS 500 Series Routers

Agenda

- 1 SP Access : Market Landscape
- 2 What's on the truck for NCS 540?
- 3 **NCS 560**
What's New
- 4 Know more about the NCS 500?
Smart SFP, MACsec, Optics, Secure DDoS
- 5 **Licensing & Commercials**

1

SP Access: Market Landscape

5G trends leading acceleration of Access Network Evolution

High Throughput/Density

Need for devices supporting 160-800Gbps, with dense interfaces
25/50/100G/400G

Low Latency

Support devices/applications requiring extremely low latency and high reliability

Stringent Timing

Need for better synchronization capabilities, Class C certified product line and support legacy networks

Secure Deployment

Enhanced security for both hardware and software
i.e., Secure ZTP, Runtime defense

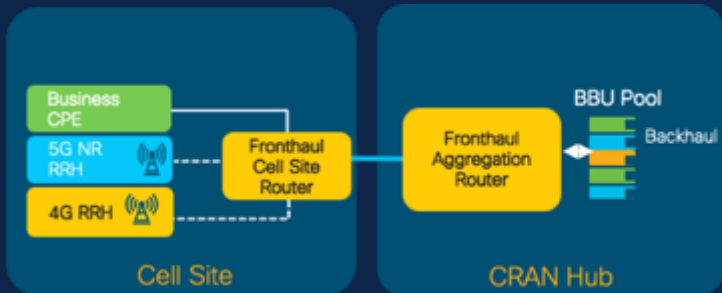
Drive enhanced user exp: Ultra HD video, AR/VR, and mobile cloud services

Drive M2M connectivity and support massive connected devices

Use cases

NCS 5XX your one stop shop for all xHaul use cases

5G Fronthaul



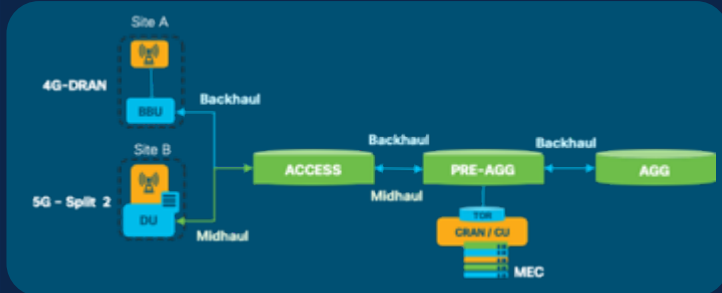
Cell Site

Aggregation

NCS540 Fronthaul: N540-FH-CSR-SYS

NCS540 Fronthaul: N540-FH-AGG-SYS

5G Midhaul and Backhaul



DU and Access

MEC-TOR

Pre-Aggregation

NCS540 Medium, Small

NCS560

NCS560, NCS540 Medium, Large

BENEFITS



New enterprise services using fronthaul network



Packetized radio stat-mux that enables SPs to increase margins



Network slicing



Density and Scale



Power Efficiency



SR Programmability

Cisco NCS 5xx Use Cases-Cont'd



Public Sector

- State/ Rural Broadband
- University WAN
- Smart City WAN
- Defense networks



Utilities

- Substation WAN
- RON



Transportation

- Connected Transport
- Public Wi-Fi
- Substation WAN



Large Enterprises

- Corporate WAN
- Telco Peering
- RON
- DCI
- Private 5G / LTE



Service Provider

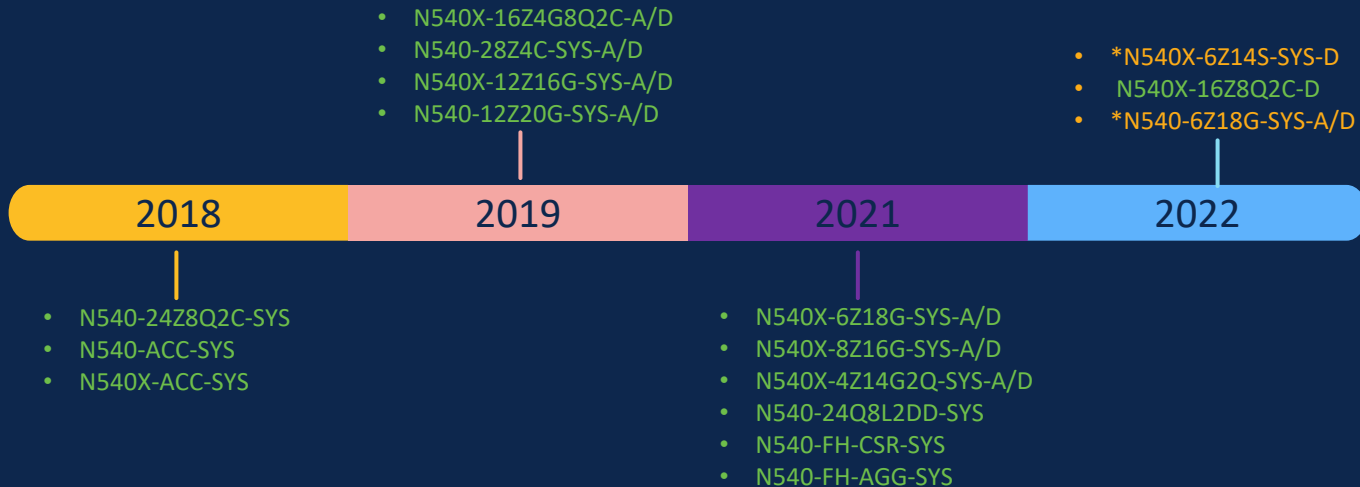
- 5G Converged SDN
- RON
- Fixed Access

2

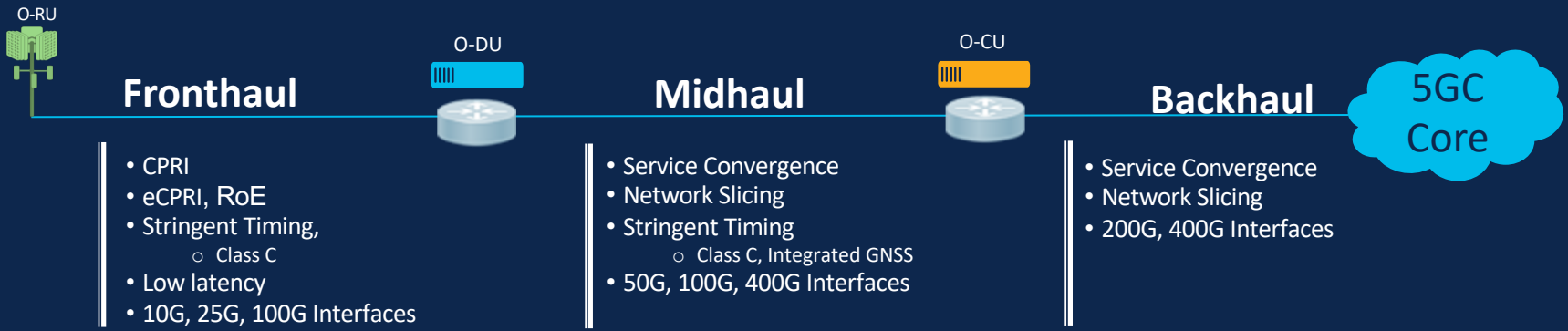
NCS 540 Portfolio Update

NCS 540 Fixed Access- Journey

*Coming soon



5G xHaul Transport



Fronthaul

- CPRI
- eCPRI, RoE
- Stringent Timing,
 - Class C
- Low latency
- 10G, 25G, 100G Interfaces

Midhaul

- Service Convergence
- Network Slicing
- Stringent Timing
 - Class C, Integrated GNSS
- 50G, 100G, 400G Interfaces

Backhaul

- Service Convergence
- Network Slicing
- 200G, 400G Interfaces



- Single series platform to support 5G RAN xHaul
- Unified platform solution for FH, MH and BH scenarios
- Simplify transport architecture and provides full flexibility

NCS 540 Medium Density Routers



N540-24Z8Q2C-SYS
N540(X)-ACC-SYS

Interfaces

2x 100/40GE
8x 25/10/1GE
24x 10/1GE

Throughput

300G

Timing

GNSS
Class B

Power

Modular:
1+1 AC/DC

Release

Aug 2018



N540X-16Z4G8Q2C-D/A

2x 100/40GE
8x 25/10/1GE
16x 10/1GE
4x 1GE Cu

300G

GNSS
Class C

Fixed:
1 AC
1+1 DC

Aug 2019



N540-28Z4C-SYS-D/A

4x 100/40GE
28x 10/1GE

300G

Class B

Fixed:
1 AC
1+1 DC

Aug 2019



N540X-12Z16G-SYS-D/A

12x 10/1GE
12x 1GE
4x 1GE Cu

160G

GNSS
Class C

Fixed:
1 AC
1+1 DC

Aug 2019



N540-12Z20G-SYS-D/A

12x 10/1GE
20x 1GE

160G

Class B

Fixed:
1 AC
1+1 DC

Aug 2019

NCS 540 Small Density Routers



N540X-6Z18G-SYS-D/A

Interfaces

6x 10/1GE
18x 1GE

Throughput

64G

Timing

Class C

Power

Fixed:
1+1 AC
1+1 DC

Release

Feb 2021



N540X-8Z16G-SYS-D/A

8x 10/1GE
4x 1GE SFP
4x 1GE RJ45
8x 1GE SFP or
16x 1GE cSFP

120G

Class C

Fixed:
1+1 AC
1+1 DC

Feb 2021



N540X-4Z14G2Q-D/A

2x 25/10/1GE
4x 10/1GE
10x 1GE
4x 1GE Combo
SFP/RJ45

120G

Class C

Fixed:
1+1 AC
1+1 DC

Aug 2021

NCS 540 Fronthaul Routers

Shipping
IOS XR - 7.3.2



N540-FH-CSR-SYS



N540-FH-AGG-SYS

Interfaces	Throughput	Timing	Power	Release
8xCPRI +*4x1/10G/CPRI, 8x1/10G , 4x10/25G 2x10/25G (802.1Qbu) 2x100G	300G	Class C	Modular 1+1 AC 1+1 DC	Feb 2021
24x10G/25G* (802.1Qbu, CPRI 3-8) 4x100G	900G	Class C	Modular 1+1 AC 1+1 DC	Feb 2021

*Universal Port = Port can be used for CPRI or eCPRI or Ethernet (1/10/25GE)

NCS 540 Large Density Router

Shipping
IOS XR - 7.4.1



N540-24Q8L2DD-SYS

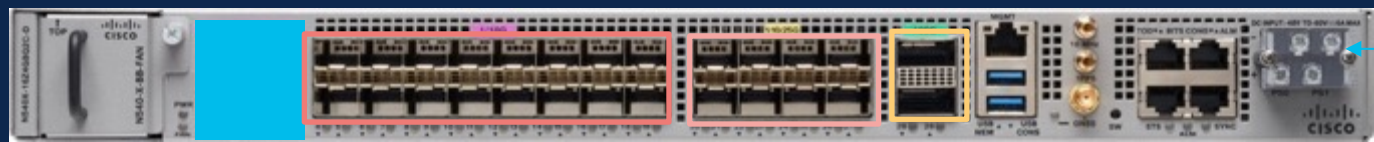
Interfaces	Throughput	Timing	Power	Release
2x400GE 8x50GE 24x25 GE	800G	Class C	Modular: 1+1 AC 1+1 DC	Nov 2021

Introducing Upcoming NCS 540 variants

N540X-16Z8Q2C-D

Now
Orderable

Quick Facts	
NPU	QAX 300G
Port Configuration	16x10G+8x25G+2x100G DC
Power/Fan/Airflow	<ul style="list-style-type: none">• Fixed PSU, Dual DC /Single AC PSU• Modular Fan Tray, Side to Side airflow
Other	<ul style="list-style-type: none">• iTemp -40C to +70C• Conformal coated
FCS	<ul style="list-style-type: none">• XR 7.5.2 (April-2022)



Fan Trays

16x 1/10GE

8x25/10/1GE

2x100GE

DC only

NCS 540 Passively Cooled

N540-6Z14S-SYS-D



April 2022
7.5.2

- 6x10GE, 14x1GE
- BCM Q-UX 64G
- No Conformal coating*
- Protection cover mandatory
- No MACSec/ No TDM



Dimension	(15.14" D x 17" W x 4.375" H), 2.5 RU
Mounting	19",23", ETSI, Vertical Mount
Power Consumption	<70W
PSU	1+1 Redundant DC (48V, 60VDC)
PSU charge immunity	4KV common mode/ 2KV differential mode
Operating Temp	-20C to 65C for up to 1800m -20C to 55C for up to 4000m
Operating Humidity	5-95% RH, non-condensing
Mgmt interfaces	USB Console & Memory Port, RJ45 console, 1G Mgmt
Synchronization	Sync E.,1588v2 – PTP OC, NTP, BC, TC, Holdover Time, Hybrid Clocking, Class C
Packet Buffer	3MB - internal + 1GB (8GB) – External DDR4

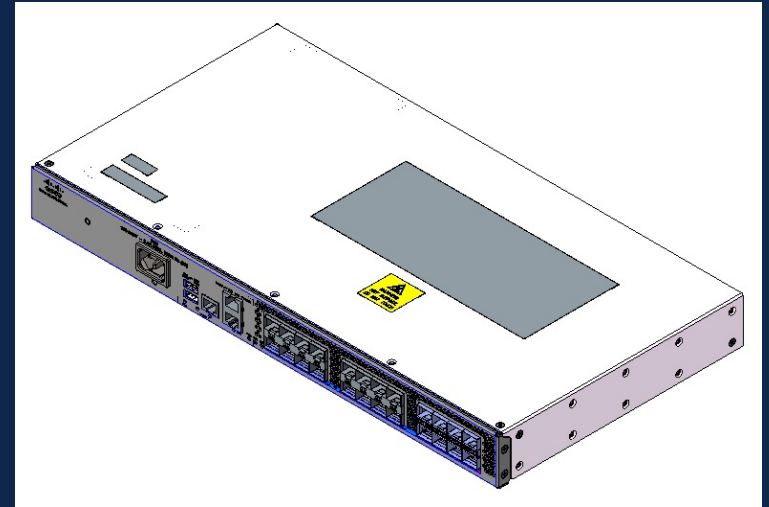
*The circuit pack is encapsulated in a large metallic heat sink to prevent contact with external air

N540-6Z18G-SYS-A/D

Q4 2022
7.8.1 GA

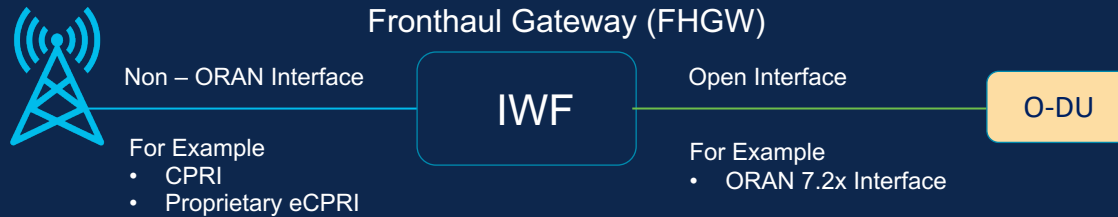
Quick Facts

NPU	QUX 64G
Port Configuration	6x 10GE SFP+, 18x 1GE SFP
Power	Single AC PSU or single dual-feed DC PSU <70W Power Consumption
Other	C-Temp 0°C to 50°C No Conformal Coating No timing = no SyncE, no PTP Dying Gasp(Roadmap) No additional surge protection for DC PSU



Open Fronthaul Gateway

What is Interface Interworking?



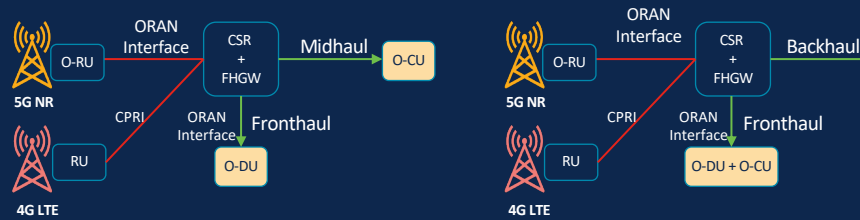
ORAN Alliance defined IWF and Open FHGW HW Platform specification as part of [ORAN.WG7.HRD.0-v01.00.pdf](#)

- It is a feature or function that converts non-ORAN interface to O-RAN 7.2.x Interface
- It can be deployed at the cell site as part of:
 - Integrated within RU
 - Cell Site Router or Cell Site Switch (As defined by ORAN)
- Enables investment protection for existing CPRI Radio Units & unified management in a brownfield network

Open platform specification enables RAN vendor to design FHGW function, without sharing proprietary interface details, to deploy on an open platform and program the FPGA resources.

Open Fronthaul Gateway Benefits

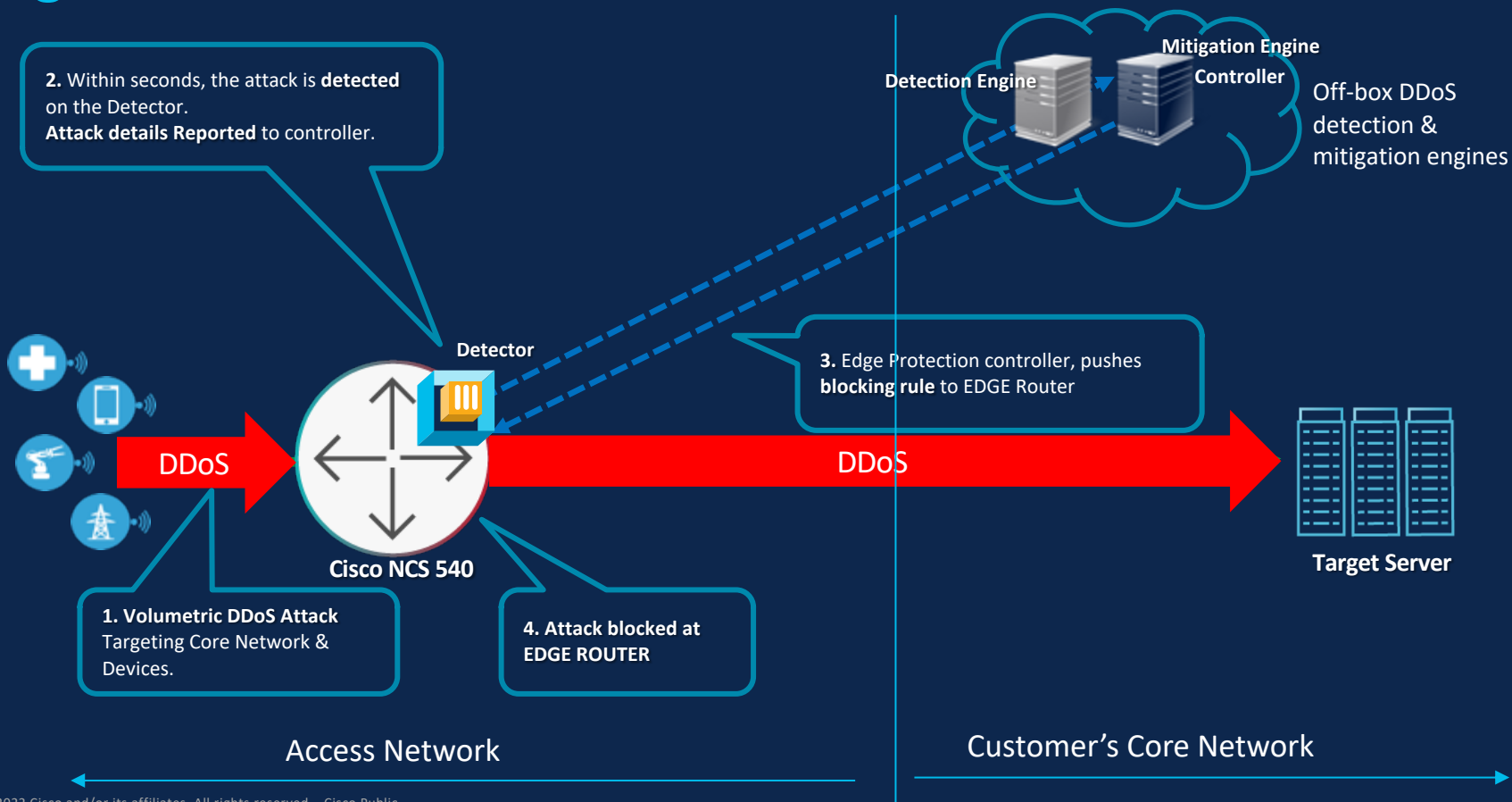
Fronthaul Gateway Specification approved in ORAN ORAN.WG7.HRD.0-v01.00.pdf



- Reduces the transport bandwidth by up to 80% through CPRI interworking and statistical multiplexing gains to improve the resource utilization at cell sites
- Allows for cost optimized, converged deployment of 4G and 5G cell site radios over a common transport infrastructure
- Reduces the cost of a virtualized DU server by offloading interfaces, IWF and Timing requirements to FHGW router
- Allows operators to deploy common hardware across RAN sites to terminate various radio interface types

Secure DDoS Protection

Edge Protection Solution on NCS540



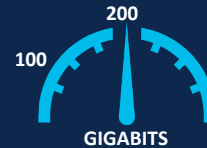
Highlights of Cisco Secure DDoS Edge Protection



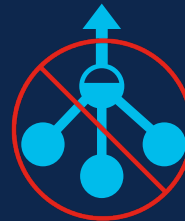
Unique Solution for Mobility



Faster Detection



Higher Throughput Protection



No NetFlow Export For DDoS

Edge Protection Demo on DEVNET



To learn more, visit us on Cisco DEVNET

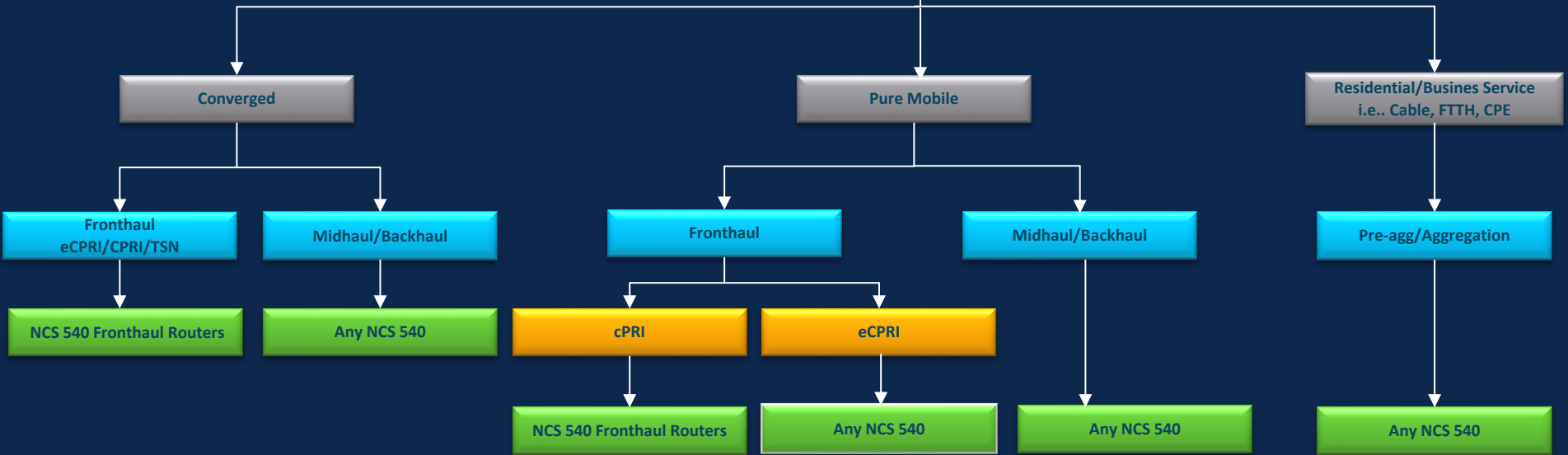
Cisco Secure DDoS Edge Protection on Devnet

<https://developer.cisco.com/docs/secure-ddos-edge-protection>

Need a development lab to learn what's possible? Visit the DevNet Sandbox for "DDoS Edge Protection" [here](#)

NCS 540 positioning summary

NCS 540 Positioning Guide



NCS 540 for xHaul deployment

	Product	5G Fronthaul (eCPRI/O-RAN)		4G/5G Fronthaul (CPRI/RoE/TSN/Class C)		Midhaul/Backhaul			
		CSR	Agg	CSR	Agg	DU and Access	MEC TOR	Pre-Agg	Differentiation
NCS 540 Fronthaul Routers	N540-FH-CSR-SYS	✓		✓		✓		✓	CPRI/eCPRI, TSN, Class C 25G, 100G
	N540-FH-AGG-SYS		✓		✓			✓	CPRI/eCPRI, TSN, Class C, 4x100G, Dense 25G
NCS 540 Small Density Routers	N540X-6Z18G-SYS-A/D	✓				✓			1/10G, Cost Optimized
	N540X-8Z16G-SYS-A/D	✓				✓			1/10G, Cost Optimized
	N540X-4Z14G2Q-A/D	✓				✓			Native 25G Cost Optimized
	N540-6Z14S-SYS-D*	✓				✓			Fanless Cost Optimized
	N540-6Z18G-SYS-A/D*	✓							1/10G, Cost Optimized
NCS 540 Medium Density Routers	N540X-16Z4G8Q2C-D/A	✓	✓			✓		✓	100G, 25G, CC, Class C
	N540X-12Z16G-SYS-D/A	✓	✓			✓		✓	Dense 1GE and 10GE, Class C
	N540-28Z4C-SYS-D/A	✓	✓			✓		✓	4x100GE
	N540-12Z20G-SYS-D/A	✓	✓			✓		✓	Dense 1GE and 10GE
	N540-24Z8Q2C-SYS N540(X)-ACC-SYS	✓	✓			✓		✓	100G, Dense 25G FRU Fans & PSUs
NCS 540 Large Density Router	N540-24Q8L2DD-SYS		✓				✓	✓	400G Coherent 50G, 25G, Class C, FRU PSU's

NCS 540 extending beyond xHaul

	Product	Carrier Ethernet		R=PHY	RON		Differentiation
		Access	Pre-Agg	R=PHY	400G	100G	
NCS 540 Fronthaul Routers	N540-FH-CSR-SYS	✓	✓	✓			25G, 100G, i-temp
	N540-FH-AGG-SYS		✓	✓			4x100GE, Dense 25G,c-temp
NCS 540 Small Density Routers	N540X-6Z18G-SYS-A/D	✓					Cost Optimized
	N540X-8Z16G-SYS-A/D	✓					Cost Optimized
	N540X-4Z14G2Q-A/D	✓					Native 25G, Cost Optimized
	N540-6Z14S-SYS-D*	✓					Fanless Cost Optimized
	N540-6Z18G-SYS-A/D	✓					Cost Optimize
NCS 540 Medium Density Routers	N540X-16Z4G8Q2C-D/A	✓	✓	✓			100G, 25G
	N540X-12Z16G-SYS-D/A	✓	✓	✓			Dense 1GE and 10GE
	N540-28Z4C-SYS-D/A	✓	✓	✓			4x100GE
	N540-12Z20G-SYS-D/A	✓	✓	✓			Dense 1GE and 10GE
	N540-24Z8Q2C-SYS N540(X)-ACC-SYS	✓	✓	✓			100G, Dense 25G FRU Fans & PSUs
NCS 540 Large Density Router	N540-24Q8L2DD-SYS		✓	✓	✓	✓	400G Coherent, 50GE, Dense 25G

3

What's New in Modular:

NCS 560 Update

NCS 560 Recap

- Two Form Factor: NCS 560-7 & NCS 560-4
- N560-RSP4/N560-4-RSP4: 800Gbps/720 Mpps (BCM QMX)
- OP2 eTCAM in N560-RSP4-E/N560-4-RSP4-E
- Flexible Port Configuration:
 - 1G, 10G, 25G, 40G, 50G, 100G
 - cSFP for dense 1G (IMA8CS1Z)
 - QSFP-DD 100G (IMA2C-DD), CFP2DCO(IMA1W) for long reach
- Modular & Redundant FTs/PSUs
- Side to Side Airflow (L-R)
- Front-to-Back Airflow with Plenum

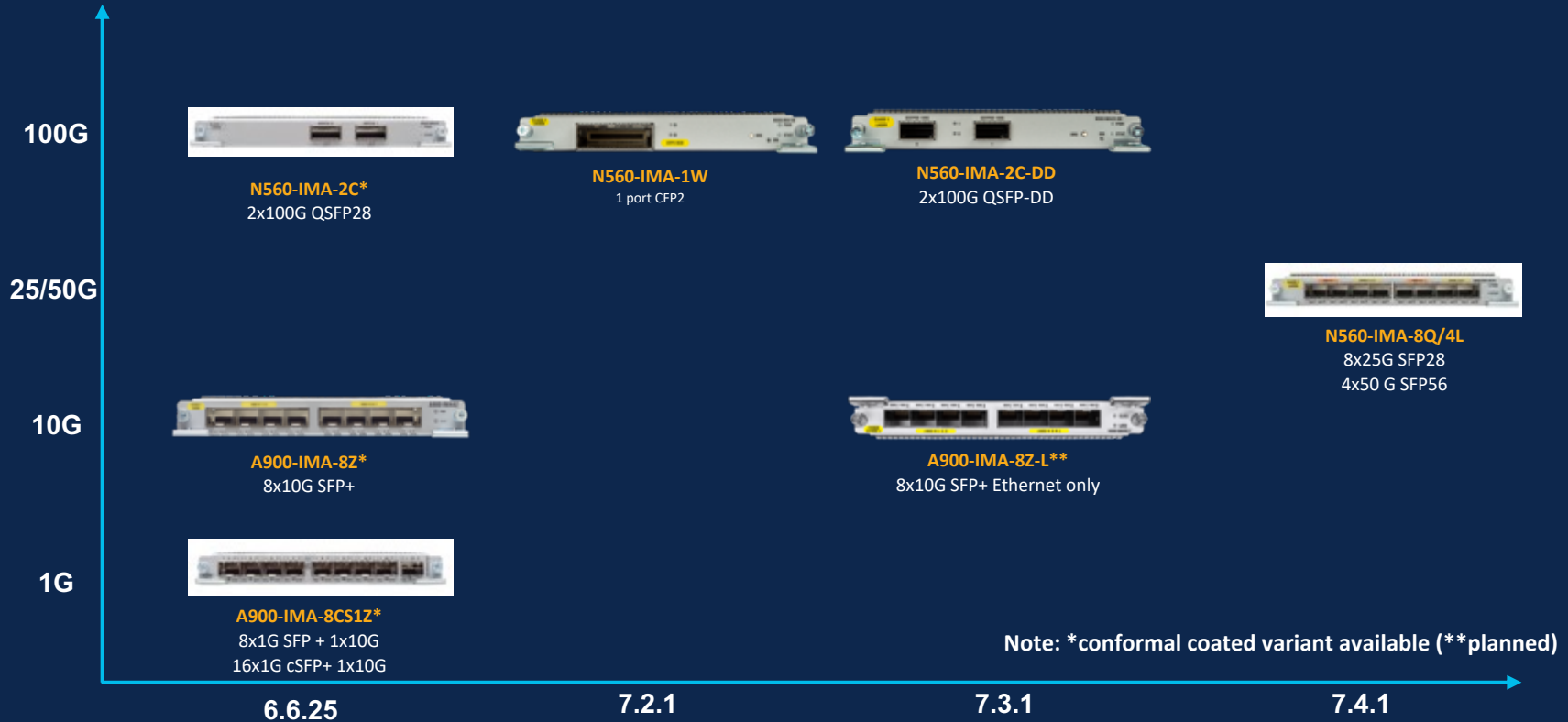


NCS 560-4
4 RU/6 slot



NCS 560-7
7 RU/16 slot

NCS 560 Interface Modules



New IM: N560-IMA-8Q/4L

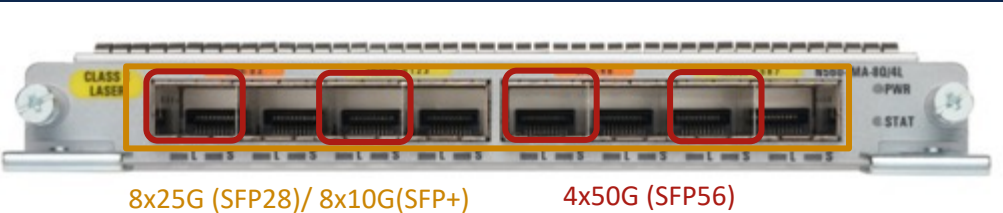
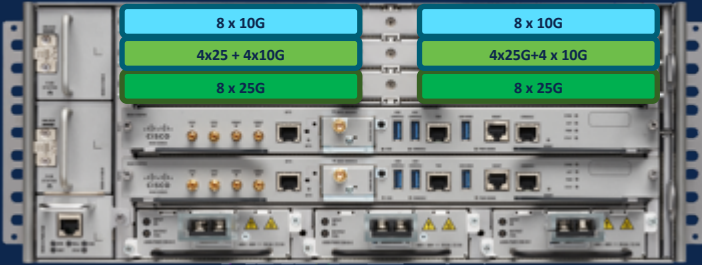
Key Highlights

- Multi Rate Interface module for 10/25/50GE operation
- Multiple Modes of operation
8x25G / 8x10G / 4x50G
4x10G + 4x25G/ 4x10G + 2x50G /
4x25G + 2x50G/
- Class B Timing for both 10G and 25G interface. (No support on 50G)
- Quad based speed:

```
hw-module quad <> slot <> mode <>
```

Hardware

- 8 ports of SFP ports to support 10G/25G/50G
- NCS560-7:
 - Supports 8 x 10G on slot 4,5,10,11
 - Supported in all modes in slot 7,9
 - NCS560-4:
 - Supports 8 X 10G in slot 4,5
 - Supports 2x50G or 4x25G or 8x10G on slot 2,3
 - Supports all mode in slot 0,1



6x100G on NCS 560-7

XR 7.7.1

- Need new FPGA Pass Through mode
- Admin plane config (reload):
 - `chassis-mode pass-through-mode enable`
- IMA2C support on slot 6,8
 - 1x100G only
- IMA8Z(-L) with partial port (4x10G) support in slot 2-5,10-13

14	8x1+1x10G	8x1+1x10G	15
12	4x10G	4x10G	13
10	4x10G	4x10G	11
8	1x100G	2x100G	9
N560-RSP4 / 4-E			
N560-RSP4 / 4-E			
6	1x100G	2x100G	7
4	4x10G	4x10G	5
2	4x10G	4x10G	3
0	8x1+1x10G	8x1+1x10G	1

4

More on NCS 500: Smart SFP, MACsec, Optics

TDM on XR with Smart SFP

Solution roadmap for Smart SFP

Phase1: Smart SFP solution on XR (Ethernet-PW)

7.5.1

- Problem statement: Customers need end-to-end XR router while upgrading their network
- Solution
 - E1 and channelized STM-1 smart SFP
 - Multi-router redundancy support (Alternate to MR-APS)
 - Clock recovery through DCR
 - 8 smart SFP per router will be supported (Based on EMC limitations)
 - EPNM support for provisioning and management* (Under discussion)
 - Platforms: N540-ACC-SYS, N540X-16Z4G8Q2C-A/D, NCS 55A2
- Target customer: Customers who need TDM light solution with end-to-end XR routers

Phase 2: Extend smart SFP support on XR (TDM-PW)

Target: 7.9.1+

- Problem statement: Extend smart SFP solution to support CEM based PW and interoperability with 3rd party TDM solutions and ASR900/NCS4200
- Solution
 - E1 and channelized STM-1
 - Both SR-APS and MR-APS support for redundancy
 - Interoperable with ASR900/NCS4200 and 3rd party TDM solutions
- Platforms: Existing + New platforms (TBD)
- Target customer: Customers who need TDM light solution along with interoperability with 3rd party TDM solutions

TDM Smart SFP Roadmap

- ✓ Ethernet PW solution support for SFP-E1F-SATOP-I, SFP-CH-OC3STM1-I on N540X-16Z4G8Q2C-A/D and N540-ACC-SYS

TDM PW Solution

7.5.1

7.8.1-Planning

7.9.1-Roadmap

7.10.-Roadmap

- ✓ Clear channel (transparent) STM1 SmartSFP support

T1,OC-3,OC-12

- ✓ SFP-E1F-SATOP-, SFP-CH-OC3STM1-I support on NCS 540- Small Density platform

MACsec

MACsec on NCS 540 Platforms

PID	SFP 1G	SFP+ 1/10G	SFP28 10/25G	SFP56 10/25/50G	QSFP28 40/100G	QSFP56-DD 40/100/400G	XR Version/ Timeline
Tortin: N540(X)-ACC-SYS, N540-24Z8Q2C-SYS	X	X	✓	-	✓	-	XR 7.3.1
Big Bend (Everglades): N540X-16Z4G8Q2C-A/D	X	X	✓	-	✓	-	XR 7.5.1
Olympic: N540-16Z8Q2C-D	X	X	✓*	-	✓*	-	XR 7.5.2
Arches: N540-24Q8L2DD-SYS	X	X	X	✓*	-	✓*	XR 7.7.1
N540X-6Z18G-SYS-D/A	X	X	-	-	-	-	NA
N540X-8Z16G-SYS-A	X	X	-	-	-	-	NA
N540X-4Z14G2Q-A	X	X	X	-	-	-	NA
N540-6Z14S-SYS-D	X	X	-	-	-	-	NA
N540-28Z4C-SYS-D/A	-	X	-	-	X	-	NA
N540-12Z20G-SYS-D/A	X	X	-	-	-	-	NA
N540X-12Z16G-SYS-A	X	X	-	-	-	-	NA

✓ → available today

✓* → feasible, on roadmap

X → not feasible on hardware

No 1G Support H/W- *SFP support in roadmap

MACsec on NCS 560

IM-PID	SFP/cSFP 1G	SFP+ 10G	SFP28 10/25G	SFP56 10/25/50G	QSFP28(DD) 100G	CFP2	XR Version/ Timeline
N560-IMA8CS1Z	✓*	✓*	-	-	-	-	7.9.1+
N560-IMA1W	-	-	-	-	-	✓*	7.9.1+
N560-IMA8Q/4L	-	-	✓*	✓*	-	-	7.9.1+

✓ → available today

✓* → feasible, on roadmap

NOTE:

1. Rest of the IMs are not MACsec capable
2. Roadmap for MACsec support is not committed

Optics

ZR/ZRP, 400G , 50G

Optics support on NCS 500

Form Factor	Speed/Spec	NCS 540	NCS 560	Comment
CFP2DCO	100G, 2x100G	NA	with N560-IMA1W	XR 7.2.1
QSFP56-DD	QDD 400G	N540-24Q8L2DD-SYS	NA	XR 7.4.1
	QDD 400G ZR/ZRP	N540-24Q8L2DD-SYS	NA	XR 7.4.1
	QDD 100G ZR	N540-24Q8L2DD-SYS	With N560-IMA2C-DD	NCS 540 Planned 7.8.1 NCS 560 Planned 7.8.1
QSFP-28	QSFP-100G ZR4	N540-24Q8L2DD-SYS N540-ACC-SYS N540-28Z4C-SYS N540X-16Z4G8Q2C-SYS	With N560-IMA2C, N560-IMA2C-DD	NCS 540 Planned 7.7.1 NCS 560 Planned 7.8.1
SFP56	50G SFP 56	N540-24Q8L2DD-SYS	With N560-IMA8Q/4L	NCS 540 : 7.6.1 NCS 560 Planned 7.8.1

Licensing and Commercials

Flexible Consumption model (FCM)

What is FCM?



- New IOS XR capability
- Software licenses used to add capacity as needed
- Simplified license tracking

How does FCM work?



- Deploy router with minimum software fill-rate
- Easily add capacity as demand increases
- Global network visibility

Why use FCM?



- Reduced upfront capital and network-wide pooling
- Software innovation
- Investment protection

Why is FCM better?



- On-going software innovation keeps IOS XR software cutting edge
- Only Cisco has network-wide pooling, license portability, more visibility

Introducing volume-based offer

- **Requirement:** Purchase “50” min quantity of any NCS 540 or NCS 560 chassis
- **Benefit:** 12-20% LP reduction
- **Restriction:** None!!! Open to all customers and partners

Continuing to drive leadership in Access Deployments



Breadth of portfolio
1G/10G/25G/50G/100G/400G
30G to 800G systems

IOS XR 7 - Simple, Modern and Trustworthy network operating system

Temp-Hardened, Low Latency, Class C, extensive timing support

Packet based fronthaul solution for end-to-end IP/MPLS solution

Innovative Business Model
Subscription based SIA, RTU Licenses

Technical expertise & Industry thought leadership
SR, EVPN, Coherent Optics

