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The bridge to possible

Converged Access & Aggregation Transport

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BRKSPG-2022

Session Takeaway

- Understand the needs for Converged SDN Transport
- Learn the Technology & Platforms to build it

Agenda

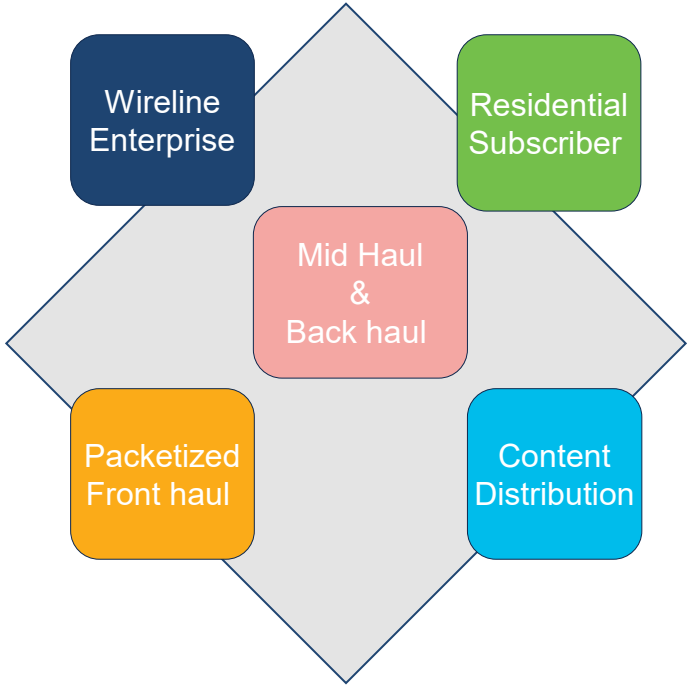
- Converged SDN Transport
- Segment Routing the Technology Enabler
- Converged Access & Aggregation Portfolio the Infrastructure Enabler
  - NCS 500
  - NCS 5500

Transport Convergence

Main Goals for New Architecture

- Converge multiple service on a single network infrastructure
- Simplify the infrastructure scaling to hundreds of thousands of nodes
- Support end to end constraint/SLA based services
- Flexible service placement with intelligence at the Edge
- Any to any connectivity between service endpoints
- End to end network resiliency and active/active services

Transport Convergence

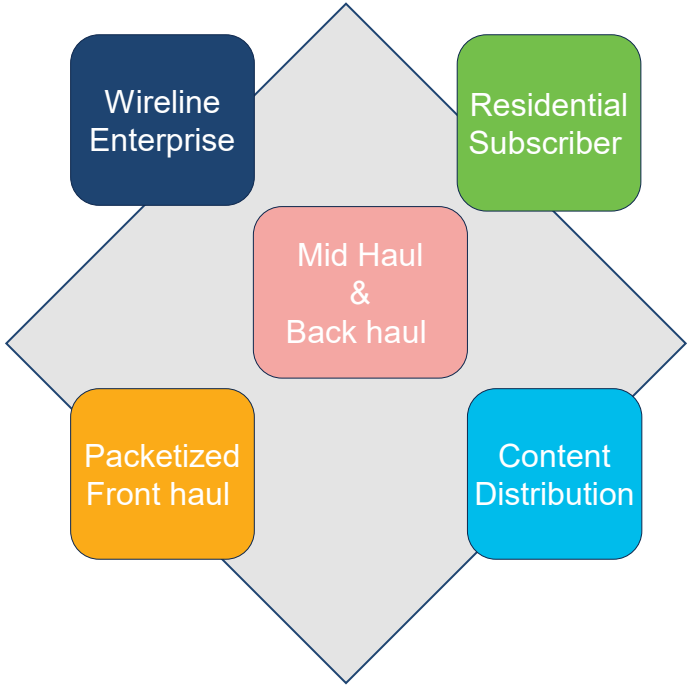


Transport Convergence

Flexibility

Visibility

Programmability

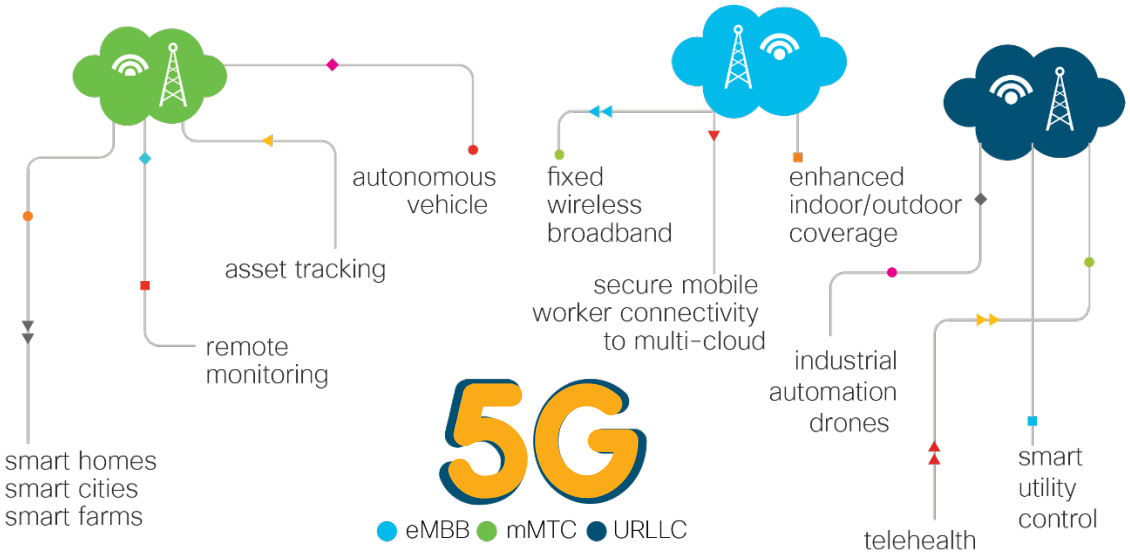


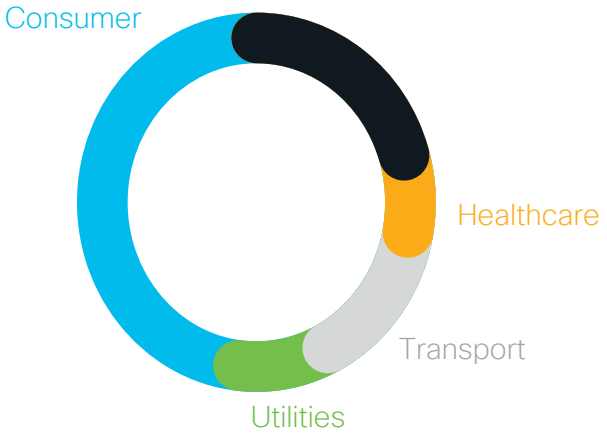
Fault Tolerant

Simplicity

Hardware and Technology assisted

5G Services = Heterogenous



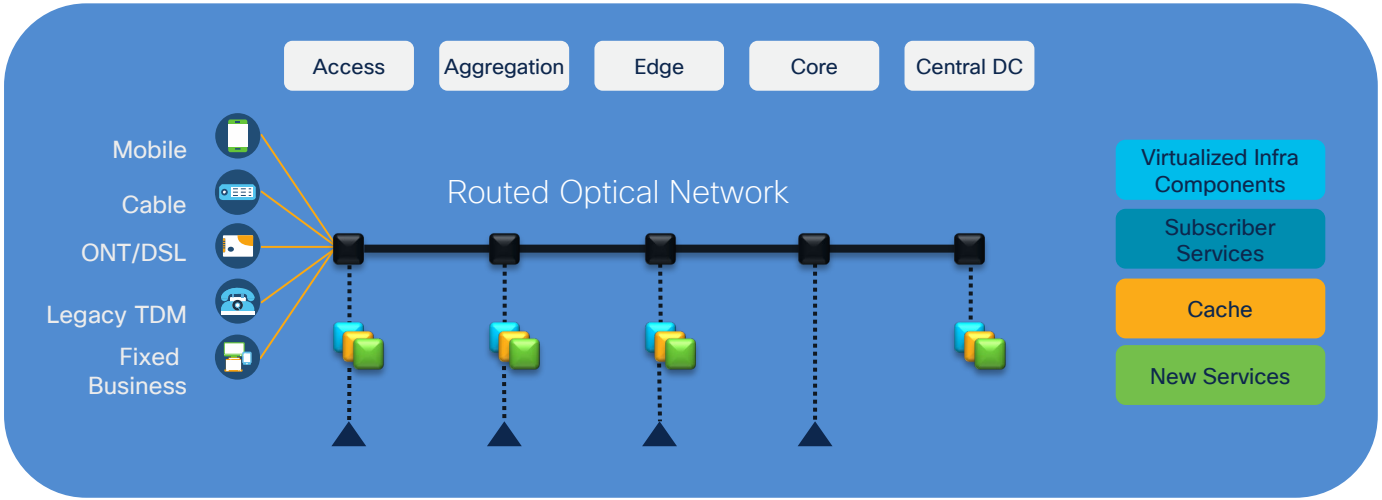


2025
Vertically targeted services will accelerate operator business growth

Source: European Commission Report, 2016

eMBB	uRLLC	mMTC
1000x BW, 50 msec – 300 msec	~1 – 25 msec Latency	1000x Density

Converged Network- The Foundation

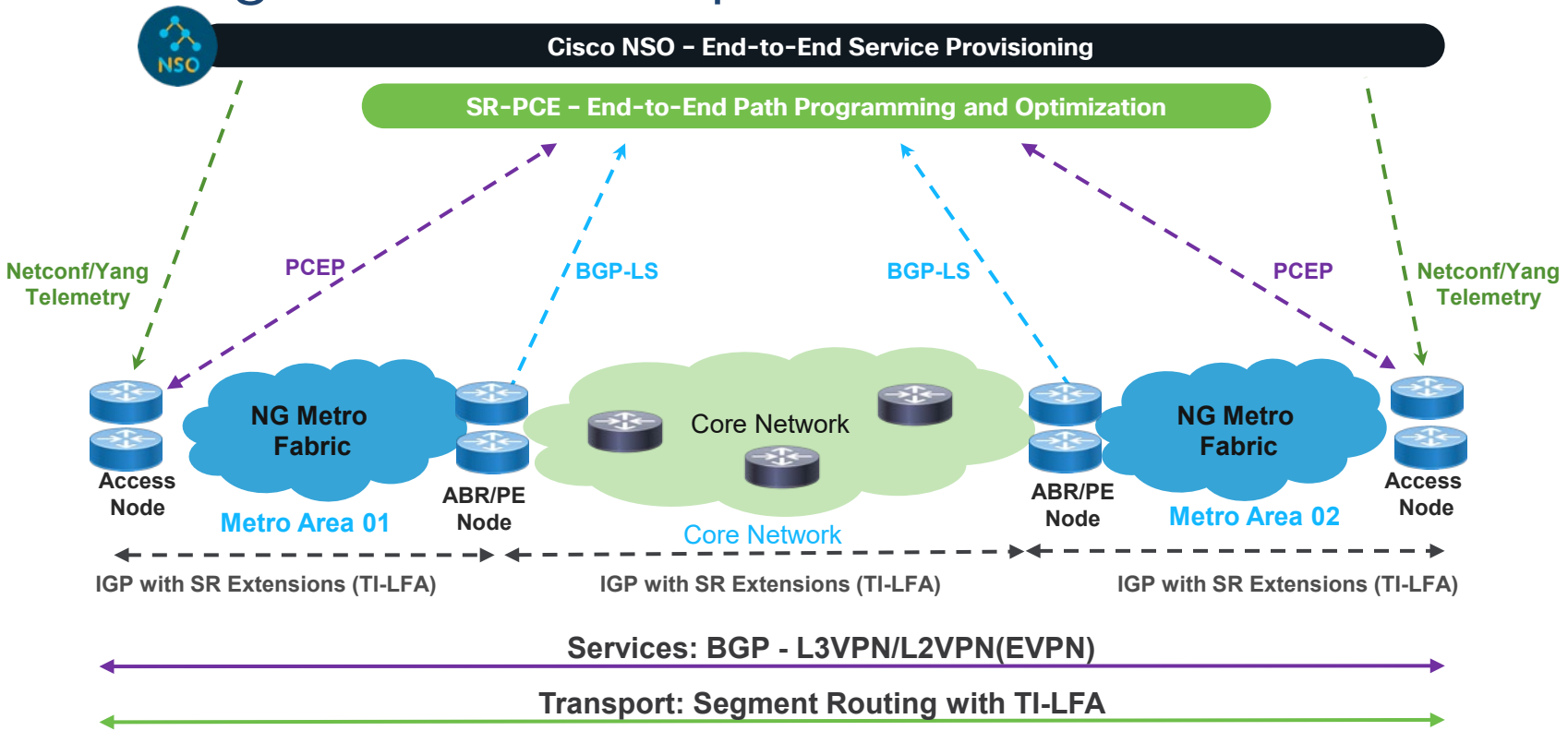


Evolve
towards a converged, software-defined network architecture

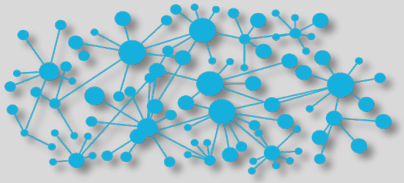
Shift
compute, subscriber management, and peering closer

Open
what if your RAN was as open as IP

Converged SDN Transport – End to End



Converged SDN Transport Toolkit



Mixed SLA Service

Unified Fabric- SR/ BGPVPN

Network Slicing & Virtualization

Automation & Programmability

Timing & Latency

Security & Visibility

Segment Routing for Converged Transport

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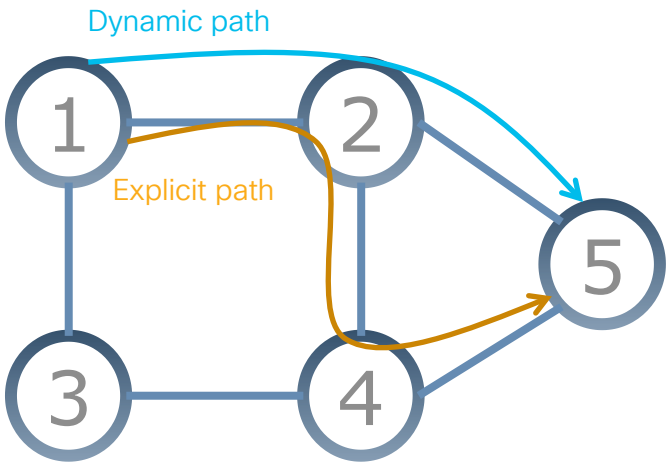
Network Simplification with Converged Transport

	Legacy	Next Gen
Technology Arch.	Unified MPLS	Segment Routing
Provisioning	CLI Driven	NETCONF/YANG
Programmability	None	SR-PCE
Telemetry	SNMP	Model-Driven
Services (L2/L3 VPN)	LDP, BGP	BGP
Scaling Mechanism	BGP-LU	SR Segment Routing
TE, FRR	RSVP-TE	
MPLS Overlay Protocol	RSVP-TE, LDP	
Connectivity Protocol	IGP	

- End-to-End Segment Routing
  - IPv4 SR-MPLS
  - SRv6
- Programmable Transport
  - Utilizes Segment-Routing PCE
  - PCE eliminates need for BGP-LU by using SR On-Demand Next-Hop
- BGP Services Control Plane
  - EVPN for L2 Services
  - L3VPN for L3 Services

Segment Routing (SR)

segments	data



Data Plane

- MPLS (segments)
- IPv6

Control Plane

- Routing protocols with SR extension (ISIS , OSPF, BGP)
- SDN Controllers (BGP, PCEP, NC/YANG)

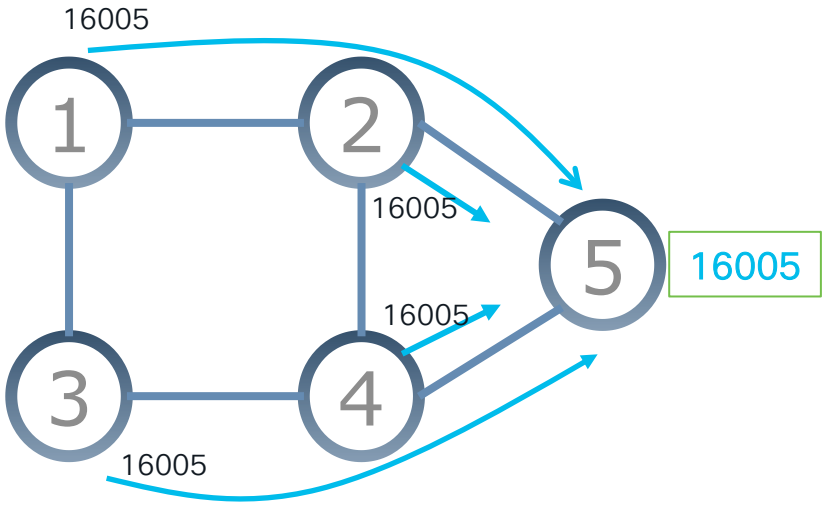
Path Construction

- Dynamic (SPF computation)
- Explicit (expressed in list)

SR Segments

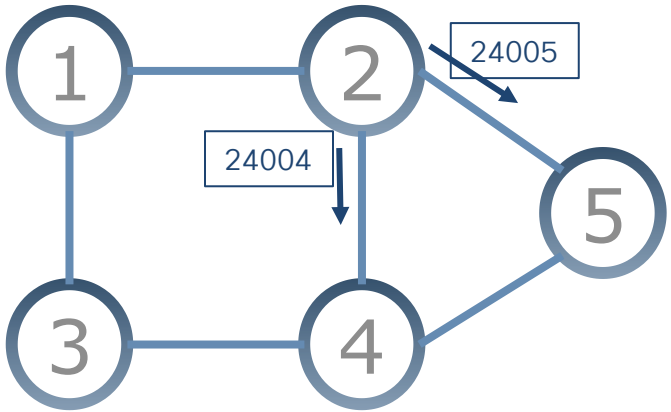
IGP Prefix Segment

- Signalled by ISIS/OSPF
- Minor extensions to the existing link-state routing protocols (OSPF & IS-IS)
- Shortest-path to the IGP prefix
- Globally unique in SR domain
  - SRGB+ Index => 16000+5 = 16005



IGP Adjacency Segment

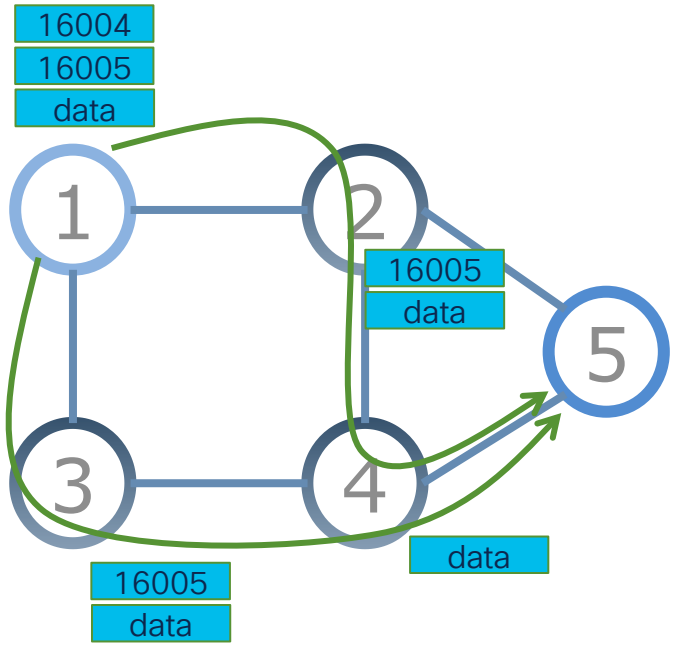
- Signalled by ISIS/OSPF
- Minor extensions to the existing link-state routing protocols (OSPF & IS-IS)
- Forwarded on IGP adjacency
- Local scope



Combining IGP Segment

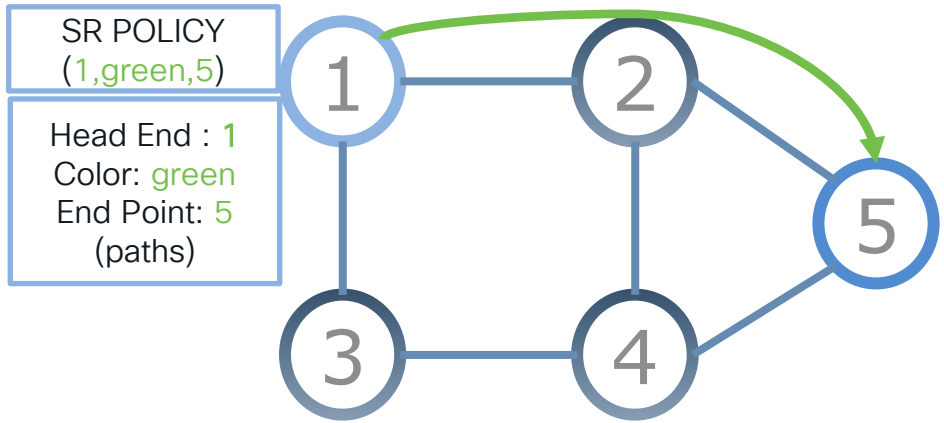
SR Policy

- Steer traffic on any path through the network
- Path is specified by list of segments in packet header, a stack of labels
- No path is signalled
- No per-flow state is created



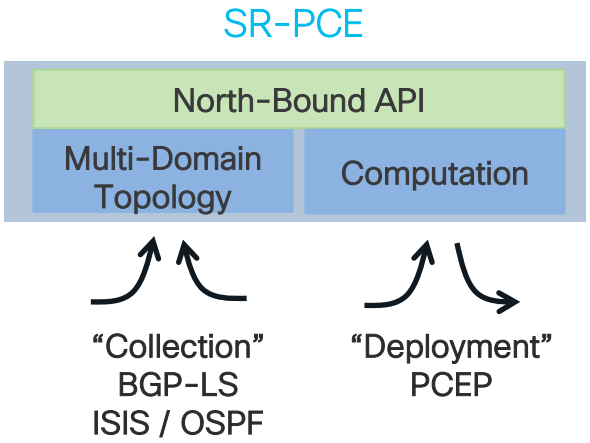
SR Policy Identification & Steering

- An SR Policy is uniquely identified by a tuple(head-end, color, end-point)
- At a given head-end, an SR Policy is uniquely identified by a tuple (color, end-point)
- Policy Color
  - BGP advertises as ext. community
  - Defines certain treatment
- Multiple candidate paths
  - explicit or dynamic



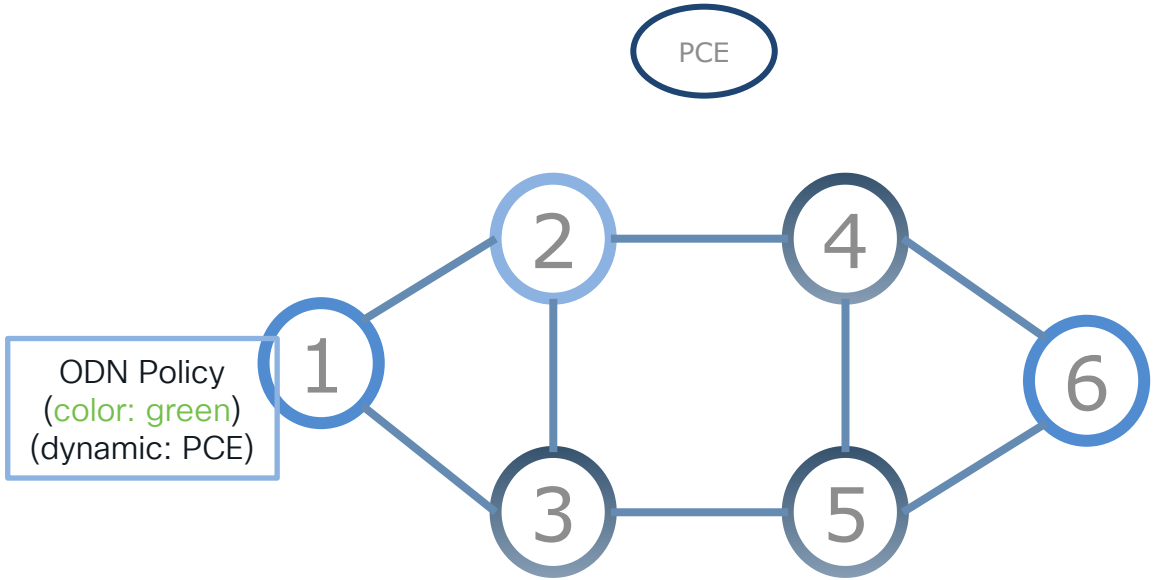
Programmable SDN Transport: SR PCE

- IOS XR-powered stateful PCE
  - Physical or virtual deployment
- Multi-domain topology collection
  - Real-time reactive feed via BGP-LS
  - Inter-area and Inter-domain with constraints and Anycast redundancy
- Computation
  - Shortest, Disjoint, Low Latency, SRLG avoidance
- SR-PCE is fundamentally distributed
  - Not a single all-overseeing entity, but distributed across the network; RR-like deployment
- Northbound APIs for fully programmatic operations

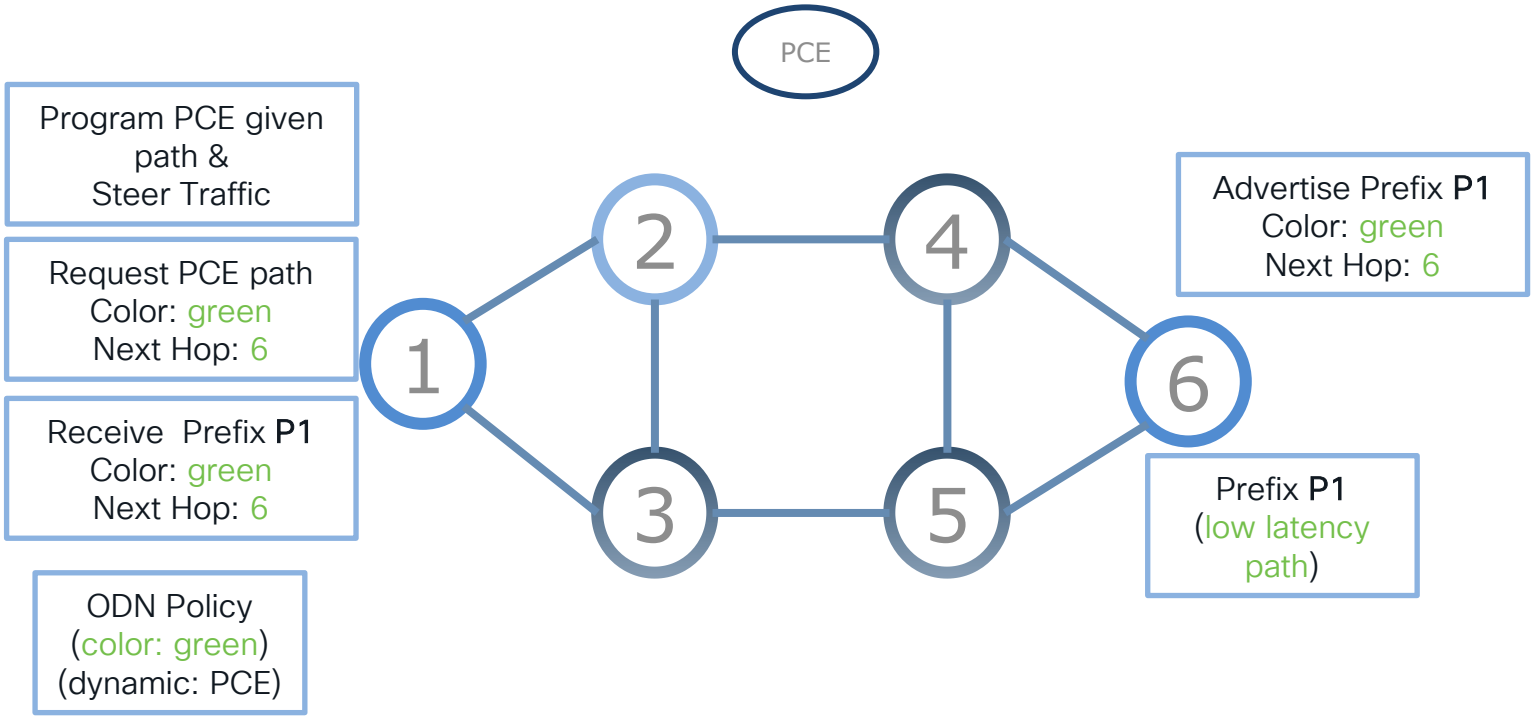


SR On Demand Next (ODN) Hop

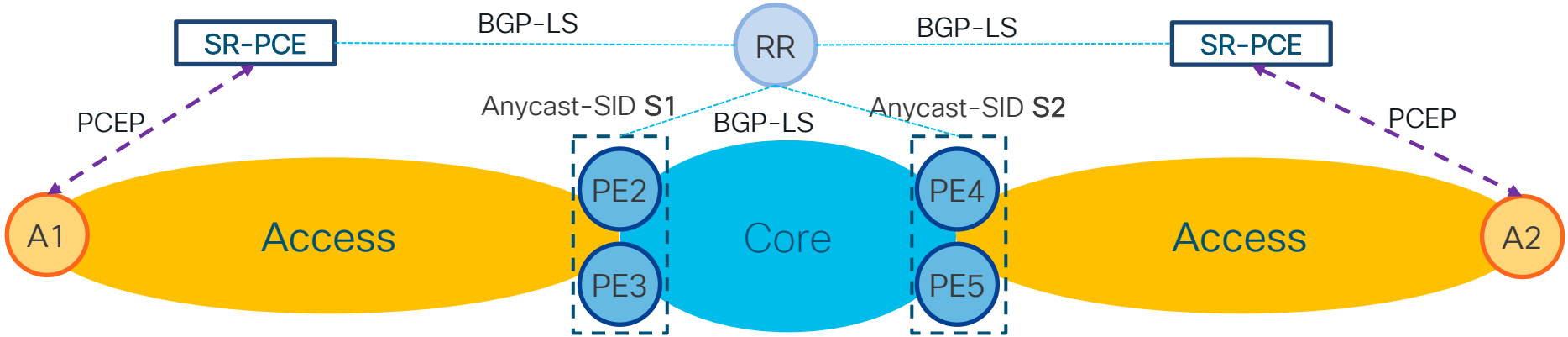
- Head End requests PCE for colored path
- End point advertises color using BGP
- Path Initiates when certain end point advertises the color



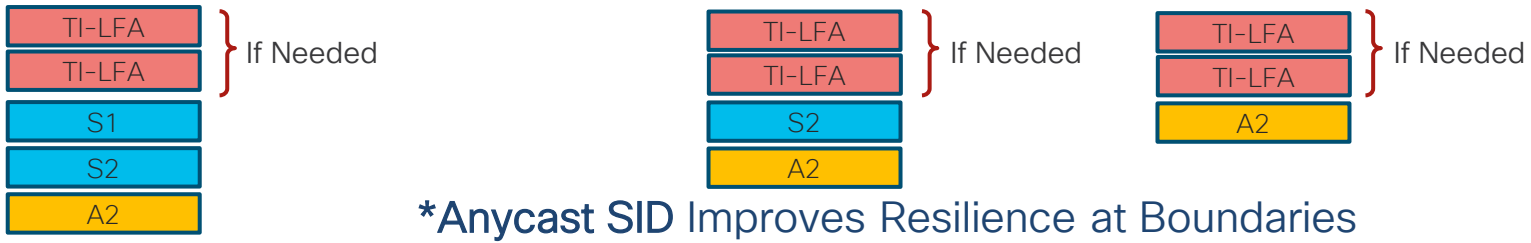
SR On Demand Next (ODN) auto steering



Inter-Domain SR-TE via SR Policy



Transport: End-To-End Inter-Domain SRTE Policy from SR-PCE

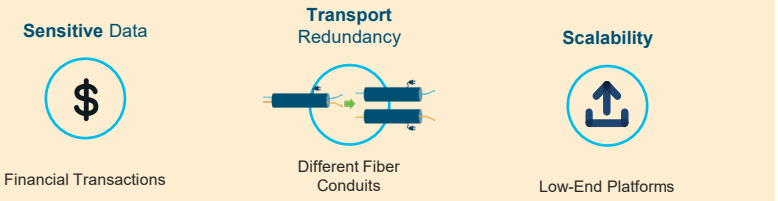


***Anycast SID** Improves Resilience at Boundaries*

SR-PCE computes Inter-Domain paths with Anycast-SID

Slicing: SR IGP Flexible Algorithms

Applicability Examples



Solution

Customized IGP algorithms defined by operator for **intent-based instantiation of traffic Engineering**

- Minimization of metrics: IGP, delay
- Exclusion of properties: link-affinity, SRLG

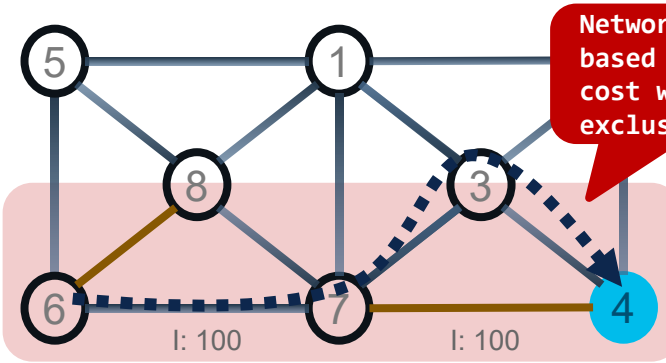
Benefits

Simplicity and Automation

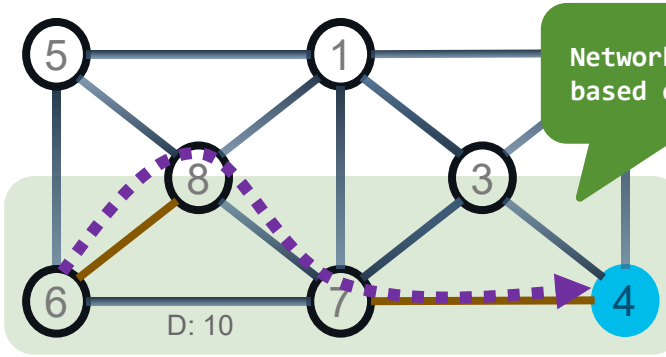
- IGP-computed TE-path from anywhere to anywhere
- Sub-50msec protection (TILFA) optimized per Flex-Algorithm plane

Scalability

- Single SID (instead of label stack) to enforce TE path
- Single prefix segment can participate in many Flex-Algos



Default IGP link metric: I:10



Measured link Delay: D:1

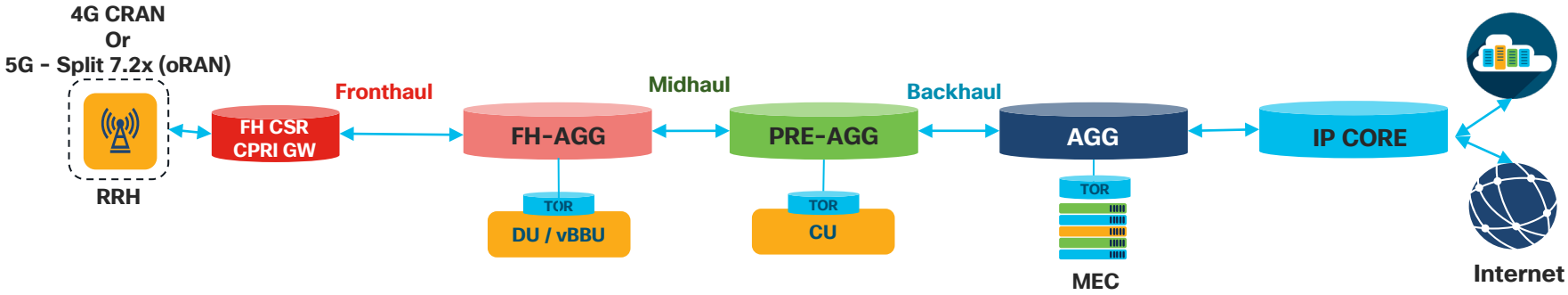
Technology Summary

- Segment Routing Transport
- TI-LFA for improving High Availability
- Programable paths with SR-PCE
- Flex Algo for Network Slicing/Segmentation
- SR ODN & Auto Steering Traffic Mapping

Converged Portfolio

Converged SDN Transport

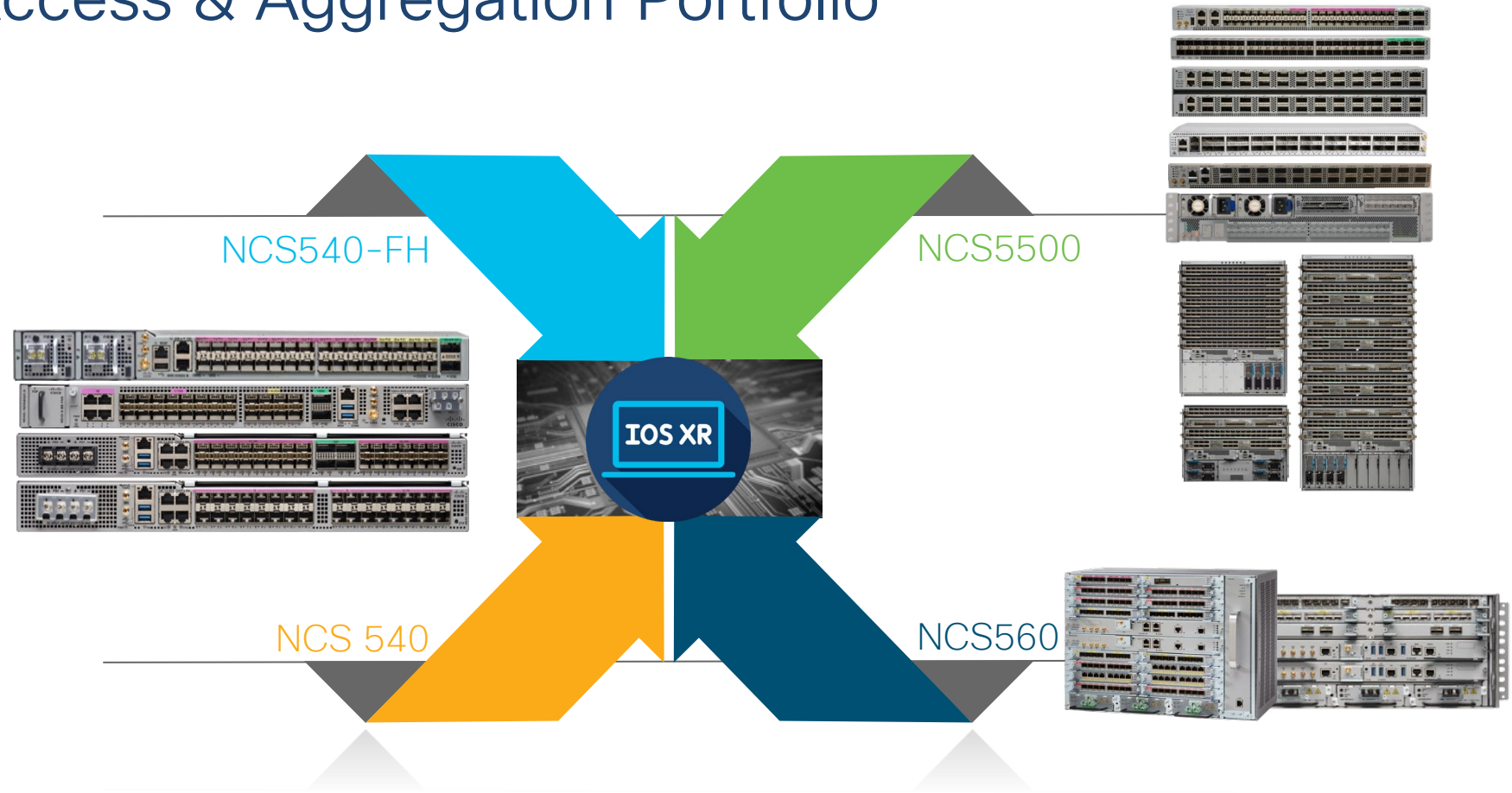
Ready and trusted hardware platforms



FH CSR	FH - AGG	PRE-AGG	AGG	Core
• NCS 540-FH • NCS 540	• NCS 540-FH • NCS 540 • NCS 560	• NCS 540 • NCS 560 • NCS 5500 Fixed	• NCS 55xx • ASR 9xxx	NCS 55xx ASR9xxx Cisco 8K

Segment-Routing

Access & Aggregation Portfolio



Portfolio Highlights

Right Sized

1RU , <300mm – 21 RU fully modular

Speed & Density

1G/10G/25G/40G /50G/100G/200G/ 400G

Secure ZTP

Secure & faster Deployment

Low Latency

Class-B, C portfolio, TSN*

Trust

Hardware anchored trusted

Single OS

Powered with Cisco IOS XR

Automation

Telemetry, Netconf-Yang

Simplified Transport & Service

SR/SRv6/EVPN

* Refer product documentation for exact capability

NCS 500

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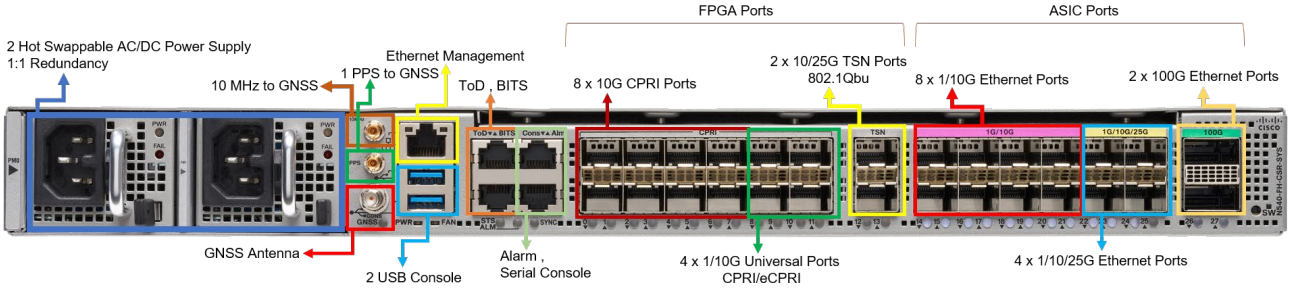
NCS 540 Medium

NCS 540	Interfaces	Throughput	Timing	FCS	Power
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	6.3.2** 6.5.2***	Modular: 1+1 AC/DC
N540X-16Z4G8Q2C-D/A 	2x 100/40GE 8x 25/10/1GE 16x 10/1GE+4x 1GE Cu	300G Max Interfaces: 564G	GNSS Class C 1pps/10MHz/ToD BITS	7.0.1	Fixed: 1 AC 1+1 DC
N540-28Z4C-SYS-D/A 	4x 100/40GE 28x 10/1GE	300G Max Interfaces: 680G	Class B 1pps/10MHz/ToD BITS	7.0.1	Fixed: 1 AC 1+1 DC
N540X-12Z16G-SYS-D/A 	12x 10/1GE 12x 1GE 4x 1GE Copper	140G Max Interfaces: 136G	GNSS Class C 1pps/10MHz/ToD BITS	7.0.1	Fixed: 1 AC 1+1 DC
N540-12Z20G-SYS-D/A 	12x 10/1GE 20x 1GE	140G Max Interfaces: 140G	Class C* 1pps/10MHz/ToD BITS	7.0.1	Fixed: 1 AC 1+1 DC

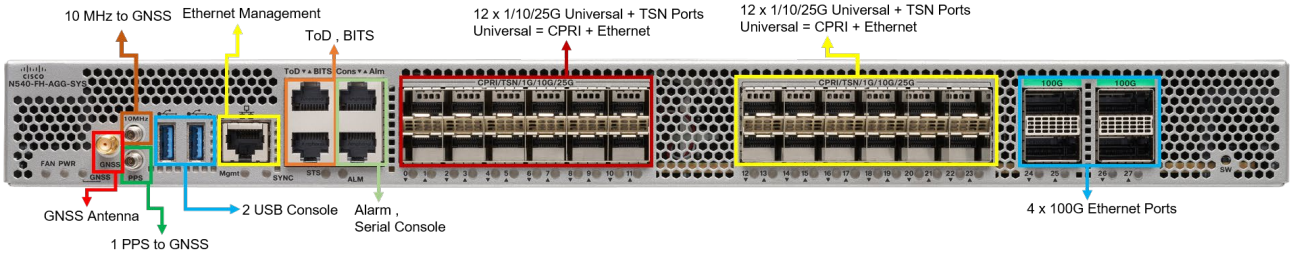
NCS 540 small

NCS 540	Interfaces	Throughput	Timing	FCS	Power
N540X-8Z16G-SYS-D/A 	8x 10/1GE 4x 1GE SFP 4x 1GE RJ45 8/16x 1GE SFP/CSFP	120G Max Interfaces: 104G	Class C 1pps/10MHz/ToD	7.3.1	Fixed 1+1 AC/DC
N540X-6Z18G-SYS-D/A 	6x 10/1GE 18x 1GE	64G Max Interfaces: 78G	Class C 1pps/10MHz/ToD	7.3.1	Fixed 1+1 AC/DC
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	Fixed 1+1 AC/DC

NCS 540 Front Haul



N540-FH-CSR-SYS
300G, modular 1+1 PSU
IOS XR 7.3.1



N540-FH-AGG-SYS
900G, modular 1+1 PSU
IOS XR 7.3.2

Packetized Front Haul

NCS 560

Right sized

800Gbps, Modular FF
Dense 1G with CSFP
1/10/25/40/50/100G
QSFP-DD , CFP2DCO

Redundancy

Fully redundant
Data & control plane.
50ms guaranteed ISSU

NCS 560-4, 4 RU, 6 IM slot

NCS 560-7, 7 RU, 16 IM slot

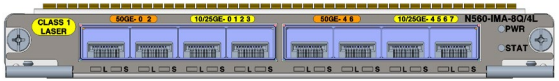
A900-IMA8CS1Z, 8/16 x1G +1x10G

A900-IMA8Z, 8x10G

N560-IMA2C, 2x40/100G

N560-IMA1W, 1x100G/200G CFP2DCO

N560-IMA2C-DD, 2x100G QSFP-DD



N560-IMA8Q/4L, 8x10/25G or 4x50G

NCS 5500

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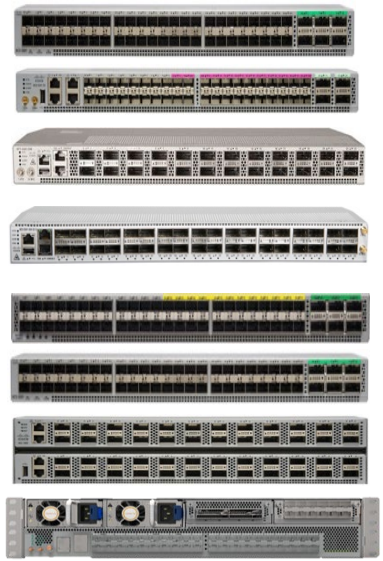
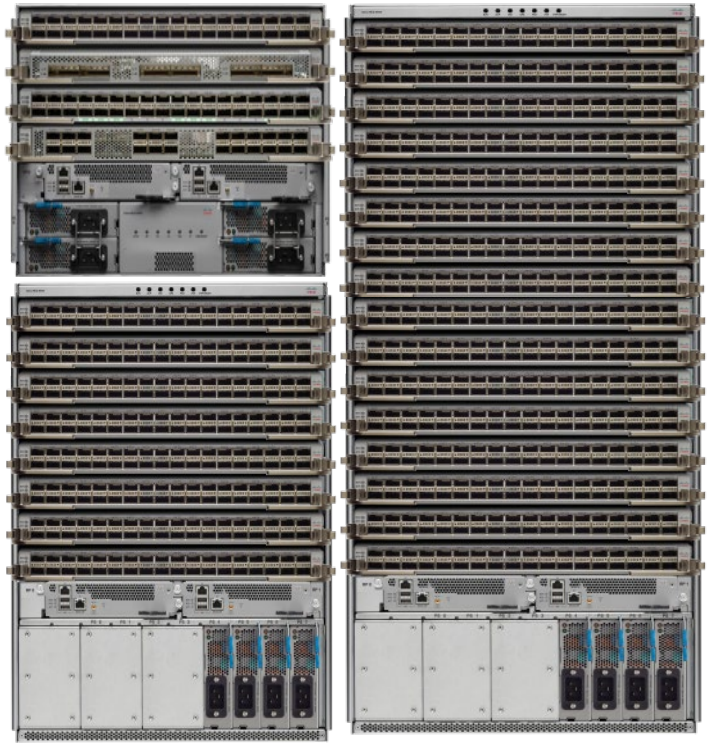
NCS 5500 Family

- Size
  - 1RU/2RU Fixed
  - 4/8/16 slot Modular
  - Capacity:
    - Staring 800G Fixed
    - Up to 9.6T on single LC
  - 3 Modular Boxes
    - 12+ Line Cards
  - 15+ Fixed Boxes





Note: Explore past session For Details

400G with NCS 5700

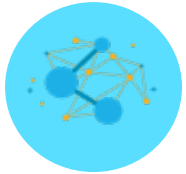
2.7x Increased Capacity

Integrated 400GE / 200GE / 100GE

Lower power per GE and high-density interfaces per RU

3rd generation LC on the same chassis

Higher Capacity



Higher Density

TCO Savings

Protect Investment

NCS 5700

Line Cards & Fixed

NCS 5700

Line Cards & Fixed

NC57-24DD

24x400G/Line card
Flexible: 200G/100G
10G/25G Breakout

NCS 5700

Line Cards & Fixed

NC57-24DD

24x400G/Line card
Flexible: 200G/100G
10G/25G Breakout

NC57-18DD-SE

30 QSFP DD port
18x400G or 30x100/200G
Flex Port/eTACM/Breakout

NCS 5700

Line Cards & Fixed

NC57-24DD

24x400G/Line card
Flexible: 200G/100G
10G/25G Breakout

NC57-36H-SE

36x100G
ZR support on 12 Ports
Breakout, class B

NC57-18DD-SE

30 QSFP DD port
18x400G or 30x100/200G
Flex Port/eTACM/Breakout

NCS 5700

Line Cards & Fixed

NC57-24DD

24x400G/Line card
Flexible: 200G/100G
10G/25G Breakout

NC57-36H-SE

36x100G
ZR support on 12 Ports
Breakout, class B

NC57-18DD-SE

30 QSFP DD port
18x400G or 30x100/200G
Flex Port/eTACM/Breakout

NCS57B1-6D24/5D-SE

24X100G QSFP-DD, 6/5x400G
QSFP-DD

Summary

Session Summary

- Converged Programmable SDN Transport
  - ✓ Transport Infrastructure Simplified
  - ✓ Fully Programmable and Automation ready
  - ✓ Resilient Flexible Services with SLA
  - ✓ Assisted by Technology & Trusted Hardware

The bridge to possible

Thank you

Appendix

Resources

Cisco Validated Design: http://xrdocs.io/design

NCS 5500: https://xrdocs.io/ncs5500/

Segment Routing: https://www.segment-routing.net/

EVPN : https://e-vpn.io/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