

# Agile Service Networking (ASN) Edge-Fabric and Cisco 8000 Router Family

**CISCO** Live !

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# Cisco Webex App

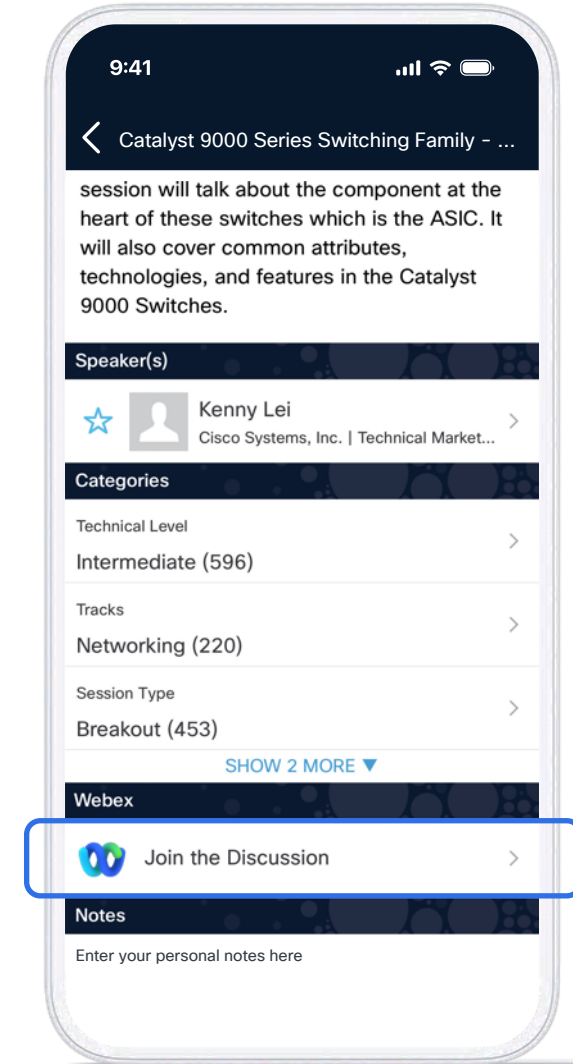
## Questions?

Use Cisco Webex App to chat with the speaker after the session

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- 1 Find this session in the Cisco Live Mobile App
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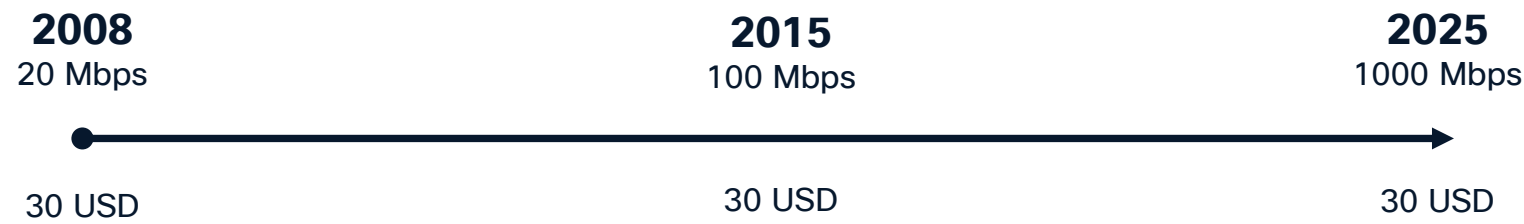


<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKMSI-2533>

# Agenda

- 01 Introduction
- 02 Options to build a Service Edge nodes
- 03 Use Cases for Edge-Fabric
- 04 NPU for Edge-Fabric
- 05 Cisco 8000 with Next-Gen NPUs
- 06 Edge-Fabric for Unified MPLS network
- 07 Q&A
- 08 Closing

# Problem Statement



Bandwidth increases expotentially



Higher Capacity



New NPU and Platform

Revenue stays flat



Optimize CAPEX and OPEX



New Architecture

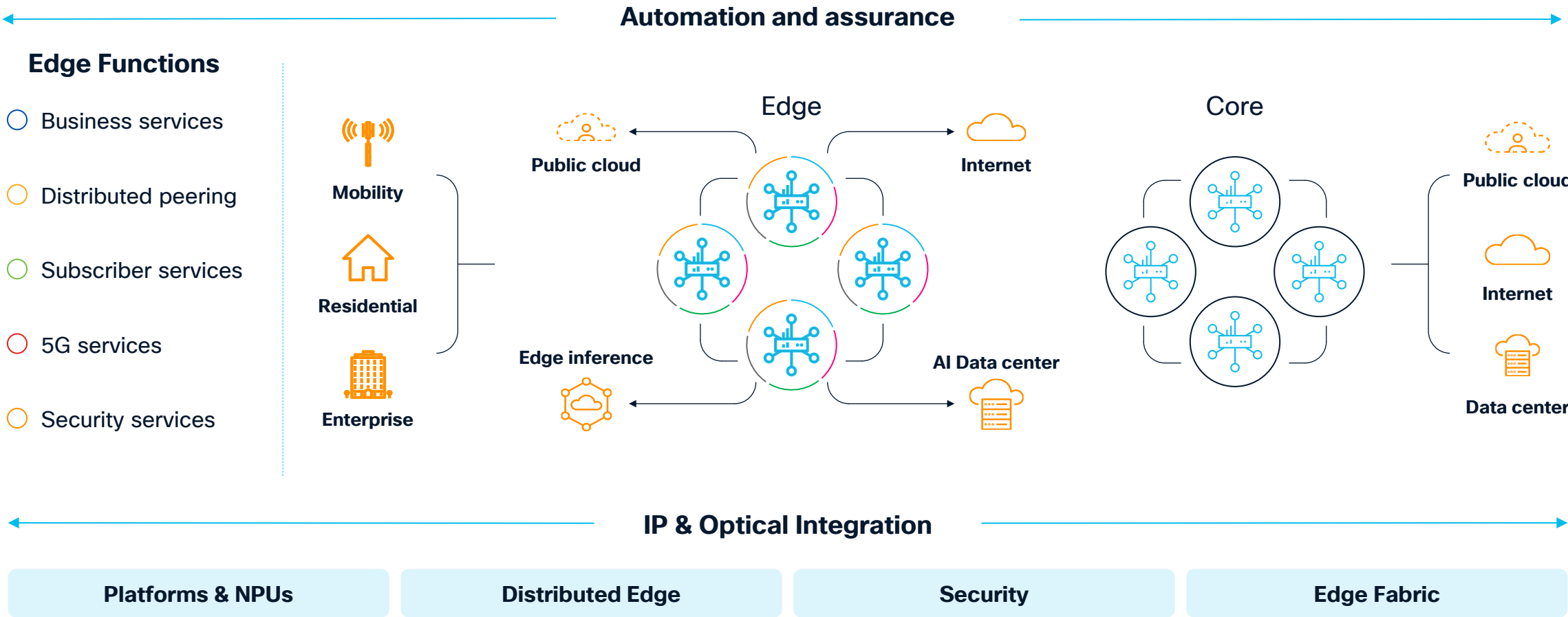
Pressure from competition and new tech-wave (Cloud, 5G, AI, Security)



Agility

# Cisco Agile Services Networking (ASN)

A network architecture that enables service providers to monetize the delivery of assured services and networking



# Options to build a Service Edge node

# Factors influencing the build

Based on various factors

Priority of each customer, country, region may be different

Port Density

Bandwidth

Services & Features Scale

Form-Factor & Rack Space

Power Consumption

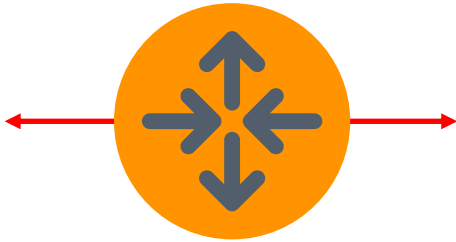
Cost

Redundancy

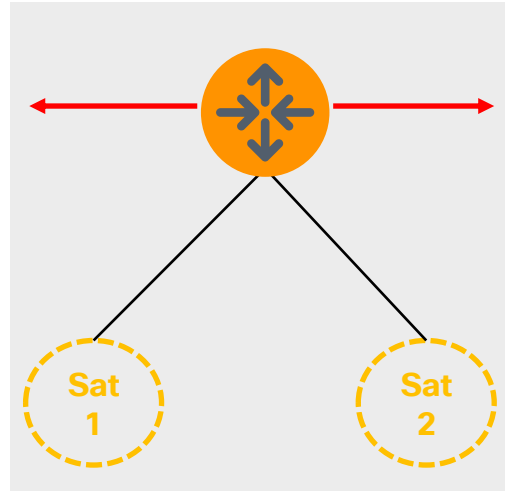
Modularity & Flexibility

Future-proofing

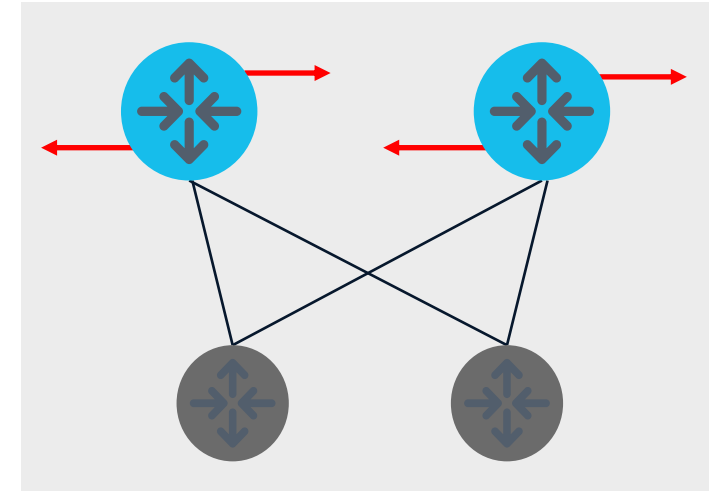
# Options to build a Service Edge node



(1) Single Modular System

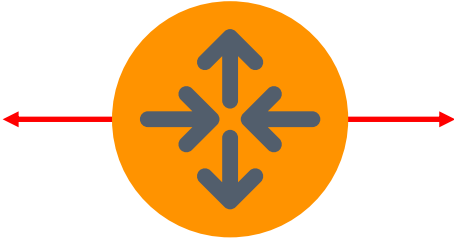


(2) Port Extender (or Satellite)



(3) Edge Fabric  
- Scale Out

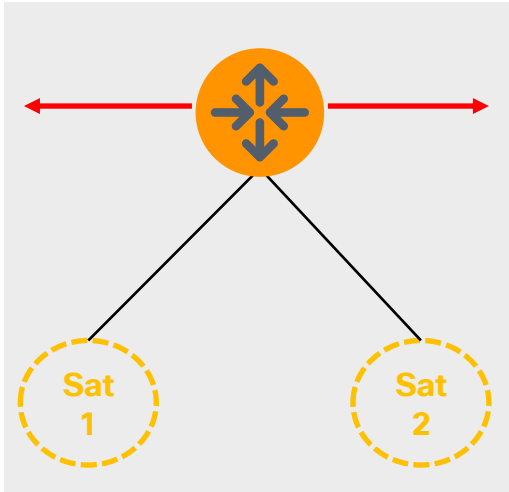
# Single Modular System



(1) Single  
Modular  
System

- **Proven** and used since the beginning of networking
- Choose the “**Right**” chassis type
- **Significant Upfront investments** on the chassis, commons, space and power
- **Well known & Established** operational process

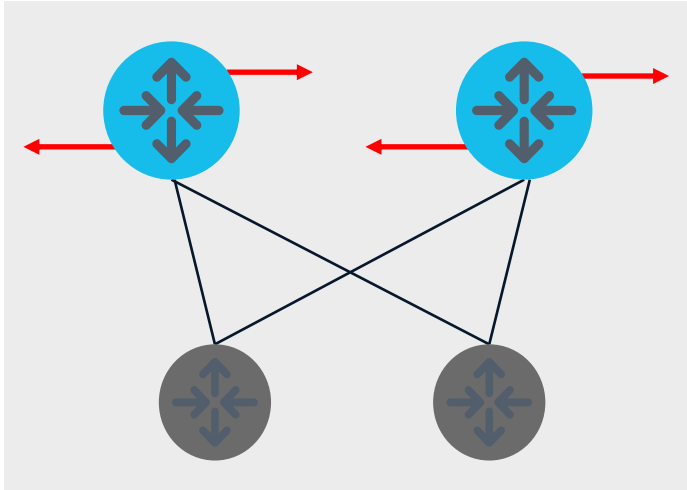
# Port Extender (or Satellite)



(2) Port  
Extender (or  
Satellite)

- Systems with 100G, 400G requires high-density, cost-effective 10G/1G interfaces
- Can be considered as “Active Patch Panel for 10G/1G”
- Achieve the same as Layer 2 Aggregator but less complexity

# Edge Fabric Scale-Out

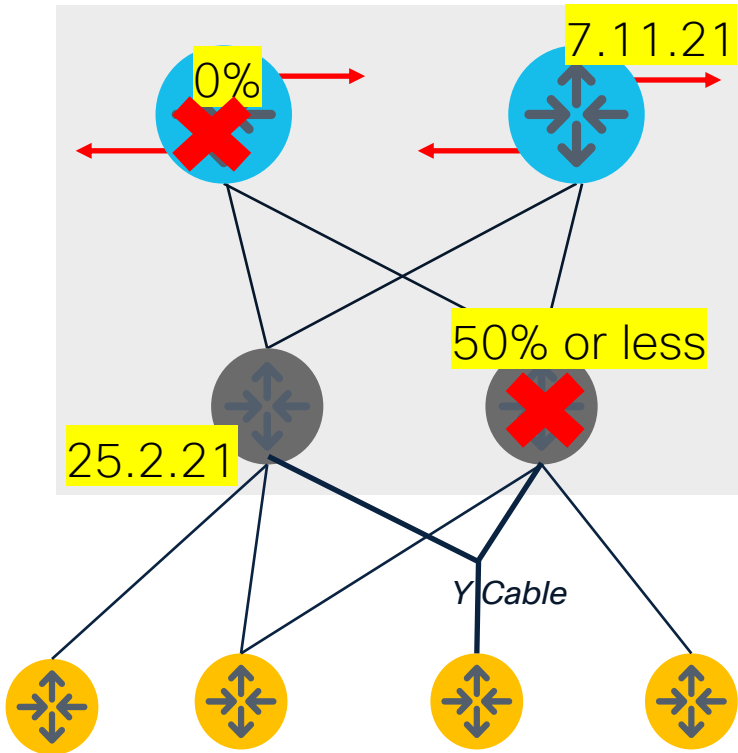


- A set of **independent routers** communicate via **standard** protocol on control plane (IGP, BGP) and data plane (MPLS, IPv6)
- Clearly defined functions
- Usually in **same physical location** (different physical locations are possible)

## (3) Edge Fabric - Scale Out

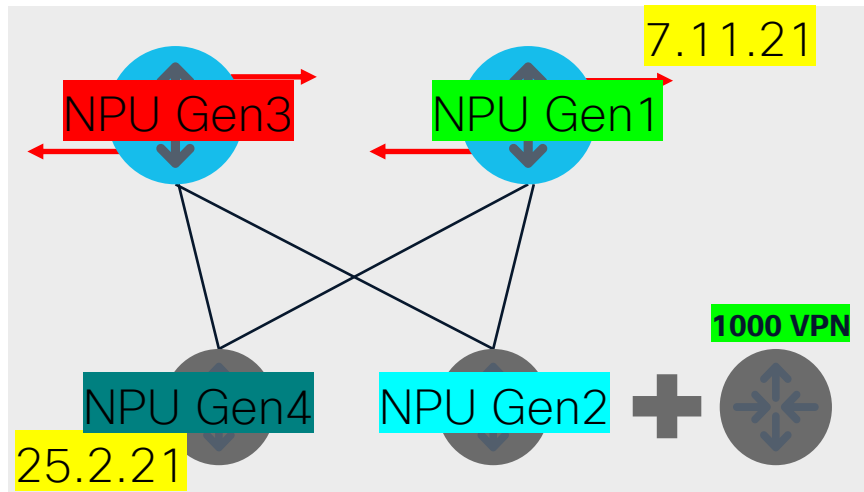
# Use Cases for Edge-Fabric

# Improving Reliability



- **Reduced Blast Radius**, device failures & error are contained.
  - Less chances to have major outage cases, especially if in central locations
- **Reduced Risks** for Software Upgrade.
  - Each component can be upgraded independently
  - Reboot is 50% faster using compact system
  - Near hitless upgrade may be achieved (when CE connections are dual-homed)
  - Maintenance Windows may be more time consuming

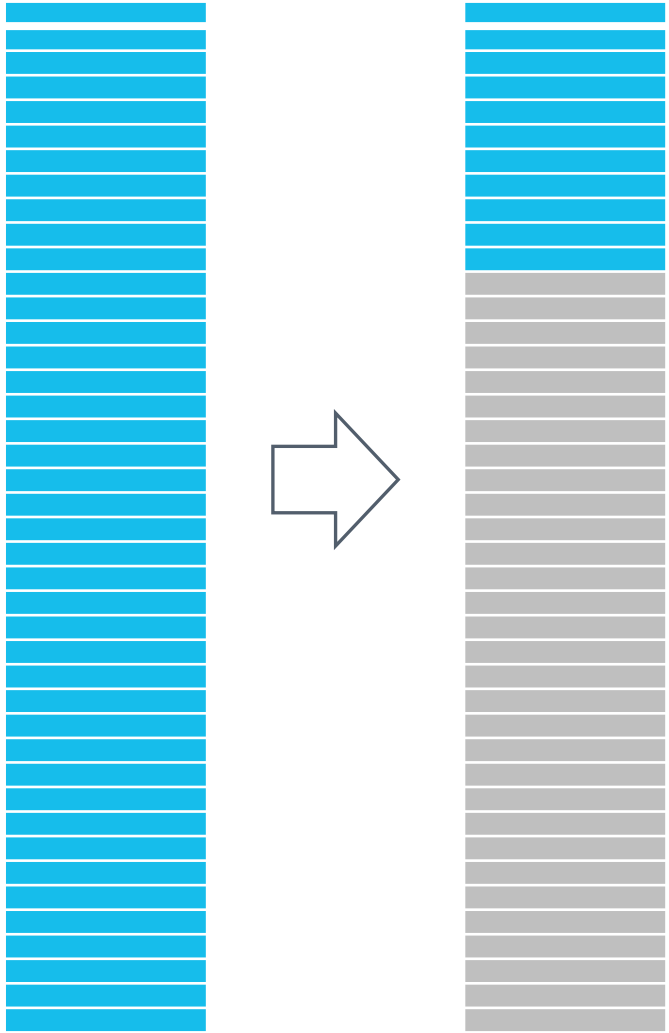
# Improving Agility



1/10/25/50/100/200/400/800 ... 1600

- Co-exist of multiple **hardware generations**
- Easy to mix different **port requirements**
- **Mix and match** of different software versions
- **Add** logical scale
- Easy to introduce new services which requires **new hardware**
- Easy to **migrate & swap out** a component

# Reducing Rackspace & Power Consumption (1)

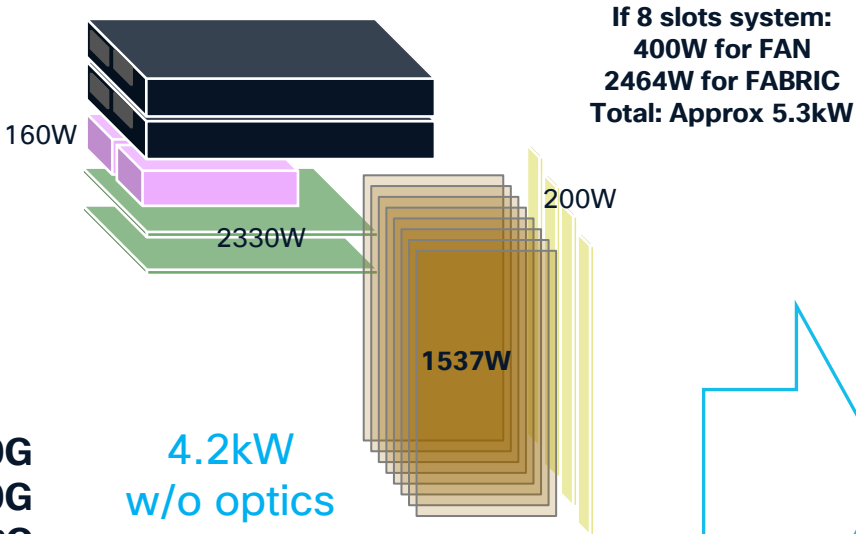


- Edge-Fabric will save **at least half** if not more of Rackspace and Power Consumption compare to legacy systems

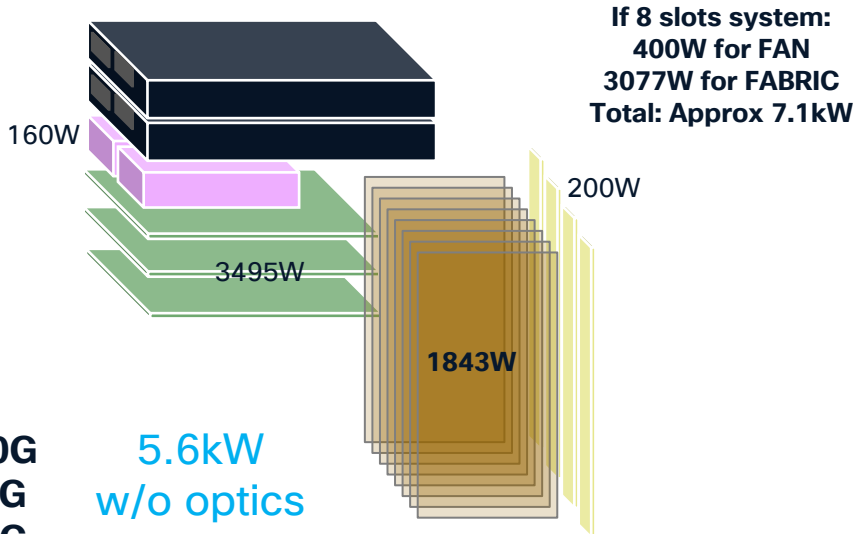
# Reducing Rackspace & Power Consumption (2)

## Cisco 8804 - 10RU

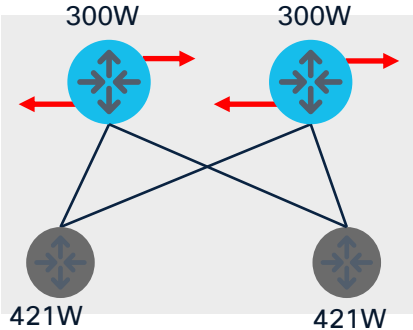
Year1:  
48 x 100G  
12 x 400G  
30%, 25°C



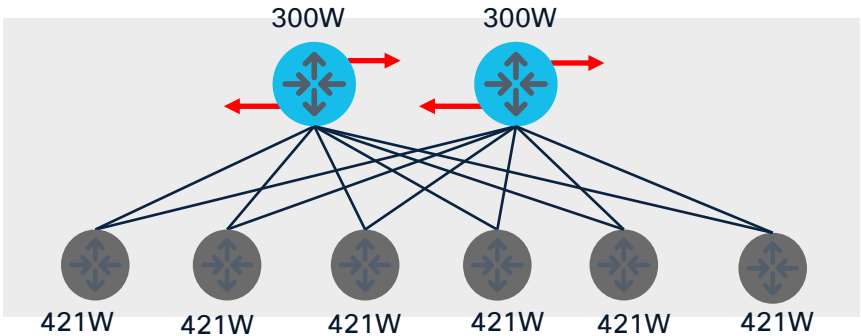
Year4:  
144 x 100G  
36 x 400G  
30%, 25°C



## Cisco 8201 - 1RU Cisco 8712 - 2RU



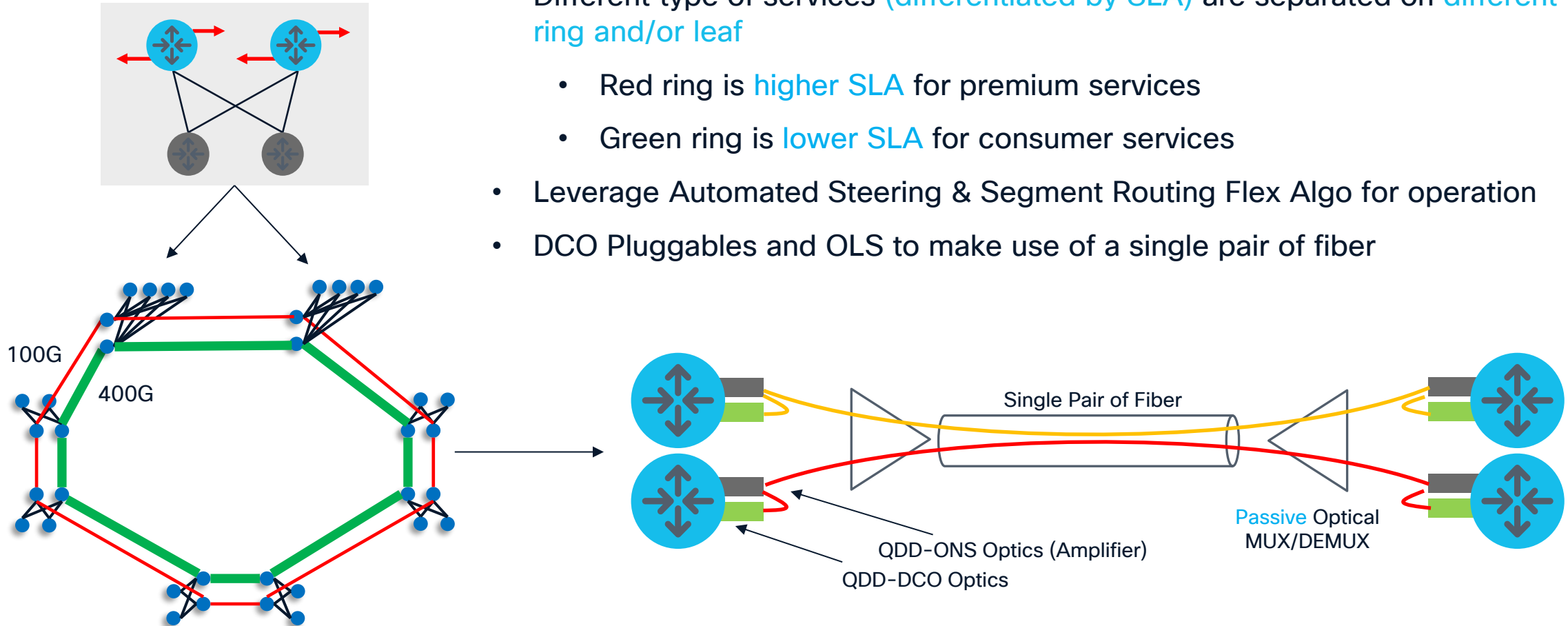
1.4kW w/o optics



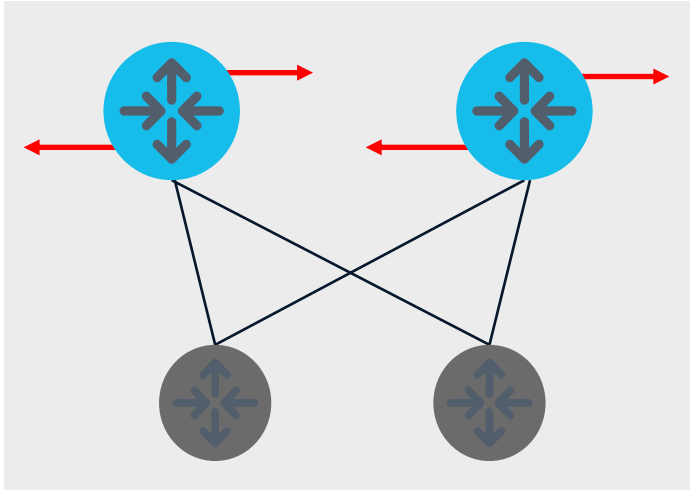
3.1kW w/o optics

# Service Separation

- Different type of services (differentiated by SLA) are separated on different ring and/or leaf
  - Red ring is higher SLA for premium services
  - Green ring is lower SLA for consumer services
- Leverage Automated Steering & Segment Routing Flex Algo for operation
- DCO Pluggables and OLS to make use of a single pair of fiber

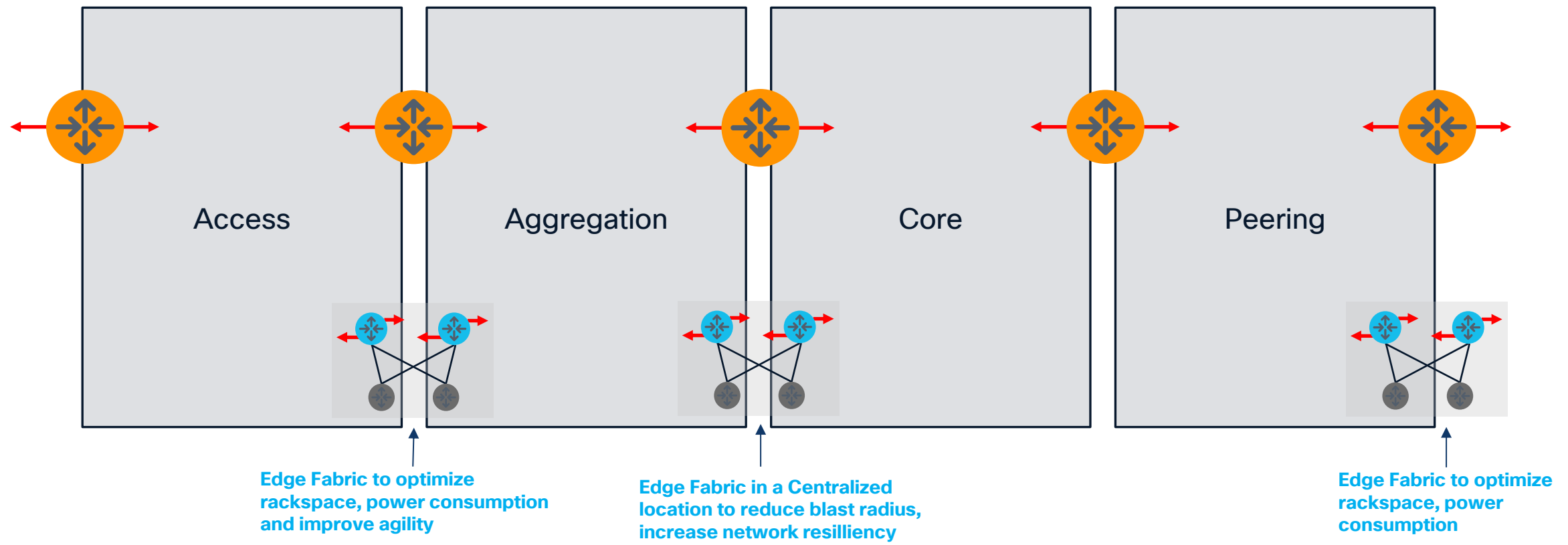


# What's the catch ...?



- More nodes means **more effort to operate, maintain**
- Topology may get **complicated**
- Some complexities can be addressed with Automation Tools and newer technologies such as SRv6, EVPN..

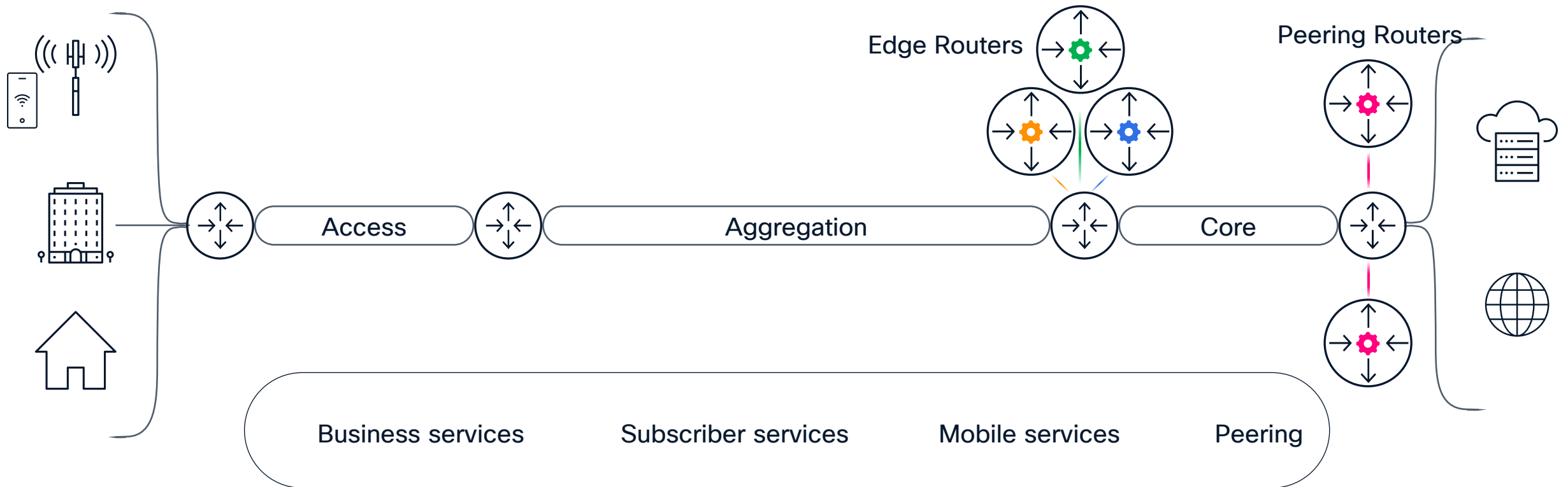
# Where to apply Edge-Fabric ?



# NPU for Edge-Fabric

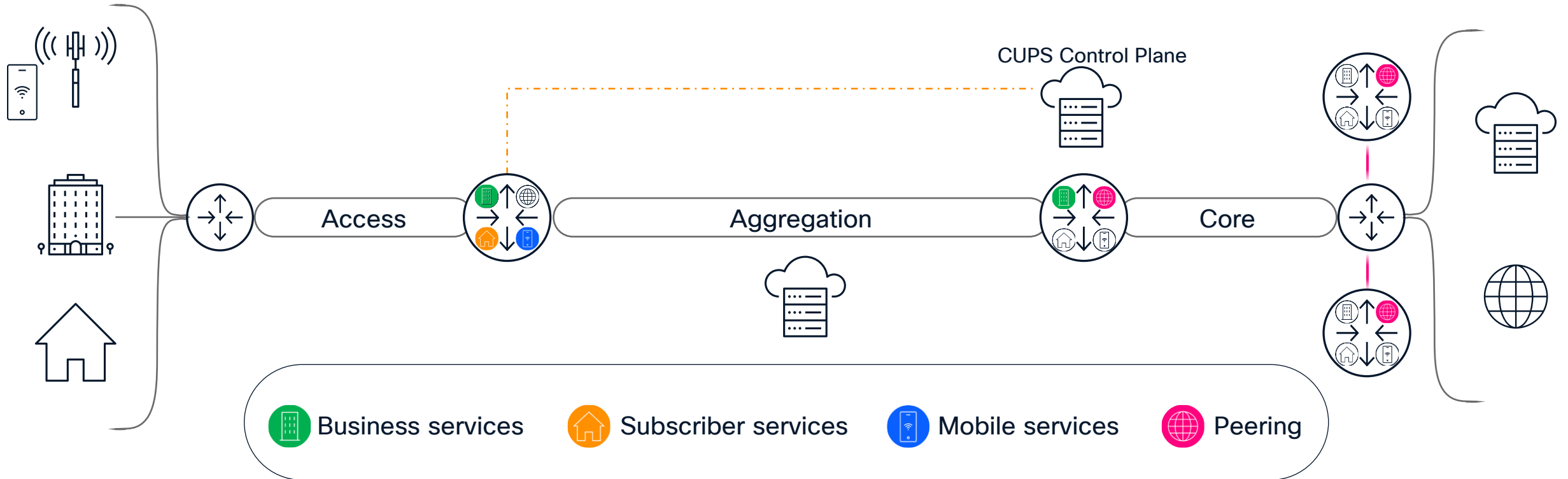
# Distribution of Services Edge

From a set of *dedicated routers* placed centrally in the network



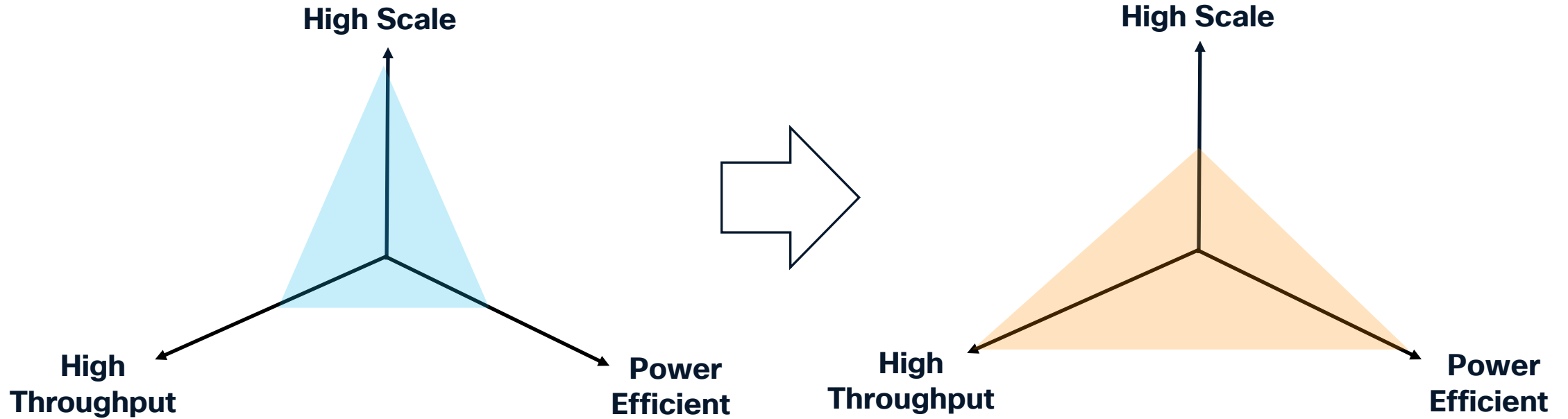
# Distribution of Services Edge

To a set of functions that can be enabled *anywhere*,  
*distributed on more devices*



# Fundamental Truth of Networking

## RFC1925 – Clause 7 & 7a

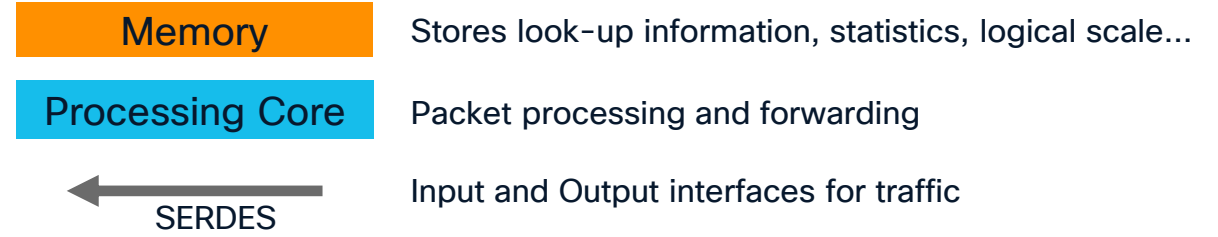
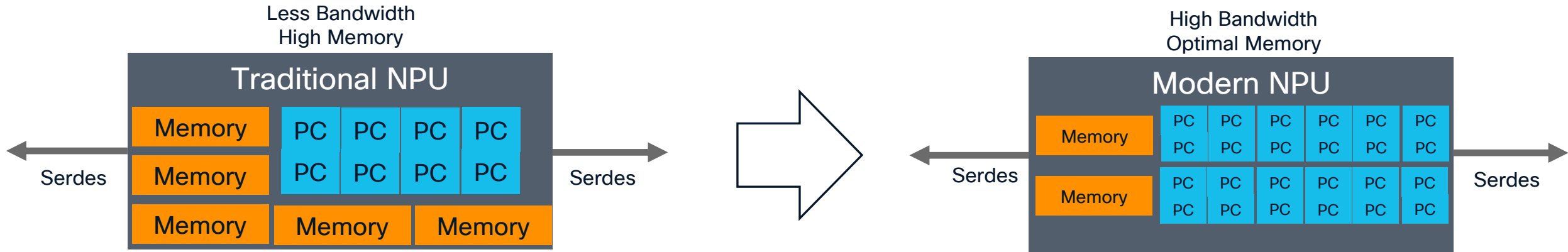


It is always something! Pick any two, can't have all three!

**It's all about Trade Offs**

# NPU's Direction

## Basic Components of any NPU



- More features at higher scale
- High QoS scale
- Power Hungry
- Lower PPS :
  - 24 x 100 Gbps
  - 30 x 100 Gbps

- Required features with enough scale
- Optimized QoS
- Extremely Power Efficient
- High PPS:
  - 192 x 100 Gbps
  - 256 x 100 Gbps
  - 512 x 100 Gbps

Disclaimer: For illustration purpose only

# NPU's Metrics in Market

Traditional Modern

- Forwarding tables (FIB, ECMP)
- Number of counters & updates per packet
- Scale of Resources
- QoS operations, hierarchy
- Buffer capacity (MB vs. GB)
- Features
- Baseline PPS
- Power vs. bandwidth (*higher plot in chart means better optimized*)
- Chip network bandwidth



# Cisco 8000 with Next-Gen NPUs

# Why did we need a new NPU architecture ?

- Requirements change  
Increased focus on bandwidth and power
- NPU architectures lasts around 10-15 years  
Underlying component technologies change

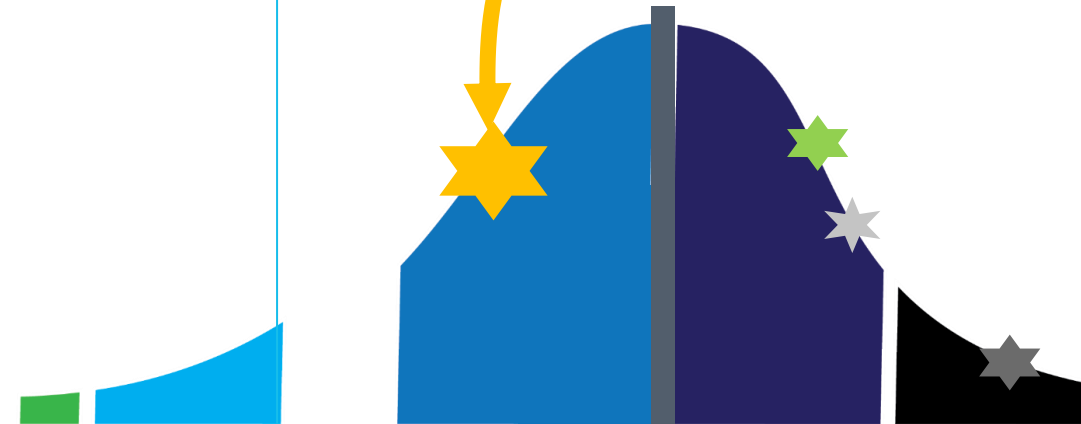
## **Silicon One** “Cisco’s Most advanced Networking chip”

Unified Network Silicon Architecture  
Powers wide range of networking devices

1.2T to 19.2T NPU shipping.

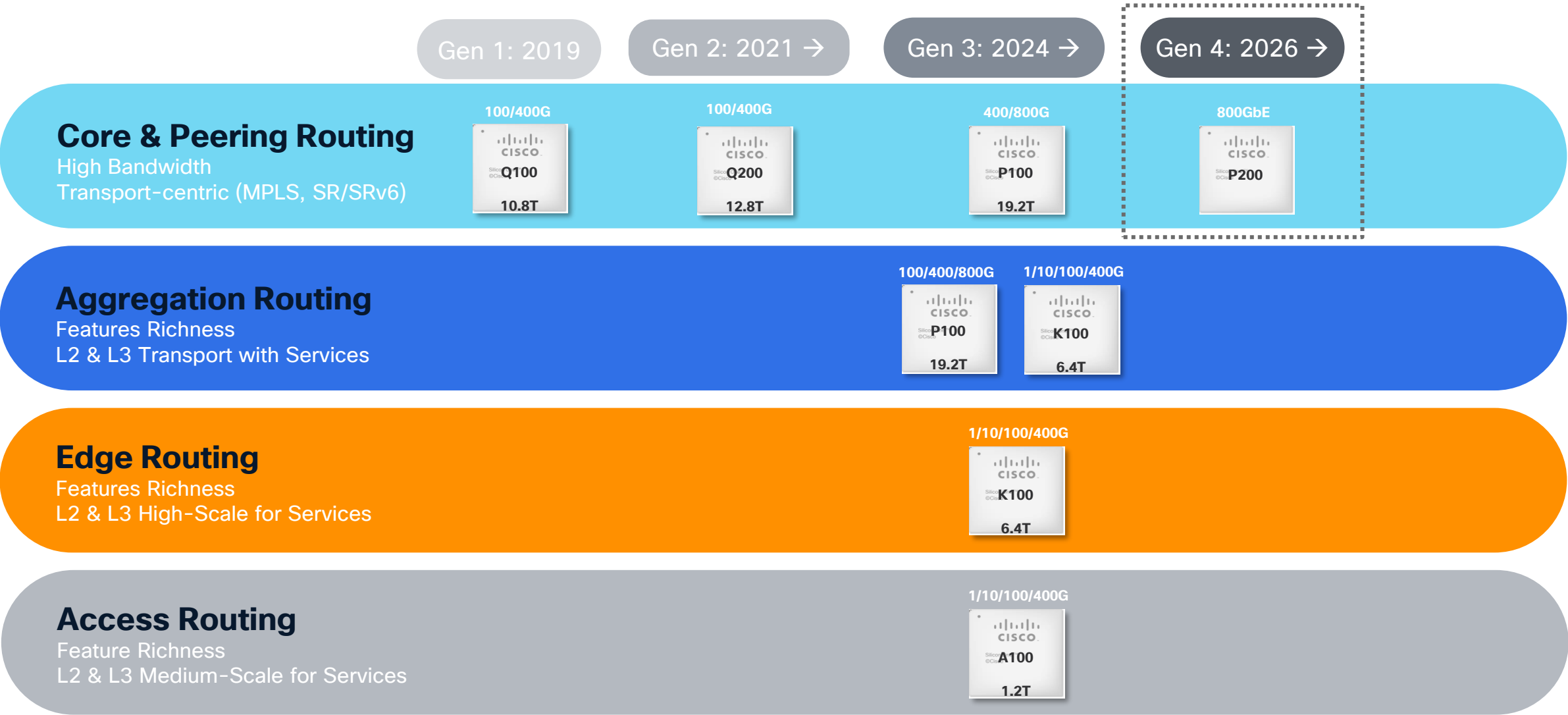
**51.2T NPU Ready**, FCS: 2026

**Deployed in major Web and SP networks**



# Cisco Silicon One

One architecture, purpose-fit NPU for Cisco 8000 Routing



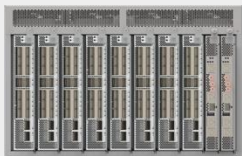
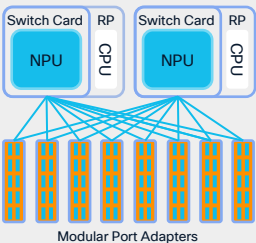
# Cisco 8000 Platform Architecture

## Fixed



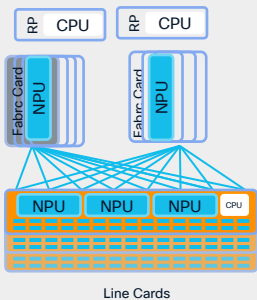
**Class-leading cost and power efficiency**  
**Small form factors (1-3RU)**  
**Best suited for Spine & Leaf Architecture**

## Centralized



**Redundancy at optimized cost & power**  
**Flexible I/O modularity**  
**Upgradability**

## Modular



**Maximum Scale-Up and Port Fanout**  
**N+1 Resiliency**  
**Future expandability, upgradeability**



### Feature Consistency

Consistent set of capabilities end-to-end where the level of logical scaling is dictated only by characteristics of the NPU configuration



### Multi-Purpose Systems

Provides flexibility, versatility, consistency for diverse customer deployment scenarios.



### Per Port Granularity

Maximize NPU performance through per port granular enablement.

# Edge Fabric Buildout with Cisco 8000

## Spine



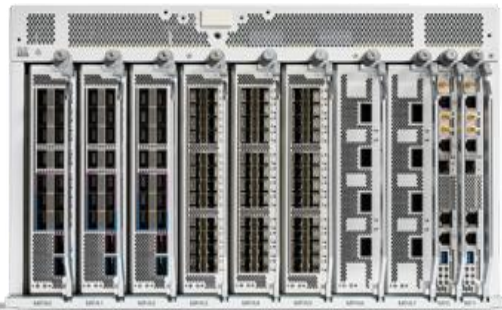
19.2T - 8212-48FH-M (P100)



12.8T - 8711-32FH-M (P100)



12.8T - 8201-32FH (Q200)



12.8T - 8608 (Q200-Centralised)

## Leaf / Spine



6.4T - 8712-MOD-M (K100)



5.6T - 8711-48Z-M (K100)



4.8T - 8404-SYS (K100-Centralised)

## Small Leaf



1.6T - 8011-32Y8L2H2FH (A100)



1T - 8011-4G24Y4H-I(A100)

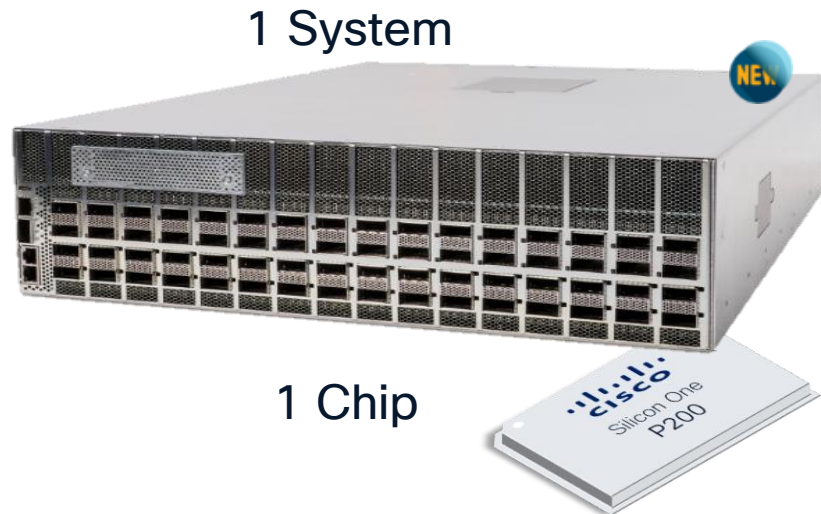


240G - 8011-12G12X4Y-A/D(A100)

Any K100 Router can also be a SPINE (with integrated edge/Peering functionality) for Clusters with A100/K100 Leaf

# Cisco 8000 64 x 800GE Router Announced

## Cisco 8223-64E(F)-M 3RU, 51.2Tbps. Fixed system



**Biggest SPINE, CORE, AGG, WEB,  
DCI  
Router !**

## Powered by New P200 (20Bpps / 51.2Tbps Full Duplex)

64 x 800GbE: Port Density

512 x 100G Radix capacity

Less power per G

MACsec/IPSec: Inbuilt Crypto

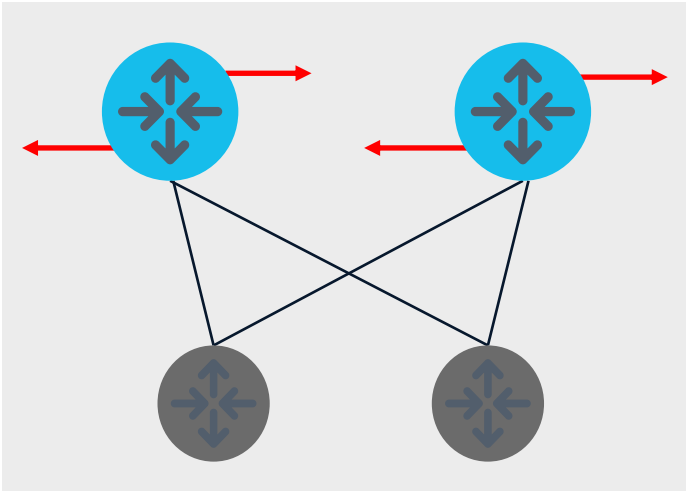
SONIC/IOS-XR/NX-OS : OS Flexibility

OSFP/QSFP: Optics Flexibility

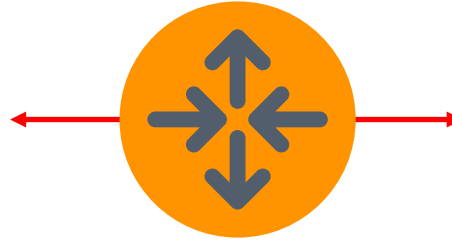
More reliable, efficient & secure



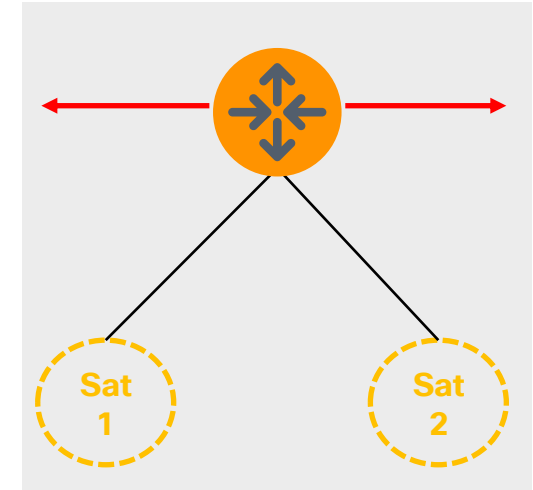
# Cisco 8000 Gen3 – Architecture Readiness



**Edge Fabric**  
Ready



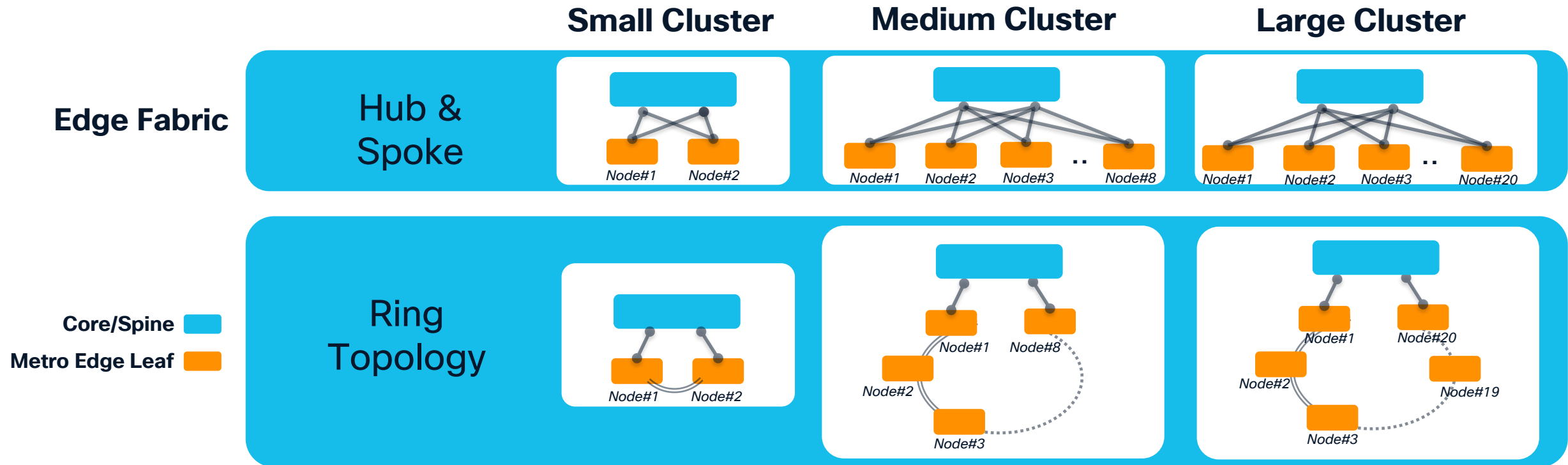
**Modular**  
*P100 Ready*  
*K100 CY26*



**Port Extender**  
Future

# Building ASN Edge-Fabric

# Agile Service-Edge Fabric Overview



- ✓ Flexible Scale out architecture
- ✓ Cluster sizing based on Bandwidth, Port speed density, Services scale per site (UNI/NNI requirements)
- ✓ Can replace network segments &/modular systems

**TOPOLOGY**

Hub & Spoke | Ring

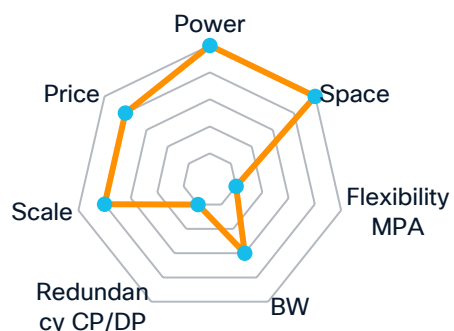
**CLUSTER SIZE**

Small | Medium | Large

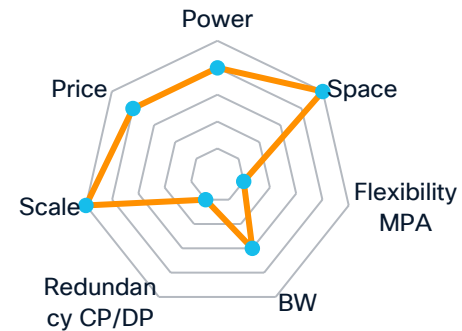
# Edge-Fabric: Choice of Clusters with Cisco 8000

## Power & Cost Optimized Clusters

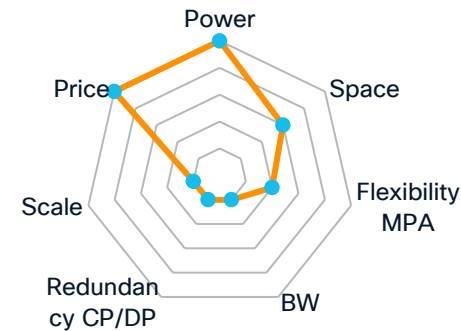
Compact-Leaf, Q200 Spine  
(2 Leaf:8711-48Z; 1 Spine: 8201-32FH)



Compact-Leaf  
(2 Leaf:8711-48Z; 1 Spine: 8711-32FH)

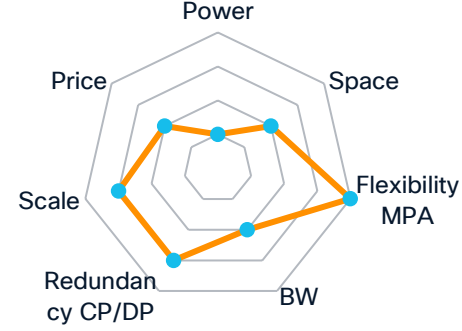


Access Leaf, Flex-Spine  
(4 Leaf:8011; 1 Spine: 8712-MOD)



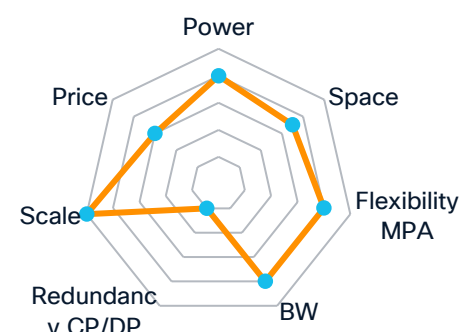
## CP/DP Redundant Clusters

Centralised Flex-Leaf  
(2 Leaf:8404; 1 Spine: 8711-32FH)

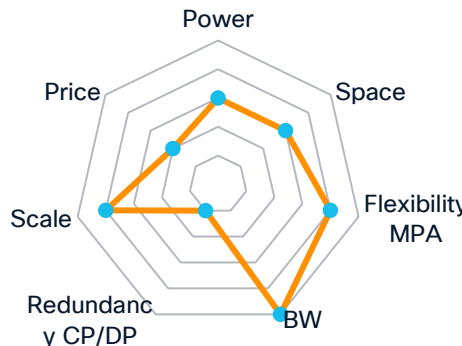


## High Bandwidth Scale Clusters

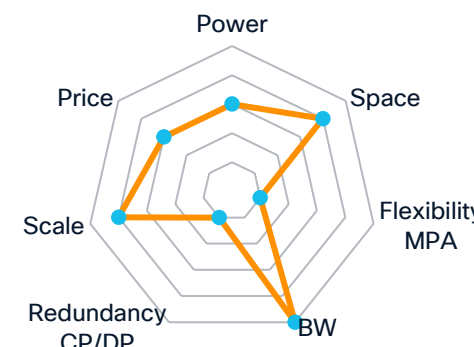
Flex-Leaf  
(2 Leaf:8712-MOD; 1 Spine: 8711-32FH)



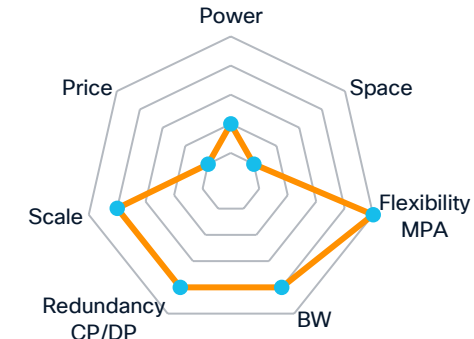
Flex-Leaf High BW Spine  
(2 Leaf:8712-MOD; 1 Spine: 8212-48FH)



Compact-Leaf High BW Spine  
(2 Leaf:8711-48Z; 1 Spine: 8212-48FH)



Flex-Leaf Centralised Q200 Spine  
(2 Leaf: 8712-MOD; 1 Spine: 8608)



Power

Space

Flexibility

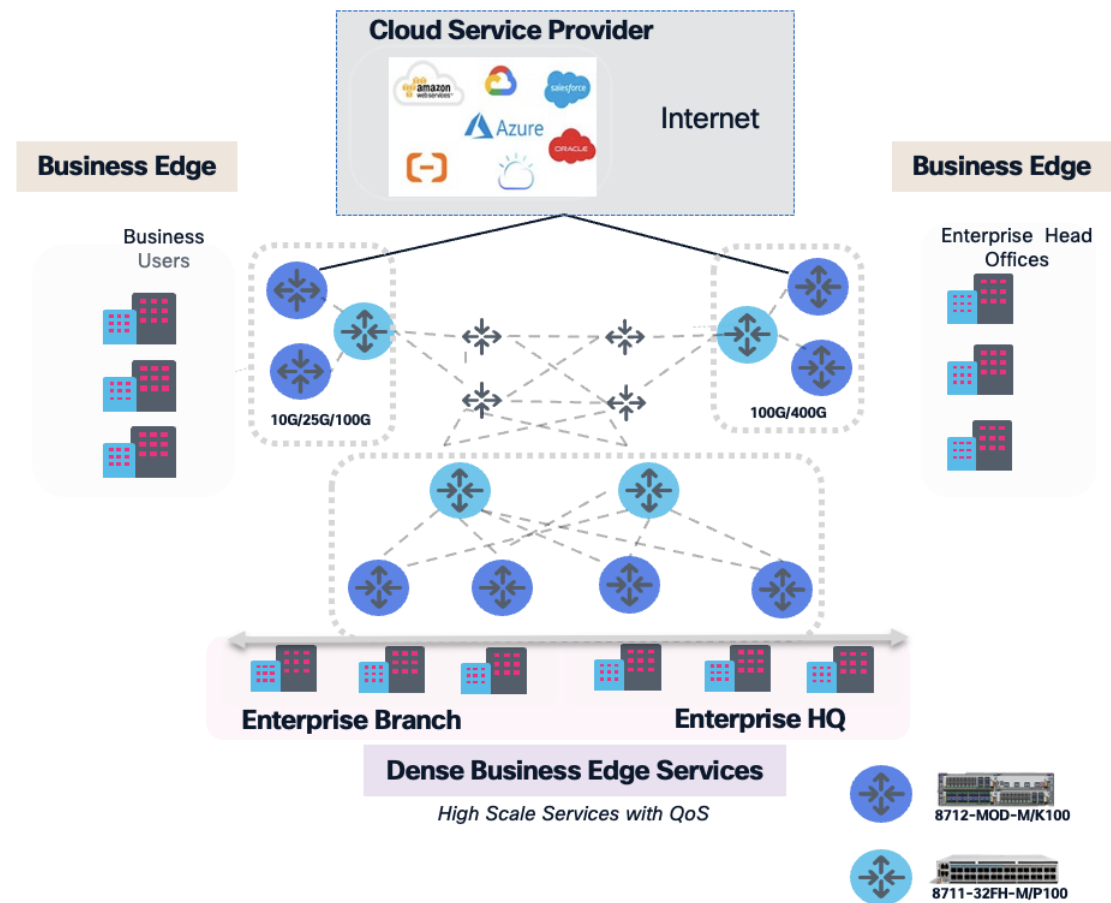
Bandwidth

CP/DP HA

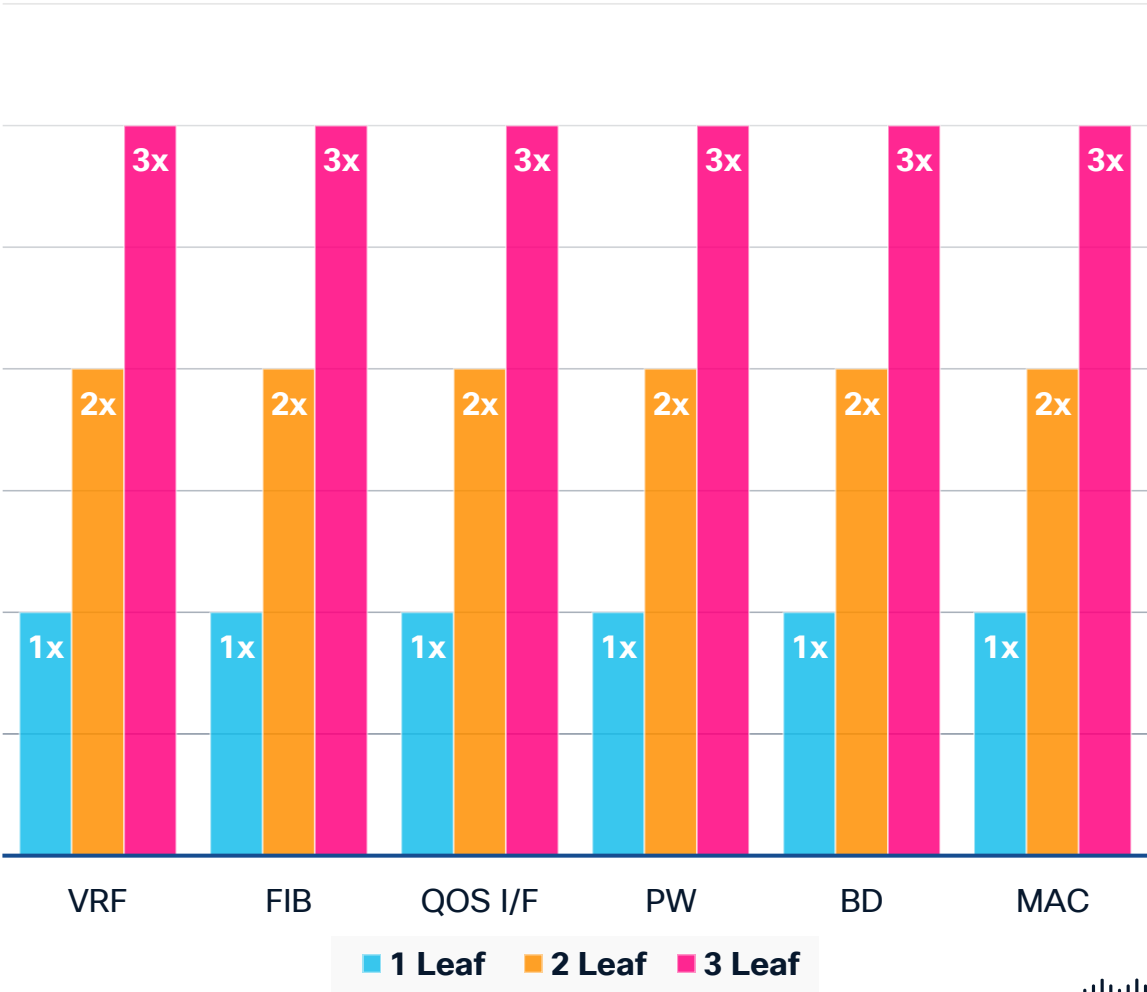
Scale

Price

# Edge-Fabric: Services Scale Out



## Horizontal Scale-Out



Note: Fabric Scale factor based on theoretical approximation.

# Scale: Edge Fabric vs Modular systems

*Fabric Scale-Out **superset** of Modular Scale*

## Fabric Scale Out:

- IP routes
- MAC Routes
- BGP RIB
- VRF
- Service Labels
- SW OAM
- BGP Peers

## Modular Full Scale Up:

- Bandwidth
- Ports
- ARP/ND
- Access-List Entries
- IGP Labels
- HW OAM: BFD, CFM

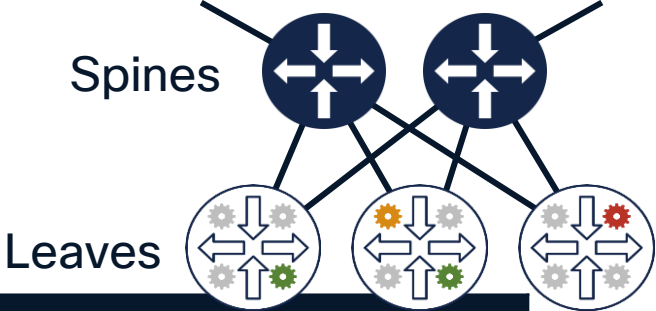
## Modular Limited Scale Up:

- L2VPN
- Interfaces
- Queues
- Policers

*System Scale Limits*

# Edge Fabric Summary

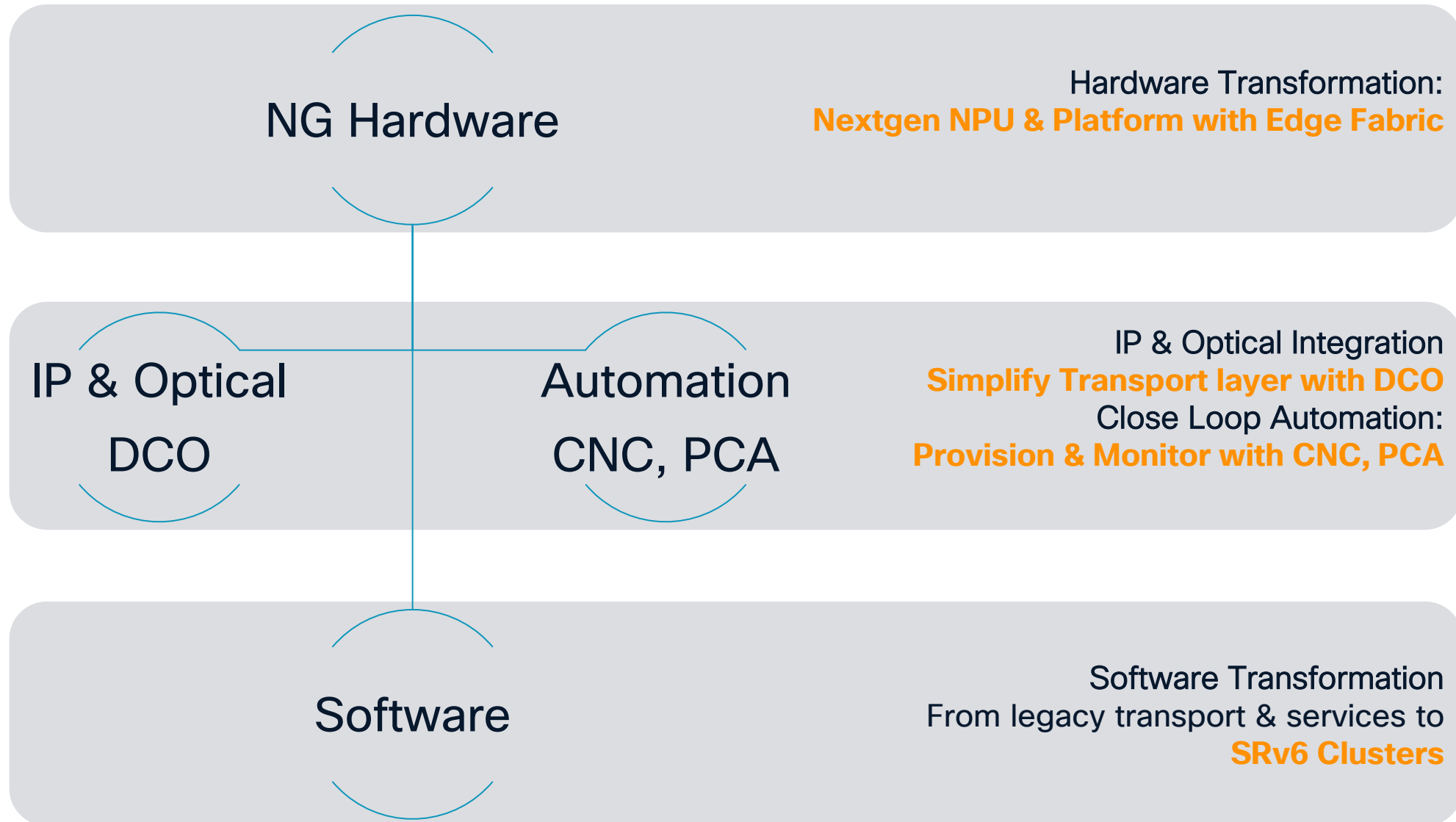
With State-of-art Cisco Silicon One 8000 Family



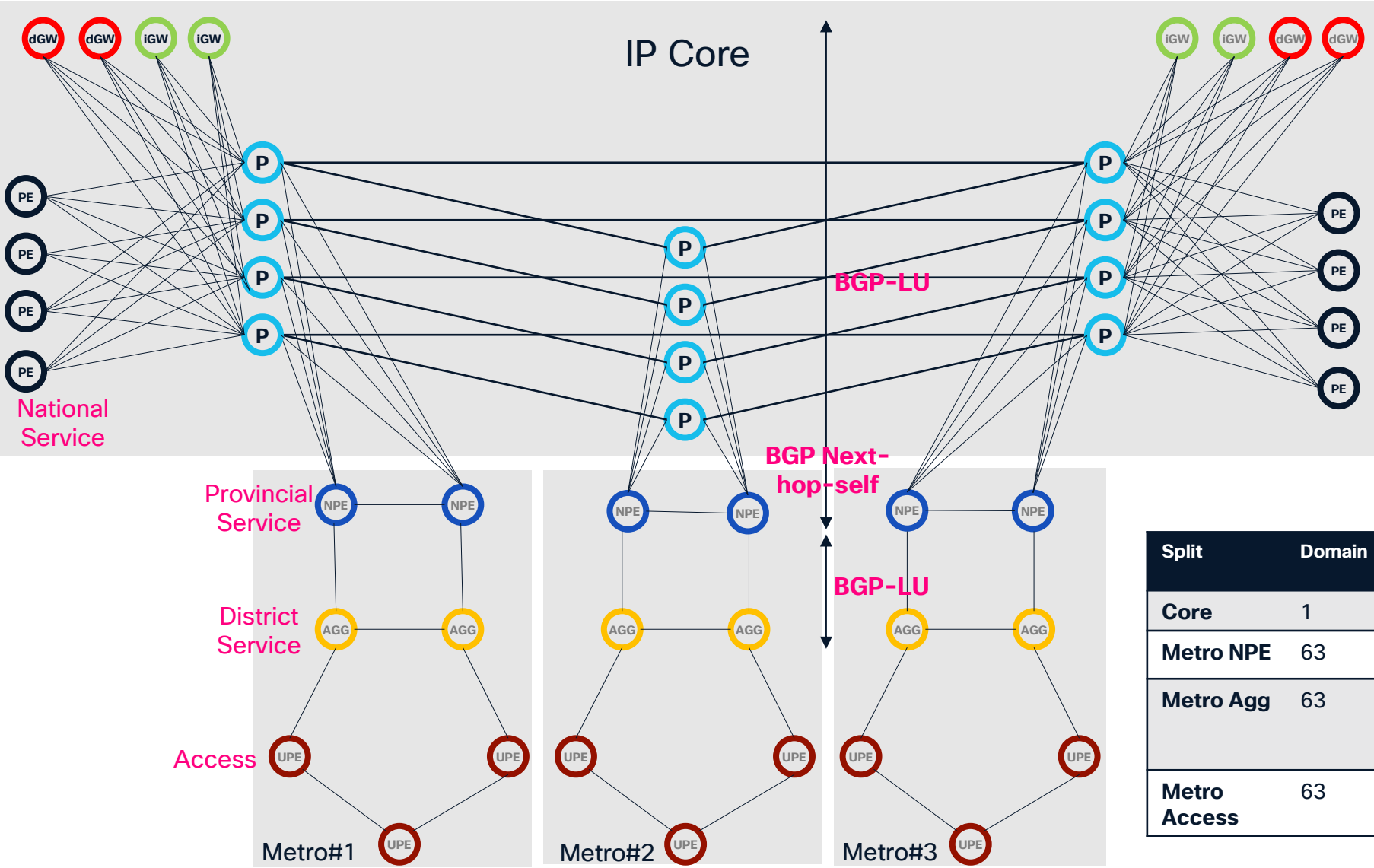
| Attribute       | Impact   | Details                                                                                                                                                                                                                     |
|-----------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Router Scale    | Positive | Horizontal Scale-out unmatched by Modular chassis                                                                                                                                                                           |
| Redundancy      | Positive | Smaller blast radius and faster reload time with network level redundancy                                                                                                                                                   |
| Network Scale   | Negative | Increase in number of nodes increases operation complexity & contributes to increase in scale of control plane (BGP, TLDP ..)<br>Must be managed with automation & optimized with NG technologies (SR PCE/ODN, SRv6 & EVPN) |
| Services Impact | Positive | Services scale will be spread across different leaf devices closer to user                                                                                                                                                  |
| Cost Impact     | Positive | Use of highly optimized NPU (Silicon-One) brings cost benefits in terms of Space, Power & Cost per service                                                                                                                  |

# Edge-Fabric for Unified MPLS network

# Network Transformation Journey



# UMMT Traditional Deployment



### Architecture

- **FMC** (Fixed Mobile Convergence).
- 50M Mobile Subs + 10M FTTx Subs + 1M IPTV

### Technology (Since 2015)

- **Unified MPLS** with 01 IPBN + 63 x Metro Ethernet Networks
- Transport: OSPF, LDP, RSVP-TE,
- Domain stitching: BGP-LU
- Services: T-LDP for L2VPN, BGP for L3VPN

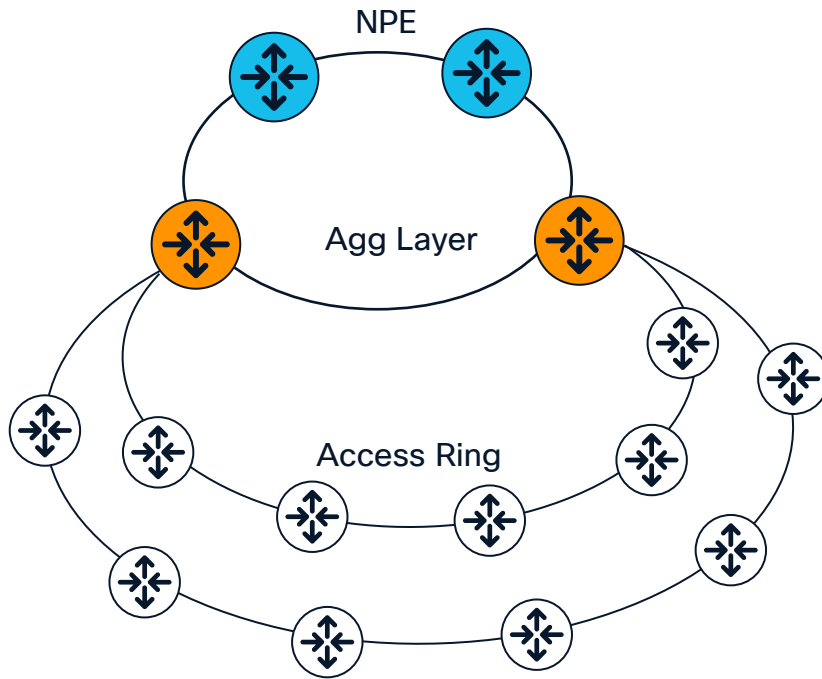
### Inventory:

- Multi-vendor Network

| Split        | Domain | Nodes per Domain       | # of Rings per domain | Total nodes |
|--------------|--------|------------------------|-----------------------|-------------|
| Core         | 1      | 300                    | -                     | 300         |
| Metro NPE    | 63     | 2                      | 1                     | 126         |
| Metro Agg    | 63     | 60<br>(2 AGG per ring) | 30                    | 3780        |
| Metro Access | 63     | 2500<br>(10 per ring)  | 250                   | 157500      |

# Edge Fabric – Hardware Transformation

# Edge Fabric: Metro Layer Scale-out



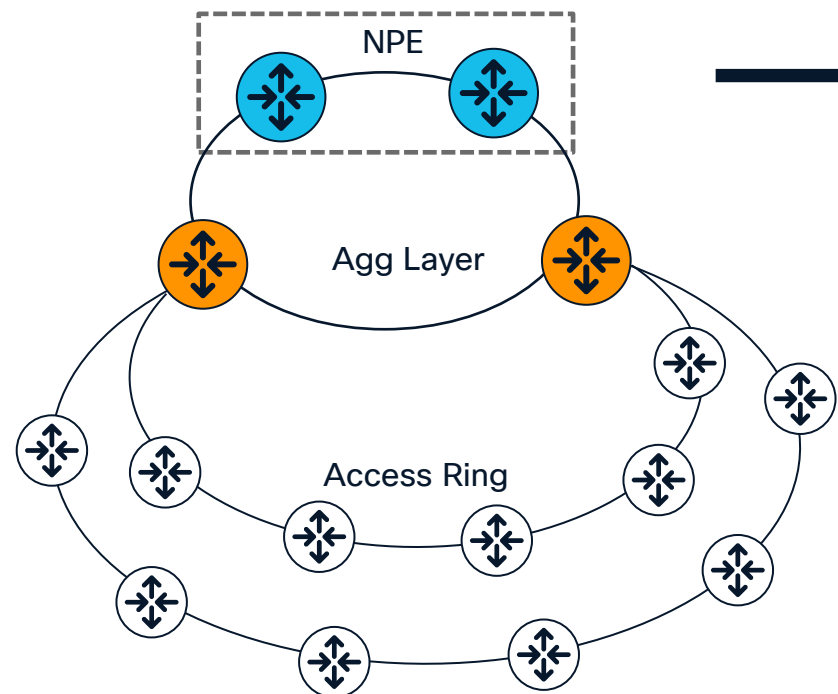
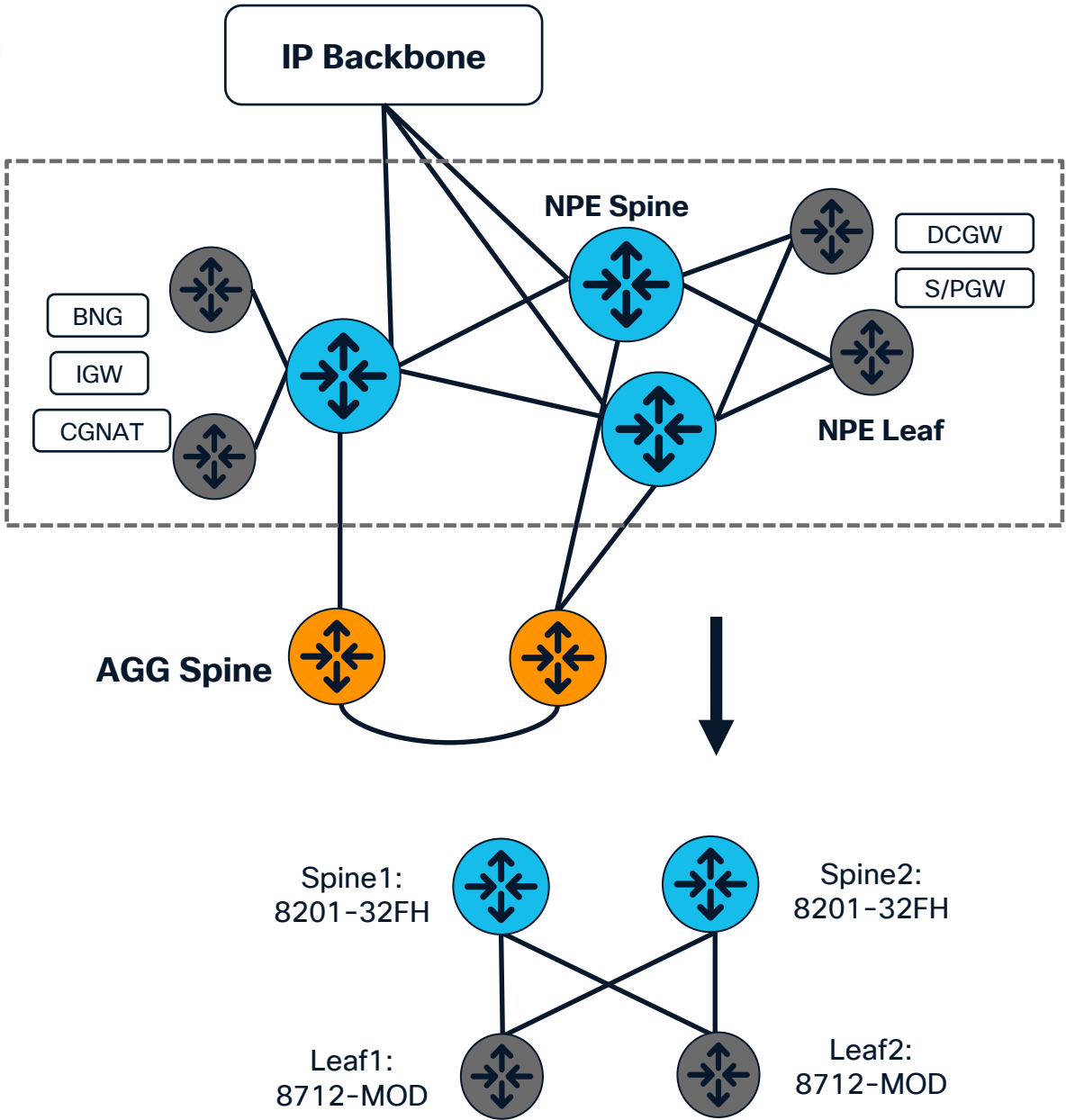
Edge Fabric Scale out at 2 Layers

1. NPE Layer

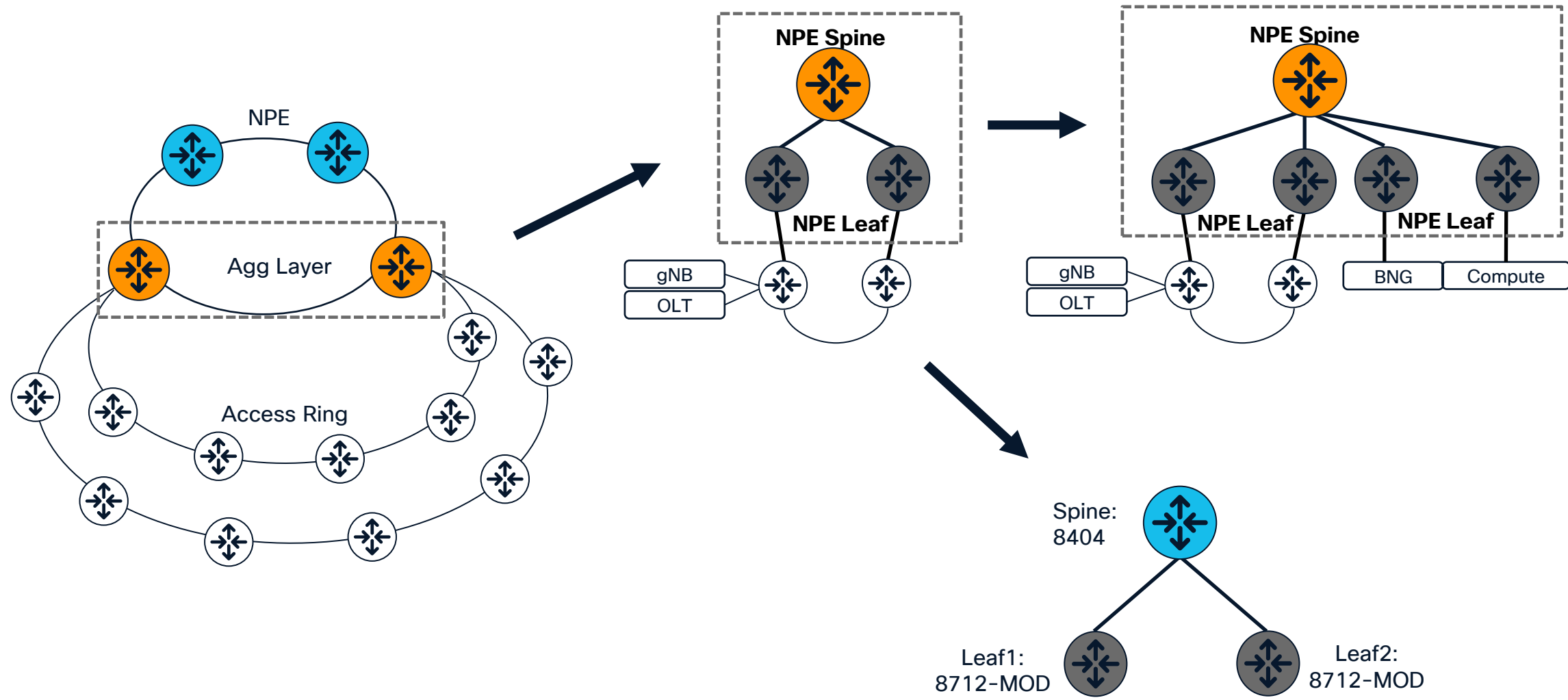
2. AGG Layer

Replacing large modular chassis with “Edge fabric” & Simplify Architecture

# Edge Fabric: Metro NPE Layer



# Edge Fabric: Metro AGG Layer



# Edge Fabric: Rack Space & Power Saving

## AGG Layer

| ASR 9010           | Edge Fabric      |
|--------------------|------------------|
| 880G Port Equipped | 4T Port Equipped |

| ASR 9010 | Edge Fabric   |
|----------|---------------|
| 21RU     | 4RU x 1 Spine |
|          | 2RU x 2 Leaf  |
| 21RU     | 8RU Total     |

| ASR 9010 | Edge Fabric     |
|----------|-----------------|
|          | 1000W x 1 Spine |
|          | 400W x 2 Leaf   |
| 3300W    | 1800W Total     |

## NPE Layer

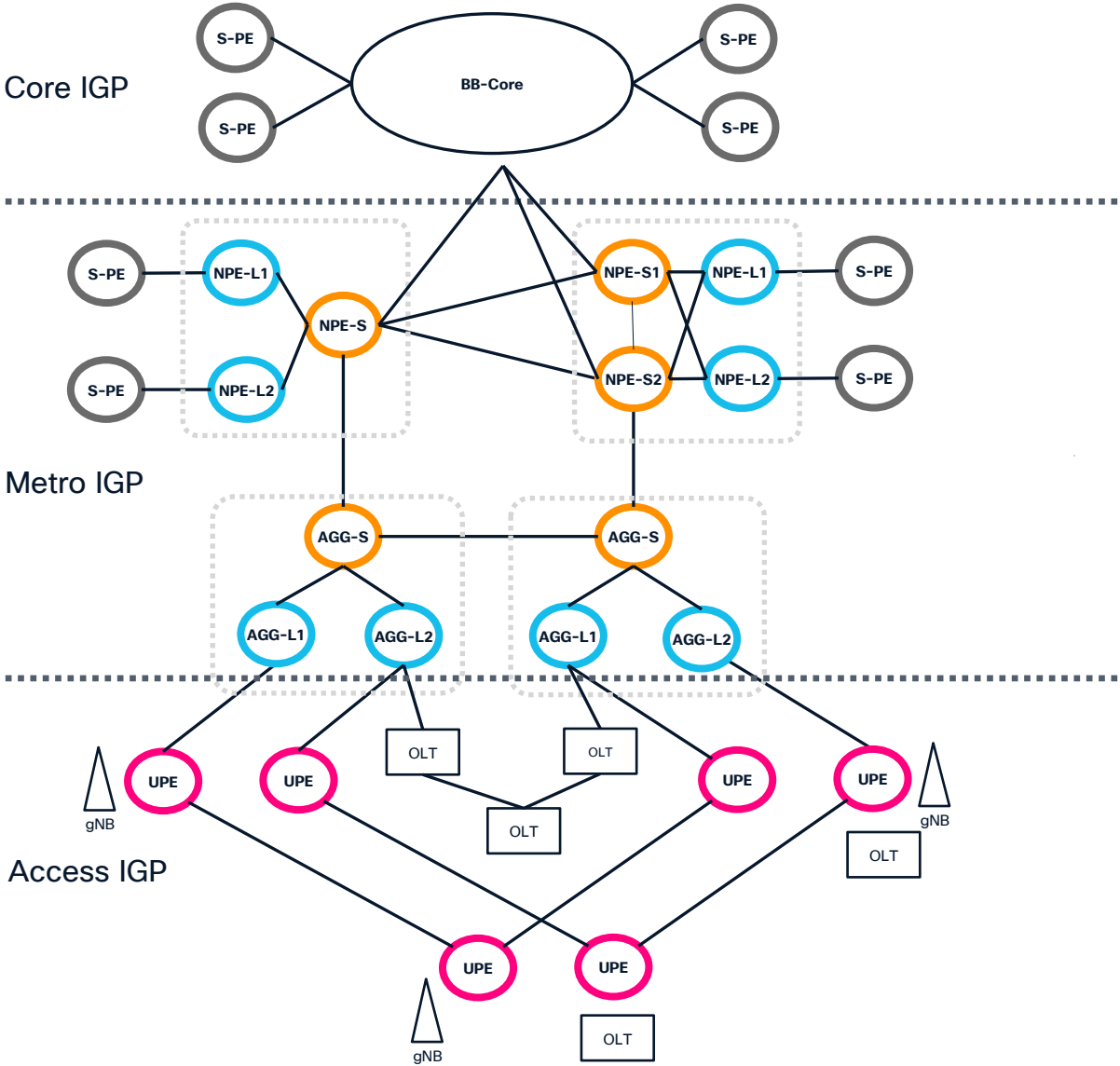
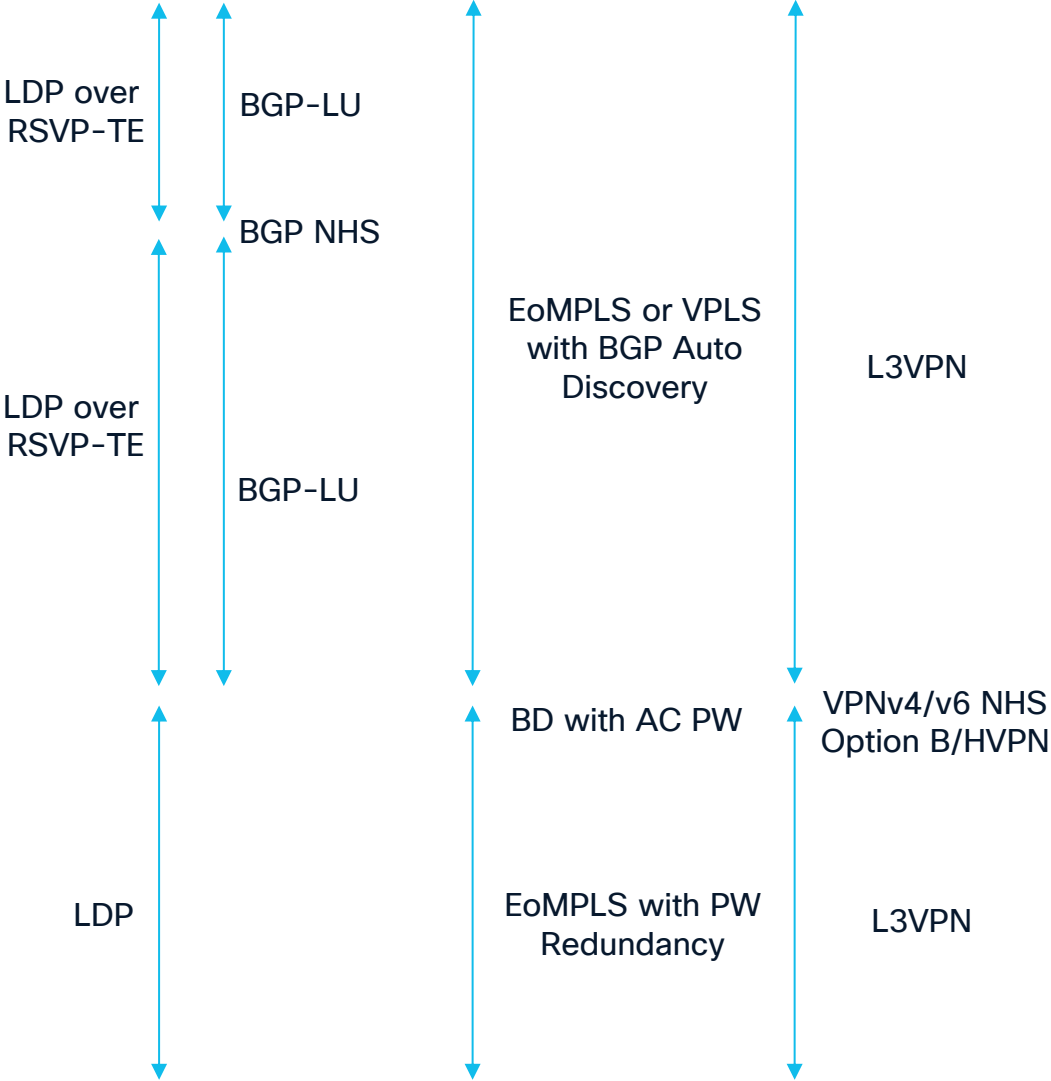
| ASR 9922           | Edge Fabric       |
|--------------------|-------------------|
| 6.2T Port Equipped | 19T Port Equipped |

| ASR 9922 | Edge Fabric   |
|----------|---------------|
| 44RU     | 1RU x 2 Spine |
|          | 2RU x 2 Leaf  |
| 44RU     | 6RU Total     |

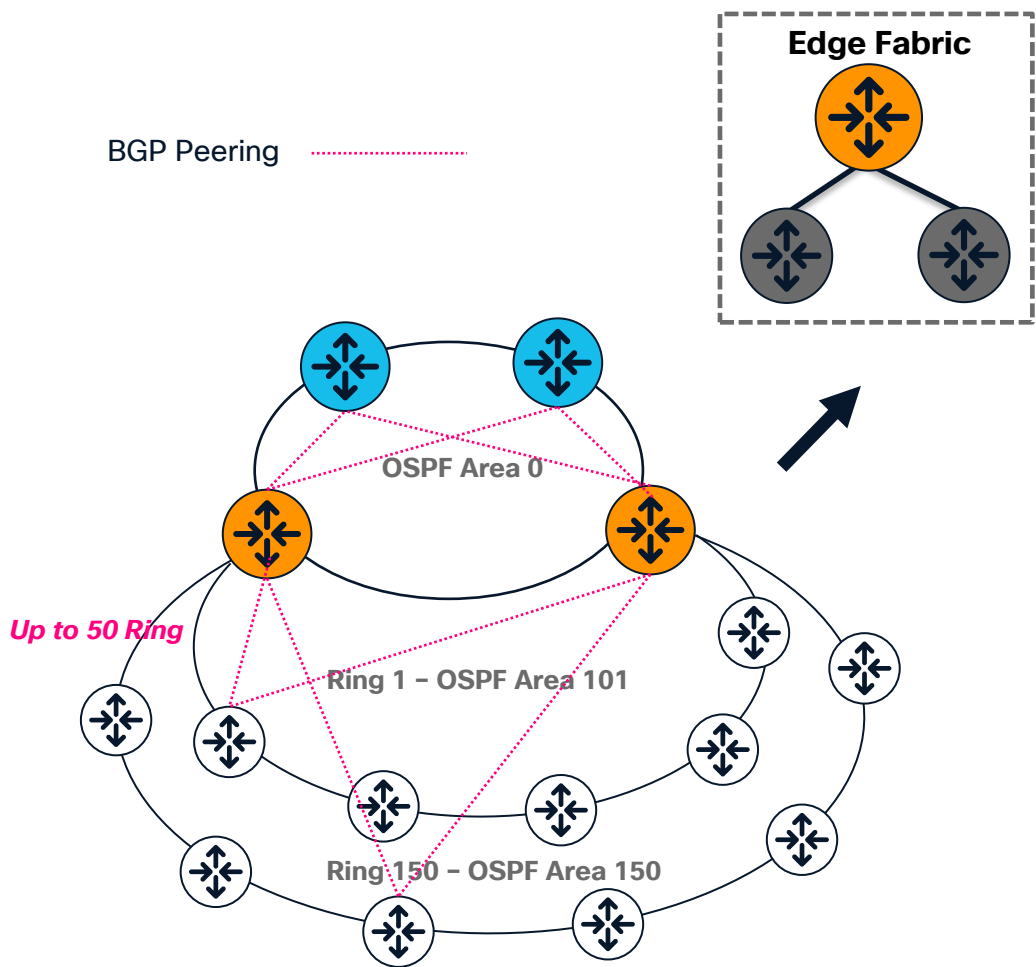
| ASR 9922 | Edge Fabric    |
|----------|----------------|
|          | 300W x 2 Spine |
|          | 400W x 2 Leaf  |
| 5886W    | 1400W Total    |

# Edge Fabric - Software Transformation

# Current Logical Design

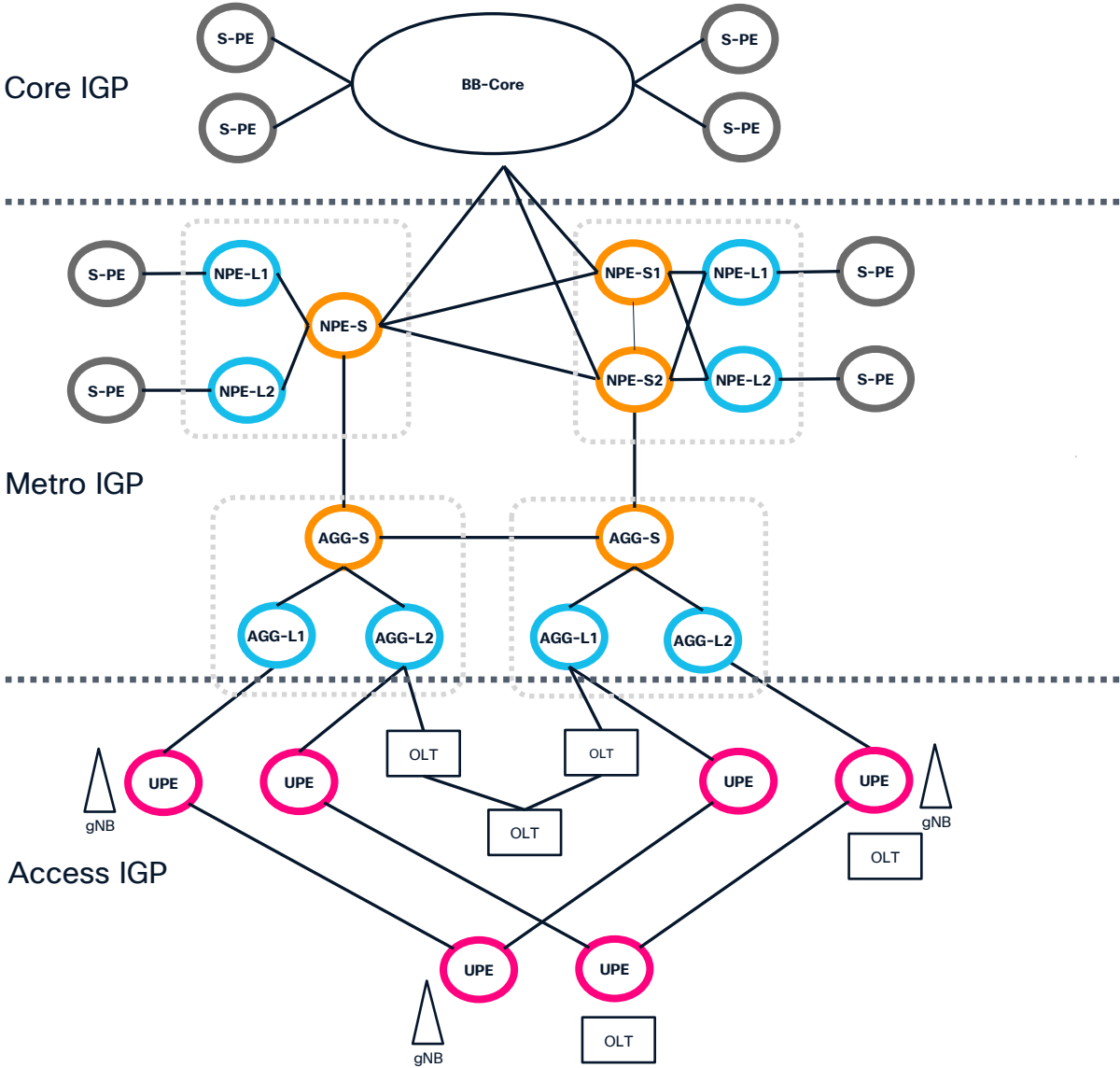


# Edge Fabric: Feature Scale Impact

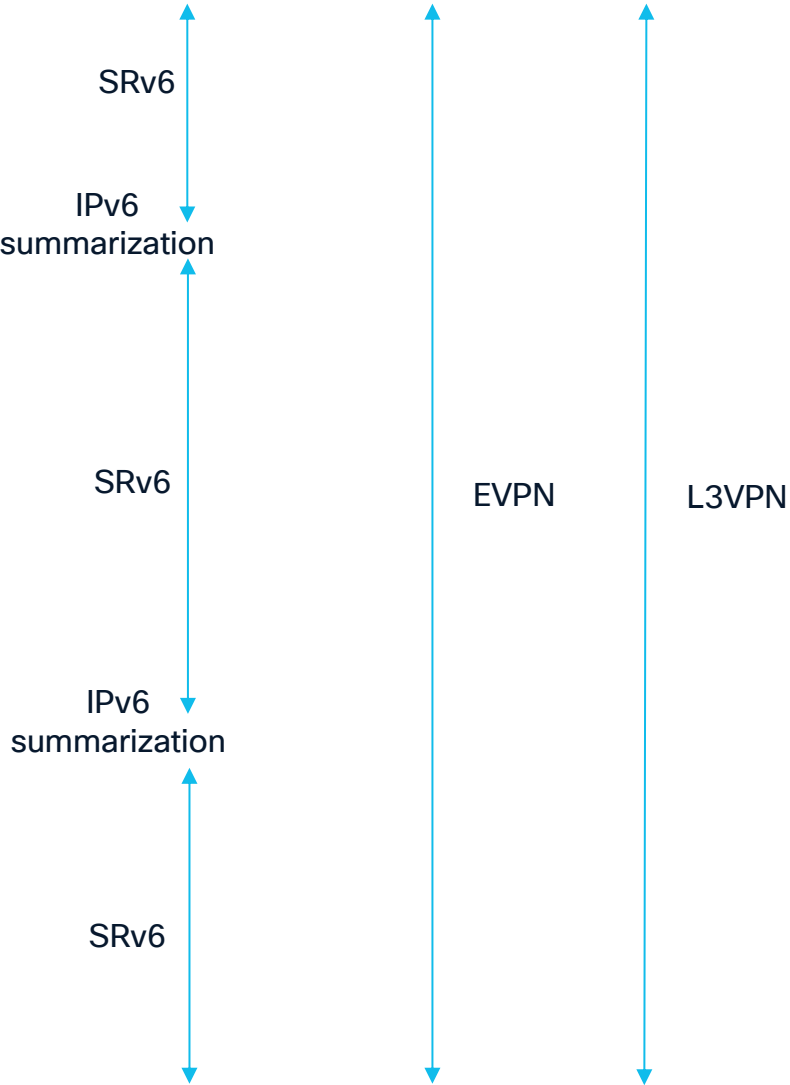


| Features                                                | Router Scale Impact                              |
|---------------------------------------------------------|--------------------------------------------------|
| OSPF LSDB Size Area 0                                   | Increase                                         |
| OSPF LSDB Size Other Areas (per AGG leaf)               | Reduced<br>(Access rings split b/w AGG Leaf)     |
| IGP/LDP Adjacencies(per AGG leaf)                       | Reduced<br>(Access rings split b/w AGG Leaf)     |
| TLDP Peering (per AGG leaf)                             | Increase<br>Optimize using EVPN                  |
| BGP Neighbors (per AGG leaf)                            | Reduced<br>(Access rings split b/w AGG Leaf)     |
| BGP LU prefixes, Remote labels, Next-hop (per AGG leaf) | Increase<br>(Proportional to NPEs/AGG scale-out) |
| L3VPN Services (inc option B)                           | No change                                        |
| L2VPN PW, BD, MAC                                       | Reduced<br>(Access rings split b/w AGG Leaf)     |

# SRv6 Simplification: End State



Final state :End to End L3VPN/EVPN



SRv6 active in Metro IGP, Core IGP, Access IGP with summarization

# SRv6 vs Traditional Resources usage

| Resources                      | SRv6 usage vs Traditional | Details                                                                                                                                                                                                         |
|--------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FIB scale – BGP + IGP          | Less                      | <ul style="list-style-type: none"><li>• IPv6 summarization at border routers</li><li>• Significant reduction on the BGP-LU route scale</li><li>• IPv6 only core</li></ul>                                       |
| MPLS labels – VPN/GRT Services | Same                      | <ul style="list-style-type: none"><li>• Similar uSID allocation for service labels</li></ul>                                                                                                                    |
| MPLS labels – BGP LU           | Very Less / Nil           | <ul style="list-style-type: none"><li>• IPv6 summarization removes BGP-LU requirement</li><li>• BGP-SU SID usage during migrations</li></ul>                                                                    |
| MPLS labels– IGP               | Less                      | <ul style="list-style-type: none"><li>• Default SID allocation only for locators</li></ul>                                                                                                                      |
| Transport complexity           | Simpler                   | <ul style="list-style-type: none"><li>• No extra Shim layers for MPLS labels</li><li>• Less recursion levels</li><li>• No intermediate states like RSVP-TE</li></ul>                                            |
| Forwarding Efficiency          | Better                    | <ul style="list-style-type: none"><li>• IPv6 based forwarding better over complex implementations ( VPN over LU over LDP over RSVP-TE )</li><li>• Less NPU cycles, better forwarding with low latency</li></ul> |

# Summary

# Key Takeaways

- Edge Fabric adds agile scale-out option for Service Edge node design
- NPUs are getting faster, greener with optimal scale
- Cisco 8000 with Silicon One is suitable for Edge Fabric
- Edge Fabric & Cisco 8000 will offer higher bandwidth with reduced power consumption and rack space
- Use of automation & latest technologies(SRv6, EVPN) will help bring down the operational complexities and Network scale

# ASN Customer Testimonial

REFERENCE

## CHALLENGES

### Customer S

- Complex and fragmented network infrastructure
- High power consumption
- Network reliability issues

### Customer C

- Adapting to complex customer demands
- Simplifying expansive network operations
- Aligning service quality with sustainability goals
- Balancing cost-effectiveness with scalability

### Customer A

- Simplify network operations
- Deliver cost-optimized performance and capacity
- Need for increased bandwidth



## Solutions

- Cisco Silicon One Cisco 8000 platform (All 3 Customers)
- Cisco Routed Optical Networking (All 3 Customers)
- SRv6 adoption (Customer S)
- Cisco CNC, PCA, NSO (Customer C, A)

## RESULTS

### Customer S

- Simplified & Converged Network
- **90% Power saving**
- **40% Lower Opex**
- Improved Reliability

### Customer C

- Simplified Network
- **50% Lower Opex**
- **97% Power saving**
- Scalable & Sustainable cost-effective services

### Customer A

- Cost effective Network. Fewer interfaces to manage
- **64% CAPEX saving**
- Increased capacity, and lower network cost and consumption

# Q & A

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