
TECHNICAL DECISION MAKER PRESENTATION

Cisco Catalyst 9000 Switching Family

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

Source presentation: Cisco. Layer23-Switch added this cover and closing resource page. Cisco and related marks belong to Cisco Systems, Inc. This material may include historical roadmap content; verify current specifications, lifecycle status, licensing, and availability before purchase or deployment.



Cisco Catalyst 9000 Series Technical Decision Makers (TDM)

Technical Marketing Engineering
July 2023





Agenda

1. Portfolio Overview

2. C9K Building Blocks

3. Catalyst 9600 Series

4. Catalyst 9500 Series

5. Catalyst 9400 Series

6. Catalyst 9300 Series

7. Catalyst 9200 Series

8. ASICs

9. IOS-XE

10. High Availability

11. Software Features

- Quality of Service
- Multicast
- Security
- App Visibility
- Optics
- Application Hosting
- Overlays
- Programmability & Automation

12. C9K Innovations

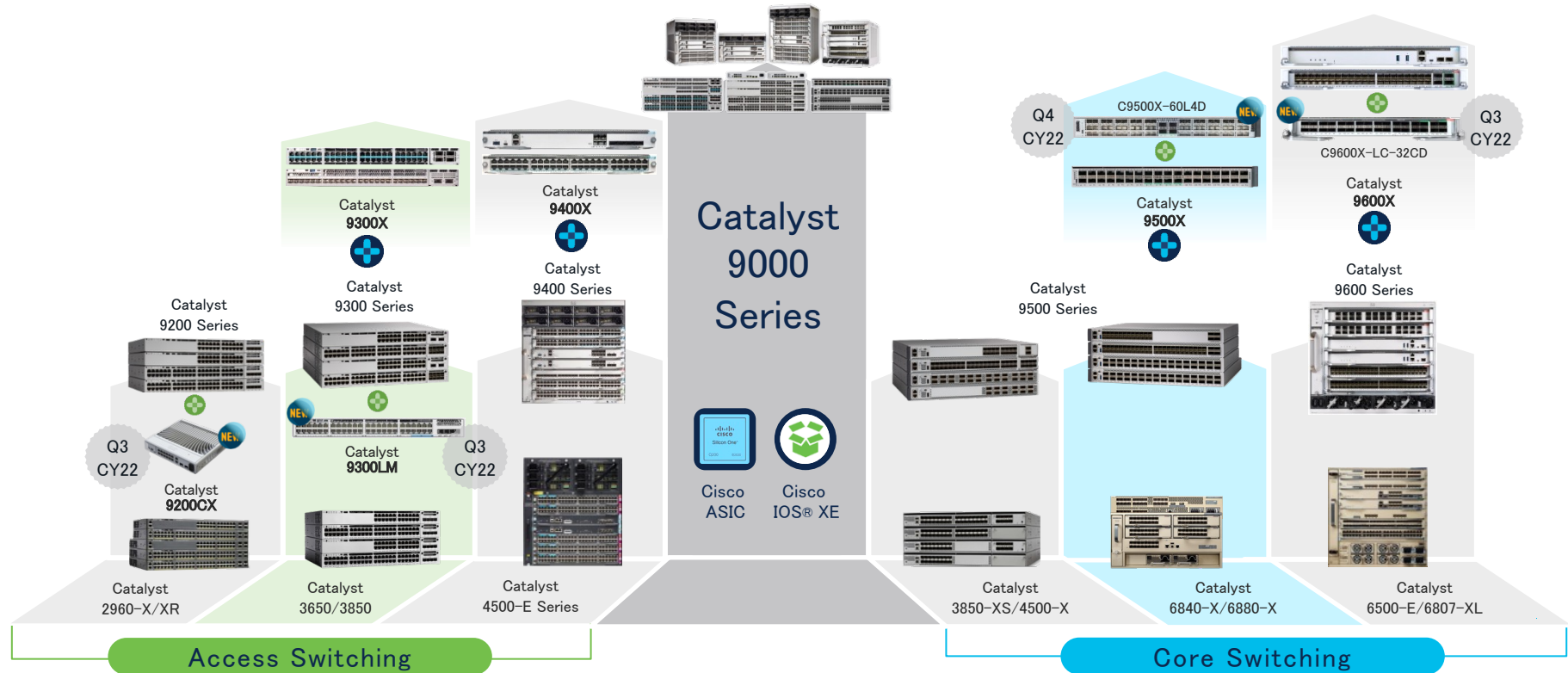
13. Design Considerations

Cisco Catalyst 9000 Switching Portfolio

One Family from Access to Core – Common Hardware & Software

2022

NEW





Catalyst 9000

Building blocks

Catalyst 9000 Series – Common Building Blocks



Programmable x86 Multi-Core CPU

Application Hosting
Secure Containers



Open IOS XE® Polaris

Model-Driven APIs
Modular Patching



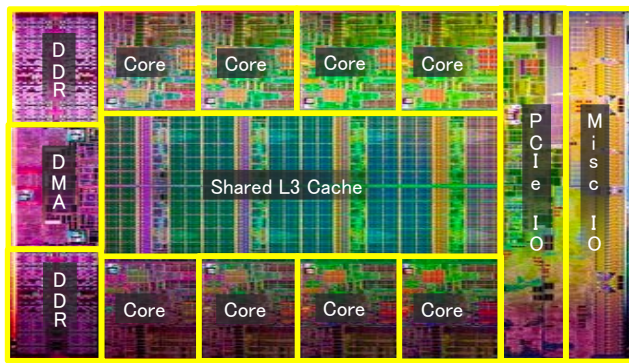
Cisco UADP & Silicon One™

Programmable Pipeline
Flexible Tables

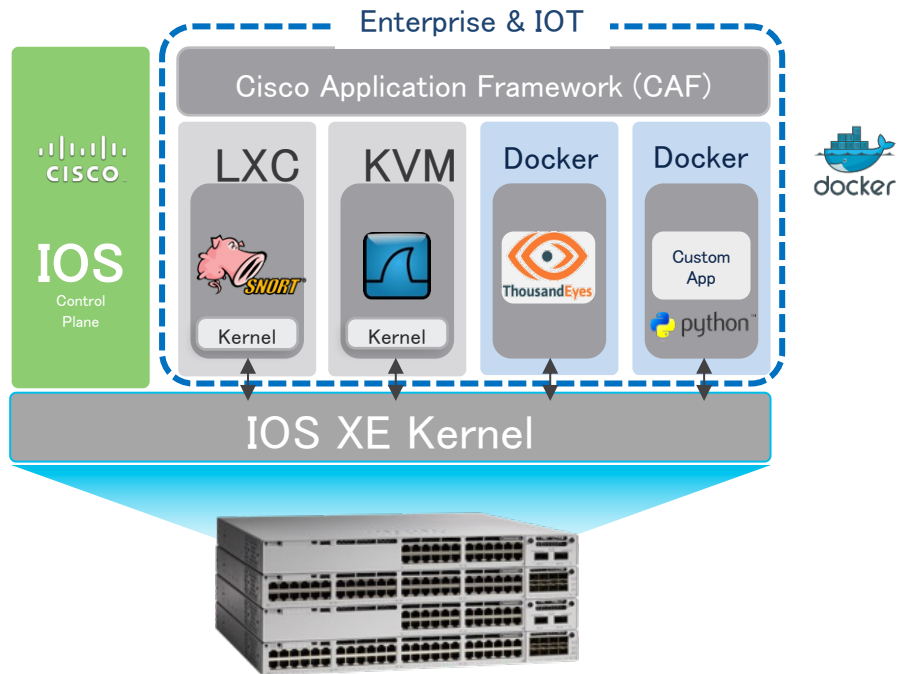
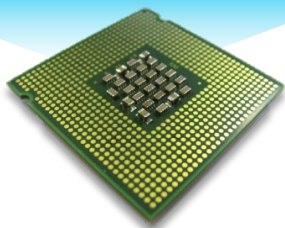
Same IOS XE image for both UADP* and Silicon One C9K platforms

* Catalyst 9200 Series uses IOS-XE Lite

Multi-Core CPU – Built for App Hosting



x86
CPU

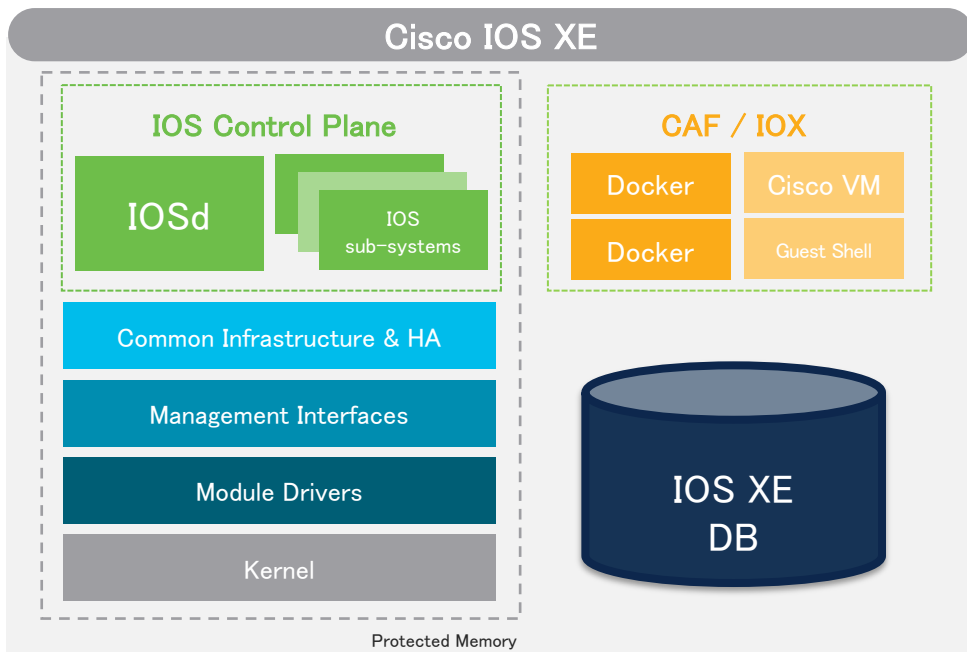


x86 CPU* enables hosting NFV devices, Containers and 3rd-party Apps

* Catalyst 9200 Series uses an embedded ARMv8 CPU



Cisco IOS XE – A Modern Operating System



Cisco IOS subsystems

Resiliency and High Availability



Cisco IOS XE database

Programmability and Open models



IOX + Docker containers

Cisco and 3rd-party App hosting

Open, Model-Driven and Secure Operating System

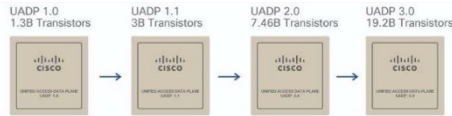


Custom ASICs – Programmable Silicon

Access Data-Plane



Cisco Silicon One™



Flexible Pipelines

Investment Protection



Adaptable Tables

Universal Deployment

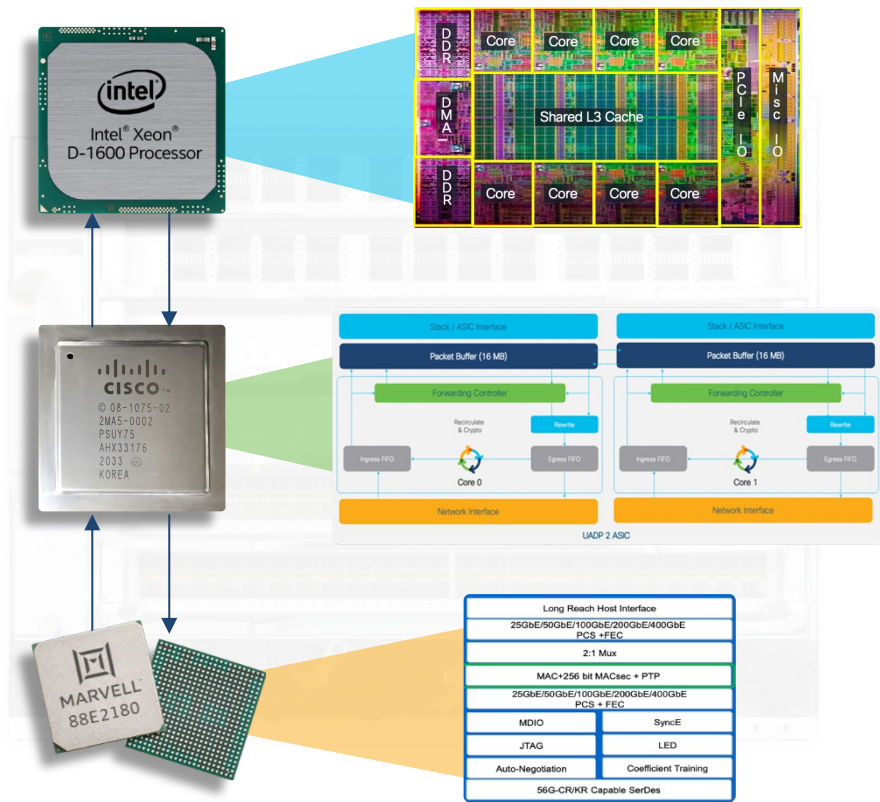


Scalable Resources

Enhanced Scale and Buffering

Flexible and Programmable ASICs – Adapt to New Technologies

Software vs. Hardware



CPU/DRAM

Where the OS “software” runs. Includes control-plane, data-plane and system-management functions.

- **OS layer** – IOSXE (IOSd) and Features, etc.
- **System layer** – FMAN, CMAN, IOMD, FED, etc.

ASIC(s)

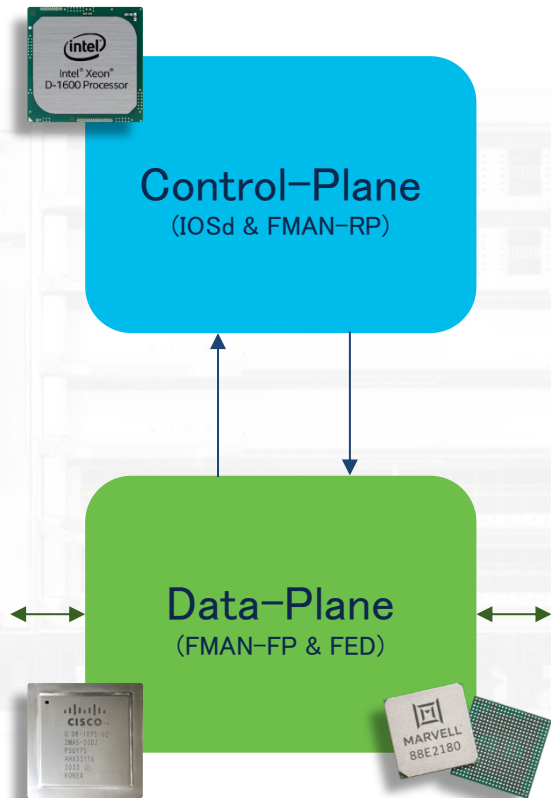
Where the “hardware” processing of traffic & services runs. Uses forwarding and state tables programmed by the software.

- **Forwarding** – L2, L3, ECMP, Encap, etc.
- **Services** – ACLs, QoS, Analytics, Encryption, etc.

Stub/PHY(s)

Transforms electrical and optical signals, splits or combines signals, and other various “physical” layer functions, such as encryption and timestamping.

Control-Plane vs. Data-Plane



Control-Plane

The “control-plane” (**Software**) is responsible for communicating with its neighbors, or control systems, to determine the forwarding topology and/or define network services. This is generally performed by one or more network protocols.

- **Routing Protocols** – BGP, OSPF, EIGRP, LISP, GRE, etc.
- **Switching Protocols** – VTP, PVST, MST, REP, QinQ, etc.

Data-Plane

The “data-plane” (**Software + Hardware**) is responsible for actual receive and transmit of network data traffic, and/or providing data services, based on information determined by the control-plane.

- **Forwarding** – L2 Switching, L3 Routing, Load-Balance, etc.
- **Services** – Access Control, QoS, Analytics, Encryption, etc.



Cisco Catalyst 9600 Series



Catalyst 9000 Modular Value Proposition

Key Modular Differentiation



Speed Transition

- 10/25G & 40G → 50G & 100/400G



Mission Critical Resiliency

- Redundant SUPs, LCs Fans and Power Supplies



Max Investment Protection

- 10+ Year Lifecycle
Easily replaceable modules



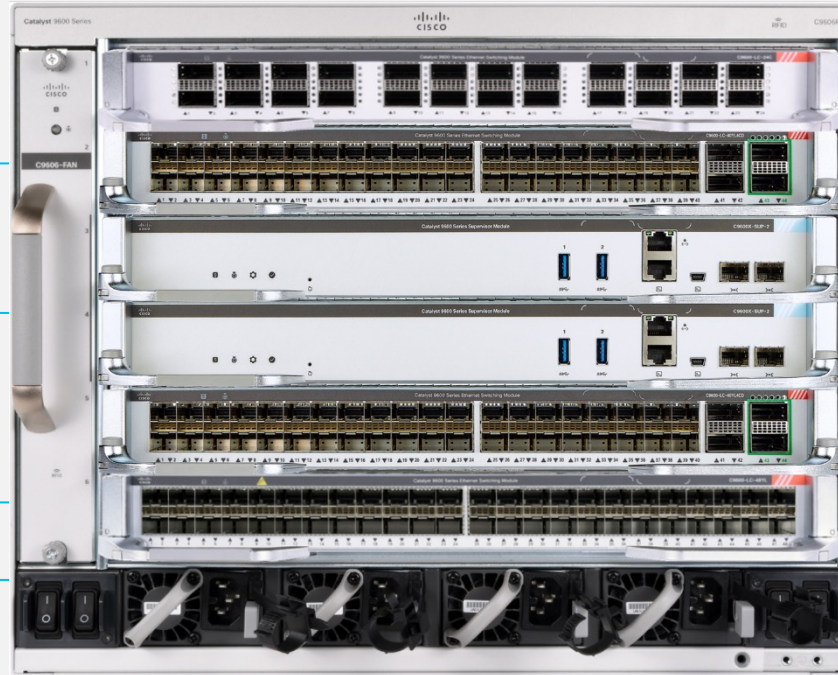
Architecture Flexibility

- Flexible ASIC templates, Deep Buffers



Catalyst 9600

Cisco Catalyst 9600 Series Chassis



Dual-serviceable
fan tray

Built-in RFID

Blue Beacons
(system/fan tray, sup,
line cards)

Modular power supplies

4-line card slots

2 supervisor slots
(dedicated)

3.2 Tbps per slot
from each
supervisor slot

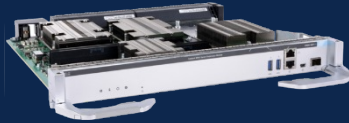
Dimensions
(HxWxD inches)
13.95 x 17.4 x 16.1
(8RU)

Catalyst 9600 Series

Extending modular core with a performance-optimized Supervisor 2



UADP
3.0



Supervisor 1

Total capacity

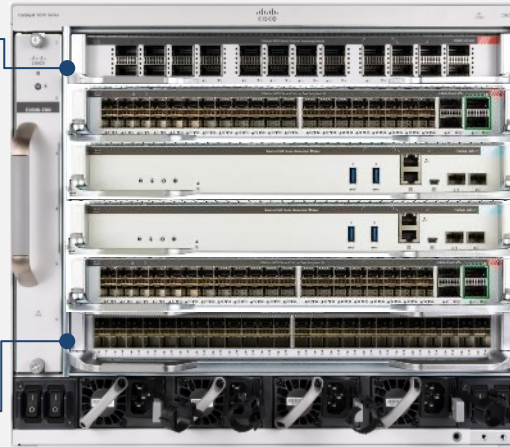
4.8 Tbps

Slot bandwidth

1.2 Tbps



Gen 1
1.2T per slot



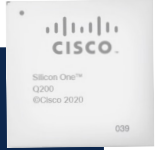
Gen 2
3.2T per slot

Gen 2
3.2T per slot

Gen 1
1.2T per slot



Silicon
One
Q200



Supervisor 2

Total capacity

12.8 Tbps

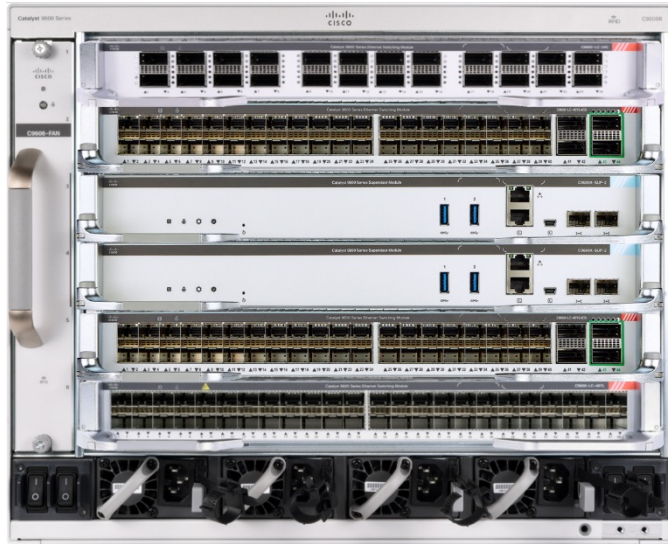
Slot bandwidth

3.2 Tbps



Cisco Catalyst 9600 Series

C9606R Chassis port-density



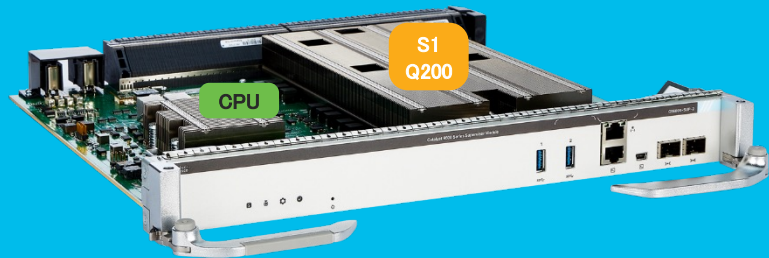
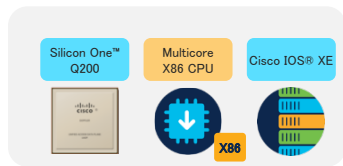
Line-Rate Non-Blocking

Port speed	Density with C9600-Sup-1	Density with C9600X-Sup-2	Maximum chassis density
400G	NA	8	32
200G	NA	16*	64
100G	48	96	128
50G	NA	224*	224
40G	96	96	128
25G	192	224	224
10G	192	224	224
5G	192	NA	192
2.5G	192	NA	192
1G	192	NA	192

* Roadmap

Catalyst 9600 Series

Supervisor 2 with Cisco Silicon One Q200



12.8 Tbps (full duplex)

3.2 Tbps per slot

1x Silicon One™ Q200 ASIC

8 core X86 CPU
@2.7 Ghz

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

32G DDR4 memory

Built-in RFID

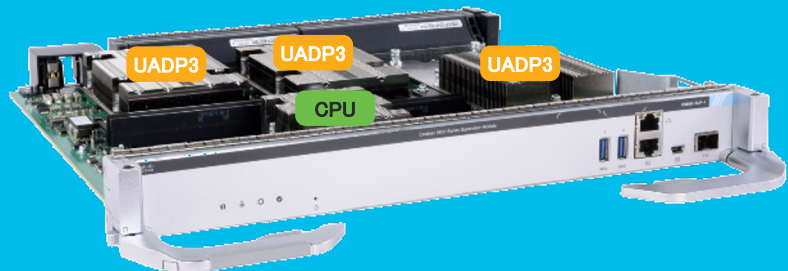
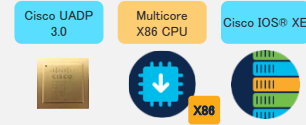
Mgmt ports: copper
and 2x10G fiber

Blue Beacon

2x USB3
1x mini-B USB console

Catalyst 9600 Series

Supervisor 1 with Cisco UADP 3.0



4.8 Tbps (full duplex)

1.2 Tbps per slot

3x UADP 3.0 ASIC

8 core X86 CPU
@2.0 Ghz

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

16G DDR4 memory

Built-in RFID

Mgmt ports: copper
and fiber

Blue Beacon

2x USB3
1x mini-B USB console

Catalyst 9600/X: New Combo Line Cards

Shipping

Catalyst® 9606R



C9600-LC-24C



C9600-LC-48YL



C9600-LC-48S

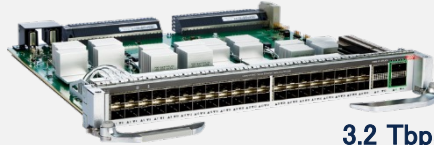


C9600-LC-48TX
(Multigigabit)



Combo line cards

C9600-LC-40YL4CD



IOS XE 17.7.1

3.2 Tbps with SUP-2
1.2 Tbps with SUP-1

C9600X-LC-32CD



IOS XE 17.9.1

With SUP-2 only
(3.2Tbps)

C9600X-LC-56YL4C



IOS XE 17.13.1

Provides for uplink requirement
without using additional slot

NEW



Dual-personality
line card



Flexible speed
support



Lower total BoM
cost, save on
additional line
cards



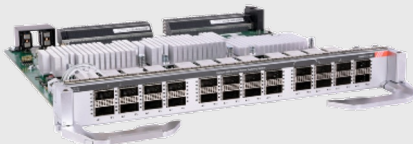
Cisco Catalyst 9600 Series

Line cards

Gen1 line cards

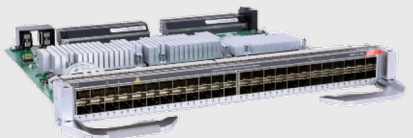
C9600-LC-24C – 100G/40G (fiber)

- 24 ports
- QSFP28/QSFP+
- Supports 100G and 40G



C9600-LC-48YL – 50G/ 25G/10G/1G (fiber)

- 48 ports
- SFP56/SFP28/SFP+
- Supports 50G,25G,10G,and 1G



C9600-LC-48TX – mGig (copper)

- 48 ports
- Copper 10G (NBASE-T/10BASE-T)
- Supports 10G,5G,2.5G,1G,100M and 10M



C9600-LC-48S– 1G (fiber)

- 48 ports
- SFP
- Supports 1G

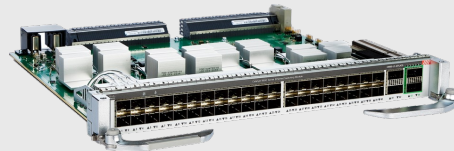


Gen2 line cards

C9600-LC-40YL4CD –

400G/200G³/100G/50G/40G/
25G/10G (fiber)

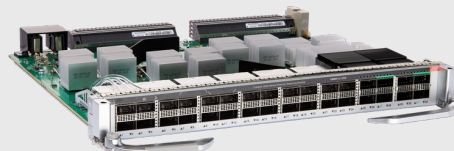
- 40+2+2 ports
- SFP56/QSFP56+/QSFPDD
- Supports 400G,200G³,100G,50G,40G,25G and 10G



C9600X-LC-32CD –

400G/200G³/100G/40G(fiber)

- 30+2 ports
- QSFP28/QSFPDD
- Supports 400G,200G³,100G, and 40G



C9600X-LC-56YL4C –

100G/50G/40G/25G/10G (fiber)

- 56 50G+4 100G ports
- SFP56/QSFP28
- Supports 100G, 50G, 40G, 25G, 10G



³ HW Capable

C9600-LC-40YL4CD

Gen2 Modules – Combo 40 x SFP + 4 x QSFP

IOS-XE 17.7.1

3.2
Tbps

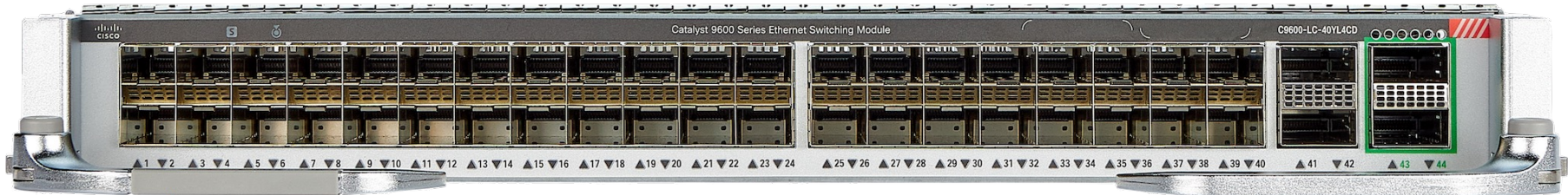
- **3.2 Tbps when working with C9600X-SUP-2**
 - 40x SFP56 ports – 10/25/50GE
 - 2x QSFP56 ports – 40/100/200GE
 - 2x QSFPDD ports – 40/100/200/400GE
- **1.2 Tbps when working with C9600-SUP-1**
 - 40x SFP28 ports – 1/10/25GE
 - 2x QSFP28 ports – 40/100GE
- **8x CDR5M PHYs**
 - MACSec, WAN-MACSec, ClearTag v3.4
 - IEEE 1588 & PTPv2
 - Hitless MUX (HMUX)
- **Various Breakout & QSA support (QSFP ports)***



Supervisor 2



Supervisor 1



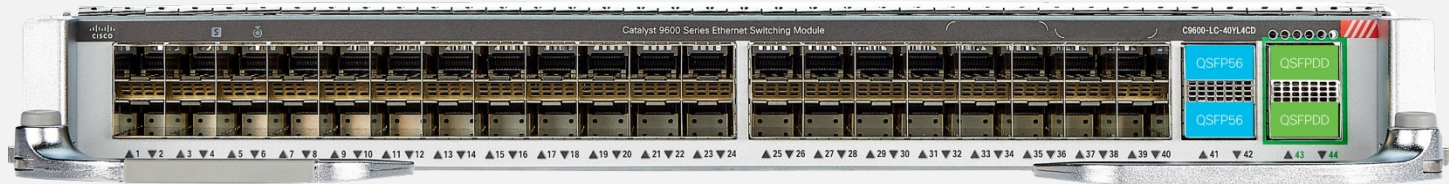
* SW Roadmap (FCS+)

C9600-LC-40YL4CD ports and speeds support

with SUP-2: 3.2 Tbps

40x 10/25/50G* + 2x 40/100/200G* + 2x 40/100/200*/400G

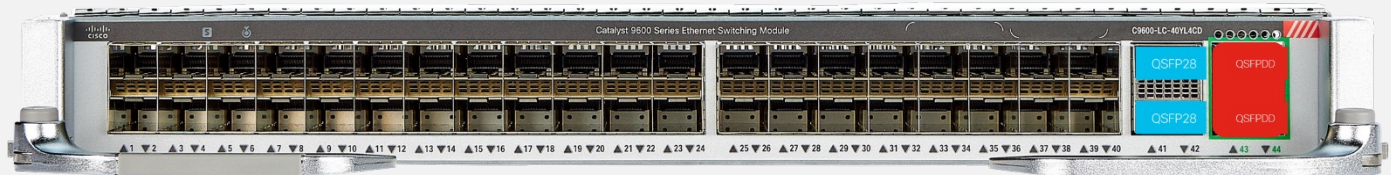
Cisco IOS® XE 17.7.1



with SUP-1: 1.2 Tbps

40x 1/10/25G + 2x 40/100G

Cisco IOS XE 17.8.1

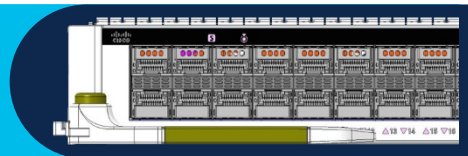


* Roadmap

Port-group Command-Line Interface (CLI)

Q200 SerDes has a limit that requires adjacent SFP ports to be the same speed

- Requires a new configuration for a “port group” of two ports to set the same speed
- Default selection is the per-module native port speed (for example, 50G for 48YL4CD)



```
[no] hw-module slot <1-6> port-group <1-20|range> select <10G|25G|50G>
```

```
C9600X-SUP2(config)# hw-mod slot 6 ?
logging      Logging onboard
port-group   configure feature on Port-group
shutdown     Shutdown a fru

C9600X-SUP2(config)# hw-mod slot 6 port-group ?
<1-20>       port-group to apply feature
range        Range of port-group

C9600X-SUP2(config)# hw-mod slot 6 port-group 1 ?
select       configure selected speed

C9600X-SUP2(config)# hw-mod slot 6 port-group 1 select ?
10G          Speed of 10Gbps
25G          Speed of 25Gbps
50G          Speed of 50Gbps

C9600X-SUP2(config)# hw-mod slot 6 port-group 1 select 10g ?
<cr>        <cr>

C9600X-SUP2(config)# hw-mod slot 6 port-group 1 select 10g
C9600X-SUP2(config)#end
C9600X-SUP2#
```

```
C9600X-SUP2# sho hw-mod slot 6 port-group
```

Port-group	Ports	Speed
1	Fif6/0/1, Fif6/0/2	10G
2	Fif6/0/3, Fif6/0/4	NONE
3	Fif6/0/5, Fif6/0/6	NONE
4	Fif6/0/7, Fif6/0/8	NONE
5	Fif6/0/9, Fif6/0/10	NONE
6	Fif6/0/11, Fif6/0/12	NONE
7	Fif6/0/13, Fif6/0/14	NONE
8	Fif6/0/15, Fif6/0/16	NONE
9	Fif6/0/17, Fif6/0/18	NONE
10	Fif6/0/19, Fif6/0/20	NONE
11	Fif6/0/21, Fif6/0/22	NONE
12	Fif6/0/23, Fif6/0/24	NONE
13	Fif6/0/25, Fif6/0/26	NONE
14	Fif6/0/27, Fif6/0/28	NONE
15	Fif6/0/29, Fif6/0/30	NONE
16	Fif6/0/31, Fif6/0/32	NONE
17	Fif6/0/33, Fif6/0/34	NONE
18	Fif6/0/35, Fif6/0/36	NONE
19	Fif6/0/37, Fif6/0/38	NONE
20	Fif6/0/39, Fif6/0/40	NONE

```
C9600X-SUP2#
```


C9600X-LC-32CD

Gen2 Module – 30 x QSFP28 + 2 x QSFP-DD

IOS-XE 17.9.1

3.2
Tbps

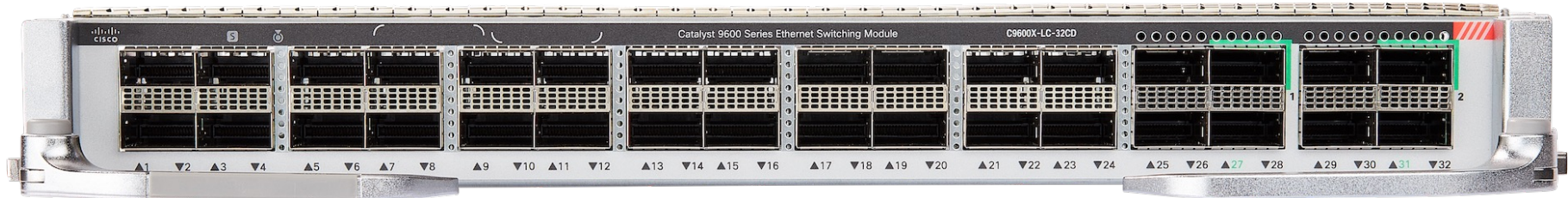
- **3.2Tbps with Supervisor 2 Only**
 - 30 x QSFP28 ports, 40/100GE
 - 2 x QSFP-DD ports, 40/100/200*/400GE
- **NOT supported with Supervisor 1**
- 8 x CDR5M + 2 x CDR5L PHYs
 - MACSec, WAN-MACSec, ClearTag v3.4
 - IEEE 1588 & PTPv2 (Precision Time Protocol)
 - Hitless MUX (HMUX)



Supervisor 2



Supervisor 1

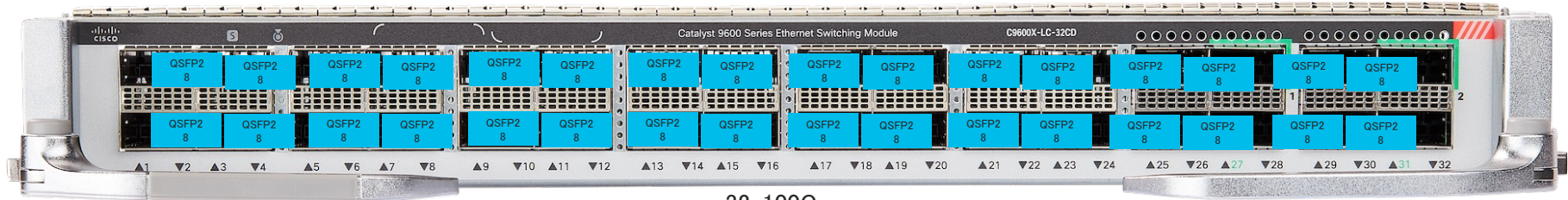


* SW Roadmap (FCS+)

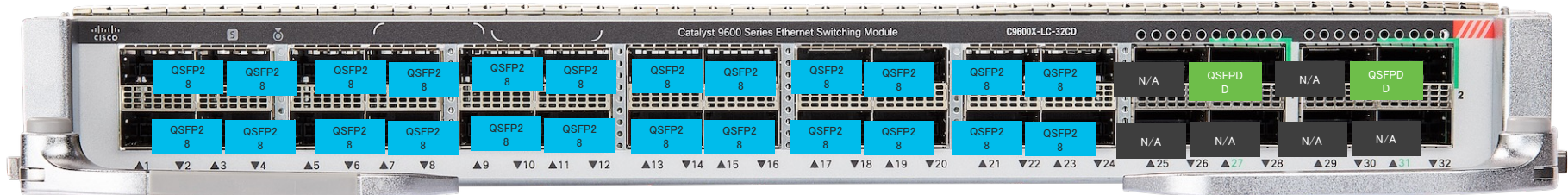
C9600X-LC-32CD

100G / 400G Port Modes

100G (QSFP28) Mode (Default):



Two 400G (QSFP-DD) Mode:



C9600X-LC-56YL4C

Gen2 Module – 56 x SFP56 + 4 x QSFP

IOS-XE 17.13.1

3.2
Tbps

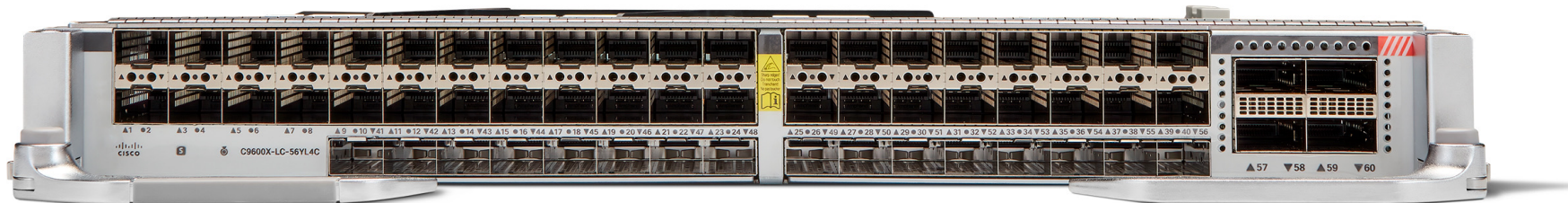
- **3.2Tbps with Supervisor 2 Only**
 - 56 x SFP56 ports, 10/25/50GE
 - 4 x QSFP ports, 40/100GE
- **NOT supported with Supervisor 1**
- **8 x CDR5M 2.0 PHYs**
 - IPsec*, MACSec, WAN-MACSec, ClearTag v3.4
 - IEEE 1588 & PTPv2 (Precision Time Protocol)**
 - Hitless MUX (HMUX)



Supervisor 2



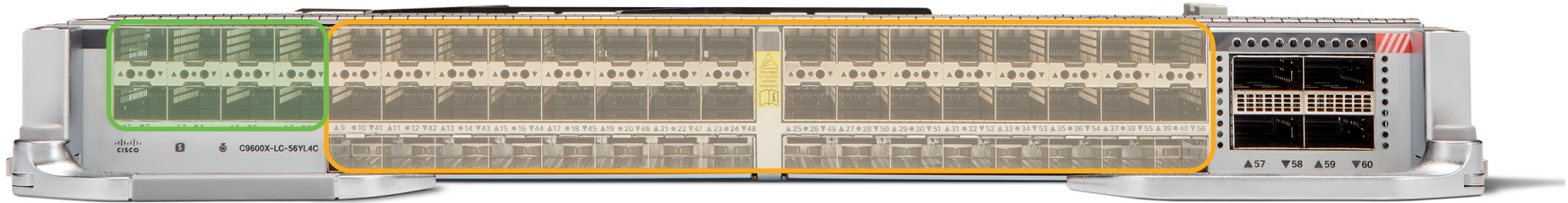
Supervisor 1



* 400G IPSEC HW Capable

** Post-FCS Features

C9600X-LC-56YL4C Transceiver Power



Port 1–8 : Up to 2.5W

Port 9–56 : Up to 1.5W

Syslog Message up on insertion of high-power optic (>1.5W)

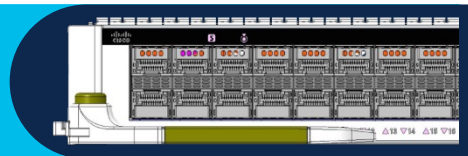
Advice to leave adjacent port empty to avoid thermal issue if high-power optic is used

Port 57–60 : No restrictions on transceiver power

Port-group Command-Line Interface (CLI)

Q200 SerDes has a limit that requires adjacent SFP ports to be the same speed

- Requires a new configuration for a “port group” of two ports to set the same speed
- Default selection is the per-module native port speed (for example, 50G for 56YL4C)



```
[no] hw-module slot <1-6> port-group <1-20|range> select <10G|25G|50G>
```

```
C9600X-SUP-2(config)# hw-mod slot 6 ?
  logging      Logging onboard
  port-group   configure feature on Port-group
  shutdown     Shutdown a fru

C9600X-SUP-2(config)# hw-mod slot 6 port-group ?
  <1-20>      port-group to apply feature
  range      Range of port-group

C9600X-SUP-2(config)# hw-mod slot 6 port-group 1 ?
  select      configure selected speed

C9600X-SUP-2(config)# hw-mod slot 6 port-group 1 select ?
  10G        Speed of 10Gbps
  25G        Speed of 25Gbps
  50G        Speed of 50Gbps

C9600X-SUP-2(config)# hw-mod slot 6 port-group 1 select 10g ?
  <cr>       <cr>

C9600X-SUP-2(config)# hw-mod slot 6 port-group 1 select 10g
C9600X-SUP-2(config)#end
C9600X-SUP-2#
```

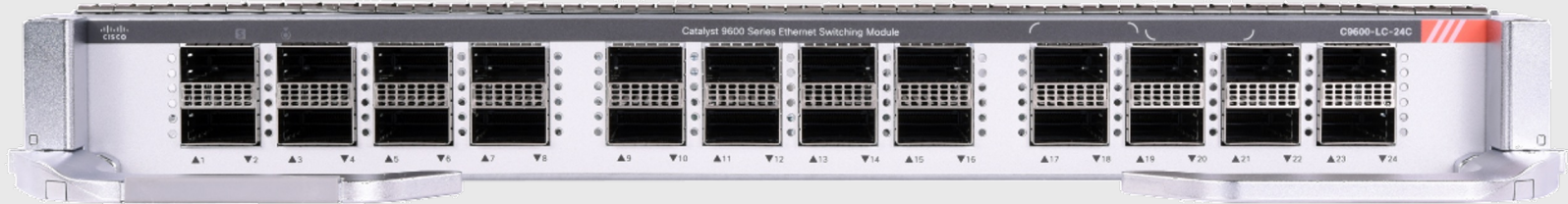
```
C9600X-SUP-2# sho hw-mod slot 6 port-group
```

Port-group	Ports	Speed
1	Fif6/0/1, Fif6/0/2	10G
2	Fif6/0/3, Fif6/0/4	NONE
3	Fif6/0/5, Fif6/0/6	NONE
4	Fif6/0/7, Fif6/0/8	NONE
5	Fif6/0/9, Fif6/0/10	NONE
6	Fif6/0/11, Fif6/0/12	NONE
7	Fif6/0/13, Fif6/0/14	NONE
8	Fif6/0/15, Fif6/0/16	NONE
9	Fif6/0/17, Fif6/0/18	NONE
.		
.		
.		
21	Fif6/0/41, Fif6/0/42	NONE
22	Fif6/0/43, Fif6/0/44	NONE
23	Fif6/0/45, Fif6/0/46	NONE
24	Fif6/0/47, Fif6/0/48	NONE
25	Fif6/0/49, Fif6/0/50	NONE
26	Fif6/0/51, Fif6/0/52	NONE
27	Fif6/0/53, Fif6/0/54	NONE
28	Fif6/0/55, Fif6/0/56	NONE

```
C9600X-SUP-2#
```

Cisco Catalyst 9600 Series

100G/40G Line card – C9600-LC-24C

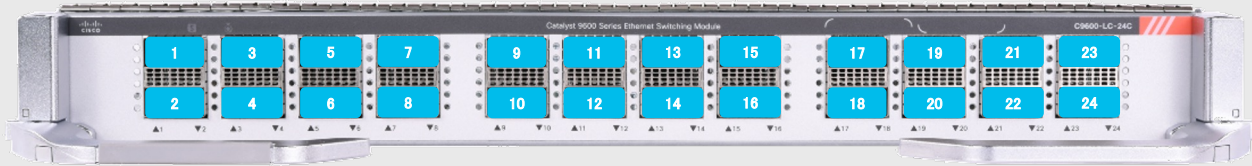


- All 24 ports are capable of 100G (QSFP28)/40G (QSFP+)
- Hardware-ready with QSA (for 1G/10G)
- With Supervisor Engine 1
 - 100G: Every 2 ports in a port-group. The odd number of ports can be 100G and the next even number port is disabled. (Maximum of 12x 100G, line rate with 187 bytes or higher)
 - 40G – 24x 40G (line rate with 148 bytes or higher)
- With Supervisor Engine 2
 - All ports support 40G or 100G (line rate with 136 bytes or higher)

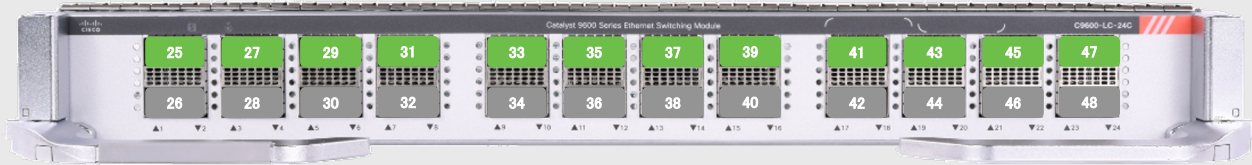
C9600-LC-24C – Port Numbering

With Supervisor 1

40G port
numbering

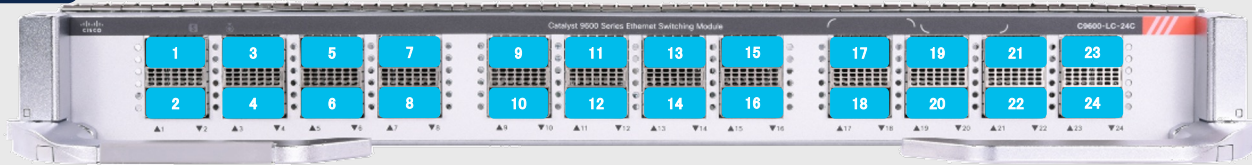


100G port
numbering



With Supervisor 2

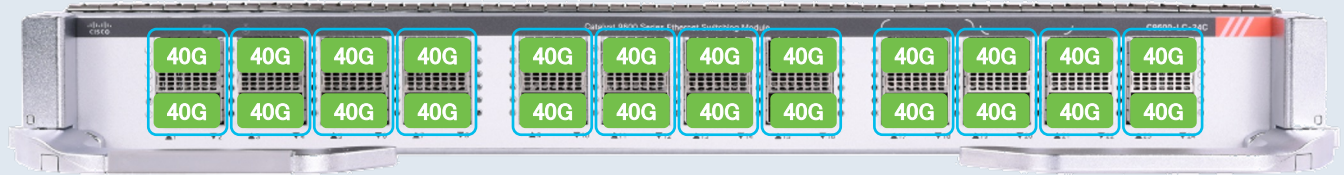
100G/40G port
numbering



C9600-LC-24C Port Speeds with Supervisor Engine 1

- This line card appears in 40G mode by default
- Use CLI to enable 100G mode

Default mode
(all ports 40G)



100G
configuration



```
Fo<slot#>/0/1  
Hu <slot#>/0/25
```

```
interface HundredGigE1/0/25 enable
```

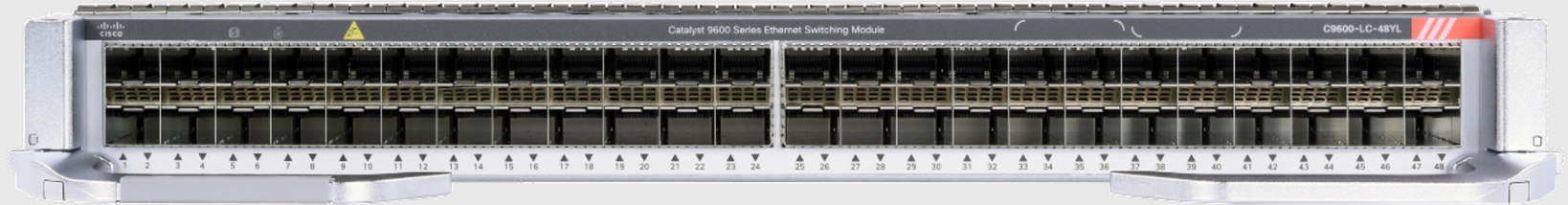


- Enable Hu1/0/25 as 100G
- Disabled Fo1/0/1 and 1/0/2

```
Fo<slot#>/0/23  
Hu <slot#>/0/47
```

Cisco Catalyst 9600 Series

50G/25G/10G/1G Line card – C9600-LC-48YL



- All 48 ports at speeds of 25G/10G/1G (Sup1)
- All 48 ports at speeds of 50G*,25G,10G (Sup2)
- Hardware capable of 10/100M (With Sup1)
- Line rate with 25G/10G/1G (at 187 bytes for 25G; any packet size with 10G/1G)
- Port reference is always "TwentyFive<slot#>/0/<port#>" and port speed is auto-detected based on the inserted transceiver (Sup 1)
- Port reference is always "FiftyGigE<slot#>/0/<port#>" and port speed is auto-detected based on the inserted transceiver (Sup 2)

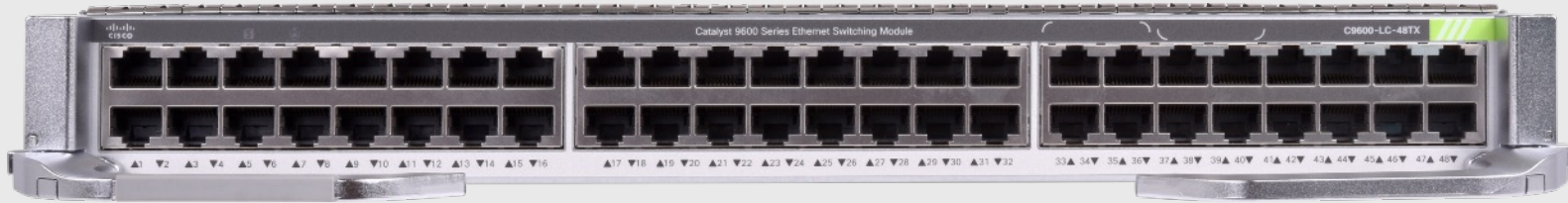
* Roadmap

Cisco Catalyst 9600 Series

mGig Line Card – C9600-LC-48TX

IOS-XE 17.1.1

For collapsed core deployment and connectivity to application servers



- All 48 ports can support 10G/5G/2.5G/1G/100M/10M (Sup1)
- All 48 ports can support 10G (Sup2)
- Line rate on all ports. Any port, any supported speed.
- No PoE
- Port reference is “Ten<slot#>/0/<port#>” and port speed is auto (default).

Cisco Catalyst 9600 Series

1G Line card – C9600-LC-48S

IOS-XE 17.2.1



- All 48 ports support 1G (Sup1 Only)
- Hardware capable of 10/100M*
- Line rate with 1G (any packet size with 1G)
- Port reference is always "Gig<slot#>/0/<port#>".
- NOT SUPPORTED WITH Sup2

* Roadmap

Catalyst 9600 Line Card Support Matrix



SUP2 hardware does not support 1GE or below speeds natively

If 1GE downlinks are required, use SUP1

	C9606 Chassis		
	C9600-SUP- 1		C9600X-SUP- 2
	C9600-LC-24C	24x 40G or 12x 100G 	24x 40G/ 100G (No MACsec) 
	C9600-LC-48YL	48x 1/10G and 25G 	48x 10/25G and 50G (No MACsec, no 1G) 
	C9600-LC-48TX	48x 1/2.5/5G and 10G (Multigigabit) 	48x 10G (No MACsec, no 1/2.5/5G) 
	C9600-LC-48S	48x 1G SFP 	
	C9600-LC-40YL4CD	40x 1/10G and 25G + 2x 40G and 100G 	40x 10/25G and 50G + 2x 40/100G and 200G* + 2x 40/100/ 200G* and 400G MACsec and WAN MACsec (no 1G)  
C9600X-LC-32CD		30x 40/100G + 2x 40/100/ 200G* and 400G MACsec and WAN MACsec (no 1G)  	
C9600X-LC-56YL4C		56x 10/25/50G + 4x 40/100G MACsec and WAN MACsec (no 1G) IPSec* 	

* Hardware capable

Catalyst 9600 Series

Power & Cooling

Catalyst 9600 Series

Power supplies



- Chassis has four slots for power supplies
- Individual on/off switch for each power supply
- Supports a mix of AC (220V) and DC power supplies

3kW AC



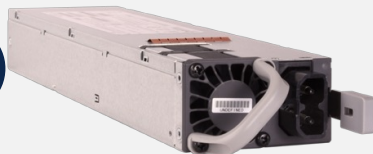
- Supports both 110V and 220V input
- 3 kW output with 220V (1500W with 110V)
- Titanium-rated power supply
- Redundant mode: Combined and N+1

2kW AC



- Supports both 110V and 220V input
- 2 kW output with 220V (1050W with 110V)
- Platinum-rated power supply
- Redundant mode: Combined and N+1

2kW DC



- Supports input range of -40V to -72V
- 2 kW output
- Platinum-rated power supply
- Redundant mode: Combined and N+1

Higher Power Budget and Resiliency with 3KW PSU



Fully loaded Gen 1 LC



Mix of Gen1& Gen2 LCs



Fully Loaded Gen2 LCs

220 V	2K	2K	2K		2K	2K	2K		2K	2K	2K	
110 V	2K	2K	2K	2K					2K	2K	2K	2K
110 V	3K	3K	3K		3K	3K	3K	3K	3K	3K	3K	



In Use



Non redundant power



Standby

Catalyst 9600 Series

Reversible fan tray



Fan tray is fully hot-swappable within 120 seconds (2 minutes)

* Optional side-to-back air baffle

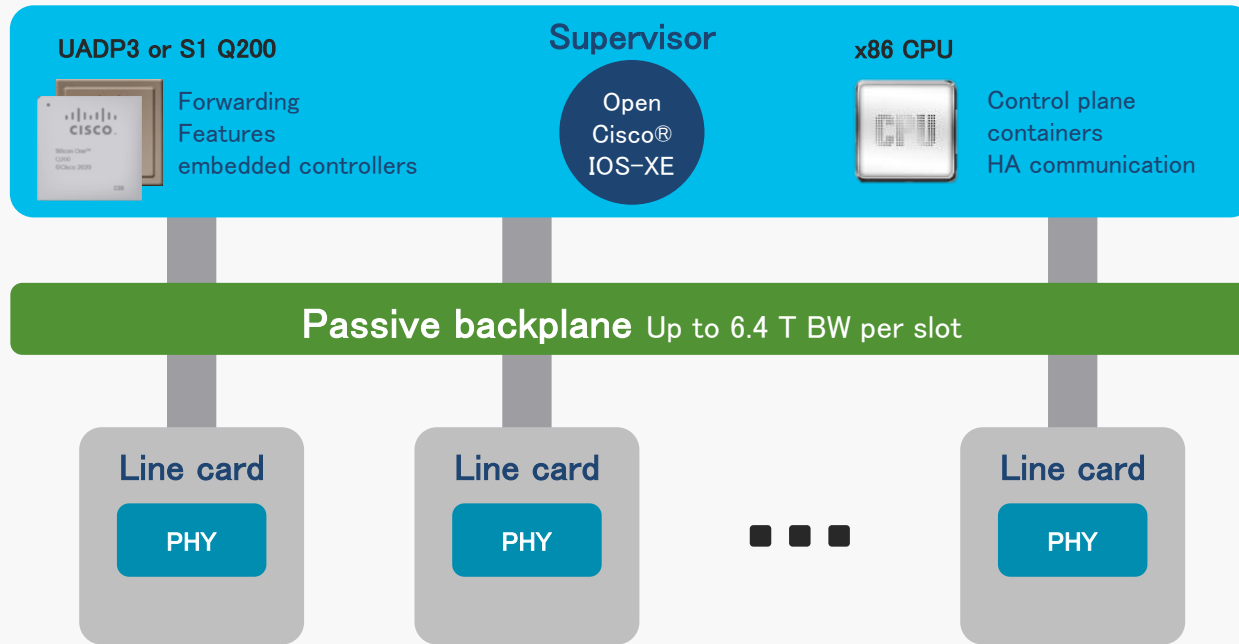
- N+1 (8+1) fan redundancy
- Flexible service: Fan tray can be replaced from the front or back
- Efficient: Variable speed per fan depends on load, temperature, and altitude (=> lower noise)
- Airflow is side to side*

Catalyst 9600 Series

Architecture

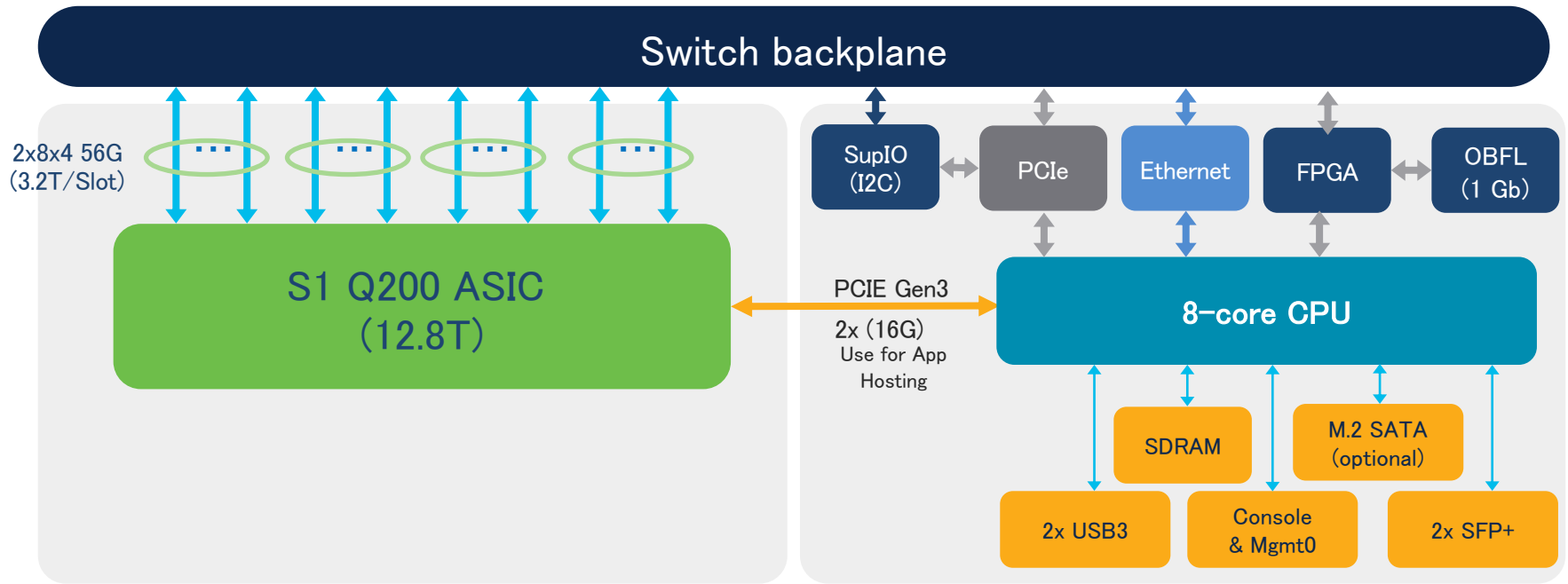
Catalyst 9600 Architecture

Centralized Architecture

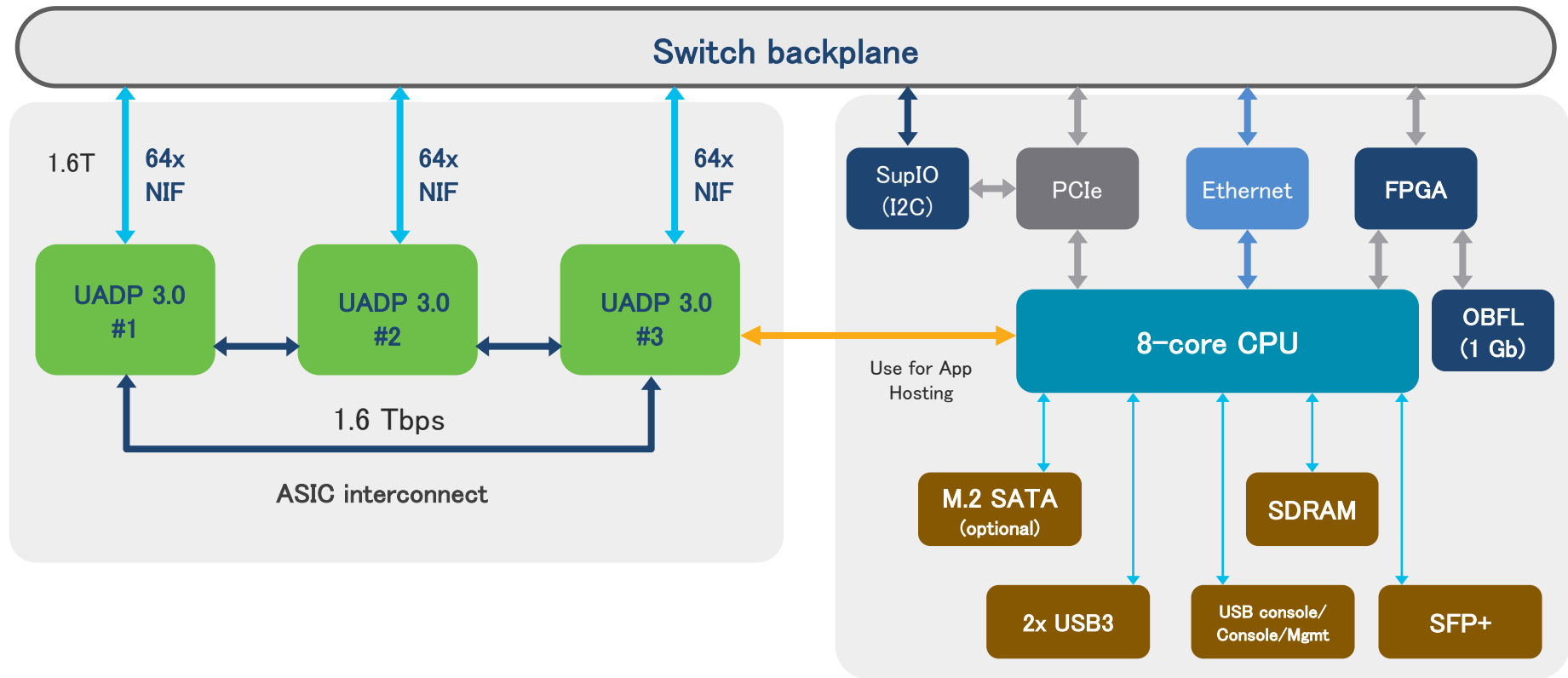


- **Centralized Architecture – Uninterrupted Supervisor Switchover**
- **Centralized Architecture** (All Forwarding & Services done in the ASIC) – **Unlock New Capabilities with a Supervisor upgrade**
- **Transparent Line cards – Compatible with new Sup**
- **Passive Backplane – Higher MTBF**
- **X86 CPU + Storage – App Hosting**

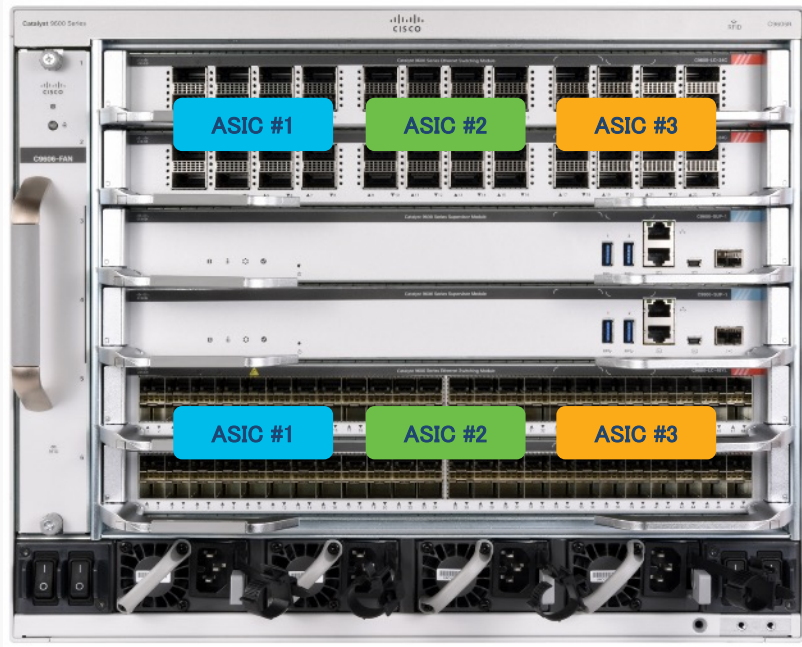
Supervisor engine 2 Block Diagram



Supervisor engine 1 Block Diagram



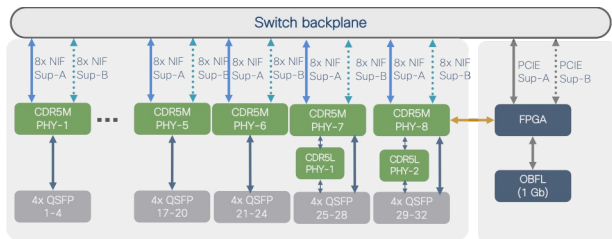
Supervisor engine 1 – ASICs to LC mapping



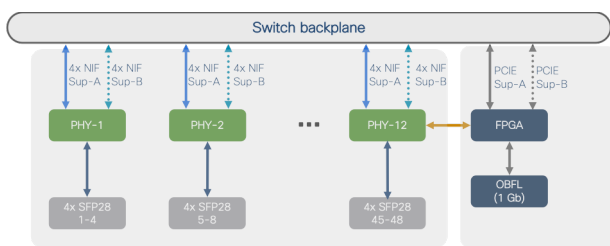
- ASIC #1: First third of the ports
 - 48-port module: 1–16
 - 24-port module: 1–8
- ASIC #2: Middle third of the ports
 - 48-port module: 17–32
 - 24-port module: 9–16
- ASIC #3: Last third of the ports
 - 48-port module: 33–48
 - 24-port module: 17–24

Line Card block diagrams

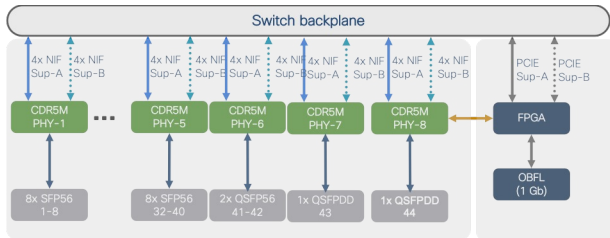
C9600X-LC-32CD



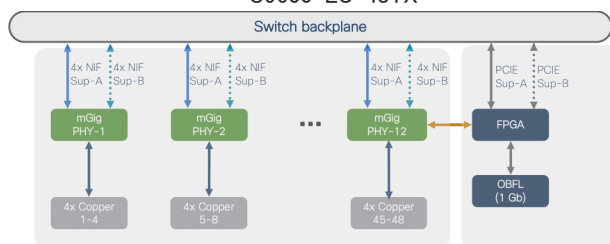
C9600-LC-48YL



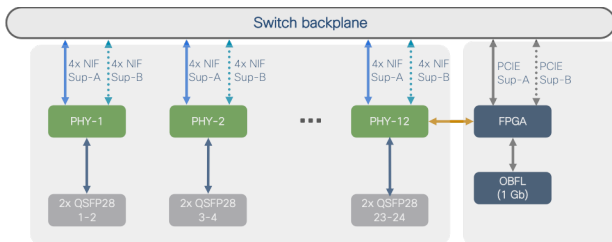
C9600-LC-40YL4CD



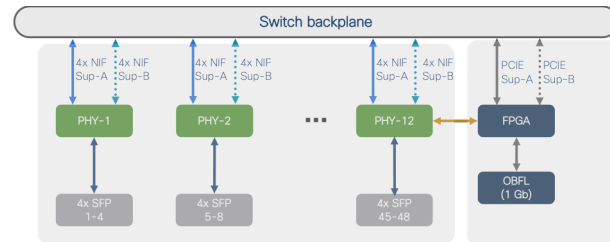
C9600-LC-48TX



C9600-LC-24C



C9600-LC-48S



Catalyst 9600X and 9600 – physical

	 Catalyst® 9600X (Silicon One™ Q200)	 Catalyst 9600 (UADP 3)
	SUP-2	SUP-1
CPU (BDW-NS, BDW)	2.7 GHz 8C Intel® (BDW-NS)	2.4 GHz 8C Intel (BDW)
DRAM (type)	32 GB (DDR4)	16 GB (DDR4)
ASIC (number)	Q200 (1x)	UADP3 (3x)
Capacity (chassis)	12.8 Tbps (full duplex)	4.8 Tbps (full duplex)
Capacity (per slot)	3.2 Tbps (full duplex)	1.2 Tbps (full duplex)
10G max	256 (40x4 + 24x4 [^] *)	192 (48x4)
25G max	256 (40x4 + 24x4 [^] *)	192 (48x4)
50G max	256 (40x4 + 24x4 [^] *)	–
40G max	96 (SUP-2 can support 128)	96 (24x4)
100G max	96 (SUP-2 can support 128)	48 (12x4)
400G max	8 (4x2)	–

* Roadmap (not committed). ^ Breakout cable ports.

Catalyst 9600X and 9600 – features and scales

	 Catalyst® 9600X (Silicon One™ Q200)		 Catalyst 9600 (UADP 3)	
	Default	Maximum (Custom)	Default	Maximum (custom)
MAC addresses	128,000	256,000	80,000	128,000
IP host routes	128,000	256,000	80,000	128,000
Multicast L2 groups	16,000	64,000*	16,000	48,000
Multicast L3 routes	32,000	64,000*	32,000	48,000
IP LPM routes	2 million	2 million	212,000	256,000
MPLS labels	256,000	512,000	32,000	64,000
SGT/OG labels	32,000	64,000	32,000	64,000
NAT* sessions	16,000*	128,000*	3000	16,000
Security ACL entries	8000	10,000*	12,000	27,000
QoS ACL entries	8000	10,000*	8000	21,000
PBR* ACL entries	8000*	10,000*	3000	16,000

* Roadmap for Catalyst 9600X (not committed).

Catalyst 9600 Series for continued market leadership

Competitive challenges

ARISTA



Campus:
7300X3

Data center:
7500R3

aruba

a Hewlett Packard
Enterprise company



CX 8400

Threats

- 7300X3 in campus with higher 40/100G density
- Positioning data center switch: 7500R3 in campus core with higher scale and speeds/feeds

Threats

- Higher port densities
- Higher route, MAC scales

Leadership with Catalyst® 9600/9600X

	Cisco Catalyst 9600X	Arista 7500R3	Cisco Catalyst 9600	Arista 7300X3	Aruba CX8400
ASIC	Q200	Jericho 2	UADP	Trident 3	Jerich o
Scale, performance, hardware differentiation					
ACL/route scale	Best	Best	Partial	Partial	Partial
MAC scale	Best	Partial	Partial	Partial	Partial
Port buffers	Best	Best	Partial	Partial	Partial
Uplinks on LC/SUP: 400G	Best	Best	Bad	Bad	Bad
MACsec, WAN MACsec	Best	Bad	Partial	Bad	Partial
Enterprise-grade campus differentiation					
Line-rate encryption MACsec, WAN MACsec, NetFlow	Best	Bad	Partial	Bad	Bad
Maximum Investment protection Common chassis, fan tray, and power supply, all Gen 1 line cards supported, 3x performance with less than 25% investment	Best	Bad	Partial	Bad	Bad
400G leadership in campus Support for 10G to 400G speeds	Best	Best	Bad	Bad	Bad

Legend

Best

Partial

Bad

Lead with investment protection: Gen 1 backward compatibility.

Highlight 400G leadership in campus.

Win with Catalyst 9600 differentiation against the competition.



Cisco Catalyst 9500 Series

Cisco Catalyst 9500 Series

Purpose-built fixed core/aggregation switches

UADP 2.0



UADP 3.0



Silicon One Q200

- 40G at the price of 10G
- Industry's first 40G enterprise switch
- Optimized 10G switch for midsize backbone



- Up-to 48 25 GE Ports
- Industry's first 100G enterprise switch
- Flexible templates



- Reversible Bi-directional Airflow
- Ultra Deep 8GB Buffers
- High route scale (2M) and Mac scale (256K)



Modular fans



Modular uplinks



Modular power supplies



Storage for application hosting

Catalyst® 9500X – Extending Cisco® Catalyst® 4500-X and 6800 Series leadership in fixed core

Upto 26x throughput (6 Tbps)

Upto 48x performance (8 Bpps)

No oversubscription

8x 400GE Density

Pluggable SSD storage

USB 3.0

8x memory and 4x flash

8 core CPU

Customizable templates

Cisco StackWise® Virtual*

*Supported on 9500 and 9500H. Roadmap for 9500X

Catalyst 9500X Family

Extending the Catalyst 9500 high-performance fixed core



Non-XL scale

Catalyst® 9500H
(UADP 3.0)



C9500-32C / C9500-32QC



C9500-48Y4C / C9500-24Y4C

Total capacity

3.2 Tbps

32x 100G or
48x 25G + 4x 100G

Core
+
Edge

XL scale

Catalyst 9500X
(Silicon One™ Q200)



C9500X-28C8D

IOS-XE 17.7.1



C9500X-60L4D

IOS-XE 17.10.1

Total capacity

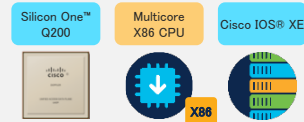
6.0 Tbps

~2
X

28x 100G + 8x 40/100/400G or
60 x 10/25/50G + 4 x 40/100/400G

Catalyst 9500X – Extending leadership in the core

Redefining the campus WAN edge



Industry first

2x switching performance

10x route scale and ultra-deep buffer

10x route scale and ultra-deep buffer

Up to 2 million route scale
8 GB of ultra-deep buffers

Industry first

Carrier-class QoS

2 levels of HQoS
VOQ architecture

Unmatched flexibility

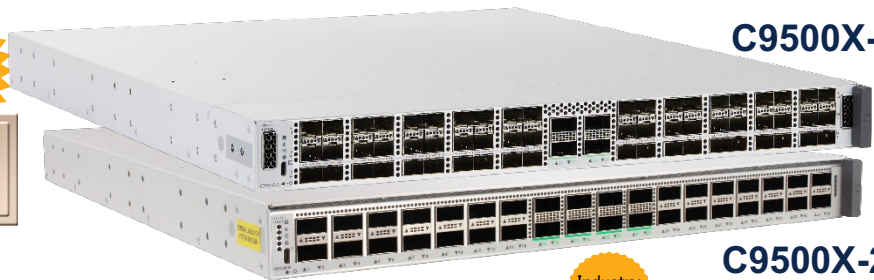
400G leadership

Secure

Application hosting

400G QSFP-DD

Powered by S1 Q200



C9500X-60L4D

C9500X-28C8D

Reversible airflow

Front to back
Back to front

Highest resiliency

Redundant fans (5+1)
Redundant power supplies
StackWise® Virtual*

Industry first

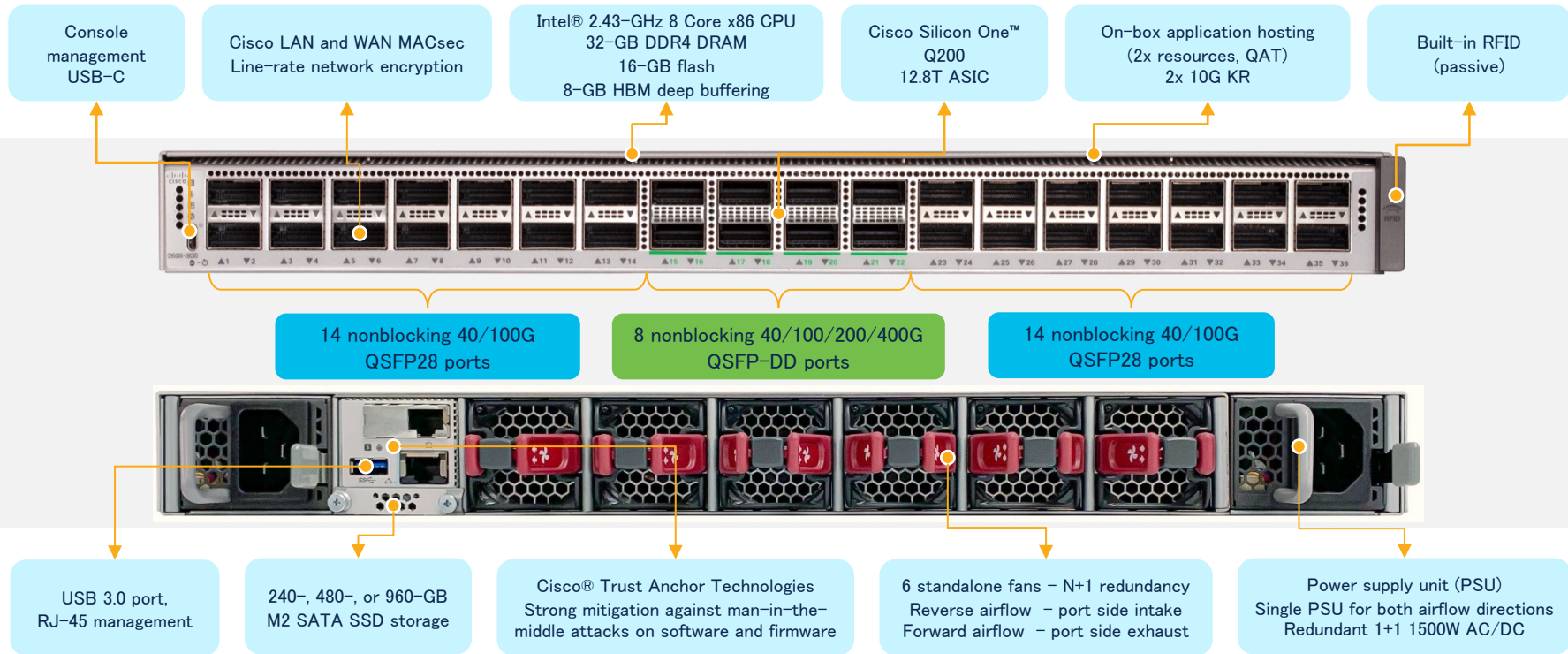
Enhanced encryption

LAN MACsec
WAN MACsec
IPSec^

*17.10.1 for C9500X-28C8D and 17.11.1 for C9500X-60L4D
^ Hardware capable – Only C9500X-60L4D

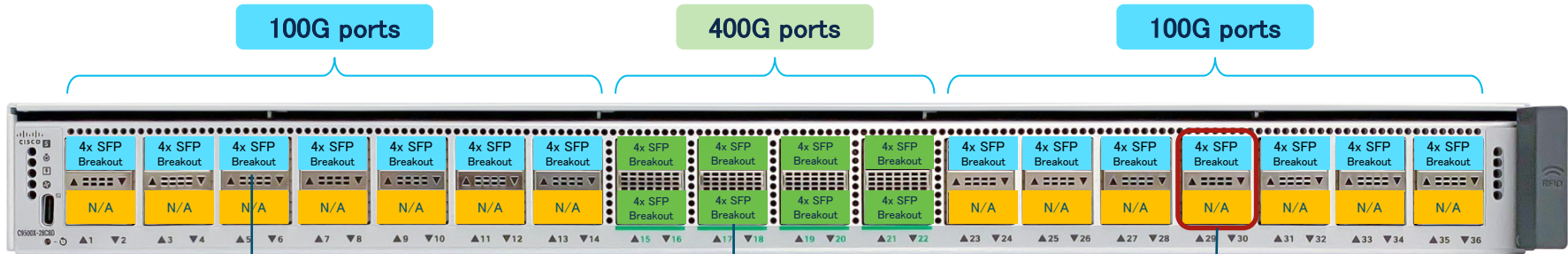
Cisco Catalyst C9500X-28C8D: line rate 6T of capacity

High-level overview



C9500X-28C8D

SFP breakout and QSA* support



- Breakout is supported on **top row (odd-numbered) 100G (QSFP28) ports**
- Breakout mode: 4x 10/25G
- **Maximum ports:** $14 \times 4 = 56$

- Breakout supported on **all 400G (QSFP-DD) ports**
- Breakout mode: 4x 10/25G, 8x 10/25G,* 4x 100G*
- **Maximum ports:** $8 \times 4 = 32$

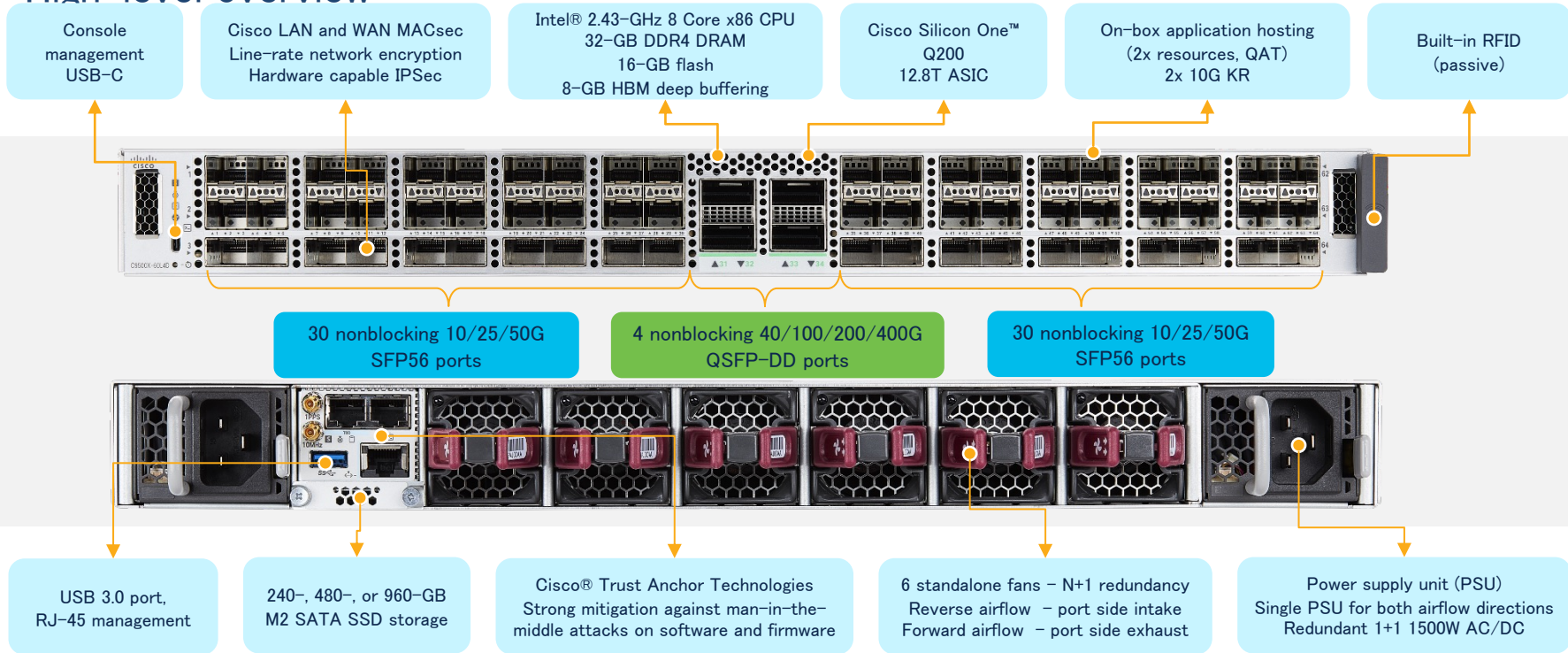
- Breakout not supported on **bottom row (even-numbered) 100G (QSFP28) ports**
- The bottom port is disabled when the corresponding top port is configured as breakout

Maximum ports with breakout at FCS: 88 (56 + 32)

* Roadmap (not committed). System can support up to 120x 10/25G.

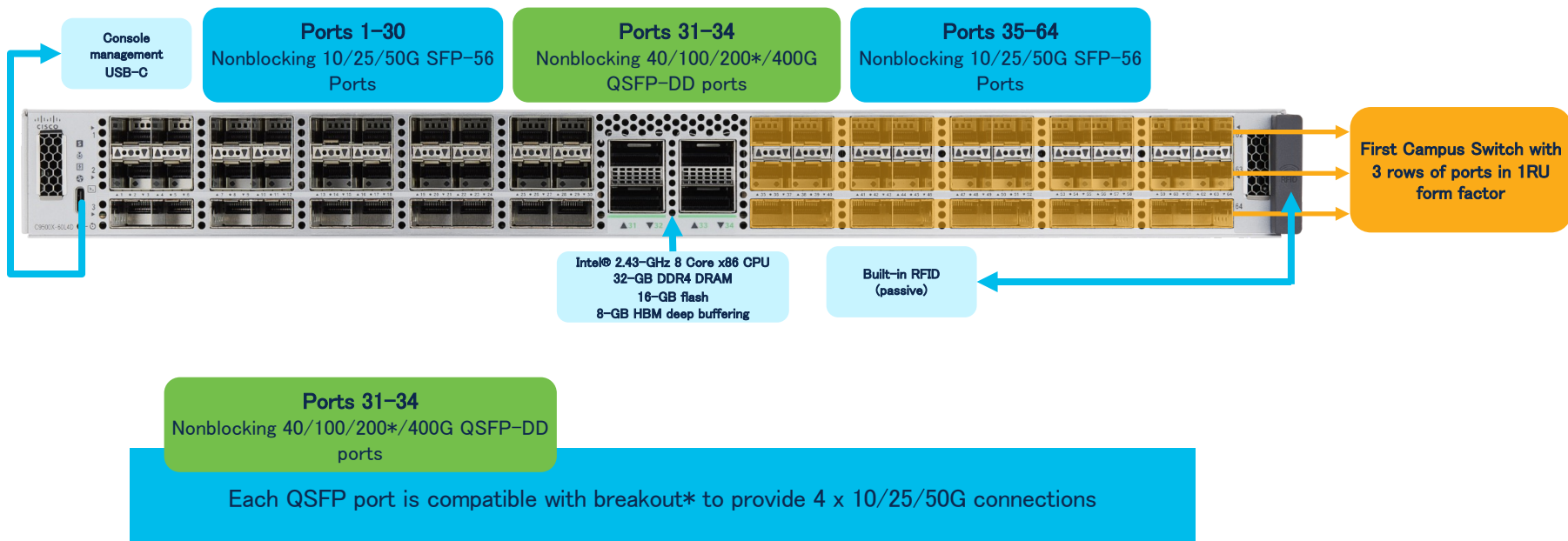
Cisco Catalyst C9500X-60L4D: line rate 4.6T of capacity

High-level overview



Catalyst C9500X-60L4D

Innovative Design

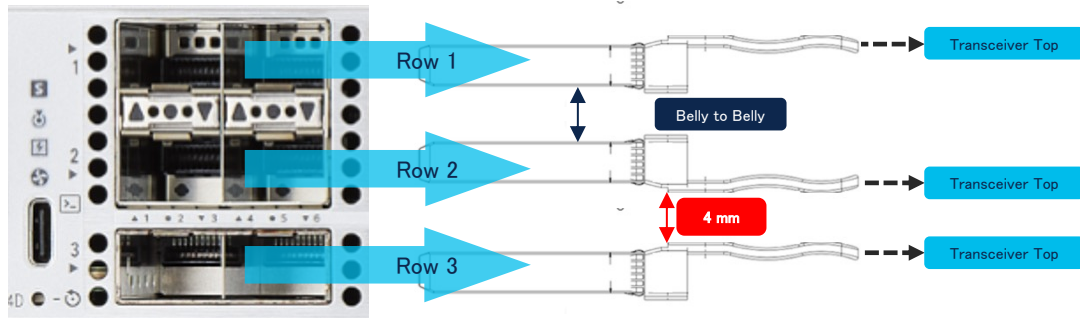


* Hardware capable. Roadmap

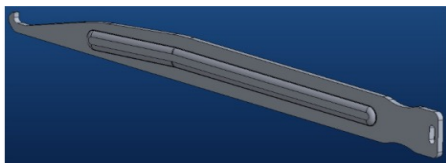
Catalyst C9500X-60L4D

Transceiver Alignment

Transceiver Alignment



- No spacing issues between Row 1 and Row 2.
- Row 1 and 2 are belly to belly with each other
- Transceiver in row 2 is inserted upside down with base of transceiver facing up
- **Minimum 4mm space between the head of transceiver in row 2 and head of transceiver in Row 3 required for smooth operation.**
- Some transceivers with bigger heads might have insufficient space when inserted both in middle and bottom rows



Low spacing between middle and bottom rows require the use of a special tool to remove transceivers without disturbing/damaging neighbouring ports.

Tool included in accessory kit with each switch.

Cisco Catalyst 9500 High Performance Series

New generation of purpose-built fixed high-end core/aggregation switches



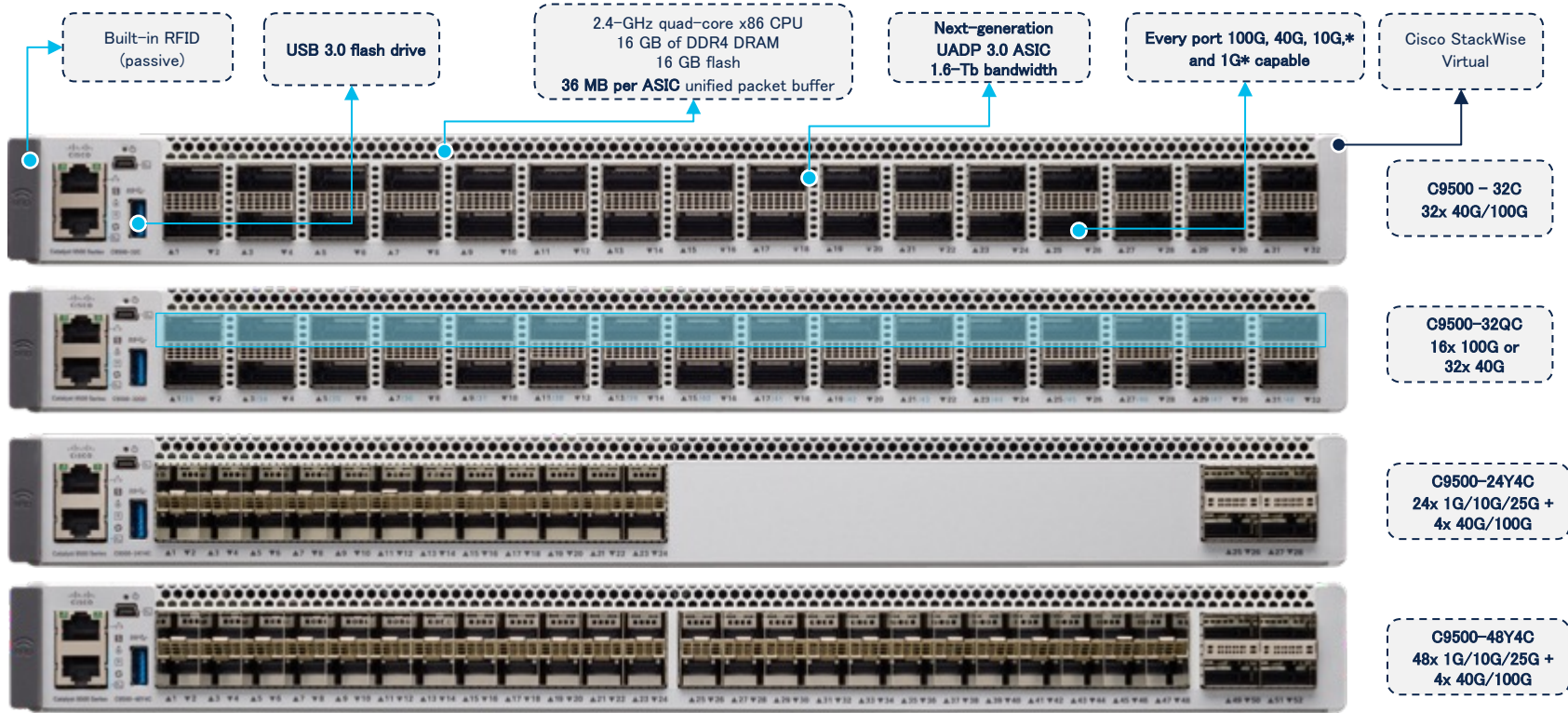
UADP 3.0



Industry's first 25G/100G enterprise switch

Cisco Catalyst 9500 High Performance Series

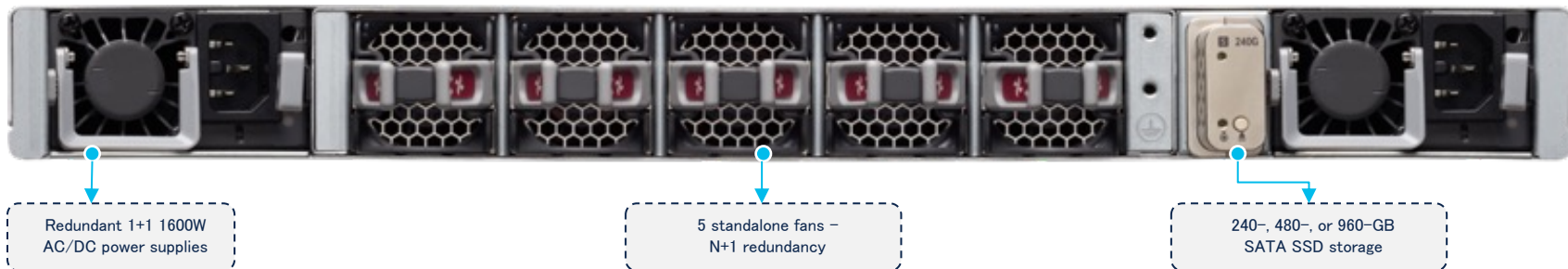
High-level overview



* With QSFP to SFP or SFP+ (QSA) adapter

Cisco Catalyst 9500 – C9500-32C

Redundant power supplies and fans



Power supply highlights

- Hot-swappable
- AC, DC, and mixed power supplies supported
- Maximum output is **1600W at 220V and 1000W at 110V**
- More than 90% power efficiency at 50% to 100% of load
- Redundant load sharing (1+1) mode only

Fan highlights

- 5 variable-speed high-efficiency fans at rear of chassis
- Detect ambient temperature and adjust fan speeds
- Fans are hot-swappable
- **Front-to-back airflow**
- Can still operate with one fan unit failure

Cisco Catalyst 9500 – C9500-32QC,24Y4C,48Y4C

Redundant power supplies and fans



Power supply highlights

- Hot-swappable
- AC, DC, and mixed power supplies supported
- Maximum output **12V/650W at 220V/110V AC Input**
- More than 90% power efficiency at 50% to 100% of load
- Redundant load sharing (1+1) mode only

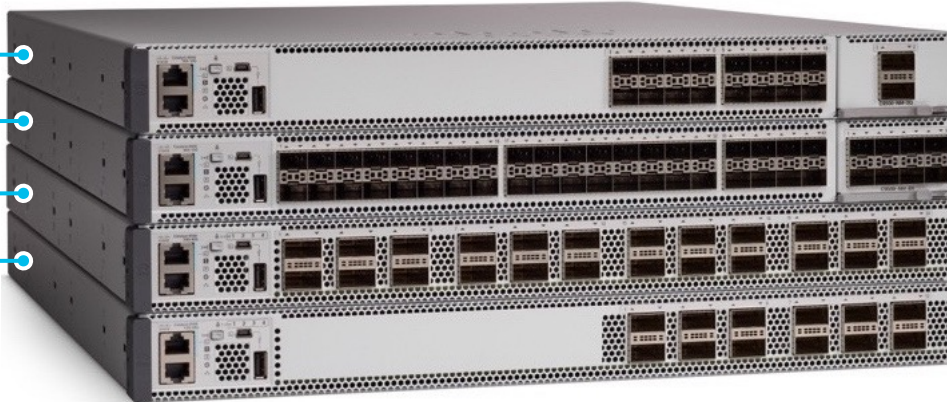
Fan highlights

- **Dual variable-speed high-efficiency fan trays**
- Thermal sensor to detect ambient temperature and adjust fan speeds
- Fan trays are hot-swappable
- **Front-to-back airflow**
- Can still operate with individual fan tray failure

Cisco Catalyst 9500 Series

New generation of purpose-built fixed midrange core/aggregation switches

- Cisco Catalyst 9500-16X
- Cisco Catalyst 9500-40X
- Cisco Catalyst 9500-24Q
- Cisco Catalyst 9500-12Q



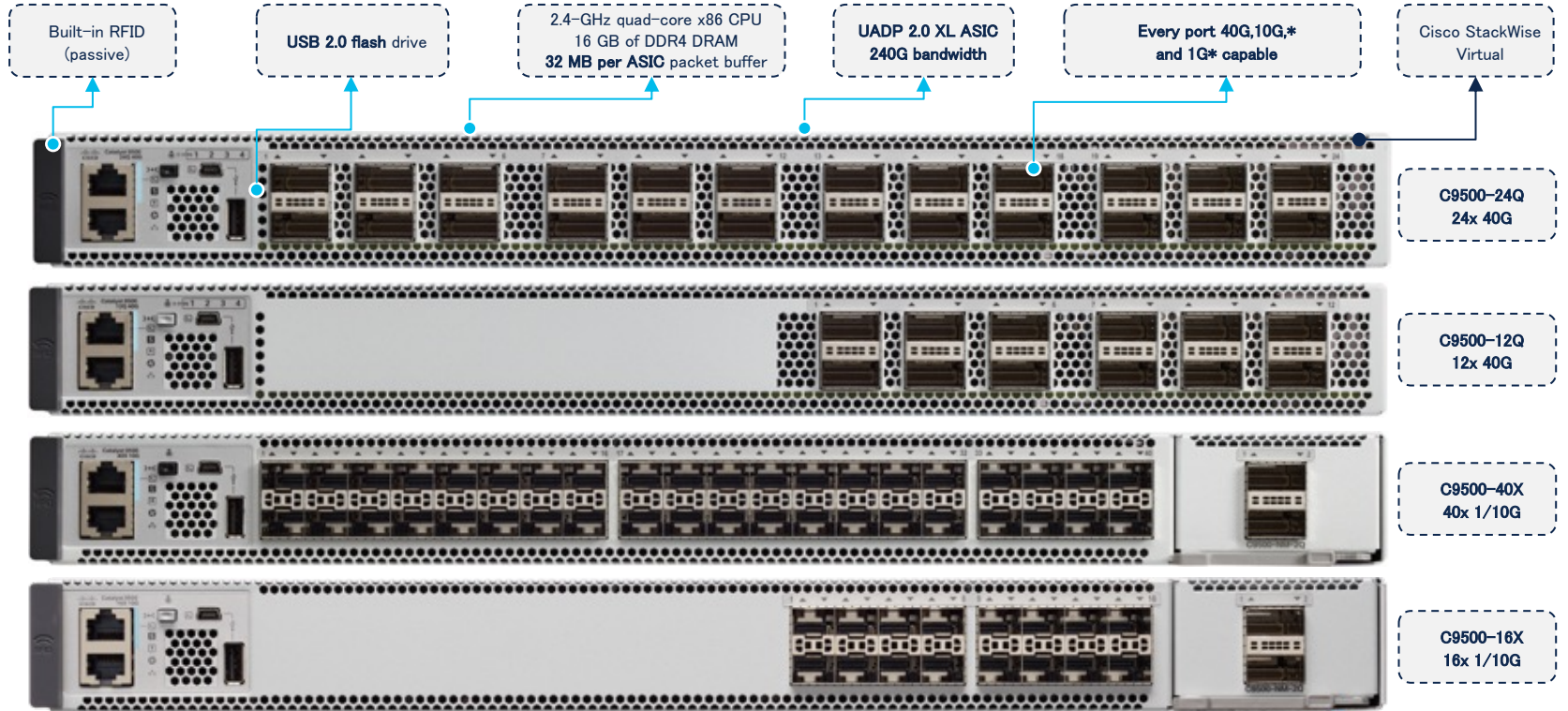
UADP 2.0 XL



Industry's first 40G enterprise switch

Cisco Catalyst 9500 Series

High-level overview



* With QSFP to SFP or SFP+ (QSA) adapter

Cisco Catalyst 9500 Series

Network modules

C9500-NM-2Q

Cisco Catalyst 9500 Series
network module 2-port
40G with QSFP+



C9500-NM-8X

Cisco Catalyst 9500 Series
network module 8-port
1G/10G with
SFP and SFP+



Uplink modules supported on C9500-40X and C9500-16X
Support for Online Insertion and Removal (OIR)

Catalyst 9500 Series

Power and Cooling

Alternate power supply for C9500 High Performance

Helping alleviate Supply chain issues

C9K-PWR-650WAC-R



C9K-PWR-650WACL-R



- Alternate 650W AC power supply to load balance the demand for power supplies
- Expected to improve overall lead times for C9500 High Performance PIDs
- C9K-PWR-650WACL-R is optional selection in CCW. No impact for existing orders
- Expected to have same certification as existing C9K-PWR-650WAC-R, except European Countries

Differences

CRITERIA	C9K-PWR-650WAC-R	C9K-PWR-650WACL-R
IEC-61000-4-5 SURGE	4KV CM, 2KV DM	2.5KV CM, 1KV DM
AC LINE HOLD-UP TIME	>=20ms@90% Load	>=12ms@100% Load
OverPower Protection (OPP)	130% x rated load	140% x rated load

Available on
CCW now

Compatibility

C9500-32QC



C9500-24/48Y4C



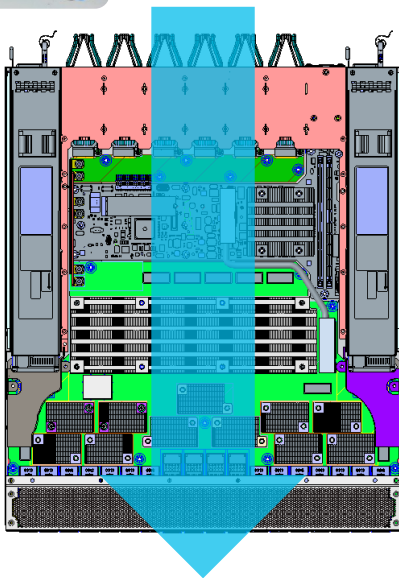
- BTU-Hr/MTBF/Power utilization with port usage same as 650WAC-R
- Platinum rated power supply.

*Not certified to be used in EU Region

Catalyst 9500X – reversible airflow



Back to front
Port-side exhaust

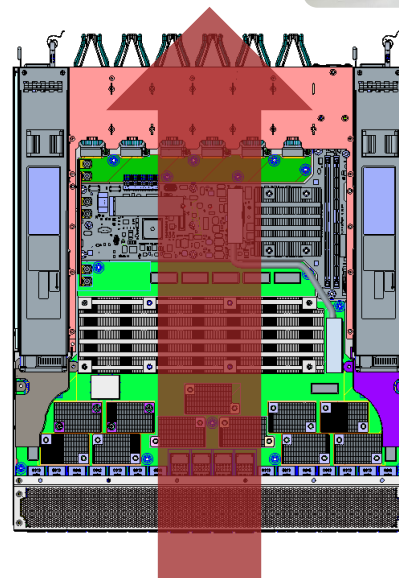


- Color of fan unit handle/latch represents direction of airflow
- Different fan product IDs for different airflow directions
 - **Royal blue** – back to front
 - **Burgundy** – front to back
- All fans must be the same color (direction) to work correctly



Single 1500W AC/DC PSU
with **Cisco Grey** latch
for both airflow directions

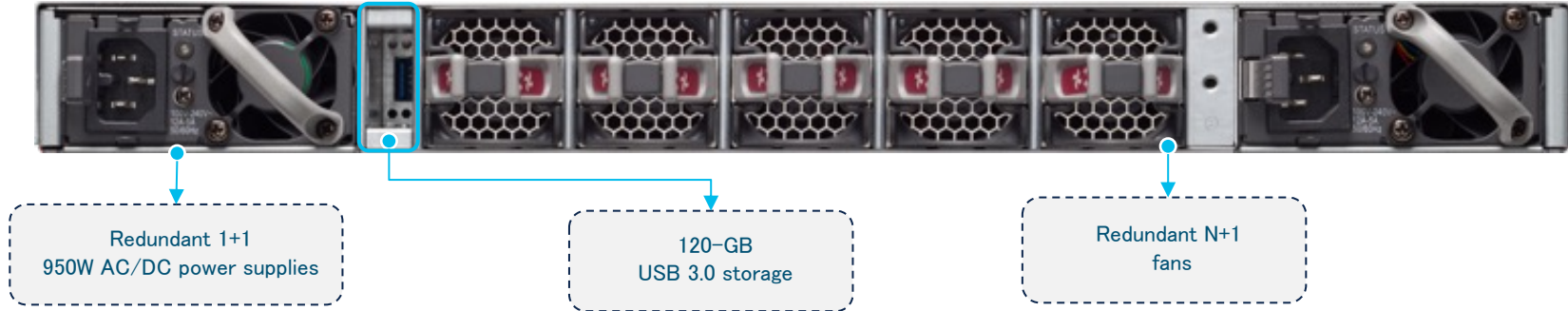
Front to back
Port-side intake



Same power supply and fan tray unit compatible with both C9500X-28C8D and C9500X-

Cisco Catalyst 9500 Series

Redundant power supplies and fans



Power supply highlights

- Hot-swappable
- AC, DC, and mixed power supplies supported
- Maximum output 12V/950W at 220V/110V AC input
- More than 90% power efficiency at 50% to 100% of load
- **Redundant load sharing (1+1) mode only**

Fan highlights

- Variable-speed high-efficiency fans
- Detect ambient temperature and adjust fan speeds
- Individual fans are OIR capable up to 120 seconds
- **Front-to-back airflow**
- Can still operate with individual fan tray failure

Cisco Catalyst 9500 Series

Power supply redundancy

Redundant mode (default)



PSU1



PSU2

- Load sharing and redundancy are enabled automatically
- Each power supply provides ~50% of capacity
- This is the recommended and only mode

Redundant mode (failure)



PSU1



PSU2

- In case of power supply or power feed failure, active power supply operates at 100% capacity

AC – DC power supplies



PSU1



PSU2

- Mix of AC and DC power supplies supported

Catalyst 9500 Power Supply compatibility

Switch Model	PWR-C4-950WAC-R	PWR-C4-950WDC-R	C9K-PWR-650WAC-R	C9K-PWR-930WDC-R	C9K-PWR-1600WAC-R	C9K-PWR-1600WDC-R	C9K-PWR-1500WAC-R	C9K-PWR-1500WDC-R
C9500-12Q	YES	YES						
C9500-24Q	YES	YES						
C9500-40X	YES	YES						
C9500-16X	YES	YES						
C9500-32C					YES	YES		
C9500-32QC			YES	YES				
C9500-48Y4C			YES	YES				
C9500-24Y4C			YES	YES				
C9500X-28C8D							Yes	Yes
C9500X-60L4D							Yes	Yes

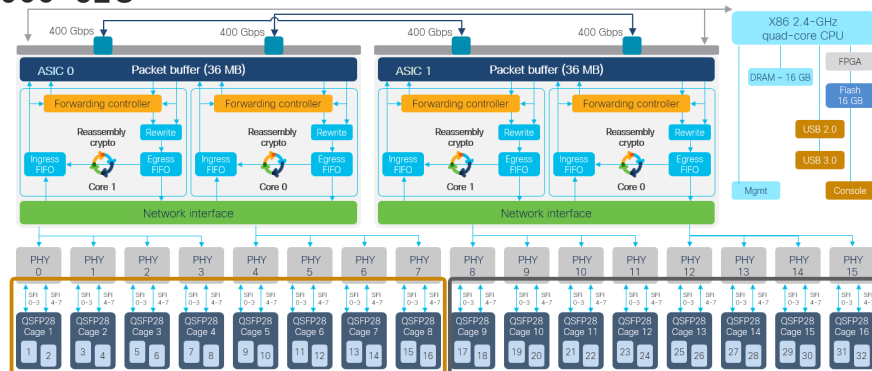


Catalyst 9500 Series

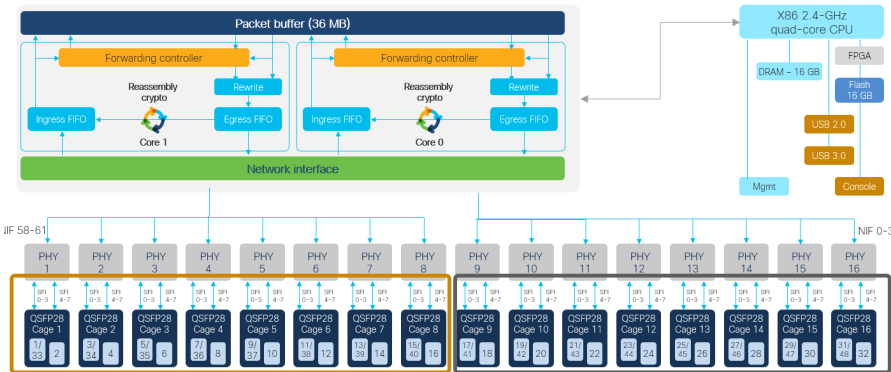
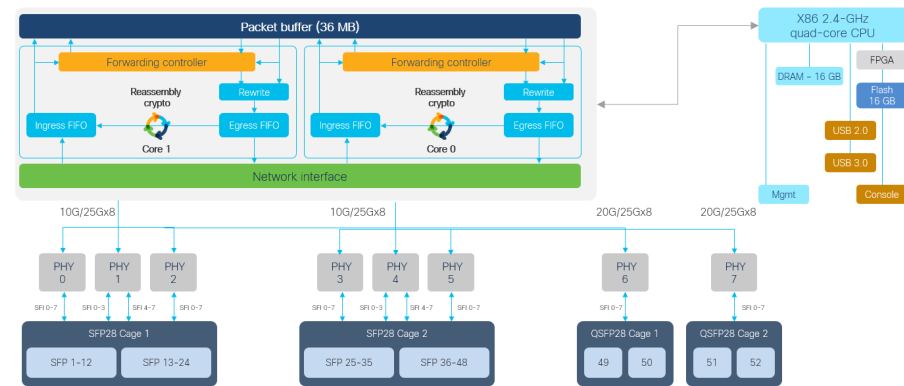
Architecture

Catalyst 9500 Series – Block Diagram

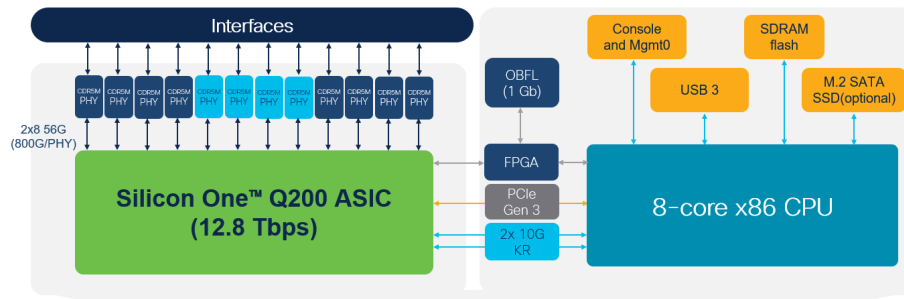
C9500-32C



C9500-48/24Y4C



C9500-32QC



C9500X-28C8D

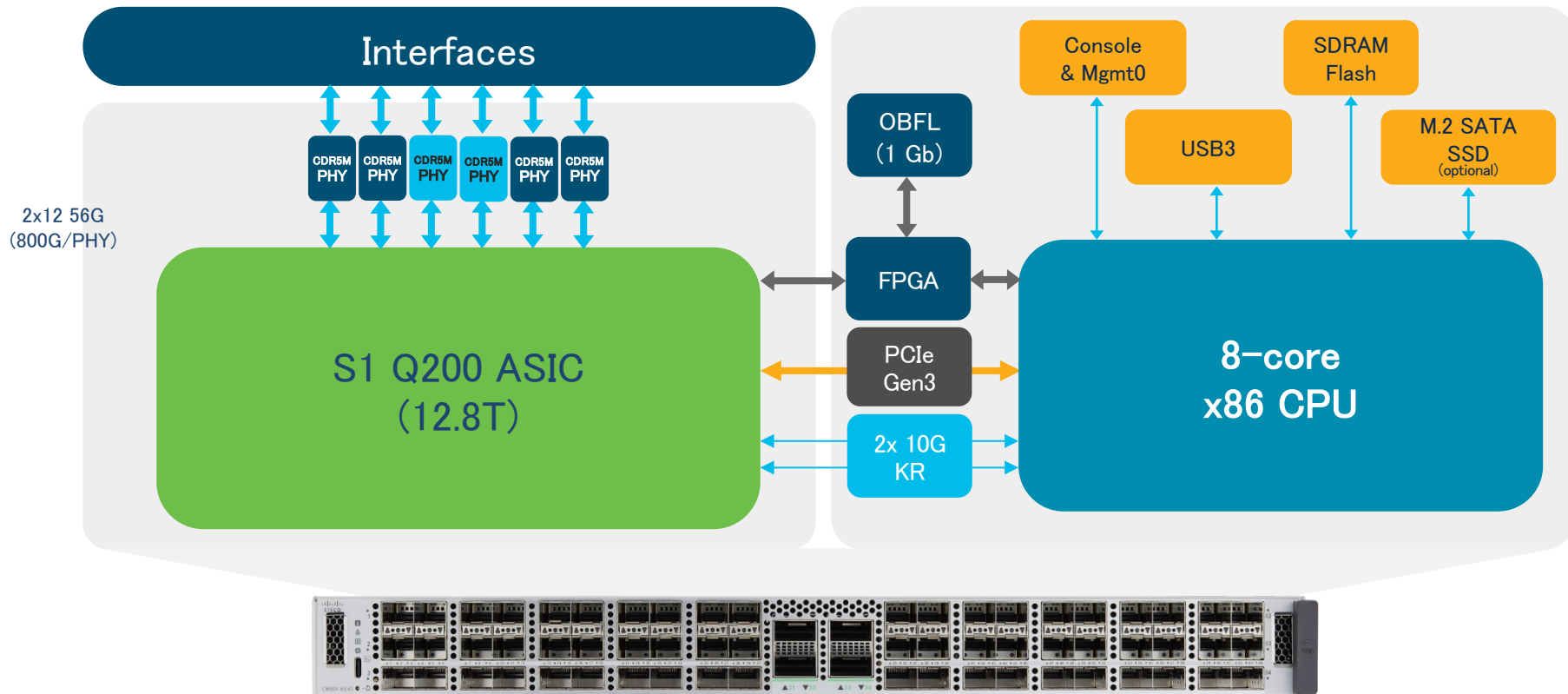
Catalyst 9500X and 9500H – physical

	 Catalyst® 9500X	 Catalyst 9500H
	Silicon 1 ASIC	UADP-3 ASIC
CPU (BDW-NS, BDW)	2.7 GHz 8C Intel® (BDW-NS)	2.4 GHz 4C Intel (BDW)
DRAM (type)	32 GB (DDR4)	16 GB (DDR4)
ASIC (number)	Q200 (1x)	UADP3 (3x)
Capacity	12 Tbps (full duplex)	Upto 6.4 Tbps (full duplex)
10G max	120 *^	Upto 48
25G max	120 *^	Upto 48
50G max	120 *^	–
40G max	(28+32)60 *^	Upto 32
100G max	(28+32)60 *^	Upto 32
400G max	8	–

* Roadmap (not committed). ^ Using Breakout cable ports.

C9500X-60L4D Block Diagram

Gen2 Fixed 1RU QSFP Switch – 60x50G and 4x100/400G



Catalyst 9500X

Port Density

	 Catalyst® 9500X–28C8D		 Catalyst 9500X–60L4D		 Catalyst 9500–48Y4C	
	S1 Family				UADP Family	
CPU ^(BDW-NS, BDW)	2.7 GHz 8C Intel® ^(BDW-NS)		2.7 GHz 8C Intel® ^(BDW-NS)		2.4 GHz 4C Intel® ^(BDW-NS)	
DRAM ^(type)	32 GB ^(DDR4)		32 GB ^(DDR4)		16 GB ^(DDR4)	
ASIC ^(number)	Q200 ^(1x)		Q200 ^(1x)		UADP 3.0 ^(1x)	
Capacity	12 Tbps ^(full duplex)		9.2 Tbps ^(full duplex)		3.2 Tbps ^(full duplex)	
	No Breakout	With Breakout	No Breakout	With Breakout	No Breakout	With Breakout
10G ^{max}	36 with QSA	88	60 Native + 4 QSA	76*	48 Native + 4 QSA	64
25G ^{max}	–	88	60	76*	48	64
50G ^{max}	–	88	60	76*	–	
40G ^{max}	36	60*	4	16*	4	
100G ^{max}	36	60	4	16*	4	
400G ^{max}	8		4		–	
Encryption	MACsec and WAN-MACsec		IPsec*, WAN-MACsec and MACsec		MACsec	

* Roadmap (not committed)

Catalyst 9500X and 9500H – features and scales

	 Catalyst® 9500X (Silicon One Q200)		 Catalyst 9500H (UADP 3)	
	Default	Maximum (Custom)	Default	Maximum (custom)
MAC addresses	128,000	256,000	80,000	128,000
IP host routes	128,000	256,000	80,000	128,000
Multicast L2 groups	16,000	64,000*	16,000	48,000
Multicast L3 routes	32,000	64,000*	32,000	48,000
IP LPM routes	2 million	2 million	212,000	256,000
MPLS labels	256,000	512,000	32,000	64,000
SGT/OG labels	32,000	64,000	32,000	64,000
NAT* sessions	16,000*	128,000*	3000	16,000
Security ACL entries	8000	10,000*	12,000	27,000
QoS ACL entries	8000	10,000*	8000	21,000
PBR* ACL entries	8000*	10,000*	3000	16,000

* Roadmap for Catalyst 9600X (not committed).

Catalyst 9500X for continued market leadership

Competitive challenges

ARISTA



Campus: 7050SX3



Data center: 7280R3

aruba
a Hewlett Packard
Enterprise company



CX 8320/25



CX 8360

Threats

- 7050SX3 in campus with higher 40/100G density
- Positioning data center switch: 7280R3 in campus core with higher scale and speeds/feeds

Threats

- Higher port densities
- Higher route, MAC scales

Leadership with Catalyst® 9500X and 9500 models

	Cisco Catalyst 9500X	Arista 7280R3	Cisco Catalyst 9500H	7050SX3	Aruba CX8300
	Q200	Jericho2	UADP	Trident3	T3/Gen 7
Scale, performance, hardware differentiation					
More IP LPM routes	Best	Best	Partial	Partial	Partial
Scaled MPLS labels	Best	Best	Partial	Partial	Partial
Extensive security, QoS, PBR ACLs	Best	Best	Partial	Partial	Partial
400G ports	Best	Best	Partial	Partial	Partial
Customizable ASIC templates	Best	Partial	Best	Partial	Partial
Enterprise-grade campus differentiation					
Line-rate encryption MACsec, WAN MACsec, NetFlow	Best	Partial	Partial	Partial	Partial
Unmatched flexibility Customizable ASIC templates, MPLS, GRE, NAT support	Best	Partial	Best	Partial	Partial
400G leadership in campus Support for 10G to 400G speeds	Best	Best	Partial	Partial	Partial

Legend

Best

Partial

Bad

Highlight higher scale, performance, and 400G leadership in campus.

Showcase unmatched customizable ASIC template capability.

Win with Catalyst 9500X differentiation against the competition.



Catalyst 9500 & 9600 Series

Customizable SDM Templates

Catalyst 9600–SUP1 & Catalyst 9500 High Performance Switch Database Management (SDM) template

Core template

Maximizes system resources for Layer 3 unicast and multicast **routes (default)**

SD–Access template

Maximizes system resources for **policy** to support **fabric** deployment

User–customizable template

Allows customizable ACL TCAM resources



Cisco Catalyst®
9600 & 9500 Series

Distribution template

Balances system resources between Layer 3 **routes** and Layer 2 **MAC** and **Netflow**

NAT template

Maximizes the **NAT** configurations on the switch

Catalyst 9600 – Sup1/Catalyst 9500 High Performance

SDM templates and scale numbers

IOS-XE 17.2.1

Feature		Distribution	Core (default)	SDA	NAT
Routes (IPv4/IPv6)		114K/114K	212K/212K	212K/212K	212K/212K
Multicast routes (IPv4/IPv6)		16K/16K	32K/32K	32K/32K	32K/32K
MAC address table		82K	32K	32K	32K
IGMP/MLD snooping		2K	2K	2K	2K
Flexible NetFlow (Ingress)		49K/ASIC	32K/ASIC	32K/ASIC	32K/ASIC
Flexible NetFlow (Egress)		49K/ASIC	32K/ASIC	32K/ASIC	32K/ASIC
SGT label		32K	32K	32K	32K
Security ACL	Ingress 		12K	8K	12K
	Egress 		15K	19K	8K
QOS ACL	Ingress 		8K	8K	4K
	Egress 		8K	8K	4K
NetFlow ACL	Ingress 		1K	1K	1K
	Egress 		1K	1K	1K
SPAN	Ingress 		0.5K	0.5K	0.5K
	Egress 		0.5K	0.5K	0.5K
PBR/NAT			3K	2K	15.5K
CPP			1K	1K	1K
Tunnel termination and MACsec			3K	3K	2K
LISP			1K	2K	1K



Customizable resources

Catalyst 9600 – Sup1/Catalyst 9500 High Performance

SDM Templates, Scale & Customization

Feature		Distribution	Core (default)	SDA*	NAT
	Routes (IPv4/IPv6)	114K/114K	212K/212K	212K/212K	212K/212K
	Multicast routes (IPv4/IPv6)	16K/16K	32K/32K	32K/32K	32K/32K
	MAC address table	82K	32K	32K	32K
	IGMP/MLD snooping	2K	2K	2K	2K
	Flexible NetFlow (Ingress)	49K/ASIC	32K/ASIC	32K/ASIC	32K/ASIC
	Flexible NetFlow (Egress)	49K/ASIC	32K/ASIC	32K/ASIC	32K/ASIC
	SGT label	32K	32K	32K	32K
	Security ACL	Ingress	12K	8K	12K
		Egress	15K	19K	8K
	QOS ACL	Ingress	8K	8K	4K
		Egress	8K	8K	4K
	NetFlow ACL	Ingress	1K	1K	1K
		Egress	1K	1K	1K
	SPAN	Ingress	0.5K	0.5K	0.5K
		Egress	0.5K	0.5K	0.5K
	PBR/NAT		3K	2K	15.5K
	CPP		1K	1K	1K
	Tunnel termination and MACsec		3K	3K	2K
	LISP		1K	2K	1K

IOS-XE 17.3.1

IOS-XE 17.4.1

Higher scale



Customizable resources

* SDA template is depreciated with 17.3.1 release

FIB Scale Customization

IOS-XE 17.3.1

* Total Multicast (L2+L3) =/≤ 48K

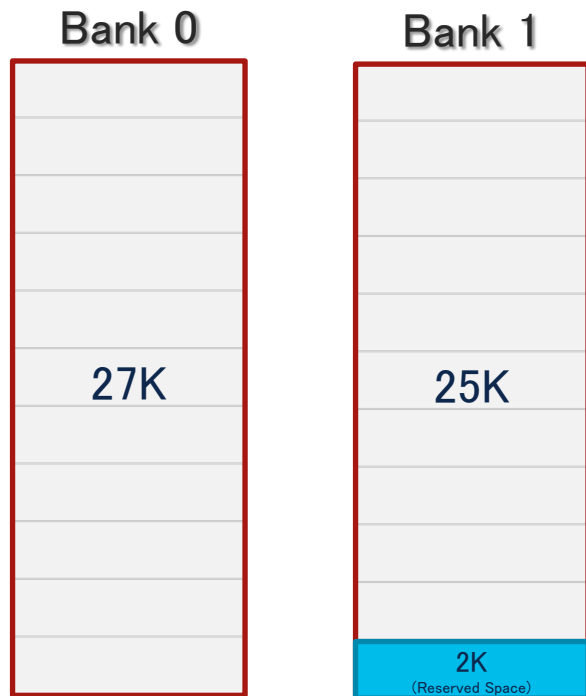
Feature	Scale Values (Min – Max)	Default Value	Step Units
L2 MAC	32K – 128K	32K	16K
L3 Unicast	64K – 256K	64K	16K
L3 Multicast *	0 – 32K	16K	16k
L2 Multicast *	0 – 32K	16K	16K
SGT & MPLS IP-to-Tag labels	0 – 64K	32K	32K
Netflow – Input	0 – 64K	32K	32K
Netflow – Output	0 – 64K	0	32K
Total Resources	416K		

Scale Values: minimum and maximum possible values
Step Units: granularity (block size) of scale per type
Default Value: default value, if it's not specified by CLI

16K – 16384
32K – 32768

ACL Scale Considerations

IOS-XE 17.4.1



ACL Features

Feature	Scale Values (Min - Max)	Default Value	Step Size	Customizable
Ingress ACL	4K - 26K, 27K	4K	2K	Y
Egress ACL	4K - 26K, 27K	4K	2K	Y
Ingress QoS	1K, 2K - 16K	1K	2K	Y
Egress QoS	1K, 2K - 16K	1K	2K	Y
PBR/NAT	1K, 2K - 16K	1K	2K	Y
LISP	1K - 2K	1K	1K	Y
Tunnels	1K - 3K	1K	1K	Y
NFL ACL	1K - 2K	1K	1K	Y
Ingress SPAN	NA	0.5K	NA	N
Egress SPAN	NA	0.5K	NA	N
CPP	NA	0.5K	NA	N
Sec. Assoc	NA	0.5K	NA	N
Macsec SPD	NA	0.25K	NA	N



Catalyst 9600X–SUP2 & Catalyst 9500X Switch Database Management (SDM) template

Default template

Maximizes system
resources
for Layer 3 unicast and
multicast **routes**

User-customizable
template
Allows customizable
ACL TCAM resources



Cisco Catalyst®
9600X & 9500X Series

Custom template

Provide flexibility for
customizing TCAM space
for specific requirements

Catalyst 9600X – Sup2/Catalyst 9500X



Features	Customizable	DEFAULT (core + edge)	Custom (min to max @ step)	
MAC addresses	✓	128,000	32,000 to 256,000	@ 1000 step
Host routes (ARP/NDP)	✓	128,000/64,000	32,000 to 256,000	@ 1000 step
Layer 2 multicast entries (IGMP/MLD)	FCS+	16,000/8000	0 to 64,000	@ 1000 step
Layer 3 multicast routes (IPv4/IPv6)	FCS+	32,000/16,000	0 to 64,000	@ 1000 step
ACL compression (SGT, DGT, OGID/v6)	✓	32,000/16,000	0 to 64,000	@ 1000 step
MPLS labels	✓	256,000	0 to 512,000	@ 1000 step
Reserved (PBR/NAT)	FCS+	16,000/8,000	0 to 256,000	@ 1000 step
	CEM	608,000 (288,000 for LPM)		
Layer 3 unicast routes (IPv4/IPv6)	FCS+	2 million/ 1 million	1 million to 2 million	@ 1 million step
Features	Customizable	DEFAULT (core + edge)	Custom (min to max @ step)	
Security ACL (IPv4/IPv6)	FCS+	8000/4000 shared*	0 to 11,000/5000	@ 1 step
Quality of service (IPv4/IPv6)	FCS+	8000/4000 shared*	0 to 11,000/5000	@ 1 step
Policy-based routing (IPv4/IPv6)	FCS+	8000/4000 shared*	0 to 11,000/5000	@ 1 step
Lawful intercept (IPv4/IPv6)	FCS+	1000 (2x 512) reserved	1000 to 5000/2500	@ 1 tap (2 ACE)
LPTS, EPC, FSPAN, NFL (IPv4/IPv6)	FCS+	1000 (2x 512) reserved	1000	@ 1 step
	TCAM	10,000 (2000 for LPM)		

* Shared is an unreserved space, first come, first served per feature.

New IOSXE & Q200 ACL Tools

OGACL Conversion and TCAM Fit Tool



IP ACL to OGACL

- ✓ Convert IP/Port ACLs into Object-Groups & OGACLs
- ✓ Dynamic Object-Group names can be Customized
- ✓ Color-coded Object-Groups for easier correlation
- ✓ Compress IP/Port ACLs for up to 70-80% less space

Group Configuration

Use the interface below to rename individual groups that were generated by the script.

Job Data

Job Input File

Job Result (Output Text)

ACL TCAM Fit

- ✓ Check if your ACEs (Security & QoS) fit into TCAM
- ✓ Parse a running-configuration to learn ACLs & Ports
- ✓ Test different C9500X & 9600X ACL + Port configs
- ✓ Identify which ACE and/or Port config exceeds size

FIT !!

Job Data

ACL Name/Feature/Policy	Block 0			Block 1			Block 2			Block 3			Block 4			Block 5		
	Interface	Used	Free	Interface	Used	Free	Interface	Used	Free	Interface	Used	Free	Interface	Used	Free	Interface	Used	Free
ingress Networ_Prot_0		1	4760		1	4760		1	4760		1	4760		1	4760		1	4760
ingress Networ_Prot_1		40	4800		40	4800		40	4800		40	4800		40	4800		40	4800
ingress Networ_Prot_2		40	4800		40	4800		40	4800		40	4800		40	4800		40	4800
ingress Networ_Prot_3		0	4874		0	4874		0	4874		0	4874		0	4874		0	4874
ingress Networ_Prot_4		40	4800		40	4800		40	4800		40	4800		40	4800		40	4800



Cisco Catalyst 9400 Series



Cisco Catalyst 9400 Series

Industry Leading Modular Access



IEEE 802.3bt
90W PoE
compliant

4-slot



Redundancy
is now
table stakes

7-slot



480G BW
per slot with
Sup2XL

10-slot

Supervisors

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

Copper Line Cards

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

Fiber Line Cards

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

Power Supplies

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

Cisco Catalyst 9400 Series

Chassis Options

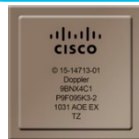


		4-slot	7-slot	10-slot
Supervisor		2 (redundant)		
Line Cards		2	5	8
Max LC ports by speed	10/100/100M	96	240	384
	1/2/5/10G	96	240	384
	1/10G SFP	96	240	384
	25G SFP	40	100	160
	40G QSFP+	24	60	96
	100G QSFP28	8	20	32
Max SUP ports by speed	10G SFP	8 (SUP1) – 4 (SUP2)		
	25G SFP	2 (SUP1-XL) – 4 (SUP2)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

Cisco Catalyst 9400X

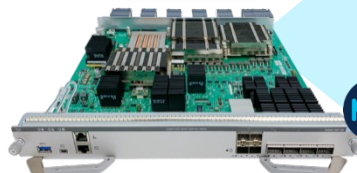
New Supervisor 2/2XL powered by Cisco UADP 3.0sec

UADP 2.0XL



SUP-1/1XL
Features
optimized

UADP 3.0sec



SUP-2/2XL
Features
and scale

NEW



Up to 240G
bandwidth



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



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



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



Up to 1.6T
bandwidth



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



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



Up to 36 MB
unified packet buffer



Up to 100G
Encryption
IPsec*, WAN MACsec*



Customizable
templates for
higher scale*

* Hardware capable, Software support in future release.

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

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

Unmatched flexibility

Maximum investment protection

100G leadership in access

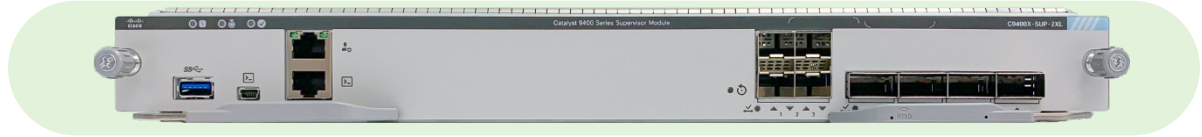
Same series, chassis options – New supervisors and line cards

Catalyst 9400 Supervisor Modules

Supported on all Chassis Types

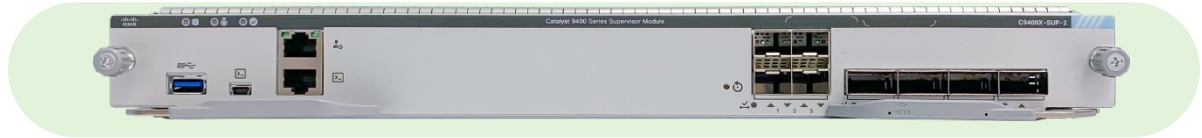
C9400X-SUP-2XL

480G/slot High-end Access



C9400X-SUP-2

240G/slot Extended Access



C9400-SUP-1XL-Y

80-240G/slot Access



C9400-SUP-1XL

80-240G/slot Access



C9400-SUP-1

80G/slot Access

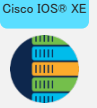
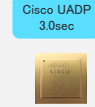


Note: Same supervisor model required in dual SUP/SSO configuration.

Catalyst 9400 Series – Sup2XL

Overview

IOS-XE 17.7.1



4.8 Tbps full duplex
(line cards and uplinks)

3x UADP 3.0sec ASICs

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

USB 3.0

MACsec-256

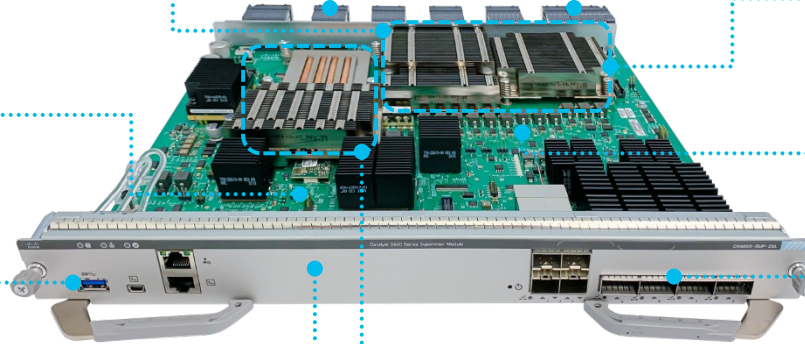
Line card slot bandwidth:
480Gb/slot with Sup2XL

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

16-GB DRAM and
16-GB flash

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

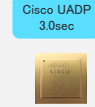
2.4-GHz 8-core x86 CPU
QAT (20G HW crypto)



Catalyst 9400 Series – Sup2

Overview

IOS-XE 17.7.1



2.4 Tbps full duplex
(line cards and uplinks)

3x UADP 3.0sec ASICs

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

USB 3.0

MACsec-256

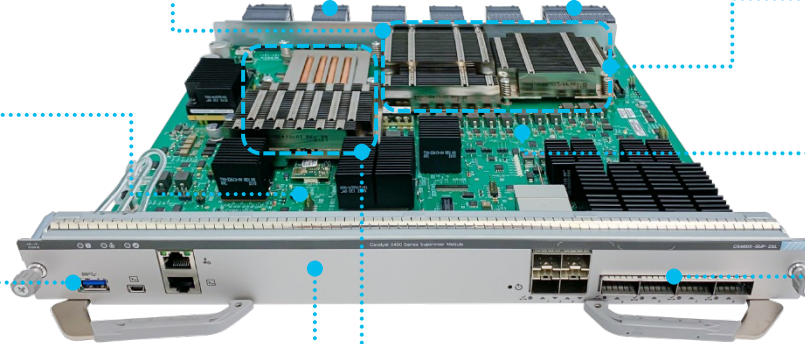
Line card slot bandwidth:
240Gb/slot

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

16-GB DRAM and
16-GB flash

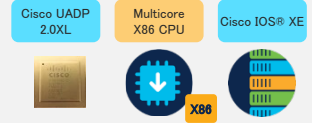
Uplinks:
4x25/10G, 4x100/40G

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



Catalyst 9400 Series – Sup-1XL

Overview



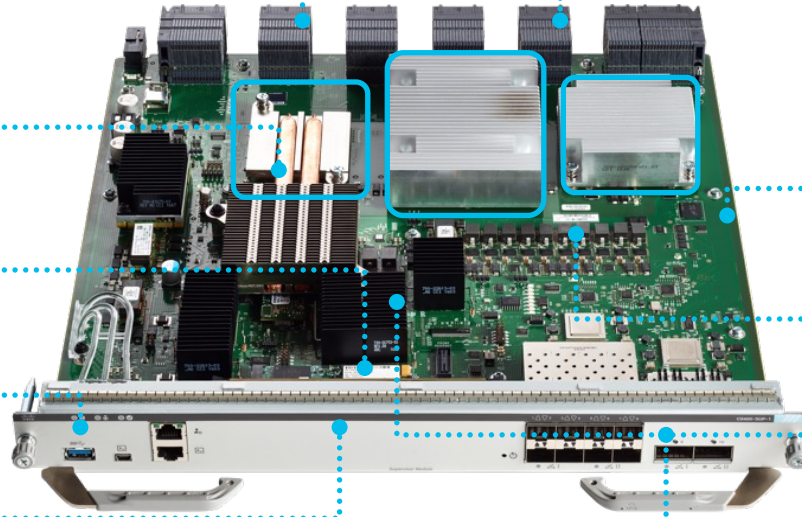
720G line cards, uplinks

UADP 2.0 XL ASICs

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

USB 2.0/3.0

MACsec-256



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

Templates: Distribution,
Core, SD Border

16G DRAM and 16G flash

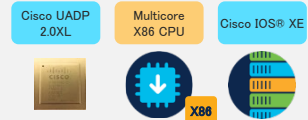
2.4-GHz quad-core x86 CPU

Uplinks:
8x 10G, 2x 40G

MACsec is not supported on 1G speed on uplinks

Catalyst 9400 Series – Sup-1XL-Y

Overview



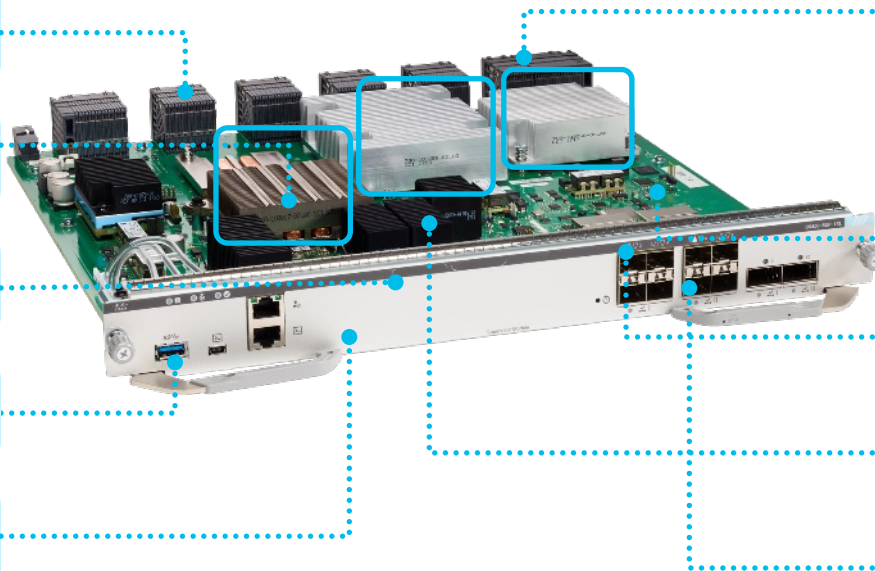
720G line cards, uplinks

UADP 2.0 XL ASICs

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

USB 2.0/3.0

MACsec-256



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

Templates: Distribution,
Core, SD Border

16G DRAM and 16G flash

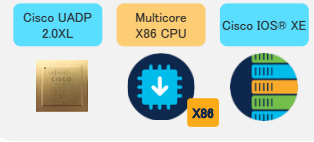
2.4-GHz quad-core x86 CPU

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

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

Cisco Catalyst 9400 Series – Sup-1

Overview



720G line cards, uplinks

UADP 2.0 XL ASICs

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

USB 2.0/3.0

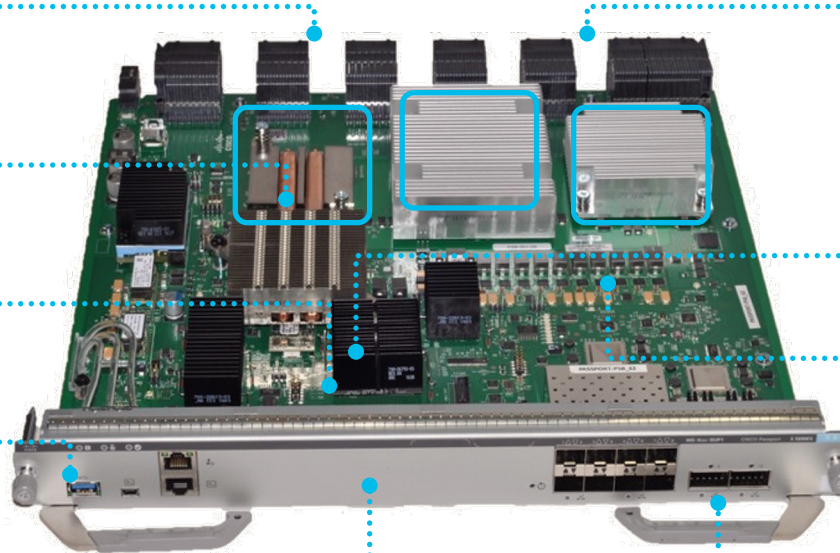
MACsec-256

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

2.4-GHz quad-core x86 CPU

16G DRAM and 16G flash

Uplinks:
8x 10G, 2x 40G

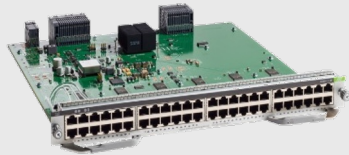


MACsec is not supported on 1G speed on uplinks

Line cards – RJ-45

TrustSec and MacSec-256 supported on all

DATA



C9400-LC-48T

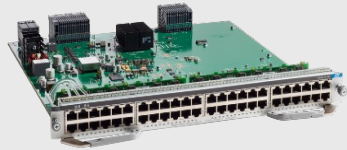
48x 10/100/1000M



C9400-LC-48HX

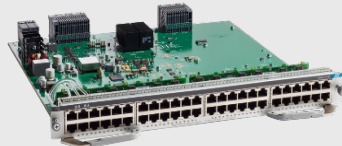
48x
100M/1G/2.5G/5G/10G
PoE+/UPOE+
up to 90W

POE+/UPOE



C9400-LC-48P

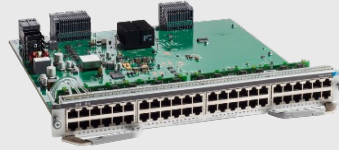
48x 10/100/1000M PoE+



C9400-LC-48U

48x 10/100/1000M UPOE®

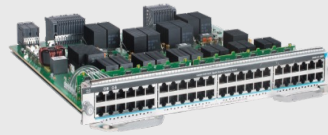
UPOE +



C9400-LC-48H

48x 10/100/1000M

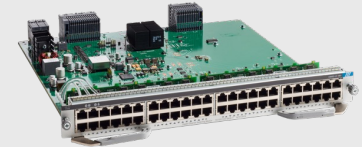
UPOE+/802.3bt



C9400-LC-48HX

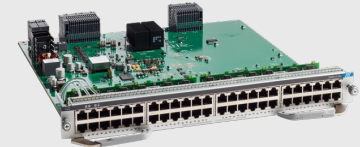
48x 100M/1G/2.5G/5G/10G
PoE+/UPOE+
up to 90W

MultiGigabit



C9400-LC-

48H
24x MultiGigabit + 24 10/100/1000M



C9400-LC-48HN

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

Line cards – SFP/SFP+/SFP28

TrustSec and MACsec-256

1/10/25Gb SFP+/SFP28



C9400-LC-24XY

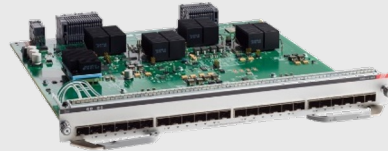
24x 10/25Gb SFP+/SFP28

1/10Gb SFP/SFP+



C9400-LC-48XS

48x 1/10Gb SFP/SFP+



C9400-LC-24XS

24x1/10Gb SFP/SFP+

1 Gb SFP



C9400-LC-24S

24x 1Gb SFP



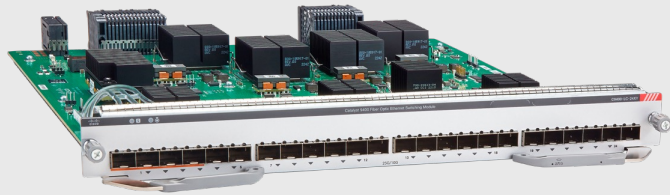
C9400-LC-48S

48x1Gb SFP

Line cards – SFP28/QSFP28

10/25G SFP28

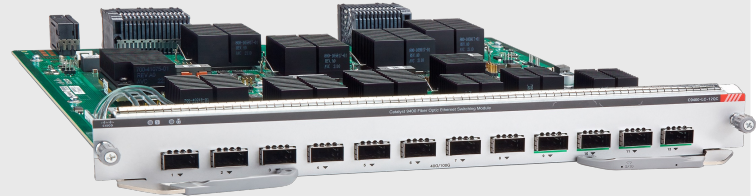
IOS-XE 17.12.1



C9400-LC-24XY
20x25Gb + 4x10Gbps

40/100Gbps QSFP28

IOS-XE 17.12.1



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

Bandwidth boost with Gen 2 supervisors



Catalyst® 9400 SUP-1/1XL

Catalyst 9400X SUP-2

Catalyst 9400X SUP-2XL

NEW

NEW

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

3x bandwidth uplift for Gen 1 line cards (80G → 240G) on 10-slot chassis with SUP-2XL

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

Bold indicates line rate

Catalyst 9400 Series

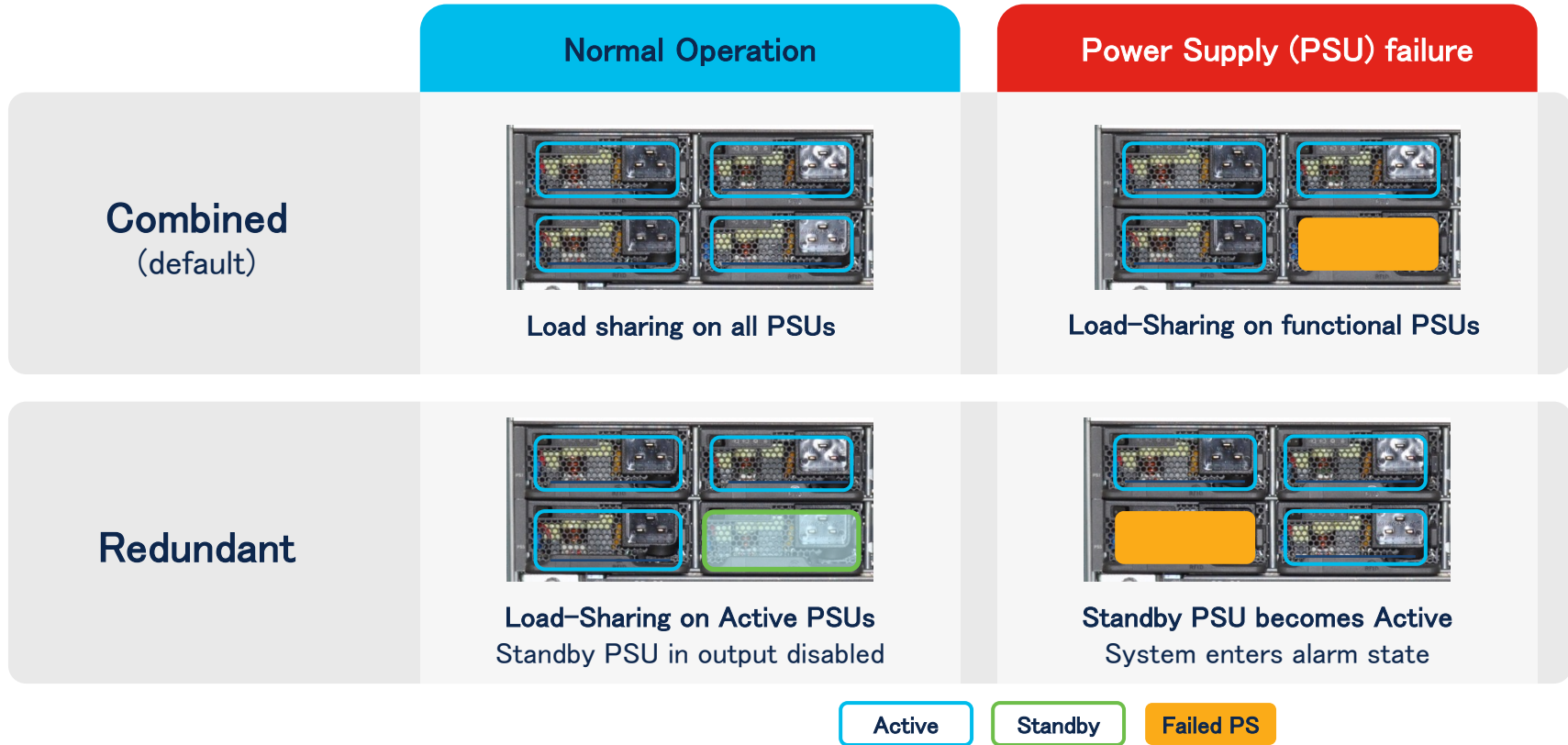
Power & Cooling

Cisco Catalyst 9400 Series – Power supplies

- **Modular Design:** 4x PSU for 4-slot or 8x PSU for 7 and 10-slot chassis
- **Load-Sharing:** Power for both Line Cards –and– Inline Power (PoE)
- **Slot Priority:** Lower-number Slot, with higher Power Priority (future)
- **Platinum-rated:** $\geq 90\%$ power efficiency
- **Power Output:**
 - 3200W AC PSU with 240V input (1570W with 120V input. 16A input)
 - 2100W AC PSU with 240V input (940W with 120V input. 10.4A input)
 - 3200W DC PSU input voltage (–40 to –72 VDC)



Catalyst 9400 Power redundancy



Catalyst 9400 Power redundancy:

N+1 and N+N redundant mode

[Power Configuration Guide](#)

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



```
SW(config)#power redundancy-mode redundant ?  
  N+N  Redundant N+N (N is active, N is standby)  
  N+1  Redundant N+N (N is active, 1 is standby)  
SW(config)#power redundancy-mode redundant N+N ?  
  <1-8> standby slot in N+N mode  
SWR(config)#
```

- Default Active is PS1 through 7, and Standby is PS8
- Standby power slot is configurable



```
SW(config)#power redundancy-mode redundant ?  
  N+N  Redundant N+N (N is active, N is standby)  
  N+1  Redundant N+N (N is active, 1 is standby)  
SW(config)#power redundancy-mode redundant N+1 ?  
  <1-8> standby slot in N+1 mode  
SWR(config)#
```

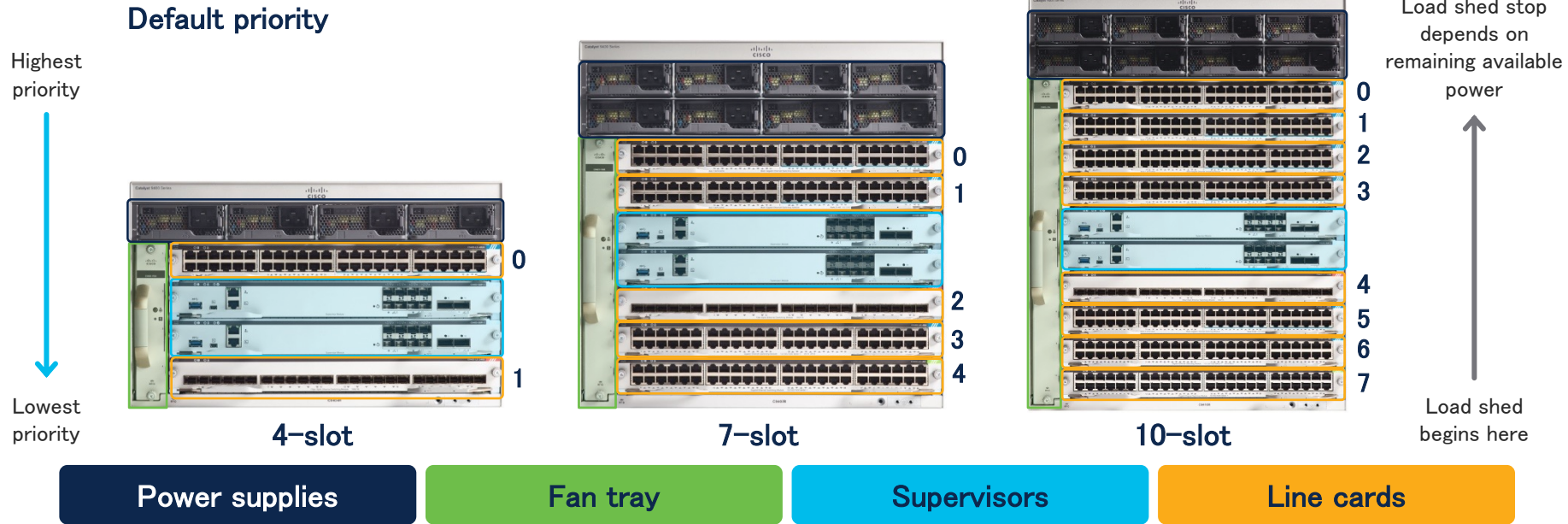
Active

Standby

Catalyst 9400 Series power management

Automatic Line Card shutdown and PoE port priority – in case of power load-shedding

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



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

UPOE+ port density with C9400-LC-48HN & LC-48HX

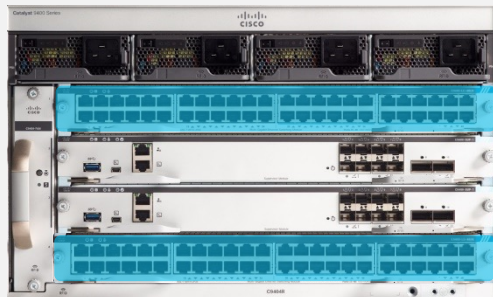
Port count for maximum 90W UPOE+ density

[Power Configuration Guide](#)



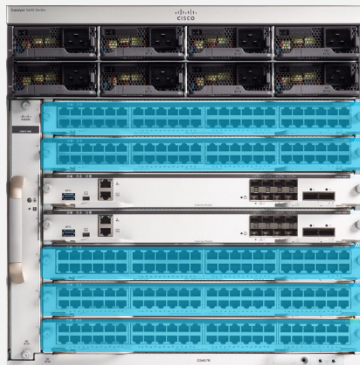
With fully-loaded **3200W** power supply in **combined mode**

C9404R



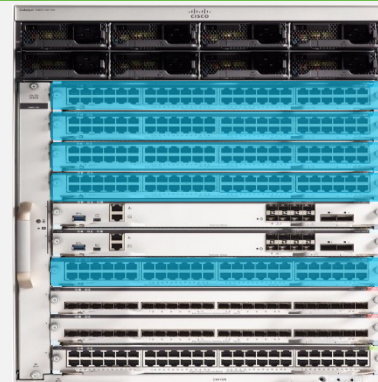
96 ports with C9400-LC-48HX
96 ports with C9400-LC-48HN
(fully-loaded chassis)

C9407R



226 ports with C9400-LC-48HX
231 ports with C9400-LC-48HN
(fully-loaded chassis)

C9410R



224 ports with C9400-LC-48HX
* 240/229 with C9400-LC-48HN
(up to 5 fully-loaded Line Cards)

*With Sup1-1XL/Sup2-2XL

Catalyst 9400 Fan Tray

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



Catalyst 9400 Series

SDM Templates

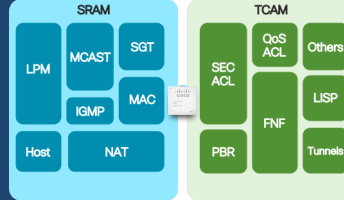
Default SDM

Access Template

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

Only option on 9400X prior to 17.11

User-Customizable ASIC Resources



Cisco Catalyst®
9400X

FIB Customization

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

ACL Customization

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

Custom SDM

Catalyst 9400X – Custom SDM Templates

SDM templates and scale numbers

Feature (ACL) TCAM

Forwarding (FIB) Hash

IOS-XE 17.11.1

NEW

FIB

Double width fields ensures IPv4 and IPv6 have the same scale

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

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

ACL ingress and egress are split between two cores

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

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

All features need dedicated space. 0 setting is not allowed

ACL TCAM

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



Customizable Resources

C9400–SUP–1XL/XL–Y SDM templates

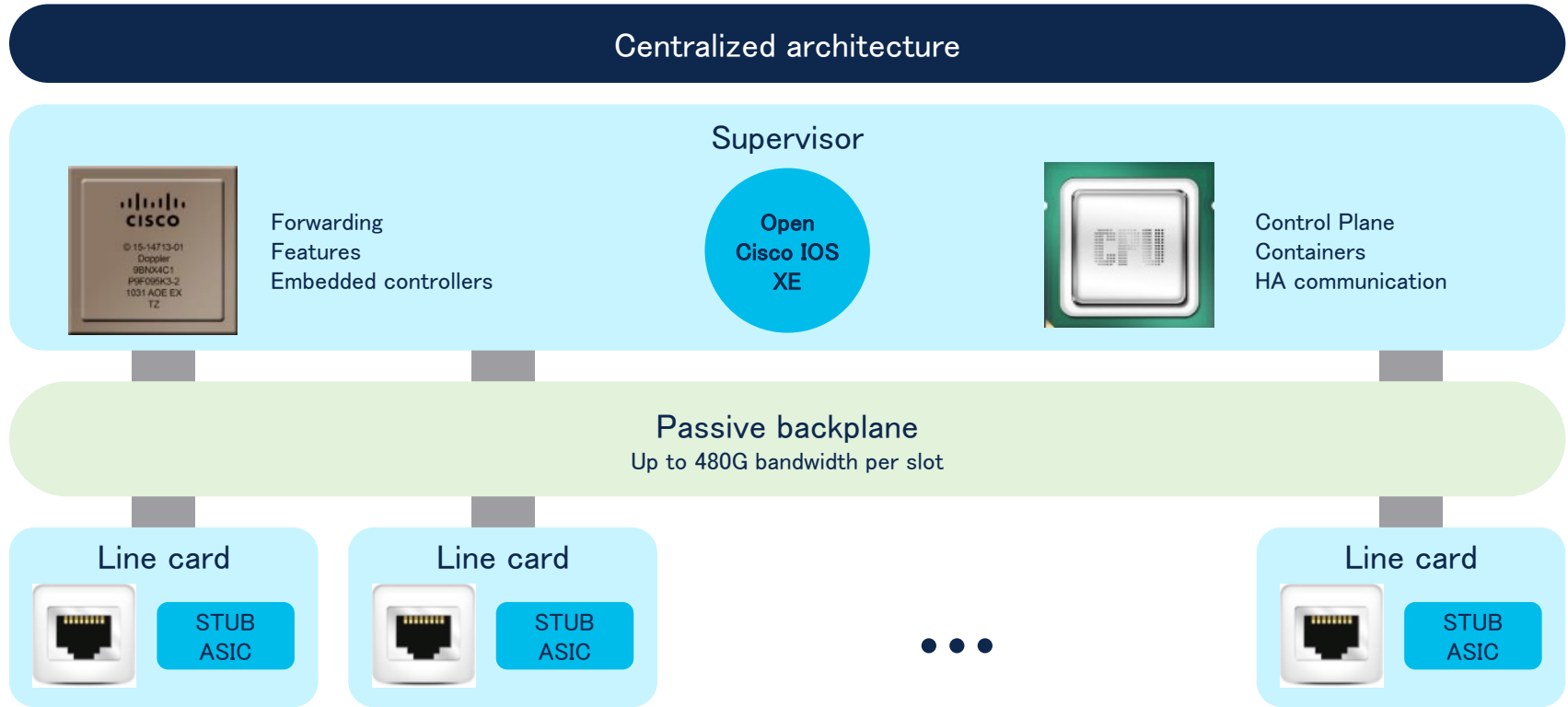
	16.6 to 16.8	16.9 and beyond		
	Access	Access	Core	NAT
Longest prefix match (LPM)	64,000	64,000	64,000	64,000
Host	48,000	48,000	32,000	48,000
Layer 2 multicast	16,000	16,000	16,000	16,000
Layer 3 multicast	16,000	16,000	32,000	32,000
MAC addresses	64,000	64,000	16,000	16,000
SGTs	8000	8000	8000	8000
Flexible NetFlow entries	128,000 per ASIC	128,000 per ASIC	128,000 per ASIC	128,000 per ASIC
Security ACLs	18,000	18,000	18,000	18,000
QoS ACLs	18,000	18,000	18,000	3000
PBR/NAT	2000	2000	2000	16,000
Tunnels	1000	1000	1000	1000
LISP	1000	1000	1000	1000
MPLS L3VPN VRFs	256	256	256	256
MPLS labels	8000	16,000	24,000	16,000
MPLS L3VPN routes VRF	16,000	32,000	32,000	32,000
MPLS L3VPN routes prefix	4000	4000	4000	4000
MVPN MDT tunnels	256	1000	1000	1000
L2VPN EoMPLS attachments	256	1000	1000	1000

Catalyst 9400 Series

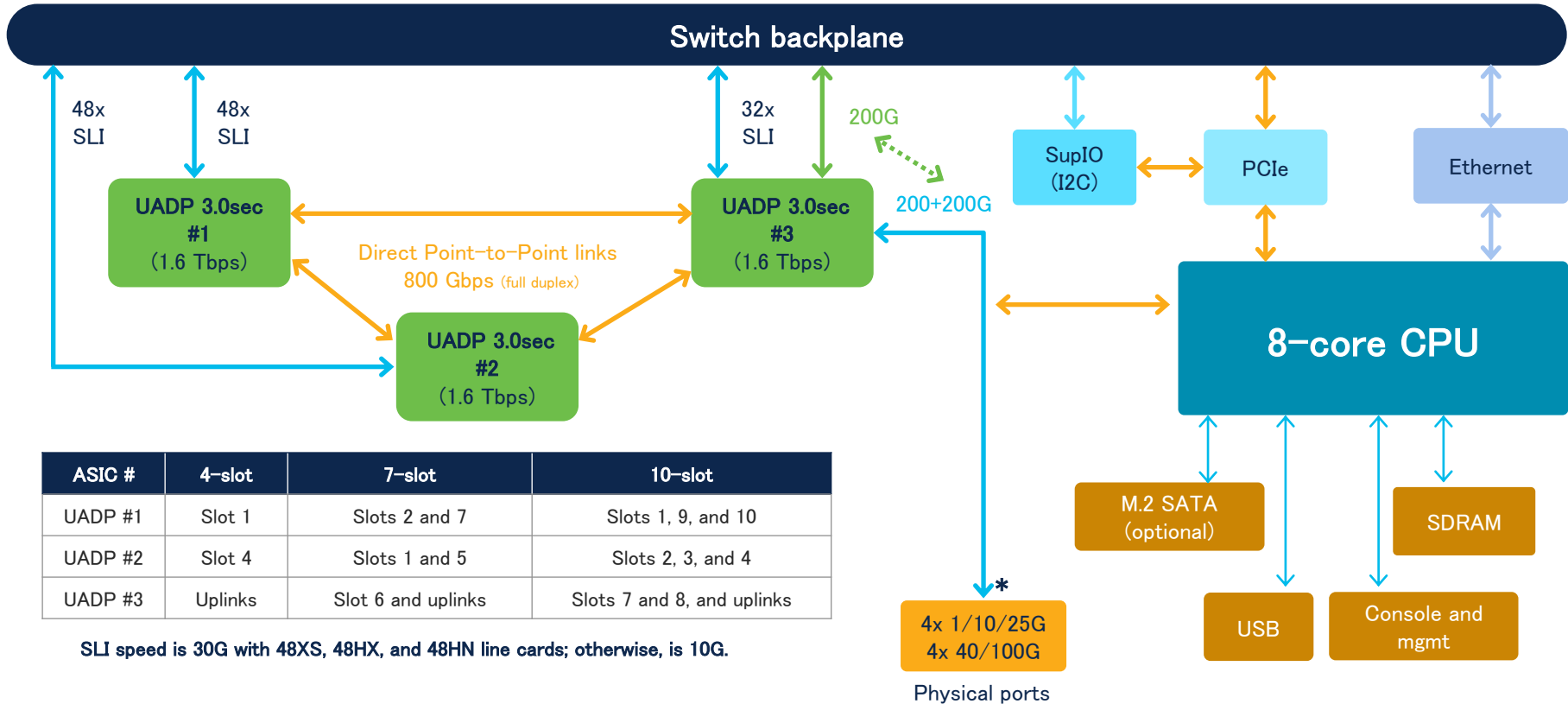
Architecture

Cisco Catalyst 9400 Series

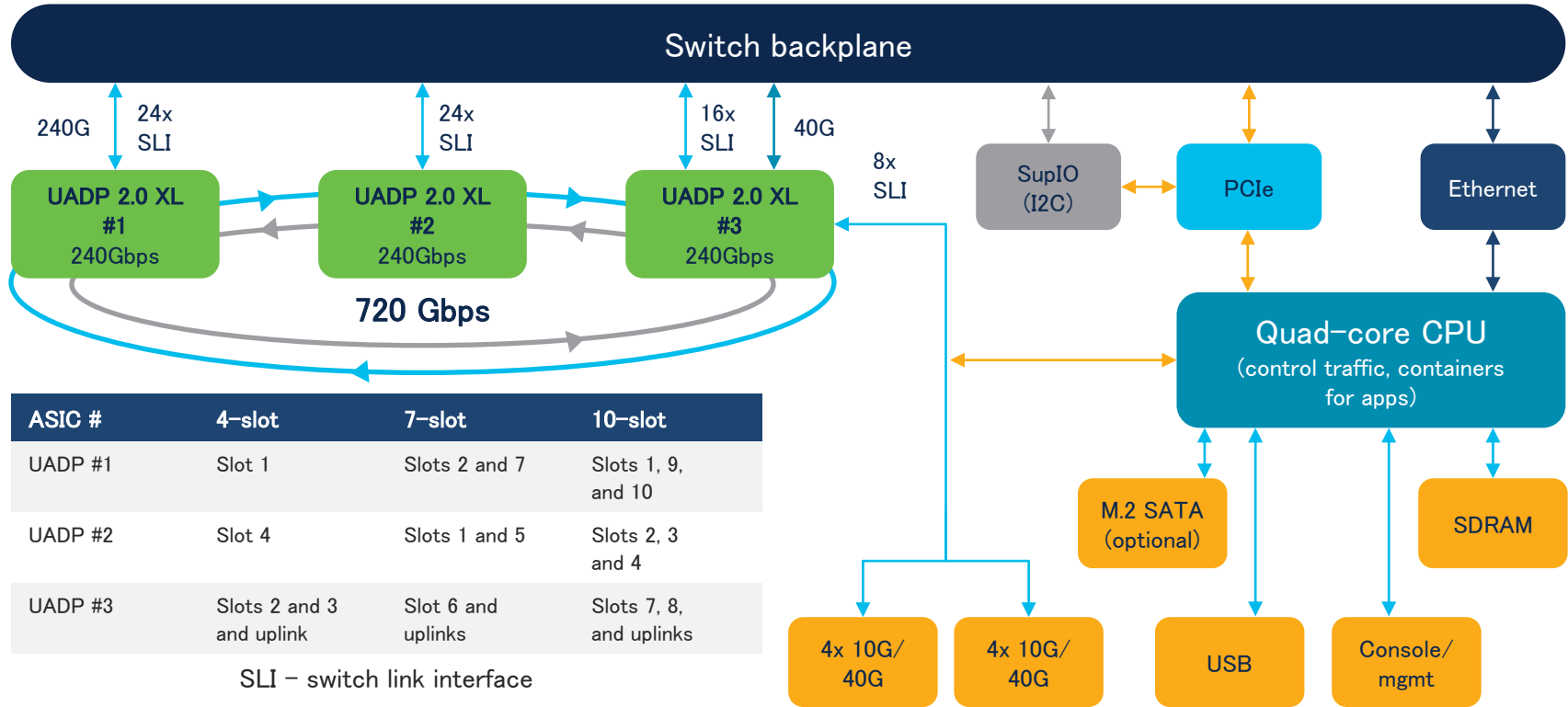
Centralized Modular Architecture



Catalyst 9400 SUP-2/2XL block diagram

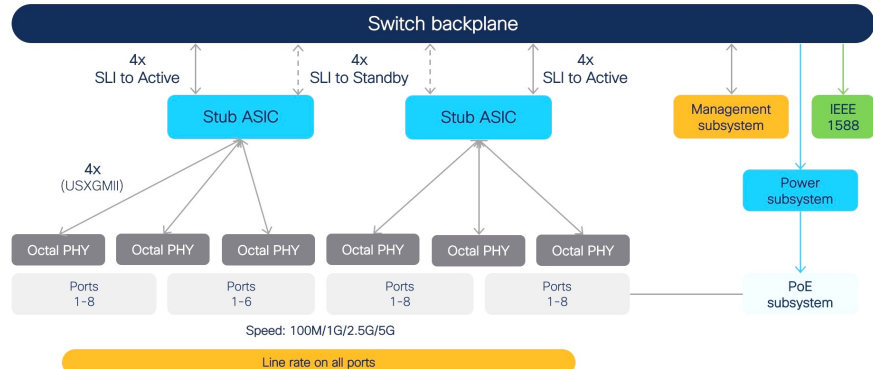


Catalyst 9400 Sup-1/1XL/1XL-Y block diagram



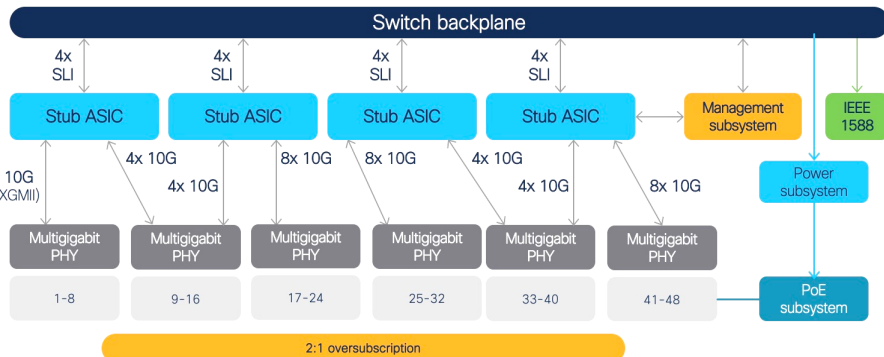
Catalyst 9400 Series – Line Cards Block Diagram

C9400-LC-48HN/Sup2



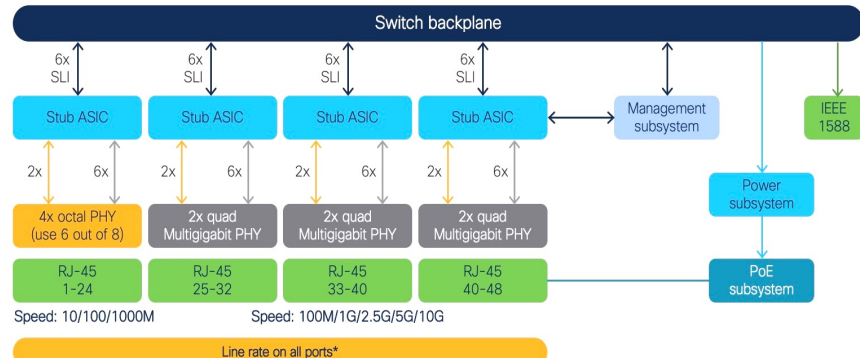
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SLI – Switch Link Interface – 30 Gbps

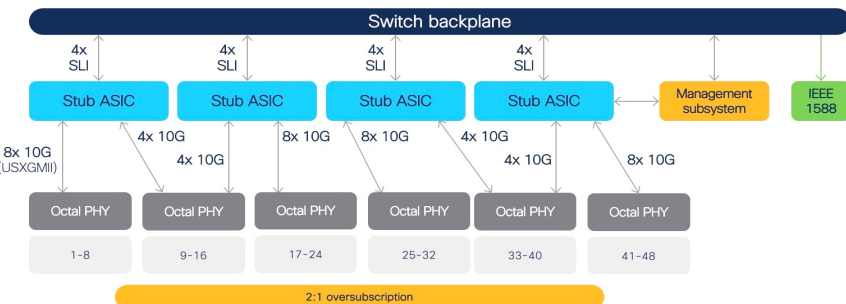


C9400-LC-48HX

C9400-LC-48UX/Sup2



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



C9400-LC-48XS

SLI – Switch Link Interface – 30 Gbps

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Catalyst 9400X vs. 9400 models – Physical

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

Catalyst 9400X vs. 9400 models – Features

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

* Software roadmap (FCS+).

SUP-2XL supported line cards

FYI

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

SUP-2 supported line cards

FYI

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

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

FYI

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

C9400X for continued market leadership

Competitive challenges

aruba
a Hewlett Packard
Enterprise company

6400



Shipping
For 1
year

Threats

- 50/100G Uplinks
- Highest MGIG/SFP+ density
- 25/40/100G aggregation
- AOS CX for cloud, security and HA

ARISTA

750



Nov,
2020

Threats

- 50/100G Uplinks
- Higher MGIG density
- Cognitive PoE
- Cloud Vision Managed

Leadership with C9400/9400X

	Cisco 9400	Aruba CX8400	Arista 750
Scale/Performance/Hardware Differentiation			
Max Full mGig ports (1/2.5/5/10G)			
90W PoE Line cards (mGig + non-mGig)			
100G Uplinks			
MAC Scale: Up to 160K, VP (STP, MST): Up to 64K, 100K			
Enterprise-Grade Campus Features Differentiation			
Full Stack Security: Encrypted Traffic Analytics, MACsec 128-bit/256-bit Link Encryption, Line Rate IPSec, Full Flexible Netflow, DNS Cloud Security Integration, FabricSec			
IoT Convergence: Embedded Wireless Controller, Wide Area Bonjour/SD-Bonjour, IEEE 1588 PTP, AVB* Application Hosting, Robust Edge Compute Capability, Fast/Perpetual POE			
Segmentation: SD-Access, EVPN-VXLAN, SGT, GBP, MPLS, VPLS, EoMPLS, MPLSoverGRE			
Application Visibility & Service Assurance: Cisco ThousandEyes Integration, NBAR2, AVC, Flexible Netflow			

* - HW ready

\$8B of Modular access installed base refresh estimated from FY21 – FY26

Lead with Investment Protection: Gen 1 backward compatibility

Win with C9400X differentiation against the competition!



Catalyst 9300 Series



Cisco Catalyst 9300 Series

Flexible High-End Fixed Access

Catalyst® 9300 models with **modular uplinks**

1G copper ports with PoE/Cisco UPOE®/UPOE+



48/24 ports data 1G



48/24 ports UPOE 1G



48/24 ports UPOE 1G



48/24 ports PoE+ 1G



48/24 ports UPOE+ 1G

Multigigabit models with UPOE



48/24 ports Multigigabit

1G fiber



48/24 ports SFP 1G

Catalyst® 9300X models with **modular uplinks**

1/10/25G Fiber



24/12 ports SFP+ 1G/10G/25G

mGig Copper models



24/48 mGig with UPOE+



48 mGig port Data only

StackWise® and StackPower cables



50CM-1M-3M



30CM-150CM

9300 Uplinks



4x Multigigabit



4x 1G SFP



8x 1/10G SFP/SFP+



2x 40G QSFP



2x 1/10/25G SFP/SFP+

9300X Uplinks



4x 100/40G* QSFP



2x 100/40G QSFP



8x 10G-Mgig



8x 25/10/1G**

Catalyst 9300 models with **Fixed uplinks**

1G Copper Data & PoE



48/24 ports PoE+/data 1G

Multigigabit models with UPOE



48/24 ports PoE+ 1G

Catalyst® 9300LM models with **Fixed uplinks**

NEW

4x25G Fixed Uplinks



40x 1G + 8 x mgig/10G



24 x 1G UPOE



48 x 1G Data



48 x 1G UPOE

Optional StackKit



Stack Adapters



50CM-1M-3M

Platinum-rated power supplies

Common components



315W AC



715W AC/DC



1100W AC



1900W AC

Modular fans



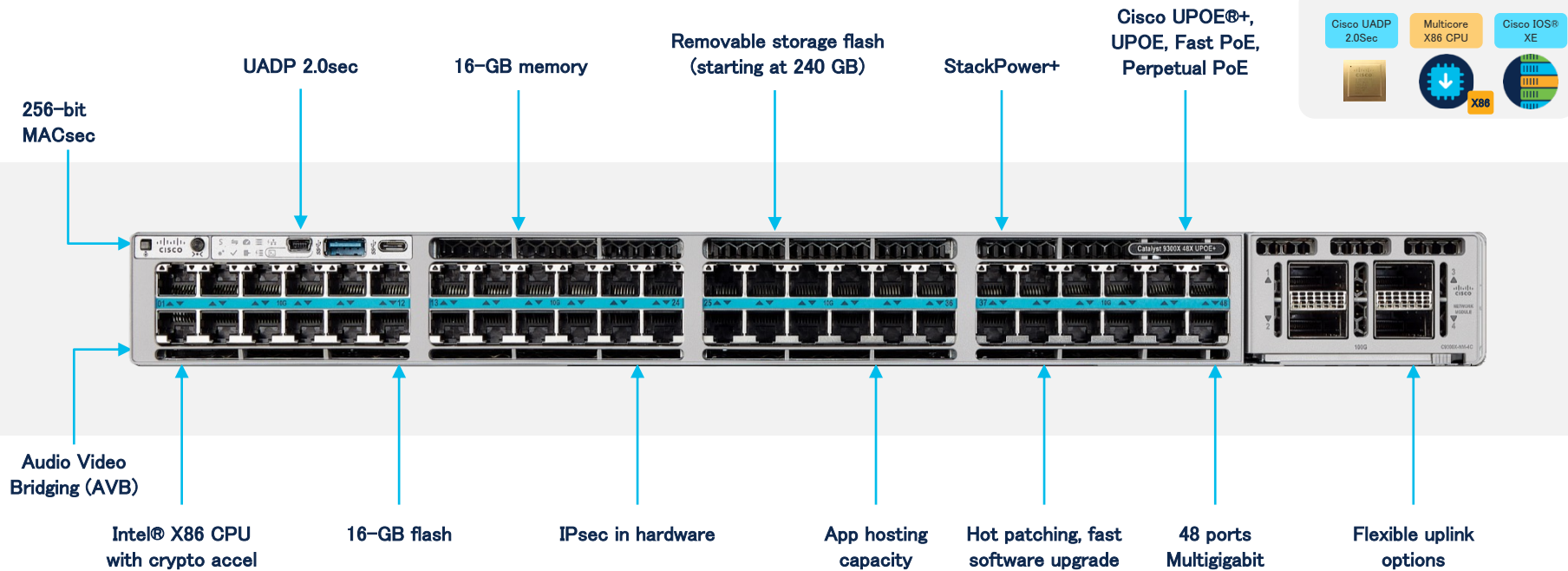
External Storage



USB 3.0
120/240GB

*Supported on 48HX and 24Y

Catalyst 9300X – High Performance Access Switch



Investment protection with Catalyst 9300X

External storage
(240-GB SSD)

Redundant fans

Redundant power



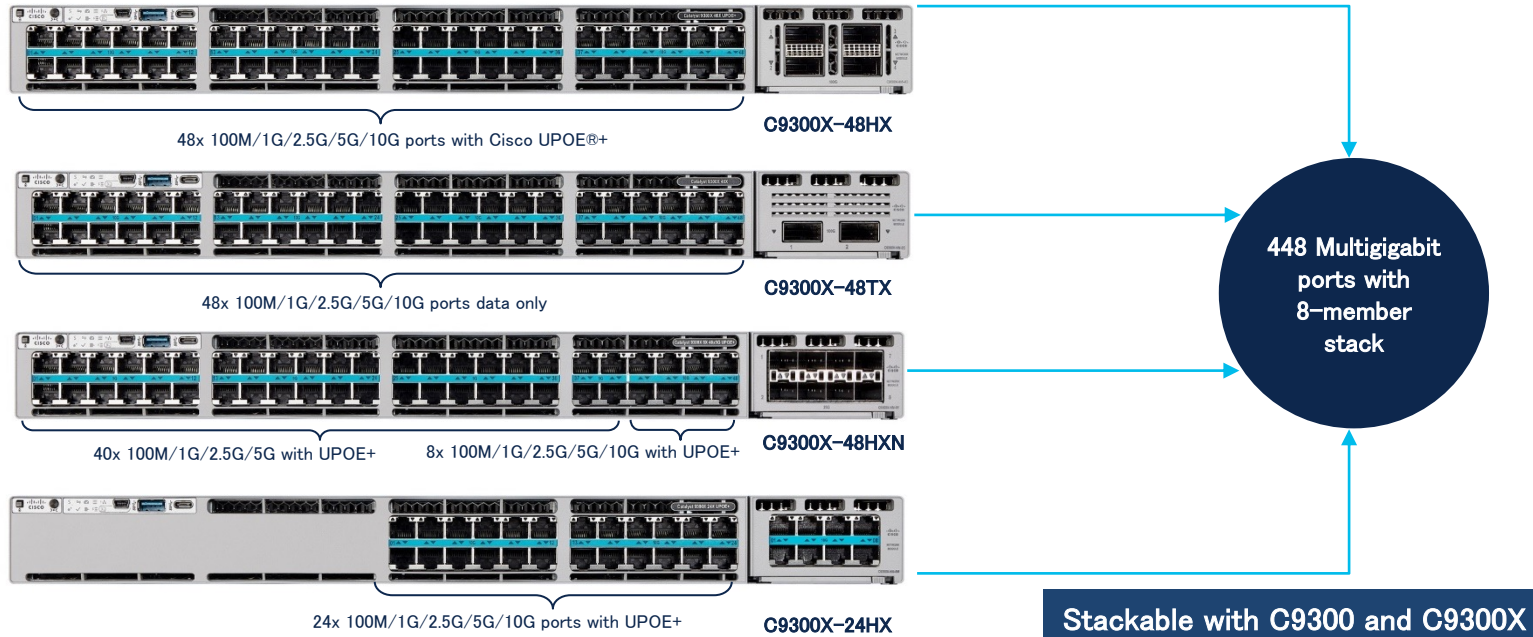
Data stack cables
1T Stacking BW

StackPower cables

Optional power supplies
(AC+DC)

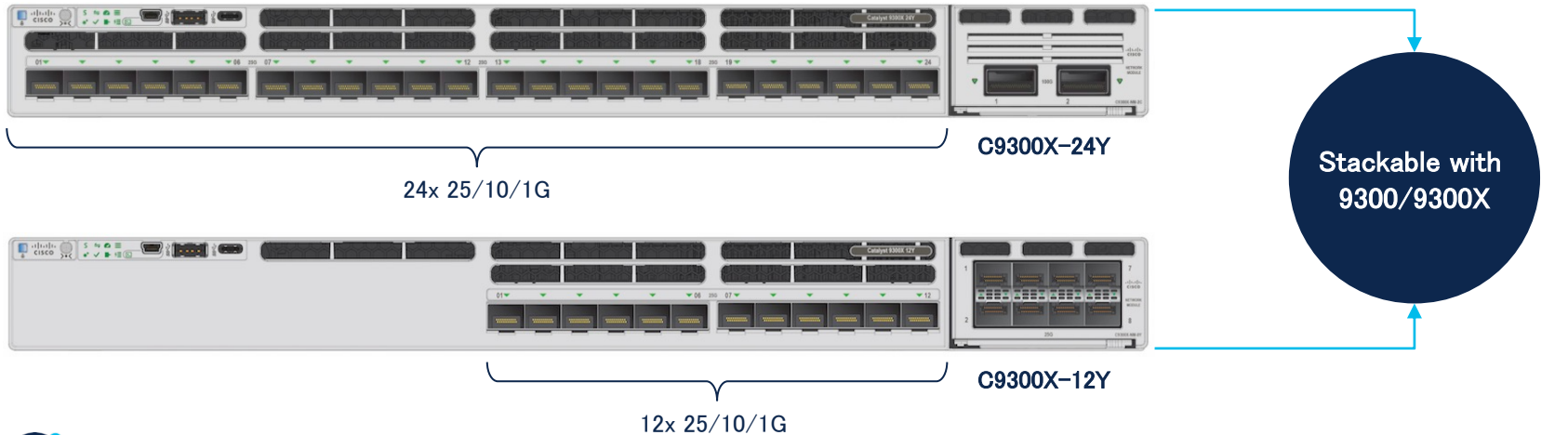
Common components and stacking backward compatible with Catalyst® 9300 Series

Catalyst 9300X Multigigabit models



Highest Multigigabit ports in the industry with standalone and StackWise®-1T

Catalyst 9300X high-speed fiber models

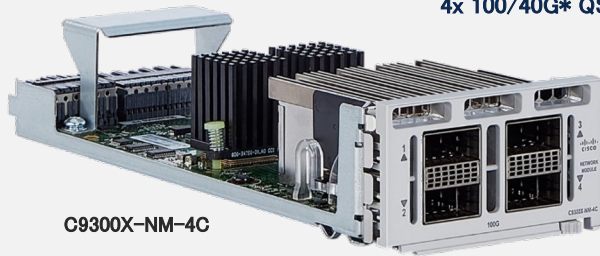


Bringing stackable high-speed fiber to access

Catalyst 9300X only uplinks

100/40G modular uplinks

4x 100/40G* QSFP



C9300X-NM-4C

2x 100/40G QSFP



C9300X-NM-2C

Multigigabit uplinks

8x 10G-Multigigabit



C9300X-NM-8M

10/25G modular uplinks

8x 25/10/1G**



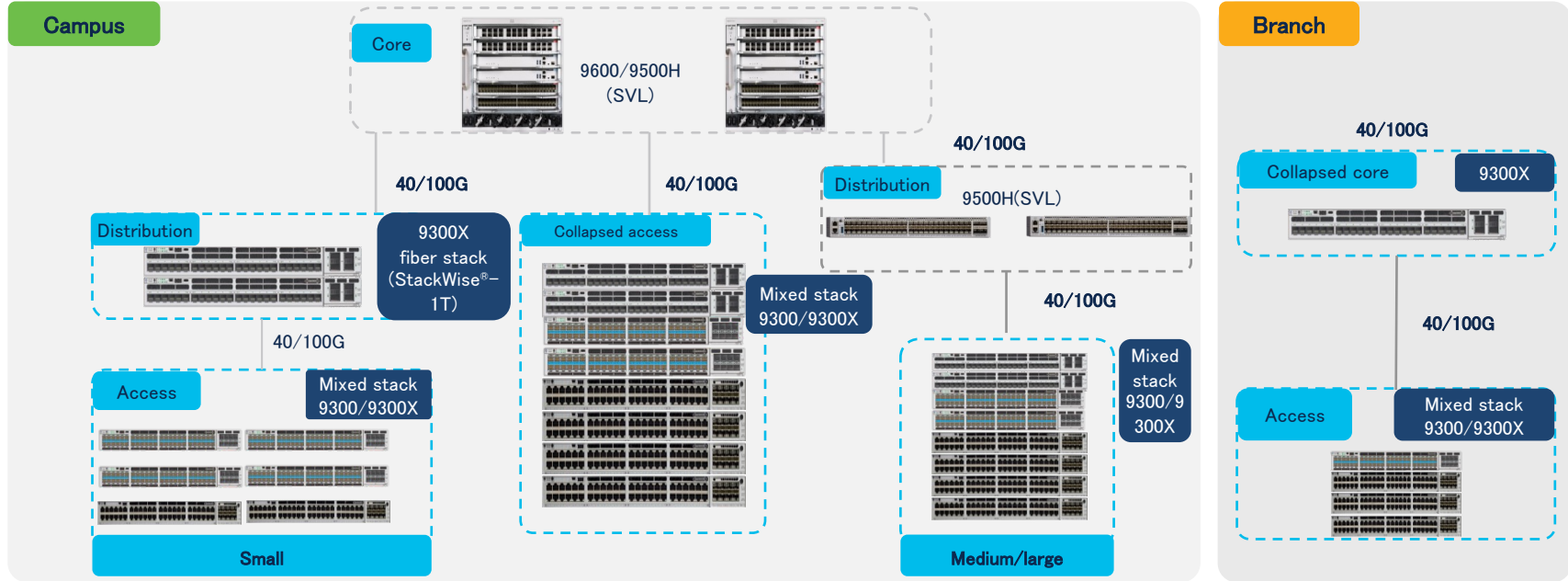
C9300X-NM-8Y

* C9300X-NM-4C is supported only C9300X-24Y and C9300X-48HX/TX.

** Last 4 ports disabled on C9300X-48HXN.

PoE is not supported on Uplink modules

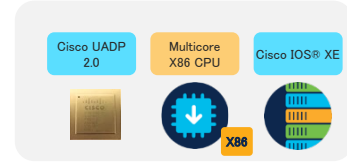
Flexible design options with the Catalyst 9300X in 2- or 3-tier architecture



Bringing 10/25/40/100G with StackWise-1 Terabit to access

Cisco Catalyst 9300 Series

Flexible Modular Uplink Models – Leading Fixed Access Switch



Catalyst® 9300 non-X models with modular uplinks

1G copper ports Data Only



48 ports data 1G



24 ports data 1G

1G copper ports with PoE/Cisco UPOE®/UPOE+



48/24 ports PoE+ 1G

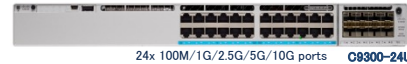


48/24 ports UPOE 1G



48/24 ports UPOE+ 1G

Multigigabit models with UPOE



24x 100M/1G/2.5G/5G/10G ports C9300-24UX



36x 2.5G ports 12x Multigigabit ports C9300-48UXM



48x 5G ports C9300-48UN

1G fiber models



48/24 ports SFP 1G

9300 Increased Scale models



C9300-48UB



C9300-24UXB



C9300-24UB

2x Buffers

2-4x Scale

More Packet Buffers

Increased Network Scale

Catalyst 9300 modular Uplinks

Common components



4x Multigigabit



4x 1G SFP



8x 1/10G SFP/SFP+



2x 1/10/25G SFP/SFP+



2x 40G QSFP

StackWise® and StackPower cables



50CM-1M-3M



30CM-150CM

Platinum-rated power supplies



315W AC



715W AC/DC



1100W AC



1900W AC

Modular Fans



Catalyst 9300 – Leading Fixed Access Switch

Built-in RFID
(passive)

USB 2.0 flash drive

X86 CPU

UADP 2.0 ASIC

USB Console
Mini-USB type B

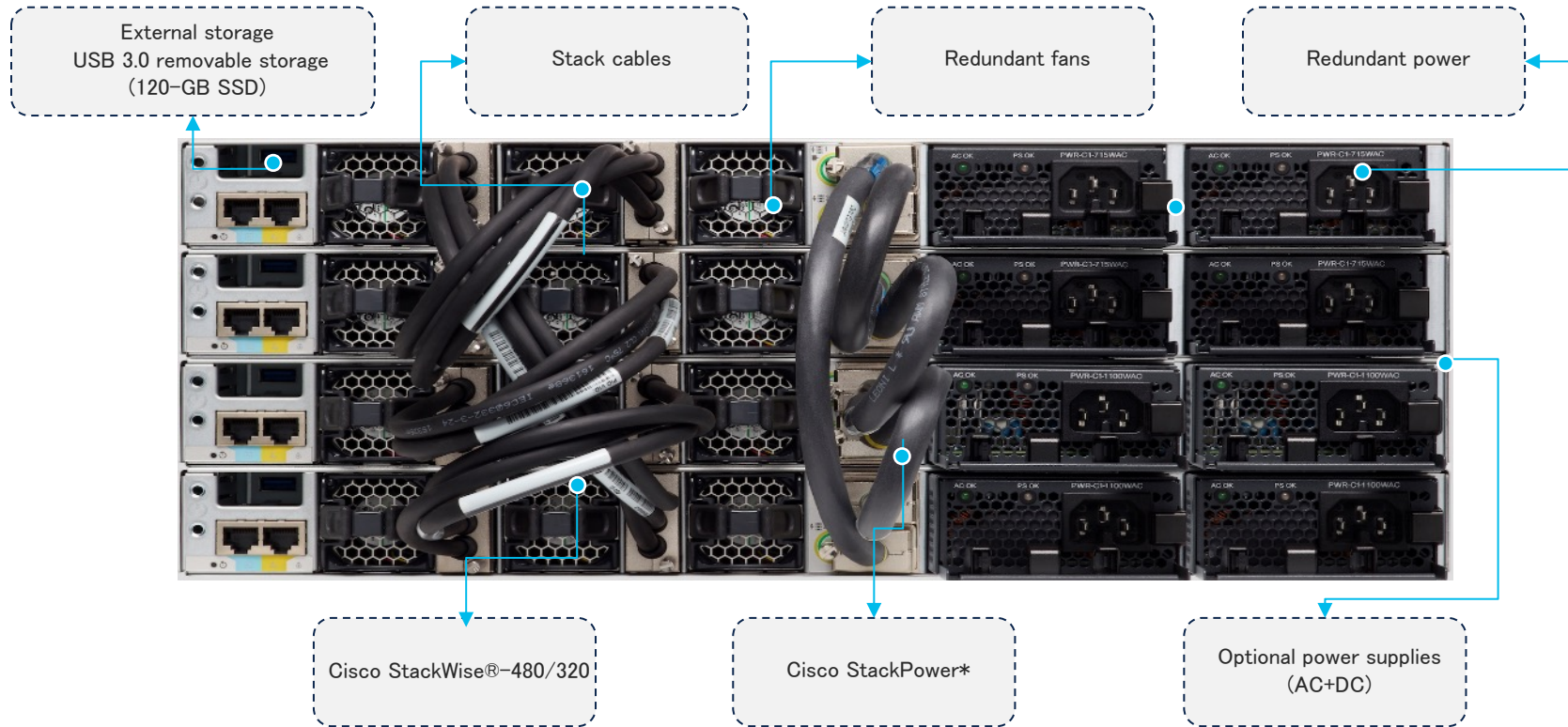
Multigigabit Capable

Unmatched POE
High power – 60/90W UPOE/UPOE+
Resiliency – Perpetual/Fast

Flexible Fixed or Modular Uplinks



Cisco Catalyst 9300 Series



* Supported only on Cisco Catalyst 9300 Series modular uplink models (C9300 SKUs).

Catalyst 9300 Increased Scale Platform

Fixed Access optimized for Media Distribution and IP Storage

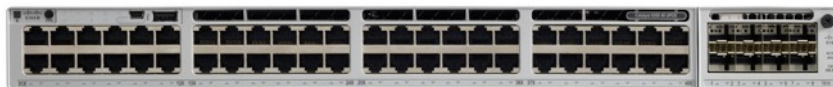


2x
Buffers

More
Packet Buffers

2-4x
Scale

Increased
Network Scale



C9300-48UB: 48 Port 1G switch with UPOE



C9300-24UXB: 24 Port Multigigabit switch with UPOE



C9300-24UB: 24 Port 1G switch with UPOE

Modular
fans

Modular uplinks

Higher-efficiency AC
and DC power supplies



8x 10G



2x 40G



4x Multigigabit



4x 1G



2x 25G



315W AC



715W AC/DC



1100W AC



1900W AC

Catalyst 9300 Leadership

UADP 2.0 XL

- Cisco IOS® XE Software
- x86 CPU and containers
- Cisco SD-Access
- Encrypted Traffic Analytics (ETA)
- AES-256/MACsec-256
- Trustworthy systems
- Cisco StackWise-480
- IEEE1588 and AVB*
- NBAR2
- Perpetual/Fast PoE
- Model-driven programmability
- Patching/GIR
- Streaming telemetry

StackWise-480

Stackpower

Cisco Catalyst 9300 MultiGigabit Switches



24x 100M/1G/2.5G/5G/10G ports



36x 2.5G ports

12x MultiGigabit ports



48x 5G ports

Highest 2.5G, 5G and MultiGigabit density in the Industry



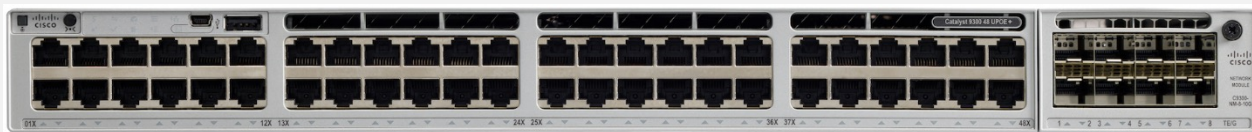
4x 1G/2.5G/5G/10G
copper uplink module



Cisco Catalyst 9300 – IEEE 802.3bt Compliance

Introducing 90W UPOE+ Models to power latest intelligent devices

C9300-48H: 48-port 1G UPOE+ Switch



C9300-24H: 24-port 1G UPOE+ Switch



- 24 and 48 port UPOE+ SKUs
- Supports 90W on all ports, Backward compatible with previous POE standards
- Wire-speed, non-blocking performance
- Seamlessly integrates with Cisco Catalyst 9300 Series copper
 - Supports same optics
- Common stacking – StackWise-480
- Common power stacking – StackPower
- Common uplink modules
- Common power supplies, fans, cables

Modular fans

Modular uplinks

Higher-efficiency AC and DC power supplies

Platinum rated



8x 10G



2x 40G



4x Multigigabit



4x 1G



2x 25G



315W AC



715W AC/DC



1100W AC



1900W AC

StackWise-480

StackPower

Catalyst 9300 Series 1G SFP Fiber

Expanding FTTD and 1G Fiber aggregation designs

C9300-48S: 48-port 1G SFP Switch



C9300-24S: 24-port 1G SFP Switch



- 24 and 48 port SFP SKUs
- Transition Catalyst 3850 1G SFP to Catalyst 9300 1G SFP
- Wire-speed, non-blocking performance
- Seamlessly integrates with Cisco Catalyst 9300 Series copper
 - Supports same optics
 - Common stacking – StackWise-480
 - Common power stacking – StackPower
 - Common uplink modules
 - Common power supplies, fans, cables

Modular fans

Modular uplinks

Higher-efficiency AC and DC power supplies

Platinum rated



8x 10G



2x 40G



4x Multigigabit



4x 1G



2x 25G



315W AC



715W AC/DC



1100W AC



1900W AC

Fiber to the desktop

1G fiber aggregation

Collapsed access

Cisco Catalyst 9300 Series

Modular Uplink options

Modular Uplinks (C9300 SKUs)



**4x Multigigabit
copper**

C9300-NM-4M



4x 1G SFP

C9300-NM-4G



**8x 10G SFP,
SFP+**

C9300-NM-8X



**2x 1G, 10G, 25G
SFP, SFP+**

C9300-NM-2Y



2x 40G QSFP

C9300-NM-2Q

* Above Uplink modules not supported on C9300X
PoE is not supported on Uplink modules

Cisco Catalyst 9300L Series

Fixed Uplink Models

Fixed Uplinks (C9300L Models)

1G & PoE+



48/24 ports Data



48/24 ports PoE+



Fixed 1G or
10G
uplinks

Fixed 1G or 10G
uplinks

UPOE & mGIG models



C9300L-48UXG-2Q 36 x 1 G Ports 12 x 100/1/2.5/5/10G UPOE Ports



C9300L-24UXG-2Q 16 x 1 G Ports 8 x 100/1/2.5/5/10G UPOE Ports



C9300L-48UXG-4X 36 x 1 G Ports 12 x 100/1/2.5/5/10G UPOE Ports



C9300L-24UXG-4X 16 x 1 G Ports 8 x 100/1/2.5/5/10G UPOE Ports

Fixed 40G
uplinks

Fixed 10G
uplinks

Optional StackWise-320 Kit

Common
components



Stack Adapters



50CM-1M-3M

Platinum-rated power supplies



315W AC



715W AC/DC



1100W AC



1900W AC

Modular Fans



* DC PS is Gold-Rated

Cisco Catalyst 9300LM(mini) Series



UADP 2.0



X86 CPU



Cisco Open IOS-XE

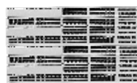


40 X 1G + 8 x mGig-10G

Fixed 25G Uplinks



UPOE
Next-gen IT/OT
Workspaces



Cisco StackWise 320
Stackable with C9300L



mGig
Wifi 6E deployments



**USB type-A front Panel
SSD***
Application hosting

IBN Innovations



HA, Hot Patching,
UPOE



MACsec 256,
ETA



On-box
App hosting



SD-Access, BGP EVPN
AVC, FNF

*FCS+ Release

Cisco Catalyst 9300LM Series

Fixed Uplinks (C9300LM Models)

Multigigabit/UPOE model



C9300LM-48UX-4Y 40 x 1 G + 8 x 100/1/2.5/5/10G UPOE Ports

4 x10/25G
Uplinks

1G Data model



C9300LM-48T-4Y 48 x 1G Ports

4 x10/25G
Uplinks

UPOE models



C9300LM-24U-4Y 24 x 1G UPOE Ports

4 x10/25G
Uplinks



C9300LM-48U-4Y 48 x 1G UPOE Ports

4 x10/25G
Uplinks

NEW

Modular Stacking



Stack Adapters



Stack Cables

NEW

Newer Higher-Efficiency C9300LM only Power supplies



600W AC



715W DC



1000W AC

Modular Fans*



FAN Module

* Data SKU utilize Fixed Fan

Catalyst 9300LM– Shallow Depth



Catalyst C9300L



Catalyst C9300LM



Catalyst C3650-mini

Dimension(W X H x D)

SKU	AC PSU	DC PSU
Data Models	17.50" x 1.73" x 12.39"	17.50" x 1.73" x 11.86"
UPOE/mGig Models	17.50" x 1.73" x 13.17"	17.50" x 1.73" x 13.03"

Migration Platform for C3650-mini

Catalyst 9300 Series

Power & Cooling

Catalyst 9300 Series

Common Components

Modular Uplink Models

(C9300/C9300X SKUs)

StackWise® and StackPower cables

- STACK-T1-50CM
- STACK-T1-1M
- STACK-T1-3M
- CAB-SPWR-30CM
- CAB-SPWR-150CM



StackWise 1T/480 & StackPower

Fixed Uplink Models

(C9300L SKUs)

Optional Stack Kit

- STACK-T1-50CM
- STACK-T1-1M
- STACK-T1-3M



- Stack Adaptors



StackWise 320

Platinum rated (90% efficiency)



350W AC-P



715W AC-P



1100W AC-P



1900W AC-P



715W WDC*

Modular Fans



N+1 redundancy on all Catalyst® 9300 Series models

Catalyst 9300 Series Switches

1900W AC PS

1900W AC-P



- Supported across all Catalyst 9300 and 9300X models and can be mixed with all other power supplies
- Currently shipping with C9300-H Models only and later for other models
- Output power of **1500W** with 115V AC input and **1900W** with 230V AC input
- Special power cable needed for 1900W AC PS

Catalyst 9300LM Series

Exclusive Components

Fixed Uplink Models

(C9300LM SKUs)

NEW

New Stack Kit

Stack Cables



Stack Adaptors



StackWise 320

NEW

Higher Efficiency 9300LM only Power Supplies



600W AC-P



1000W AC-P



715W DC

Modular Fans



* Data SKU utilize Fixed Fan

Mixed AC/DC Power Supplies supported on 9300LM Series Models

Catalyst 9300 Series

SDM Templates

Catalyst 9300 Series Switches

Switch Database Management (SDM) template

Access template

Maximizes system resources
for unicast and multicast
routing and security



Cisco® Catalyst®
9300 Series Switches

NAT template *

Maximizes the Network
Address Translation (NAT)
configurations on the switch

* NAT template is not applicable to Catalyst 9300B and 9300X models, NAT entries are included in default template for Catalyst 9300B and 9300X models

Catalyst 9300 Series Switches

SDM template – CLI

	Command	Purpose
Step 1	Show sdm prefer	Display the template in use
Step 2	Configure terminal	Enter Global Configuration mode
Step 3	Sdm prefer { access nat }	Specify the SDM template to be used on the switch
Step 4	End	Return to Privilege exec mode
Step 5	Reload	Reload the operating system
Step 6	Show sdm prefer	Display the template in use

```
9300_L#sh sdm prefer
Showing SDM Template Info
```

```
This is the Access template.
Number of VLANs: 4094
Unicast MAC addresses: 32768
Overflow Unicast MAC addresses: 1024
L2 Multicast entries: 8192
Overflow L2 Multicast entries: 512
L3 Multicast entries: 8192
Overflow L3 Multicast entries: 512
Directly connected routes: 24576
Indirect routes: 8192
STP Instances: 1024
Security Access Control Entries: 5120
QoS Access Control Entries: 5120
Policy Based Routing ACEs: 1024
Netflow Input ACEs: 256
Netflow Output ACEs: 768
Flow SPAN ACEs: 1024
Tunnels: 512
LISP Instance Mapping Entries: 512
Control Plane Entries: 512
Input Netflow flows: 32768
Output Netflow flows: 32768
SGT/DGT (or) MPLS VPN entries: 8192
SGT/DGT (or) MPLS VPN Overflow entries: 512
Wired clients: 2048
MACSec SPD Entries: 256
MPLS L3 VPN VRF: 255
MPLS Labels: 2048
MPLS L3 VPN Routes VRF Mode: 7168
MPLS L3 VPN Routes Prefix Mode: 8192
MVPN MDT Tunnels: 256
L2 VPN EOMPLS Attachment Circuit: 256
MAX VPLS Bridge Domains : 128
MAX VPLS Peers Per Bridge Domain: 32
MAX VPLS/VPWS Pseudowires : 1024

These numbers are typical for L2 and IPv4 features.
Some features such as IPv6, use up double the entry size;
so only half as many entries can be created.
* values can be modified by sdm cli.
```

Catalyst 9300 Series Switches

SDM template –Lookup tables

Forwarding resources

	Cisco Catalyst™ 9300X	Cisco Catalyst 9300	Cisco Catalyst 9300B	Cisco Catalyst 9300L/LM
MAC addresses	32,000	32,000	64,000	32,000
Host/direct routes	24,000	24,000	48,000	24,000
IGMP groups	8,000	8,000	16,000	8,000
LPM/indirect routes	15,000	8,000	64,000	8,000
Multicast routes	8,000	8,000	16,000	8,000
SGTs	8,000	8,000	8000	8,000

Feature resources

	Cisco Catalyst 9300X	Cisco Catalyst 9300	Cisco Catalyst 9300B	Cisco Catalyst 9300L/LM
Security ACL entries - Port ACL (PACL) - VLAN ACL (VACL) - Router ACL (RACL)	8,000	5,000	18,000	5,000
QoS ACL entries	4,000	5,000	18,000	5,000

NetFlow

NetFlow entries: 128,000/64,000/64,000 per UADP 2.0 XL/2.0/2.0sec ASIC

Catalyst 9300 Series – Packet Buffers

Ingress buffers

For Ingress Queuing and Scheduling (IQS) (dedicated and shared)

Egress stack buffers

For Egress Stack Queuing and Scheduling (SQS) (dedicated and shared)

Egress port buffers

For egress port queues (AQM)

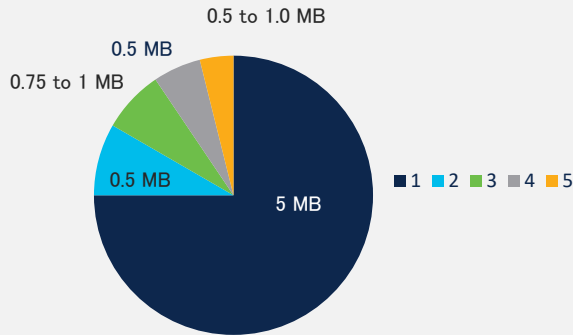
Temporary buffers

For packet from the stack or CPU

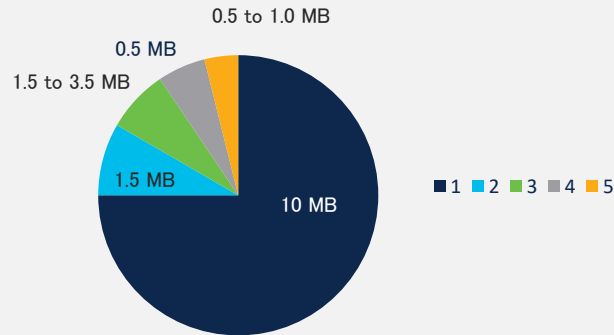
Allocation: Dedicated buffers are used first

Catalyst 9300 – Buffer Complex composition

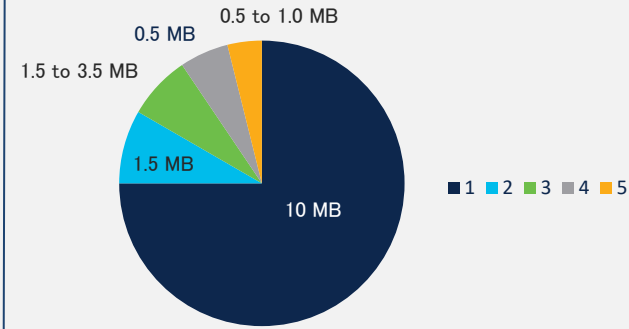
UADP 2.0



UADP 2.0 XL



UADP 2.0sec



Catalyst 9300/L models

- Total of 16 MB buffer on switch
- 8 MB packet buffer per core is shared by ingress and egress data paths

Catalyst 9300B models

- Total of 32 MB buffer on switch
- 16 MB packet buffer per core is shared by ingress and egress data paths

Catalyst 9300X models

- Total of 16 or 32 MB buffer on switch depending on Single or Dual Asic switch
- 16 MB packet buffer is shared by ingress and egress data paths

StackPower

Modular uplink models only
(Catalyst 9300 and 9300X models)

StackPower – Overview

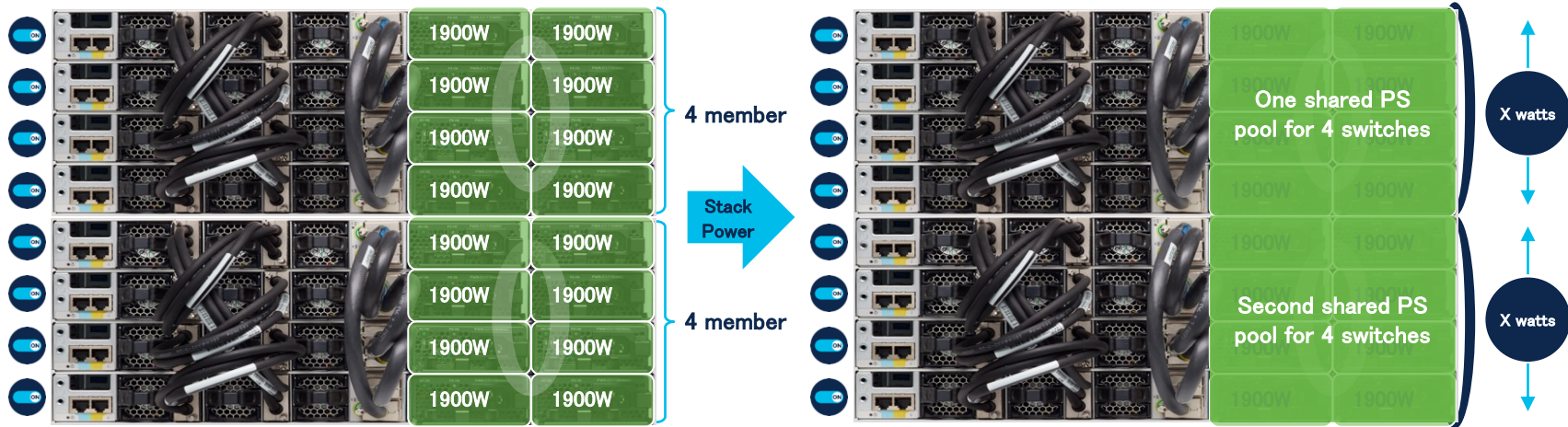
“Zero-footprint” Redundant Power System (RPS) deployment



- Provides RPS functionality with **zero RPS footprint**
- **Pay-as-you-grow** architecture – Similar to the data stack
- **1+N redundancy** with inline power
- Up to **four switches** in a StackPower ring
- **Multiple StackPower** possible within one data stack
- Up to **eight switches** in a star topology with an expandable power system (XPS)

StackPower is not supported on Catalyst 9300L SKUs

Highly available StackPower

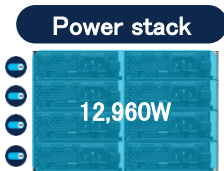


- Pools power from all Power Supplies (PS)
- All switches in StackPower share the available power in the pool
- Each switch is given its minimum power budget

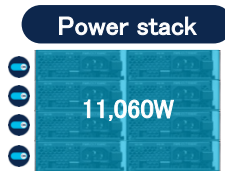
Power stack modes



Combined mode
(default mode)



Redundant mode
(user configurable)



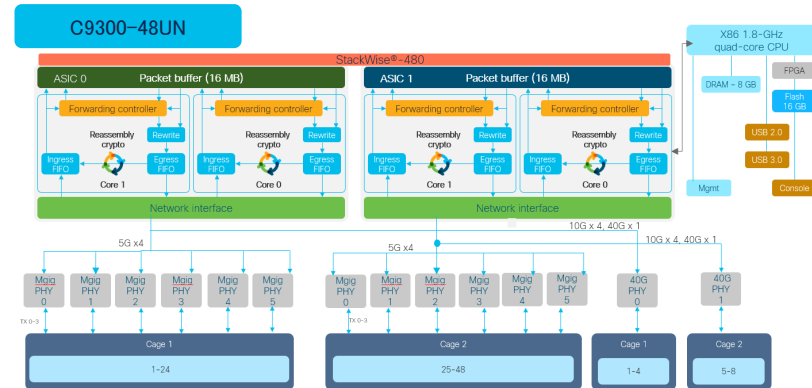
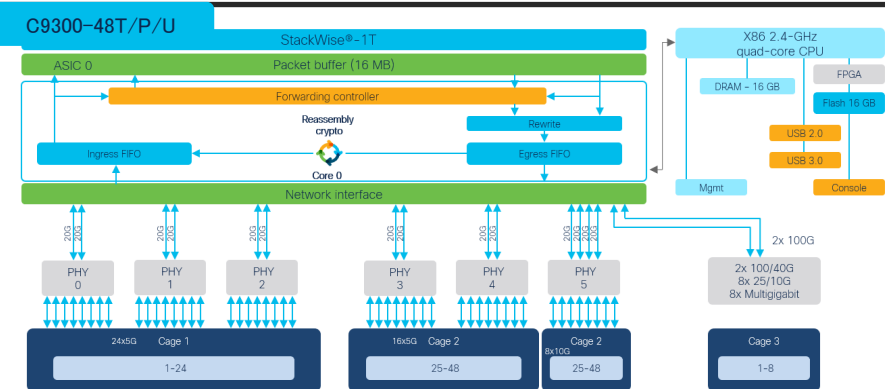
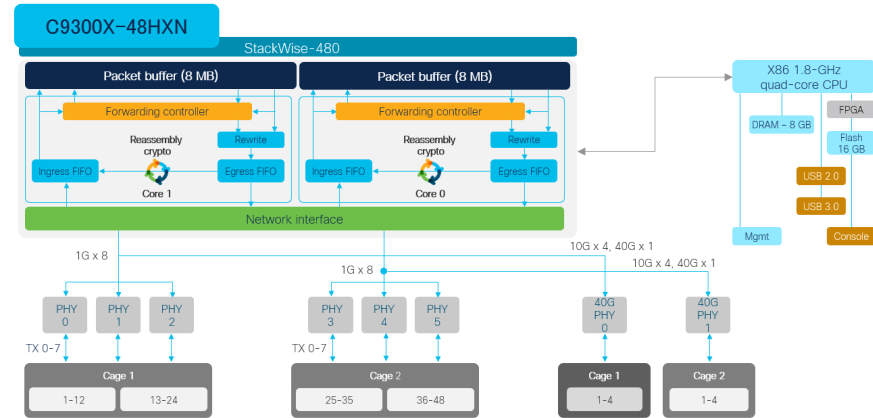
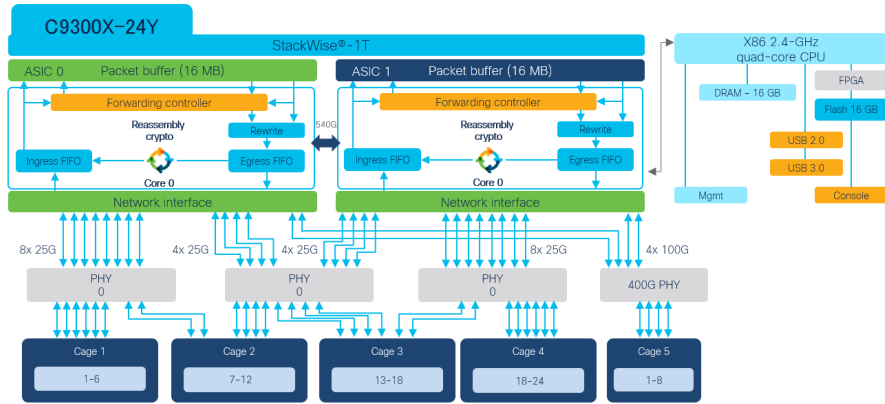
- All power supplies contribute to common output power budget

- One of the highest valued power supplies is not used in the power budget calculation

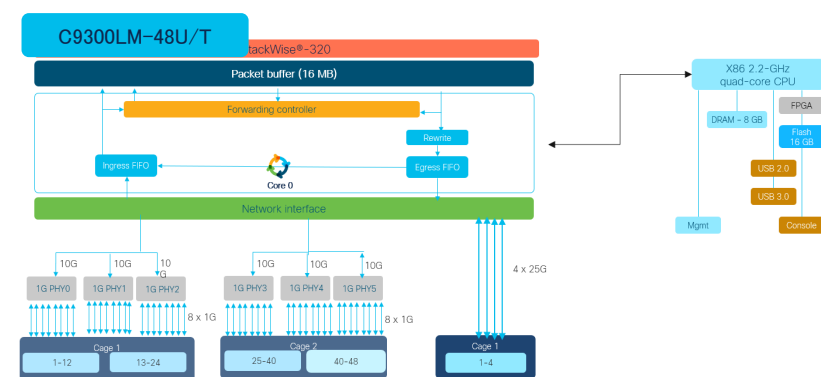
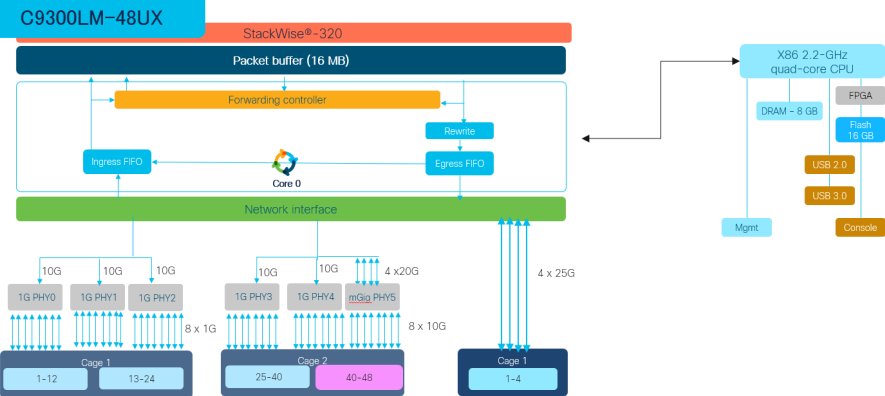
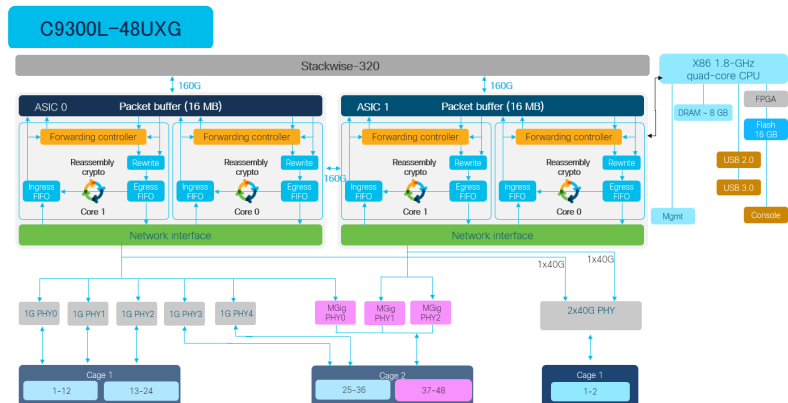
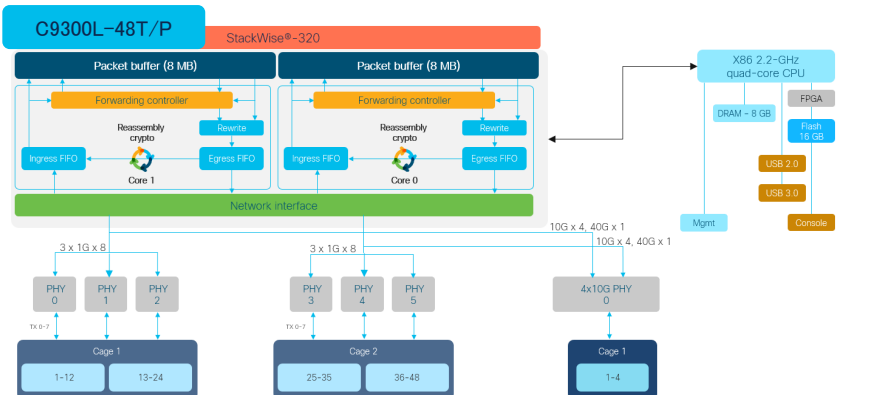
Catalyst 9300 Series

Architecture

Cisco Catalyst 9300 modular uplink models

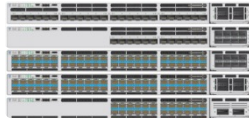


Cisco Catalyst 9300 fixed uplink models



Catalyst 9300 Series – Market-leading fixed switches

Catalyst® 9300X



Catalyst 9300



Mixed (Catalyst 9300 + 9300X)



Deployment type	High-speed access and distribution	Access	Access and distribution
Stacking	1 terabit	480G	480G
StackPower	✓ (+ higher power budget)	✓	✓
Hardware-based IPsec	✓	✗	✗
Dense uplinks	Up to 100G	Up to 40G	Up to 100G
Fiber models	Up to 25/10G SFP+	Up to 1G SFP	Up to 25/10G SFP+
Max 10G copper ports (1RU)	48	24	48
App hosting	✓ (~2x app hosting capacity)	✓	✓



IBN innovations



Full SD-Access, Fabric-in-a-Box, embedded wireless controller



Wired Assurance, SD-Access, AVC, FNF



ETA, MACsec-256



On-box app hosting



HA, hot patching, StackPower, UPOE+



Cloud integrations: Secure Network Analytics, Cisco Umbrella®, Cisco DNA Spaces

Catalyst 9300X for continued market leadership

Legend

Best

Partial

Bad

Competitive challenges



CX6300



Threats

- Higher Multigigabit density
- 50G uplinks



720XP



Threats

- 2x 100G uplinks
- 4x 25G uplinks



EX4400



Threats

- 90W PoE with Multigigabit ports
- 24- and 48-port offerings along with 48-port fiber



5520



Threats

- 24- and 48-port models with 90W PoE, MACsec and fabric support

Leadership with Catalyst® 9300/9300X

	Catalyst 9300/X	Aruba CX6300	Arista 720XP	Juniper EX4400	Extreme 5520
Hardware differentiation					
48 Multigigabit ports + 90W Cisco UPOE®+	Best	Bad	Bad	Partial	Partial
12 or 24x 10/25G SFP+/SFP28 (collapsed core/distribution) SKU	Best	Bad	Bad	Bad	Bad
Support 25/40/100G uplinks	Best	Partial	Partial	Partial	Partial
Stackwise-1T (backplane stacking) and StackPower	Best	Bad	Bad	Bad	Bad
Stack members	8	10	12	10	8
Enterprise-grade campus features differentiation					
Full stack security: Encrypted Traffic Analytics, MACsec 128-bit/256-bit link encryption, line-rate IPsec, Cisco TrustSec®, Full Flexible NetFlow, FabricSec	Best	Bad	Bad	Bad	Partial
High availability: Stackwise-1T, StackPower, NSF/SSO, xFSU (<30 seconds downtime), patching	Best	Partial	Partial	Partial	Partial
IoT convergence: Embedded wireless controller, Wide Area Bonjour/SD-Bonjour, IEEE 1588 AVB/PTP, application hosting, robust edge compute capability	Best	Bad	Partial	Bad	Partial
Segmentation: SD-Access, EVPN-VXLAN, SGT, GBP, MPLS, VPLS, EoMPLS	Best	Partial	Partial	Partial	Partial
Application visibility and service assurance: Cisco® ThousandEyes integration, NBAR2, AVC, Flexible NetFlow	Best	Partial	Partial	Partial	Partial

Win with Catalyst 9300 leadership and differentiation against the competition.



Cisco Catalyst 9200 Series



Cisco Catalyst 9200 Series

Next generation of entry-level access switches for intent-based networking



Security



Resiliency



Application
experience

Fixed Uplinks



48 ports Full POE+/Partial POE+/Data, 1G/10G Uplink



48 ports Full POE+, 12xmGig, 10G Uplink

48 ports Full POE+, 8xmGig, 25G Uplink



24 ports Full POE+/Data, 1G/10G Uplink



24 ports Full POE+, 8xmGig, 10G Uplink

24 ports Full POE+, 8xmGig, 25G Uplink

Modular Uplinks

Recommended for small scale SDA deployments



48 ports Full POE+/Partial PoE+/Data

48 port Full POE+ with 32 VN**



48 ports Full POE+, 8xmGig



24 ports Full POE+/Data

24 ports Full PoE+ with 32 VN**



24 ports Full POE+, 8xmGig

Modular
fans

Higher Efficiency AC FRU Power Supplies

Modular uplinks

FRU Fan



Silver
Rated



125W

FRU PSU



Platinum
Rated



600W



Platinum
Rated



1000W

FRU Uplinks*



4x 1G



4x 10G



2x 25G



2x 40G

Cisco Catalyst 9200 Series highlights

UADP 2.0 mini

Cisco IOS XE Software

Limited-scale SD-Access

MACsec-128 link encryption

Trustworthy solutions

Perpetual/Fast PoE

Programmability

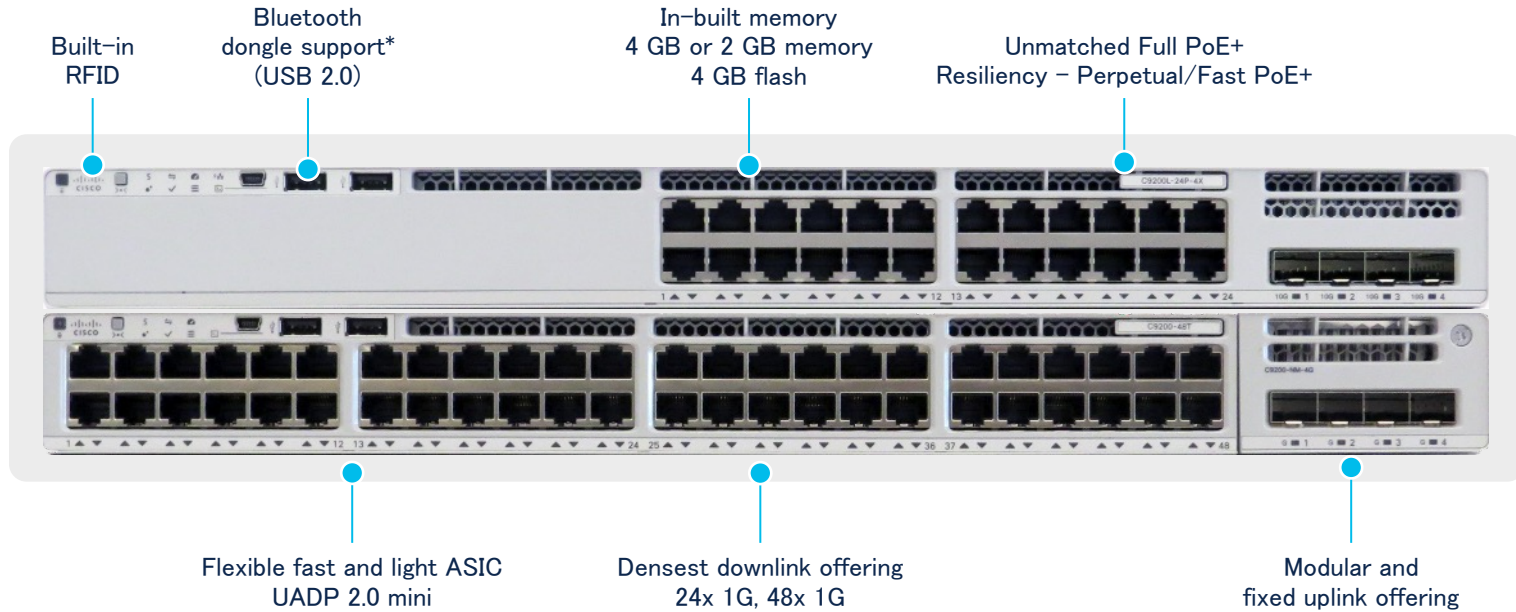
Cold patching

Full Flexible NetFlow
streaming telemetry

*C9200 1G skus support 1/10G uplinks while C9200 mGig will support 10/25/40G uplinks

**C9200 32 VN skus only support 1/10G uplinks and these skus cannot be stacked with other C9200 skus

Cisco Catalyst 9200 Series Switches



* Hardware capable

Cisco Catalyst 9200 Series

Multigigabit models

Cisco Catalyst 9200 Series switching SKUs

Cisco Catalyst 9200 with Modular Uplinks

PoE+



2x 25G Uplinks

16x 1G and 8x Multigigabit Ports

PoE+



2x 40G Uplinks

40x 1G and 8x Multigigabit Ports

Cisco Catalyst 9200L with fixed uplinks

PoE+



2x 25G Uplinks

16x 1G and 8x Multigigabit Ports



4x 10G Uplinks

16x 1G and 8x Multigigabit Ports

PoE+



2x 25G Uplinks

40x 1G and 8x Multigigabit Ports



4x 10G Uplinks

36x 1G and 12x Multigigabit Ports

All models support Full PoE+

Modular power supplies available on all SKUs

Cisco Catalyst 9200 Series

Data & PoE SKUs

Cisco Catalyst 9200 Series switching SKUs

Data/PoE+ (modular uplinks and fans)

Data



24 ports



48 ports

PoE+



24 ports



48 ports

4x 1G and 4x 10G uplinks

Data/PoE+ (fixed uplinks and fans)

Data



24 ports



48 ports

PoE+



24 ports



48 ports

4x 1G and 4x 10G uplinks

Modular power supplies available on all SKUs

Cisco Catalyst 9200 Series

Enhanced VN Models

Cisco Catalyst 9200 Series switching SKUs for SD-Access Fabric Edge

Cisco Catalyst 9200-24PB

24x 10M/100M/1G Downlink Ports



4 x 1/10G SFP/SFP+ Uplink Module

Cisco Catalyst 9200-48PB

48x 10M/100M/1G Downlink Ports



4 x 1/10G SFP/SFP+ Uplink Module

All models support Full PoE+

32 VN/VRF Supported with 31 User Configurable and 1 Default

Cisco Catalyst 9200 Series

Modular uplink options



C9200-NM-4G

- 4x 1G
- SFP transceivers
- Supported on all modular SKUs



C9200-NM-4X

- 4x 10G
- SFP and SFP+ transceivers
- Supported on all modular SKUs



C9200-NM-2Y

- 2x 25G
- SFP and SFP+ transceivers
- 1/10/25G Speed support
- Supported on all 9200 mGig SKUs only

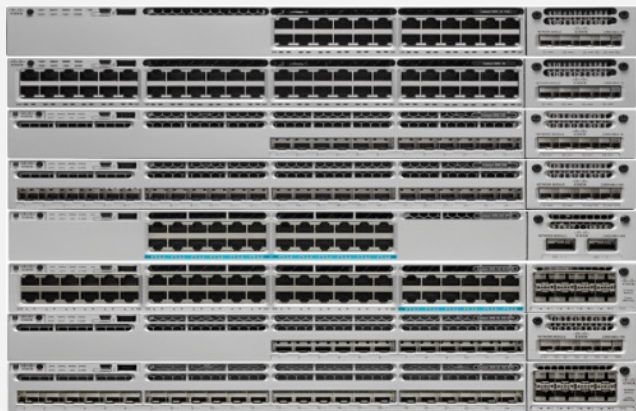


C9200-NM-2Q

- 2x 40G
- QSFP transceivers
- Supported on all 9200 mGig SKUs only

All modular uplink modules are field-replaceable units
Modular uplinks supported on Cisco Catalyst 9200 Series modular SKUs

StackWise-160/80* with SSO



Up to 8-
member stack



- StackWise-160 supported on all modular Cisco Catalyst 9200 Series switching models
- StackWise-80 supported on all fixed Cisco Catalyst 9200 Series switching models
- Same Cisco IOS XE and license required on all members

Stacking kit →



Stack adapters



Stacking cable

Ordered
separately

Stacking cable comes with three options:
50 cm, 1 m, or 3 m

*Mixed stacking not supported between StackWise-160 and StackWise-80

Catalyst 9200 Series

Power & Cooling

Resilient power supplies

Silver rated (80% efficiency)



125W AC

Supported only on 1G data SKUs

Platinum rated (90% efficiency)



600W AC

Supported only on 24-
port PoE+ SKUs



1000W AC

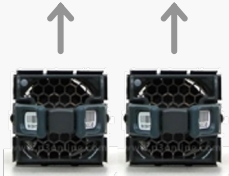
Supported only on 48-
port PoE+ SKUs

Load sharing (1+1) mode supported for PoE+ SKUs

Power supplies are field-replaceable units
Redundant power supply should be identical

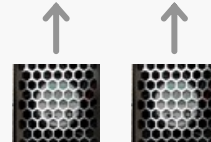
Resilient fan modules

Cisco Catalyst 9200 Series modular models



Field-replaceable fan modules

Cisco Catalyst 9200 Series fixed models



Fixed fan modules

Switch can operate on a single fan at ambient temperature

Catalyst 9200 Series – UADP 2.0 Mini

Lookup tables

Forwarding resources

	Modular SKUs (9200 and 9200CX)	Fixed SKUs (9200L)
MAC	32,000	16,000
Host route	10,000	8000
IGMP groups	1000	1000
Indirect route	4000	3000
Multicast route	1000	1000
SGT	2000	2000

Feature resources

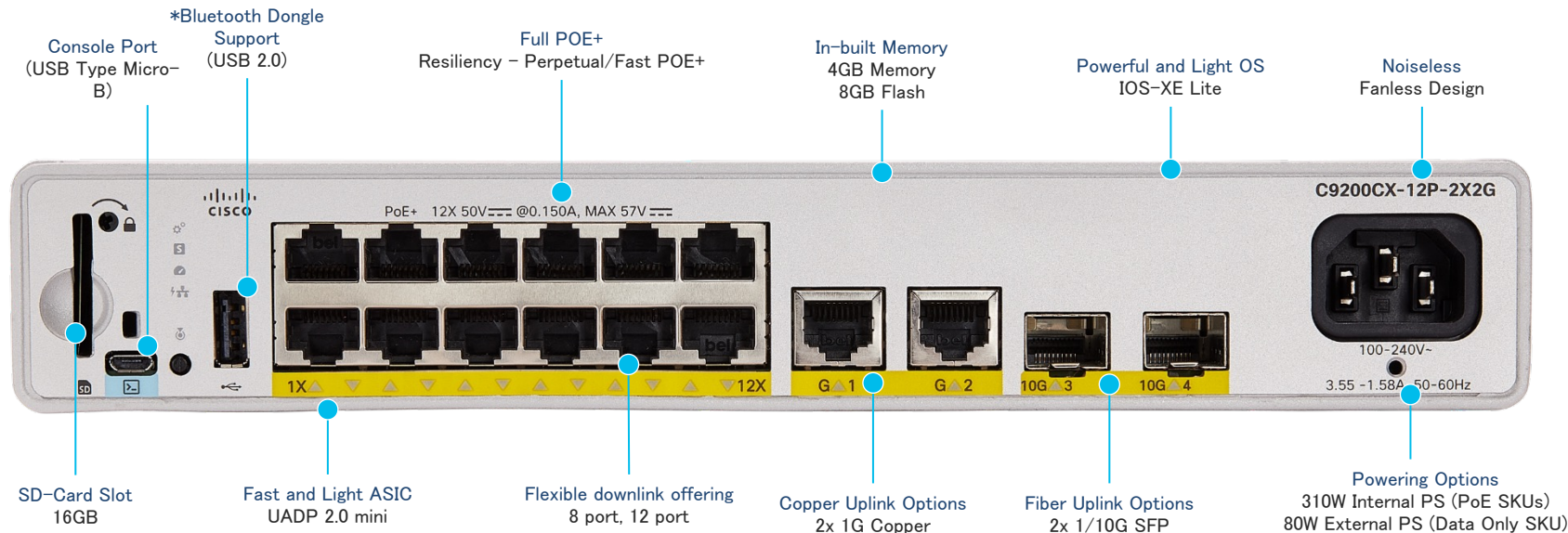
	Modular SKUs(9200 and 9200CX)	Fixed SKUs (9200L)
Security ACL • Port ACL (PACL) • VLAN ACL (VACL) • Router ACL (RACL)	1000	1000
QoS ACL	1000	1000
NetFlow ACEs	128	128

NetFlow

NetFlow entries: 16,000 per ASIC

Catalyst 9200CX

The New Catalyst 9200CX Compact Series Switches



* Hardware Capable

Catalyst 9000 Feature Richness Packed in a Compact Form Factor

Catalyst 9200CX Compact Family

AC Power Supply Units

Shipping

12 and 8 Port PoE+ Models

C9200CX-12P-2X2G



- 12 x 1G PoE+
- 2 x 1G copper and 2 x SFP+ uplinks
- Internal AC power supply
- 240W PoE power budget

C9200CX-8P-2X2G



- 8 x 1G PoE+
- 2 x 1G copper and 2 x SFP+ uplinks
- Internal AC power supply
- 240W PoE power budget

12 Port Data-Only Model

Shipping

C9200CX-12T-2X2G

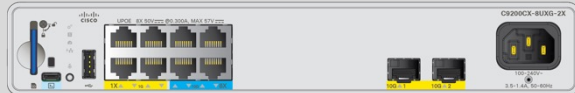


- 12 x 1G data
- 3 x 1G copper and 2 x SFP+ uplinks
- Fully Powered by 802.3bt Class 6 60W Uplink
- OR External 80W Power Supply

mGig/UPOE Model

Q3
CY23

C9200CX-8UXG-2X



- 4x mGig/10G + 4x 1G
- 8x 802.3bt Type 3 Class 6 60W (all ports)
- 2x 1/10G SFP+
- Internal AC power supply
- 240W PoE power budget

Wi-Fi 6/6E with Catalyst 9100 Series APs

AP	PoE power consumption	Link speed	Link Layer Discovery Protocol (LLDP)
C9136I	802.3bt (UPOE)	5G	47.3W
C9162I	802.3bt (UPOE)	2.5G	25.5W
C9164I	802.3bt (UPOE)	2.5G	30W
C9166	802.3bt (UPOE)	5G	30.5W

Powered by
Cisco IOS-XE Lite

SD-Access

MACsec-256

Programmability

Full Flexible NetFlow

Trustworthy solutions

Cold patching

Perpetual/Fast PoE

Bonjour Service Peering

UADP 2.0 Mini

Multicore
X86 CPU

Cisco IOS®
XE Lite



All Uplink Ports can be simultaneously used. Providing maximum bandwidth when needed.

Catalyst 9200CX Compact Family

HVDC Power Supply Units

NEW

HVDC 1G/PoE+

Orderable

C9200CX-8P-2X2GH



- 8 x 1G PoE+
- 2 x 1G copper and 2 x SFP+ uplinks
- Internal HVDC power supply
- 240W PoE power budget

C9200CX-12P-2X2GH



- 12 x 1G PoE+
- 2 x 1G copper and 2 x SFP+ uplinks
- Internal HVDC power supply
- 240W PoE power budget

NEW

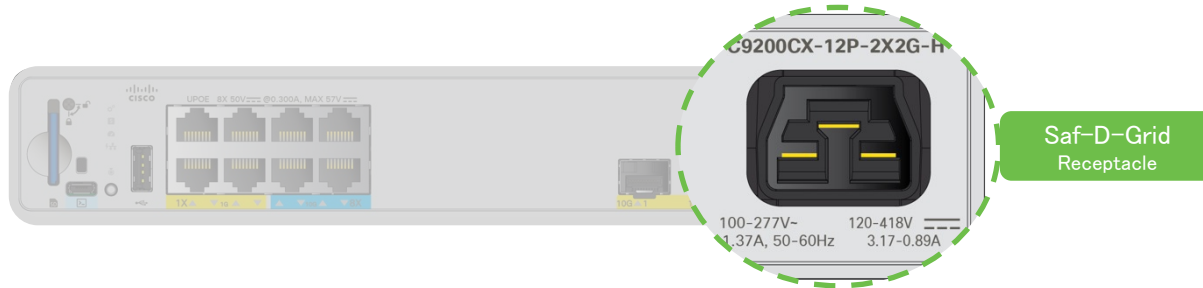
HVDC mGig/UPOE

Q3
CY23

C9200CX-8UXG-2XH



- 4x mGig/10G + 4 x 1G (802.3bt Type 3 Class 6 60W all ports)
- 2x 1/10G SFP+
- Internal HVDC power supply
- 240W PoE power budget



Saf-D-Grid
Receptacle

Powered
by AC or
HVDC

Powering Options

AC (100-240VAC)

Plenum Voltage (277VAC)¹

HVDC (120V-418VDC), 380VDC²

Cabling Options³

Ring terminal to SAF-D-GRID

C14 to SAF-D-GRID

C20 to SAF-D-GRID



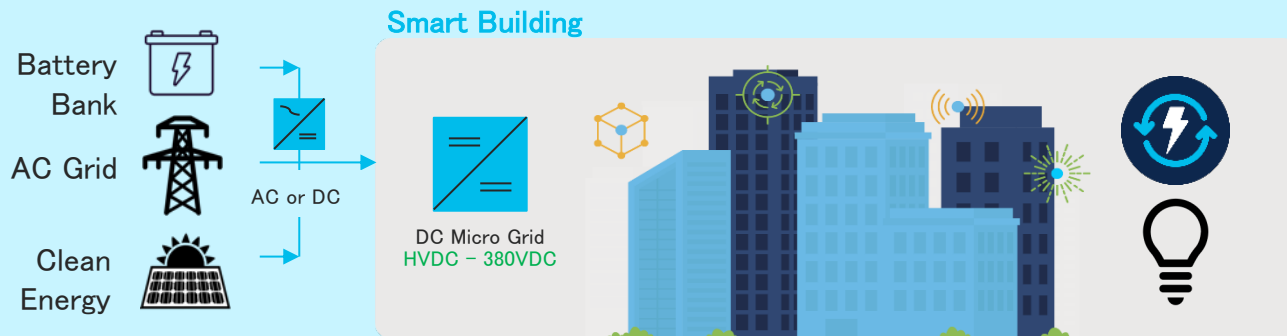
Investment protection
with MAX flexibility!

³ Cables not provided with switch

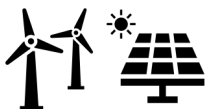
¹ Need a plenum rated enclosure

² 380VDC, commonly used in DC micro grids and Class 4 deployments

Why High Voltage DC?

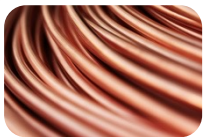


Benefits



Avoids double conversion. **From DC → AC, then AC → DC:**

- Production of Wind/Solar power is in DC
- Electrical devices with transistors use DC power



Higher voltage helps reduce conductor material required (less copper) or improve transition efficiency:

- Controllability
- Better voltage regulation



Considerably lower power losses compared to 120VAC when transporting over long distances:

- Offshore power needs/Undersea power lines
- Power transmission for longer distances

Catalyst 9200CX – Next Generation Compact Switches



	Catalyst® 3560CX models		Catalyst® 9200CX models
Market-Leading Encryption	AES 128-Bit MACsec	+	AES 256-Bit MACsec
Network Visibility	Limited Flexible NetFlow	+	Full Flexible NetFlow
SD Bonjour Services	Not Available	+	Bonjour Service Peering
Programmability	Basic Scripting with Python	+	YANG Models (RESTCONF, NETCONF, gNMI), ZTP
Application Visibility	Smart Logging, Limited Flexible Net Flow, and AVC	+	Streaming Telemetry (NETCONF Dial-In and gRPC Dial-Out) SD-AVC w/ NBAR2
SDA Fabric	SDA Extended Node Capability	+	SDA Edge Node Capability (16VNs)



innovations



Assurance w/ Cisco DNAC



Wired assurance,
SD-Access, AVC, FNF



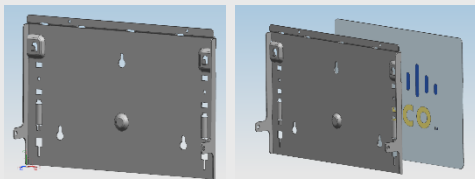
ETA,
MACsec-256



Cisco
TrustSec

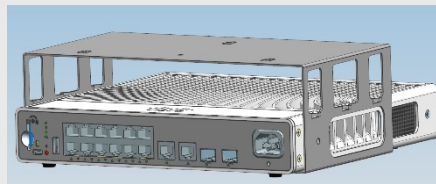
Catalyst 9200CX Mounting Options

Wall Mount (C9K-WALL-TRAY)



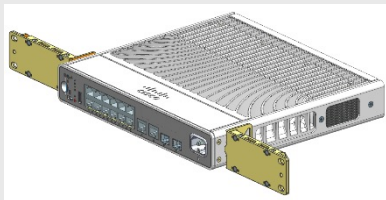
- With mounting tray and screws
- With mounting tray and magnet (in case of metal wall)

Table-Top/Bottom/Shelf Mount (C9K-CMPCT-DESK-MNT)



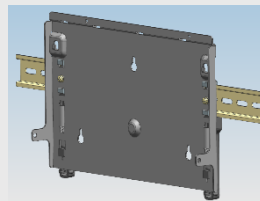
- With mounting tray and screws
- With mounting tray with magnet (in case of metal desk or shelf)

Rack Mount (RACKMNT-19-CMPACT)



- With mounting screws

Din Rail Mount (C9K-CMPCT-DIN-MNT)



- With a mounting tray and rail mount

Flexible mounting options for all mounting use-cases

Catalyst 9200CX Scale Enhancements

Forwarding Resources

	C9200/CX	C3560CX
MAC	32k	16k
Host Route	10k	4k
IGMP Groups	1k	1k
Indirect Route	4k	1k
Multicast Route	1k	1k
SGT	2k	2k

Feature Resources

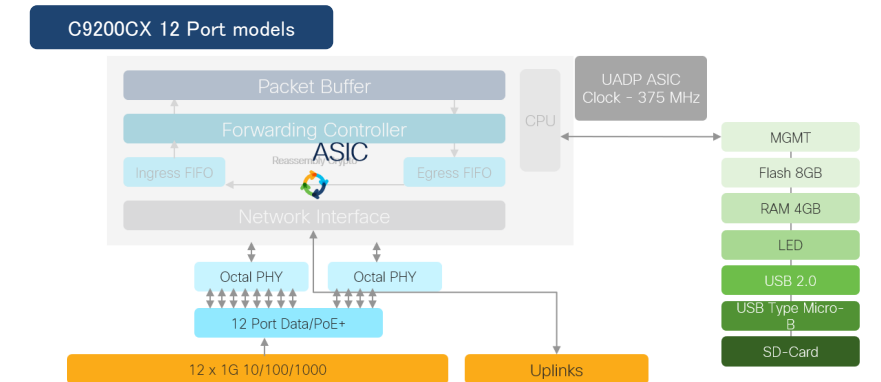
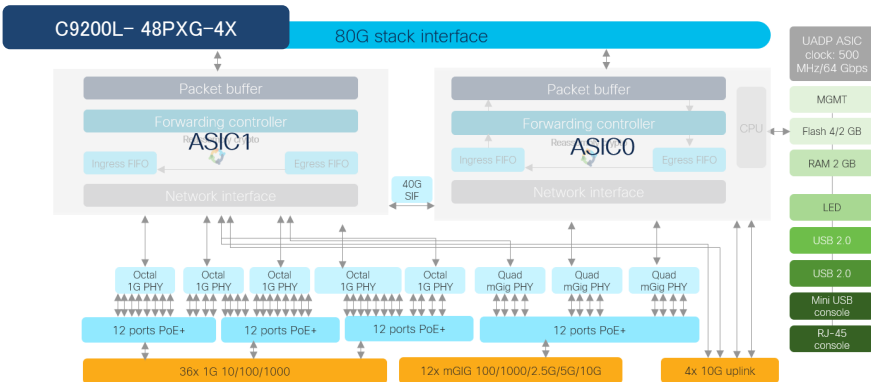
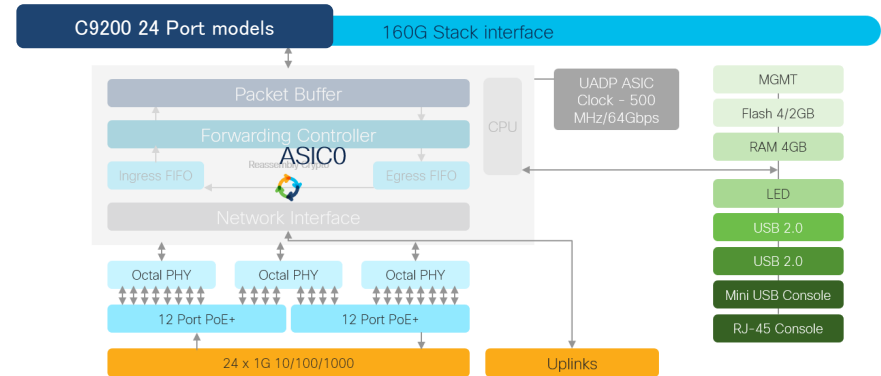
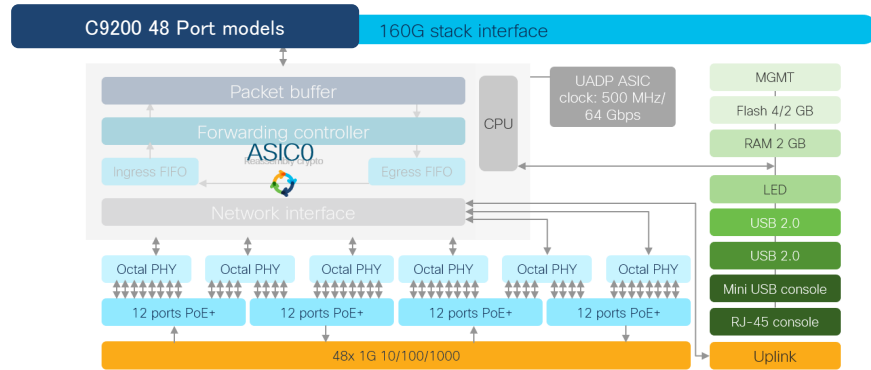
	C9200/CX	C3560CX
Security ACL • PACL • VACL • RACL	1k	375
QoS ACL	1k	375
NetFlow Entries	16k	8k

Higher Scale in the Same Form Factor

Catalyst 9200CX Series

Architecture

Cisco Catalyst 9200 Series





Catalyst 9000 Series

Cisco IOS XE

Catalyst 9000 Series – Common Building Blocks



Programmable x86 Multi-Core CPU

Application Hosting
Secure Containers



Cisco IOS XE® Polaris

Model-Driven APIs
Modular Patching



Cisco UADP & Silicon One™

Programmable Pipeline
Flexible Tables

Same IOS XE image for UADP* and Silicon One C9K platforms

* Catalyst 9200 Series uses IOS XE Lite

Cisco IOS XE – Architecture Evolution

Same look and feel – more powerful architecture



Cisco IOS



- **Monolithic OS**
- Compact
- High performance

Cisco IOS XE 3.7.x(SE)



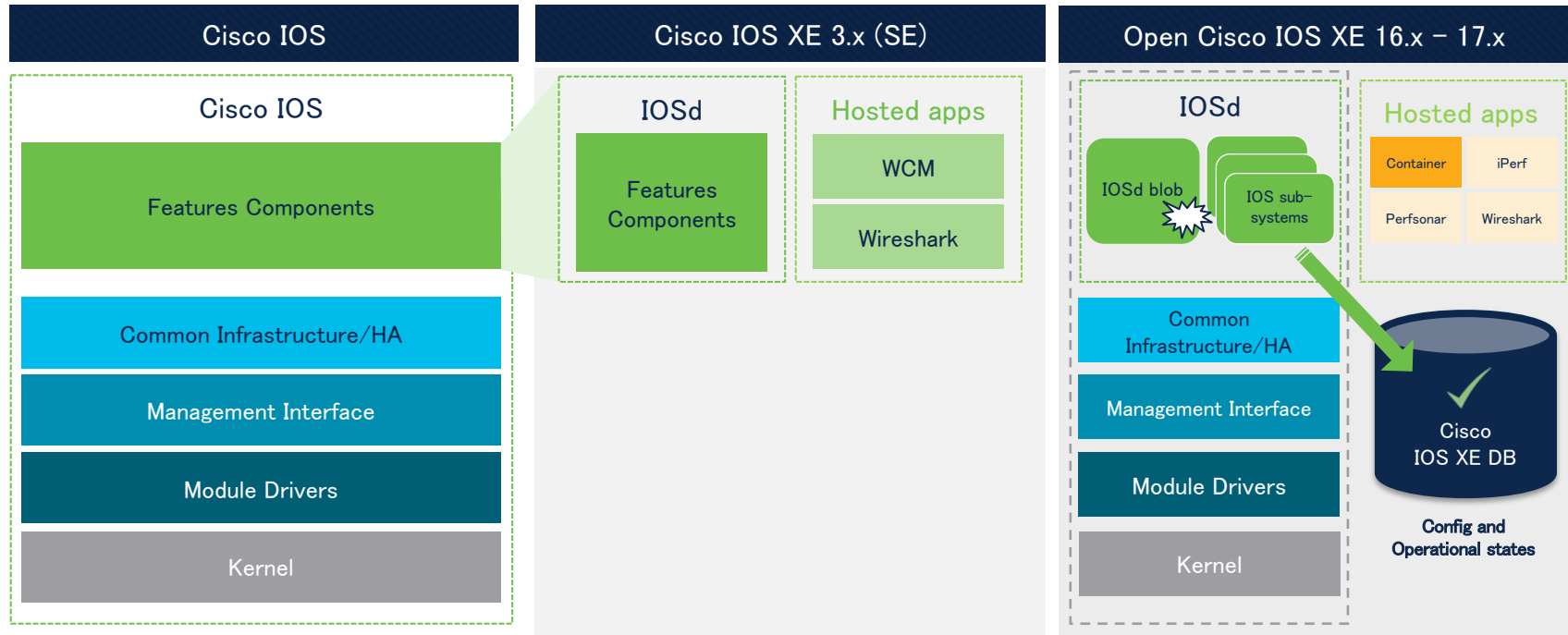
- **Monolithic IOSd:** Control-plane
- Sub-packages for data plane
- Linux daemons hosting capability
- Message parsing capability

Cisco IOS XE 16.x – 17.x



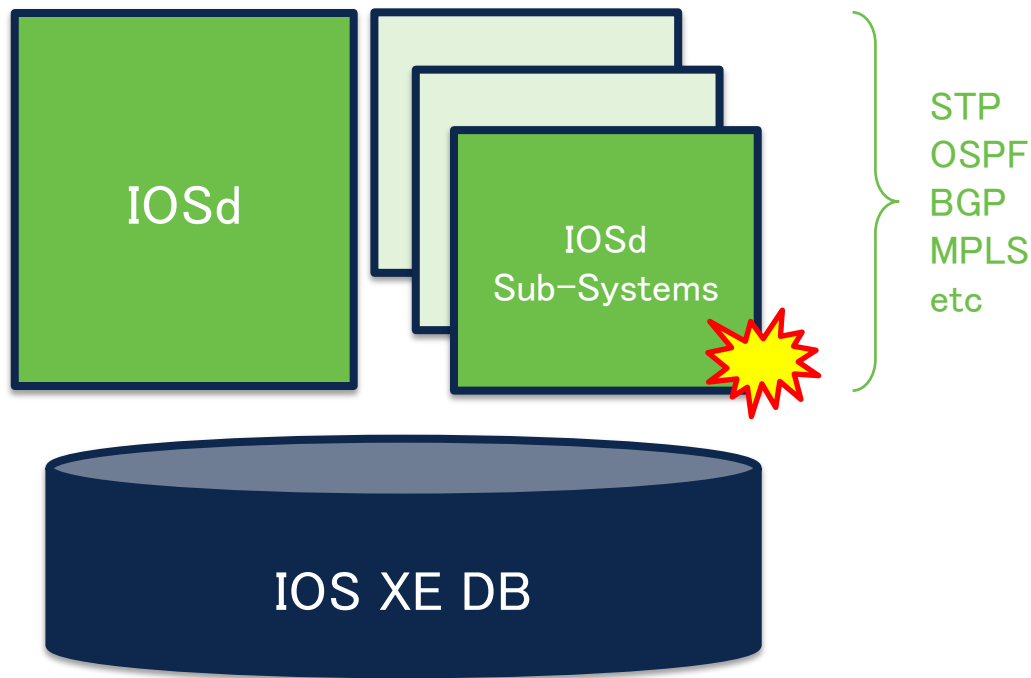
- **IOSd:** Component assemblies
- **Modularized features:** Sub-packages
- **Distributed Operating System**
- **IOS XE (Crimson) Database**
- Radioactive tracing and events

What is “Open” Cisco IOS XE?



Modern Software Architecture – with the same look and feel

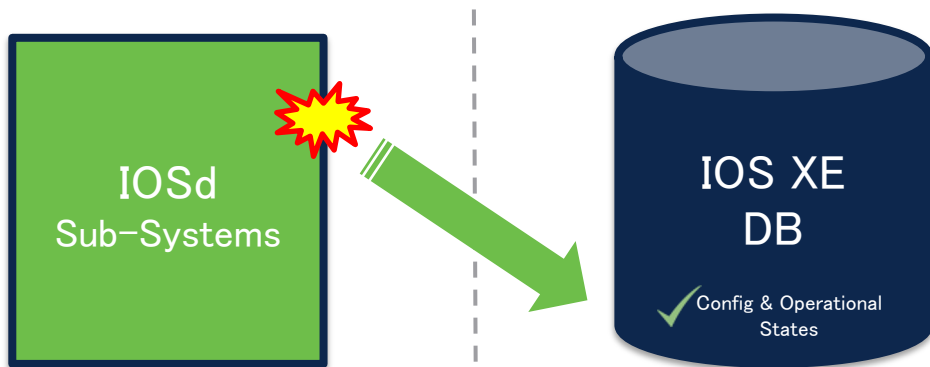
Open IOS XE – IOS Sub Systems



Failure of one
IOS XE
Sub-System(s) -
keeps rest of the
system intact

IOSd Sub-Systems enhance IOS Resiliency

Open IOS XE – Hardware DB



The IOS XE DB contains Configuration
& Operational States

Higher Application UP Time

Quicker Recovery

Better Convergence

Decoupling Code & Data protects the Configuration & Operational States

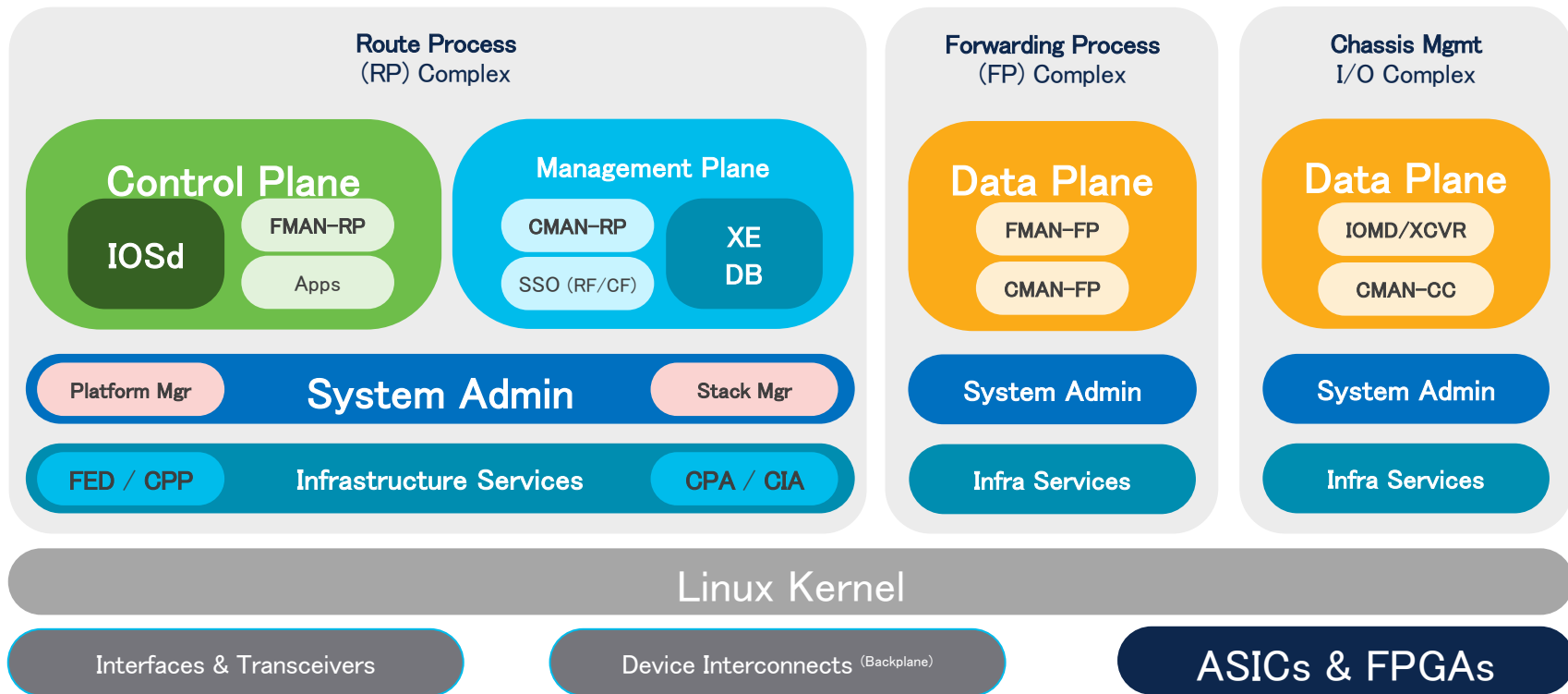
Link State	STP State	OSPF State	Logs
Link State	Logs	MST State	
BGP State	Tunnel State		

Data Models

[illegible]

Cisco IOS XE Architecture

Modularized Components for Software Abstraction



Cisco IOS XE Software

PI vs. PD Software Components



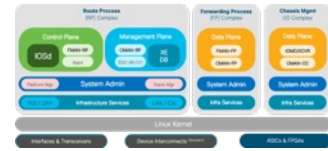
Platform Independent (PI)

- **IOS** – Internetwork Operating System
- **FMAN** – Forwarding Manager
- **RP** – Routing Process
- **FP** – Forwarding Process
- **CGM** – Classification Group Manager
- **WCM** – Wireless Controller Module
- **IFM** – Interface Manager
- **PDS** – Packet Distribution Service
- **LSMPI** – Linux Shared Memory Punt Interface



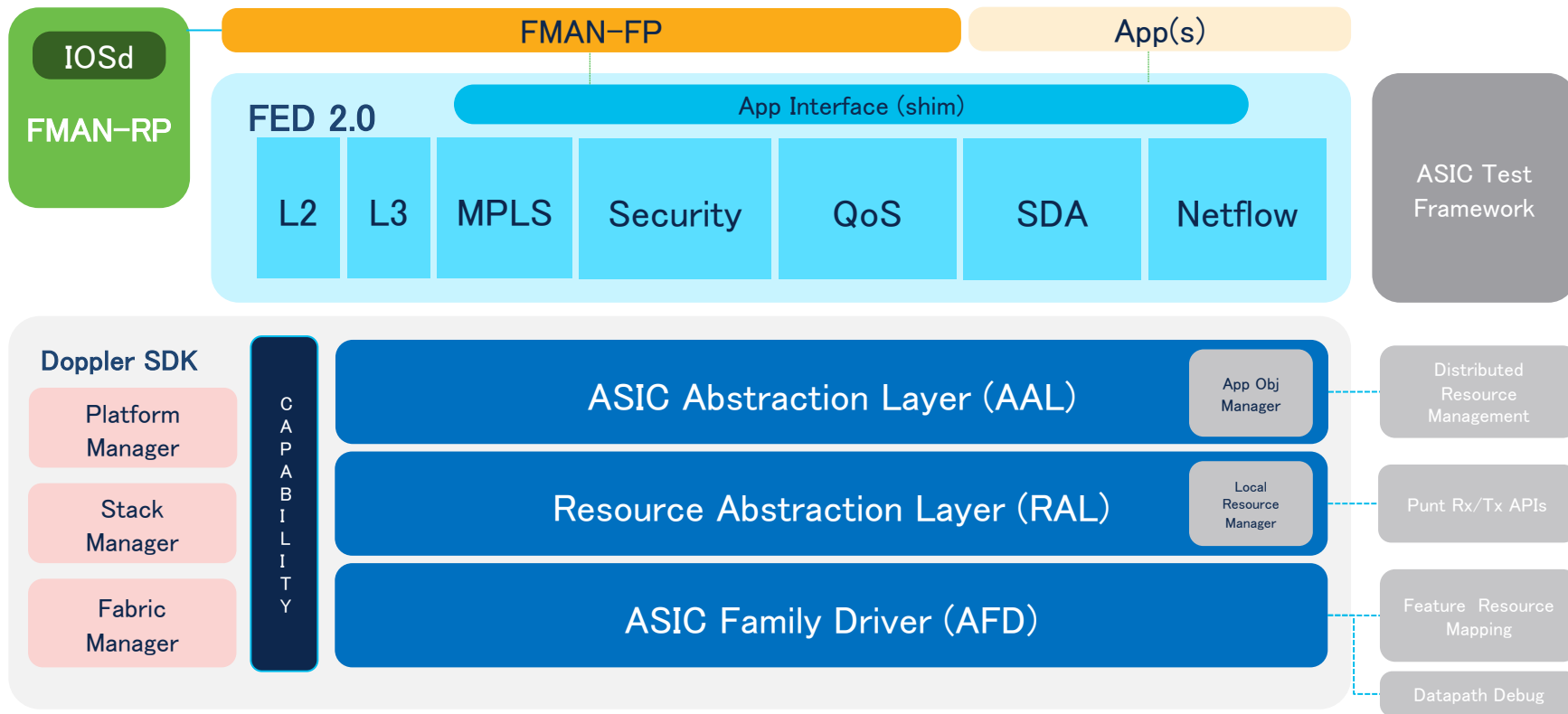
Platform Dependent (PD)

- **CPA** – Common Platform Abstraction
- **IOMD** – I/O Manager
- **CMAN** – Chassis Manager
- **PMAN** – Platform Manager
- **SMAN** – Stack Manager
- **XCVR** = Transceiver/Optics
- **Table Manager** – Client & Server
- **FED** – Forwarding Engine Driver
- **Punject** – Punt+Inject (CPU) interface



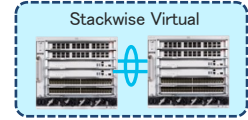
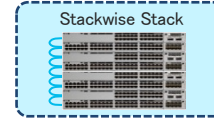
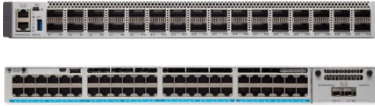
Cisco IOS XE on Catalyst 9000 Series

Hardware Forwarding Architecture

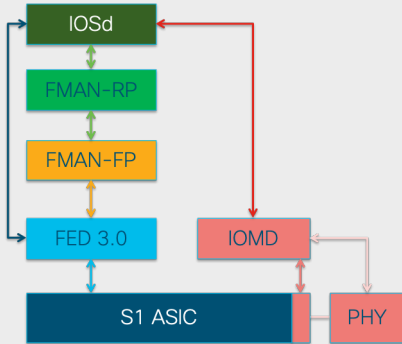


Fixed vs. Modular vs. Stacking

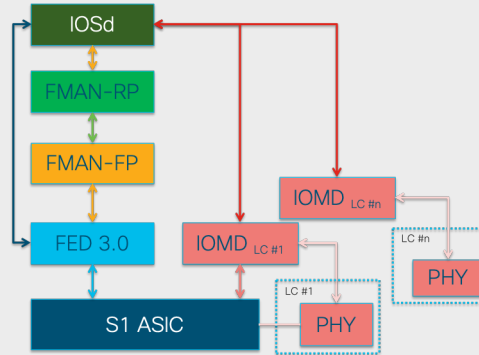
Reusing Common Elements of OS Architecture



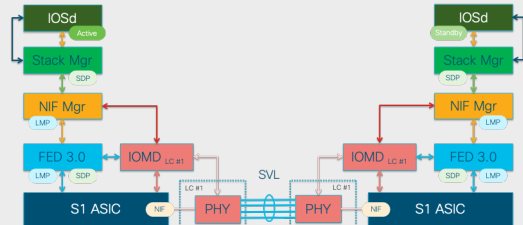
Fixed Platform



Modular Platform



Stacked Platform(s)



IOS XE – Same Software on all 9K Platforms



Same Binary Image
On all C9K

Software Download

Downloads Home / Switches / Campus LAN Switches - Core and Distribution / Catalyst 9600 Series Switches / Catalyst 9606R Switch / Software on Chassis / IOS XE Software- Bengaluru-17.6.3(MD)

Search...

Expand All Collapse All

Suggested Release

Bengaluru-17.6.3(MD)

Amsterdam-17.3.5(MD)

Latest Release

Gibraltar-16.12.8(MD)

Catalyst 9606R Switch

Release Bengaluru-17.6.3 MD

☆☆☆☆☆ (0)

My Notifications

File Information

CAT9300/9400/9500/9600 UNIVERSAL
cat9k_iosxe.17.06.03.SPA.bin
Advisories

Simple Certification & Qualification

Release Date	Size
01-Apr-2022	970.13 MB

Easier Image Management

Related Links and Documentation

Bugs/PSIRTs are fixed
across family

cat9k_iosxe.17.06.03.SPA.bin

Single IOSXE “Binary” Image for entire Catalyst 9000 Series

Cisco IOS XE Lite

Powering the Catalyst 9200 Series switches

Optimized for Catalyst 9200 Series switches



Same image across all Catalyst 9200/L & CX Series



Consistent

- Same code base as Cisco IOS XE



Light Weight

- Optimized for lower memory
- Reduced image size by 50%



Optimized

- Removed unused libraries
- IOSd optimizations
- Bash Optimizations



Modern

- Model-driven programmability
- Streaming telemetry
- Network monitoring

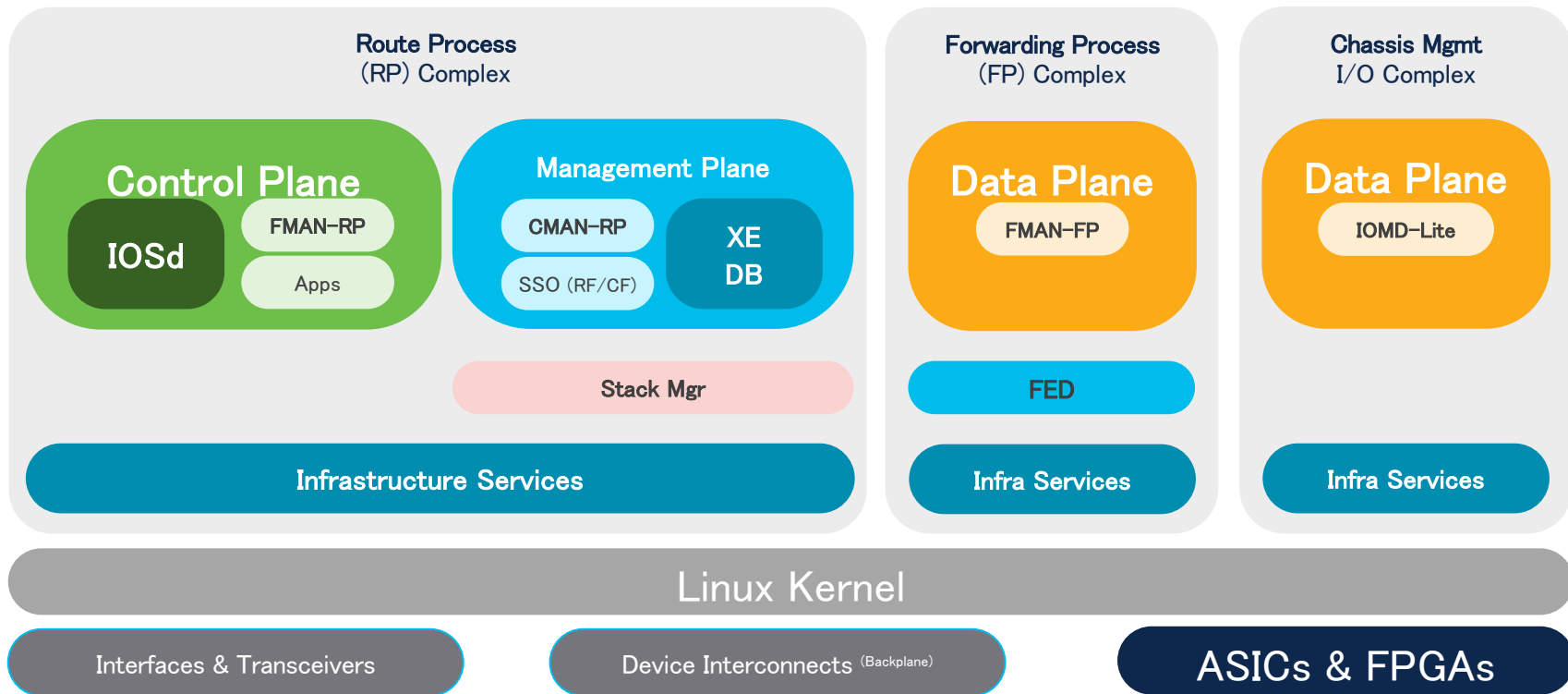


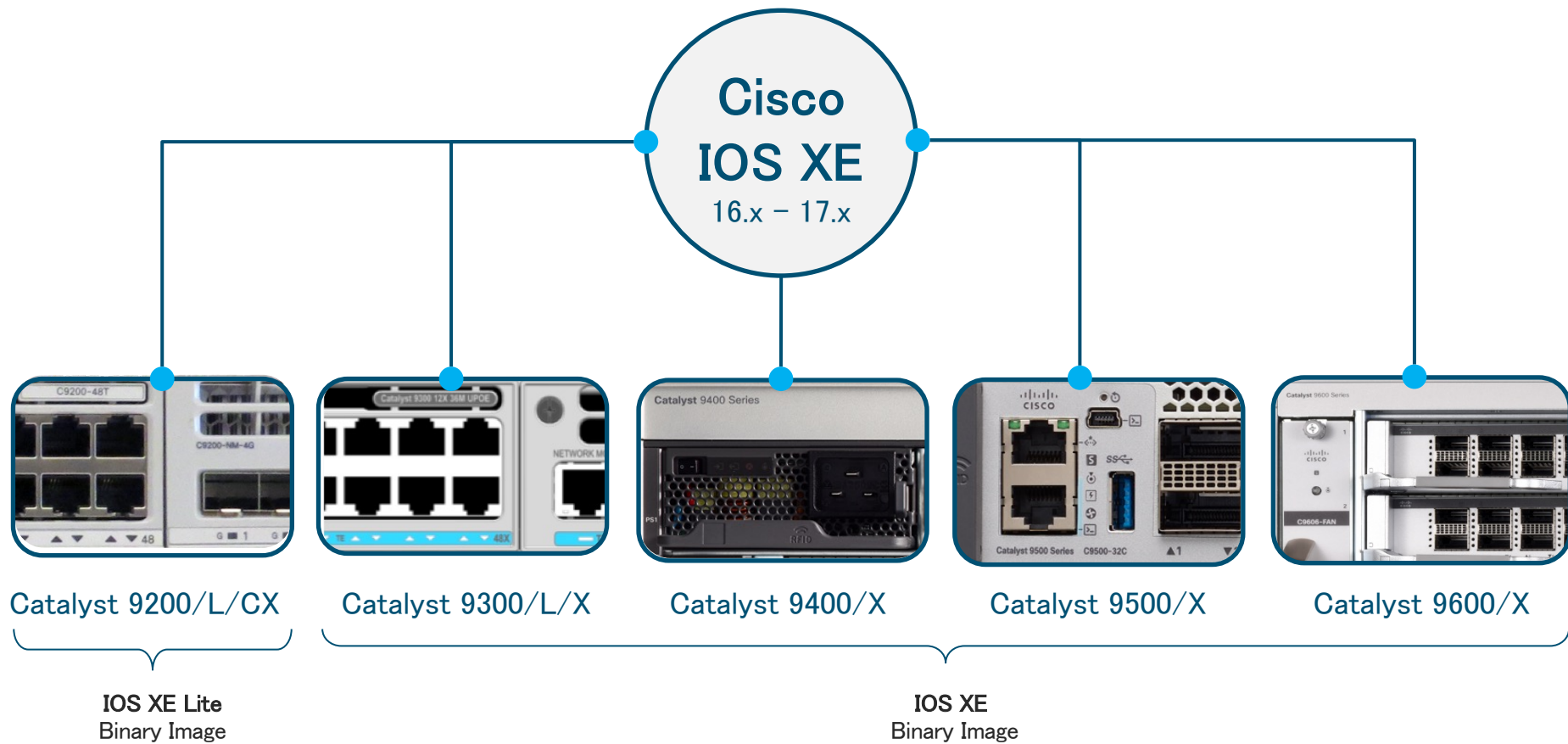
Highly Available

- Modular feature block – Enables Patching
- Status Recovery
- Failure Isolation

Cisco IOS XE “Lite” Architecture

Same code base as Cisco IOS XE – Optimized for ARM CPU & Memory





Catalyst 9000 runs the same IOS XE Operating System



Catalyst 9000 Series

Programmable ASICs

Catalyst 9000 Series – Common Building Blocks



Programmable x86 Multi-Core CPU

Application Hosting
Secure Containers



Cisco IOS XE® Polaris

Model-Driven APIs
Modular Patching



Cisco UADP & Silicon One™

Programmable Pipeline
Flexible Tables

Same IOS XE image for UADP* and Silicon One C9K platforms

* Catalyst 9200 Series uses IOS XE Lite

Why do we need ASICs?

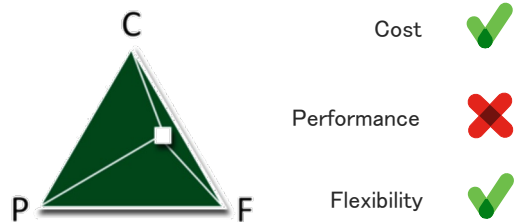
A 'general-purpose' CPU may be fast at running random-access applications, on a laptop or server, but **processing and forwarding 'network traffic'** is a different matter.

Network traffic requires **constant searching of large memory tables** (e.g. L2 tables for MAC addresses, L3 tables for IP routes, L4 ACLs for Security and QoS, etc.)

In a CPU – there are limited data paths and tables are held in off-chip memories (e.g. DRAM) that can incur significant performance penalties for frequent access.

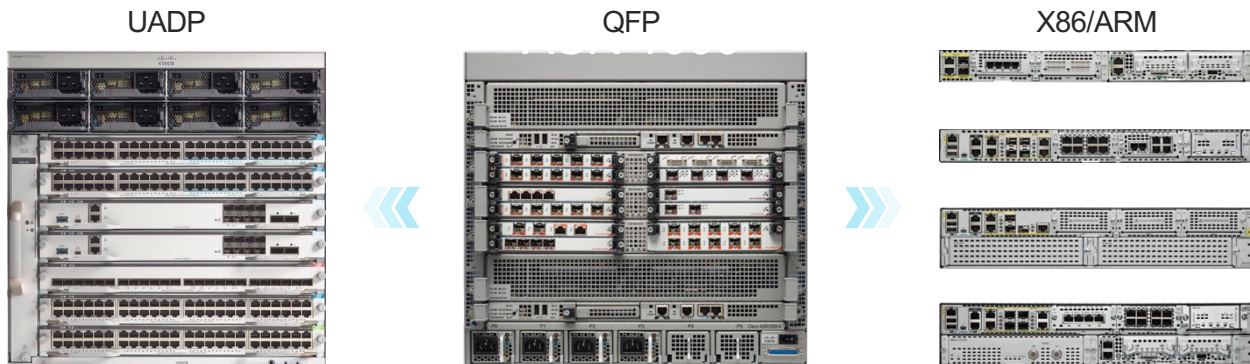
Remember, this is **Millions – Billions** of packets per second

CPUs are
Flexible but **Slow**



Hardware vs. Software Data-Plane

ASIC-based vs. CPU-based



Hardware-Based (ASIC)

PROs

- **High Throughput**
- Gbps – Tbps
- High Port Density
- HW-based Services
- Lower COGs

CONs

- **Less Flexible**
- PI + PD Development
- Longer Dev & Test
- Scale limited by HW
- Limited Services

Software-Based (CPU)

PROs

- **More Flexible**
- PI Only Development
- Faster Dev & Test
- Scale limited by CPU
- Lots of Services

CONs

- **Low Throughput**
- Mbps – Gbps
- Low Port Density
- SW-based Services
- Higher COGs

Cisco Silicon One™

Q200 Architecture

Introducing Cisco Silicon One™

One Architecture – Multiple Devices



Q202

3.2 Tbps

7nm FinFET
1 Slice SOC



Q201

6.4 Tbps

7nm FinFET
3 Slice SOC



Q100

10.8 Tbps

16nm FinFET
6 Slice SOC



Q200

12.8 Tbps

7nm FinFET
6 Slice SOC

- First network silicon to break the 10-Tbps barrier
- Comprehensive routing, with switching efficiency
- Flexible P4 NPL programmable packet processing

- **Multiple functions:** system-on-chip, line-card or fabric
- **Multiple form factors:** fixed or modular
- **Multiple networks:** Enterprise, Data Center and SP

www.cisco.com/c/dam/en/us/solutions/collateral/silicon-one/white-paper-sp-product-family.pdf

Cisco Silicon One™ Q200

Industry leading Switching and Routing Silicon



12.8 Tbps



8.1 Bpps



8GB HBM
for
deep buffers



2M IPv4
or 1M IPv6
routes



P4 NPL
Programmable
Pipeline



50G
PAM4
Serdes

Cisco Silicon One™ Q200
**Industry Leading
12.8T System on Chip**



First 7nm ASIC
providing lowest Watts/GE
power consumption



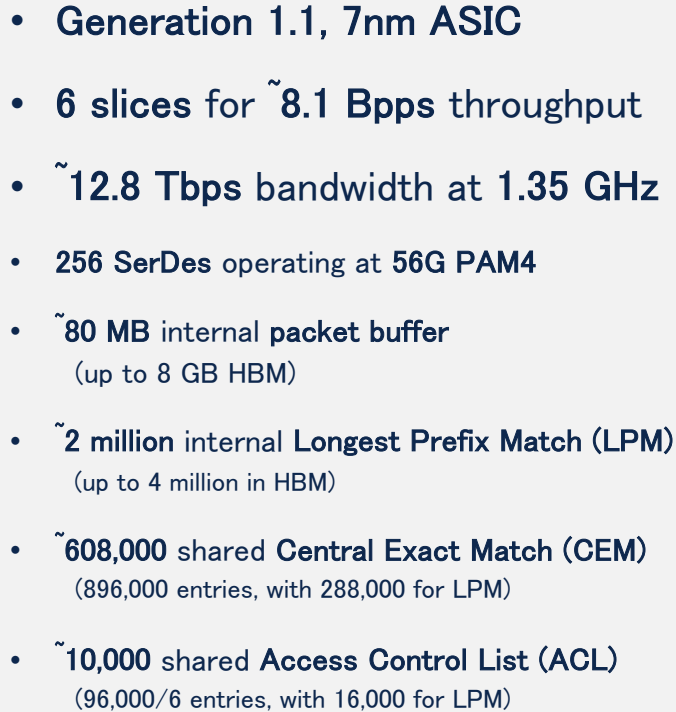
Fully P4 programmable
enabling feature velocity



Multi-Slice architecture
for flexibility and scale

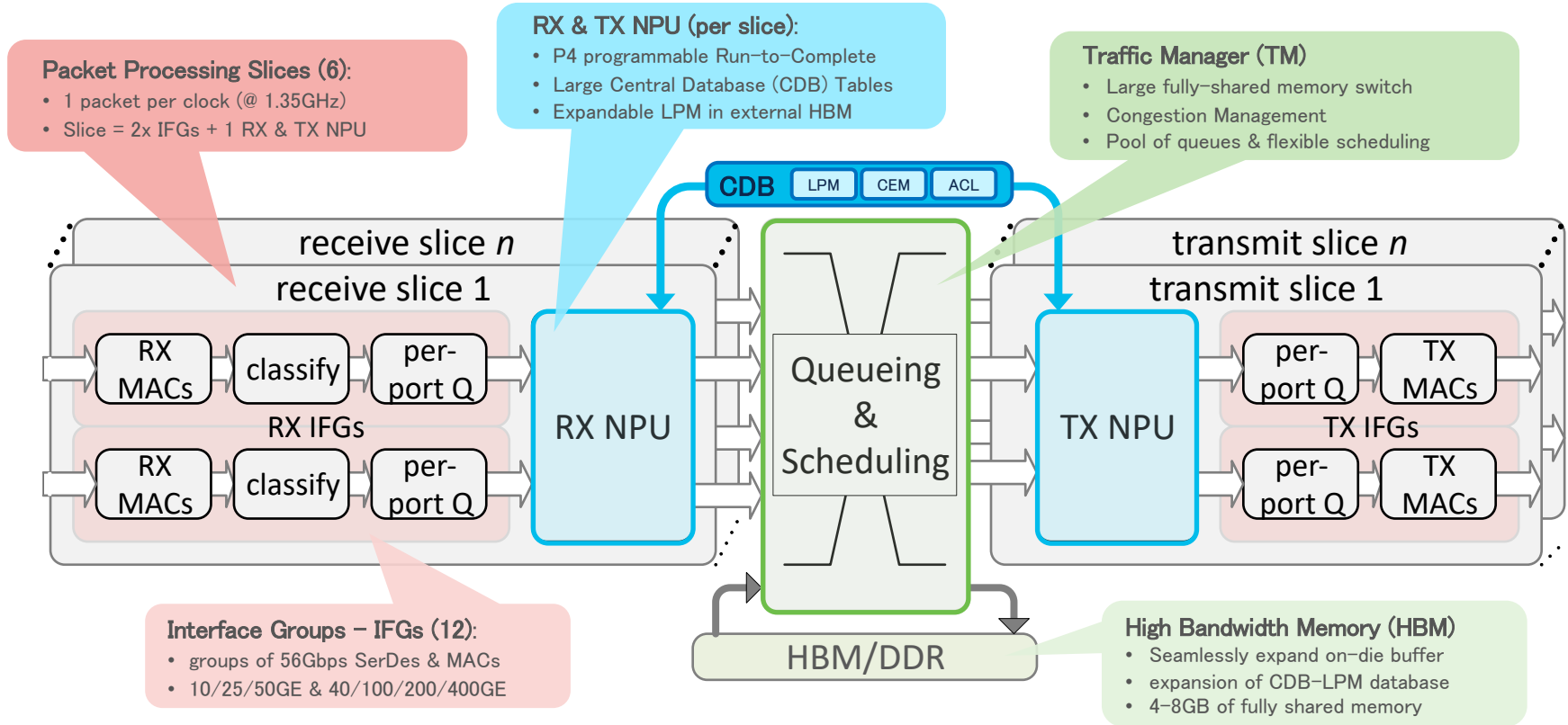
Routing Capabilities with Switching Power and Performance

Programmable Next-Generation Core ASIC



Cisco Silicon One™ Q200

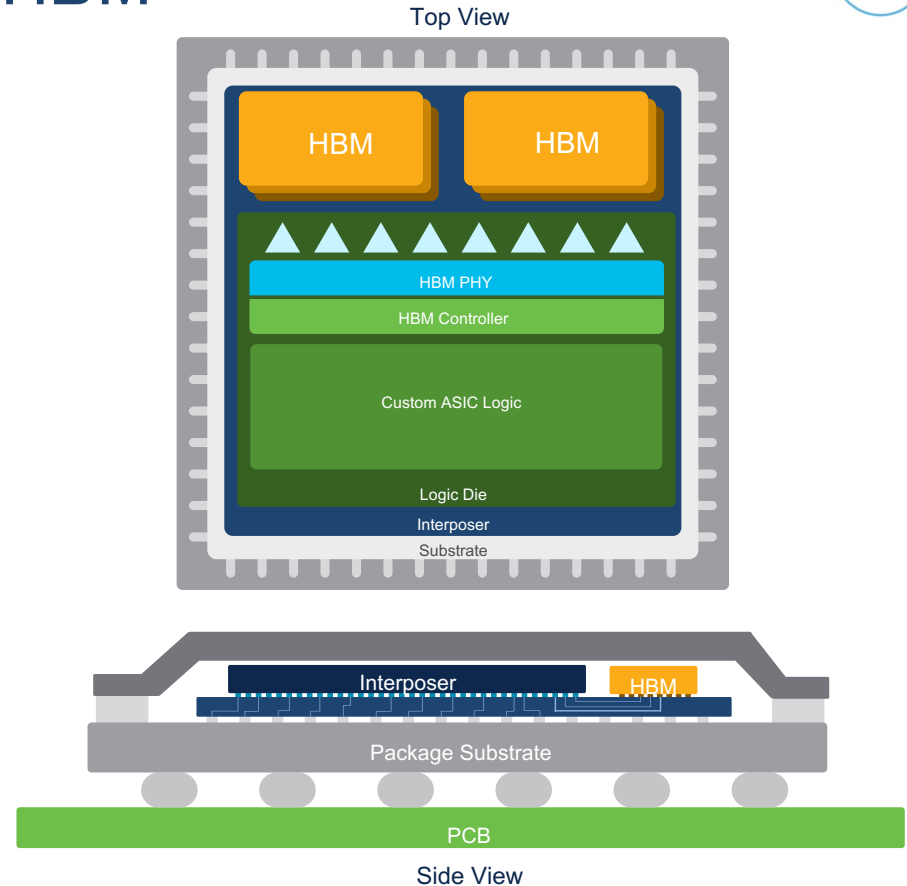
ASIC Architecture & Block Diagram



Cisco Silicon One™ Q200 – HBM

High Bandwidth Memory

- **Augments local on-die memory**
 - use local (SMS) buffer until full
 - use HBM for bursting or congestion
- **Deep buffering** (+ FIB expansion) on-package at high-speed
- **2 x stacks of 2.5D** memory with wide-bus interposer = ~2.4 Tbps full duplex
- Interposer connects ASIC die to on-package HBM memory



Cisco Silicon One™ Q200 – Central Databases

Onboard LPM, CEM & ACL memory



Q200 CDB includes the Central L2/L3 Forwarding and ACL databases:

LPM – SRAM database for IP/mask routing implemented by Longest Prefix Match algorithm

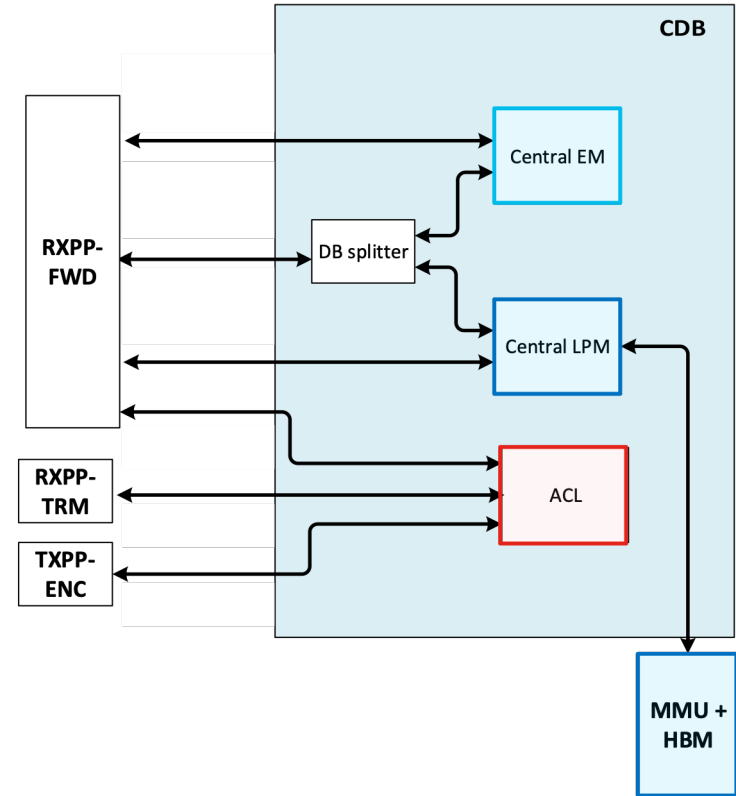
- Primarily used by IPv4 and IPv6 unicast routing
- Up to* 2M IPv4 route entries, or 1M IPv6 route entries
- LPM can be extended (from CDB) to HBM

CEM – SRAM database for MAC & Host (/48, /32 or /128), Multicast & Labels implemented by Exact Match algorithm

- For features using an exact match (every bit, no mask)
- Up to 608K IPv4 entries, or 304K IPv6 entries
- CEM can be flexibly reallocated for different tables

ACL – TCAM classification database, contains Security, QoS and Services Access Control List entries

- For features that use (match criteria + action) policies
- Up to 8K IPv4 ACL entries, or 4K IPv6 ACL entries
- OG/SGACLs use CEM, with only action ACEs in TCAM



* Exact scale depends on IP/mask distribution (contiguous vs. random) and hash efficiency. Sample tests with IPv4 GRT is ~1.85M

Cisco Unified Access Data Plane

UADP Architecture

Cisco Unified Access Data-Plane (UADP®)

Common ASIC Architecture for Switching Access, Distribution & Core



UADP 2.0m

120 Gbps

16nm FinFET
1.3B Transistors
1 Core + ARM CPU



UADP 2.0/XL

240 Gbps

28nm FinFET
7.6B Transistors
2 Core



UADP 2.0sec

480 Gbps

16nm FinFET
7.6B Transistors
1 Core2 + SEC



UADP 3.0

1.6 Tbps

16nm FinFET
192.B Transistors
2 Core



UADP 3.0sec

1.6 Tbps

16nm FinFET
192.B Transistors
2 Core + SEC

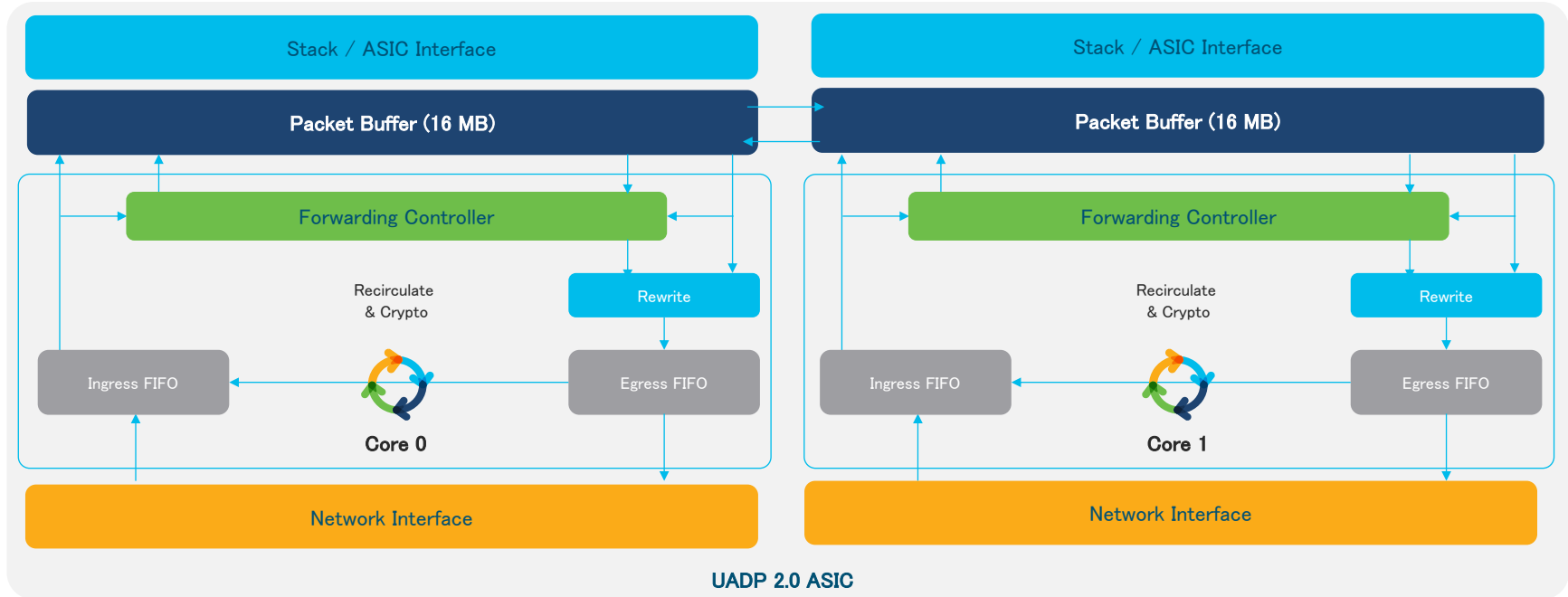
- Multiple generations and formats, same architecture
- Rich flexible forwarding & services memories
- First fully programmable microcode network silicon

- **Multiple functions:** system-on-chip or line-card
- **Multiple form factors:** fixed or modular
- **Multiple places:** Access, Distribution and Core

community.cisco.com/t5/networking-blogs/uado-the-powerhouse-of-catalyst-9000-family/ba-p/3764605

Cisco UADP – Dual-Core ASIC

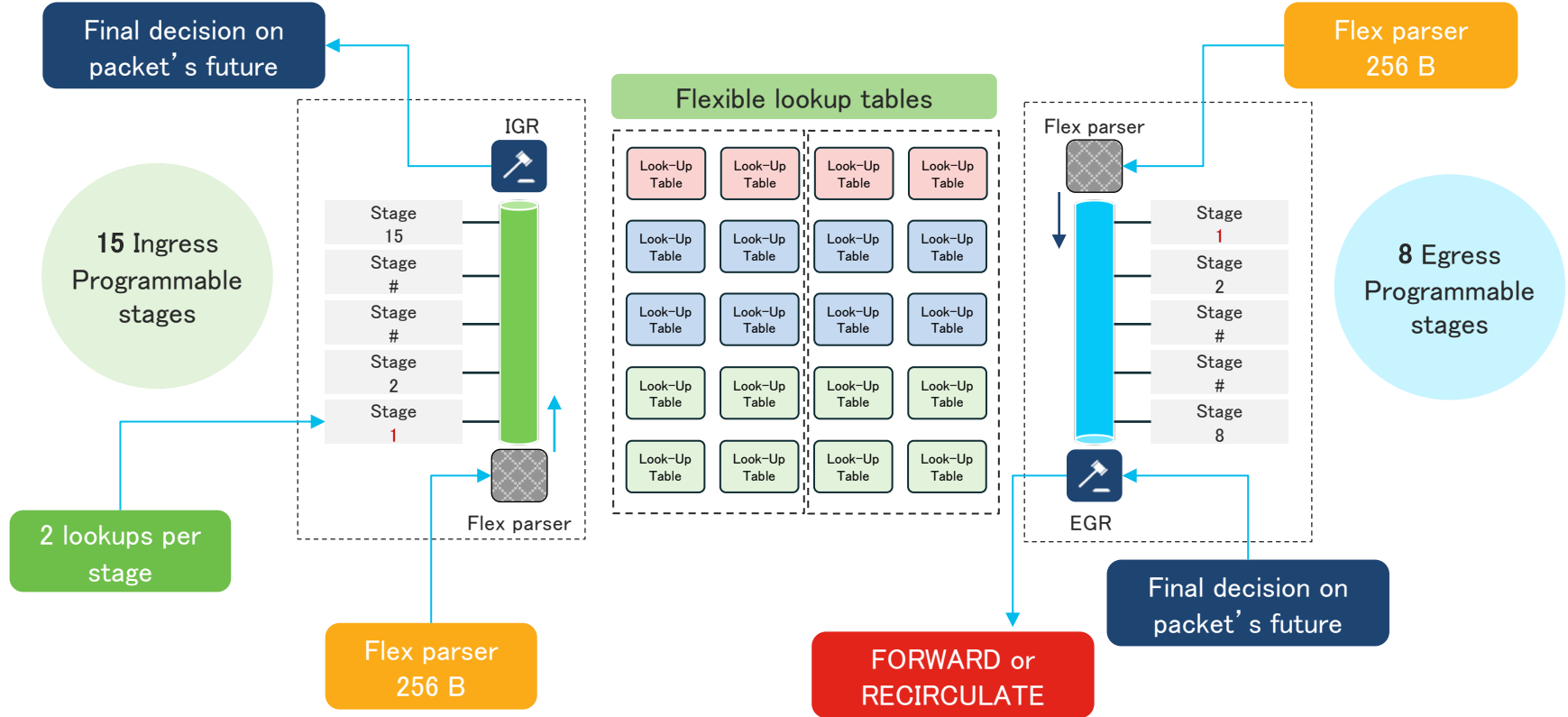
Parallel Processing Pipelines





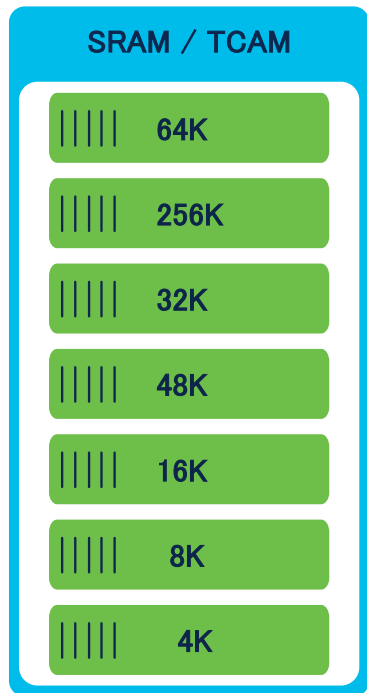
Cisco UADP – Flexible Lookups

Programmable Ingress and Egress Processing Stages



Cisco UADP – Flexible Tables

Customizable ASIC tables for universal deployment flexibility



- MAC
- IPv4/v6
- Unicast
- Multicast
- NetFlow
- ACL
- SGACL
- QoS
- NAT
- SPAN

Flexible ASIC templates



Customize table sizes for each role – based on the Place in Network

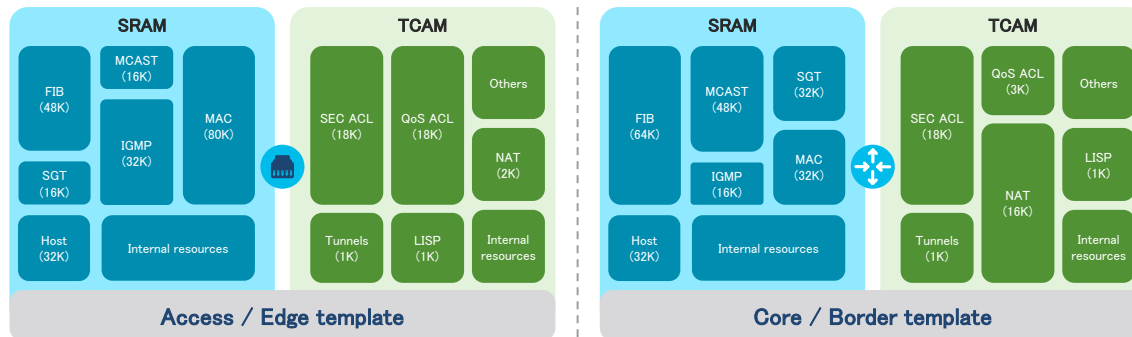


Table sizes can be tailored to support multiple templates

Cisco Unified Access Data Plane

UADP 3.0

UADP 3.0 – SOC ASIC for Core Switching

Used in Catalyst 9600-SUP1, 9500(H) and 9400X-SUP2



UADP 3.0



19.2
billion transistors
16nm technology



Customizable
ASIC templates



36 MB
Unified buffer



Double-Width
memory tables



3X FIB
table scale



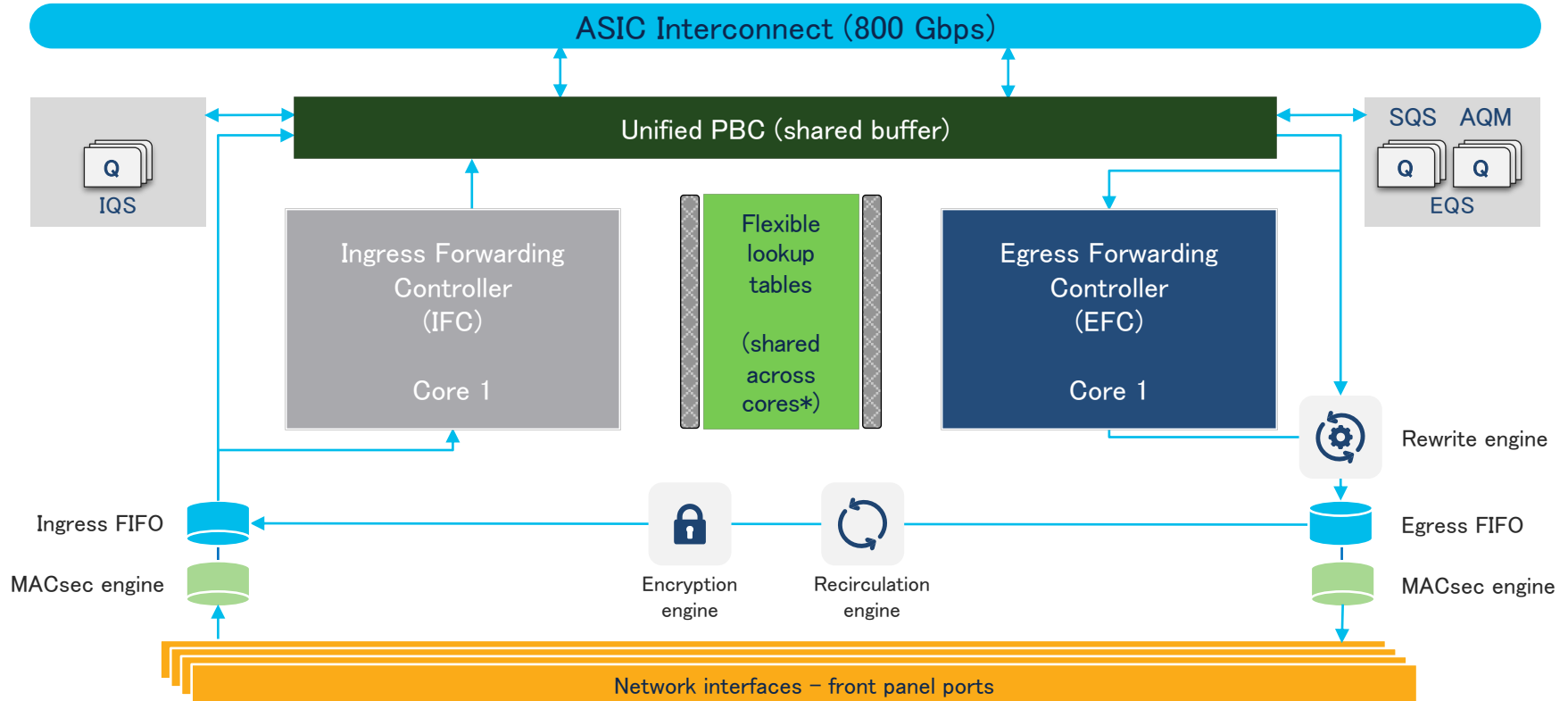
Up to 1.6 TB
bandwidth



1G, 10G,
25G, 40G & 100G

UADP 3.0 – Architecture

ASIC Block Diagram



Cisco Unified Access Data Plane

UADP 2.0

UADP 2.0 – Flexible ASIC for Access Switching

Used in Catalyst 9300, 9400 and 9500 Series



Investment protection

Flexible pipeline



Universal deployments

Adaptable tables



Enhanced scale and buffering

Multicore resource share

1 2 3

384,000 flex
counters



Shared
Lookup



Up to 240G
bandwidth



Up to 2X to 4X
forwarding TCAM



Embedded CPUs



Up to 32 MB
packet buffer



Up to 64,000 x2
NetFlow records

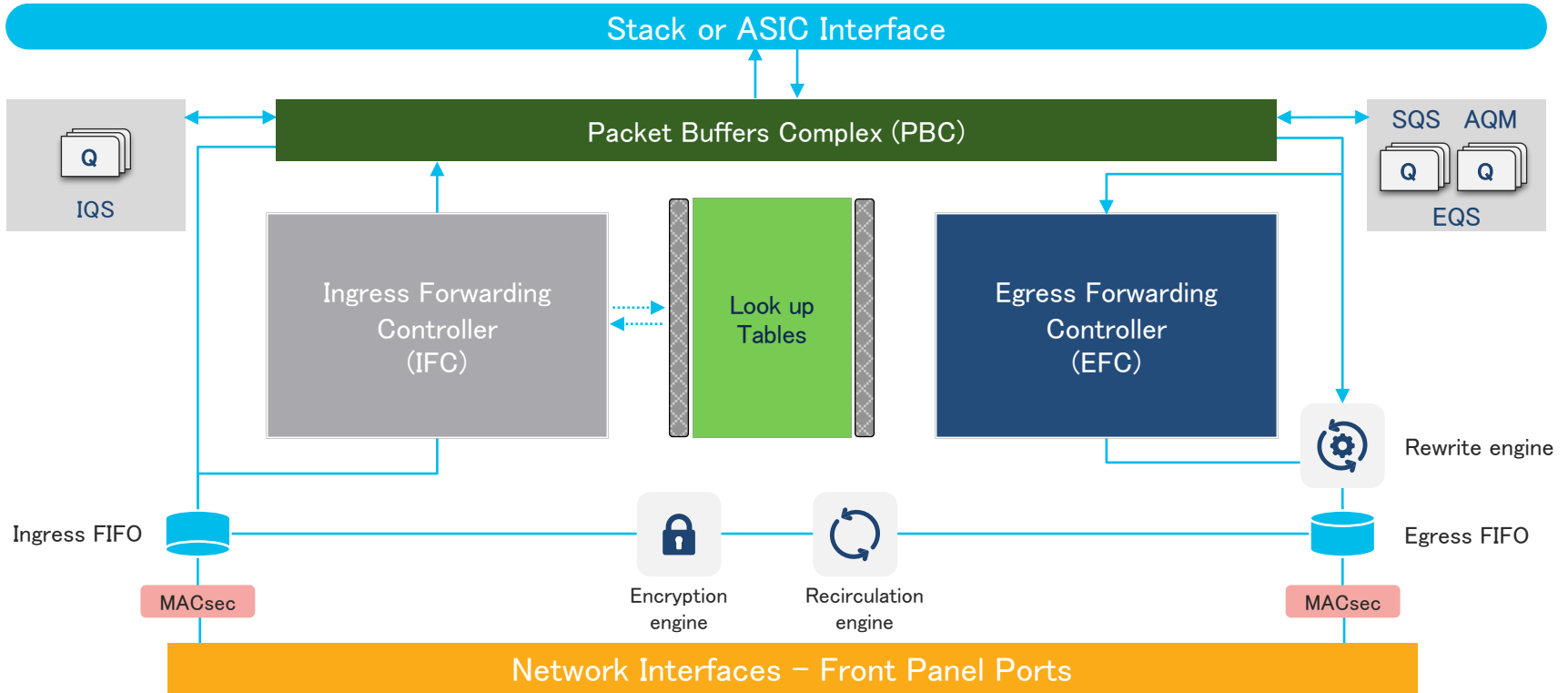
UADP 2.0 & XL



7.46
billion transistors
28nm technology

UADP 2.0 – Architecture

ASIC Block Diagram



UADP 2.0 Mini

Architectural simplicity with powerful innovations



Investment protection
Flexible pipeline



Enhanced scale and buffering
Multicore resource share



100G
bandwidth



6-MB
packet buffer



1G, 2.5G, 5G, 10G, 40G
Supports different speeds



16,000
NetFlow records



Flexible
Programmable modules



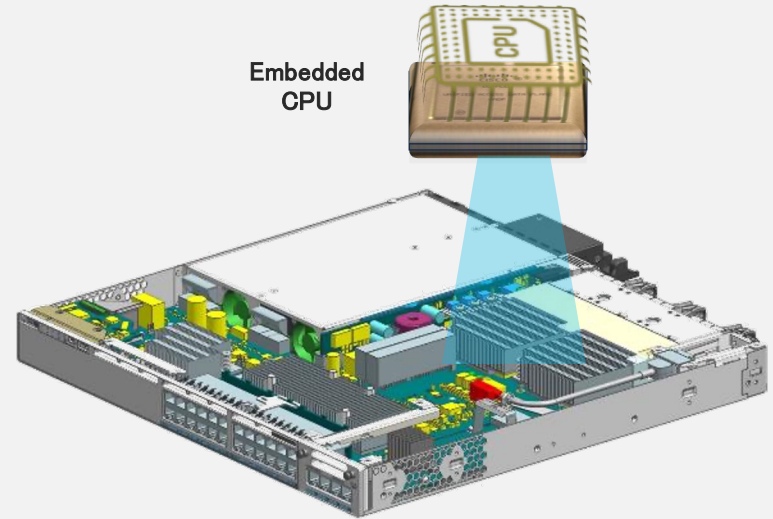
SDM templates
Flexibility



160G, 80G
stacking capacity



Up to 2x to 4x
forwarding + TCAM



Embedded
CPU



Catalyst 9000 Series

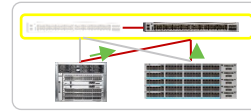
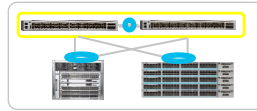
High Availability

Catalyst 9000: Pinnacle of Resiliency



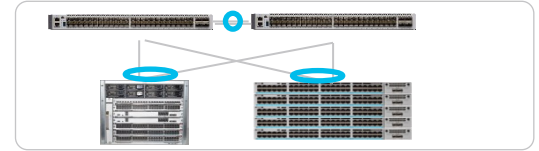
Platform Resiliency

- **Redundant Switches and Supervisors** for Standalone and Modular Switches with Non-Stop Forwarding and Routing (NSF/NSR)
- **Redundant Fan & Power** Supply in case of any hardware failure



Design Resiliency

- **StackWise Virtual:** Redundant System for high availability, simplified design and configuration
- **GIR:** No downtime when device removed for maintenance



Operational Resiliency

- **ISSU:** Upgrade software with minimal to no traffic loss
- **xFSU :** Upgrade or Reload the Catalyst 9300 with very minimal traffic loss
- **Hot Patching:** No downtime for bug fixes (no reboot)

Eliminate downtime with High Availability designed at every level

Catalyst 9000: Platform Resiliency



C9300 Fixed Platform

- **StackWise: Redundant System for high availability** with NSF/SSO
- **StackPower:** Redundant Power Supplies providing 1+ N redundancy
- **Redundant Fan & Power** Supply in case of any hardware failure



C9400/C9600 Modular Chassis

- **Redundant Supervisor:** Redundant System for high availability, simplified configuration
- **Redundant Fan & Power** Supply in case of any hardware failure



C9500 Fixed Platform

- **StackWise Virtual:** Redundant System for high availability with NSF/SSO
- **Redundant Fan & Power** Supply in case of any hardware failure

Sub-second Traffic impact during failures across C9k Family

Mission-Critical Resiliency

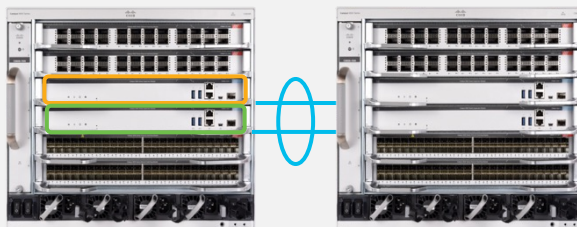
Your business stops if the network is down



Cost of only one hour of downtime to an average enterprise > \$300,000**

** Based on industry reports from Gartner and ITIC

Catalyst 9600 Series
(Dual chassis w/ StackWise Virtual)



Catalyst 9400 Series



Catalyst 9500 Series

Architecture

In-Service Software Upgrade (ISSU)

- Upgrade software with minimal or no traffic loss

StackWise® Virtual

- Virtualized redundant system for simplified configuration & protocols

Operating system

Hot Patching (SMU)

- No downtime for critical fixes (no reboot)

Graceful Insertion/Removal

- No downtime when device in maintenance

xFSU on C9300/L Standalone/Stack

- < 30 sec traffic downtime – Standalone upgrade

Platform

Redundant Supervisors

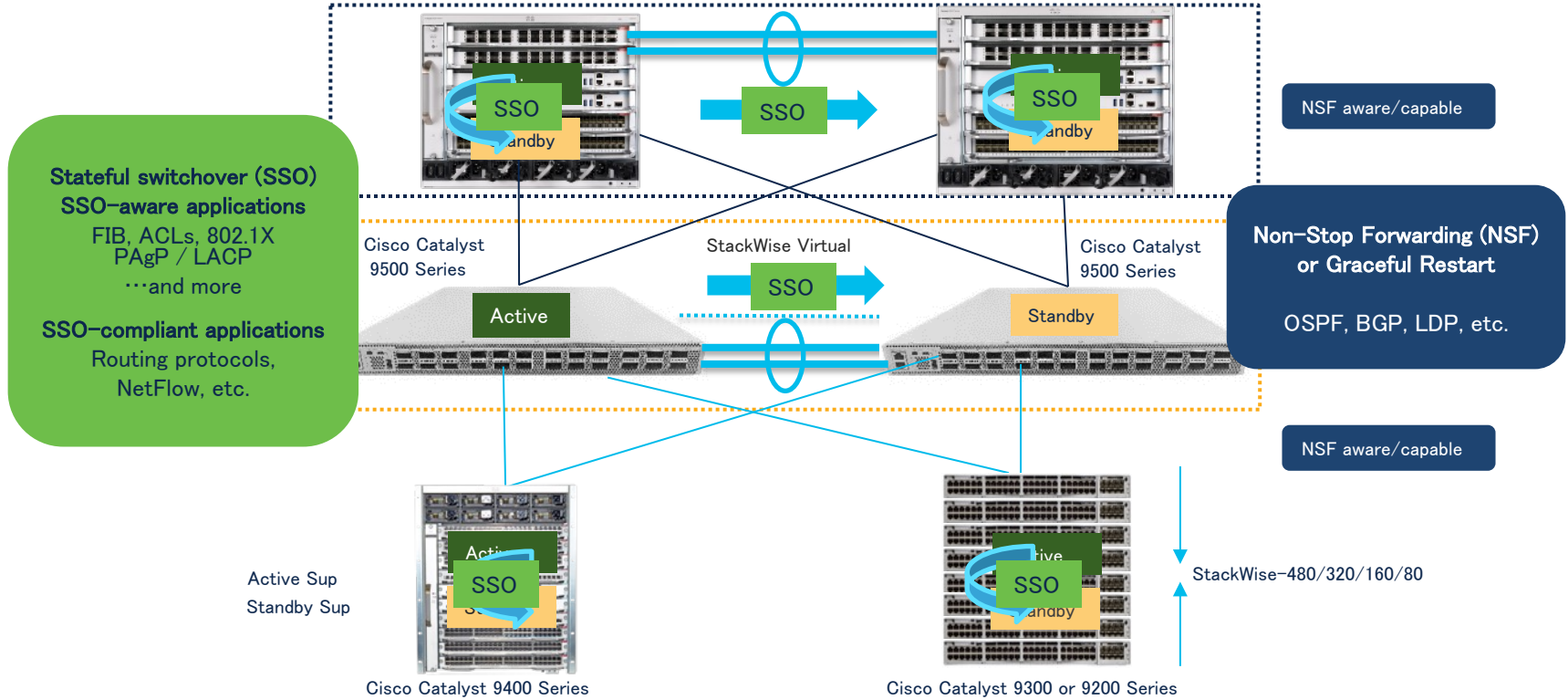
- Modular Switches with NSF/SSO
- SWV Quad-SUP RPR

Redundant Fan & Power Supplies

- In case of any hardware failure

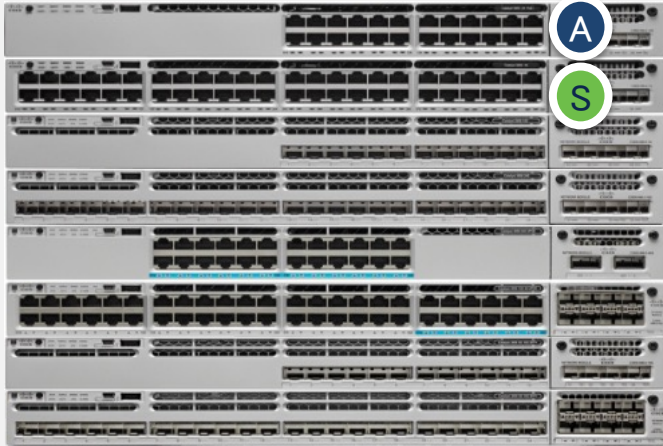
Eliminate downtime with *high availability* designed at every level

High Availability in Campus SSO/NSF



Cisco Catalyst 9200 Series

StackWise-160G/80G with Stateful Switchover (SSO)



Up to 8-
member data
stack with SSO

Centralized control plane

Distributed data plane

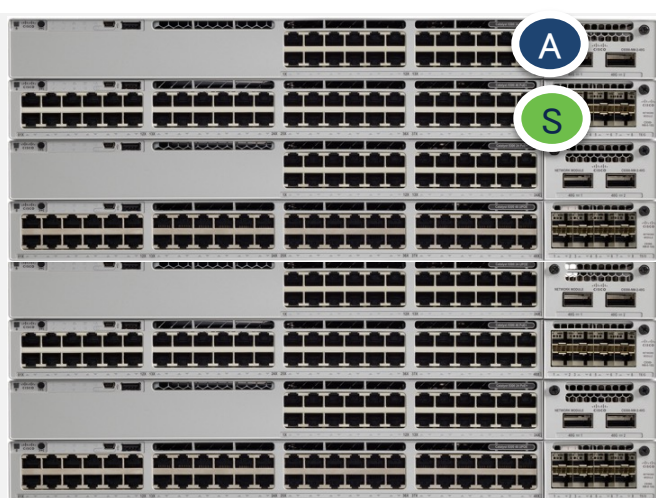
N+1/1+1 stateful redundancy
with active and standby

- StackWise-160 supported on all modular Cisco Catalyst 9200 Series switching models
- StackWise-80 supported on all fixed Cisco Catalyst 9200L Series switching models
- Same Cisco IOS XE and license required on all members

*Mixed stacking not supported between C9200 and C9200L

Cisco Catalyst 9300(X)(L)(LM) Series

StackWise-1T/480G/320G with SSO and Non-stop Forwarding (NSF)



StackWise-1T/480G*/320G

Up to 8-
member data stack
with SSO and NSF

Centralized control plane

Distributed data plane

N+1/1+1 stateful redundancy
with active and standby

- StackWise-1T supported on all modular Cisco Catalyst 9300X Series switching models
- StackWise-480 supported on all modular Cisco Catalyst 9300 Series switching models
- StackWise-320 supported on all fixed Cisco Catalyst 9300L Series switching models
- Same Cisco IOS XE and license required on all members

* Mixed stack of C9300X and C9300 is supported with StackWise-480 Speeds

Catalyst 9300 Platform Resiliency for Power Supplies

Normal

PS failure

Combined
(default)



Load sharing on all PSs



Load on Single PS

Redundant



System and PoE Load sharing on active PS
Standby PS shares the load of a system only



Standby PS becomes active
System enters alarm state

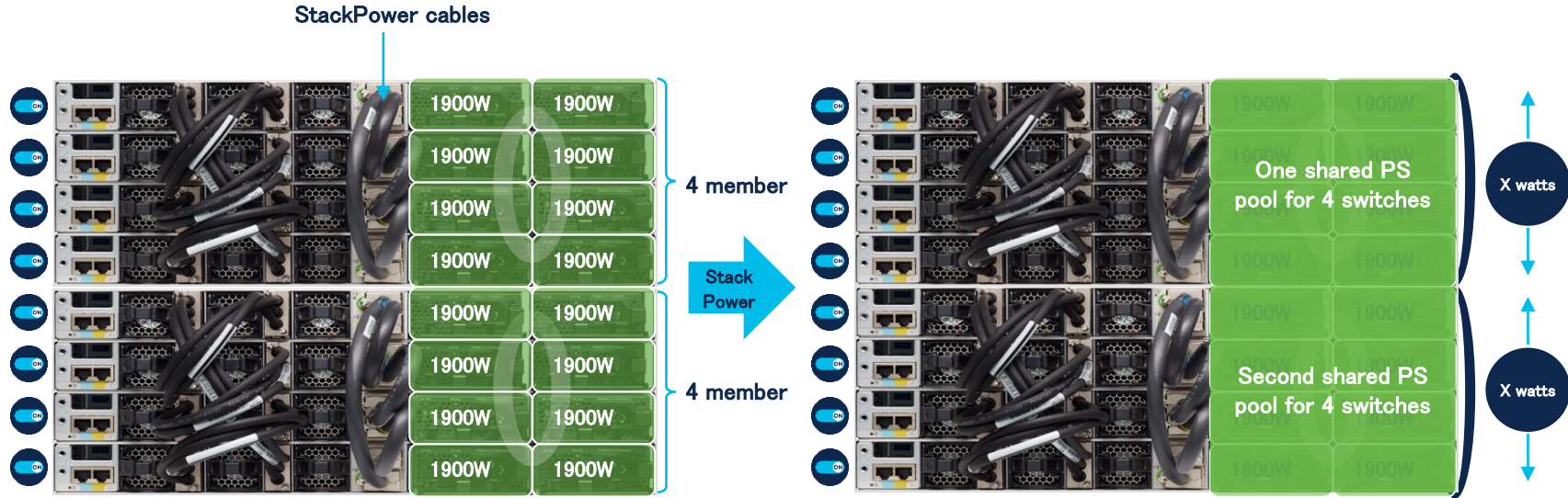
Failed PS

Active

Standby

Power Redundancy with Stacking Power Supplies

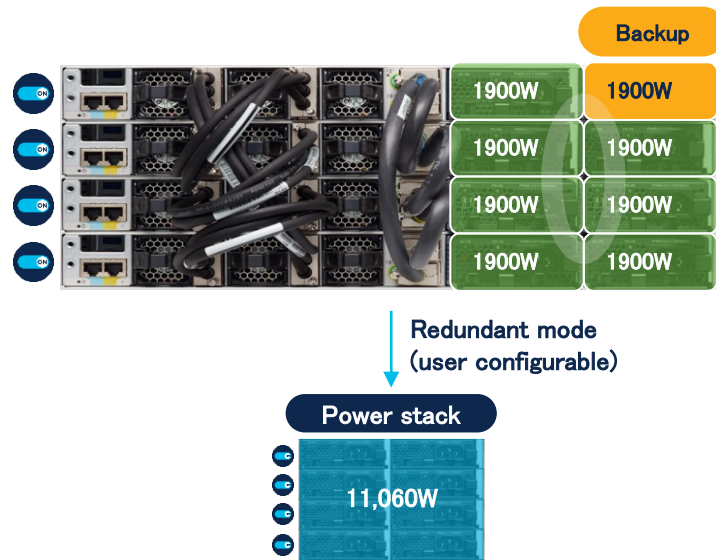
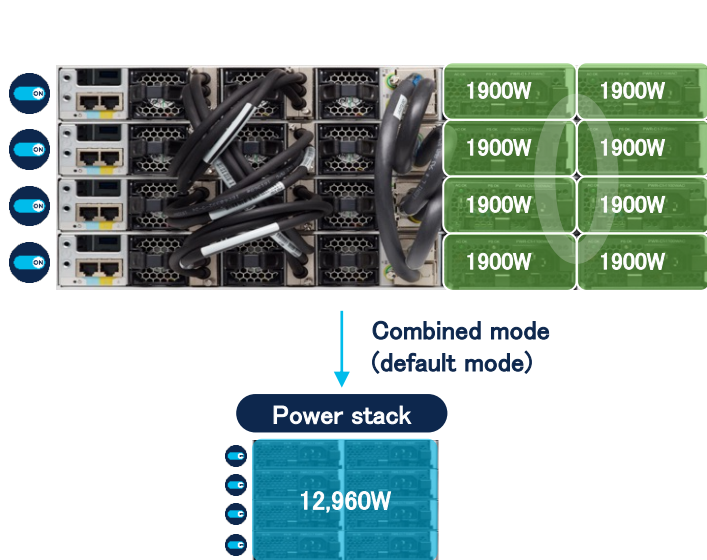
StackPower



- Pools power from all Power Supplies (PS)
- All switches in StackPower share the available power in the pool
- Each switch is given its minimum power budget

- 1+N Redundancy with inline power
- Up to 4 switches in one StackPower Ring
- Multiple Power stacks possible in one data stack

Power stack modes

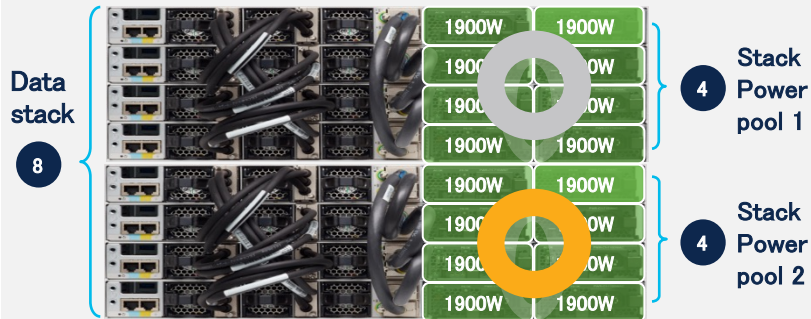


- All power supplies contribute to common output power budget

- One of the highest valued power supplies is not used in the power budget calculation

Power stack deployment models

Ring model (default)



Power sharing and redundancy are available only within individual pools

Star model (requires XPS 2200 device)



Power sharing and redundancy extend across all eight members in the stack

PoE Redundancy at Port Level

2-event classification

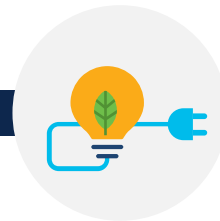
- Fast power negotiation without Link Layer Discovery Protocol (LLDP)
- Physical layer negotiation < 1 second

Perpetual PoE

- Uninterrupted PoE power during control plane reboot

Fast PoE

- Bypasses Cisco IOS® control plane boot
- Restores power to Powered Device (PD) within 30 seconds of power resumption



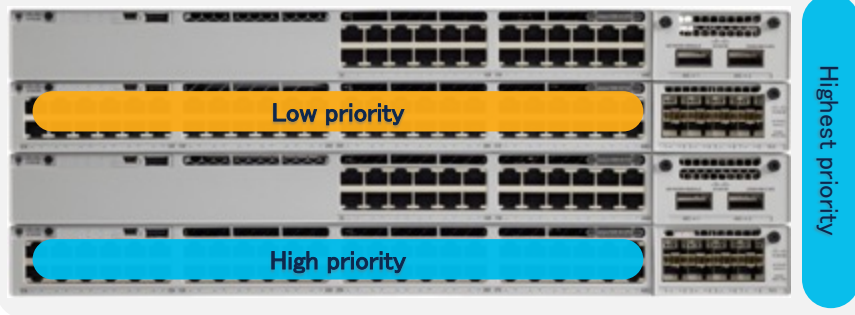
Power priority

- Load shedding

Standalone mode



Stack mode



Load shedding based on configured priority

1. Low-priority ports
2. High-priority ports
3. Switch priority – **Highest priority**

```
9300-GIR-Access-144#show stack-power load-shedding switch 1
```

Power Stack Name	Stack Mode	Stack Topolgy	Total Pwr(W)	Rsvd Pwr(W)	Alloc Pwr(W)	Unused Pwr(W)	Num SW	Num PS
Powerstack-1	SP-PS	Stndaln	1100	30	240	830	1	1

SW	Power Stack Name	Priority Sw-Hi-Lo	Consumd Sw(W)	Consumd Hi(W)	Consumd Lo(W)	Alloc Hi(W)	Alloc Lo(W)
1	Powerstack-1	4-13-22	153	0	0	0	0

Switch 1 High Priority Active (powered) Ports:

Switch 1 High Priority Inactive (unused) Ports:

Switch 1 Low Priority Active (powered) Ports:

Switch 1 Low Priority Inactive (unused) Ports:

Gi1/0/1, Gi1/0/2, Gi1/0/3, Gi1/0/4, Gi1/0/5, Gi1/0/6,
Gi1/0/7, Gi1/0/8, Gi1/0/9, Gi1/0/10, Gi1/0/11, Gi1/0/12,
Gi1/0/13, Gi1/0/14, Gi1/0/15, Gi1/0/16, Gi1/0/17, Gi1/0/18,
Gi1/0/19, Gi1/0/20, Gi1/0/21, Gi1/0/22, Gi1/0/23, Gi1/0/24,

Extended Fast Software Upgrade

C9300/L- 17.3.2

C9300X- 17.7.1

C9300LM- 17.9.1

Catalyst® 9300/9300/9300L/9300LM standalone



#Install add file image activate reloadfast commit

Control plane

Data plane

< 30
seconds of
traffic
impact

Catalyst 9300X/9300/9300L/9300LM stack



#Install add file image activate reloadfast commit

Active control plane

Data plane

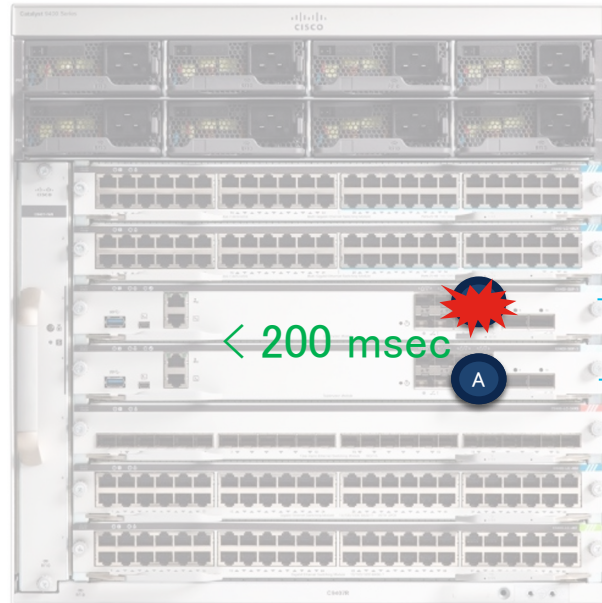
< 30 seconds
of traffic impact
for all ports in
the stack

Catalyst 9400/9600 Platform – Supervisor Redundancy

Non Stop Forwarding(NSF) or
Graceful Restart

OSPF,BGP,LDP, etc

NSF Capable



Stateful Switchover (SSO)

SSO Aware Applications

Forwarding Information Base

IEEE 802.1x
PAgP / LACP

...and more

SSO Compliant Applications

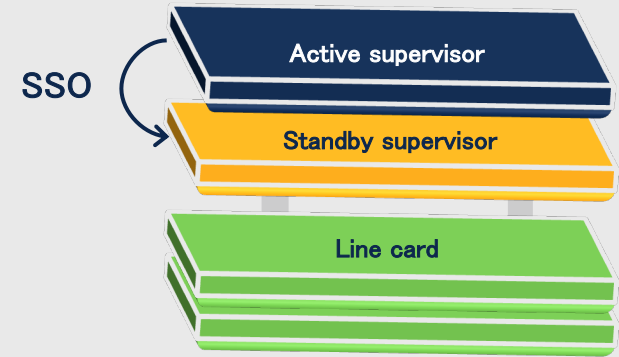
Routing Protocols, Netflow, etc

Dual Supervisors Required to provide both Control and Data Plane Redundancy

Dual-supervisor ISSU

In-Service Software Upgrade (ISSU) overview

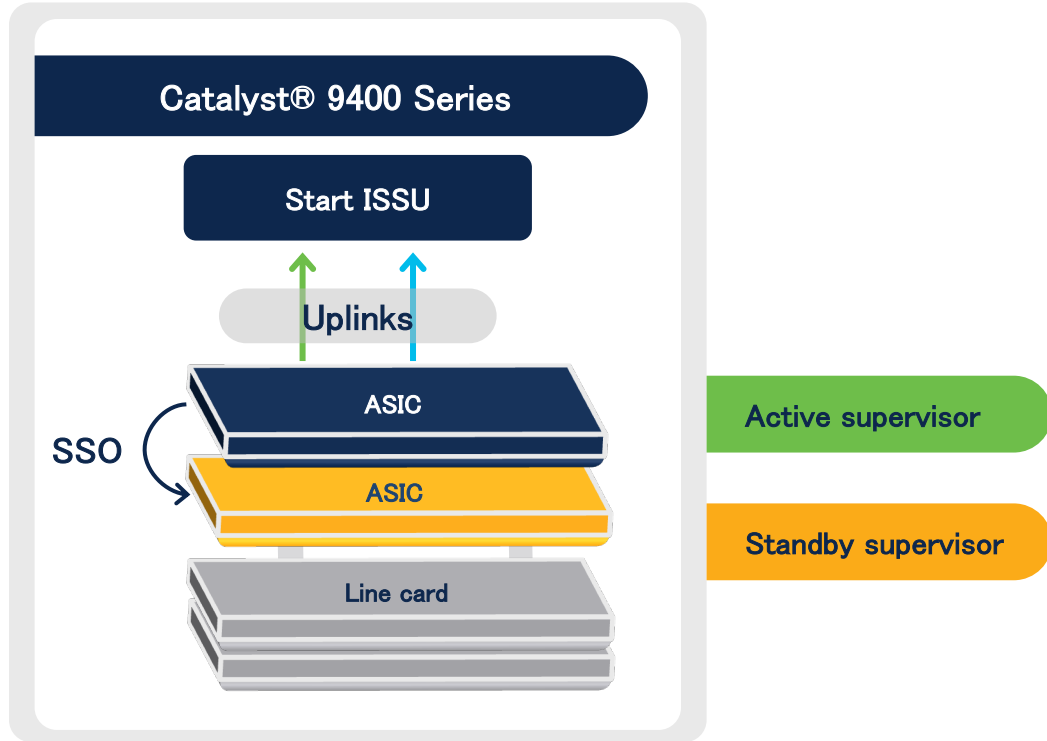
- ISSU provides a mechanism to perform software upgrades and downgrades (major or minor release) without taking the **complete switch** out of service
- Leverages the capabilities of Nonstop Forwarding (NSF) and SSO to always allow one of the supervisors in the chassis to keep forwarding traffic during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



Catalyst® 9400/9600 Series

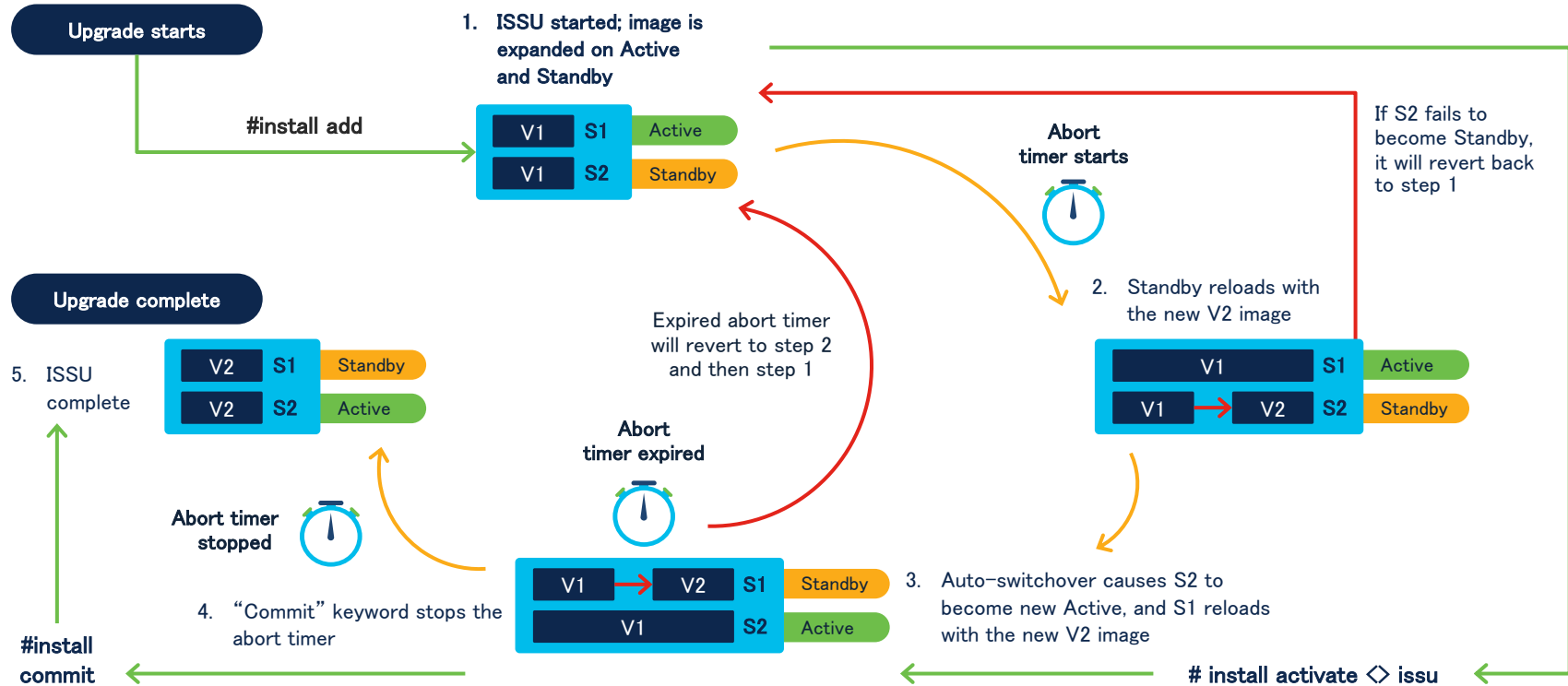
ISSU process

Dual supervisors



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

Cisco Catalyst 9000 family ISSU workflow



Catalyst 9400 Power Supply Redundancy

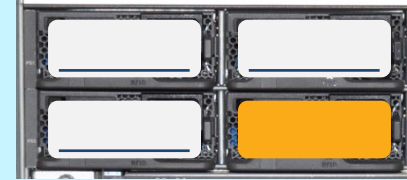
Normal

PS failure

Combined
(default)



Load sharing on all PSs



Load sharing on functional PSs

Redundant



Load sharing on active PSs
Standby PS in output disabled



Standby PS becomes active
System enters alarm state

Failed PS

Active

Standby

Power redundancy: N+1 and N+N

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



- Default active is PS1 through 7, and standby is PS8
- Standby power slot is configurable



```
SW(config)#power redundancy-mode redundant ?  
    N+N  Redundant N+N (N is active, N is standby)  
    N+1  Redundant N+N (N is active, 1 is standby)  
SW(config)#power redundancy-mode redundant N+1 ?  
    <1-8> standby slot in N+N mode  
SWR(config)#
```

```
SW(config)#power redundancy-mode redundant ?  
    N+N  Redundant N+N (N is active, N is standby)  
    N+1  Redundant N+N (N is active, 1 is standby)  
SW(config)#power redundancy-mode redundant N+1 ?  
    <1-8> standby slot in N+1 mode  
SWR(config)#
```

Active

Standby

Catalyst 9400 Series power management

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

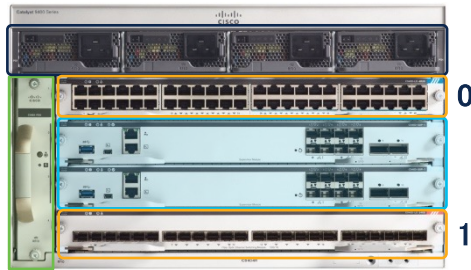
8 priority levels, 0 to 7, with 0 having the highest and 7 the lowest priority

Default priority

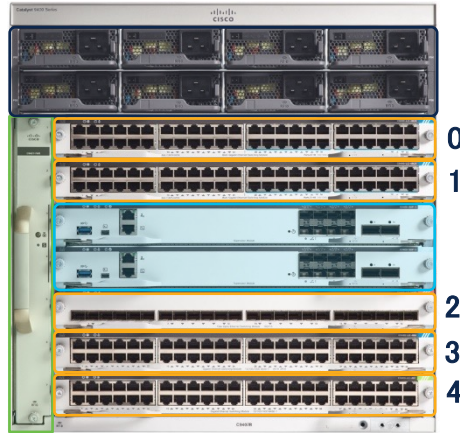
Highest
priority



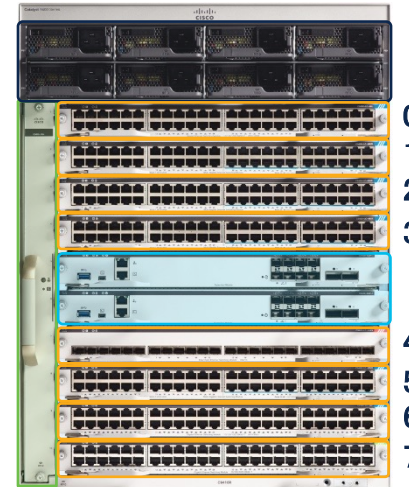
Lowest
priority



4-slot



7-slot



10-slot

Load shed stop
depends on
remaining available
power



Load shed
begins here

Power supplies

Fan tray

Supervisors

Line cards

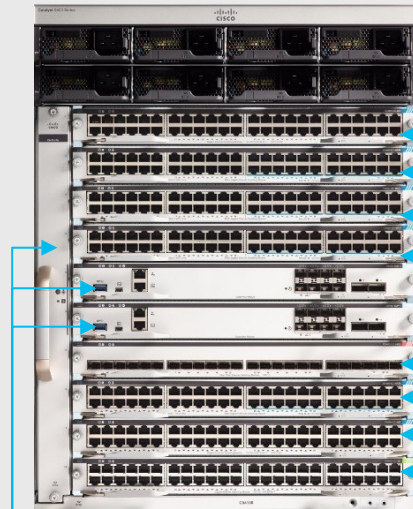
Supervisors and fan tray have the highest priority and will shut down last

Power priority

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

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

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



Highest priority

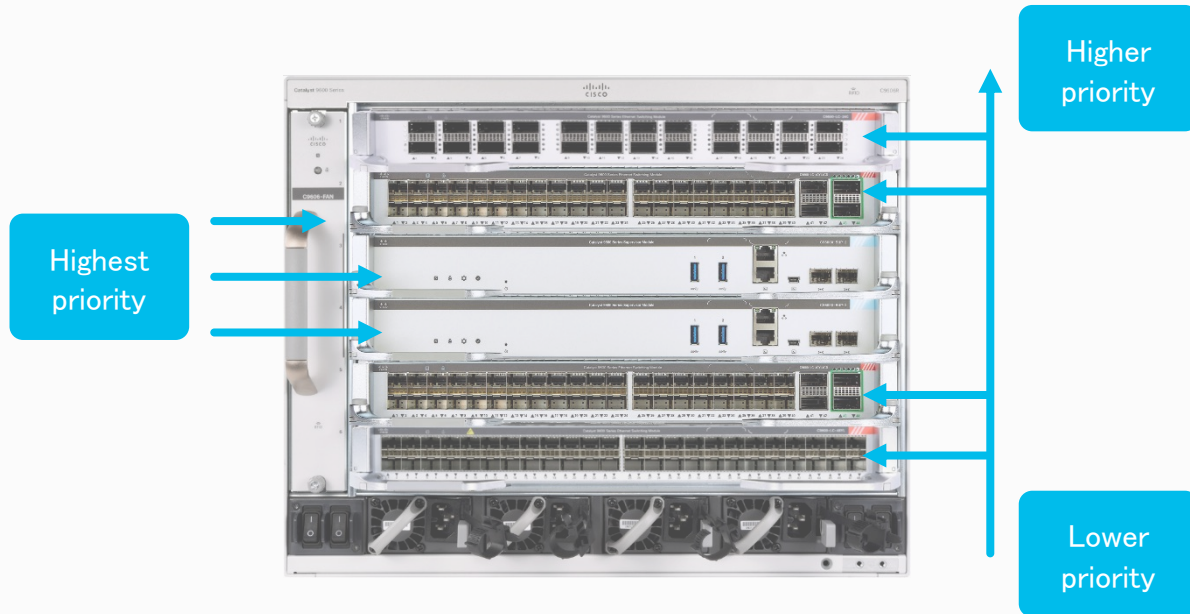
User-configurable priority

Cisco Catalyst 9600 Series

Power supply redundancy

	Normal operation	Power supply failure	AC and DC power supplies
			
Requirement	• AC: No mixing of 110V input and 220V input	• Mix DC and AC: AC input needs to be 220V	
Operation	• Equal load sharing and all active	• Equal load sharing among the remaining power supplies	• Equal load sharing
Power budgeting	• Combined mode: Use all available power supplies for system budgeting • N+1 mode: Use N power supplies for system budgeting	• Combined mode: Line card can shut down if there isn't enough power • N+1 mode: Always enough power with single power supply outage	• Combined mode: Line card can shut down if there isn't enough power • N+1 mode: Always enough power with single power supply outage

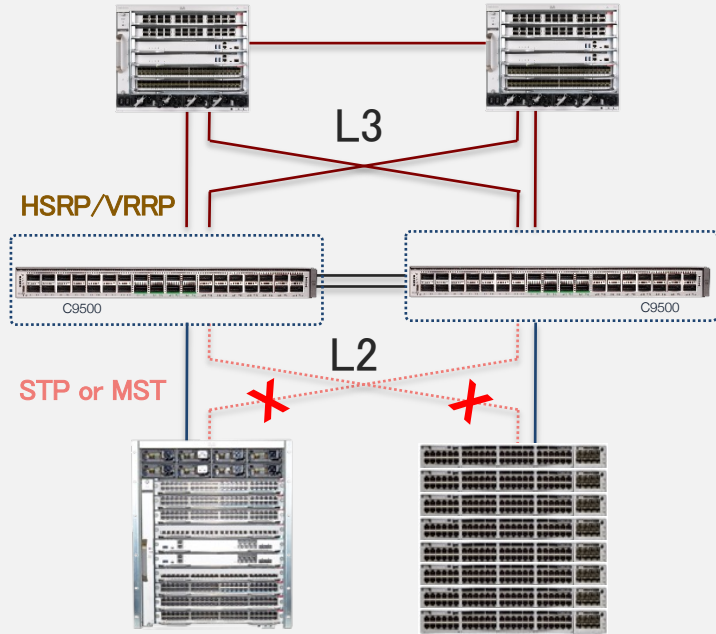
Catalyst 9600 Power priority



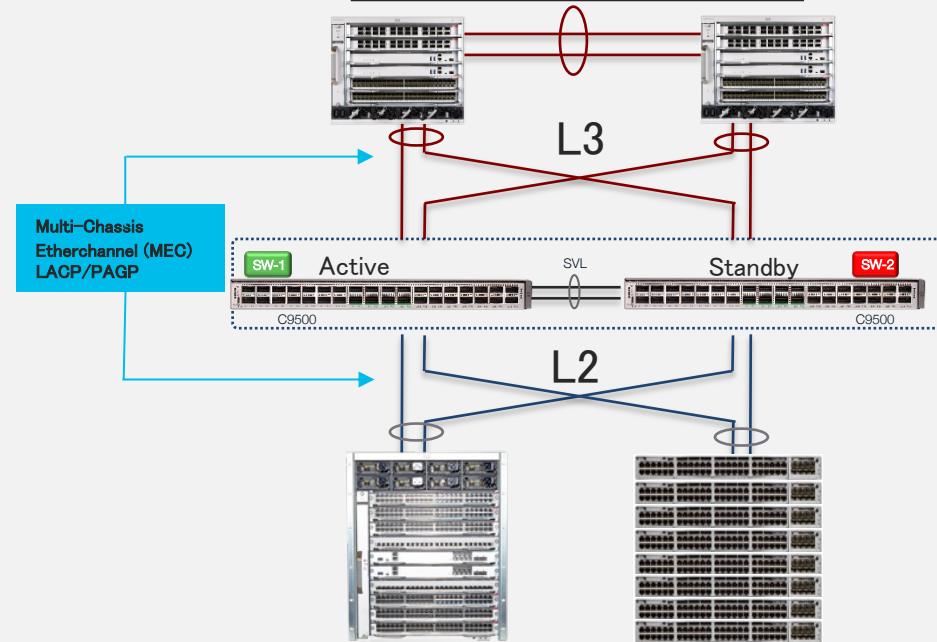
- All components in the system are assigned with a power priority level
- Supervisors and the fan tray have the same highest priority level
- Line cards with lower slot numbers have the higher power priority level by default
- User-configurable power priority for line card slots is on the roadmap

Campus Design Resiliency with StackWise Virtual

Traditional Design with FHRP with STP

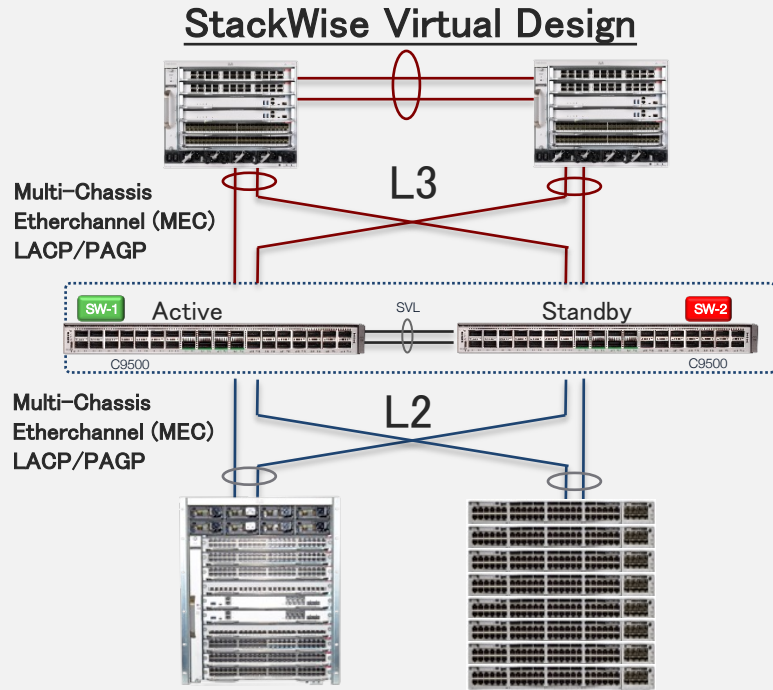


StackWise Virtual Design



- Simplify Operations by Eliminating STP, FHRP and Multiple Touch-Points
- Double Bandwidth & Reduce Latency with Active-Active Multi-chassis EtherChannel (MEC)
- Minimizes Convergence with Sub-second Stateful and Graceful Recovery (SSO/NSF)

StackWise Virtual Platform Support

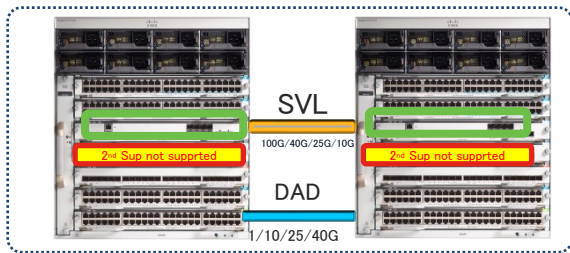


	SW-1	SW-2
Model	9400/9500/9600	9400/9500/9600
Software Version	Check Config Guides	Check Config Guides
Software License	Network Advantage	Network Advantage
Inter-Chassis Link	400/100/40/25/10G	400/100/40/25/10G
Max Inter-Chassis Link	8	8
Dual-Active Detection Link	4	4

- Sub-Second Traffic Convergence with Centralized Control Plane
- Traffic Load-Balancing with Active-Active Multi-Chassis EtherChannel and Distributed Forwarding Architecture

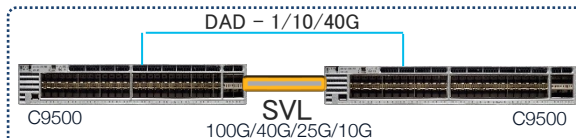
StackWise Virtual – Platform Requirements

Catalyst 9400– All Chassis models



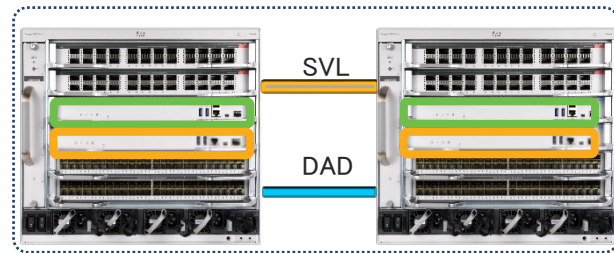
- SVL on Sup1/1XL/1XL-Y supported from 16.9.X and 16.11 onwards. Sup2/2XL supported from 17.9.1 Release
- SVL Configuration is supported on both Supervisors and Fiber Line Cards (> 10G)
- Quad SUP RPR is not supported

Catalyst 9500– All Models



- SVL is supported on all C9500/Uplink modules and C9500H models
- SVL Configuration is supported on 10G and higher speeds.
- C9500X will be supported from 17.10.1 Release

Catalyst 9600



- SVL is supported on C9600 with Sup1 from 16.12.1 Release. Sup2 will be supported from 17.10.1 Release
- Quad SUP RPR is supported only with SUP1

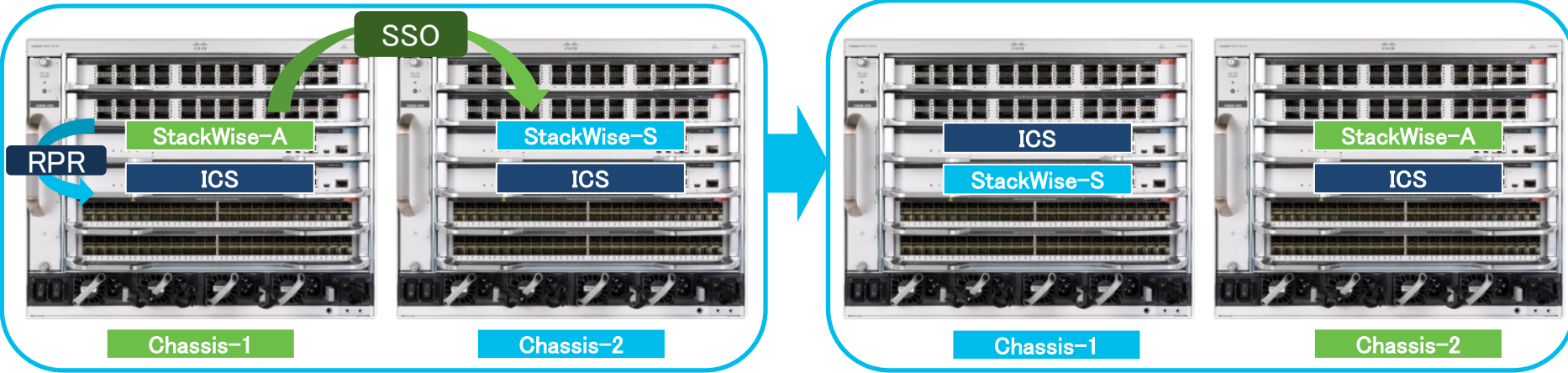
Note: SVL requires Network Advantage License

Catalyst 9600 StackWise Virtual

Quad SUP RPR



IOSXE 17.2.1*



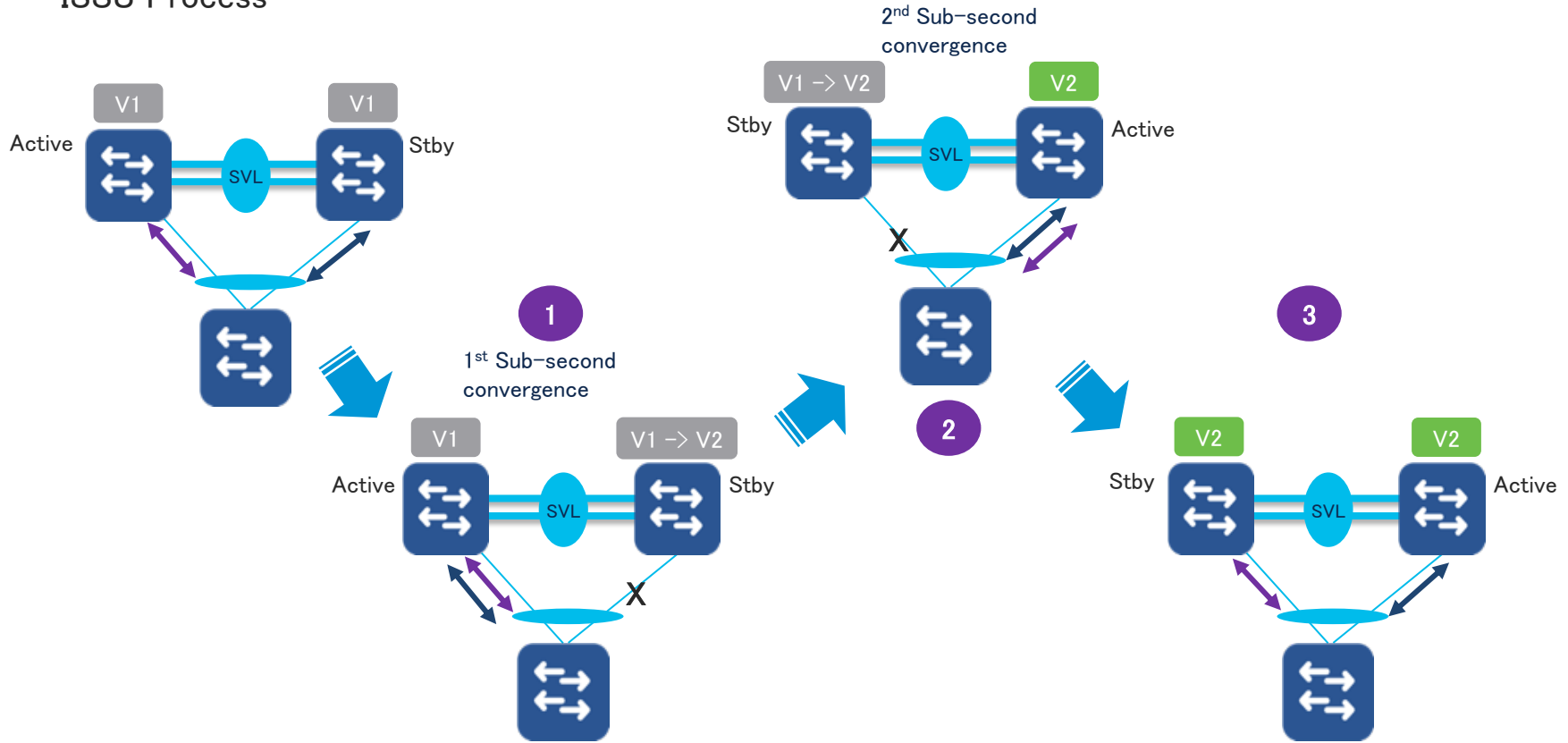
- Active supervisor in chassis-2 become StackWise Active
- Warm standby supervisor in chassis-1 continue the boot process
- Become StackWise standby while the line cards in chassis-1 reset

RPR: Route Processor Redundancy
SSO: Stateful Switchover
StackWise-A: StackWise Virtual Active
StackWise-S: StackWise Virtual Standby
ICS: In-chassis Warm Standby

*Dual sup SVL was supported starting 16.10.1 onwards

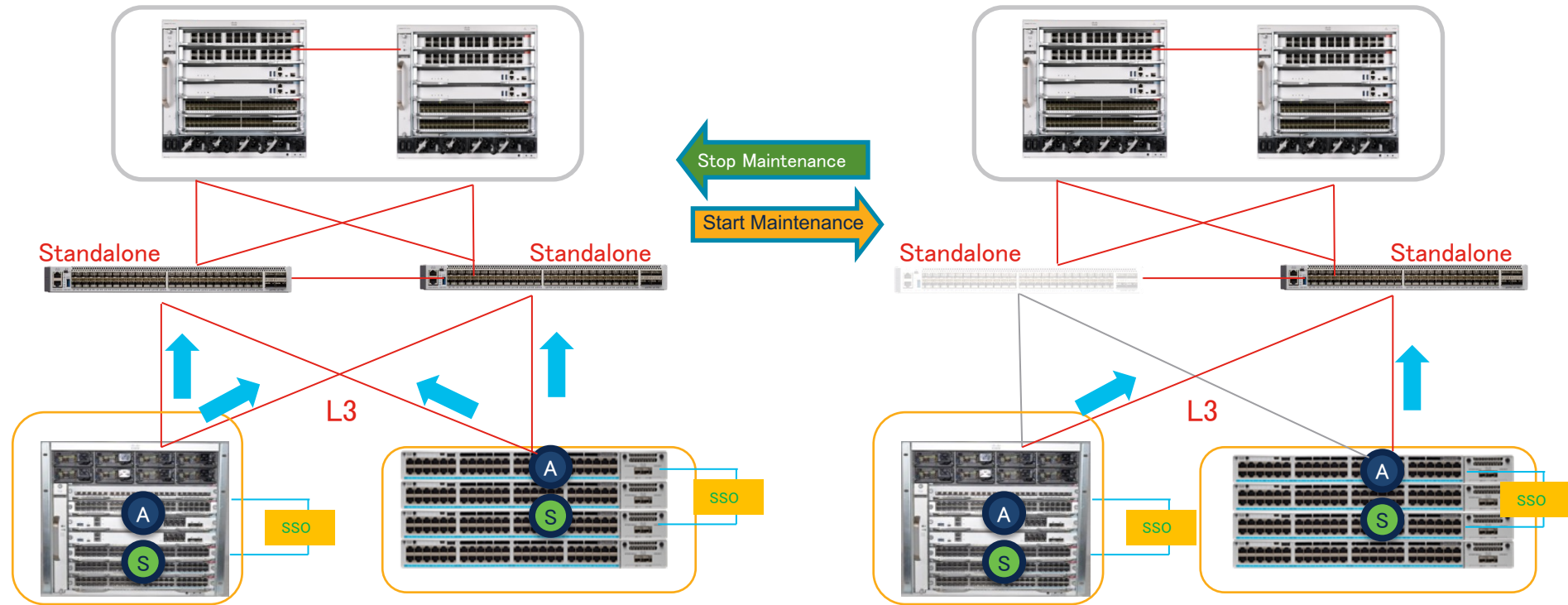
Stackwise Virtual ISSU

ISSU Process

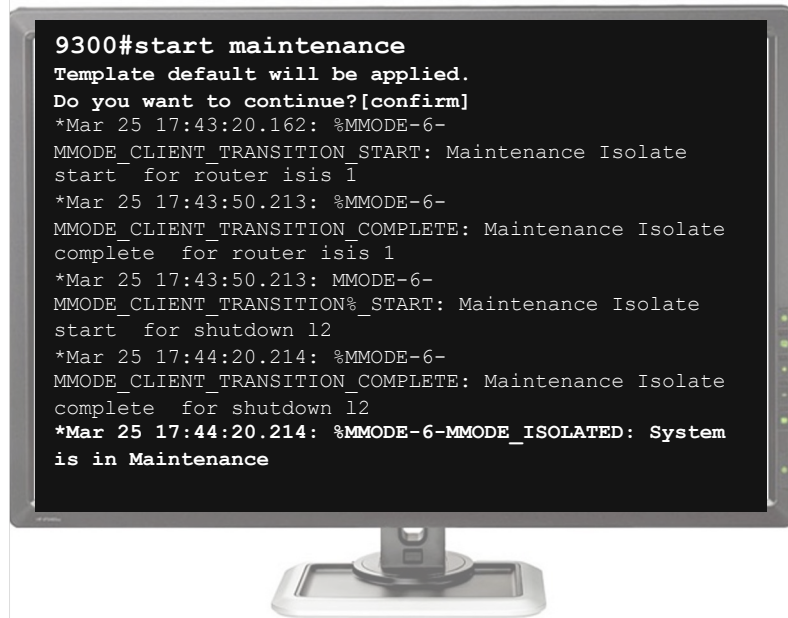


Graceful Insertion and Removal (GIR)

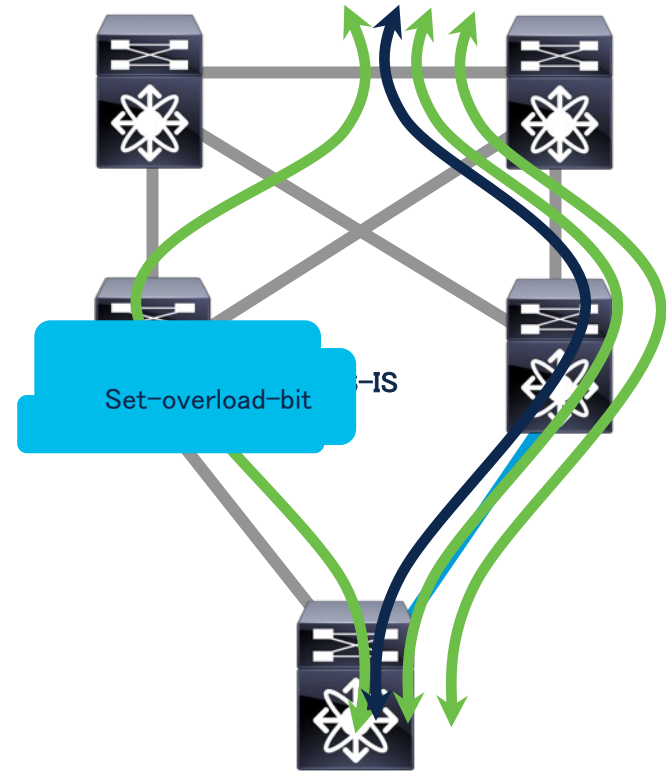
Routed Access Multi-Tier Architecture



Layer 2 and 3 Topology with GIR Maintenance



Order for maintenance:
EGP → IGP in parallel (ISIS) → L2



Ready for Software Patching

SMU is an emergency point fix positioned for expedited delivery to a customer in case of a network down or revenue affecting scenario.

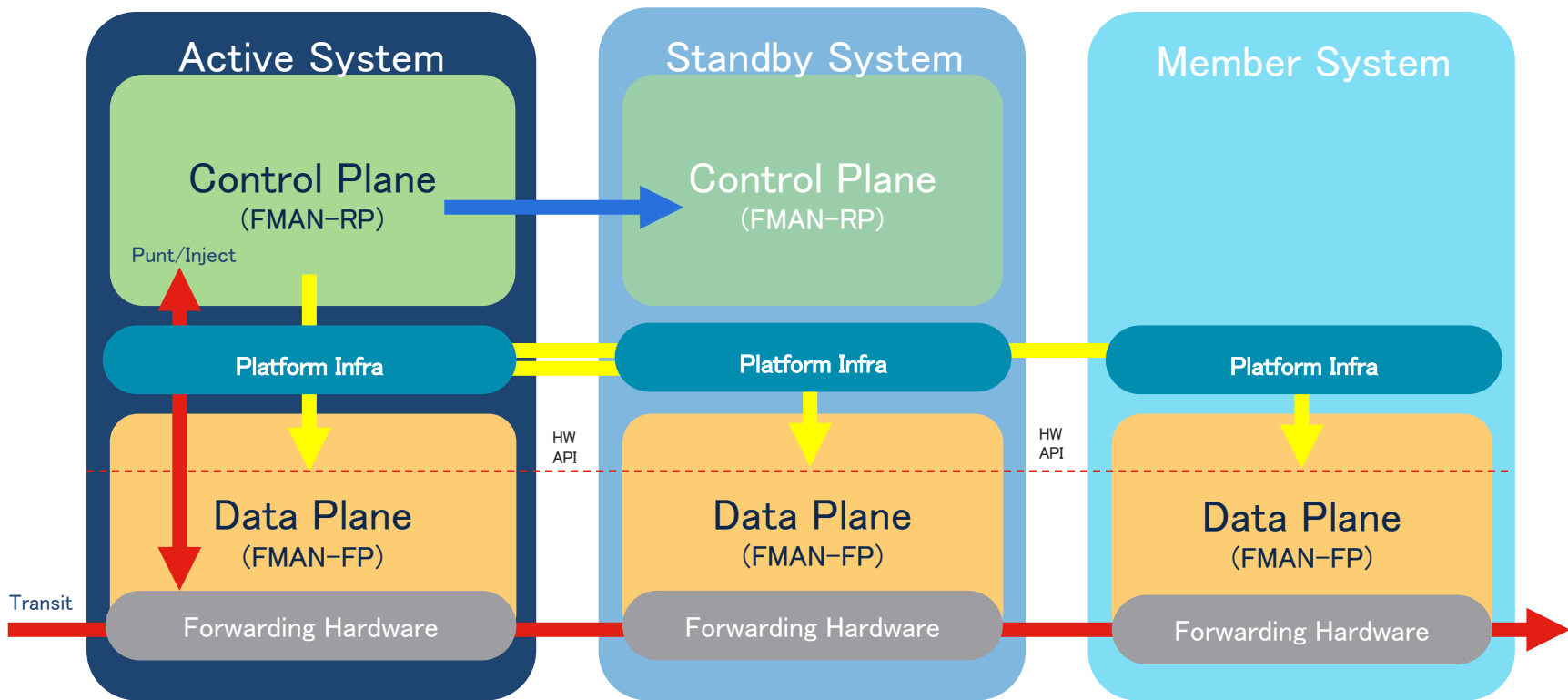
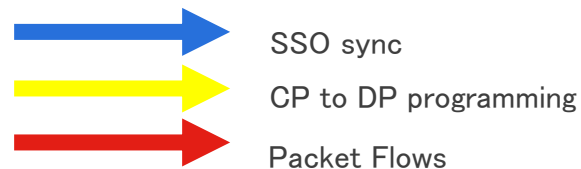
Cold Patching: Install of a SMU will require a system reload in the first release. It is traffic impacting.

Hot Patching: Install of a SMU does not require a reload.



Cisco IOS XE High Availability

Control Plane to Data Plane Programming



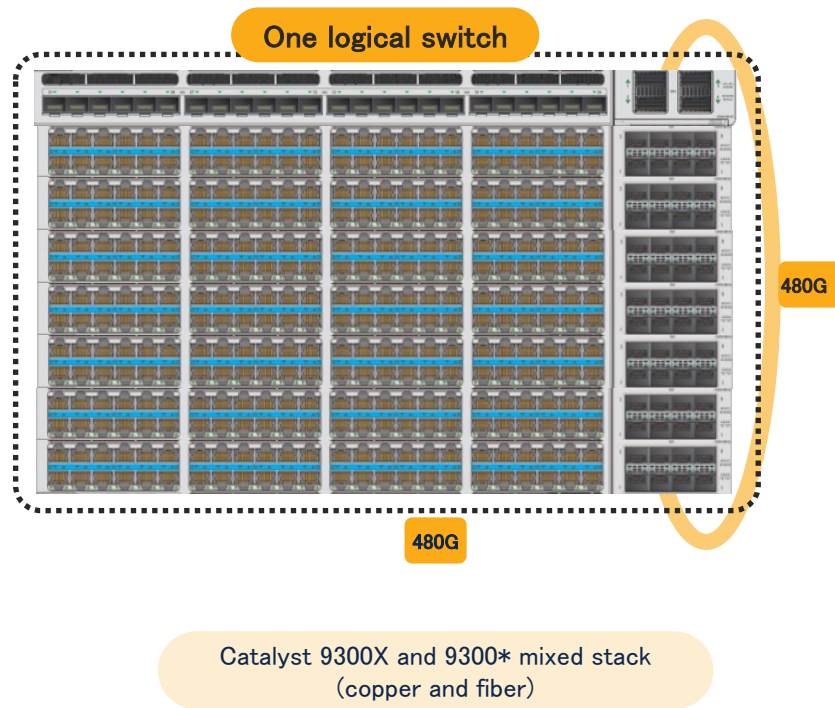
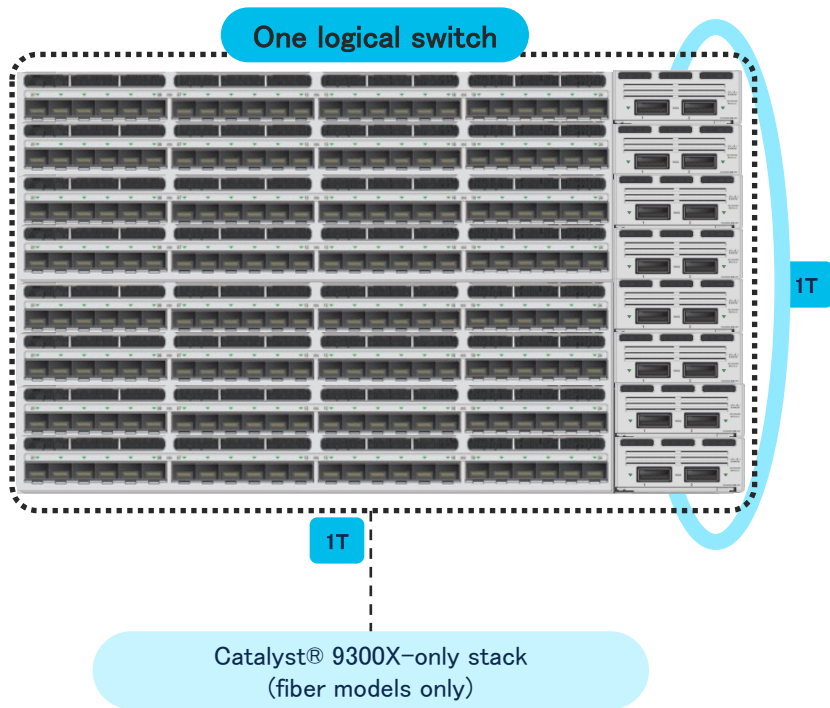
High Availability

StackWise- 1T/480/320



Stack Bandwidth:

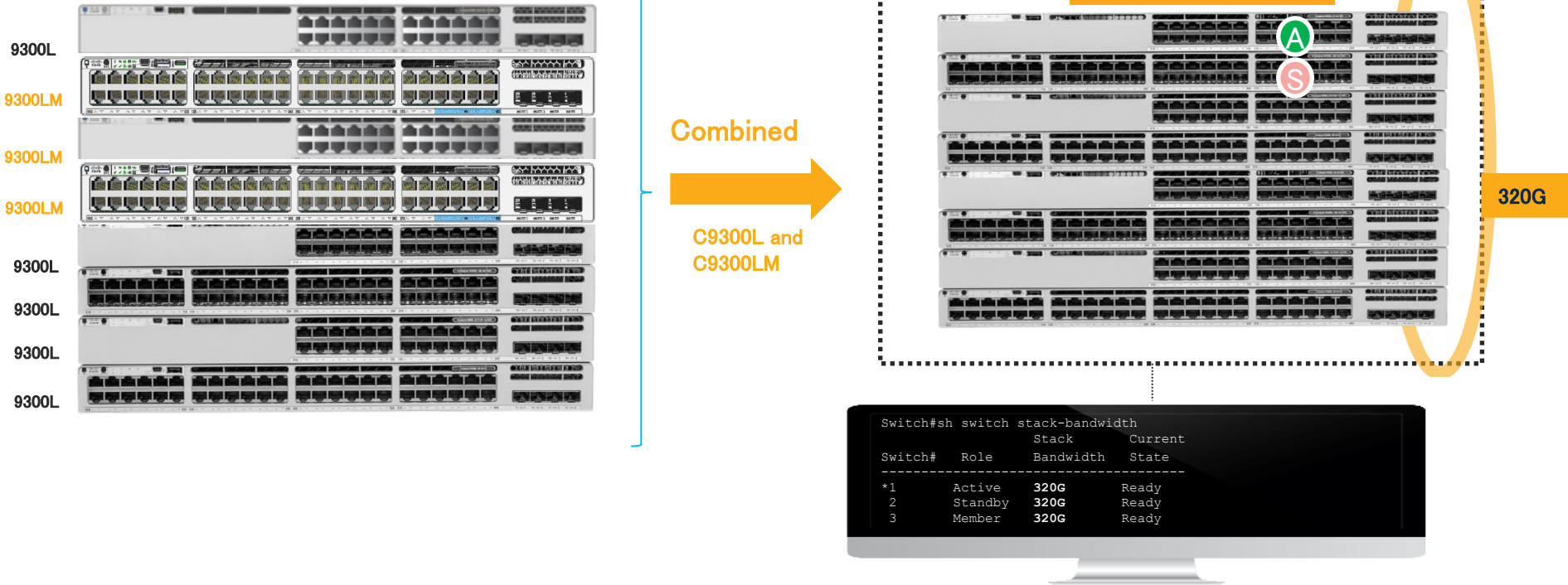
Catalyst 9300X and 9300 mixed stack



* Catalyst 9300B and 9300L models are not supported in mixed stack.

Stack Bandwidth:

Catalyst 9300L and 9300LM mixed stack





Catalyst 9000 Series

Quality of Service

QoS Features in Catalyst 9000



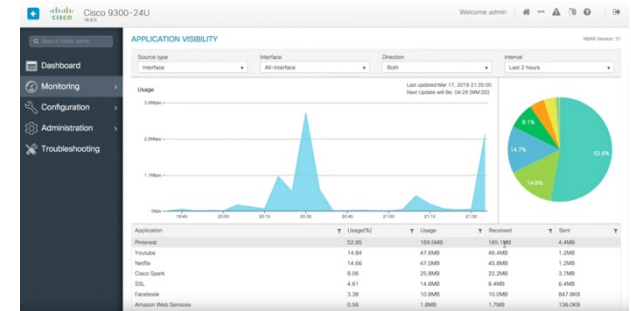
QoS Features

- Trust/Conditional Trust
- Classify Traffic
- Police Traffic
- Remark/Conditional Remark



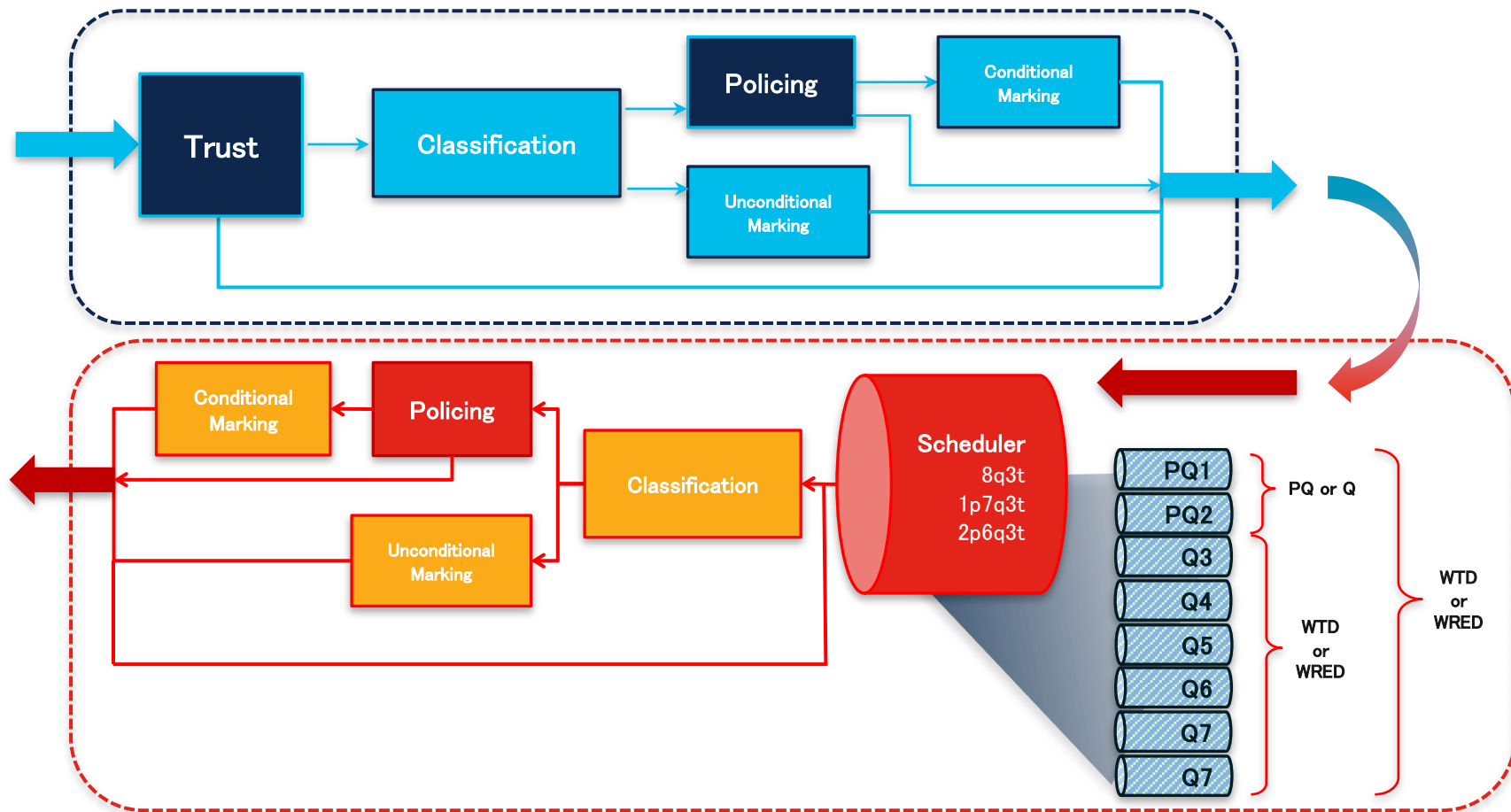
Queuing Features

- Prioritize strict traffic (PQ)
- Schedule traffic based on weight (WRR)
- Shape the traffic rate (SRR)
- Manage Congestion (WRED/WTB)
- Dynamic or hybrid buffering*

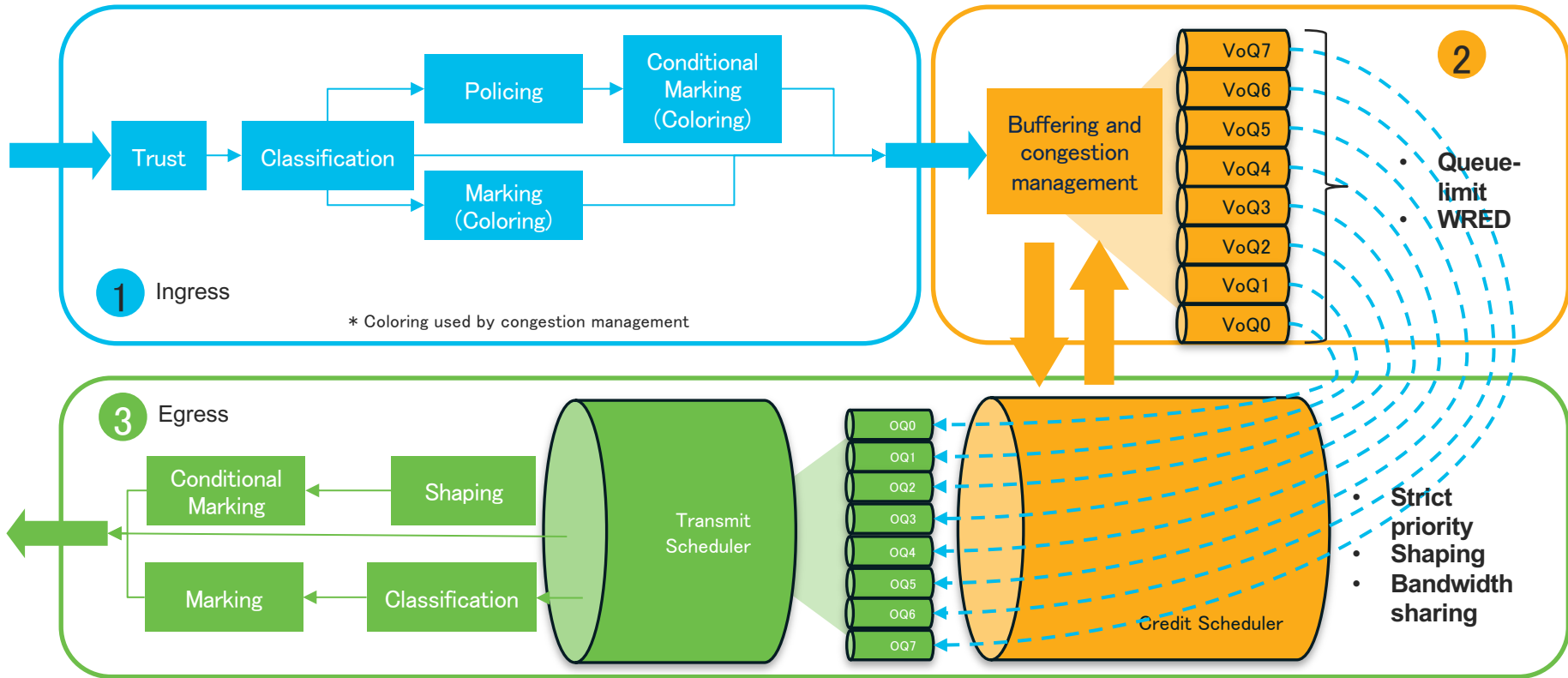


* Based on the ASIC

UADP Catalyst 9000 QoS



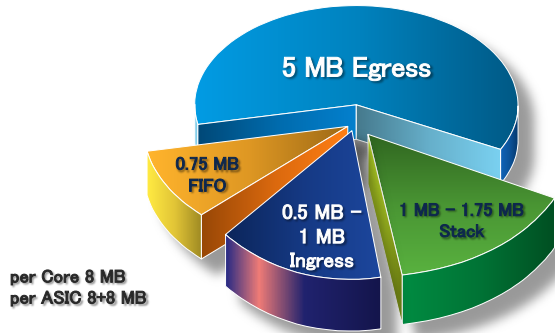
Silicon One Catalyst 9000 QoS



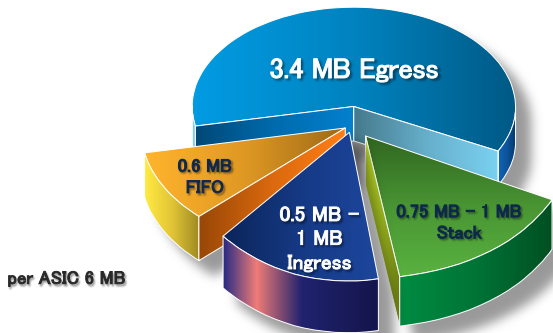
UADP Catalyst 9000 QoS

Buffer Size Comparison

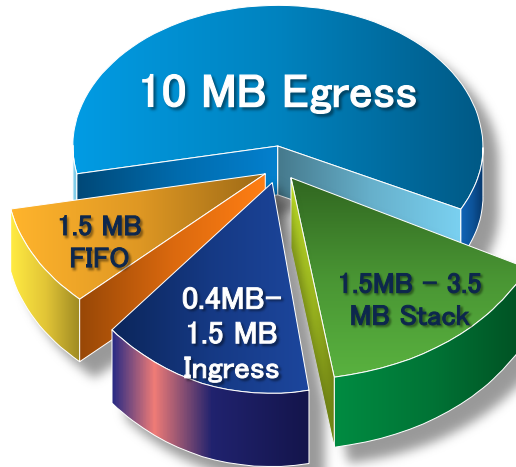
UADP2.0



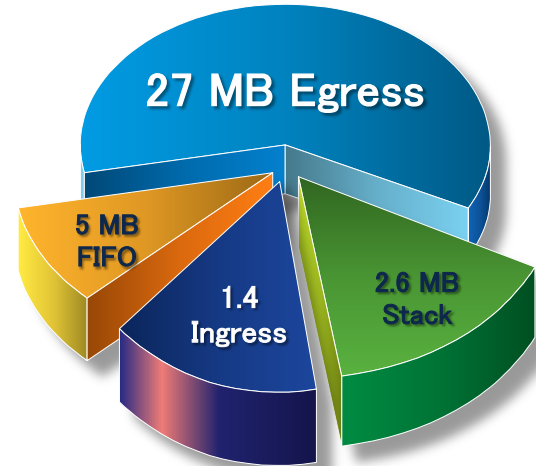
UADP2.0 Mini



UADP2.0XL



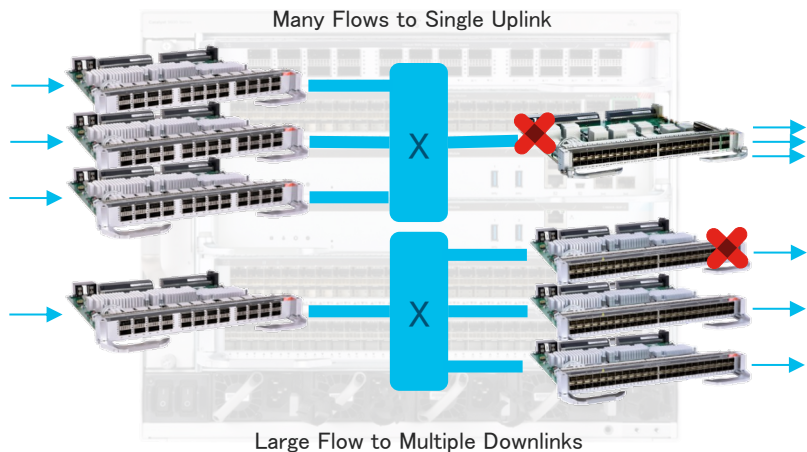
UADP3.0



Silicon One Catalyst VoQ and Buffering



No Head-of-Line Blocking



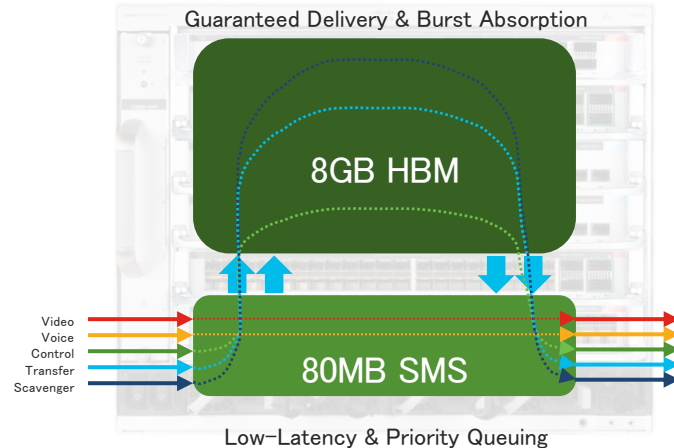
Many Flows to a Single Uplink

- Common on (expensive) WAN/Edge uplinks
- Even if bandwidth available, buffers can fill up

Large Flow to Multiple Downlinks

- Common for Multicast & Broadcast traffic
- One slow receiver can penalize other ports

Local vs. HBM Buffers



Low-Latency Local Shared Memory Buffers

- Voice & Video are very latency-sensitive
- Multiple levels of Strict Priority Queuing

Deep High-Bandwidth Memory Buffers

- Guarantee delivery of session-oriented flows
- Reserve buffers to absorb occasional bursts

Silicon One vs UADP QoS – 1/2

Features	UADP ASIC	Silicon One ASIC (Q200)
Trust	Trust all ports by default	Trust all ports by default
Classification	Based on Packet header and ACL for both ingress and egress	Based on packet header and ACL for ingress Based on packet header for egress
Marking	Header, Table-map, QoS-Group for ingress Header and table-map for egress	Header, Table-map, QoS-group, traffic-class , discard-class for ingress Header and table-map for egress
Policing	Both ingress and egress	Ingress only

Silicon One vs UADP QoS – 2/2

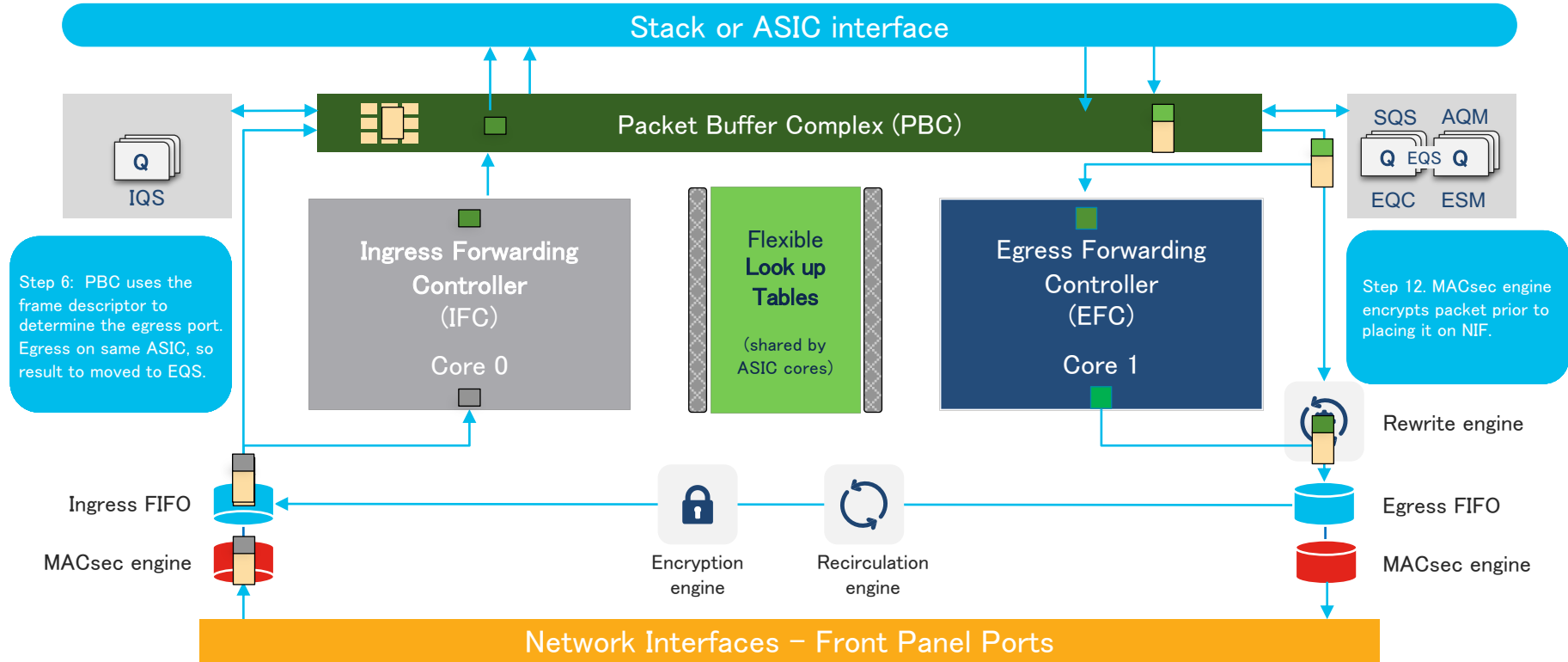
Features	UADP ASIC	Silicon One ASIC (Q200)
Queueing	Based on header or QoS group Bandwidth and Bandwidth remaining	Based on traffic-class Bandwidth remaining
Buffering	Dedicated and shared buffer with DTS	SMS: Low-latency & priority queueing HBM: Guaranteed Delivery & Burst Absorption
Shaping	Egress	Egress
Congestion Management	WTD: three thresholds per class WRED: three thresholds' pairs per class	WTD: two threshold per class WRED: two thresholds' pairs per class

Catalyst 9000 Series

QoS & Packet Walks

Cisco UADP – Packet Walks

Generic Unicast Packet Walk – Same ASIC

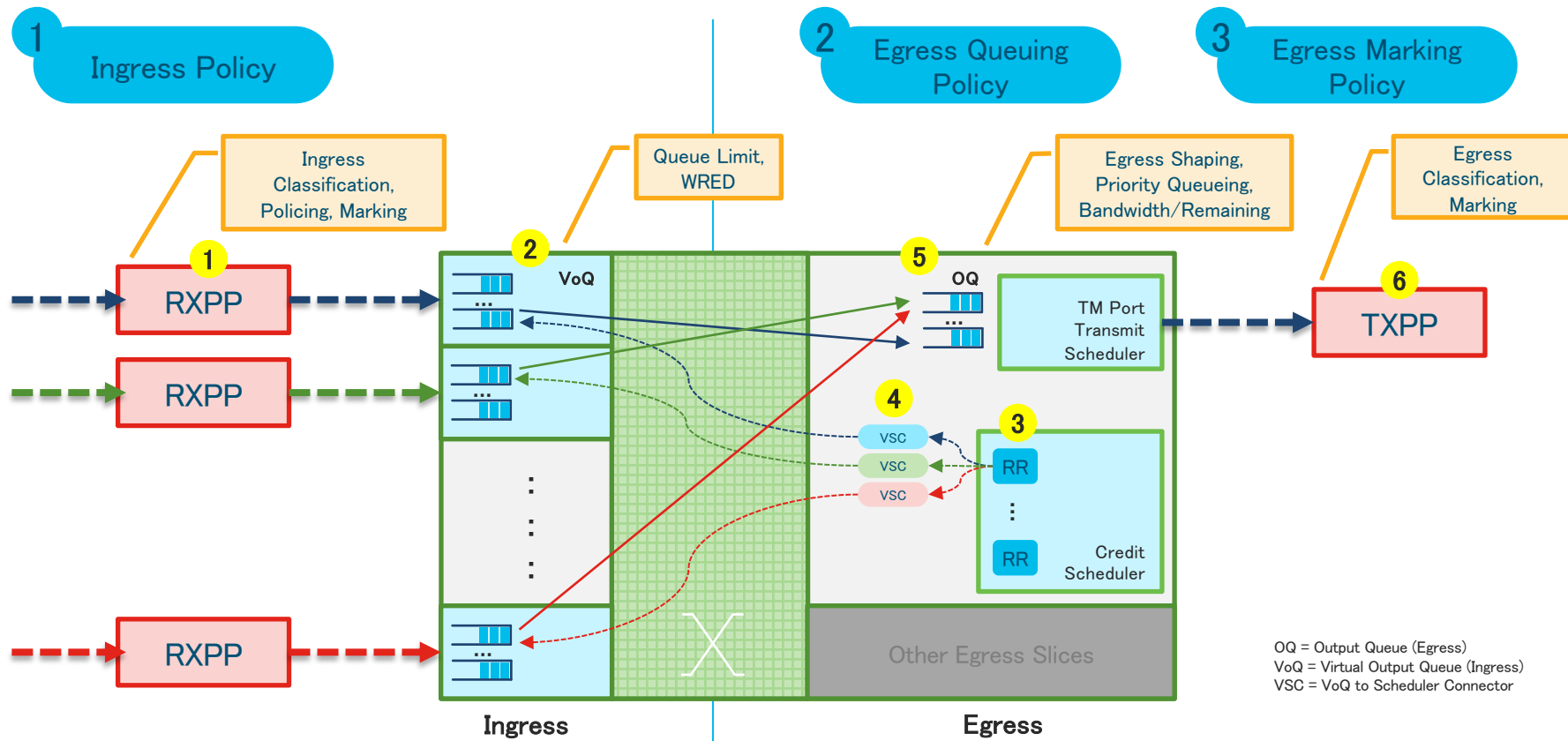


Generic Unicast Packet Walk



Cisco S1 Q200 – Packet Walks

QoS Queuing and Policy Enforcement Points





Catalyst 9000 Series

Multicast

Catalyst 9000 Series

Multicast Highlights

IPv4 multicast

- PIM-SM, SSM, and Bidir
- AutoRP, BSR RP, MSDP
- MVPN, Multicast VRF-Lite
- Multicast load splitting
- IPv4 multicast HA

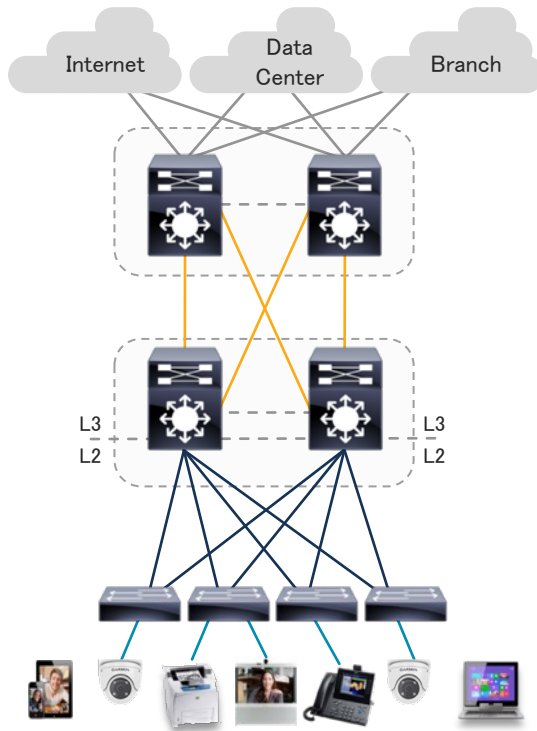
Core

- Dual-stack IPv4 / IPv6
- PIM-SM, SSM and Bidir
- IGMPv2,v3 snooping
- Stub multicast routing
- PIM BFD
- IPv4 multicast HA

Distribution

- IGMP v1,v2,v3 snooping
- IPv4 multicast QoS & ACL
- IGMP v1,v2 filtering

Access



IPv6 multicast

- PIM-SM and SSM
- IPv6 BSR RP
- IPv6 embedded RP
- IPv6 multicast HA

Core

- Dual-stack IPv4 / IPv6
- PIM-SM and SSM
- MLDv1,v2 snooping
- HW register and RPF
- HSRP-aware PIM
- IPv6 multicast HA

Distribution

- MLD v1,v2 snooping
- IPv6 multicast QoS & ACL
- MLD v1,v2 filtering

Access

Catalyst 9000 Multicast

Multicast Highlights



Performance

- High L2 and L3 multicast throughput
- Low latency (average ~5us for IMIX)



Flexible Scalability

- Different SDM templates allow reallocating Multicast routes & IGMP snooping groups



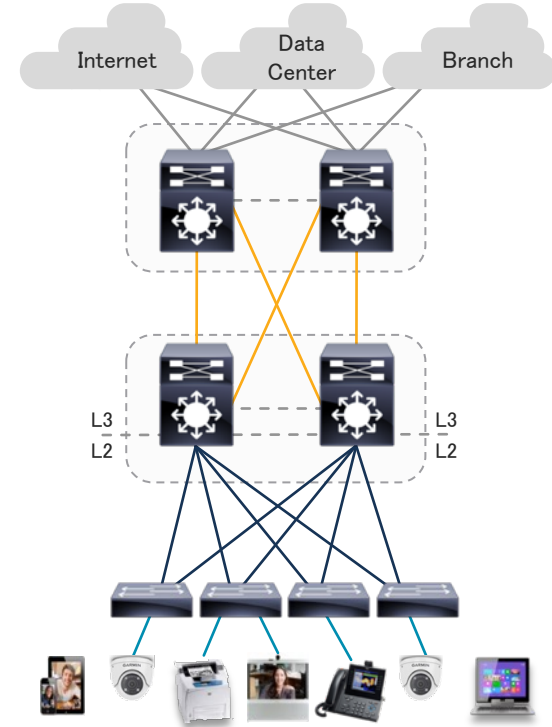
Optimized Replication

- Replications are done at the egress stage
- Single copy in buffer memory, during replication



Enhanced Features

- IP-Based forwarding for IGMP snooping
- IGMPv3 snooping explicit host tracking

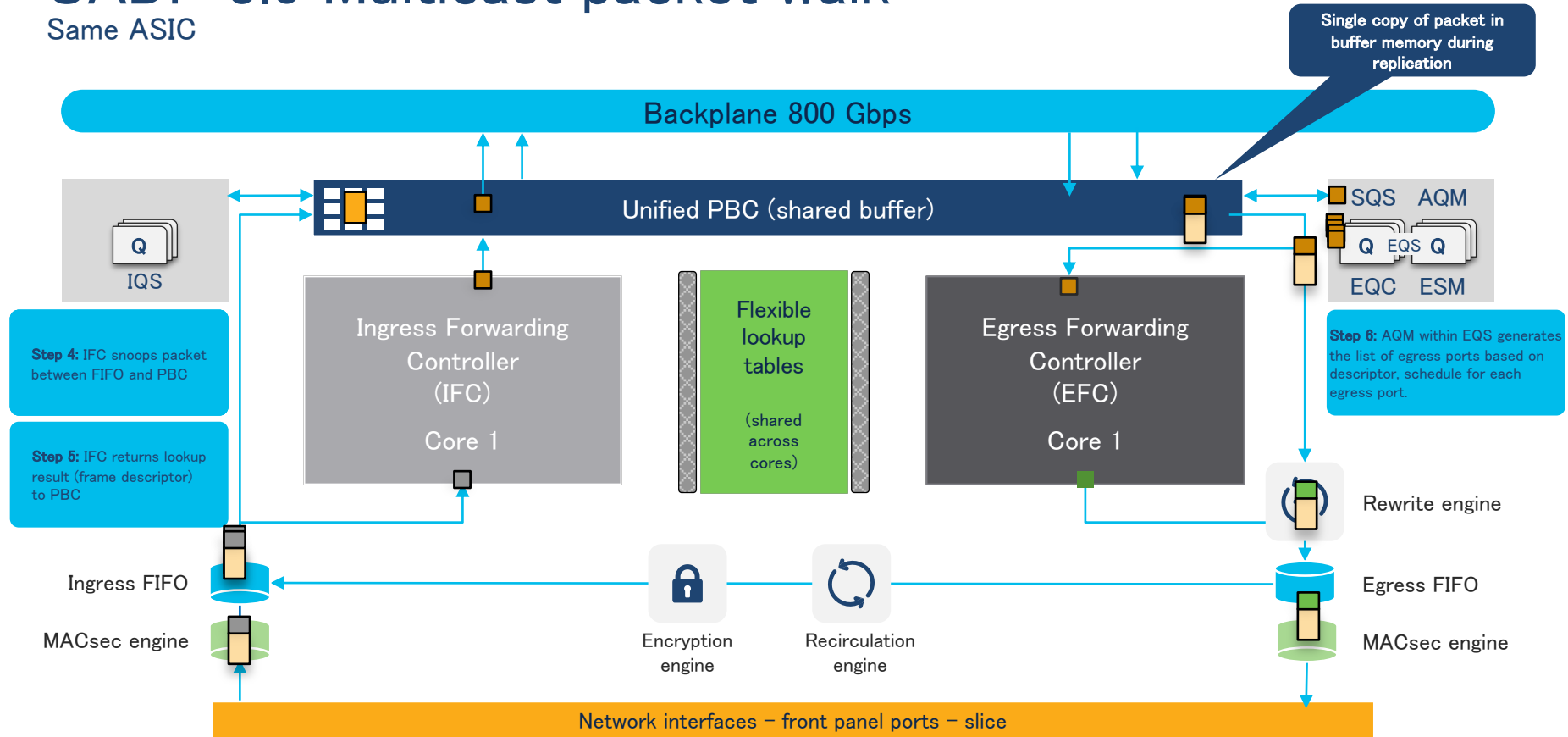


Catalyst 9000 Series

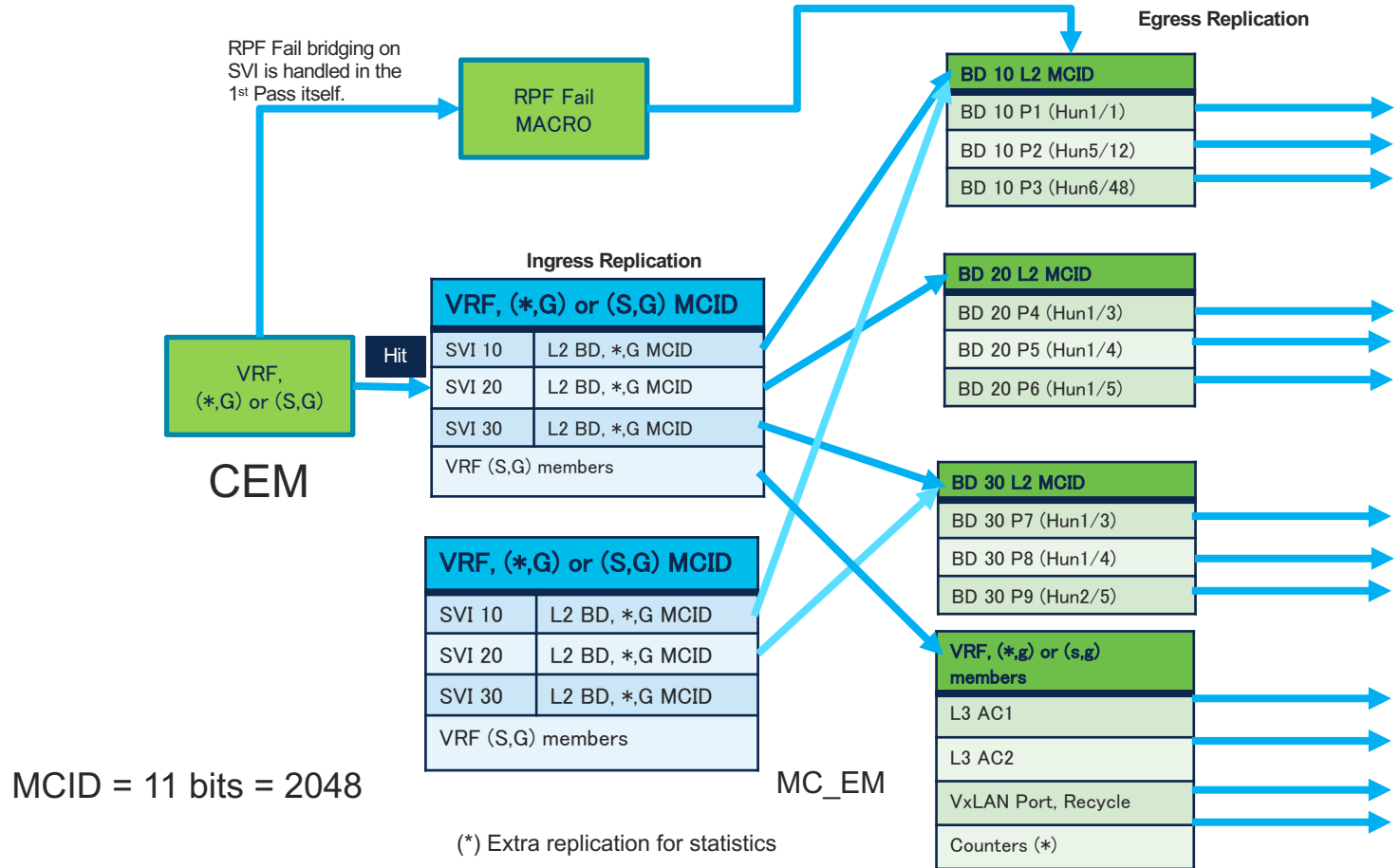
Multicast Packet Walks

UADP 3.0 Multicast packet walk

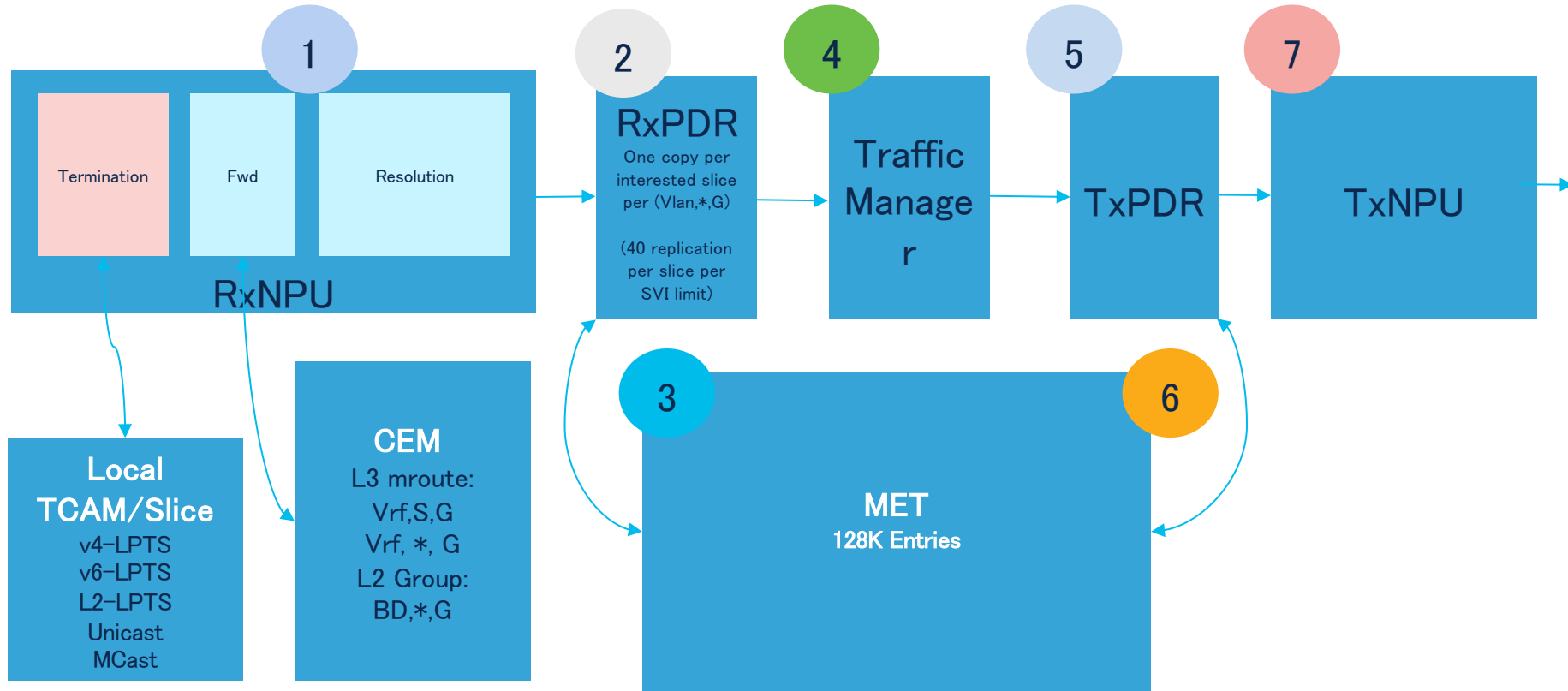
Same ASIC



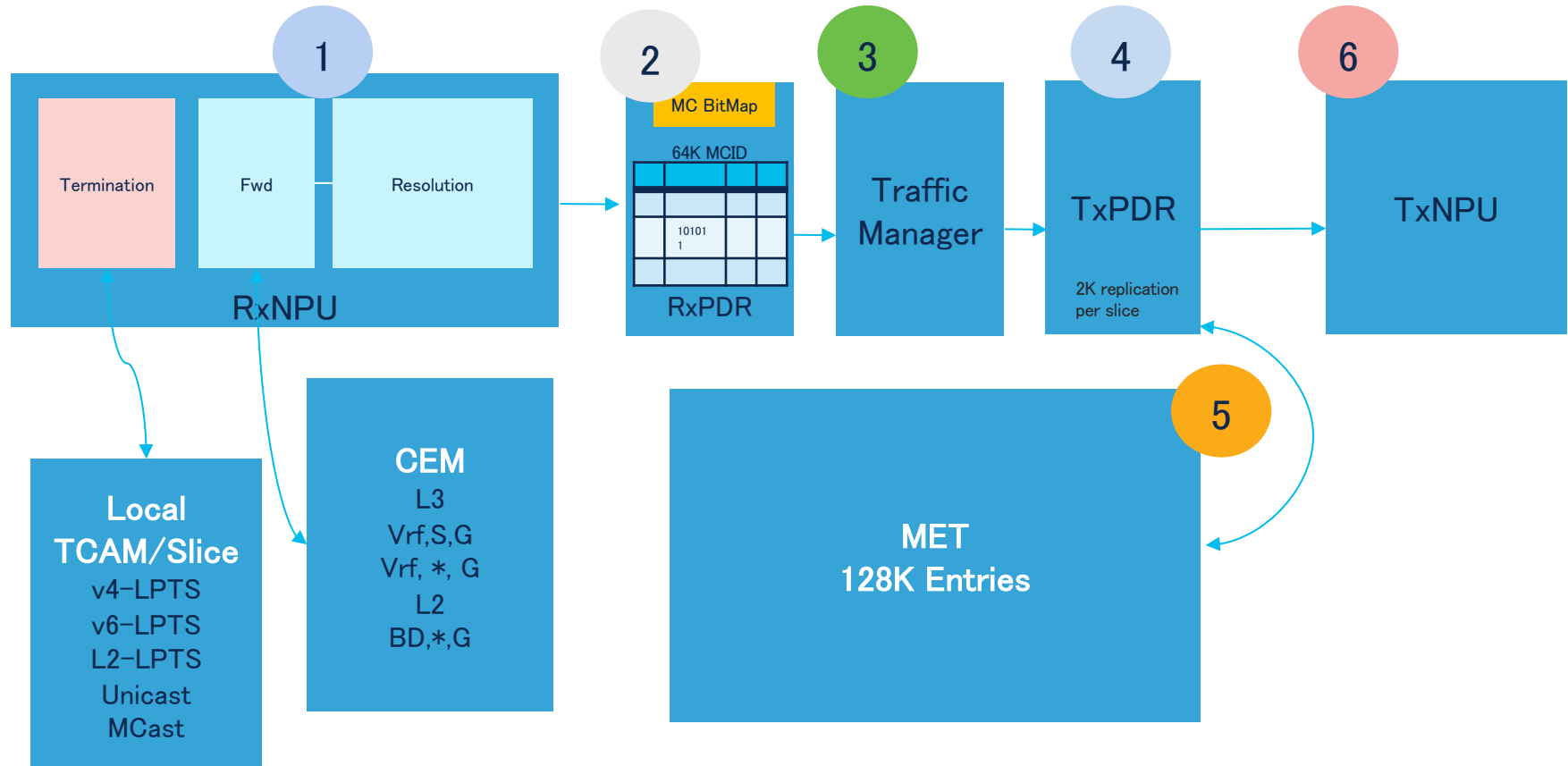
S1 Q200 – Multicast Replication Mode



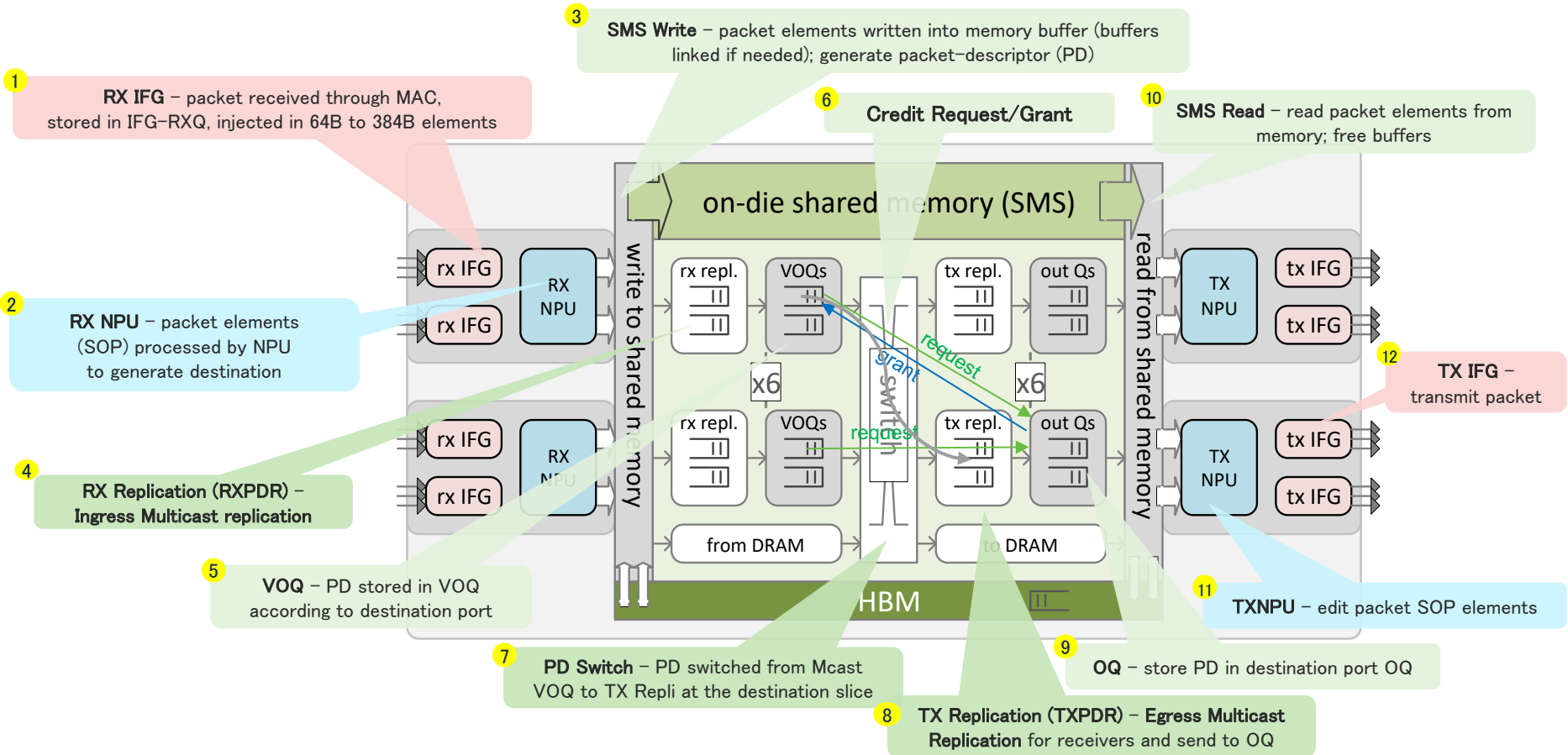
Ingress + Egress Replication– L3 SVI + L2 Ports



Egress Replication- L3 Routed & L2 Bridged



S1 Q200 – Multicast Packet Walk



Multicast Scales

Catalyst 9200/9300 – Multicast Scale



Feature/Product	Catalyst 9200	Catalyst 9300L/LM	Catalyst 9300	Catalyst 9300B	Catalyst 9300X
PIM Neighbors	500	250	500	500	500
IPv4 mroutes	1k	8k	8k	16k	8k
IPv6 mroutes	512	4k	4k	8k	4k
IGMP Groups	1k	8k	8k	16k	8k
MLD Groups	512	4k	4k	4k	4k
OIFs per group	250	NA	NA	NA	NA

*The numbers are with the default template when multiple templates are supported.

Catalyst 9400/9500/9600 – Multicast Scale

Feature/Product	Catalyst 9400	 Catalyst 9400X	Catalyst 9500 UADP2	Catalyst 9500 UADP3	Catalyst 9600 UADP3	 Catalyst 9500X Q200	 Catalyst 9600X Q200
PIM Neighbors	500	500	500	500	500	1k	1k
IPv4 mroutes	16k	16k	16K	32K	32K	32K	32K
IPv6 mroutes	8k	16k	8K	32K	32K	16K	16K
IGMP Groups	16k	16k	16K	16K	16K	16K	16K
MLD Groups	8k	16k	8K	16K	16K	8K	8K
OIFs per group	500	500	250	250	250	250	250

*The numbers are with the default template when multiple templates are supported.



Catalyst 9000 Series

Security

Catalyst 9000 Security

Platform Trustworthy Solutions

Design/
Develop

Plan/
Order

Source

Make

Quality

Delivery

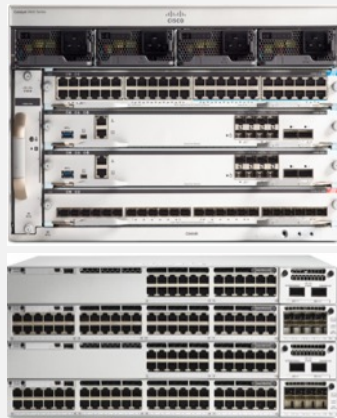
Service/End
of Life (EOL)

Physical security practices + security technology innovations + logical security processes

PnP SUDI support
Two-way trust

Image signing
Authentic OS

**Hardware
authenticity**
Genuine hardware



Secure boot
Boot sequence
check

**Integrity
verification**
Malware protection

Runtime defenses
64-bit ASLR

Cisco® trustworthy systems use industry best practices to help ensure full development lifecycle integrity and end-to-end security

Cisco Catalyst 9000 Security

Four types of Security ACLs

Router ACL (RACL)

Used to permit or deny the movement of traffic between Layer 3 subnets

Applied as an input or output policy to a **Layer 3 interface, SVI, or Layer 3 EtherChannel interface**

Standard/extended ACLs

VLAN ACL (VACL)

Used to permit or deny the movement of traffic between Layer 3 subnets and VLANs or **within a VLAN**

Applied as a policy to a VLAN; is inherently applied to **both inbound and outbound traffic**

Standard/extended ACLs

Port ACL (PACL)

Used to permit or deny the movement of traffic between Layer 3 subnets and VLANs or **within a VLAN**

Applied as a policy to a **Layer 2 switch port interface or EtherChannel interface**; is applied to **inbound traffic only**

Standard/extended/
MAC ACLs

Security group ACL (SG ACL)

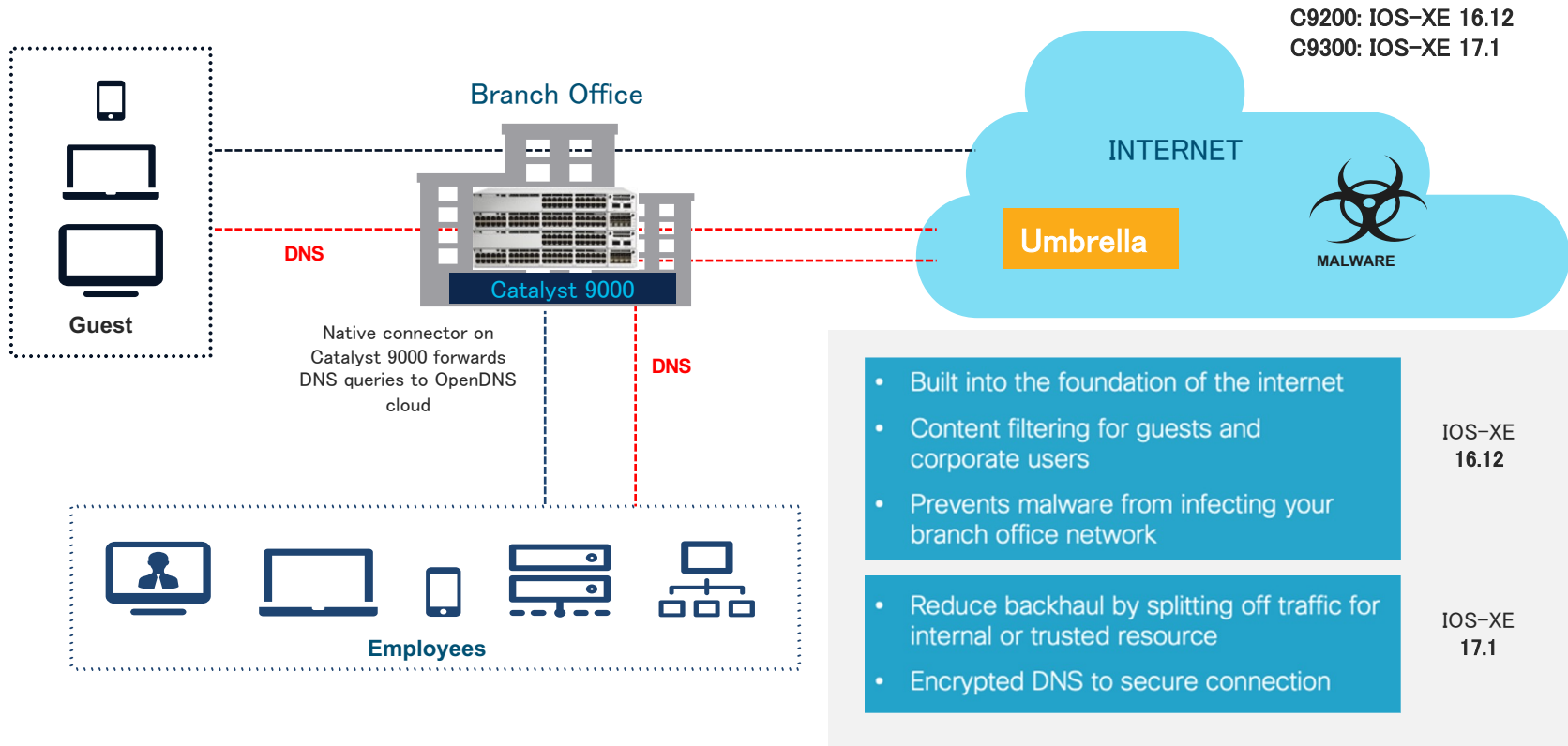
Used to permit or deny the movement of traffic based on the SGTs that are assigned

Applied as a policy to a Layer 2 switch port interface; is applied to **inbound traffic only**

Standard/extended/
MAC ACLs

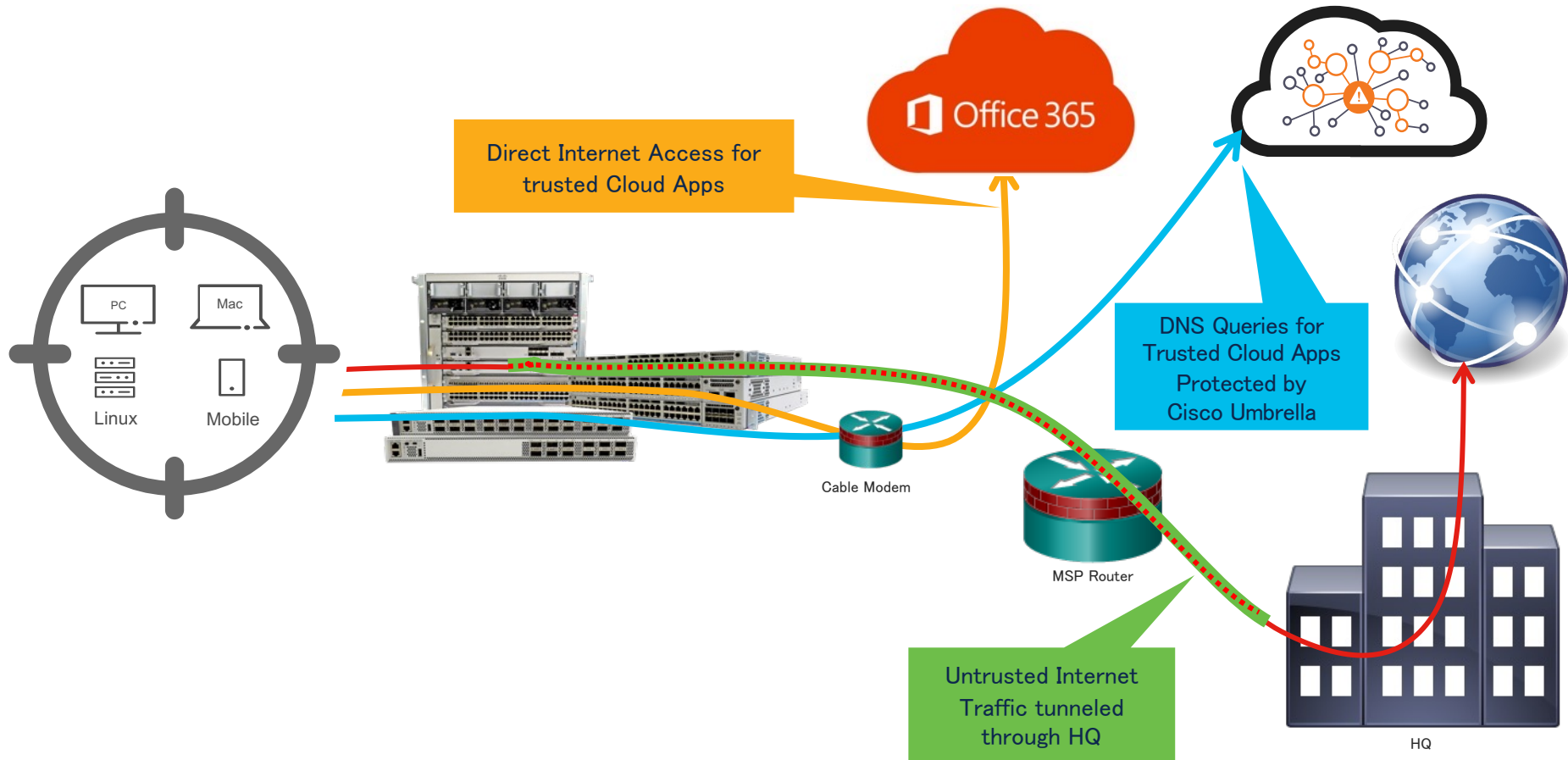
Cisco Umbrella Native Connector

Available on Catalyst 9000 Series Switches



* Requires a Cisco Umbrella™ license

Direct Cloud Access to optimize bandwidth



Cisco Secure Cloud Analytics (Formerly Stealthwatch Cloud)

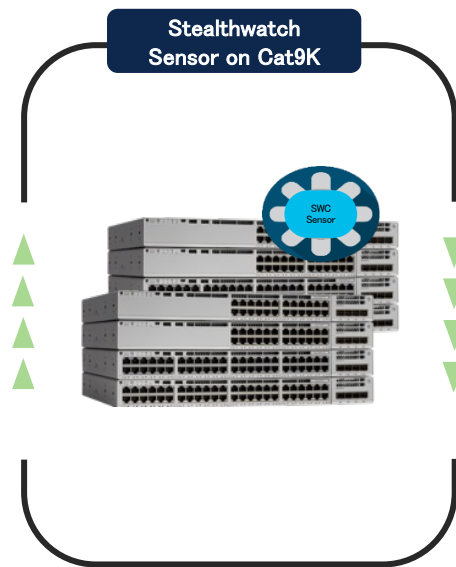
Cloud Sensor on Cat9K

No need for additional probes in network. Inbuilt FNF collector

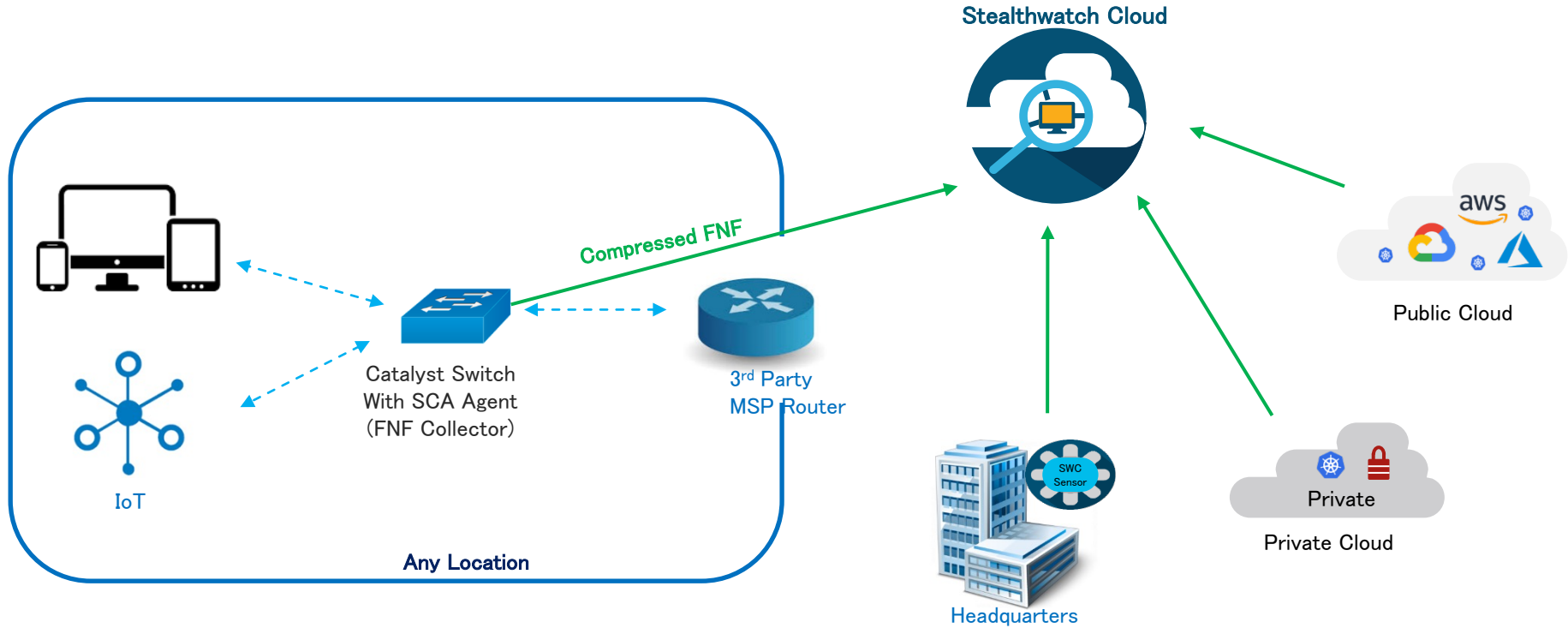
Protects the data and sends to StealthWatch cloud for analysis with encryption

Consumes less WAN Bandwidth – ZIP Compressed FNF records

Simplified FNF configuration

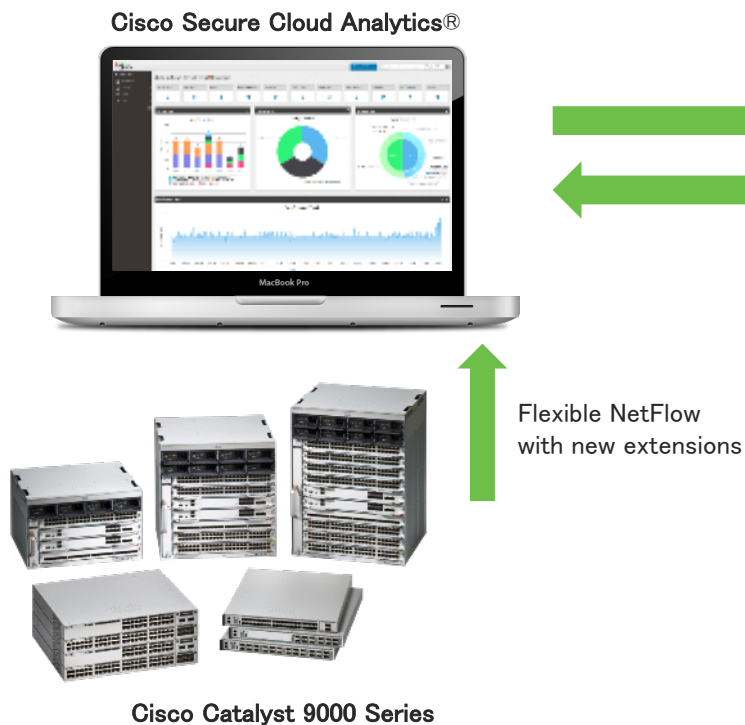


Secure Cloud Analytics Native Integration



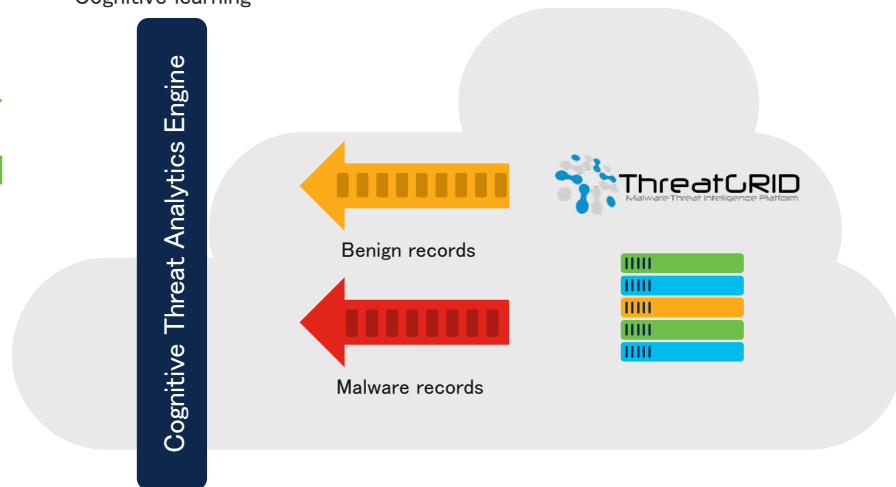
Catalyst 9000 Security

Encrypted Traffic Analytics (ETA)



* Cisco Catalyst 9200/9400-Sup2/9500H(X) and 9600(X) Series does not support ETA

Cognitive learning



**Encrypted
Traffic Analytics**
99%+ accuracy

Media Access Control Security (MACsec 256)

Available on Cisco Catalyst 9000 Series Switches

Enhanced security with AES 256-bit
MACsec encrypted data plane

1

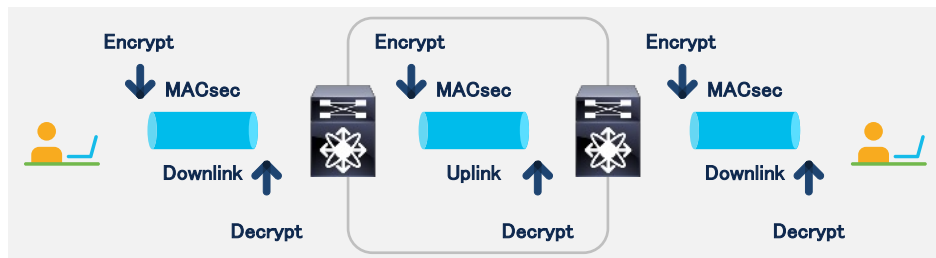
Extended packet
numbering

2

Standard MKA key exchange
(802.1ae)

3

“AES-256” keys
Stronger security



	Cisco Catalyst 9200 Series	Cisco Catalyst 9300 Series	Cisco Catalyst 9400 Series	Cisco Catalyst 9500 Series	Cisco Catalyst 9600 Series
Switch to switch	Supported (128-bit)	Supported (128-bit, 256-bit)	Supported (128-bit, 256-bit)	Supported (128-bit, 256-bit)	Supported (128-bit, 256-bit)
Switch to host	Supported (128-bit)	Supported (128-bit, 256-bit)	Supported (128-bit, 256-bit)	Supported (128-bit, 256-bit)	Supported (128-bit, 256-bit)

Benefits

Complete access security

Complete cross-platform alignment
with uplink/downlink support

Protection against “Inside threats”

Securing campus infrastructure

Hop-by-hop Ethernet encryption

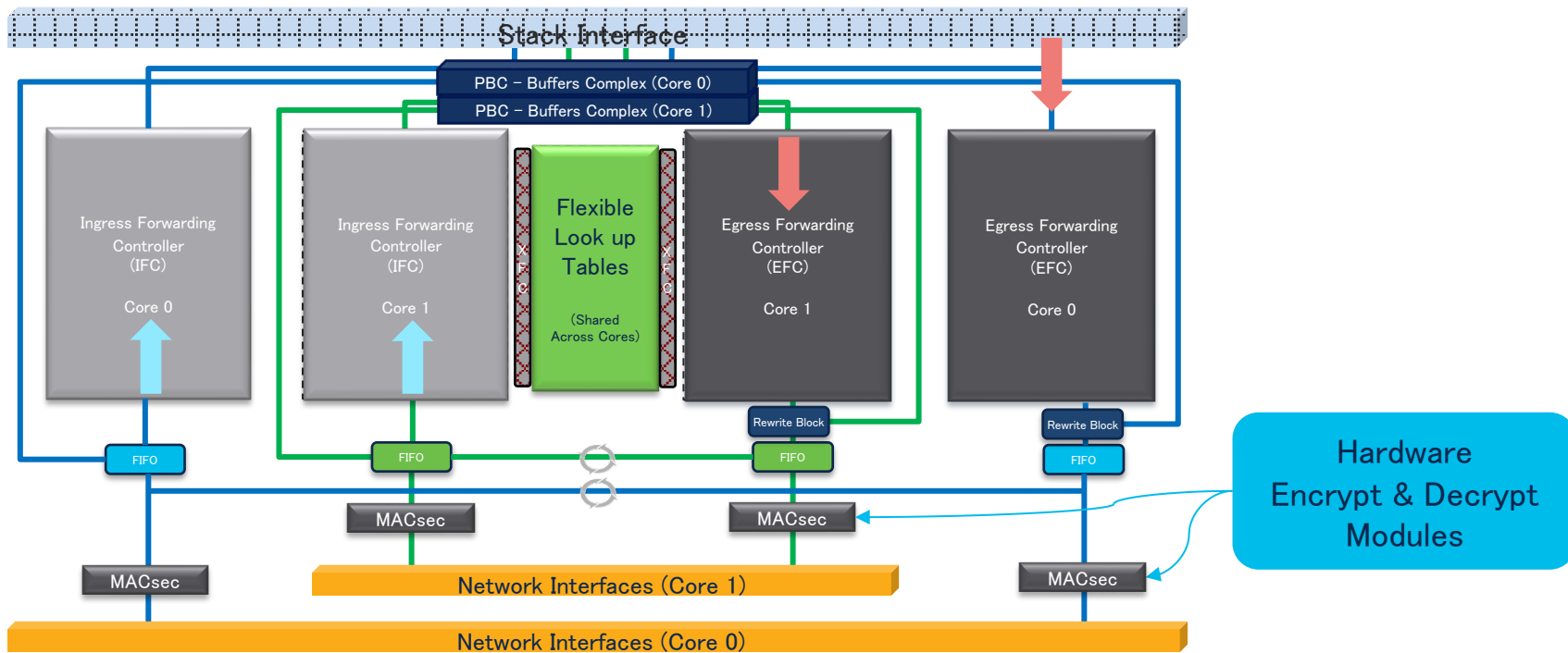
Line-rate performance on all ports

256-bit MACsec – Network Advantage

128-bit MACsec – Network Essentials

Catalyst 9000 Security – MACsec in Hardware

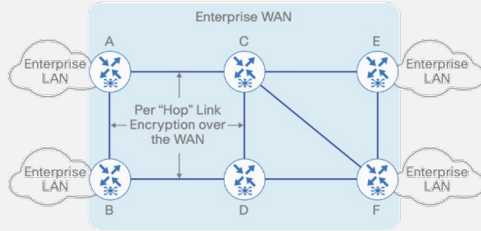
UADP 2.0/3.0/Mini ASIC



WAN MACsec overview and use cases

Enabled in hardware on Catalyst 9000 Switches

MACsec

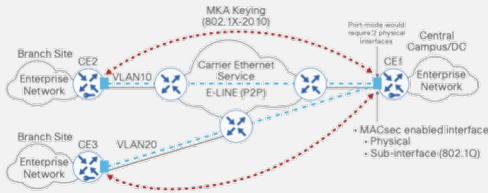


- Hop-by-hop encryption
- Directly connected Layer 2 links **only**
- Secure any direct link in campus/WAN, including DWDM
- 256/128-bit AES encryption



Supported on **all Catalyst® 9000** models
All ports and speeds simultaneously

WAN MACsec



- End-to-end encryption across Layer 2 Ethernet WAN service
- EoMPLS/VPLS, Q-in-Q
- Point-to-point or point-to-multipoint
- Applications include secure site interconnect, DCI, storage replication
- 256/128-bit AES encryption



Catalyst 9600X



Catalyst 9500X

Supported on **Silicon One™** platforms*
All ports/speeds (up to 400G) simultaneously



Catalyst 9400X



Catalyst 9300X

Roadmap support access **Catalyst 9300X and 9400X**
Aggregate speed up to 100G

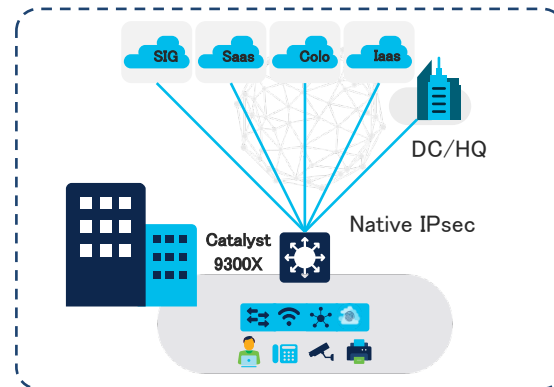
* Requires Release 17.8.1 and HSEC key (\$1 PID).

Catalyst 9300X – Purpose built for the new edge

Software
Cisco IOS® XE 17.6.2
With Cisco DNA Advantage
(HSEC key (1\$) for export control)



Cisco Catalyst 9300X



Encryption	Authentication
AES-128-CBC	HMAC/SHA1
AES-128/256-GCM	GMAC
Tunnel mode	
Encapsulation – ESP	
IKEv2	

Static virtual tunnel interface

IPv4/IPv6

OSPF/BGP

Policy Based Routing

Multicast Routing

NAT traversal

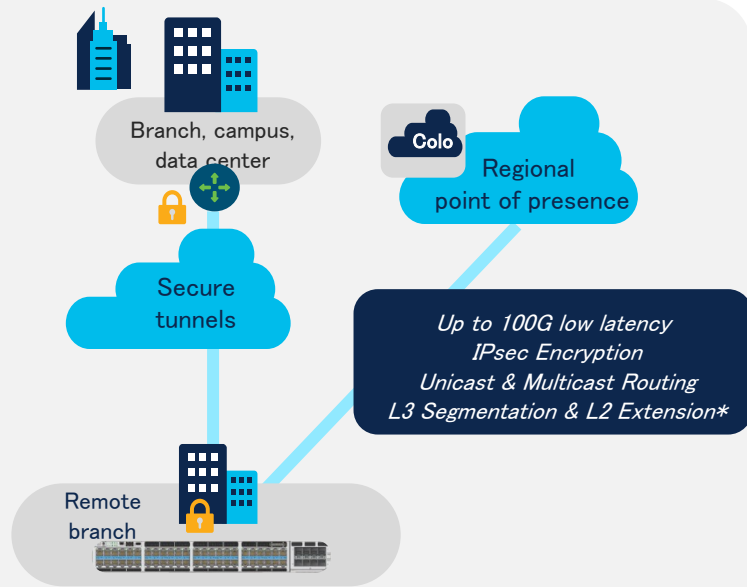
Layer 3 segmentation over IPsec

Layer 2 extension over IPsec

* Roadmap.

Catalyst 9300X – Purpose built for the New Edge

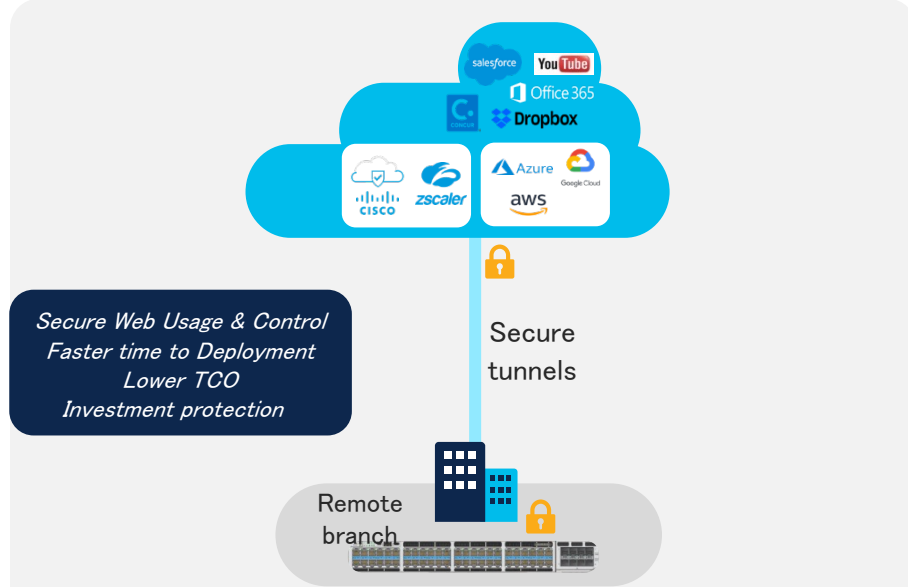
Secure connectivity to anywhere



Cisco Catalyst 9300X

Site-to-site

100G line-rate IPsec encryption with low-latency forwarding



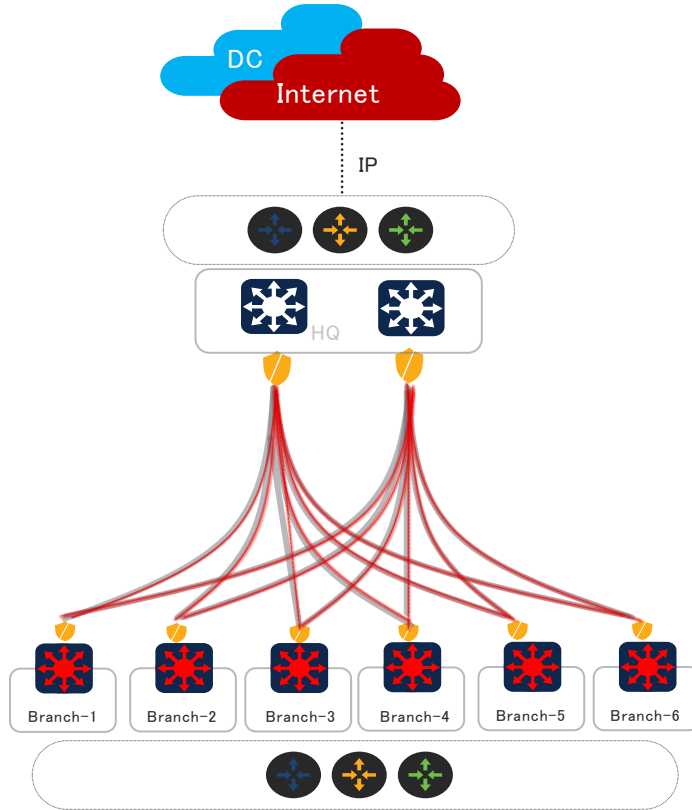
Cisco Catalyst 9300X

Site-to-cloud

Standards-based IPsec for secure direct internet access and cloud-native workloads

BGP EVPN over IPsec

Secure Fabric



Key Benefits

- Scalable Segmentation over IPSEC
- Secure End-to-End Fabric

Ingress Replication

Layer 2 Extension BGP EVPN

Layer 3 Overlay BGP EVPN

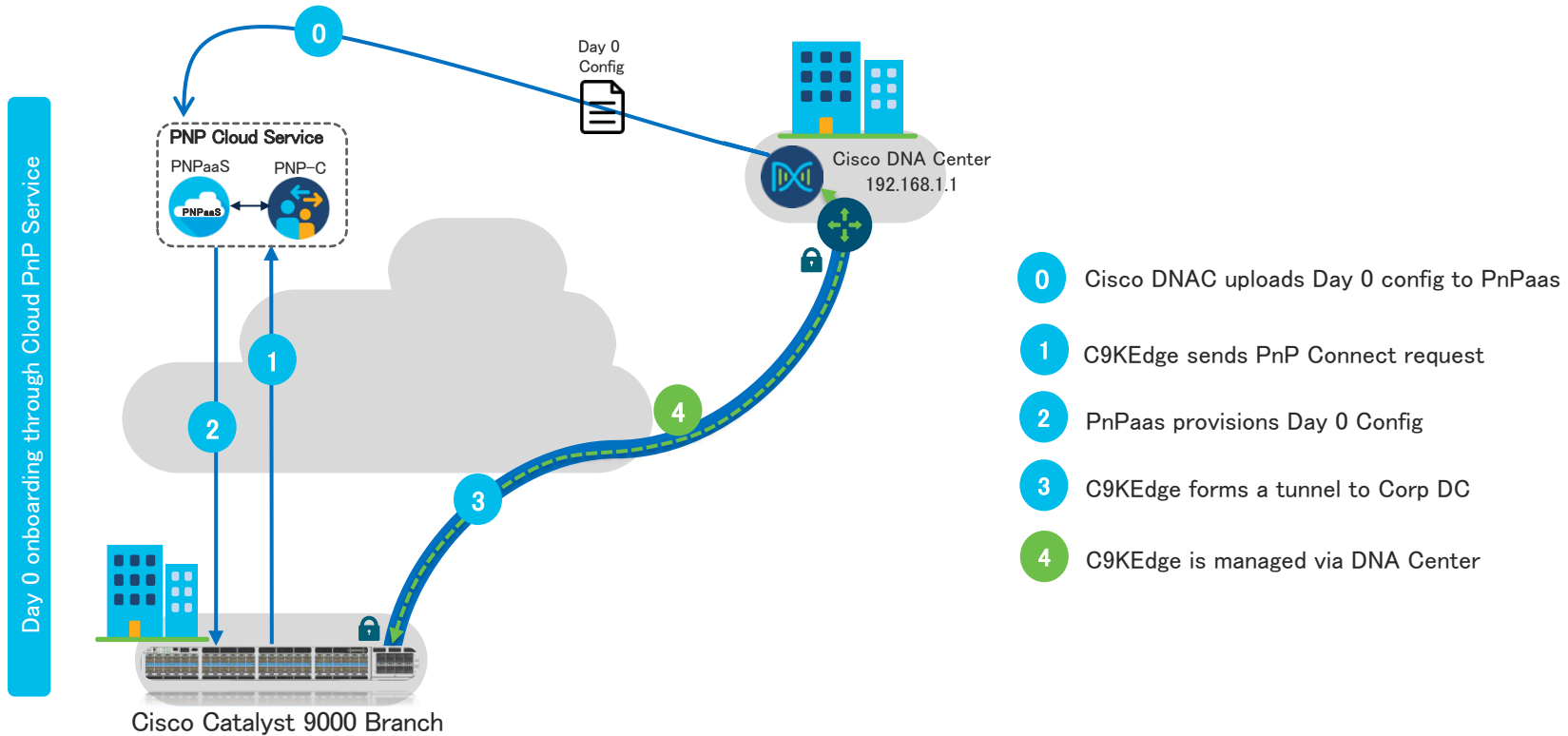
Underlay OSPF/BGP

Secure Overlay IPsec

Catalyst 9k Edge – Automation & Monitoring

	 Turnkey*	 DIY
		 
Day 0: Onboarding	 DNA Center	ZTP
Day 1: Tunnel Provisioning	 DNA Center	NETCONF/RESTCONF, Python, Ansible, Terraform, CLI
Day N: Tunnel Monitoring	 DNA Center	SNMP, Telemetry

Day 0 Automation Workflow for Cat9k Edge



Catalyst 9k Edge – Automation & Monitoring

Day 0 On-boarding

Onboard New Edge Device using PnP Cloud

Note: After onboarding the device please navigate to [PnP](#) to view device status.

Device Details Day-0 Configuration Preview

Select Site*

Global/US/SJC-13/FLR-1

You are logged in as smart account user Admin. Select the virtual account.

Select Virtual Account*

CVD

Select from the available devices in the virtual account.

Select Device*

FOC2546VZDF (C9300X-48TX)

Enter the management IP of the device. We will create a feedback interface using this IP address. To be able to manage the selected device from DNA Center, an IPsec tunnel (Tunnel 1) will be created from the switch to the specified head-end router, as part of the PnP starter configuration.

Management IP*

192.168.100.6

Is your head-end router managed in DNA? You can add up to 2 head-end routers for redundancy.

Yes No

Head-End Router IP*

128.107.211.25

Redundant Head-End Router IP (Optional)

TUNNEL PARAMETERS

Pre-Shared Key (PSK)*

License

HSEC License Token

Head-End Router

C9300X-Edge

Day 1 SIG Tunnel Provisioning

Choose Site and Device

Select the device that you intend to use for this tunnel.

Site

Select the site first and then select from eligible devices.

Site*

Global/AMER/San Jose/Sig 1/Floor 1

Device*

C9300X-SJ-02

Number of Tunnels*

4

Enter the tunnel name and select the source interface for each tunnel. We will auto-generate the tunnel number.

TUNNEL 1

Tunnel Name*

SJ-ATT

Tunnel Source Interface*

GigabitEthernet0/0/0 (192.168.33.44)

Use the same interface for Tunnel IP

TUNNEL 2

Tunnel Name*

SJ-ATT-2

Tunnel Source Interface*

GigabitEthernet0/0/0 (192.168.33.44)

Use the same interface for Tunnel IP

TUNNEL 3

Tunnel Name*

SJ-Verizon

Tunnel Source Interface*

GigabitEthernet0/0/1 (192.168.12.12)

Use the same data center location for all tunnels

Review

Day N Tunnel Monitoring

Secure Tunnels (5)

Search

Type Site to Site Site to SIG/SASE Site to CSP

Device Name	Source Interface	Tunnel Name	Status	Type	Actions
C9300X-SJ-01	GigabitEthernet0/0/0 (192.168.33.44)	SJ-NY-Tunnel01	Up	Site to Site	
C9300X-SJ-02	GigabitEthernet0/0/0 (192.168.33.44)	SJ-ATT	Up	Site to SIG/SASE	
C9300X-SJ-02	GigabitEthernet0/0/0 (192.168.33.44)	SJ-ATT-2	Up	Site to SIG/SASE	
C9300X-SJ-02	GigabitEthernet0/0/0 (192.168.33.44)	SJ-Verizon	Down	Site to SIG/SASE	
C9300X-SJ-02	GigabitEthernet0/0/0 (192.168.33.44)	SJ-Verizon-2	Up	Site to SIG/SASE	

5 Records

SIG Tunnel Traffic Redirection

Configure Tunnel Traffic

Choose whether you want to allow all traffic or selected traffic through the tunnel.

Tunnel Traffic

Default Route Selected selected traffic

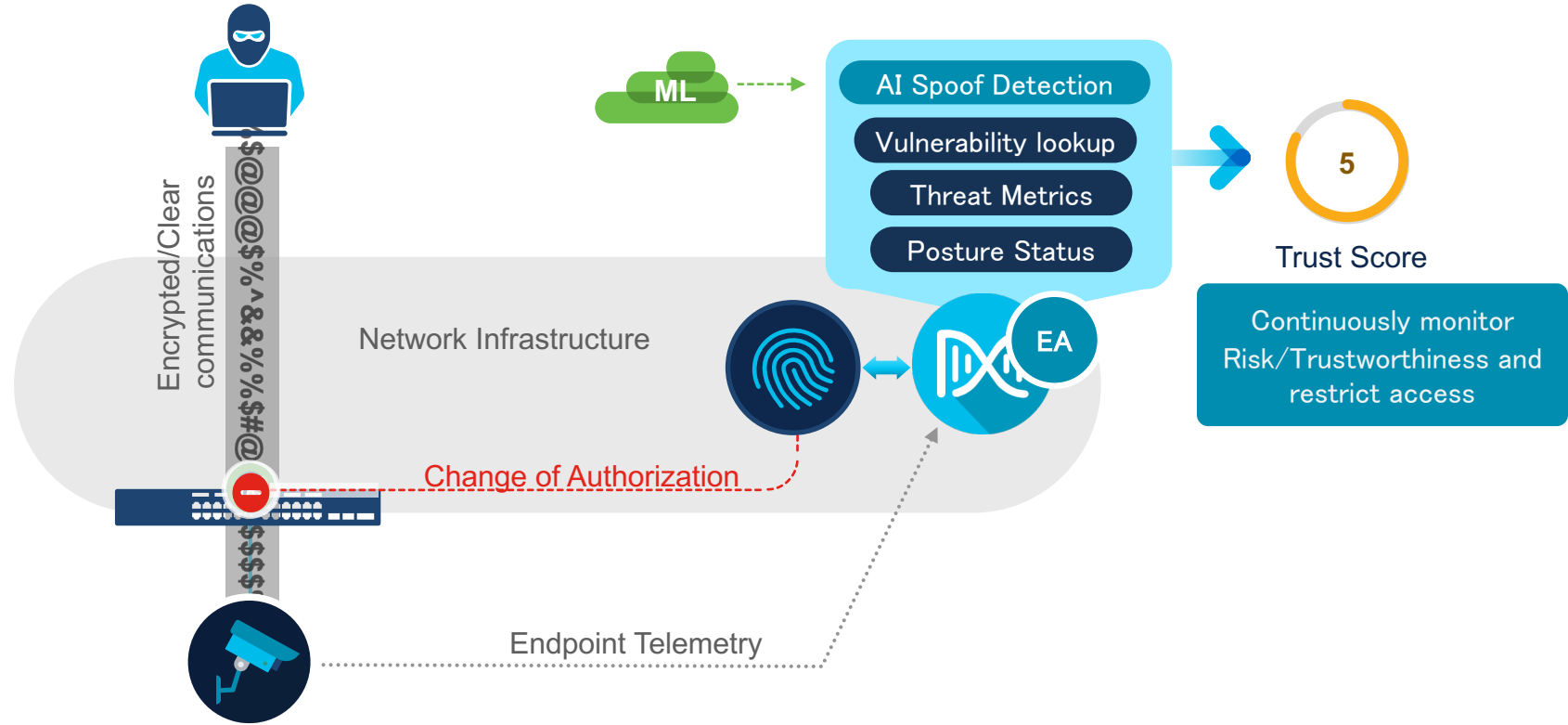
All traffic is sent through the IPsec tunnel to Cisco Umbrella.

Add the subnets you want to allow through the tunnel. For each subnet, select the ingress interface on the C9300X switch.

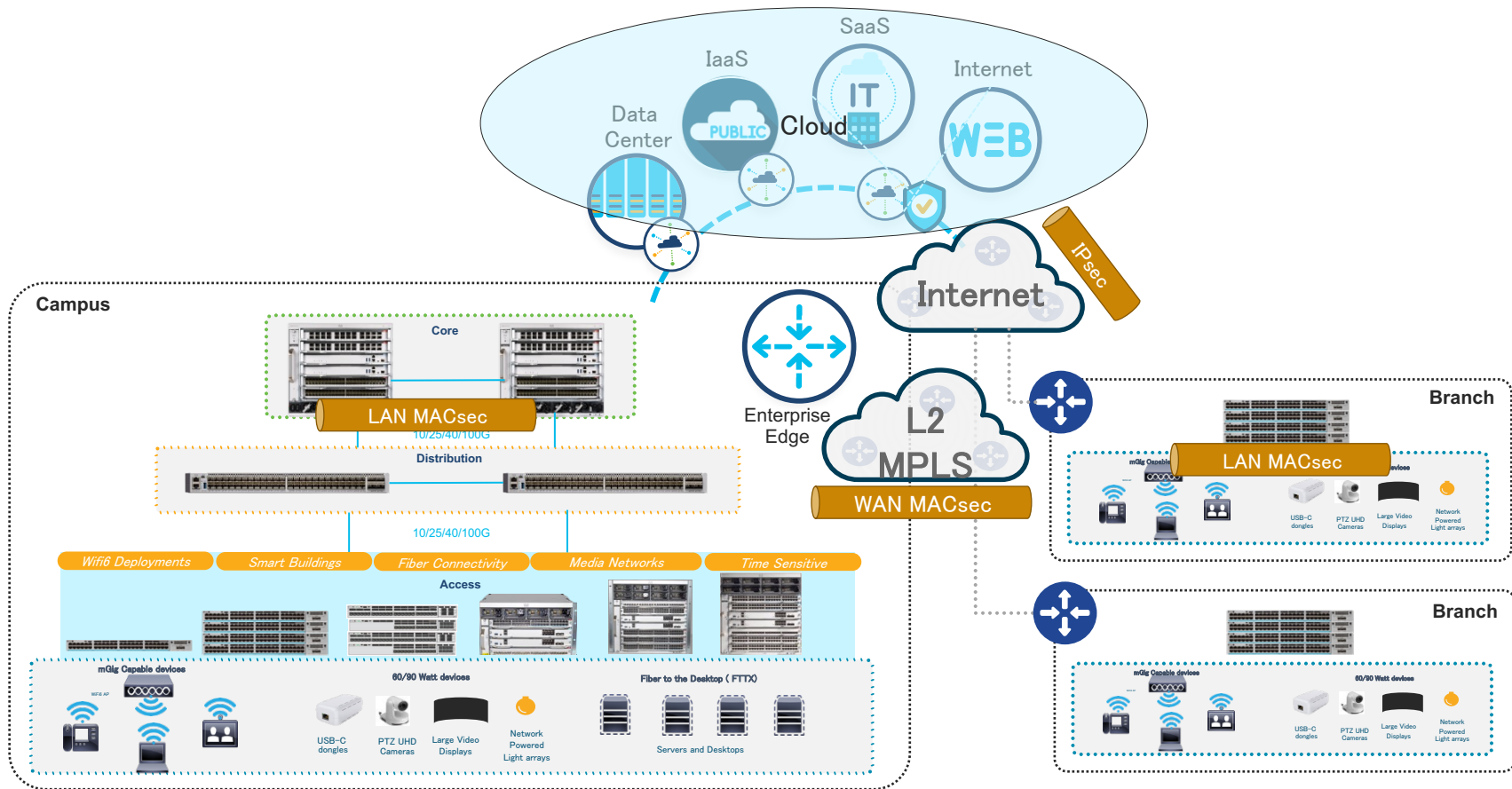
Subnet* 192.168.10.0/24 Ingress interface on C9300X* Vlan123 (123.123.123.1)

Subnet* Ingress interface on C9300X*

Trust Analytics – Ongoing Validation of “Trust”



End-to-End Security for Campus





Catalyst 9000 Series

Application Visibility and Control

Granular Detection, Advanced Monitoring & Business Logic Based Policies



Granular App Detection Encrypted Application



Fault Isolation, Troubleshooting Performance Assessment

The screenshot displays the Cisco APIC-Enterprise Module interface. At the top, the title bar reads "APIC-Enterprise Module". Below it, the "Application Policy" section is active. On the left, a sidebar lists various application categories: Business Tools, Location Services, Voice & Video, File Sharing, and Internet Security. The main content area is divided into three panels. The first panel, "Categorized Applications", shows a list of applications with their counts: Business Tools (87), Location Services (41), Voice & Video (35), and File Sharing (18). A "Top 8 App Categories" link is below the list. The second panel, "Create Custom Applications", features a large circular gauge showing "41%". The third panel, "Define Application Policy", shows a donut chart with "Default" (green) and "Relevant" (red) segments. An "Apply Changes" button is in the top right corner.

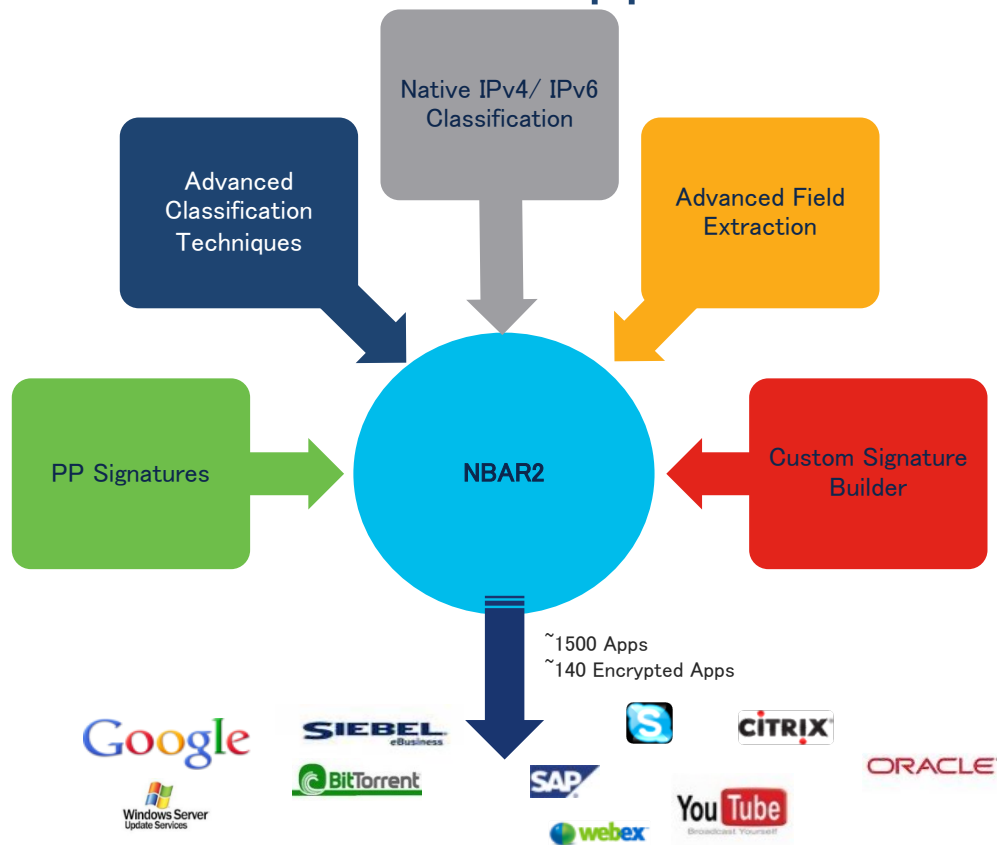
Application Category	Count
Business Tools	87
Location Services	41
Voice & Video	35
File Sharing	18

Policy Status	Count
Default	8
Relevant	24



Prioritized Applications, Bandwidth Management

Network Based Application Recognition 2 (NBAR2)



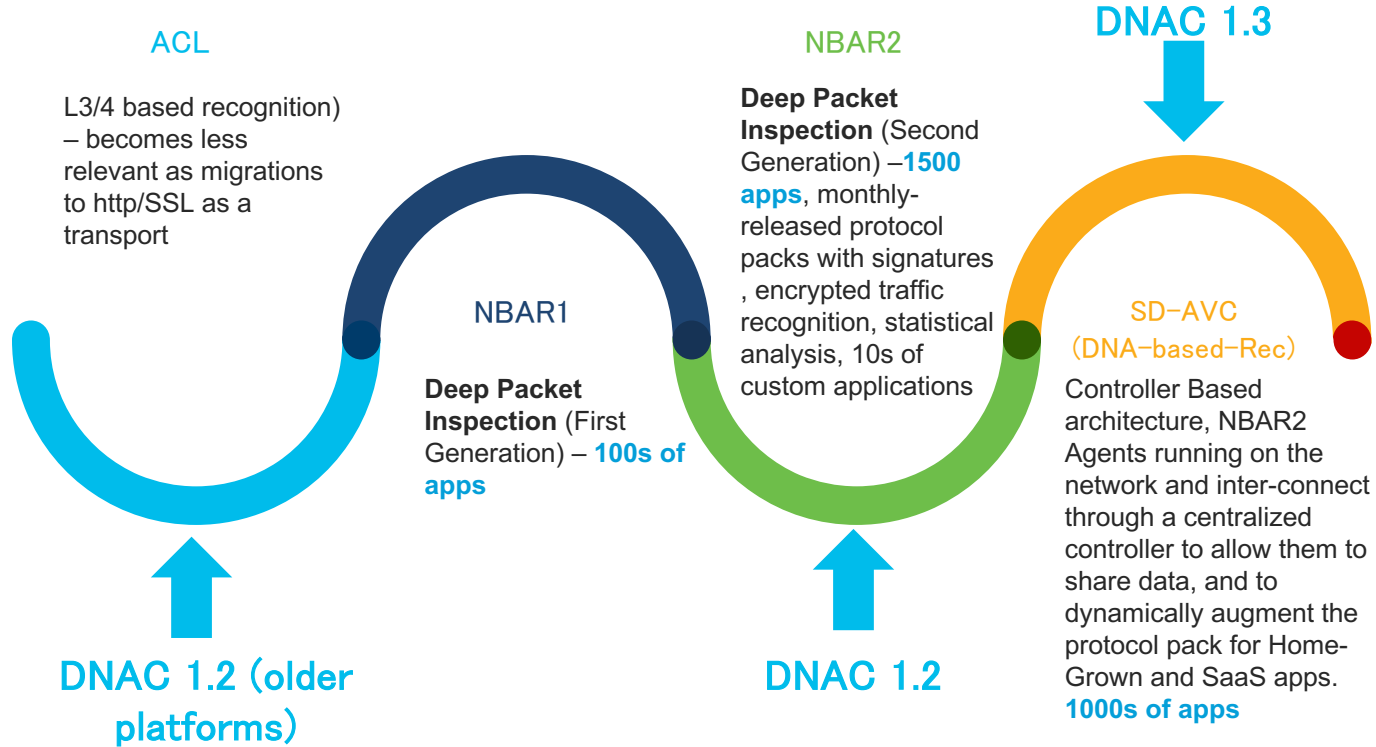
IOS-XE 16.6.3	Catalyst 9300
IOS-XE 16.9.1	Catalyst 9400/9500
IOS-XE 16.11.1	Catalyst 9200
NOT SUPPORTED	Catalyst 9500H/X, 9600X, 9400 Sup-2

- Optimize application experience.
- Periodic hitless protocol pack updates improving application recognition capabilities.

SD-AVC in Cisco DNA-Center

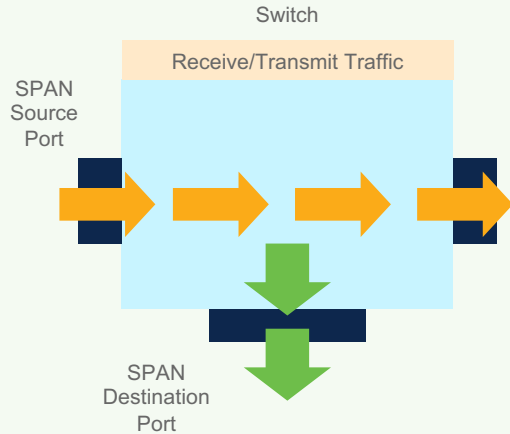
Application Recognition Service

How The Network Classifies Applications? Several Generations of Technologies:



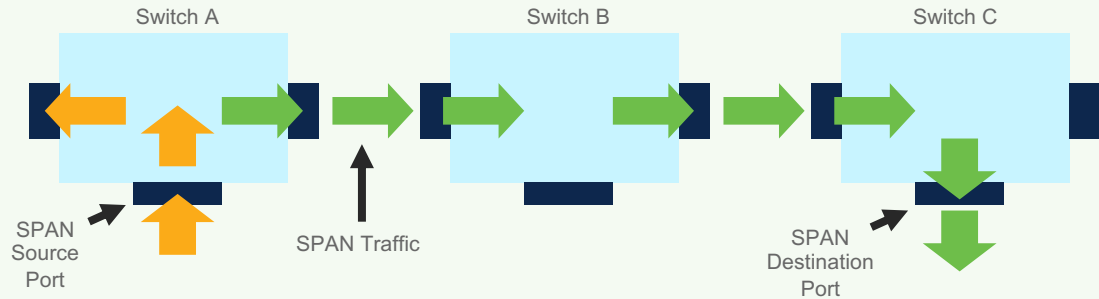
Local SPAN and RSPAN

SPAN



- Source and Destination are on the same physical switch.
- Both incoming and outgoing traffic can be replicated and sent to SPAN destination.
- Multiple source ports and vlans are supported as source.

RSPAN



- Source and destination ports are on different physical switches.
- The switches however must share a common L2 RSPAN vlan between them.
- Traffic is replicated and sent over a dedicated RSPAN vlan.
- At destination switch match the RSPAN vlan as the source.

Encapsulated Remote SPAN (ERSPAN)*



- Source and destination ports are on different physical switches in different networks without a common L2 domain.
- Traffic traversing across the WAN network requiring encapsulation.
- GRE tunnels leveraged to support traffic replication in hardware.
- Both ERSPAN source and ERSPAN destination are supported.
- DNA-Advantage license required.

* Roadmap for 9400X-Sup2, 9500X and 9600X-Sup2.

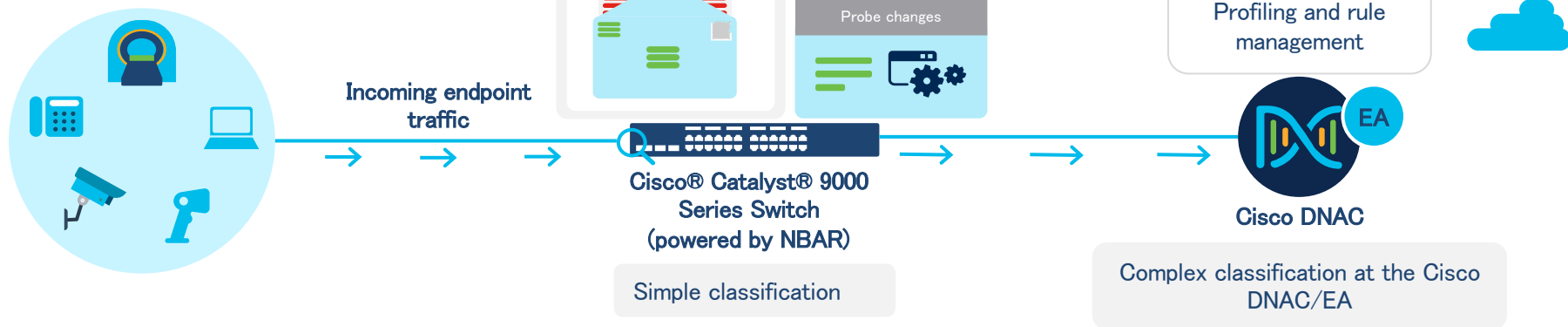
SPAN Scale table

	Catalyst 9200	Catalyst 9300	Catalyst 9400	Catalyst 9500(X)	Catalyst 9600(X)
SPAN sessions (Source)	8*	8*	8*	8*	8*
SPAN sessions (Destination)	66*	66*	66*	66*	66*
SPAN Source Ports	all interfaces	all interfaces	all interfaces	all interfaces	all interfaces
SPAN Destination Ports	64	64	64	64	64
Total Sessions	66	66	66	66	66

* Combination of Source and Destination can't exceed Total number of sessions.

AI Endpoint Analytics – Profiling using NBAR/SDAVC

- Granular Profiling using Deep Packet Inspection
- ML Crowdsourcing offers Admin profile label suggestions
- Provide Multi-Factor Classification(MFC) to endpoints
- Additional context from ISE





Catalyst 9000 Series

Optics

Copper vs. Fiber Media

More details in PPT Notes



Category 5, 6 & 7

Unshielded (UTP)

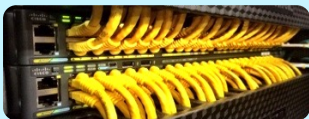
Shielded (STP)

RJ45 (Access to Endpoints)

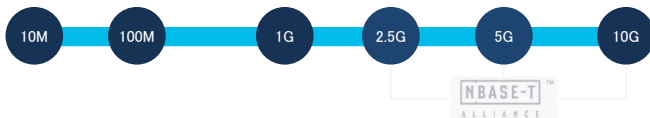


Cat6A
(Offset Wires)

Cat5E
(Flush Wires)



Category	Frequency	Distance	Data Rate	Shielding
5E	100-350 MHz	100m	1000 Mbps	UTP or STP
6	250-550 MHz	1G - 100m 10G - 50m	1 Gbps 10 Gbps	UTP or STP
6A	500-550 MHz	100m	10 Gbps	UTP or STP
7	600 MHz	100m	10 Gbps	Shielded only



OM3, OM4 & OM5

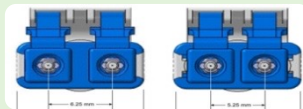
Multi-Mode (MMF)

Single-Mode (SMF)

Wave-Division
Multiplex (WDM)

SFP (Access & Distribution)

QSFP (Core & Edge)



SFP-LC
LC Duplex

mSFP
Mini LC Duplex



SMF



MMF



MPO12
12 Fibers

MPO24
24 Fibers



Single-Mode Color
Coded Boots on MTP



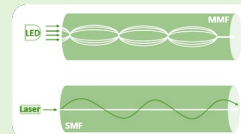
Multimode Color
Coded Boots on MTP

Multimode

- Short distance cable runs (less than 1000ft.)
- High bandwidth support
- Higher cable cost
- Lower electronics cost
- Easier to terminate due to larger core size

Single Mode

- Long distance cable runs (greater than 1000ft.)
- Highest bandwidth support
- Lower cable cost
- Higher electronics cost
- Harder to terminate due to smaller core size



www.cisco.com/c/en/us/products/interfaces-modules/transceiver-modules/

www.cisco.com/c/en/us/products/collateral/switches/catalyst-9000/nb-06-cat9000-panduit-cables-wp-cte-en.html

Cisco Catalyst 9000 Series

Seamless backbone speed migration enabling any speed, any distance

Drive speed migration

25G

- SR/CSR/LR/ER/ZR SFP
- 10G/25G multi-rate optics
- 10/25G-CSR (4x distance)
- 1/0/25G-LR-S (10km on SMF)

40G

- SR/CSR/LR/ER/ZR/BiDi QSFP
- 1G/10G multi-rate optics (with QSA adapter)
- 4x 10G breakouts*

100G

- SR/LR/ER QSFP
- 40G/100G multi-rate optics
- 4x 10G, 4x 25G breakouts*

400G

- 40G/100G/200G*/400G multi-rate optics
- 4x10/25/50/100G 2x200 G breakouts*

10G/1G

Baseline 10G/1G* support for legacy/traditional deployments

Flexible deployment



1G to 400G



Fiber infrastructure investment protection



Diverse deployment options

www.cisco.com/c/en/us/products/interfaces-modules/transceiver-modules/

* Roadmap

100/400GE – A Better Alternative

Provides seamless migration path from 40GE

Designation	Speed
D	400GE
C	100GE
Q	40GE

Catalyst 9600



C9600X-SUP2 & LC-32CD



C9600-SUP1 & LC-24C

Catalyst 9500



C9500X-28C8D



C9500-32C

Catalyst 9400



C9400X-SUP2XL



C9400-SUP1XL

Catalyst 9300



C9300X-NM-4C



C9300X-NM-2C

Reduced CapEx through reuse of existing cabling

Single-Lane optics provide port densities similar to 40G

Gradual migration options with support of Dual-Rate Optics

Reduced OpEx through savings in power and cooling

Cisco 400G optics

Support for QSFP-DD



100 m, MMF
SR8 QSFP28



10 km, SMF
LR8 QSFP28



500 m to
2 km, SMF
DR4 QSFPDD
FR4 QSFPDD



5 m, copper
CU QSFPDD
Built-in cable/optics



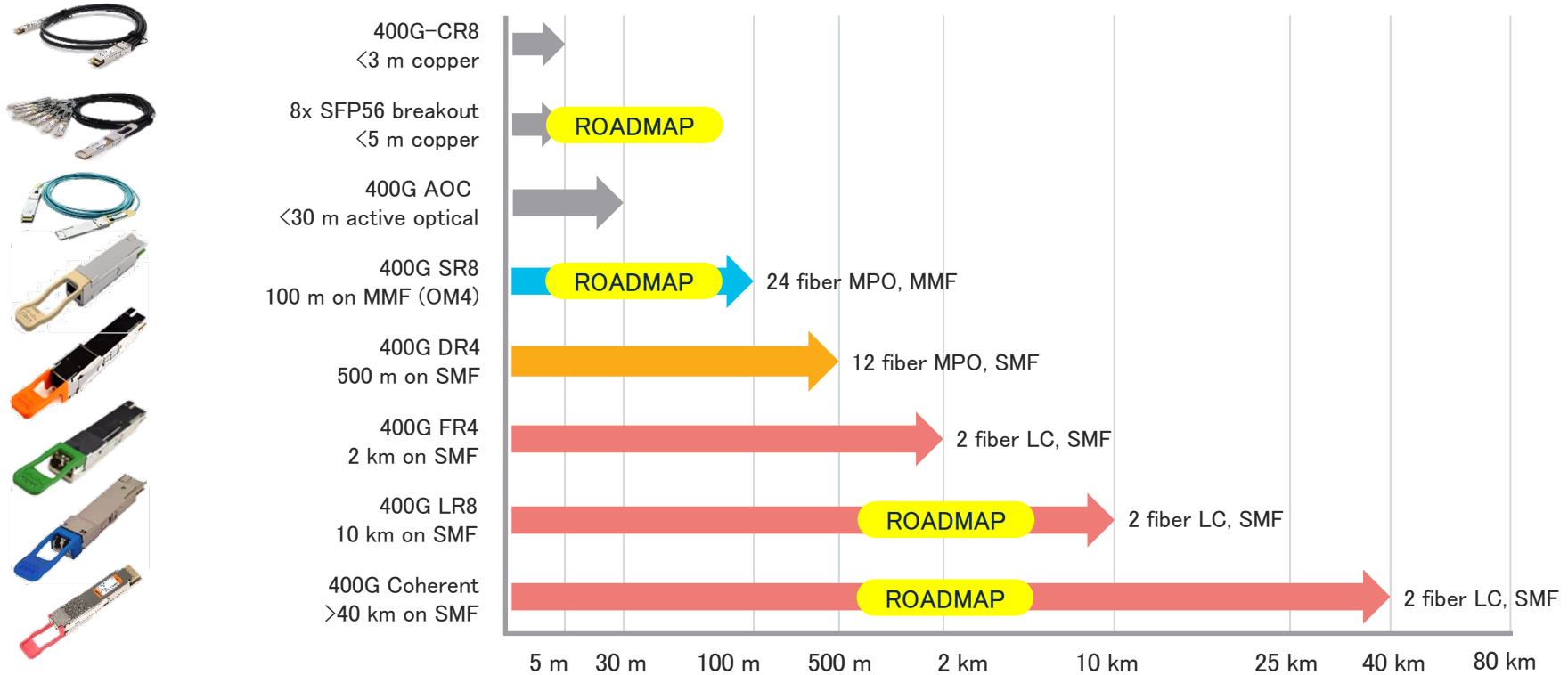
30 m, optical
AOC QSFPDD
Built-in cable/optics



10 m, copper
8x50G
BREAKOUT

Cisco QSFP-DD 400G transceivers

- Multimode fiber, parallel
- Multimode fiber, duplex
- Single-mode fiber, parallel
- Single-mode fiber, duplex
- Direct Cables



Cisco 100G optics

Support for QSFP28



100 m, MMF
SR4 QSFP28



10 km, SMF
LR4 QSFP28



40 km, SMF
ER4 QSFP28



100 m,
MMF
**SRBD
QSFP28**



500 m,
MMF
**PSM4
QSFP28**



30 m,
Direct Attach
**CU/AC/AOC
QSFP28**



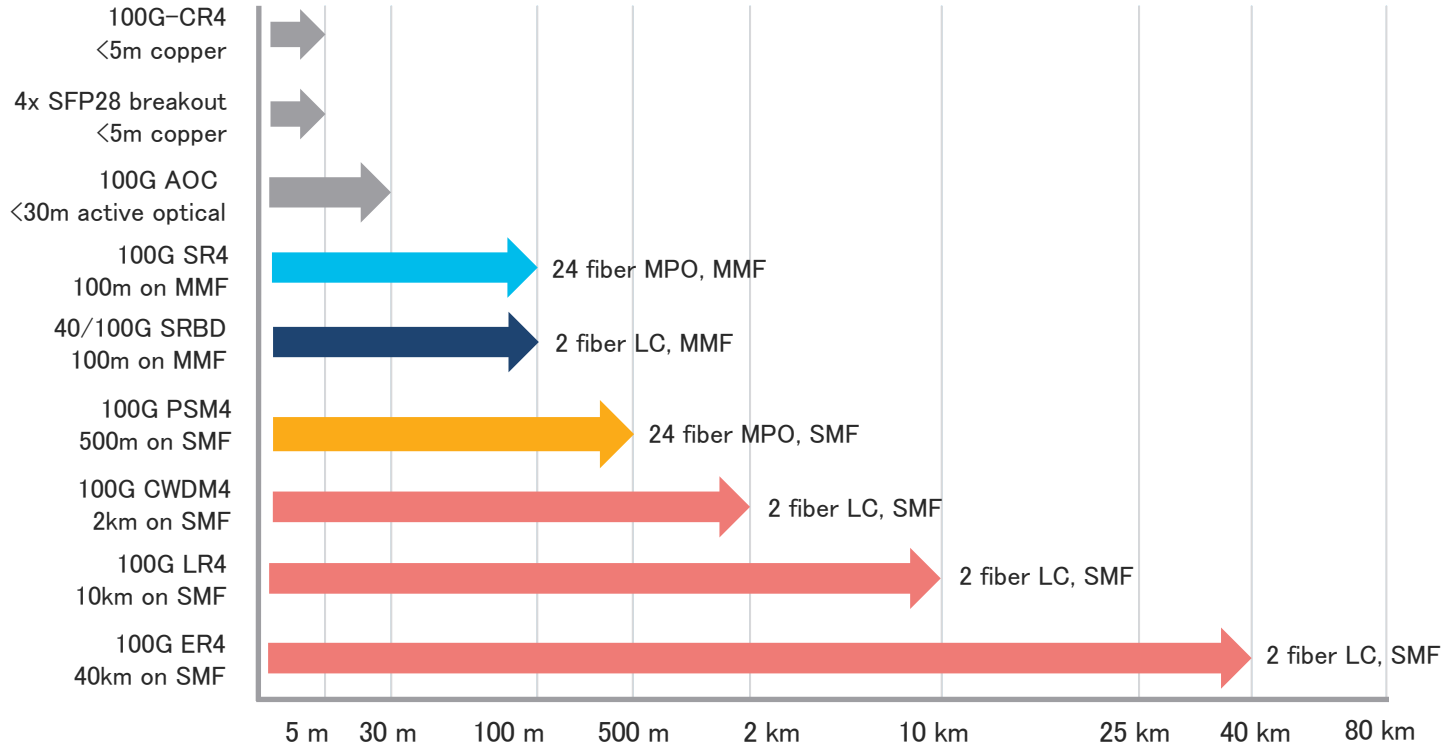
QSFP
to SFP
**QSA
ADAPTER**



10 m,
copper
**4x25G
BREAKOUT**

Cisco QSFP28 100G transceivers

- Multimode fiber, parallel
- Multimode fiber, duplex
- Single-mode fiber, parallel
- Single-mode fiber, duplex
- Direct Cables



Cisco 40G optics

Support for QSFP+ optics



100 m, MMF
SR4 QSFP+



10 km, SMF
LR4 QSFP+



40 km, SMF
ER4 QSFP+



150 m,
MMF
**BD
QSFP+**



2 km, SMF
**WSP-
Q40GLR4L
QSFP+**



10 m,
AOC optical
**CU/AC/AOC
QSFP+**



QSFP
to SFP
**QSA
ADAPTER**



10 m,
copper
**4x10G
BREAKOUT**

Cisco QSFP+ 40G transceivers

- Multimode fiber, parallel
- Multimode fiber, duplex
- Single-mode fiber, parallel
- Single-mode fiber, duplex
- Direct Cables



4x10G breakout CR4(AC)
<10 m active optical

4x SFP+ breakout (1.5W)
<5 m copper

40G AOC (1.5W)
<30 m active optical

40G CU (1.5W)
<5 m copper

40G SR4/ SR4/ SR4-S (1.5W)
150 m on MMF (OM4)

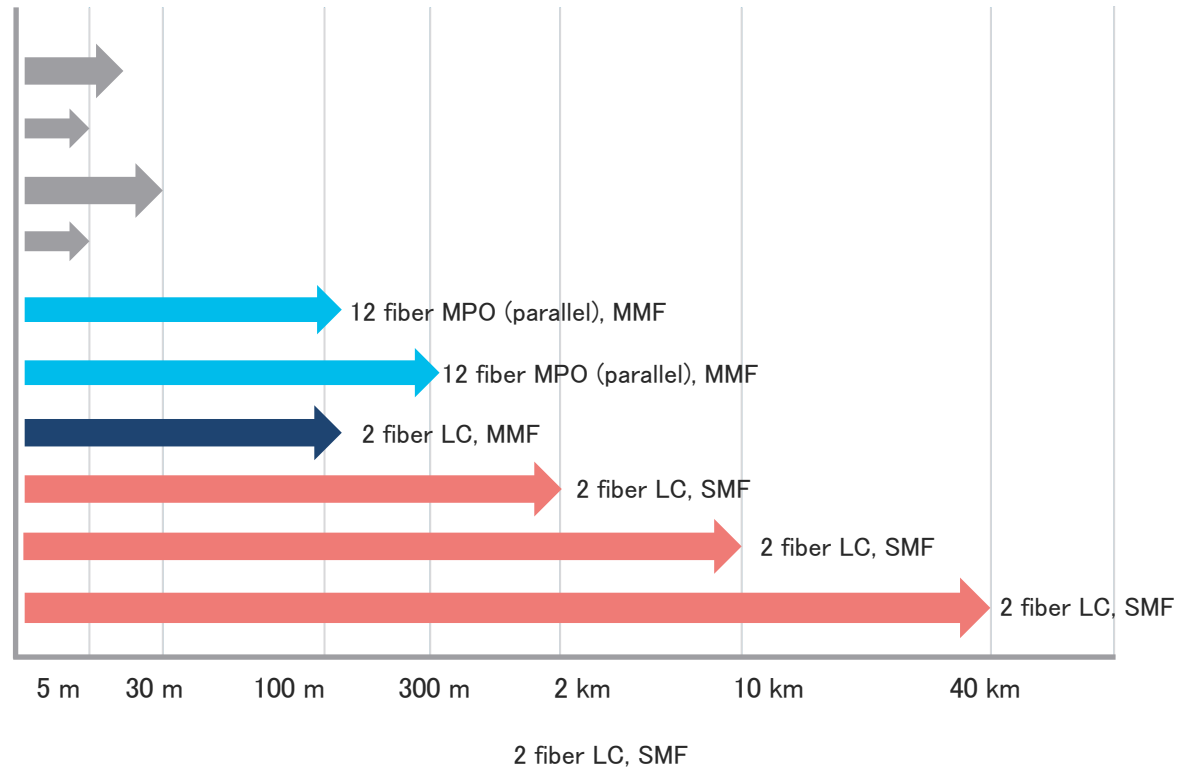
40G CSR4 (1.5W)
400 m on MMF (OM4)

40G SR Bidi (3.5W)
150 m on MMF (OM4)

40G LR4 Lite (3.5W)
2 km on SMF

40G LR4 (3.5W)
10 km on SMF

40G ER4 (3.5W)
40 km on SMF



25/50GE – A Better Alternative

Provides seamless migration path from 1/10GE

Designation	Speed
L	50GE
Y	25GE
X	10GE

Catalyst 9600



C9600X-SUP2 & LC-40YL4CD



C9600-SUP1 & LC-48YL

Catalyst 9500



C9500X-60L4D



C9500-48Y4C

Catalyst 9400



C9400X-SUP2XL



C9400-SUP1XL-Y

Catalyst 9300



C9300X-NM-8Y



C9300-NM-2Y

Reduced CapEx through reuse of existing cabling

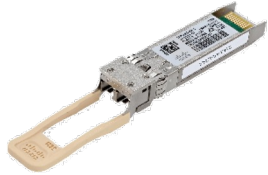
Single-Lane optics provide port densities similar to 10G

Gradual migration options with support of Dual-Rate Optics

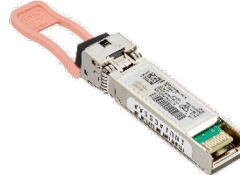
Reduced OpEx through savings in power and cooling

Cisco 25G optics

Support for 25G optics



100 m, MMF
SR SFP28



300 m/400 m, MMF
10/25G CSR
SFP28



10 km, SMF
10/25G LR
SFP28



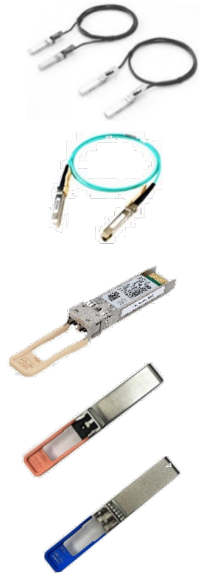
10 m fiber
AOC cables



10 m, copper
CU cables

Cisco SFP28 25G transceivers

- Multimode fiber, parallel
- Single-mode fiber, dual
- Single-mode fiber, parallel
- Cables



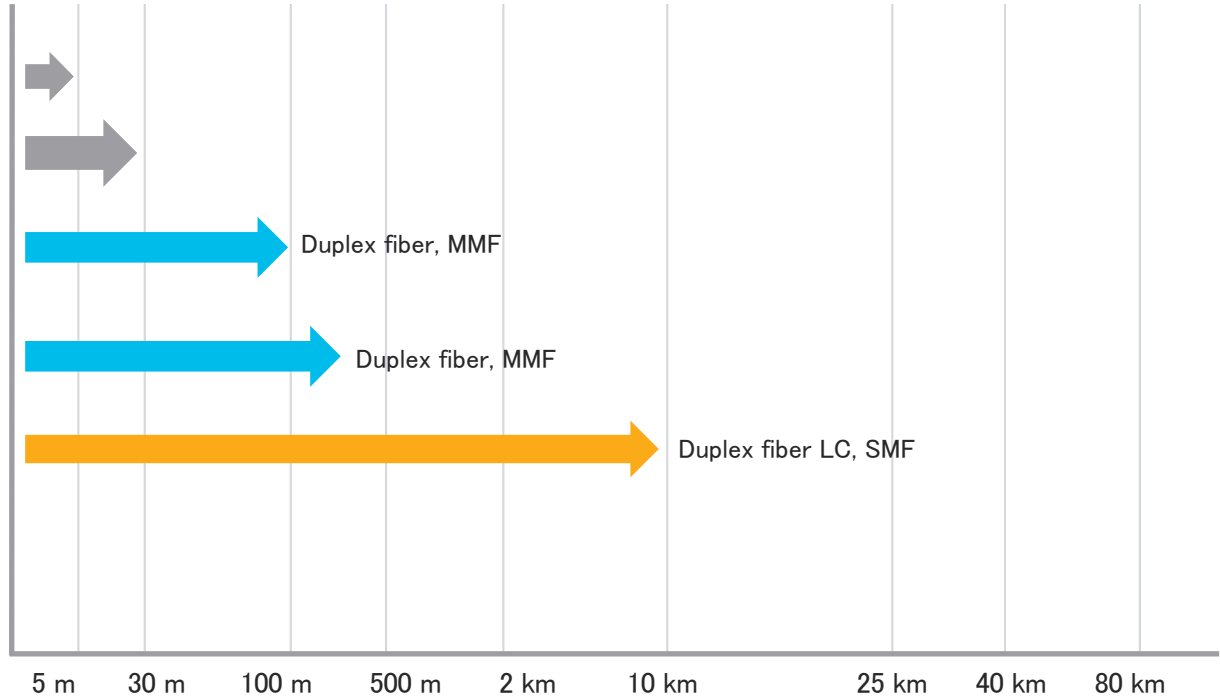
<5 m copper (1W)

25G AOC (1W)
1 to <10 m active optical

25G SR (1.5W)
70 m on MMF (OM3)
100 m on MMF (OM4)

10/25G CSR (1.5W)
300 m* on MMF (OM3)
400 m* on MMF (OM4)

10/25G LR (1.5W)
10 km on SMF



* Depends on fiber quality



Catalyst 9000 Series

Application Hosting

New strategic capabilities with App Hosting on C9K Switches

Existing Hardware

Managed via CLI
or DNA-C

Real Time Processing

Lower Latency

Save Bandwidth



IT Operations and
Monitoring Tools

Consolidate Physical
Infrastructure



Security Agents
and Functions

Enhance Visibility &
Security Enforcement



Cloud Gateways with
Serverless Edge Compute

Reduce App Latency
& Optimize App Traffic

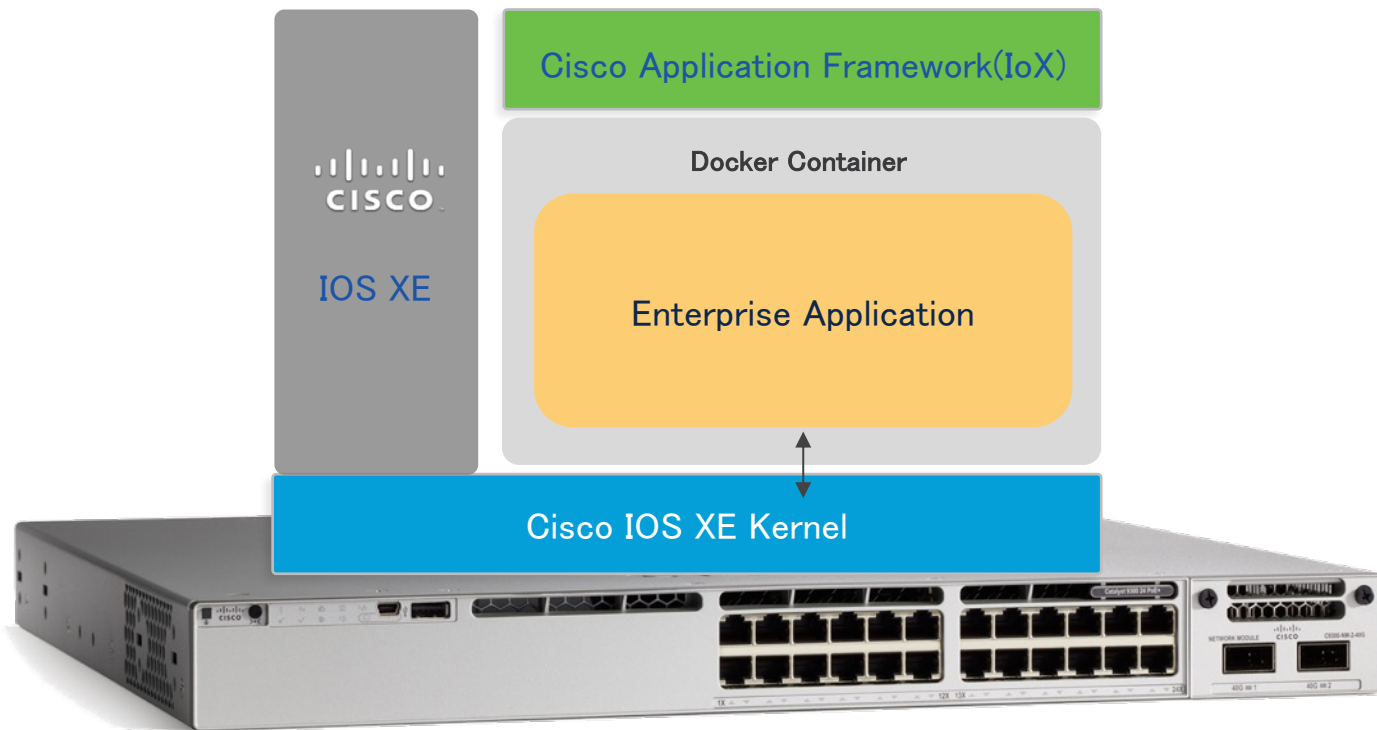


Customer Specific
Applications

3rd Party App Hosting

Rich ecosystem
partnership with 25+
certified apps and
200+ active customer

Catalyst 9000 Application Hosting Infra



HW resources for App Hosting

	Resource type	Catalyst 9300	Catalyst 9300-X	Catalyst 9400	Catalyst 9400-X	Catalyst 9500	Catalyst 9500-X	Catalyst 9600	Catalyst 9600-X
Networking	AppGig Port	1x1G	2x10G	1x1G	2x10G	Mgmt Port*	2x10G	Mgmt Port*	Mgmt Port* (2x10G CPU ports)
Resources	Memory	2GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB
	CPU	1 core	2 core	1 core	1 core	1 core	1 core	1 core	1 core
	Storage	240GB (USB3.0/SSD)	240GB (USB3.0/SSD)	480-960GB (SATA)	480-960GB (SATA)	480-960GB (SATA)	480-960GB (SATA)	480-960GB (SATA)	480-960GB (SATA)

* Using loopback with any external ports

Catalyst 9300-X

USB 3.0
240GB



Back panel



Catalyst 9400-X

M2 SATA
480/960GB



Plug into removable SUP



Catalyst 9500-X

M2 SATA
480/960GB



Back panel



Catalyst 9600-X

M2 SATA
480/960GB

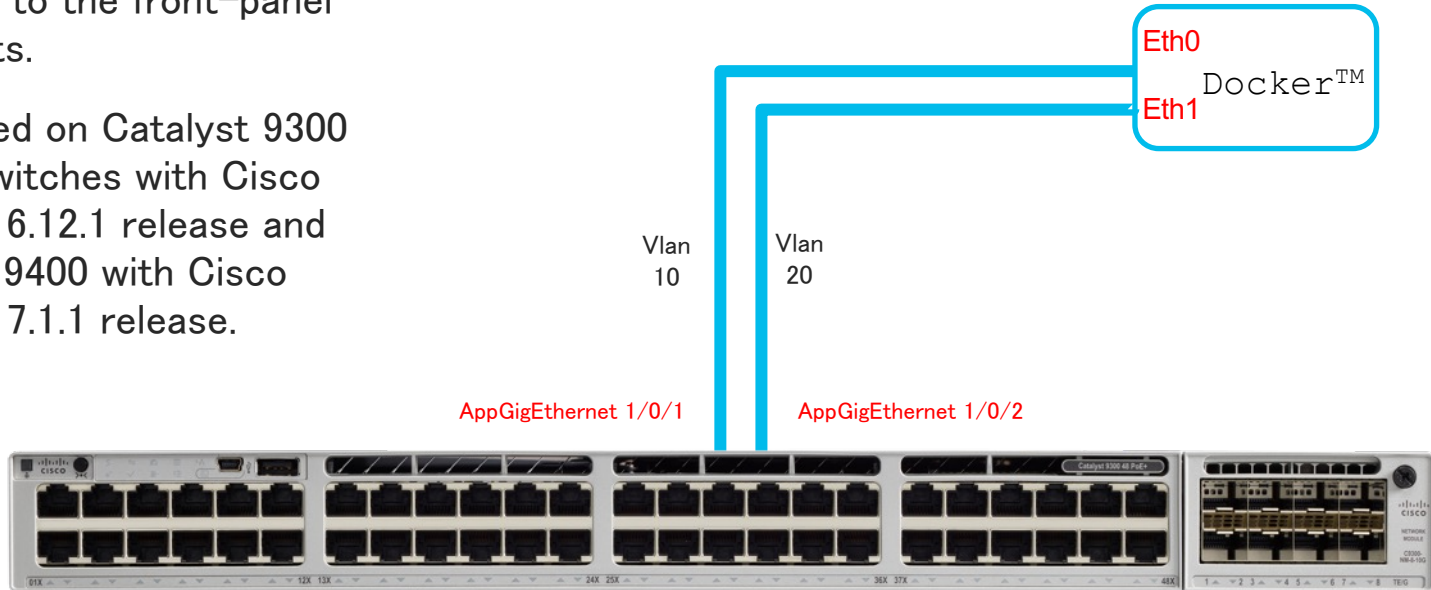


Plug into removable SUP



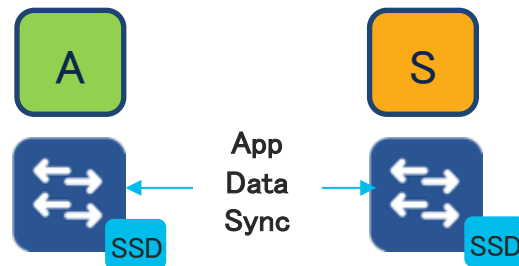
AppGigEthernet Port

- An internal hardware data port which is hardware-switched to the front-panel data ports.
- Introduced on Catalyst 9300 Series switches with Cisco IOS XE 16.12.1 release and Catalyst 9400 with Cisco IOS XE 17.1.1 release.



App Hosting High Availability with Auto-Restart

- Provides cold restartability of application and the underlying app hosting framework
- Retain the last configured operational state of app in the event of system switchover or restart
- 1+1 redundancy mode
- Same storage type (Flash* or SSD) required on both Active and Standby
- Enabled by default



Supported Platforms	Release
9300 StackWise (1+1 mode only)	17.2.1
9400 Dual Sup (Single Chassis & StackWise Virtual)	17.5.1
9500H StackWise Virtual	17.5.1
9600 Dual Sup (Single Chassis & StackWise Virtual)	17.5.1

* Flash is only for Cisco Singed app



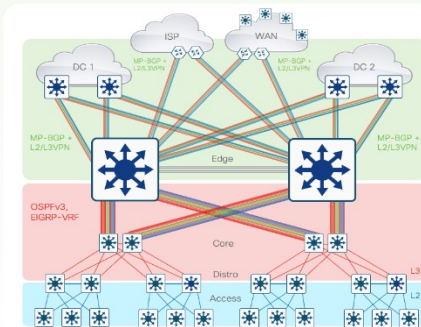
Catalyst 9000 Series

Overlay Networks

Campus Solutions & Designs

1

MPLS (L2/L3VPN)

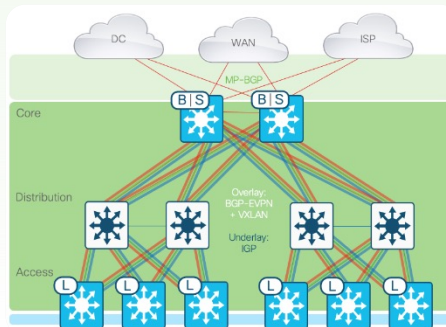


- L3 Underlay + L2/L3 VPN Overlay
- Virtual Private Networks
- L3 VRF-based Segmentation
- WAN/Edge + VPN Services

MP-BGP, PIC, LDP, MPLS/VPLS, SR
MVPN, LSM, Extranet, MSR
SSO, NSF/NSR, ECMP, GIG
VPN-FNF, Uniform/Pipe QoS, PBR, IPACL

2

EVPN (L2/L3VNI)

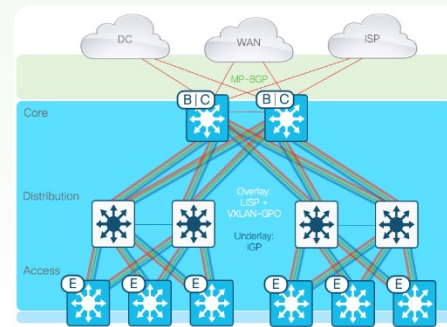


- L3 Underlay + L2/L3 VNI Overlay
- Virtual Network Instances
- L2/L3 VNI-based Segments
- Common WAN/LAN Services

MP-BGP + EVPN AF, VXLAN, VRF-Lite
Anycast Gateway, TRM, L2 BUM
SSO, NSF/NSR, ECMP, GIG
Fabric-FNF, Uniform QoS, IPACL/OGACL

3

SDA (L2/L3VNI + SGT)



- L3 Underlay + L2/L3 VNI Overlay
- Scalable Group Tagging
- L2/L3 VNI + SGT Segments
- LAN Services + Group-Based Policy

LISP, VXLAN, MP-BGP, VRF-Lite
Anycast GW, LISP HER/Native, L2 BUM
SSO, NSF/NSR, ECMP, GIG
Fabric-FNF, App QoS, SGACL

MPLS Deployment with Catalyst 9k

Virtualized L2/L3 Overlay

- Control-Plane: BGP, MPLS, MVPN
- Data-Plane: LDP/mLDP
- Policy-Plane: L2/L3 VPN

L3 Underlay + L3 Hand-off

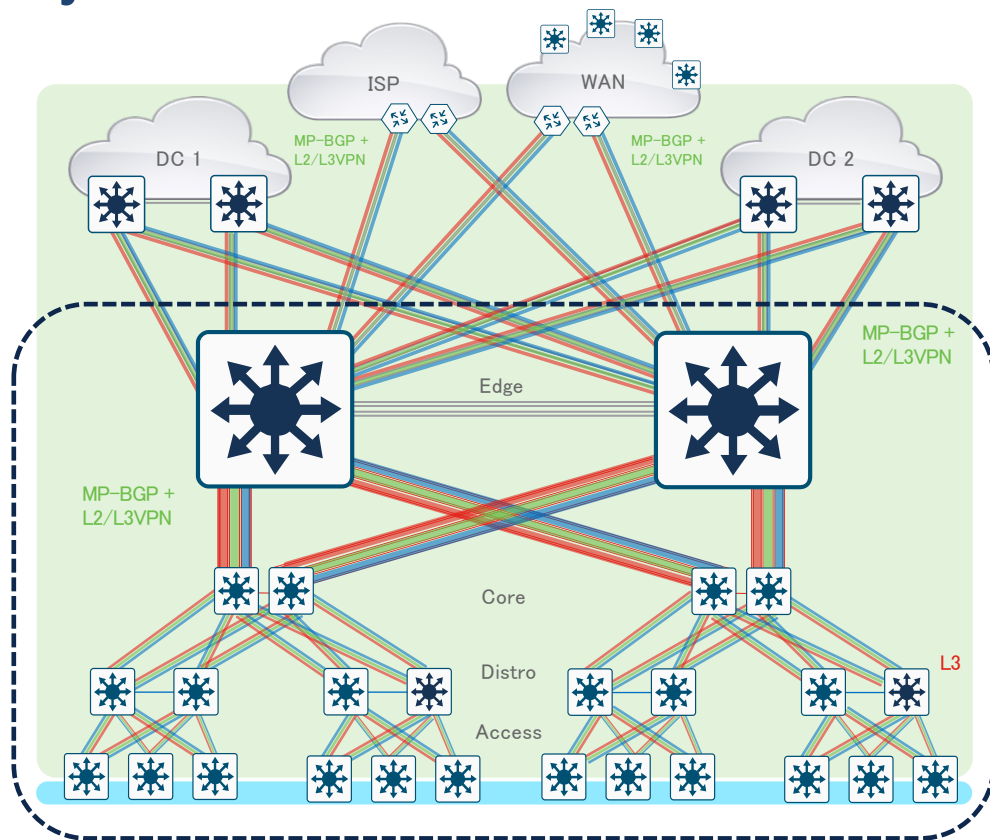
- Any IGP in the core (EIGRP/OSPF/ISIS)
- North (outside): L3 MP-BGP, MPLS/LDP, MVPN/mLDP
- South (inside): L3 IGP/BGP, PIM + MSDP

Multicast

- MDT Default and MDT Data to optimize Multicast traffic

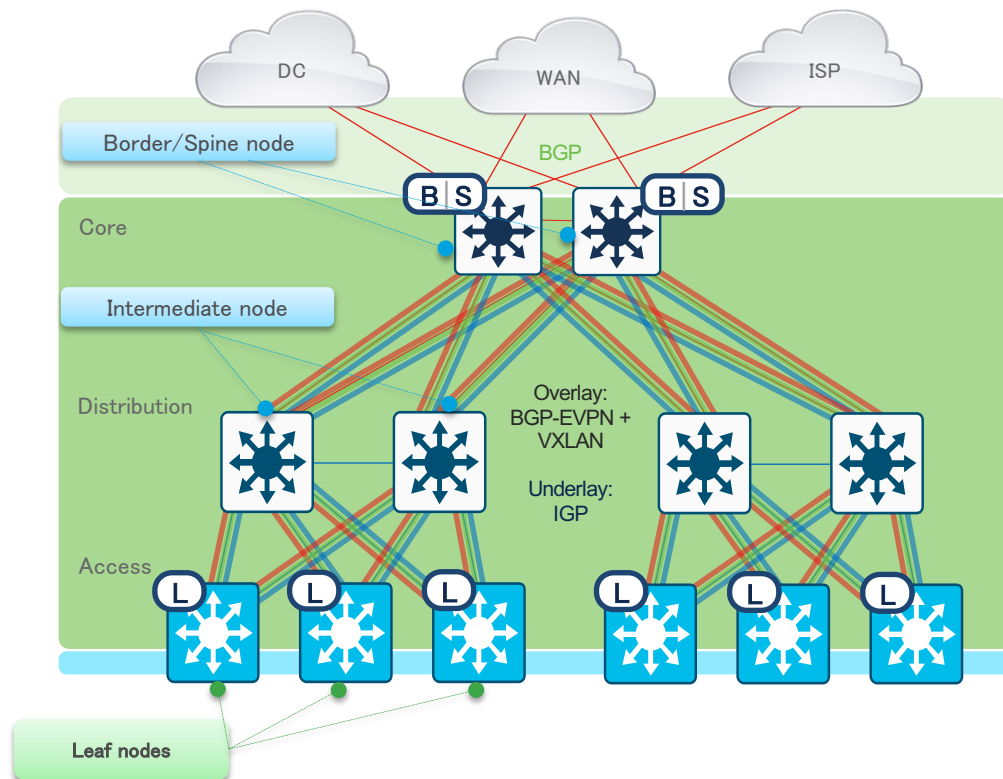
Traffic-Engineering

- RSVP for Traffic Engineering



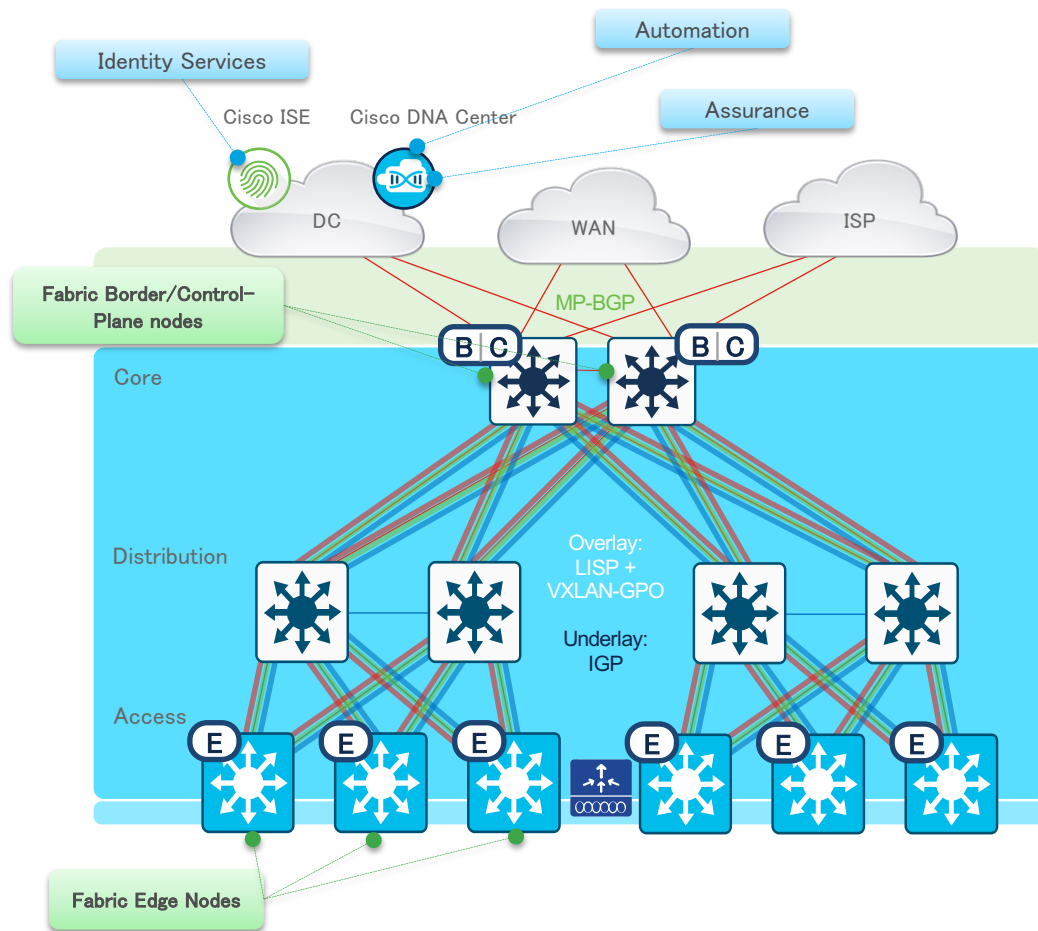
BGP EVPN Fabric with Catalyst 9k

- **Border** – A gateway point of between EVPN fabric and external network domain. Border Support: VRF-Lite, MP-BGP, 802.1Q, VPLS + EVPN Internetworking
- **Spine** – Reflects the L2/L3 VPN prefixes providing hierarchical neighbor peering, learning and distribution point. Spine Support: MP-BGP, Route-Reflector
- **Intermediate** – A Layer 2 or Layer 3 (IP/MPLS) Underlay network system providing basic transport and forwarding plane.
- **Leaf** – An origination and termination point of VXLAN enabled overlay network. Leaf Support: Distributed Anycast Gateway/Centralized Gateway, L2VNI/L3VNI, ARP Suppression, Ingress/Static Replication, Tenant Routed Multicast, Private Vlan's, Multi-homing, Ethernet Segment Identifier (ESI), VXLAN encapsulation.



Cisco SD-Access

- **Network Automation** – Simple GUI and APIs for intent-based Automation of wired and wireless fabric devices
- **Network Assurance** – Data Collectors analyze Endpoint to Application flows and monitor fabric device status
- **Identity Services** – NAC & ID Services (e.g. ISE) for dynamic Endpoint to Group mapping and Policy definition
- **Control-Plane Nodes** – Map System that manages Endpoint to Device relationships
- **Fabric Border Nodes** – A fabric device (e.g. Core) that connects External L3 network(s) to the SD-Access fabric
- **Fabric Edge Nodes** – A fabric device (e.g. Access or Distribution) that connects Wired Endpoints to the SD-Access fabric
- **Fabric Wireless Controller** – A fabric device (WLC) that connects Fabric APs and Wireless Endpoints to the SD-Access fabric

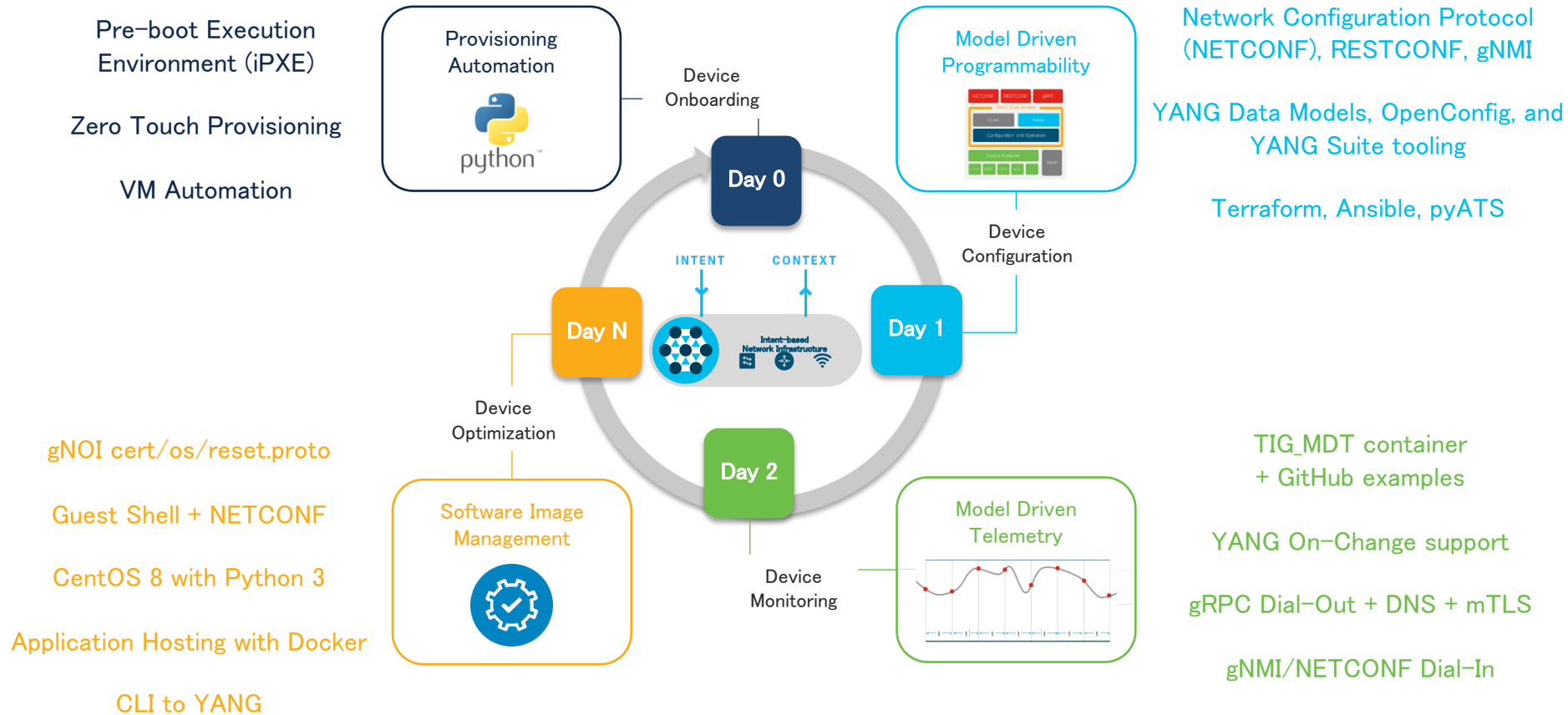




Catalyst 9000 Series

Programmability and Automation

IOS XE Programmability & Automation Overview

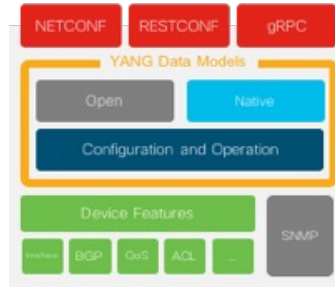


Programmability across Enterprise platforms

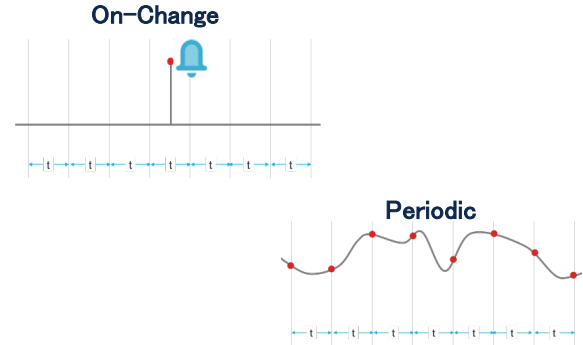
Application hosting
And containers



Model-based API and
programmability



Streaming
telemetry



Flexibility and control

Network
Analytics
Tools

Docker*

Monitoring
Tools

Network automation

Programmable
Interfaces

Candidate
Datastore

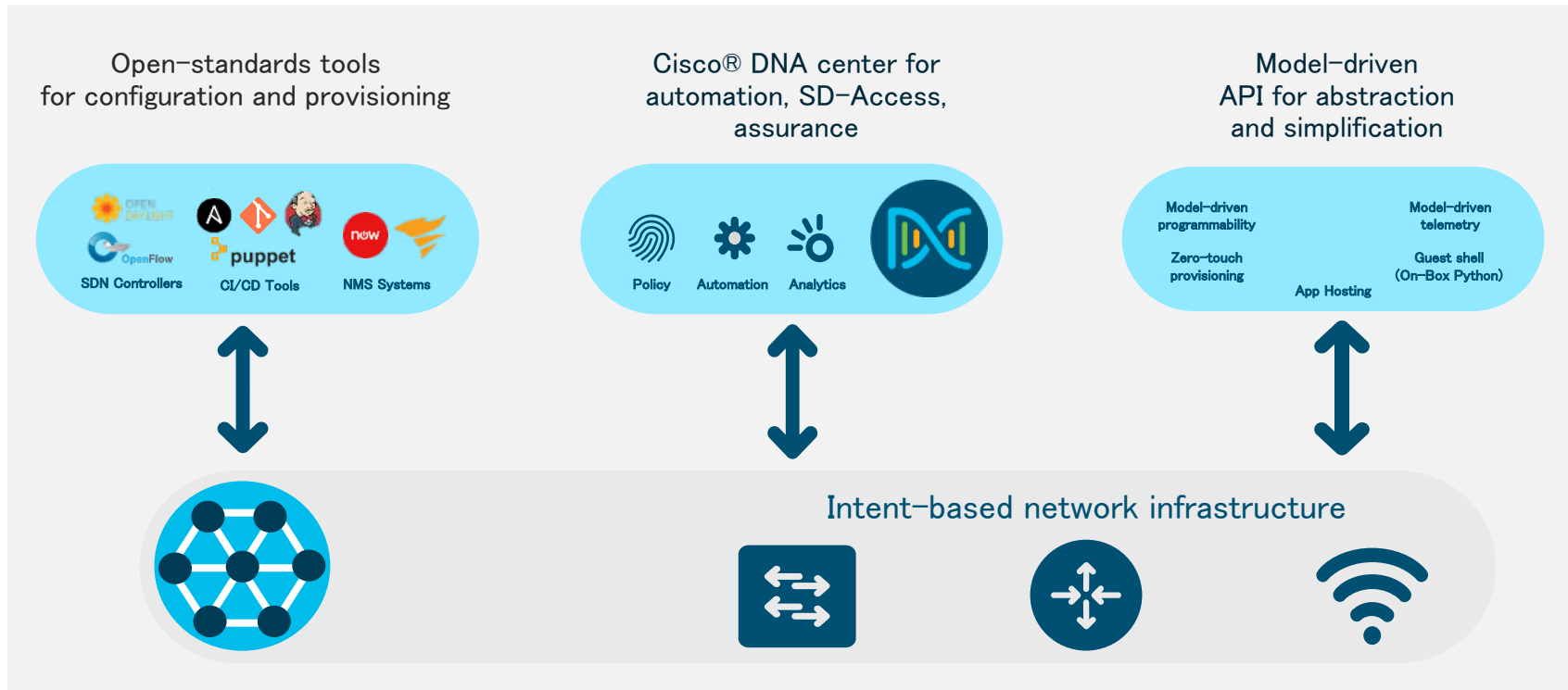
Consistent
Models

Monitoring the network

Real Time Monitoring
e.g. Grafana, Kibana

On-change &
Periodic Telemetry

Software Defined – Open, Programmable, Flexible Scaled operations

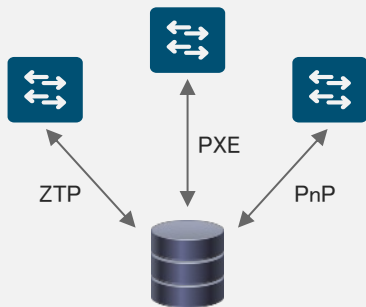


Catalyst 9000 – Simplify network operations open-standards APIs



Day 0

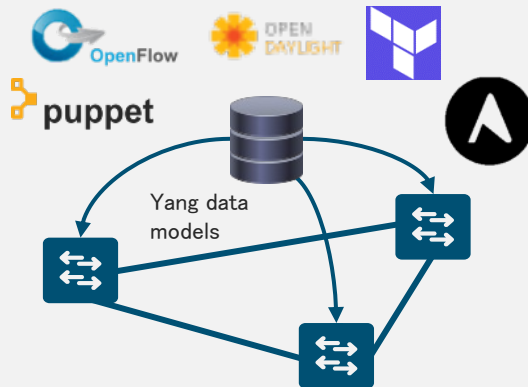
Device onboarding



Automatic device bring-up using industry-standard interface

Day 1

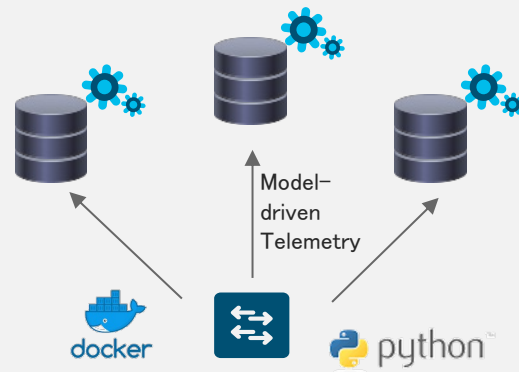
Model-driven configuration mgmt



Open-source tool support for configuration and provisioning

Day N

Monitoring, analytics, SW management



Model-driven telemetry for monitoring and analytics; Docker support for third-party app hosting, On-Box Python

Plug in to operational in minutes

Model Driven Telemetry (MDT) Interfaces

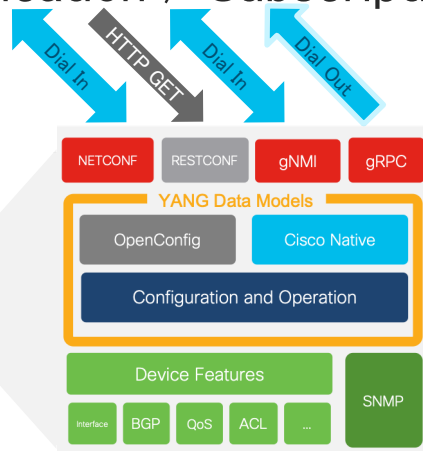
↔ Dial In: Collector establishes a connection to the device then subscribes to telemetry (pub/sub)

↔ Dial Out: Telemetry is pushed from the device to the collector based off configuration (push)

- Support for any YANG data
- Structured data
- XML, JSON & PROTO encoding
- Periodic and on-change
- Reduced device resource impact



Publication / Subscription



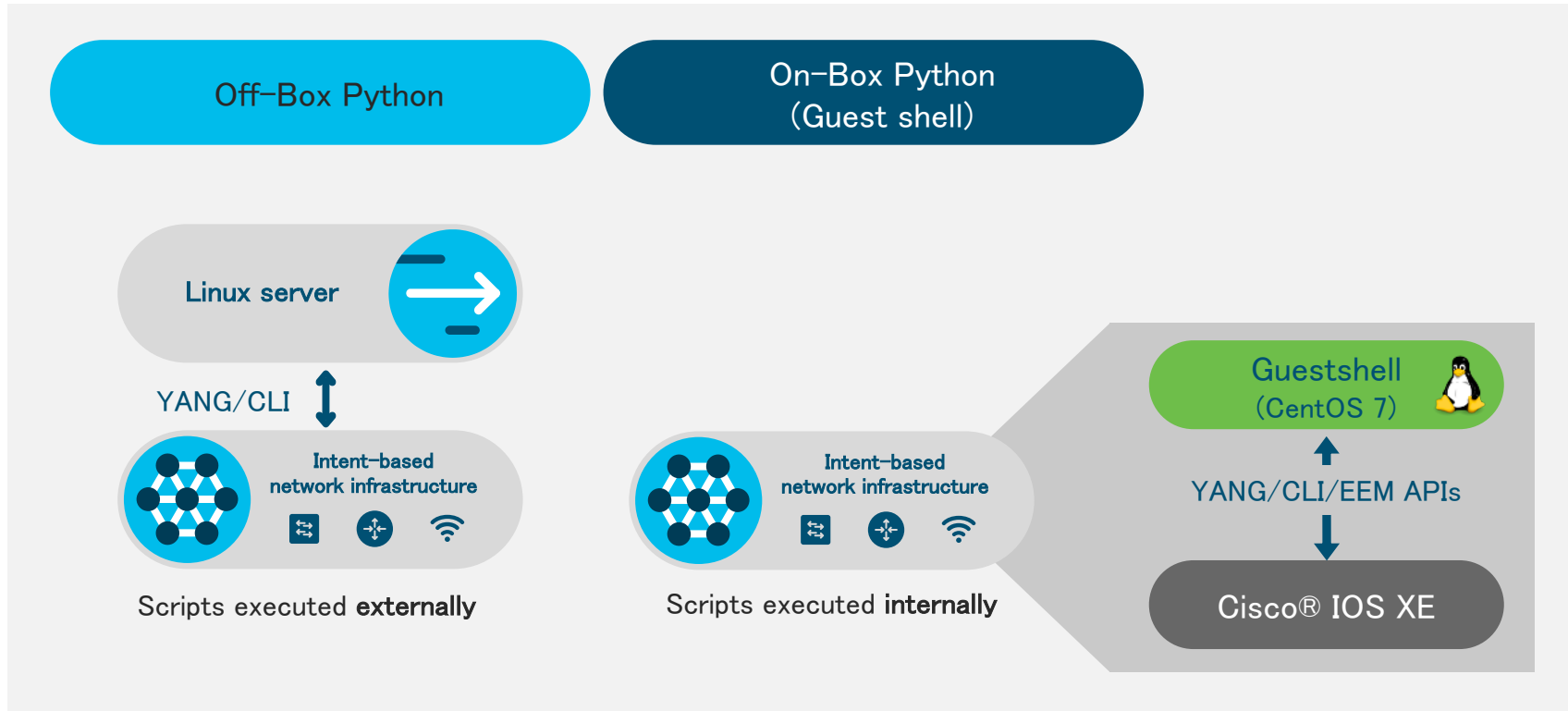
XML, JSON and kvGPB encoding

Consistent YANG data models between interfaces

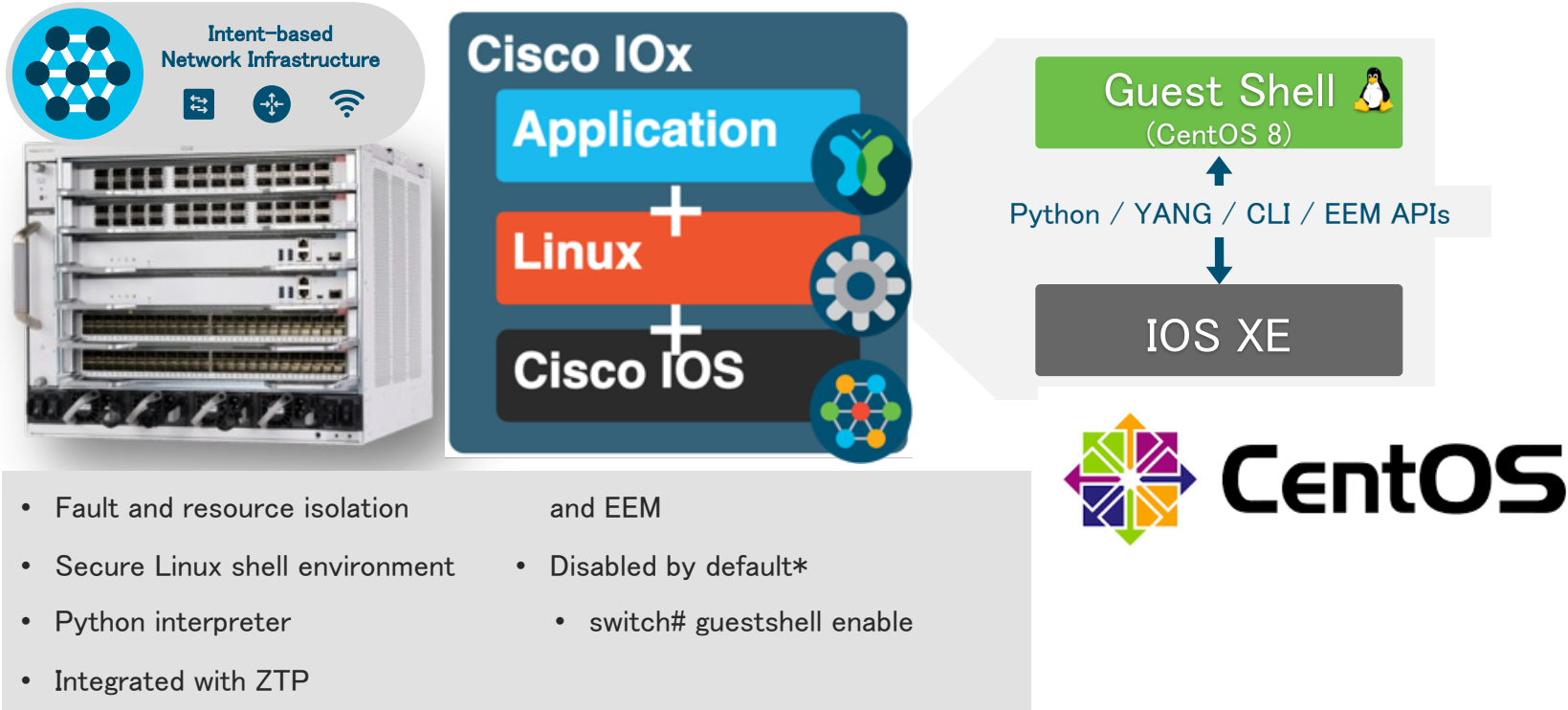
On-change event and time-based publication options

Export enriched, consistent, and concise data with context from devices for a better user and operator experience

Using Python with Cisco IOS XE devices



ZTP and Guest Shell with CentOS 8 and Python 3





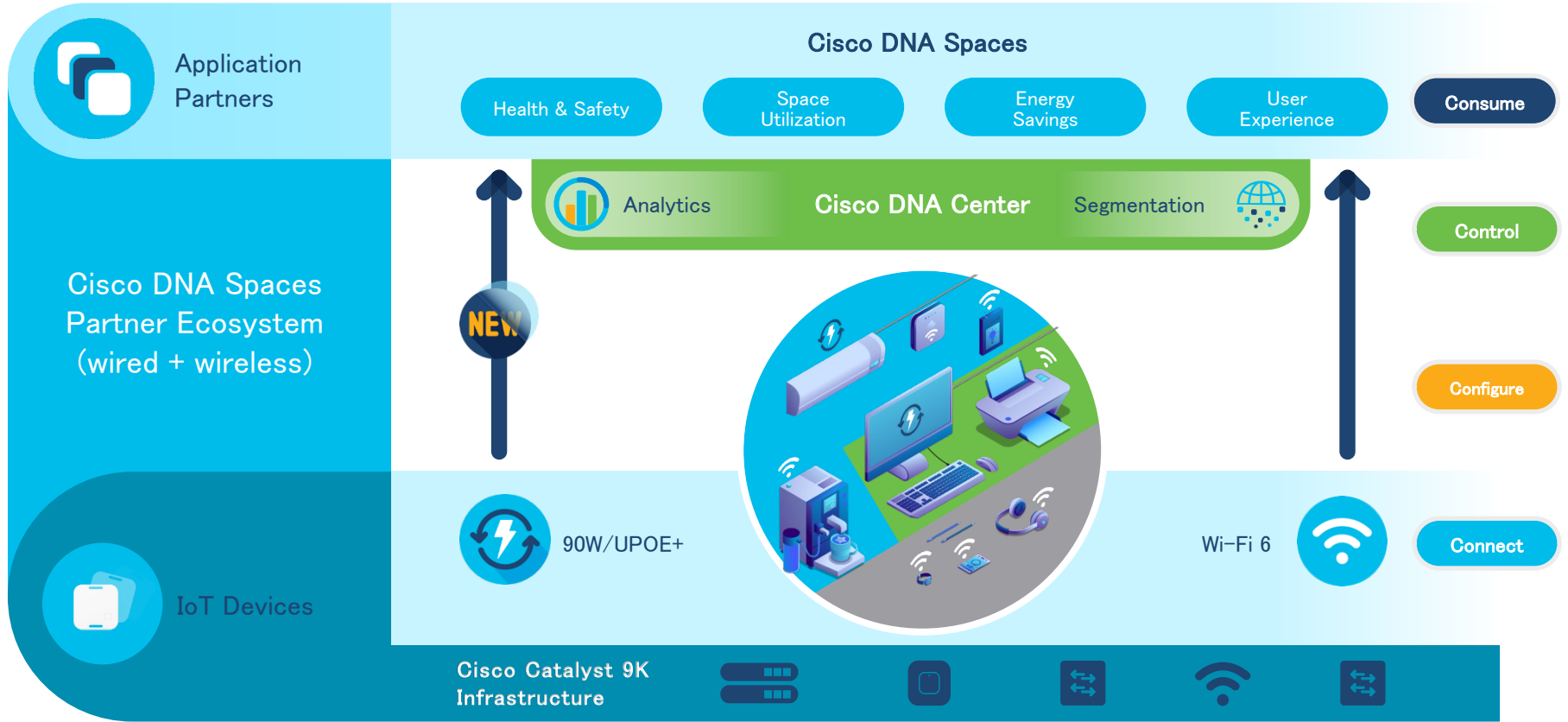
Catalyst 9000

Unique Innovations

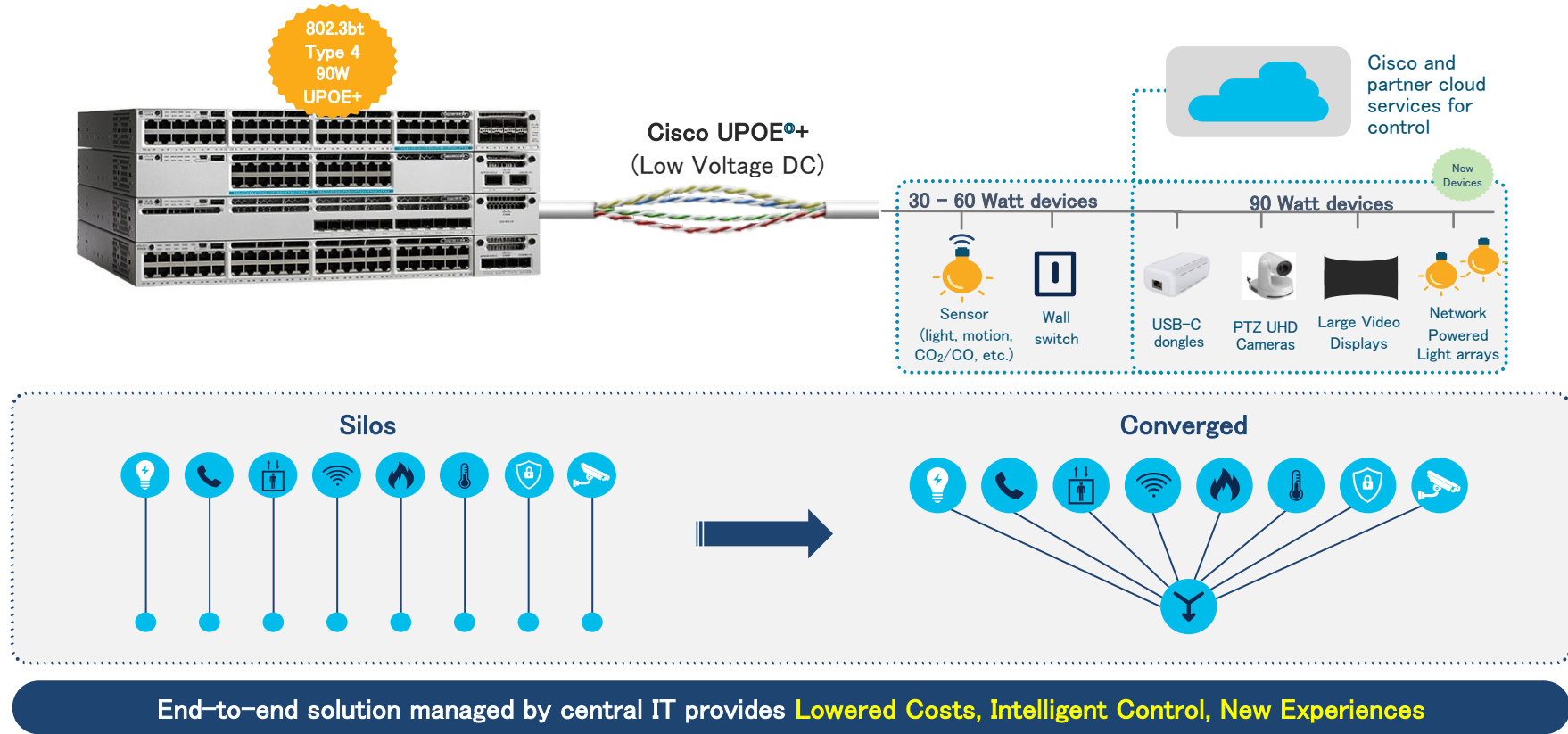
Catalyst 9000 Series

Catalyst Powered Smart Buildings

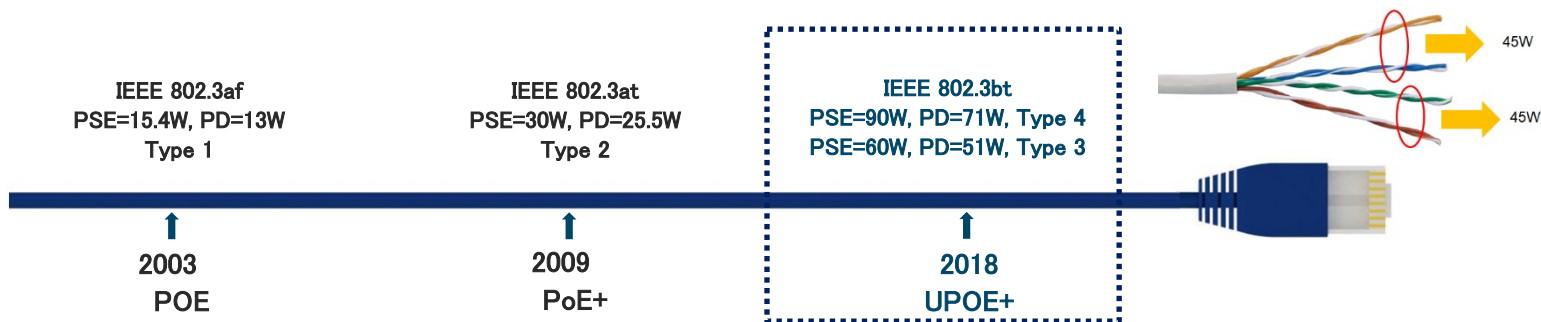
Cisco Smart Buildings Architecture



90W POE + IT/OT Convergence in Smart Buildings

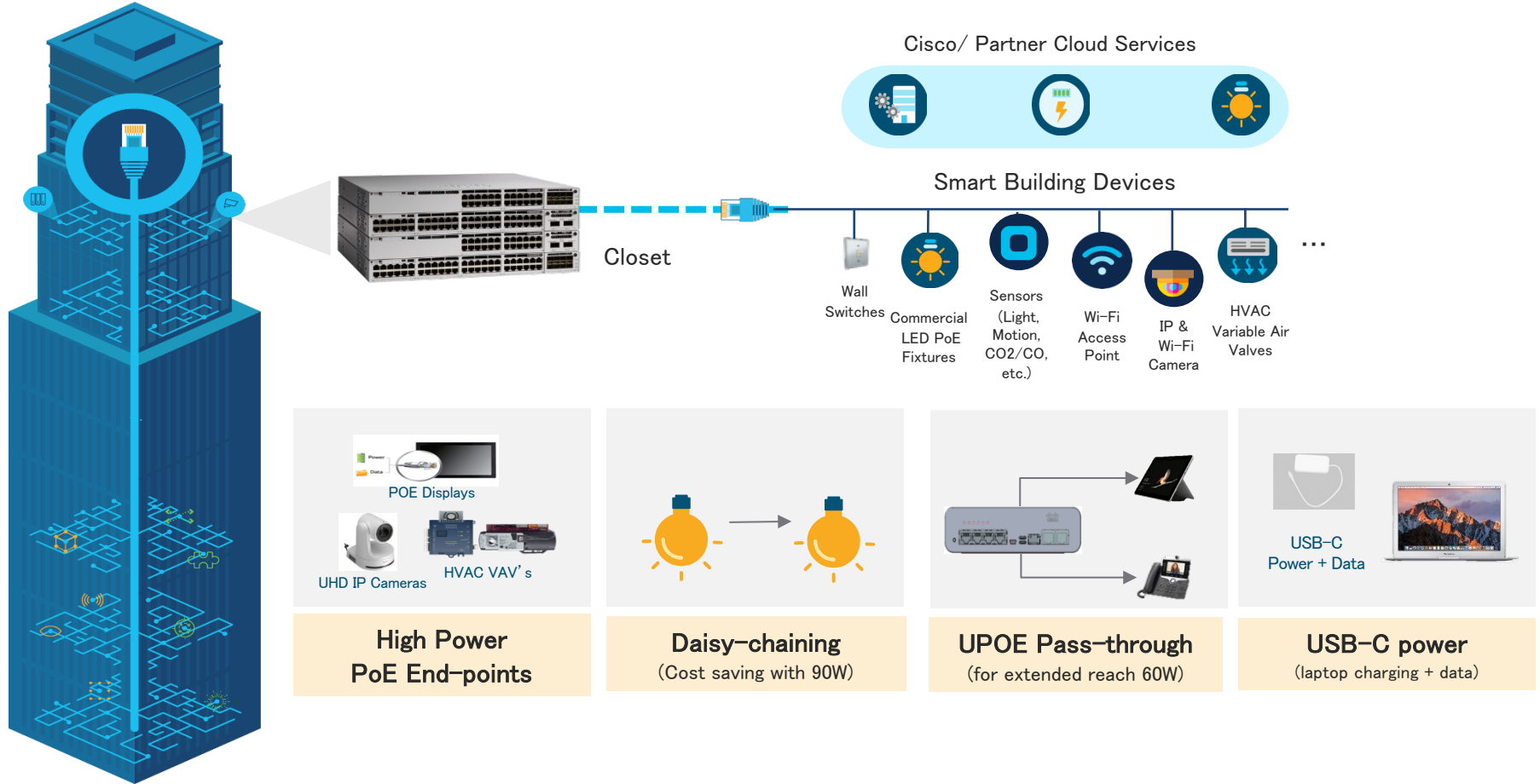


IEEE 802.3bt – 90W Power Over Ethernet



- Enables **Delivery of up to 90W** to a powered device, over four pairs of Category 5e and above cables
- Introduces **4 new Classes** for PDs – class 5 to class 8; PSE output 45W – 90W, PD input 40W – 73W
- Introduces **2 new Types** for PSEs & PDs – Type 3(60W) and Type 4 (90W)
- Enables support for **Dual Signature PDs & Single Signature PDs**
- Supports **Power Demotion** to handle scenarios where Type 4 PD is connected to a Type 3 PSE

90W UPOE+ Standard driving new IT/OT Use Cases



Cisco innovations in Power over Ethernet (PoE)

Deliver a robust low-voltage infrastructure

2-event classification

- Fast power negotiation without Link Layer Discovery Protocol (LLDP)
- Physical layer negotiation
< 1 second

Perpetual PoE*

- Uninterrupted PoE power during control plane reboot

```
Switch(config)# interface  
gigabitethernet2/0/1  
  
Switch(config-if)#  
power inline port perpetual-poe-ha
```

Fast PoE*

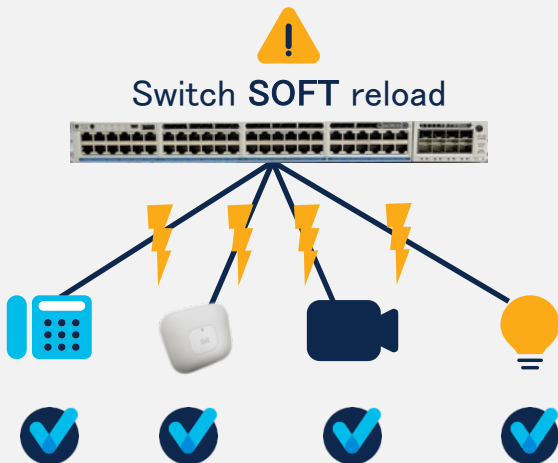
- Bypasses Cisco IOS® control plane boot
- Restores power to Powered Device (PD) within 30 seconds of power resumption

```
Switch(config)# interface  
gigabitethernet2/0/1  
*Switch(config-if)#power inline port  
perpetual-poe-ha  
Switch(config-if)#power inline port poe-ha
```



Perpetual PoE

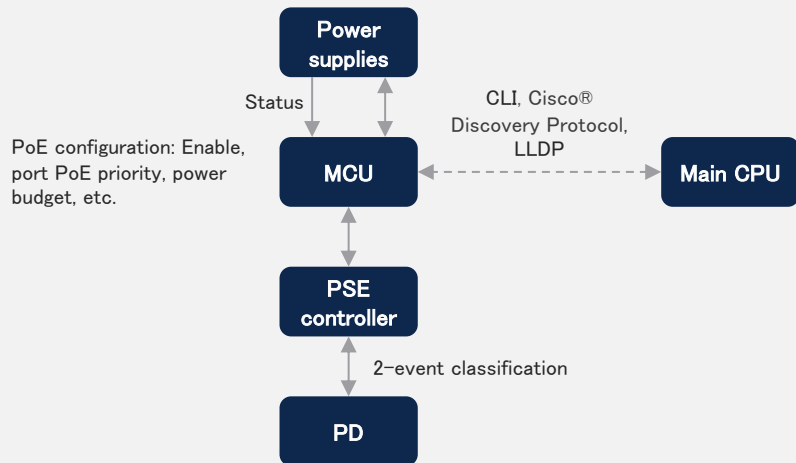
PoE devices connected to switch stay powered even on switch reload



```
Switch> enable
Switch# configure terminal
Switch(config)# interface
gigabitethernet2/0/1
Switch(config-if)#
power inline port perpetual-poe-ha
Switch(config-if)# end
```

- PoE devices continue to get **last negotiated power**
- Applicable to “soft” reload – Image upgrade, software crash, manual reboot
- Supported with stacking deployments
- Not applicable during power outage to switch or when front end processor is removed
- Not applicable when switch is in hibernation mode

Fast PoE



```
Switch> enable
```

```
Switch# configure terminal
```

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

```
Switch(config-if)#power inline port
```

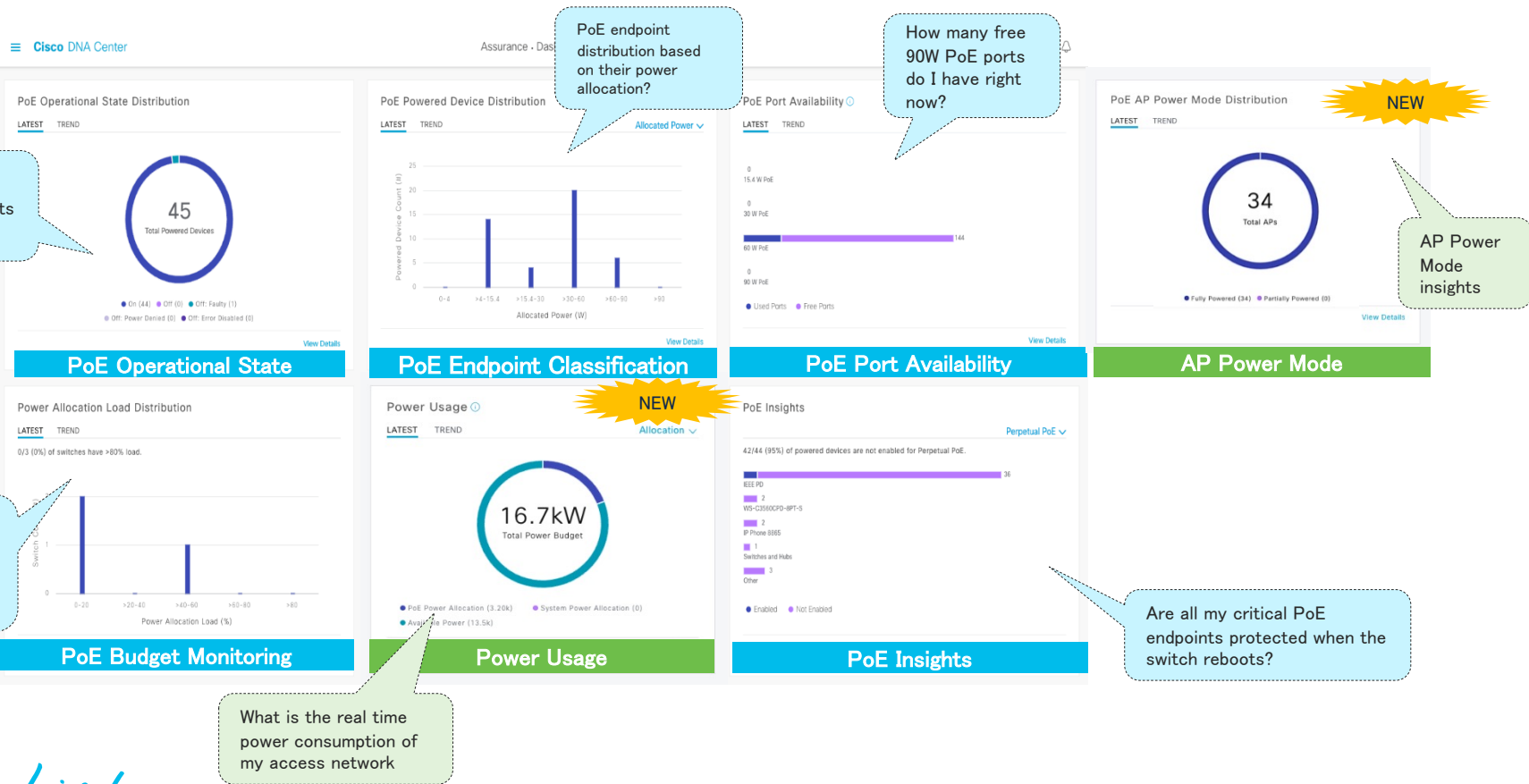
```
perpetual-poe-ha
```

```
Switch(config-if)#power inline port poe-ha
```

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

- Restores power to PD less than 30 seconds after restoration of power
- Works even before Cisco IOS® comes up
- Allocates last power (stored in NVRAM) drawn from PDs
- Works in stacking deployments

Assurance with Cisco DNA Center PoE Analytics



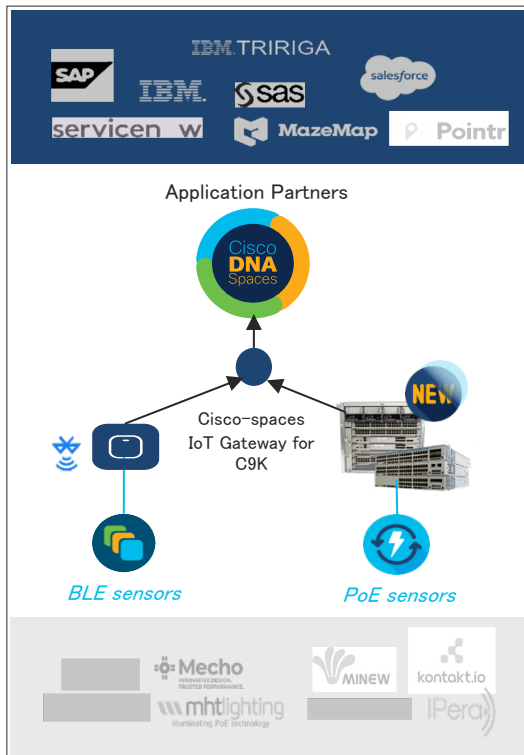
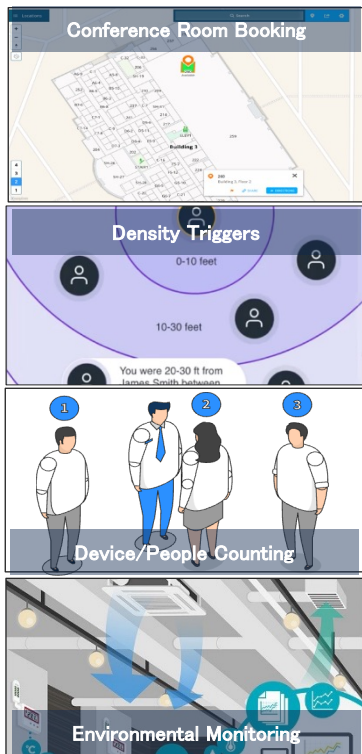
CISCO *Live!*

#CiscoLive

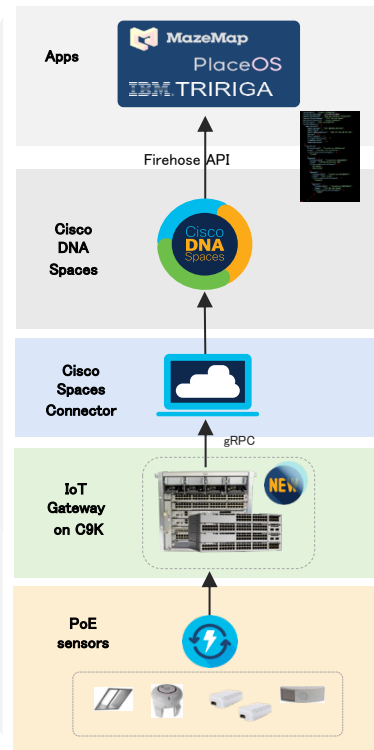
Cisco DNA Spaces IoT Gateway for C9K Switches

Democratizing Enterprise IoT

OUTCOMES



ARCHITECTURE



Wired IoT Gateway – Provisioning and Support

1

Add Switch

Connector

Wired DNA Spaces Con...

Switch Name

Enter Switch name

Switch IP

Enter Switch IP

Netconfig Username

Enter Netconfig username

Netconfig Password

Enter Netconfig Password

Enter Switch IP, Username & Password

Save & Close Save & Add Next Switch

2

Manage Connector

Enable IoT Services on Cisco DNA Spaces Connector

Use Manual Configuration to setup IoT Services in switches when the configuration can not be applied automatically.

Use the three dots action of Enable/Disable Stream to apply configuration changes to the switches.

Switch Name	Connector IP	Switch IP	Operation Status	Operation Log	Last updated
9300-standalone	172.26.202.170	172.26.202.204	NOT INITIATED	Successfully set config	May 21, 2021, 3:19:27 PM
C9300-stack	172.26.202.165	172.26.202.166	SUCCESS	Successfully set config	May

First Previous 1 Next Last

Manage Switch

Set in IoT Services stream authentication and certificate to allow switches to connect with the Cisco DNA Spaces Connector

Disable Service Enable Service

Sample configuration

3

Configure Switch

Destination SPAN VLAN

Enter the destination SPAN VLAN

Destination SPAN VLAN IP address

Enter the destination SPAN VLAN IP address

Source SPAN VLAN list

Enter the source SPAN VLAN list

Use comma as a separator for multiple vlan

Monitor SPAN origin IP address

Enter the Monitor SPAN origin IP address

On application SPAN IP address

Enter the On application SPAN IP address

Application DNA Spaces Connector VLAN

Enter the application DNA Spaces Connect

☐ Use DHCP

On application IP address

Enter the On application IP address

On application netmask

Enter the On application netmask

On application gateway address

Enter the On application gateway address

Cancel Configure



IoT Gateway

- Hosted as a docker container
- 1 VCPU, 1GB RAM
- Life cycle management via Spaces Connector



Available on Catalyst 9000 series UPOE/UPOE+ switches
Catalyst® 9300/L and Catalyst 9400

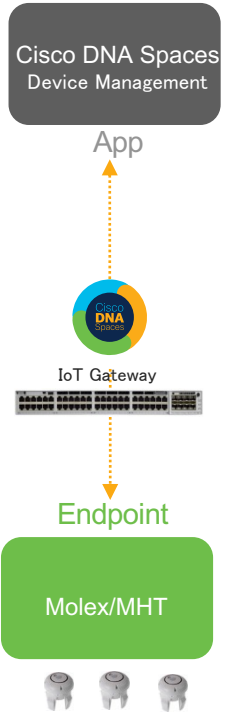
Cisco DNA Spaces Extend License bundled
with Cisco DNA Advantage

Indoor IoT Services: Environmental Monitoring

The screenshot displays the Cisco DNA Spaces interface. On the left, a sidebar shows navigation options: Home, **Devices**, Groups, Policies, and Settings. Under 'Devices', there are tabs for Floor Beacons, AP Beacons, and **Wired Devices** (highlighted with a dashed box). Below these, a filter for 'All Campuses' shows 'All Wired Sensors' with a count of 2. The main content area is titled 'Wired Device - 68:27:19:d1:5c:40' and includes a timestamp 'As of: Apr 26th, 2022 01:2'. It contains two sections: 'Wired Device Information' and 'Sensor Information'. The 'Wired Device Information' section lists details such as Label (MHT Sensor), Device ID (11445), Node Mac Address (68:27:19:d1:5c:40), Last Seen (2022-04-14T20:34:30.891Z), Location (Global->SJC03->Floor 2), Group (-), Make (-), and Vendor (-). The 'Sensor Information' section, titled 'Wired OT Endpoint Sensor Data on DNA Spaces', shows four sensor cards: Pp1 (50), Pp2 (50), Occupancy (Occupied), and Temperature (72 Fahrenheit). Each card includes an update timestamp from April 14th, 2022. A dashed box highlights the 'Wired Devices' tab and the sensor data section.

Device ID	Node Mac Address	Label	Last Seen
11445	68:27:19:d1:5c:40	MHT Sensor	Apr 14th, 2022 01:34:15 PM 12 days ago
11438	68:27:19:d1:5c:a1	MHT Sensor	Apr 14th, 2022 12:42:5 PM 12 days ago

Sensor	Value	Updated at
Pp1	50	Apr 14th, 2022 01:34:15 PM 12 days ago
Pp2	50	Apr 14th, 2022 01:34:15 PM 12 days ago
Occupancy	Occupied	Apr 14th, 2022 01:34:15 PM 12 days ago
Temperature	72 Fahrenheit	Apr 14th, 2022 01:34:15 PM 12 days ago



Smart building partners

Architecture and Engineering (A&E)

Role: Line of Business Facing Partners, Digital Experience & Integration Services

Care About: Expand consulting services for delivering end-to-end solutions



Independent Software Vendors (ISV)

Role: Deliver analytics, IoT Platform and LoB applications validated on Cisco network

Care About: Access to Cisco partner/sellers and sell more SW licenses



Global Industry Partner (GIP)

Role: OEM, Embed or Embrace Cisco Technology as key component to their offering, Industry thought Leader

Care About: Grow vertical solutions, drive consistent roadmap for customers



Independent Hardware Vendors (IHV)

Role: Embed sensors, devices, SW into solution

Care About: Sell their products/services in our reference architecture



Systems Integrator (SI)

Role: Deliver large-scale strategy and Business transformation services

Care About: Consulting services engagement retail and IoT use cases



IT Resellers

Role: Sell Cisco infrastructure & professional services aligned to Retail

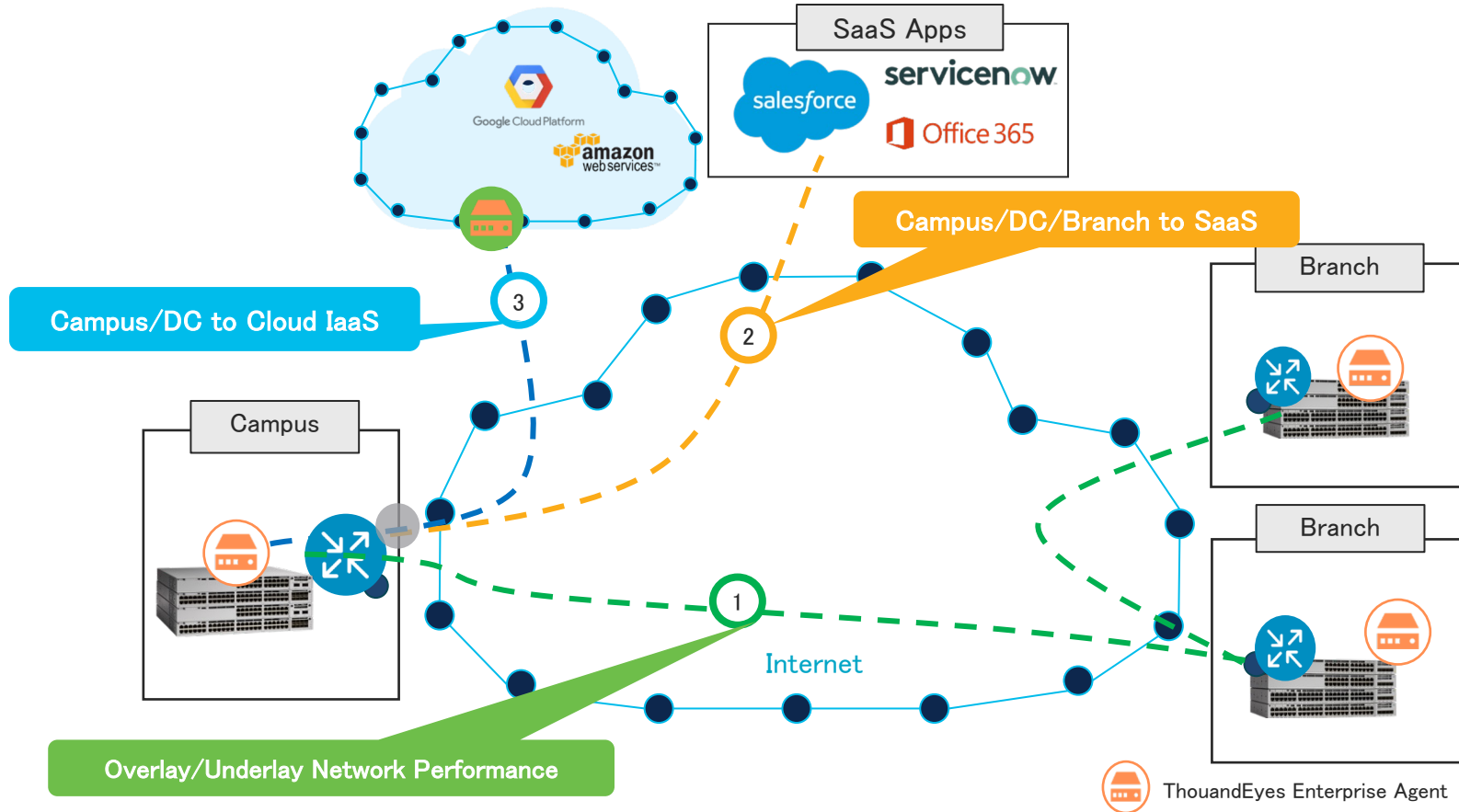
Care About: Develop long term Client relationship expanding product & services revenue.



Catalyst 9000 Series

Service Assurance with ThousandEyes

Service Assurance with ThousandEyes

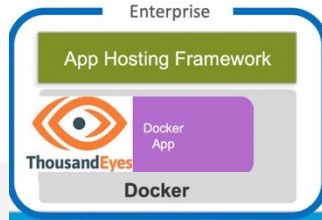


ThousandEyes Enterprise Agent

ThousandEyes now included with Cisco DNA licenses

New and existing Catalyst 9000 switches now include ThousandEyes service assurance

App hosting: no extra hardware



- Run ThousandEyes agent natively on flash of 9300/9400 switches
- Out of the box access to ThousandEyes for new switches

Cisco DNA subscription benefits

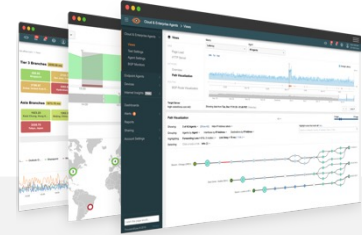


Cisco DNA
Essentials
Cisco DNA
Advantage
Cisco DNA
Premier



- Includes 22 x ThousandEyes Units for a month
- Pool entitled test capacity to deploy anywhere within your network

Data Visualization



- License to ThousandEyes SaaS-based management platform
- Access to Dashboards, alerts and reporting tools



Campus
connectivity



Modern WAN



Application
experience

*Choose from a menu of several networking, web and voice tests
Browser-based tests need the use of SSD and consume more ThousandEyes units

C9K Hosted ThousandEyes Enterprise Agent



ThousandEyes Enterprise Agent

Agent installed in Flash

Test Included:

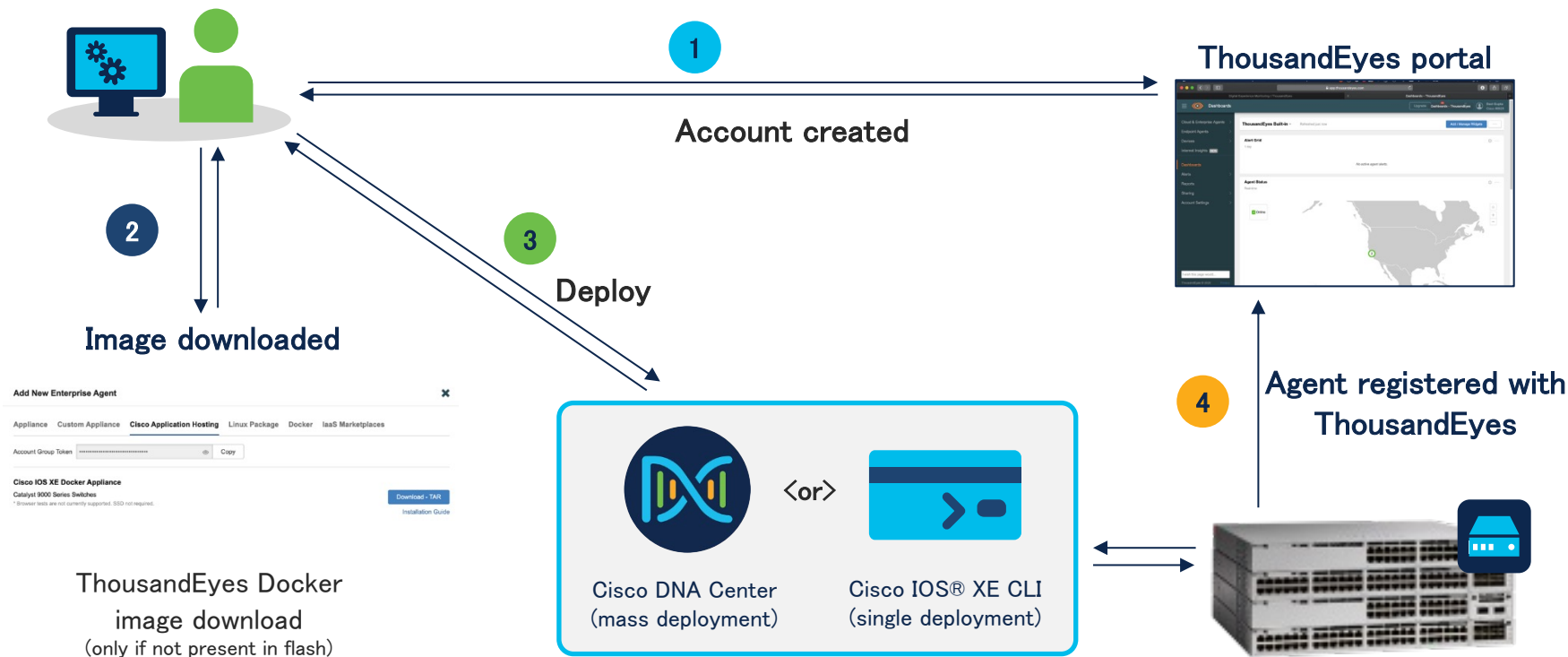
- **Web** – HTTP Server, FTP Server
- **DNS** – DNS Server, DNS Trace, DNSSEC
- **Network** – Agent to Agent, Agent to Server
- **Voice** – SIP Server, RTP Stream, Voice Call

Agent installed in SSD

Test Included:

- **Web** – HTTP Server, FTP Server
- **DNS** – DNS Server, DNS Trace, DNSSEC
- **Network** – Agent to Agent, Agent to Server
- **Voice** – SIP Server, RTP Stream, Voice Call
- **BrowserBot** – Page load & Transaction (IOS-XE 17.6.1 required)

ThousandEyes deployment workflow



Catalyst 9000 Series

Cisco DNA Service for Bonjour

Multi-Vendor Support with a Global Customer Base

Media

SONY



Google

harman/kardon*



AVB

Audinate

BARCO

Panasonic®

visual engineering
LIGHTWARE

Video/Conferencing

 webex
by CISCO

zoom

 **CRESTRON**

And More!

Global Enterprise Customers *

7000+



Enterprise



Healthcare



Education



Financial



Public Sector



Manufacturing



Hospitality



Media



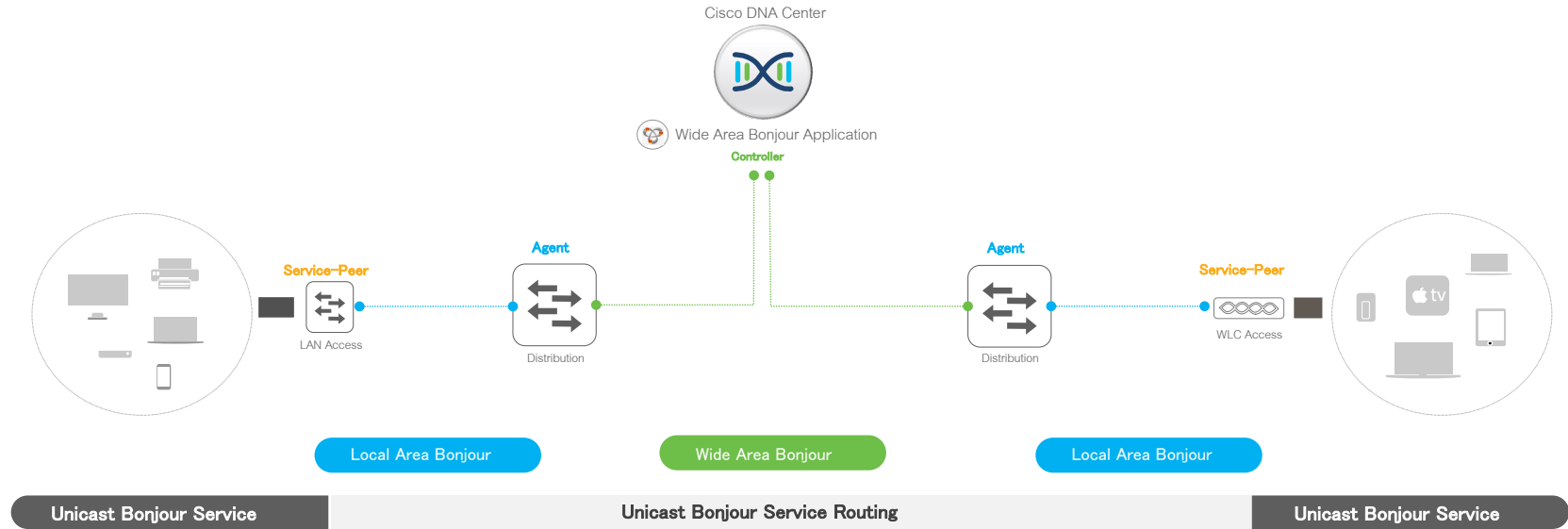
Transportation



Retail

*App Downloads Since 9/19

Cisco DNA Service for Bonjour



Hierarchical

- 2-Tier Service Routing
- Structured Role and Function
- mDNS Flood-Free Networks



Secure

- Policy-Based Service Management
- IT controlled deterministic services
- Protected network flood boundaries



Location

- Deep granular location-based service
- Location-aware Wide Area Bonjour
- Flexible design any Enterprise Network



Performance

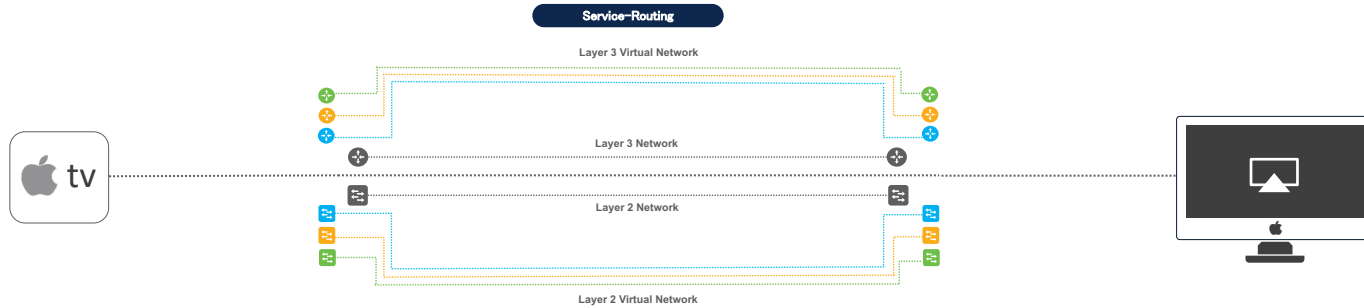
- Improved system performance
- Increase network bandwidth
- Flexible design any Enterprise Network



Battery Life

- May assist improve battery-life
- On-demand Query response mode
- Increase Wireless network bandwidth

Fully Routable Bonjour Solution



Service-Routing

- Routes Non-Routable
- Enterprise Grade Solution
- Seamless Integration
- Transparent Experience



Use Case



Cisco DNA-Center
Cisco Catalyst 9000 Series Switches
Cisco Catalyst 9800 WLC



Apple Computers and iPad
AirPrint
KeyNote
Apple TV
Apple Classroom
macOS File | Screen share



Challenges

Limited services boundaries. Classic Printers
Scale, Performance and Resiliency
Location-based Services Distribution



Solution

Wide Area Bonjour with AirPrint Helper
Distributed Service with granular location
Intuitive User experience



Outcome

Seamless Integration
Improved User productivity
End-to-End service-oriented network



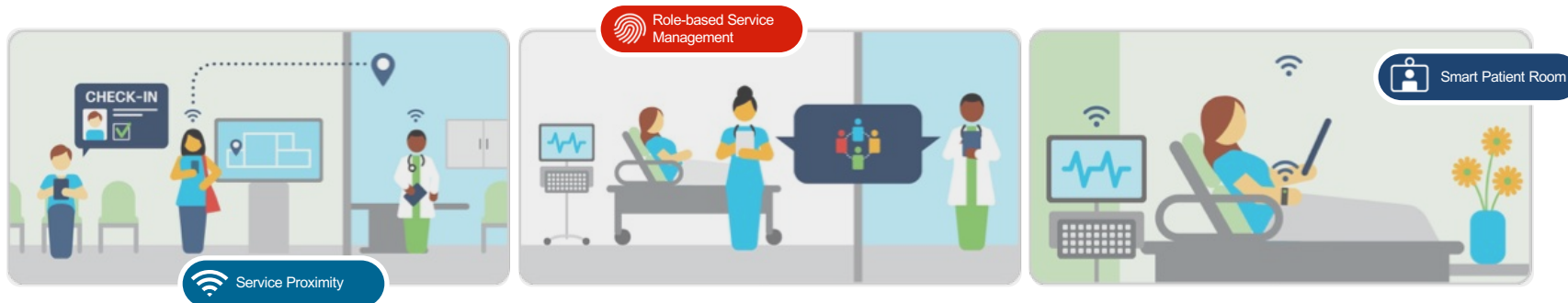
Use Case



Cisco DNA-Center
Cisco Catalyst 9000 Series Switches
Cisco Catalyst 9800 WLC



Apple Computers and iPad
AirPrint
Apple Handoff
Apple TV
macOS File | Screen share
Mobile Printing



Challenges

- Role-based segmented Bonjour service
- Granular service location boundaries
- Personalized Patient service



Solution

- Secure Wide Area Bonjour for Overlay Networks
- Multi-level deep service network boundaries
- Network + OS service sharing security



Outcome

- Seamless Overlay Network Integration
- Improved Staff, Patient & Guest experience
- Secure service-rich modern healthcare network



Use Case



Cisco DNA-Center
Cisco Catalyst 9000 Series Switches
Cisco Catalyst 9800 WLC



Apple Computers and iPad
AirPrint
Apple Handoff
Apple TV
Smart Device Management
macOS File | Screen share
Mobile Printing
Video Conferencing



Challenges

- Role-based segmented Bonjour service
- Multi-vendor Bonjour service integration
- Scale, Performance and Resiliency



Solution

- Secure Wide Area Bonjour for Overlay Networks
- Industry-standard Bonjour gateway function
- High performance and resilient services gateway



Outcome

- End-to-End service-oriented network
- Enterprise-grade service routing solution
- Secure, Scalable and Seamless in any network



	Cisco DNA Service for Bonjour	Wide Area Bonjour App	Catalyst 9600	Catalyst 9500	Catalyst 9400	Catalyst 9300	Catalyst 9200	Catalyst 9800 WLC	Nexus 9000
Platform Series	DN2-HW-APL DN2-HW-APL-L DN2-HW-APL-XL		Any	Any	Any	Any	Any (Including CX)	Any	Nexus 9300
Minimum Software	2.2.2.0	2.2.2.0	17.6.2 X-Series : 17.10.1	17.6.2 X-Series : 17.10.1	17.6.2 Sup-2 : 17.10.1	17.6.2 X-Series : 17.10.1	17.11.1	17.6.2	10.2(3)F
Supported Role	Platform	Controller	SDG-Agent Service-Peer	SDG-Agent Service-Peer	SDG-Agent Service-Peer	SDG-Agent Service-Peer	SDG Service-Peer	Service Peer	SDG Agent
Wide-Area Support	—	●	●	●	●	●	Roadmap	—	●
Local-Area Support	—	●	●	●	●	●	●	●	●
Service Scale	—	150000	15000	12000	10000	7500	1000	14000	4500
Software License									
Local and Wide-Area License	—	—	DNA- Advantage	DNA- Advantage	DNA- Advantage	DNA- Advantage	DNA- Advantage	DNA- Advantage	Advantage
System Mode									
Cluster	HA Cluster	Multi-Instance	StackWise Virtual	StackWise Virtual	StackWise Virtual	StackWise-480	StackWise-160	HA Cluster	vPC Domain
Default	Single Host	Single Instance	Standalone	Standalone	Standalone	Standalone	Standalone	Standalone	Standalone
Wired/Wireless Network Support									
Wired – Multilayer	Required	●	●	●	●	●	●	—	●
Wired – Routed Access	Required	●	●	●	●	●	●	—	●
Wireless – Local Mode	Required – Distributed Design Optional – Collapsed Design	●	●	●	●	●	●	●	●
Wireless – FlexConnect Mode	Optional	●	●	●	●	●	●	Switch mDNS Gateway	—
Wireless – Catalyst 9100 EWC, Meraki, Multi-Vendor	Optional	●	●	●	●	●	●	Switch mDNS Gateway	—
Overlay Network Support									
Cisco SD-Access	Required	●	●	●	●	●	—	—	—
Cisco SD-Access Wireless	Required	●	●	●	●	●	—	Switch mDNS Gateway	—
BGP EVPN VXLAN	Required	●	●	●	●	●	●	—	●
MPLS VPN	Required	●	●	●	●	●	●	—	—
Multi-VRF	Required	●	●	●	●	●	●	—	●
Operation									
Assurance	—	●	—	—	—	—	—	—	●
SNMP MIB Support	—	—	●	●	●	●	●	—	—

Catalyst 9000 Series

Precision Time for Audio & Video

Audio Video Bridging (IEEE 802.1BA)

Fewer cables and a transparent collaboration experience

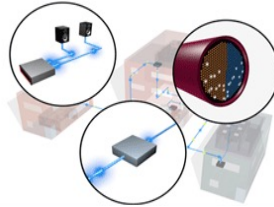
Traditional AV network



Quality of experience

- Improved time-synchronized audio/video (latency <2 milliseconds)
- Standard QoS to simplify and automate switch configuration
- Ability to scale with higher bandwidth (1G/10G)

Digital AV network (Dante, Cobranet, AVB)



Scalability

- Allows device interoperability
- Eliminates proprietary networks
- Increases flexibility to add new media applications

Media on AVB over Cisco hardware



Lower TCO

- Lower cost and complexity (60% CapEx and 35% OpEx savings) over 5 years*
- Added functionality and control
- No proprietary license fee per endpoint

AVB not supported on Cisco Catalyst 9400 and 9300 Series in StackWise-480

*Source: Axon and Axis report.

Digitization of Audio/Video with Catalyst Switches

Audio Video Bridging – Now supported on all C9500's

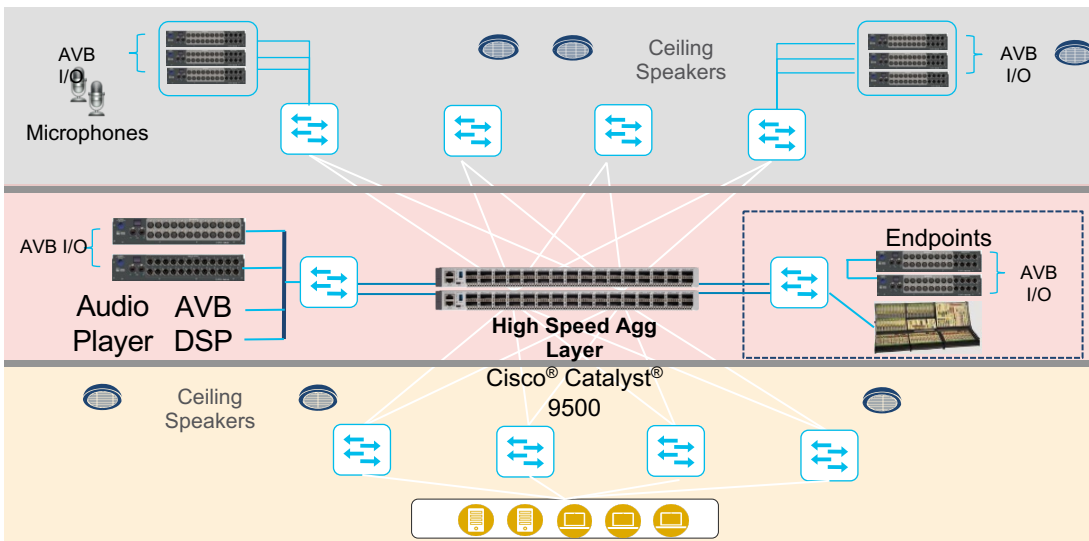
Ecosystem Partners

biamp.

AudioScience



Meyer Sound



AVU
Certified

Network
Advantage

Catalyst 9300



All SKUs

Catalyst 9500

C9500-16X
C9500-40X
C9500-24Q
C9500-12Q



Catalyst 9500

C9500-24Y4C
C9500-48Y4C
C9500-32QC
*C9500-32C

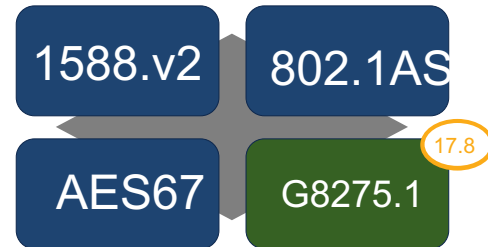
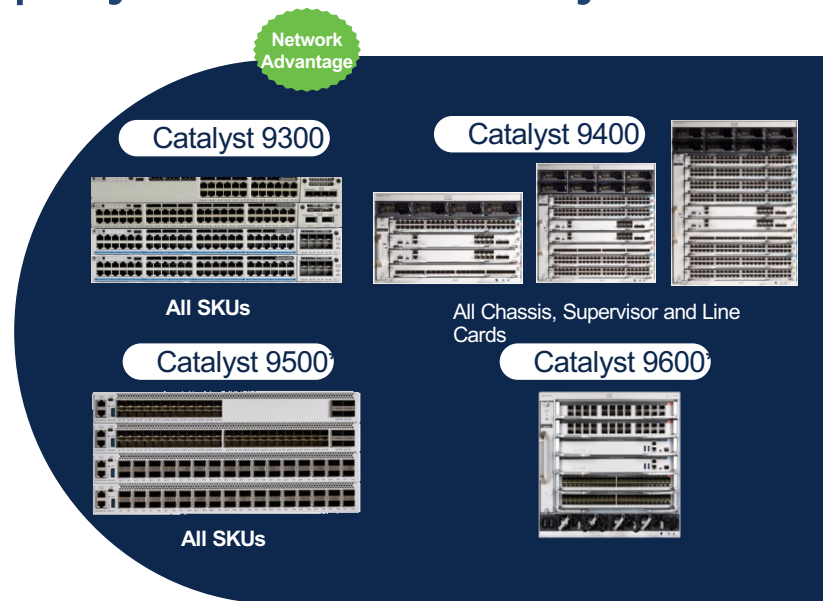
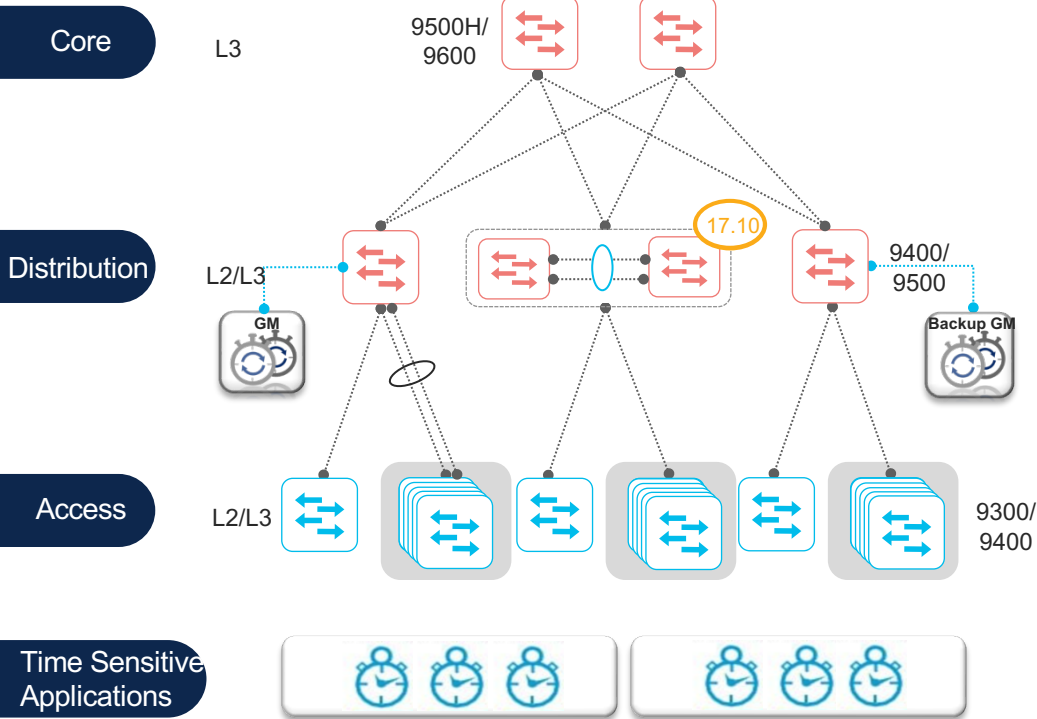


NEW

* AVB supported on first 16 ports

Expanding C9K Precision Time Deployment Flexibility

With Stackwise Support and G8275.1 Profile



* 9500X/9600X – HW capable

Where are things going?

Glimpse into the Future

- WLC to Core SVI scale growing $\geq 256K$ MACs
- WIFI6E, 5G and IOT Devices & Sensors

- Collapsed LAN Core + SP/WAN Edge designs
- IPv4 GRT is $\geq 850K$ and IPv6 GRT is $\geq 50K$

- Flexible L2/L3 multicast group allocation in CEM
- Hardware Replication and specialized QoS

- MVPN MDT with Profile 0, 1, 12 & 13
- NG-MVPN with Profiles 14 & 15

- User defines IP/masks to simple OG/SG name
- OGID/SGT labels are stored in Exact Match table

- Only the Permit/Deny ACEs stored in TCAM
- OG/SGACL with same ACEs can reuse entries

[illegible]

- P2P LAN MACsec with 802.1ae
- P2MP WAN MACsec with 802.1q ClearTag

- P2P SVTI IPsec with IKEv2, ESP
- P2MP DVTI IPsec with IKEv2, ESP

The diagram illustrates two network architectures. On the left, 'Many Flows to Single Linklet' shows a single linklet (a blue box) receiving multiple flows (represented by different colored arrows). Some flows are blocked, indicated by red 'X' marks. On the right, 'Guaranteed Delivery & Virtual Resource' shows a virtual resource (a green box) with 8GB HBM and 80MB S/M's. It receives multiple flows (represented by different colored arrows) and guarantees delivery and virtual resource allocation. The diagram shows that the virtual resource can handle multiple flows simultaneously, unlike the single linklet.

- Eliminate Head-of-Line Blocking at egress
- Support for logical (e.g. sub) interfaces with HQoS

- Local buffers for low-latency strict-priority queuing
- HBM buffers for burst absorption & guaranteed delivery

The diagram illustrates the Cisco Software-Defined Access & Zero Trust Network architecture. At the center is a cloud icon labeled 'Cisco Cloud'. Surrounding it are several interconnected components: 'Segmentation' (top), 'Secure Access' (top right), 'Rapid Threat Containment' (right), 'Continuous Trust Assessment' (bottom right), 'Endpoint Visibility' (bottom left), 'Trust Analytics' (top left), and 'Endpoint Analytics' (left). Each component is represented by a circular icon with a corresponding label. Below the central cloud icon is a banner that reads 'Cisco Software-Defined Access & Zero Trust Network'. The entire diagram is set against a dark blue background with a grid pattern.

- L2/L3 virtual overlay, with macro & micro segments
- Full automation, assurance & policy with Cisco DNA

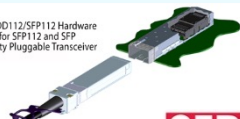
- Hardware Flexible NetFlow and IPFIX
- AVC/NBAR2 and SDAVC/CBAR to ID clients & apps

Speeds and Feeds



25/50G → 100G SFP

NEW
SFP-DD/SFP-DD112/SFP112 Hardware
Specification for SFP112 and SFP
Double Density Pluggable Transceiver
Revision 5.1

**SFP-DD**

SFP-DD = Two SFPs in One

- Great Innovation
- SFP-DD Specification released on September 14, 2017 at EICC
- see sfp-dd.com
- SFP-DD packs two SFPs in one cage
 - Similar to how QSFP-DD is backward compatible to QSFP, SFP-DD supports SFP+ — VERY IMPORTANT
- 
- The diagram illustrates the SFP-DD module and its connector. On the left, a 3D perspective view of the SFP-DD module is shown, with a label 'SFP-DD module has two rows of contacts' pointing to the top and bottom contact areas. On the right, a 2D top-down view of the SFP-DD connector is shown, with labels 'First Row supports standard SFP' and 'Second Row supports SFP-DD' pointing to the respective contact rows. A small inset image shows a standard SFP module for comparison.

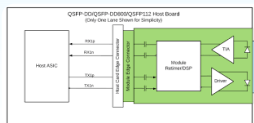
SFP-DD(112): 100Gbit/s using **PAM4**



100/400G → 800G QSFP

Introducing 800G Pluggable Transceivers

For next-generation high-speed connectivity:



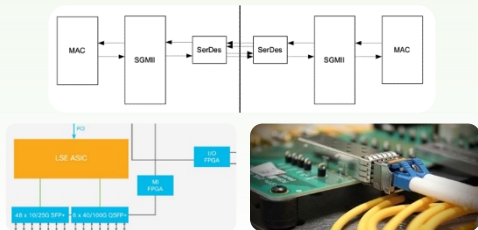
OSFP-DD800



QSFP-DD(112): 800Gbit/s using PAM4



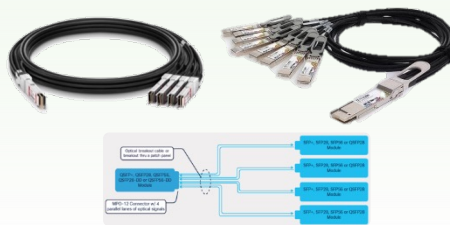
Direct-Drive (PHYLESS)



Transceiver **uses SFI/SGMII** to connect directly to the **ASIC SerDes** (no PHY)



4x100G & 8x50G Breakout

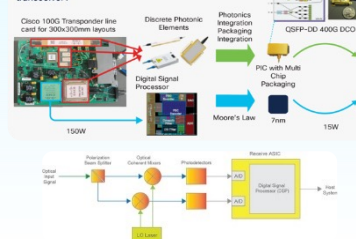


QSFP-DD (400G) can be split into
4 x 100G QSFP28 or **8 x 50G SFP56**



Coherent Optics

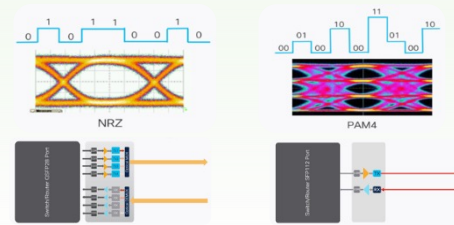
What is a Digital Coherent Optic (DCO) transceiver?



Uses **phase of optical signal** vs. power level



Single Lambda



Uses a **single 112G PAM4** signal
vs. 4 x 28G NRZ signals



Catalyst 9000 Series

Campus Design Considerations



What is a “Campus”?

The basic **Merriam–Webster** definition of a [Campus](#) is:

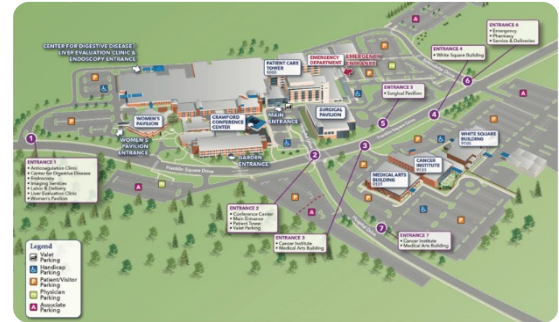
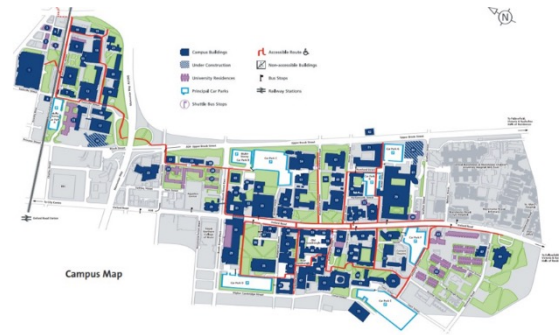
A group of one or more buildings, and surrounding grounds, where people and their belongings work together.

Common examples are **Hospitals & Research Centers**, **Schools & Universities** and **Corporations & Offices**.

Using this – it’s clear a [Campus Network](#) is focused on:

- **People** (Users, Vendors, etc.)
- **People’s devices** (PCs, Phones, Printers, etc.)
- **Similar geographic area** (LAN, WLAN or MAN, etc.)
- **Access to other domains** (WAN, ISP, DC & Cloud, etc.)

This includes **many different network technology areas** (Wired, Wireless, Security, QoS, Management, etc.) with a common focus on **providing users & devices “access”**.



Campus is focused on User Access

Campus = Geography

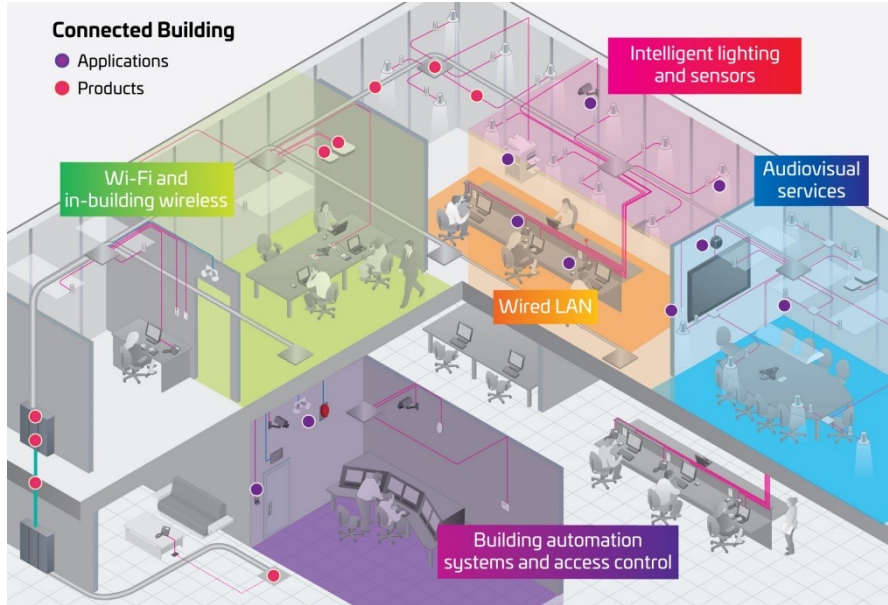
Buildings are spread out. Multiple floors per building



www.cisco.com/c/en/us/solutions/cisco-on-cisco/enterprise-networks.html

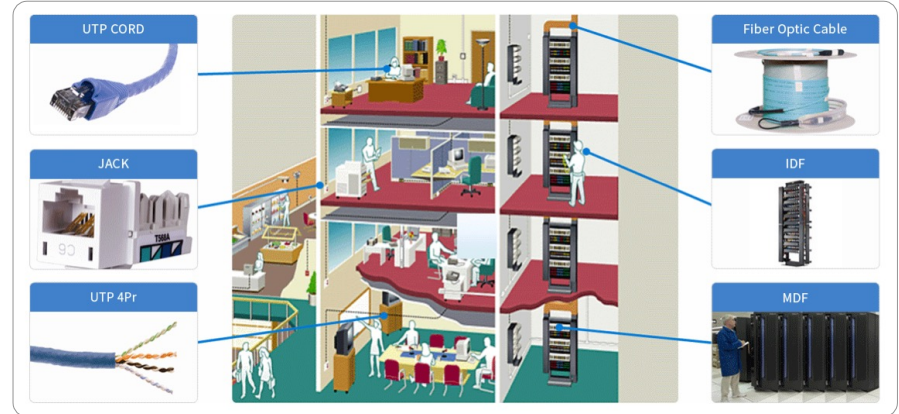
Campus Networks

Building MDF/IDF & Wiring Closets



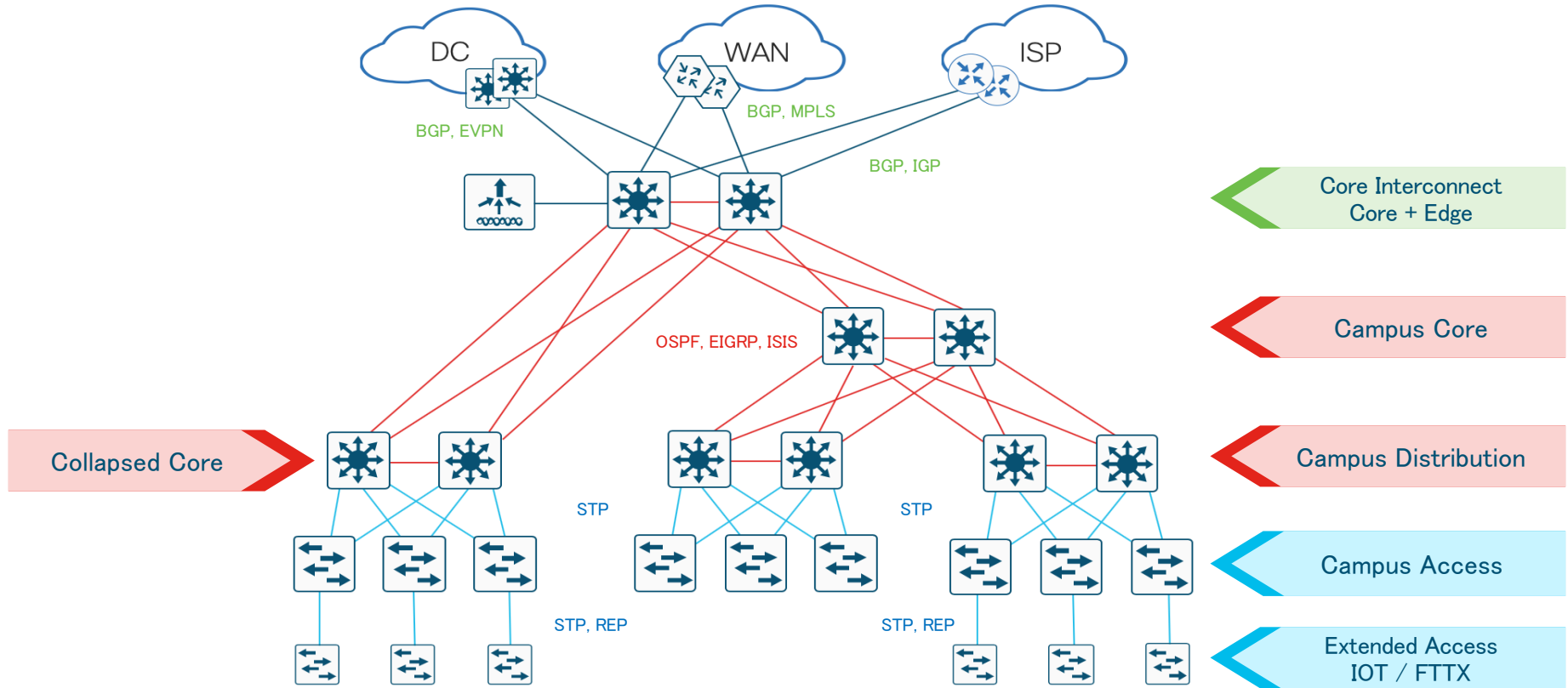
MDF = Main Distribution Framework (Core)

IDF = Intermediate Distribution Framework (Distro/Access)

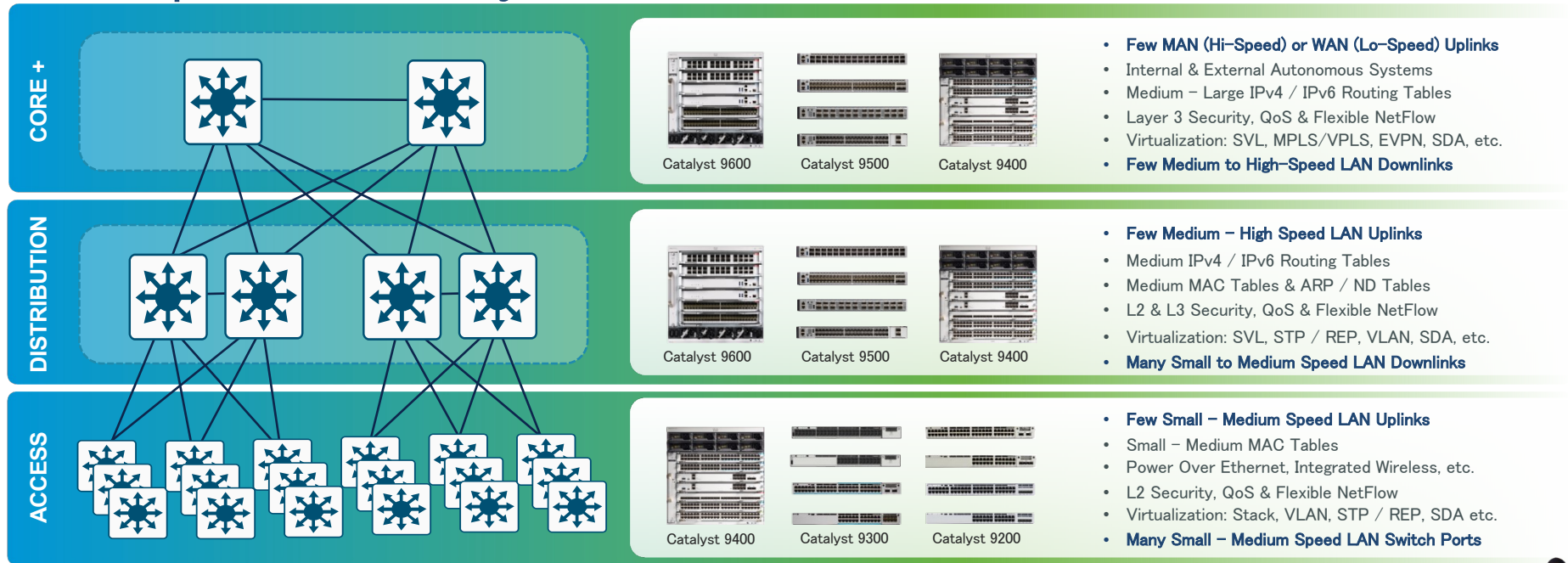


www.cisco.com/c/en/us/solutions/design-zone/networking-design-guides/campus-wired-wireless.html

Campus PINs & Topology



Campus Multi-Layer Model



Always 3 “Logical” Layers

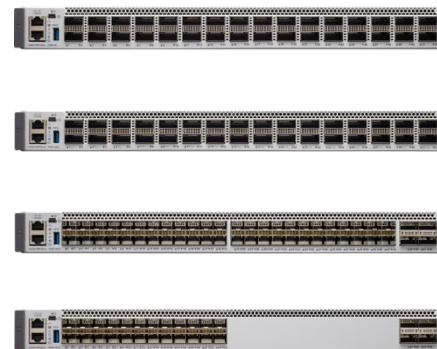
- Each layer serves a specific set of functions
- Each layer has a specific set of requirements

If you collapse layers –
your multi-layer device
needs to support
all “logical” functions





Modular vs. Fixed Platforms



Modular

PROs

- **More Flexible**
- Longer Life-Cycle
- Higher Port Density
- More Power/Cooling
- Redundant Processors

CONs

- **More Complex**
- BW limit by Chassis
- Slow(er) Dev & Test
- Lower MTBF
- Higher COGs

Fixed

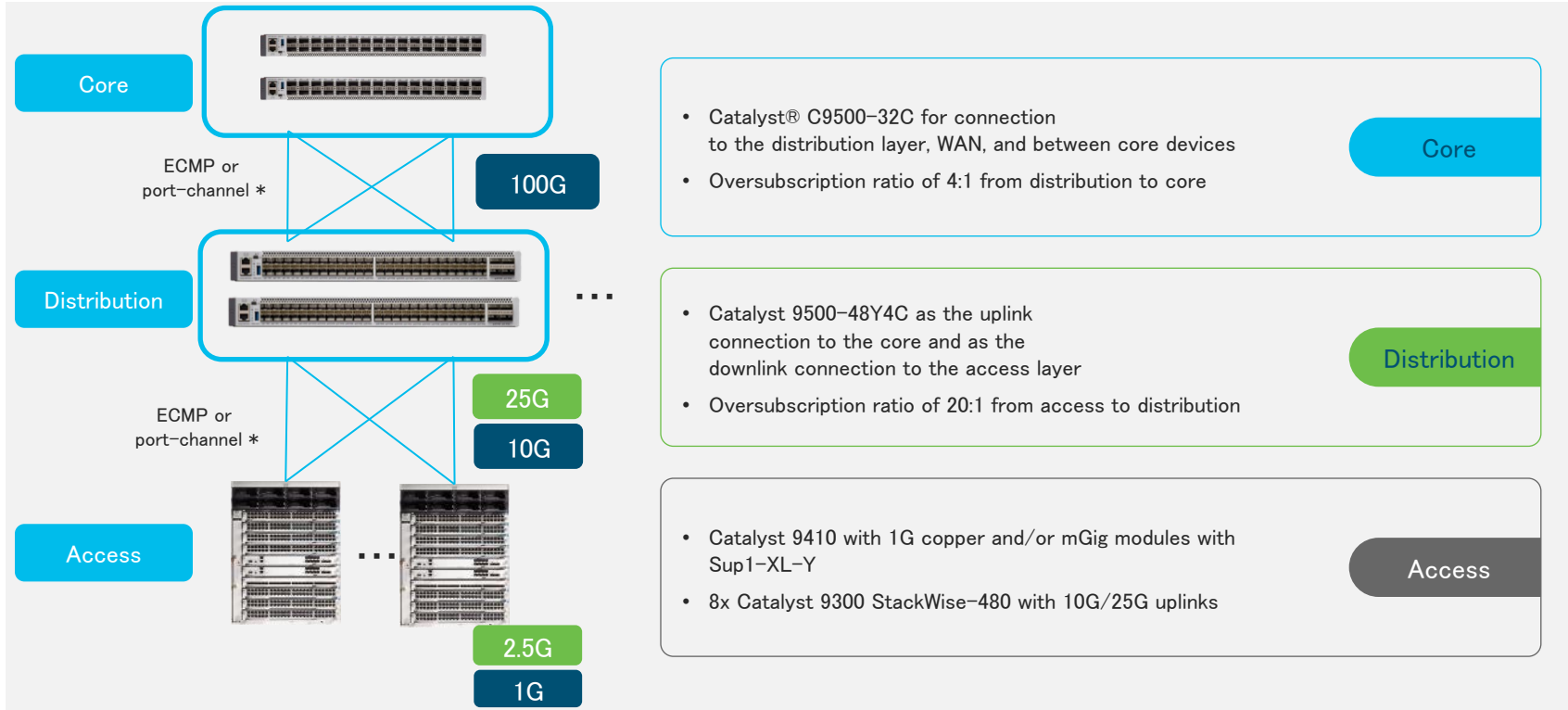
PROs

- **Less Complex**
- Swap Chassis for BW
- Faster Dev & Test
- Higher MTBF
- Lower COGs

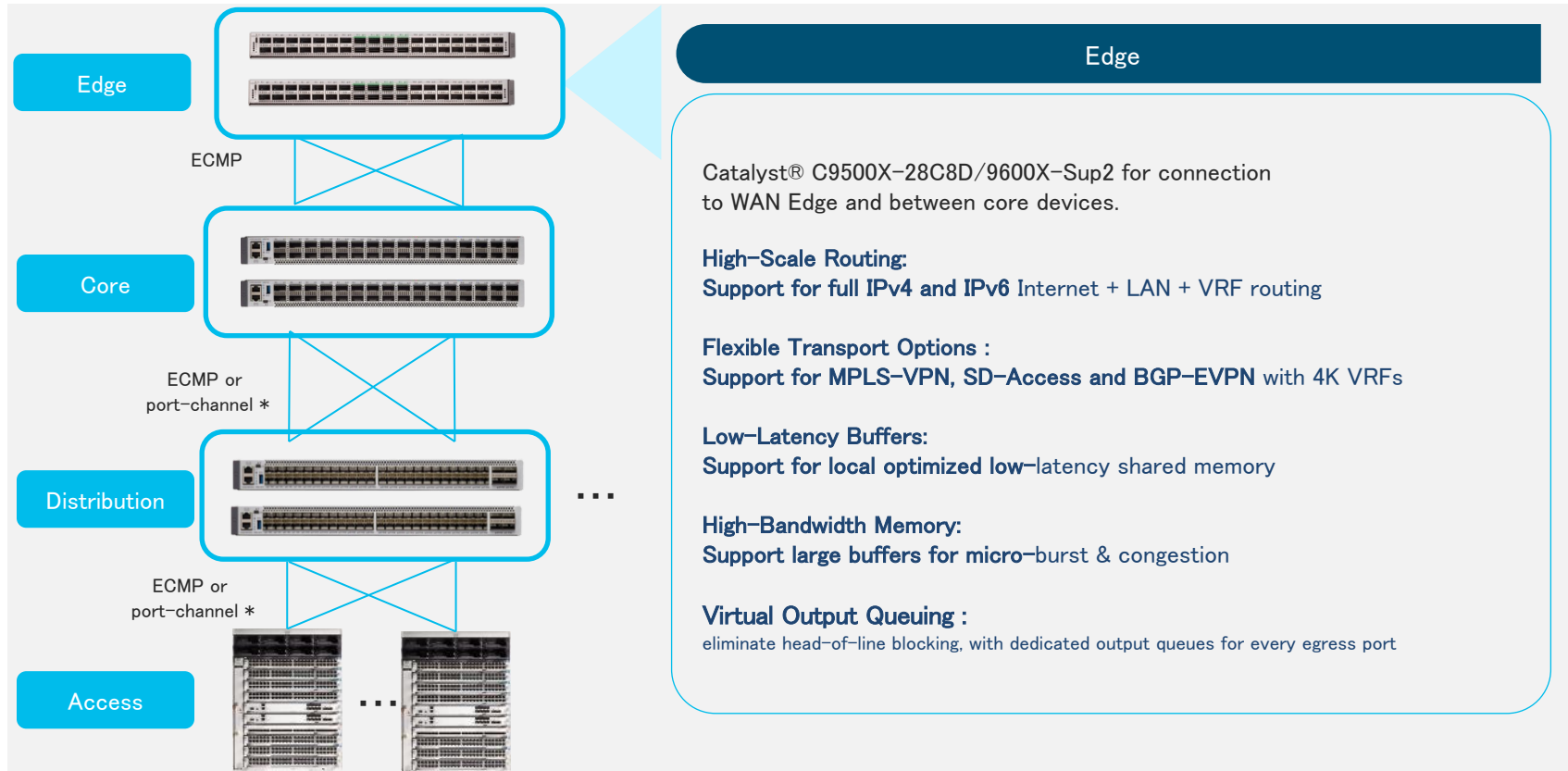
CONs

- **Less Flexible**
- Shorter Life-Cycle
- Lower Port Density
- Less Power/Cooling
- Single Processor

Example of a Traditional Three-Tiers Campus Design



Example of a Four-Tiers – Campus + Edge Design



C9600/9500 – Place In Network (PIN)

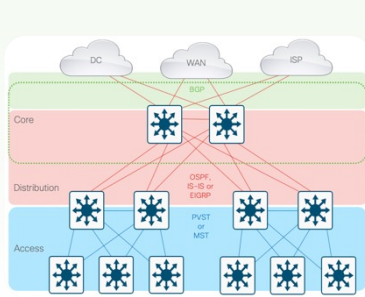
BGP

IGP

STP

1

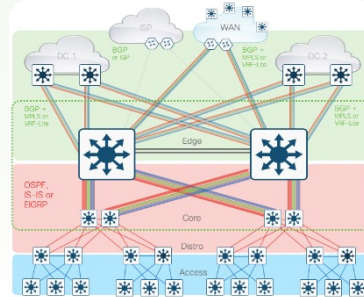
Layer 3 Core



- Base L3 Routing
- High-BW, Port Density
- Simple ACL
- Simple QoS

2

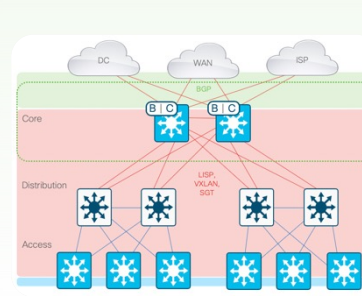
Layer 3 Core + Edge



- L3 Core + Edge Services
- DCI, WAN, Internet
- Edge Security, VPN & OGACL
- Complex H-QoS

3

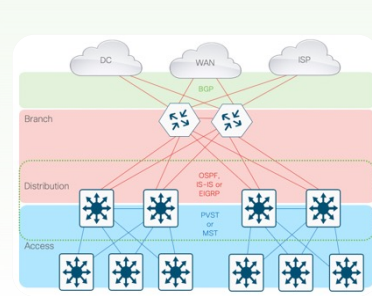
Fabric (SDA & EVPN)



- L3 Core + VXLAN Fabric
- Border, Edge, CP/RR
- L2 & L3 VNI & SGACL
- App-based QoS

4

Collapsed Core



- L3 Core + Distribution
- L2 Services to Access
- First Hop Security
- Access QoS & AVC



Edge +
Core



Catalyst 9600X
with SUP-2



Catalyst 9500X
models

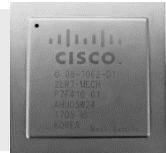


Catalyst 9600
SUP-1



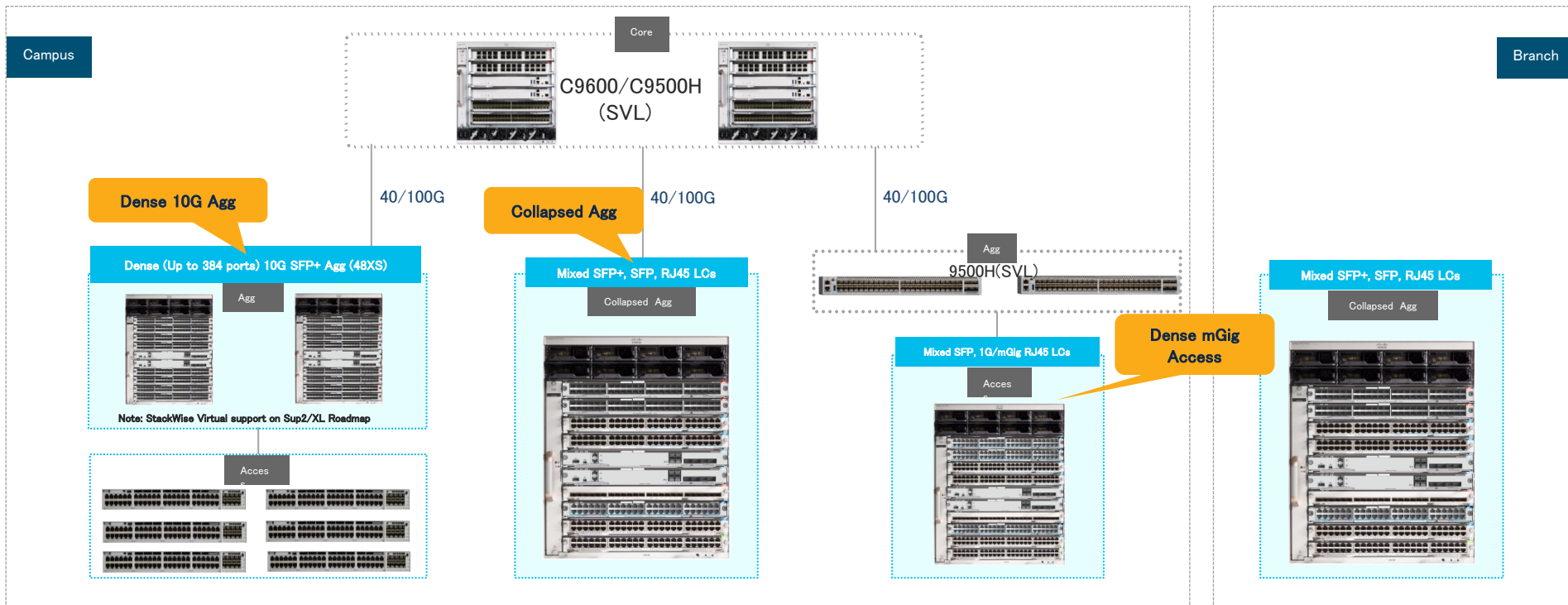
Catalyst 9500
models

Core +
Distribution



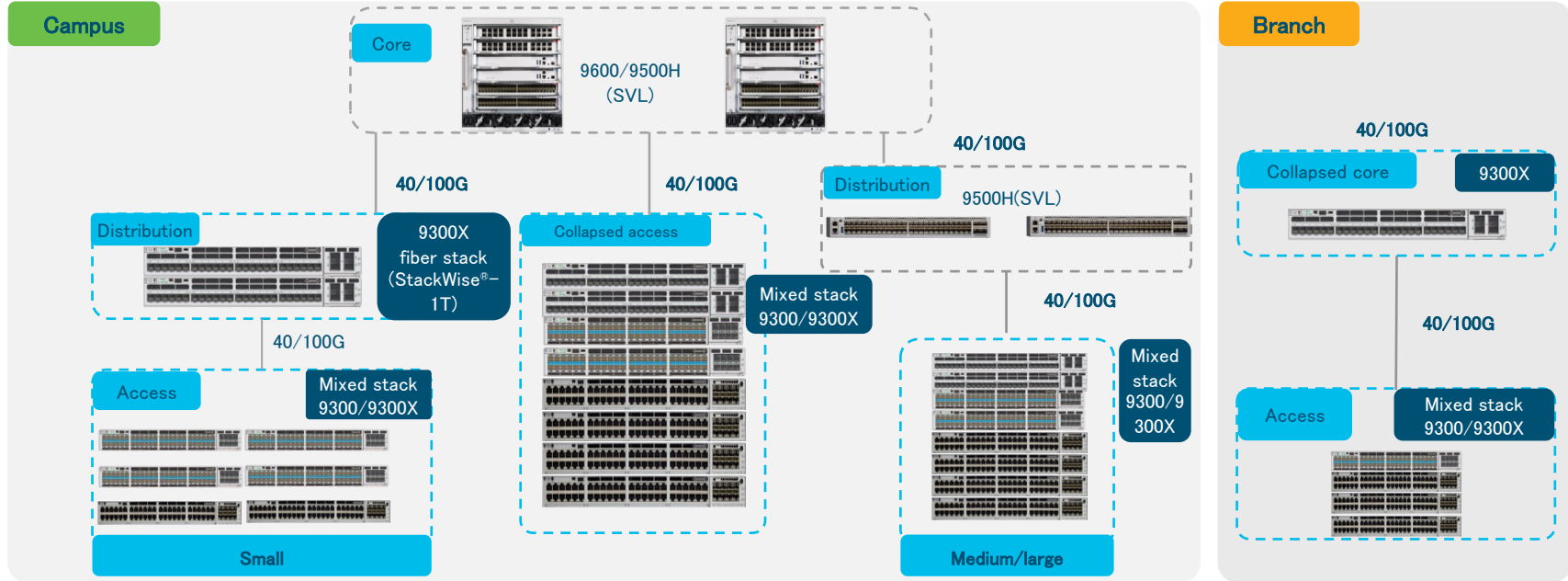
Catalyst 9400 Deployment Flexibility

- C9400X enables dense 10G SFP+ distribution and multigigabit access



Flexible design options with the Catalyst 9300X

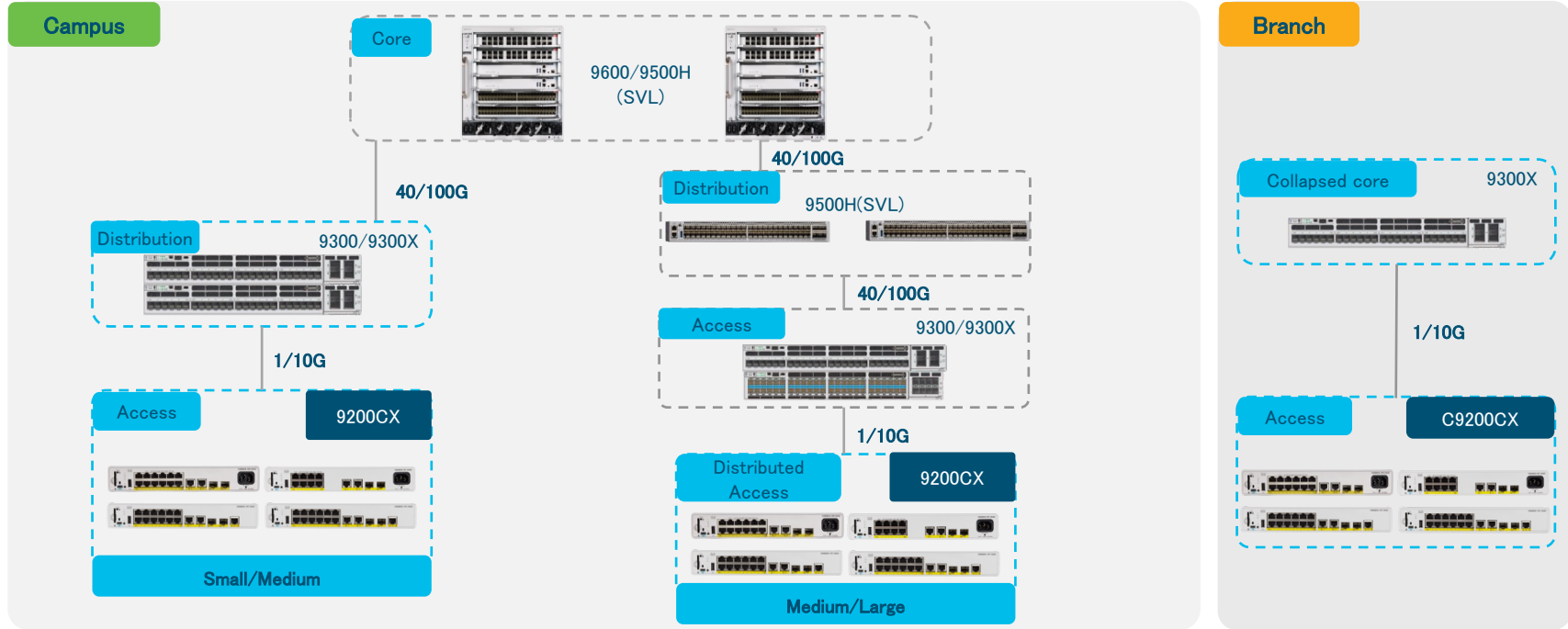
2 or 3-tier architecture



Bringing 10/25/40/100G with StackWise-1 Terabit to access

Flexible Design Options with the Catalyst 9200CX

3 or 4-tier Architecture



Bringing Flexible and Compact Access Switching to the Enterprise Campus



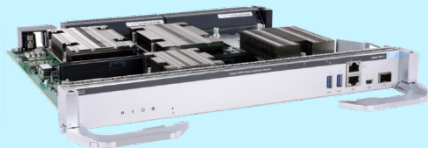
Catalyst 9000 Positioning

Catalyst 9500 & 9600 Series Core Positioning

Next Generation Core + Edge Switching with Silicon One Q200



Feature Optimized C9500 & C9600-SUP-1



C9600-SUP-1



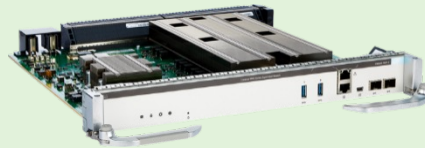
C9500

- ✓ Best-in-class Enterprise Core feature set
- ✓ Low speeds (1G – 40G) and port density
- ✓ Comprehensive MPLS, EVPN and SDA
- ✓ Ideal for Campus Core, Collapsed Core + Agg

Ideal for C6K non-XL deployment migration



Performance Optimized C9500X & C9600X-SUP-2



C9600X-SUP-2



C9500X

- ✓ Unmatched forwarding scale and performance
- ✓ High speeds (10G – 400G) and port density
- ✓ Scaled MPLS and SDA, WAN-MACsec
- ✓ Ideal for Campus Core + Edge, or Centralized WLC

Ideal for C6K XL deployment migration



Cisco Catalyst Access Switching Positioning

Secure, resilient campus



Catalyst® 9400

Catalyst 9300



SD-Access



SD-Access
extended nodes

Choose Catalyst 9400 Series or Catalyst 9300 Series modular uplink models (C9300X and C9300) models

- Designed for security, mobility, IoT, and cloud
- High availability, ETA, application hosting

Business-critical branch



Catalyst 9300X models

Branch-in-a-Box
No router



Catalyst 9300L models

Fabric-in-a-Box
External router



SD-Access

Choose: A) Catalyst 9300 Series fixed uplink models (C9300L models) with external router

- Full security with visibility
- High availability, ETA, application hosting

B) Catalyst 9300X models for complete branch solution

+ IPsec, firewall, additional app hosting

Simple branch



Border + Control plane



Edge

Catalyst 9200 Series



SD-Access

Consider Catalyst 9200 Series (C9200 and C9200L models)

- Extended automation and policy
- Limited VRFs



Choose Catalyst 9400 or 9300/9300L for innovations in Intent-Based Networking (IBN)



Full SD-Access, fabric-in-a-box,
Embedded Wireless Controller



Wired Assurance,
SD-Access, AVC



ETA,
MACsec-256



On-box
app hosting



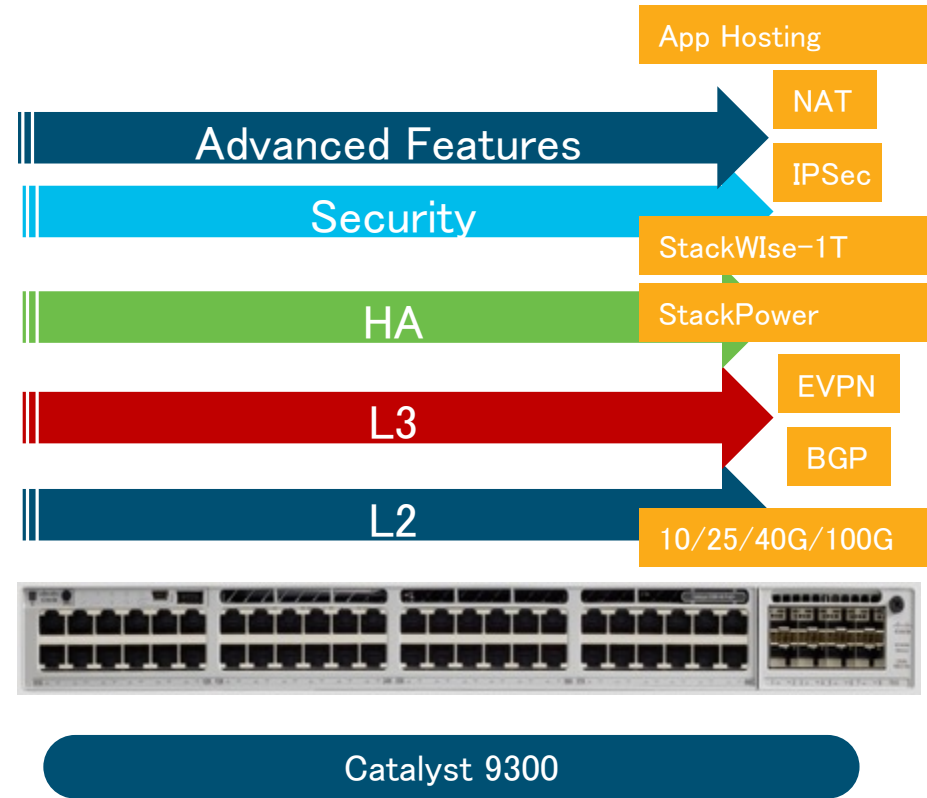
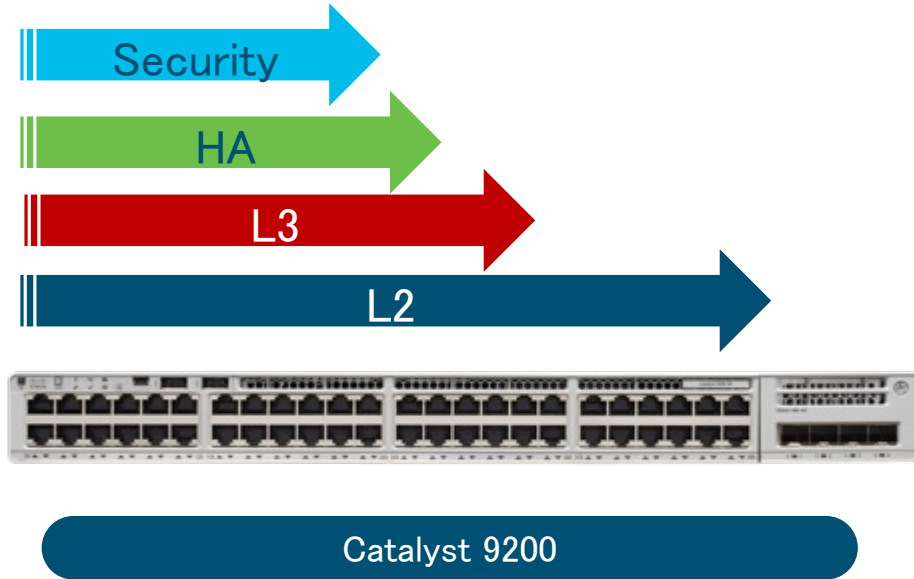
HA, hot patching,
StackPower, Cisco UPOE+

Entry point for IBN



SD-Access, fabric edge, Full NetFlow

Fixed Access Positioning



Branch Office and Small Campus

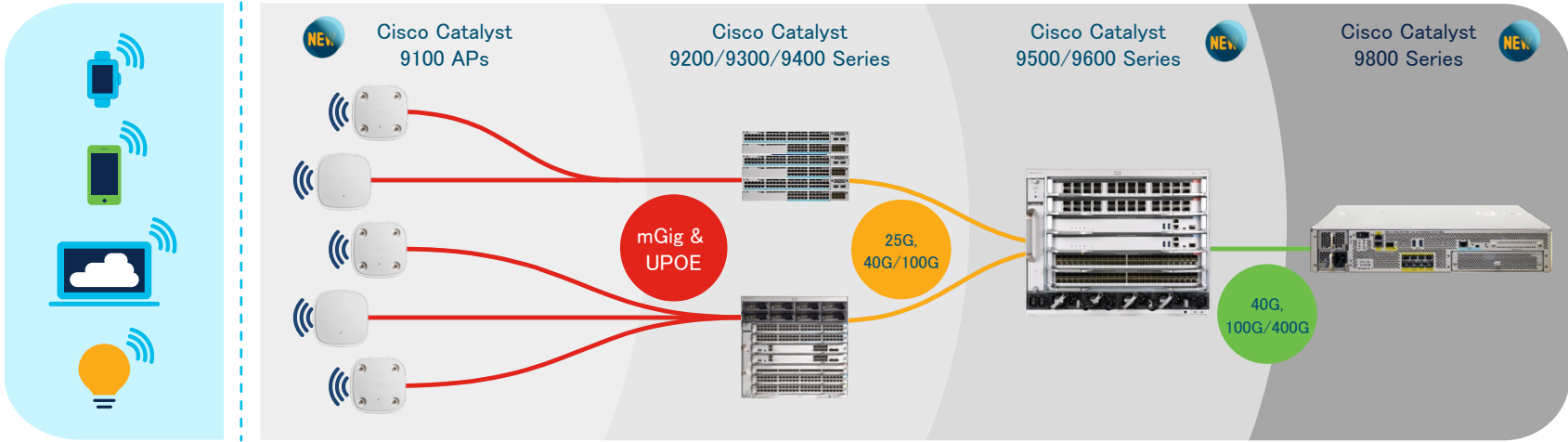
Small to Large Campus



Catalyst 9000 Summary

Cisco Catalyst 9000 Family

Scalability, Reliability, Security across the network



← The Full Experience, End to End →

Built for Intent-Based Networking



Automation



Security



Analytics

Cisco Catalyst 9000

The Fastest Ramping Product!



“Catalyst 9K continues to be the fastest ramping product in the company's history”

— Chuck Robbins, CEO Cisco Systems

Catalyst 9000 platform

shipping since June 21, 2017

30,000+ Customers

...and growing!

The Channelco®

CRN®

Products of
the Year

2017

The Channelco®

CRN®

Products of
the Year

2018

2X Winner Overall Product of the Year



New Catalyst Comparison App

For 1D Scale and Performance Numbers

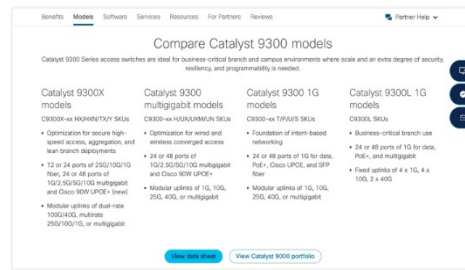
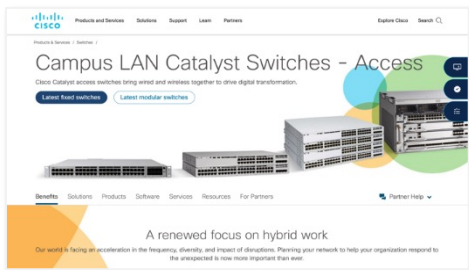
NEW



NEW

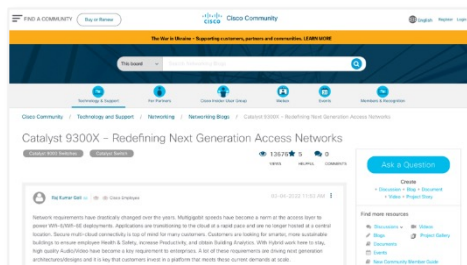
<https://ccapp.cisco.com>

Catalyst 9000X Series – Public Collateral



- [Cisco - Enterprise Networks - Switching](#)
- [Catalyst 9000 Switches At-a-Glance](#)
- [Catalyst 9000 Frequently Asked Questions](#)

- [Catalyst 9300 Series Switches data sheet](#)
- [Catalyst 9400 Series Switches data sheet](#)
- [Catalyst 9500 Series Switches data sheet](#)
- [Catalyst 9600 Series Switches data sheet](#)



- [Catalyst 9300X Technical Blog \(Community\)](#)
- [Catalyst 9400X Technical Blog \(Community\)](#)
- [Catalyst 9500X Technical Blog \(Community\)](#)
- [Catalyst 9600X Technical Blog \(Community\)](#)



- [Under the Hood of the Catalyst 9000X \(TFD\)](#)
- [Network Insiders Podcast](#)
- [Meet the C9300X](#)
- [Meet the C9400X](#)
- [Meet the C9500X and C9600X](#)

Catalyst 9000X Series – Platform TDMs



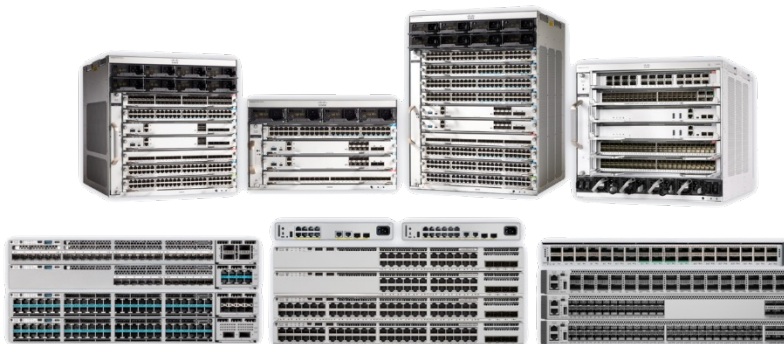
EN Switching @ SalesConnect

9400

- [Catalyst 9400 Series @ SalesConnect](#)
- [Catalyst 9400 Series – Platform TDM](#)

9300

- [Catalyst 9300 Series @ SalesConnect](#)
- [Catalyst 9300 Series – Platform TDM](#)



9600

- [Catalyst 9600 Series @ SalesConnect](#)
- [Catalyst 9600 Series – Platform TDM](#)

9500

- [Catalyst 9500 Series @ SalesConnect](#)
- [Catalyst 9500 Series – Platform TDM](#)

9200

- [Catalyst 9200 Series @ SalesConnect](#)
- [Catalyst 9200 Series – Platform TDM](#)

Catalyst 9000X Series – Feature TDMs



Access Switching

High Availability

Catalyst 9000 StackWise Virtual (TSV) [2]	More >
Other Colateral Validated 04 Aug 2021 Source: Business Unit	
Cisco StackWise-480 vs. MLAG [2]	More >
Other Colateral Validated 04 Aug 2021 Source: Business Unit	
Catalyst 9000 CMT [2]	More >
Other Colateral Validated 08 Dec 2021 Source: Business Unit	
Catalyst 9000 Extended Fast Software Upgrade (EFSU) [2]	More >
Other Colateral Validated 08 Dec 2021 Source: Business Unit	
Catalyst 9000 Preempt (PRA) [2]	More >
Other Colateral Validated 01 Sep 2021 Source: Business Unit	
Catalyst 9000 SWIFTower [2]	More >
Other Colateral Validated 05 May 2021 Source: Business Unit	

Analytics & Telemetry

Catalyst 9000 NetFlow [2]	More >
Other Colateral Validated 04 Aug 2021 Source: Business Unit	
Catalyst 9000 SPAN and its Variants [2]	More >
Other Colateral Validated 26 Sep 2021 Source: Business Unit	
Catalyst 9000 WireShark [2]	More >
Presentations Validated 28 Sep 2021 Source: Business Unit	
Catalyst 9000 Application Visibility and Control (AVC) [2]	More >
Presentations Validated 30 Jun 2021 Source: Business Unit	

Security

Catalyst 9000 Cloud Security & Analytics [2]	More >
Presentations Validated 18 Dec 2021 Source: Business Unit	
Catalyst 9000 NATFAT [2]	More >
Presentations Validated 01 Aug 2022 Source: Business Unit	
Catalyst 9000 Trustworthy [2]	More >
Presentations Validated 14 Jul 2021 Source: Business Unit	
Catalyst 9000 Device Telemetry [2]	More >
Other Colateral Validated 25 Feb 2021 Source: Business Unit	
Catalyst 9000 NetFlow [2]	More >
Other Colateral Validated 18 May 2022 Source: Business Unit	
Catalyst 9000 Identity Based Networking Services (IBNS) 2.0 [2]	More >
Other Colateral Validated 02 Sep 2021 Source: Business Unit	
Catalyst 9000 IPSec TDM [2]	More >
Presentations Validated 27 Aug 2022 Source: Business Unit	

Info

Catalyst 9000 Optics [2]	More >
Presentations Validated 25 Feb 2021 Source: Business Unit	
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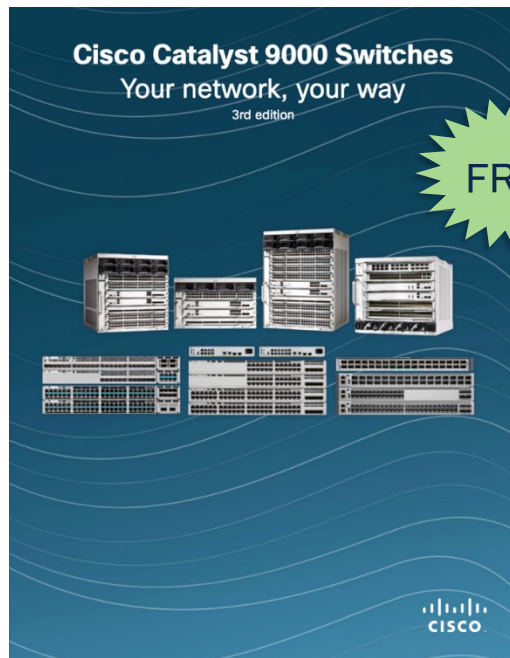
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- cisco.com/go/cat9K
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