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You make possible

Cisco Catalyst 9400/9500/9600

Switching Architecture

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@siddkrishna

BRKARC-2105

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October 28 - 31, 2019 · Cancun

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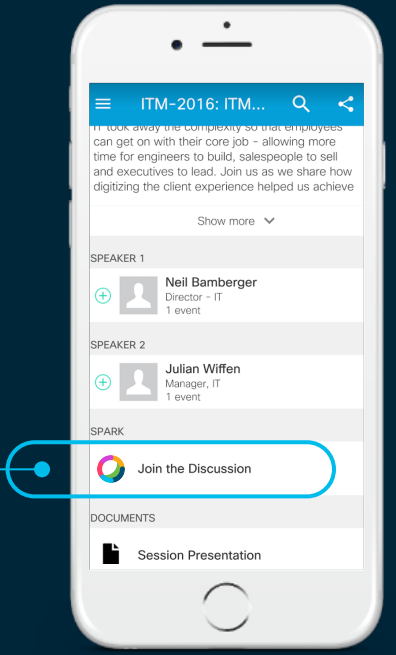

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Video

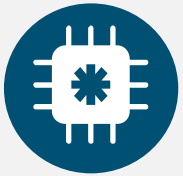
Cloud

IoT

AR/VR/WiFi6

These trends are reality today and creating new requirements for the
Campus of the Future

Scale



Agility

Integrated Security

High Availability

Convergence

Visibility & Assurance

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Catalyst 9K Family

Built for Campus of the Future

The goal of this session is to give you an

Architectural View

of the

Catalyst 9400, 9500 & 9600 Switch Series

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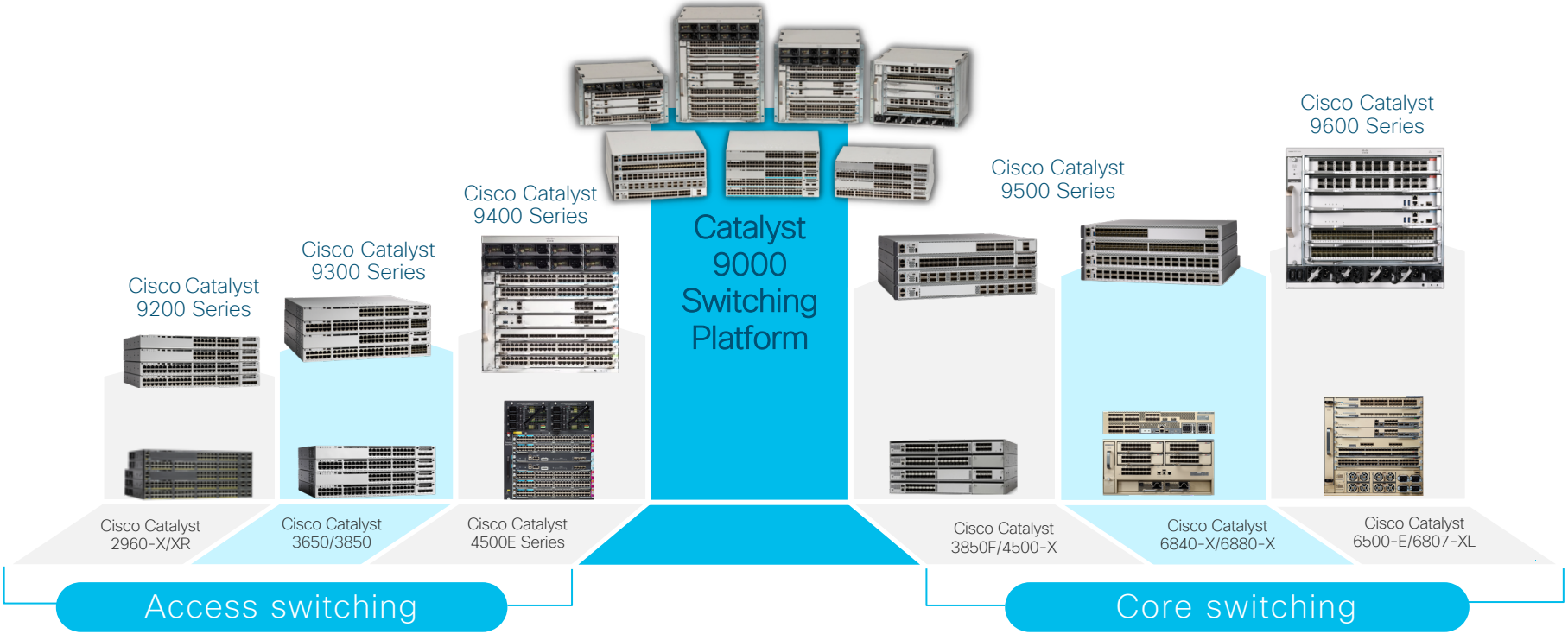
Catalyst Switching – Fully Refreshed Portfolio



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Building Blocks

You make security **possible**

Catalyst 9000 – Common Building Blocks

Secure containers
Application hosting

x86

x86 multi-core CPU

Programmable pipeline
Flexible tables

UADP 2/3

Model-driven APIs
Streaming telemetry

Open and
extensible Cisco IOS® XE

Building Blocks to Face the challenges of Campus of the Future

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Cisco Innovation – UADP ASIC

In 2013 Cisco Introduced UADP

(Unified Access Data Plane)

- Performance
- Flexibility
- Programmability

UADP brings Flexibility without compromise on Performance

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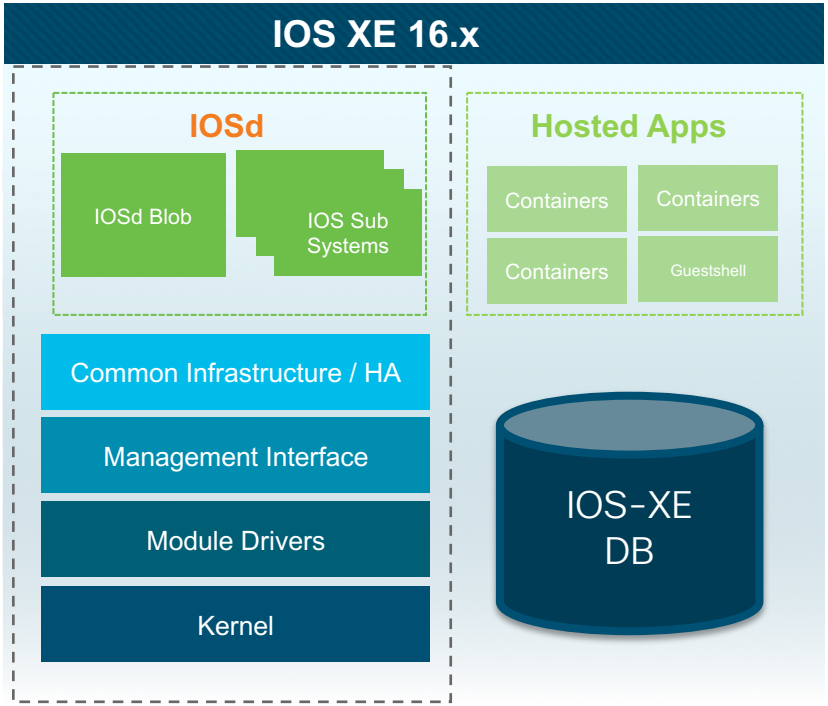
Open IOS XE – A Modern Operating System



IOS Sub Systems
Resiliency & HA

IOS XE Database
Programmability & Open Models

Container Support
3rd Party App Hosting

Open, Model Driven & Secure Operating System

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User Centric Design of Catalyst 9K

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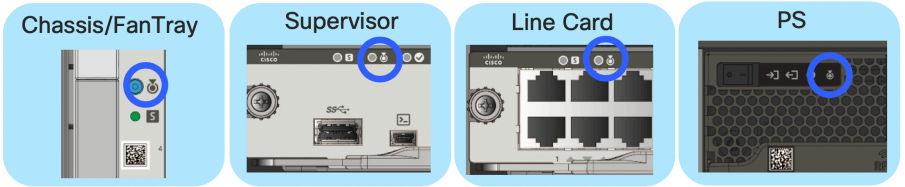
Simplified Operations and Serviceability

Lower TCO with better ergonomics

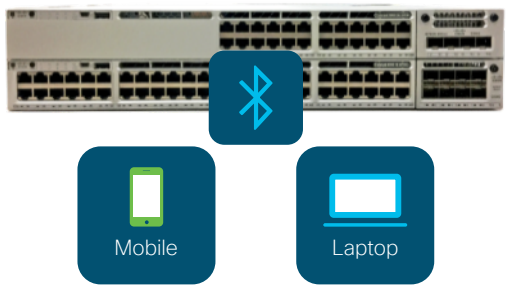
Inventory management efficiency with built-in RFID

Ease of serviceability with blue beacons on each component



Ergonomic design with industry-standard icons

Wireless console access with Bluetooth



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Catalyst 9400/9600 – Cool Fan Trays

Fan Trays Serviceable from Front and Back

Barometer

Temperature Sensors

Variable Speed Fans

Flexibility in Cabling & Maintenance

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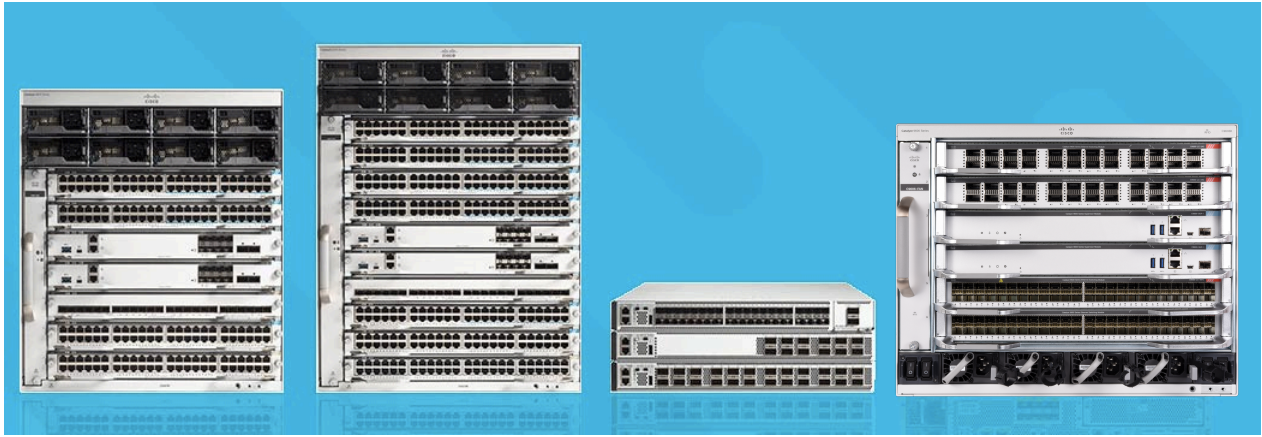
The Catalyst 9K Family

In this Session:
Modular Access, Distribution & Core



Catalyst 9400	Catalyst 9500	Catalyst 9600
Modular Access & Distribution Switches	Fixed Core & Distribution Switches	Modular Core & Distribution

Built on Cisco's Innovative Hardware & Open IOS-XE

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Catalyst 9K Family Members

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Catalyst 9400

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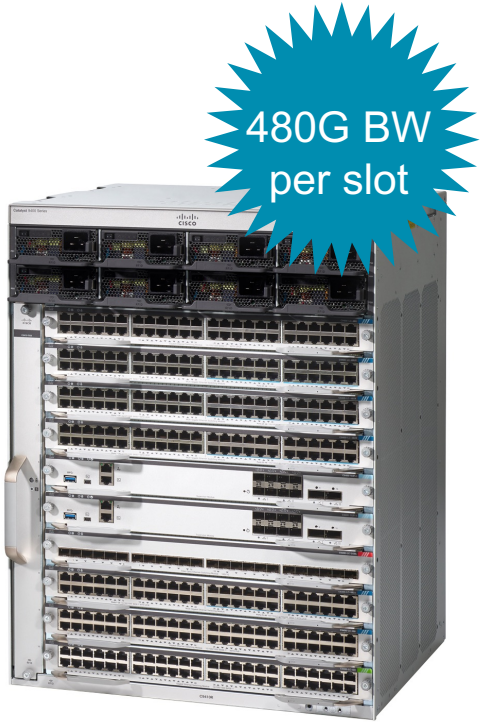
Catalyst 9400

With
IOS-XE 17.1

4-Slot

7-Slot



10-Slot

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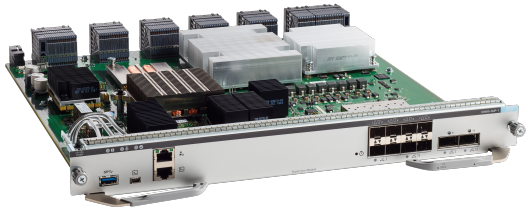
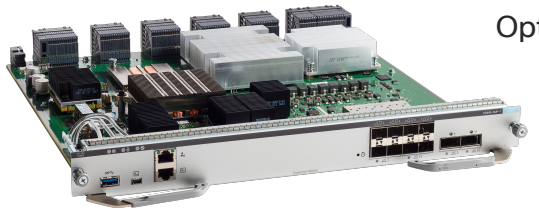
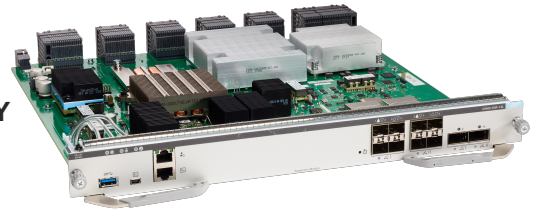
Supervisors

UADP 2.0 XL ASICs | 2.4Ghz Quad Core x86 CPU | M.2 SATA SSD

USB 2.0/3.0 | MACSec256 | 16G DRAM and 16G Flash

		Line Card Slot BW:	Template:	Uplinks:
C9400-SUP-1		4 Slot: 80G 7 Slot: 80G 10 Slot: 80G	Access	1G 10G 40G
C9400-SUP-1XL		4 Slot: **240G** 7 Slot: **120G** 10 Slot: **80G**	Access, **Core,** **SDA**	1G 10G 40G
C9400-SUP-1XL-Y				1G 10G **25G** 40G

Optimized for Distribution/Core deployment

Optimized for Core deployment

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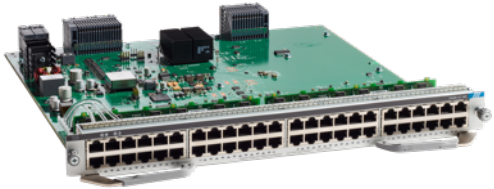
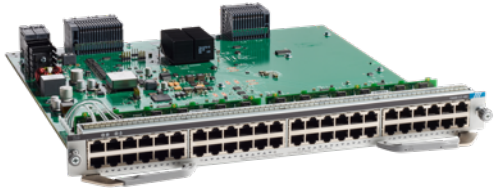
Line Cards – Copper

48x 10/100/1000 Data

RJ45 (Data)
48x 10/100/1000
TrustSec and MACSec(256)

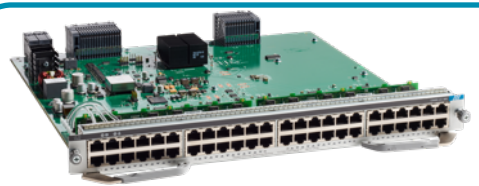


48x 10/100/1000 PoE/PoE+



48x 10/100/1000 PoE/PoE+/UPOE

RJ45 (UPOE)
48x 10/100/1000
PoE/PoE+; PoE/PoE+/UPOE
TrustSec and MACSec(256)



24x 1G + 24x mGig UPOE

RJ45 (mGig)
24x 10/100/1000 + 24x
100/1G/2.5G/5G/10G
PoE/PoE+/UPOE
TrustSec and MACSec(256)

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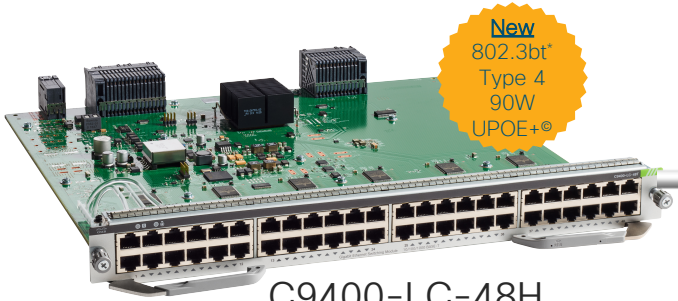
NEW Catalyst 9400 90W UPOE+ Line Card

NEW

Highest UPOE+ scale in industry to power latest intelligent devices



C9400-LC-48H

Cisco UPOE+©
(low voltage)

Cat5e/6

Cisco and partner cloud services for control

New Devices

30 - 60 Watt devices

90 Watt devices

Wall switch

Network Powered Light arrays

PTZ UHD Cameras

Large Video Displays

HVAC VAV's

Catalyst 9400

- Up to 260* x 90W concurrent power
- IEEE 802.3bt standards compliant
- 48 x 1G Ports per line card
- Up to 8 x 3200W AC/DC PSU

Investment Protection with 90W UPoE+

*10-slot chassis w/o power redundancy. Subject to available PoE power budget in chassis

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Line Cards - Fiber

24x SFP

48x SFP

SFP (1G)
48x 100/1000
TrustSec and MACSec(256)

24x SFP/SFP+

Fiber (1G/10G)
24x 1G/10G
TrustSec and MACsec(256)

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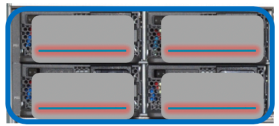
Power Supplies

- **Modular Design**: 4 PS for 4 slot chassis; 8 PS for 7 and 10 slot chassis
- Shared: Power for both **Data and Inline Power**
- **Platinum PS**: 90%+ efficiency
- Power Supply Options:
  - **3200W AC** PS With 240V input. (1570W with 120V input. 16A input)
  - **2100W AC** PS With 240V input. (940W with 120V input. 10.4A input)
  - **3200W DC** PS With -40V to -72V input.

Combined (Default)



Load sharing on all PSs

Redundant

N+1 & N+N Modes

Load sharing on active PSs
Standby PS in output disabled

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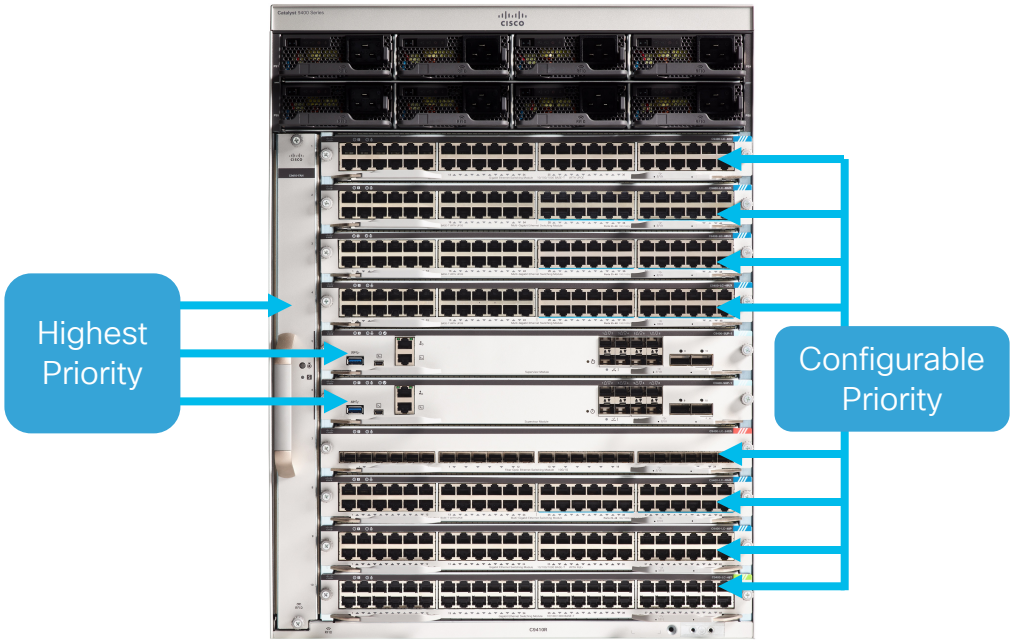
Power Priority

- All components in the system are assigned with power priority level
- Supervisors and Fan Tray has the same highest priority level
- Lower slot# has the higher power priority level by default if "`power supply autoLC shutdown`" is configured
- Configurable power priority for line card slots

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



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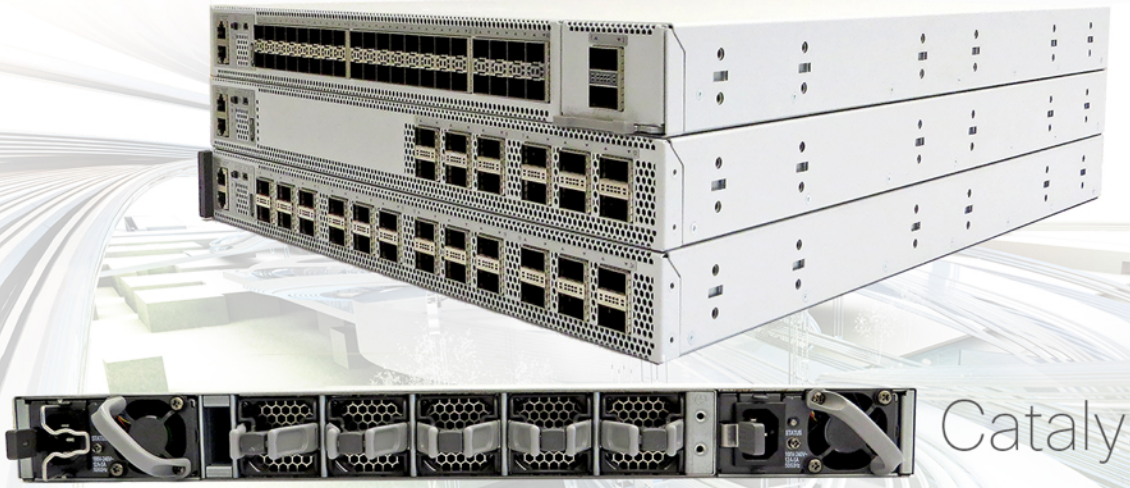
Catalyst 9500



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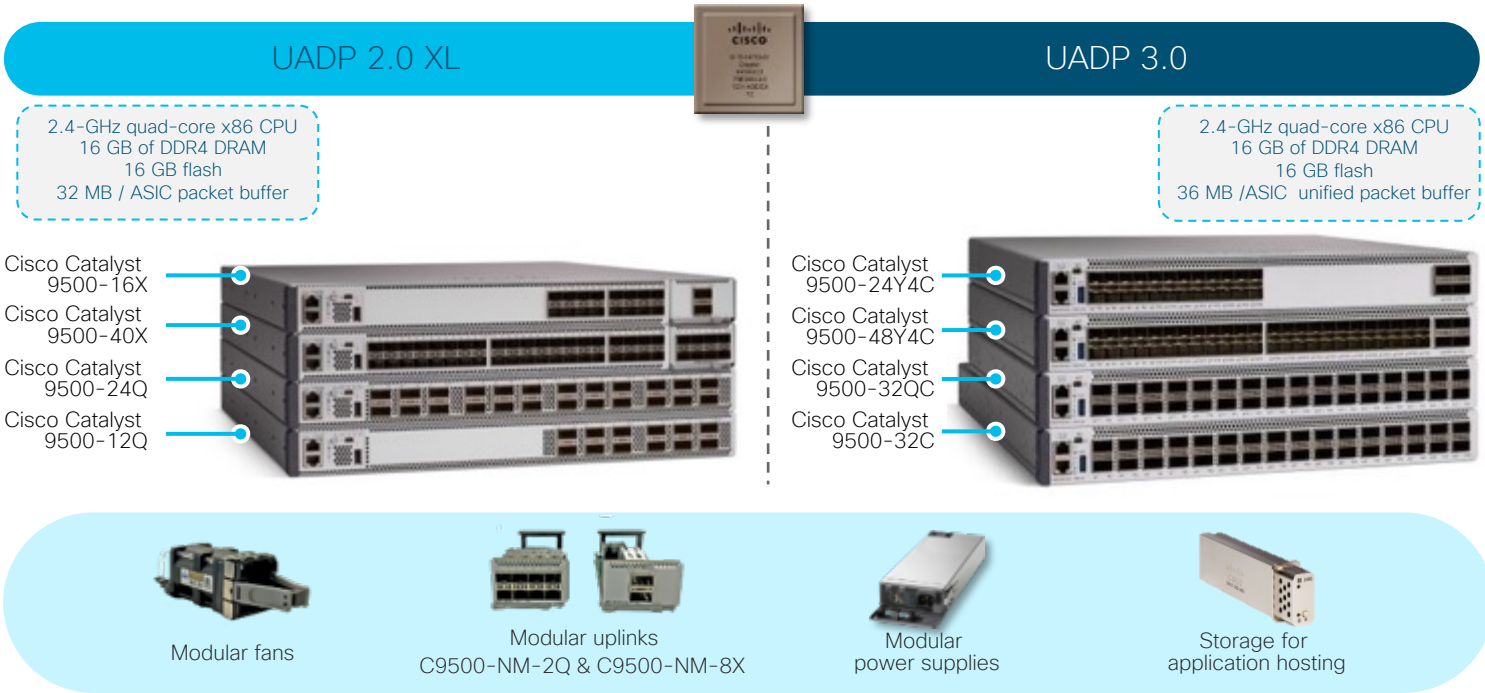
Cisco Catalyst 9500 Series

New generation of purpose-built fixed core/aggregation



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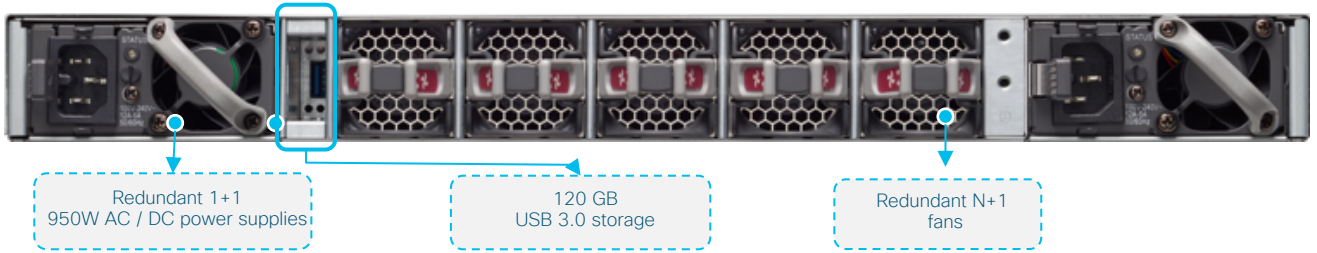
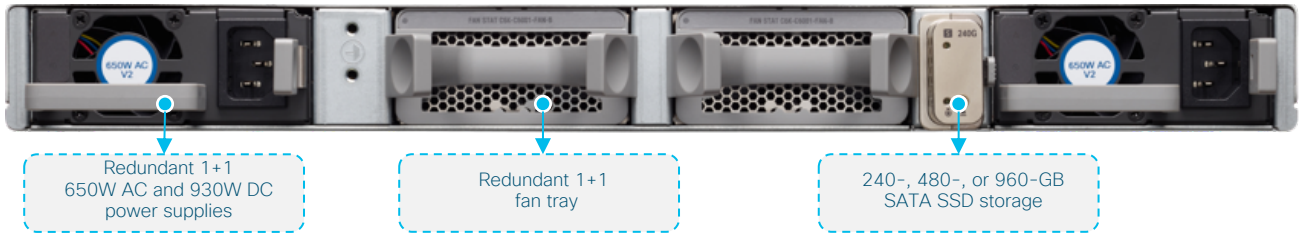
Redundant Power Supplies and Fans

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



C9500-32C

C9500-32QC, 24Y4C, 48Y4C



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Catalyst 9600

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Cisco Catalyst 9600 Series
Chassis

Port speed	Density with supervisor 1	Maximum chassis density
100G	48	128
40G	96	128
25G	192	192
10G	192	192
1G*	192	192

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)

6.4 Tbps per slot from each supervisor slot

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

*Support with IOS-XE 16.12.2 & 17.1.1

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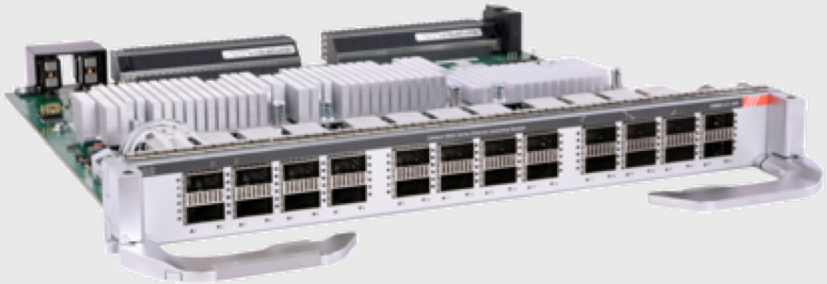
Cisco Catalyst 9600 Series
Line cards

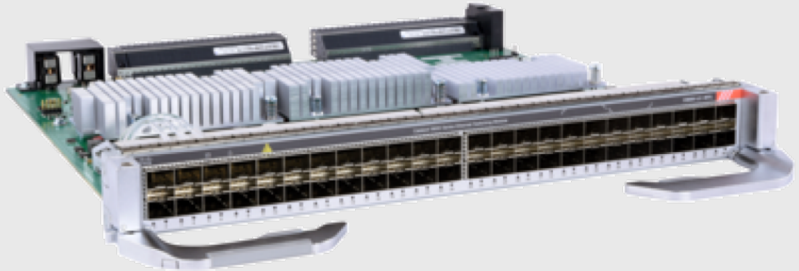


C9600-LC-24C – 100G/40G (fiber)

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

C9600-LC-48YL – 25G/10G/1G* (fiber)

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



NEW *Support with IOS-XE 16.12.2 & 17.1.1
The Y in the product ID (PID) indicates the hardware capability

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Cisco Catalyst 9600 Series
Power supplies

- Chassis has 4 slots for power supply
- Individual on/off switch for each power supply
- Supports a mix of AC (@220V) and DC power supplies

AC

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

DC

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

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Platform Architecture & Layouts

You make networking **possible**

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UADP 2.0 XL

- **Investment Protection**
  Flexible Pipeline
- **Universal Deployments**
  Adaptable Tables
- **Enhanced Scale/Buffering**
  Multicore resource share

384K Flex Counters

Shared Lookup

Up to 240GE Bandwidth

Up to 2X to 4X Forwarding + TCAM

Embedded CPUs

Up to 32MB Packet Buffer

Up to 64K x2 Netflow Records

7.46B Transistors

28nm Technology

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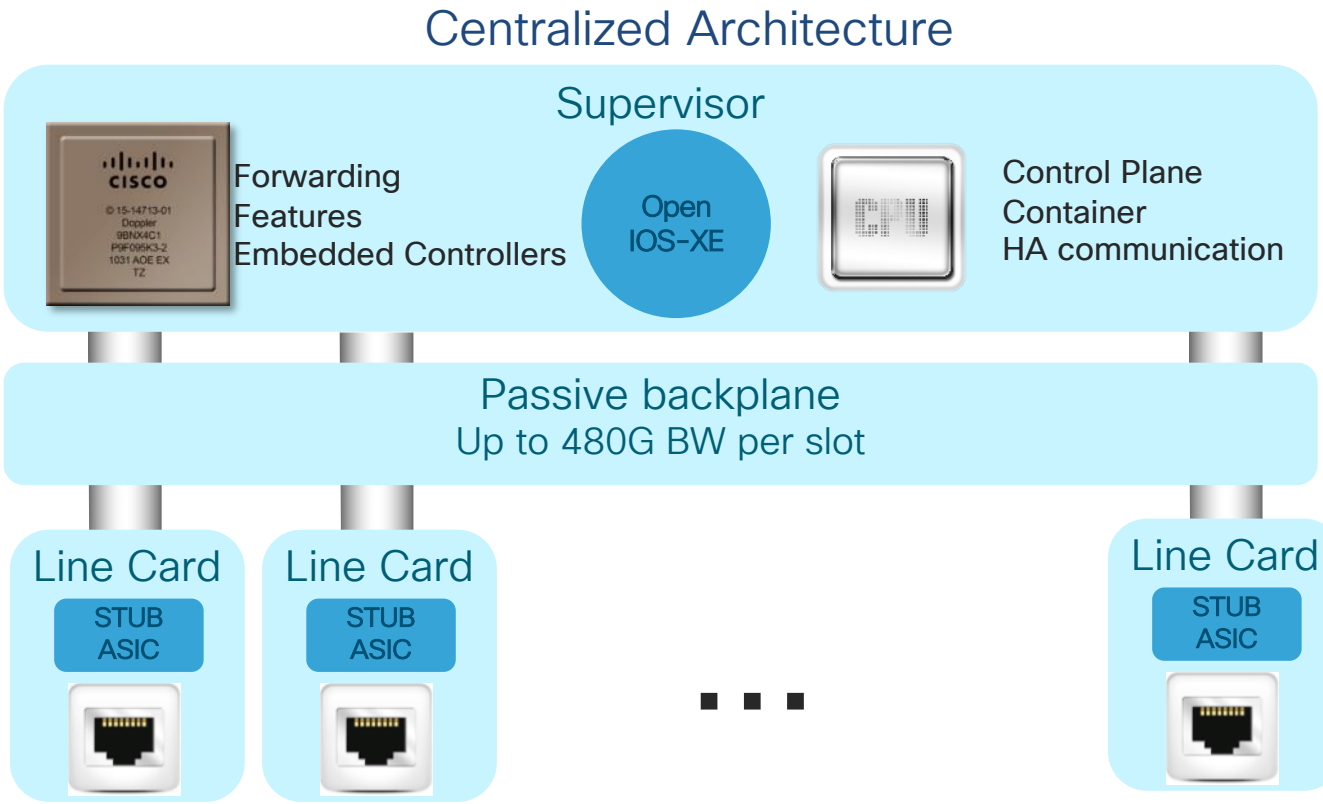
Catalyst 9400 Architecture



- Uninterrupted Sup switchover and software update
- Upgrade Supervisor unlock new capability
- High MTBF with passive backplane

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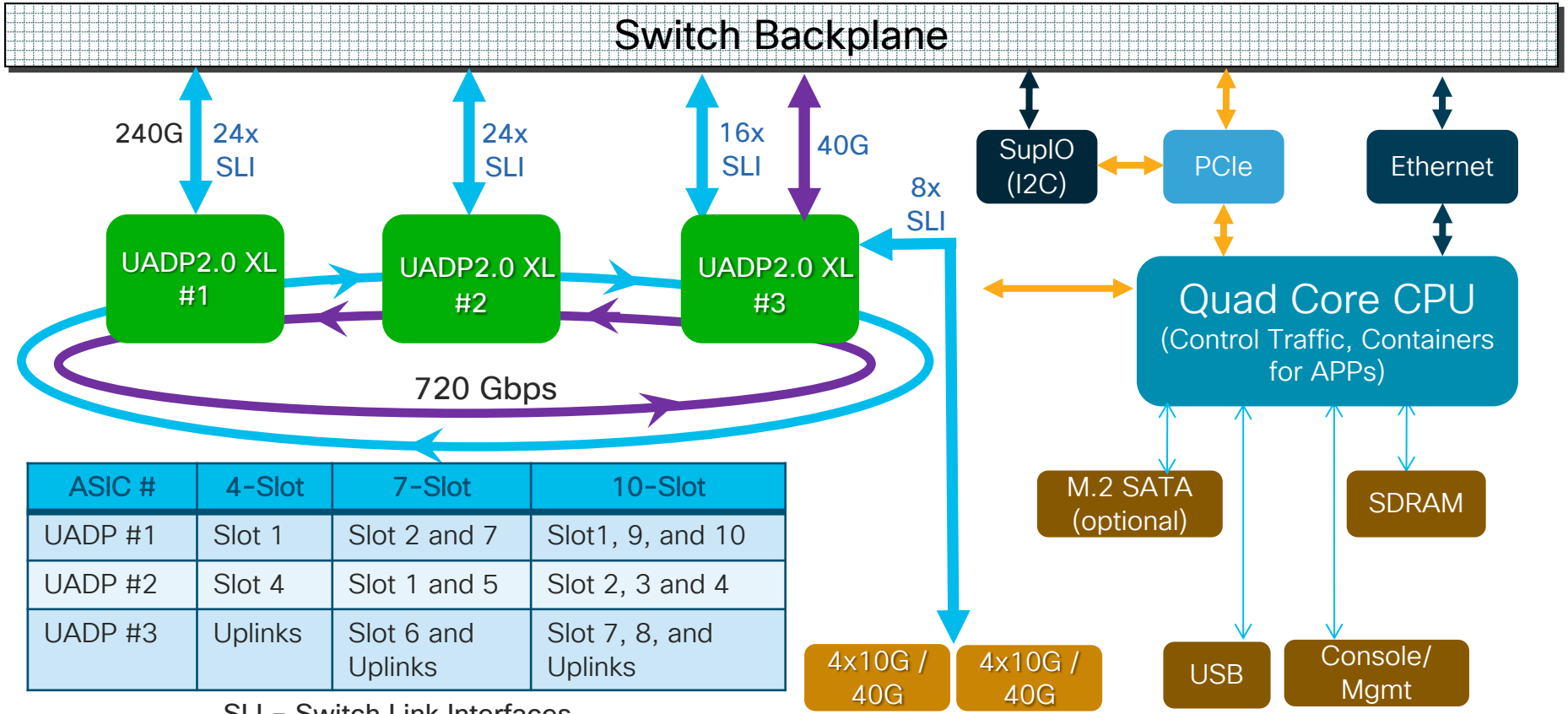
Sup-1/Sup-1XL Block Diagram



ASIC #	4-Slot	7-Slot	10-Slot
UADP #1	Slot 1	Slot 2 and 7	Slot1, 9, and 10
UADP #2	Slot 4	Slot 1 and 5	Slot 2, 3 and 4
UADP #3	Uplinks	Slot 6 and Uplinks	Slot 7, 8, and Uplinks

SLI – Switch Link Interfaces

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UADP 3.0

- Investment Protection — Flexible Pipeline
- Universal Deployments — Adaptable Tables
- Enhanced Scale/Buffering — Multicore resource share

- Performance
- Flexibility
- Programmability

Up to 384K Flex Counters

Shared Lookup

Up to 1.6T Bandwidth

Up to 2X to 4X Forwarding + TCAM

Up to 20B Transistors

16nm Technology with latest ASIC

Embedded Microprocessors

Up to 36MB Packet Buffer

Up to 64K x2 Netflow Records

Flexible & Programmable ASIC – Adapts to the New Technologies

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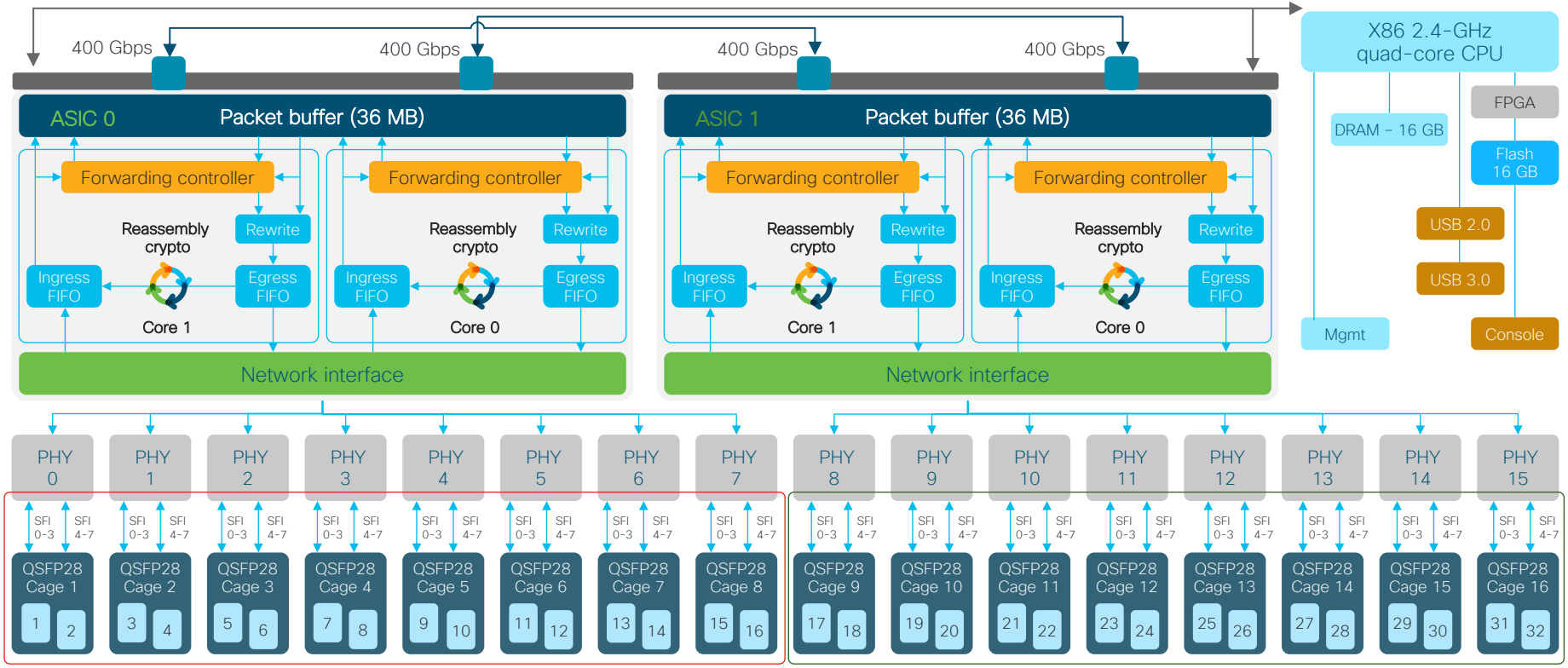
Cisco Catalyst 9500-32C Block Diagram



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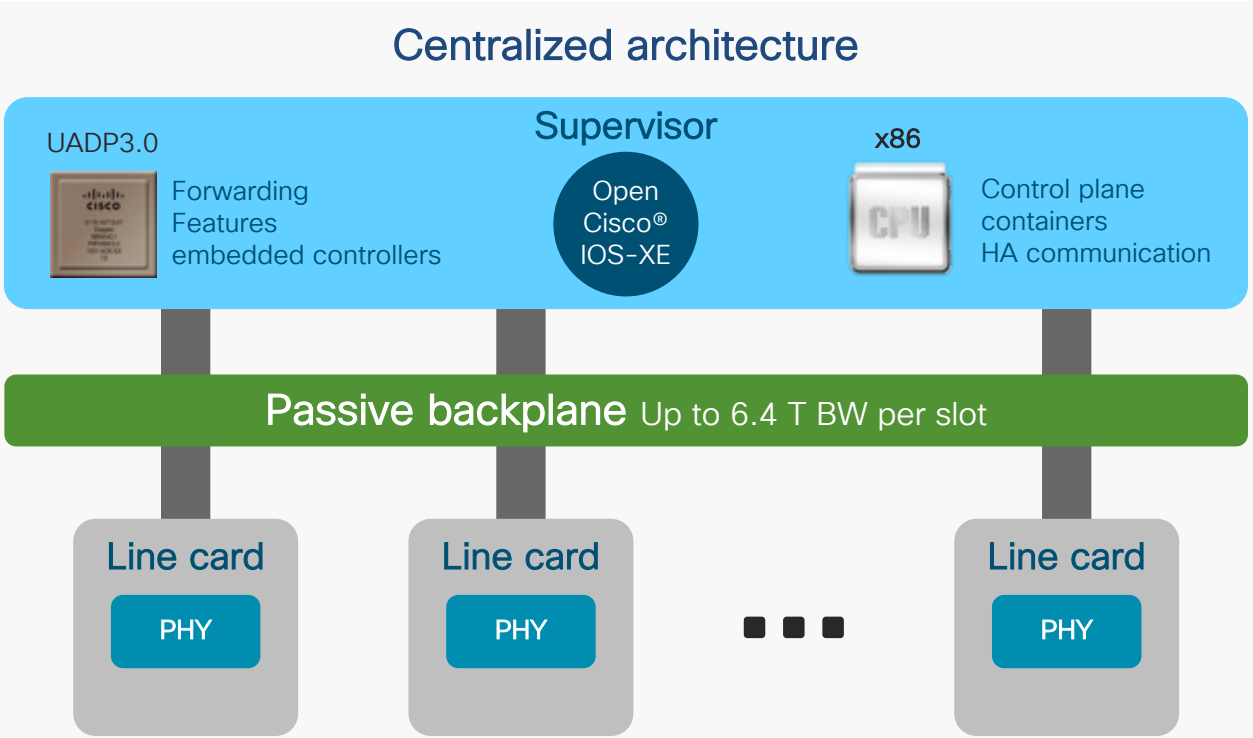
Catalyst 9600 Architecture



- Centralized architecture => **Uninterrupted supervisor switchover**
- Centralized architecture (Forwarding, queuing, and security are done on the supervisor) => **Unlock new capability** with a supervisor upgrade
- Transparent line cards => **Compatible** with new sup
- Passive backplane => **High MTBF**
- X86 CPU + storage => **App hosting**

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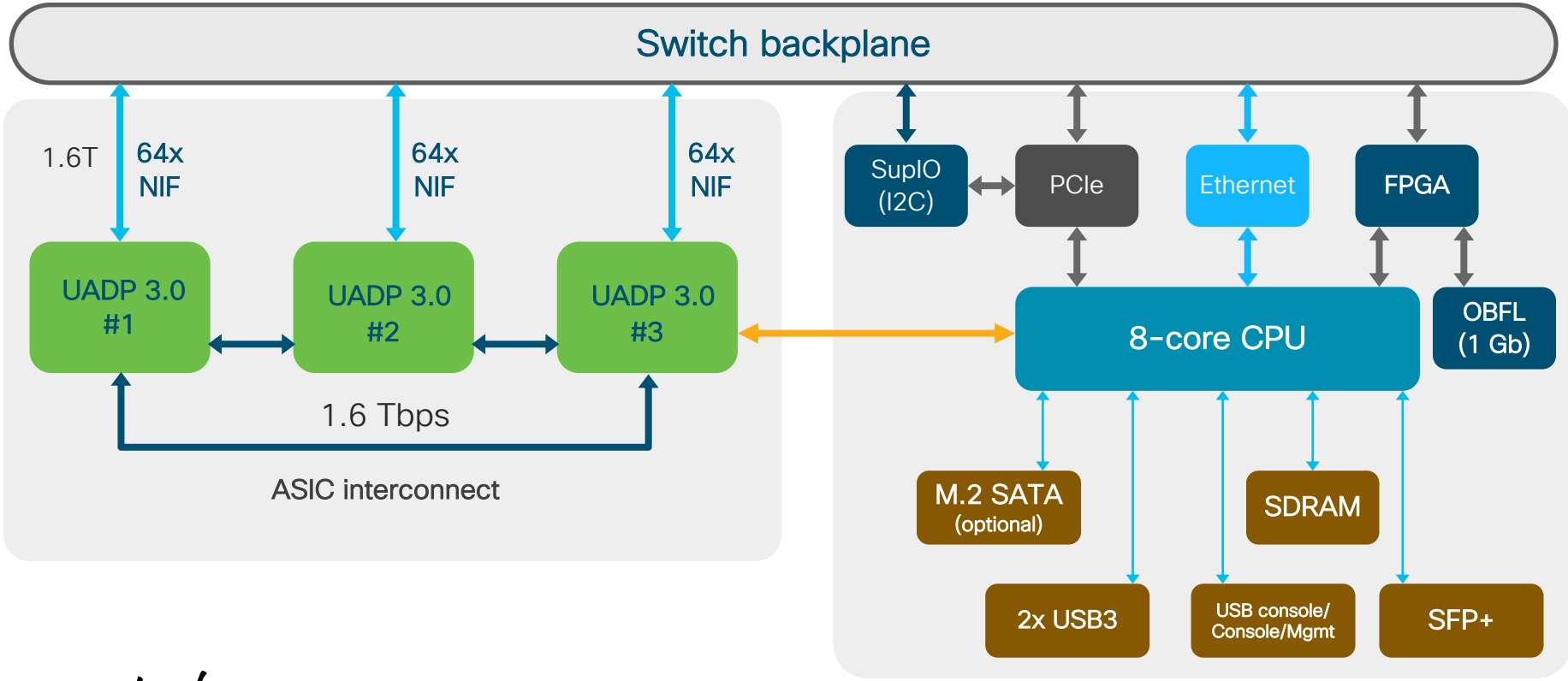
Supervisor 1 – Block Diagram



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UADP ASIC

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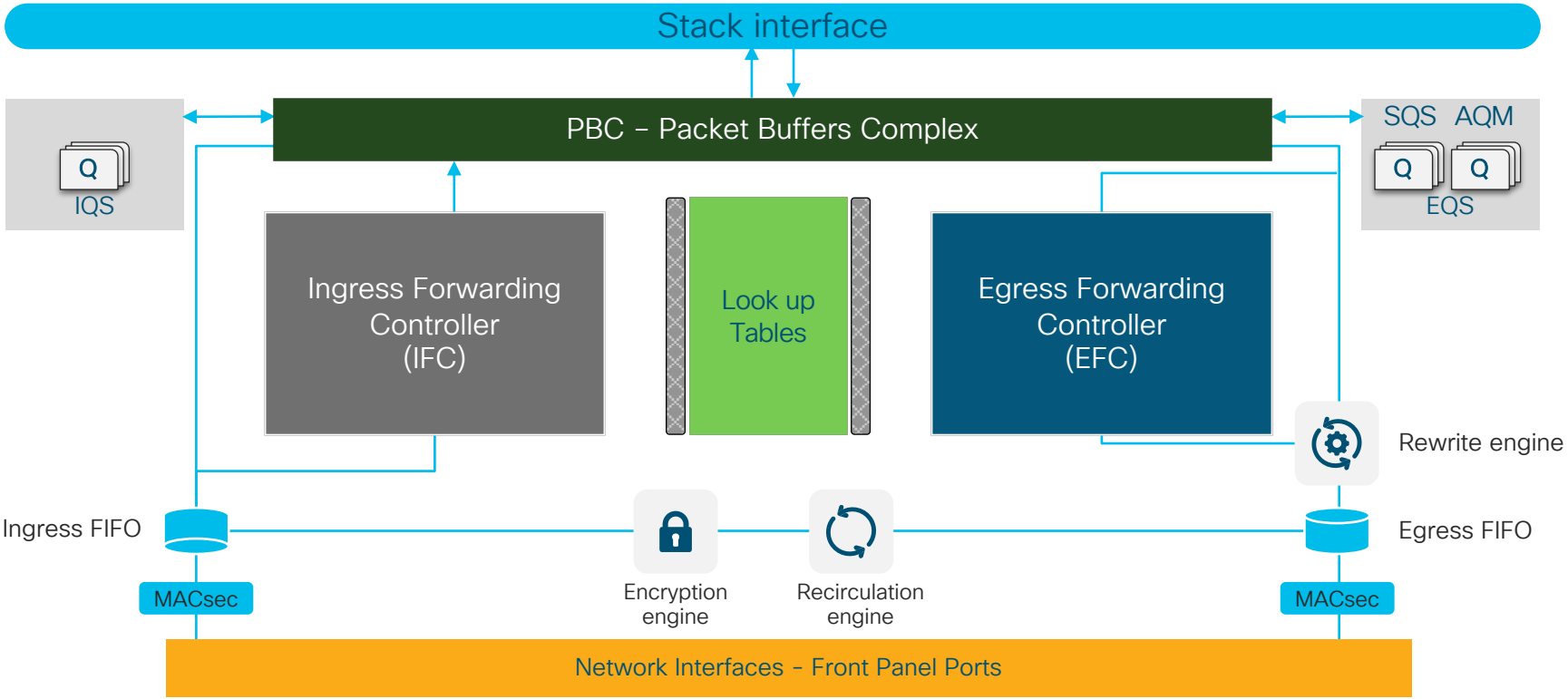
UADP Core Architecture



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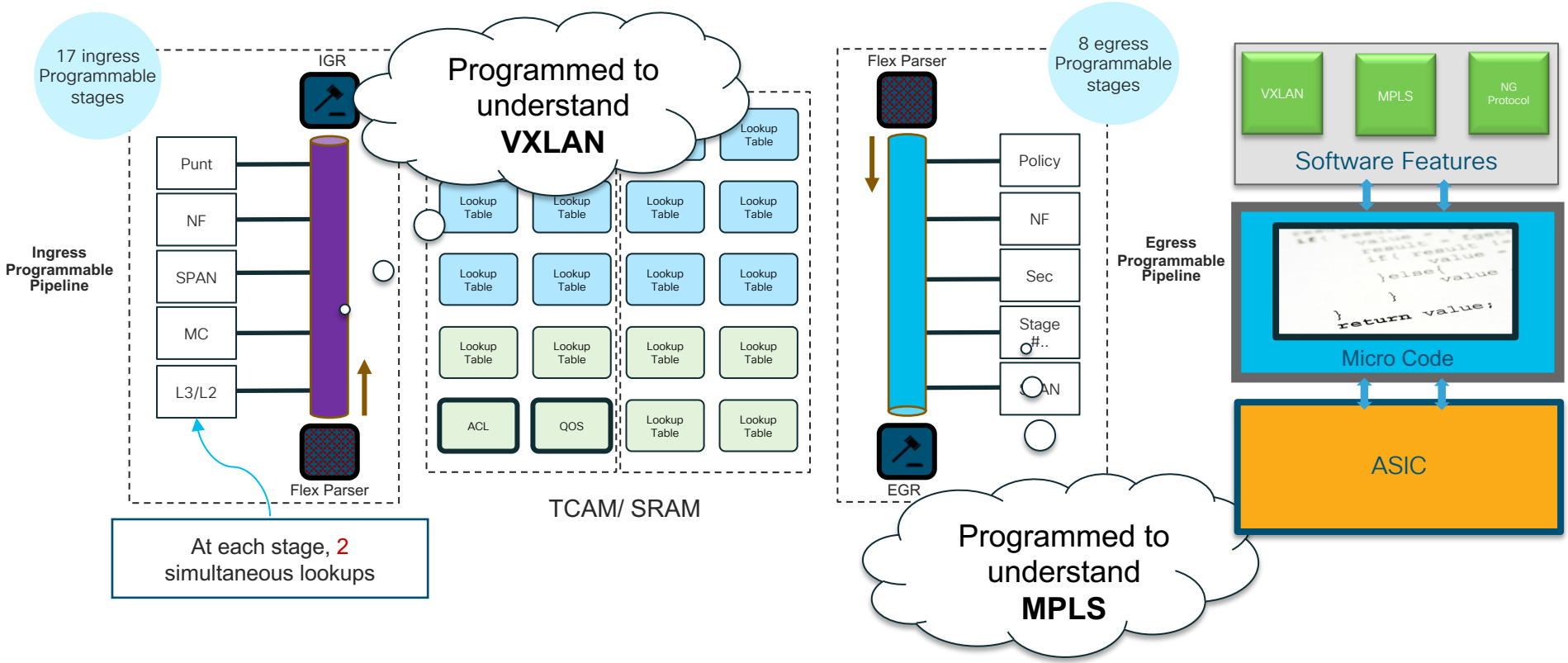
UADP – Programmable Pipelines



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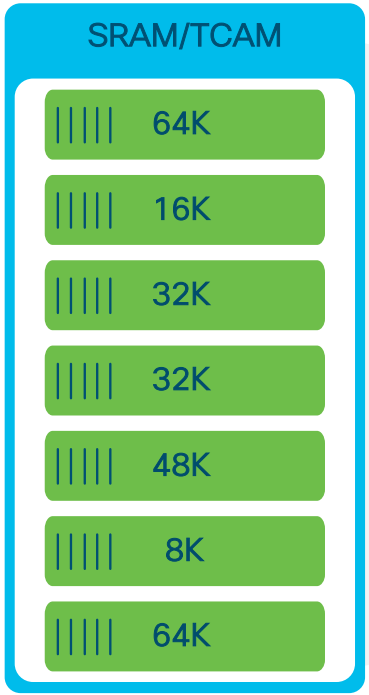
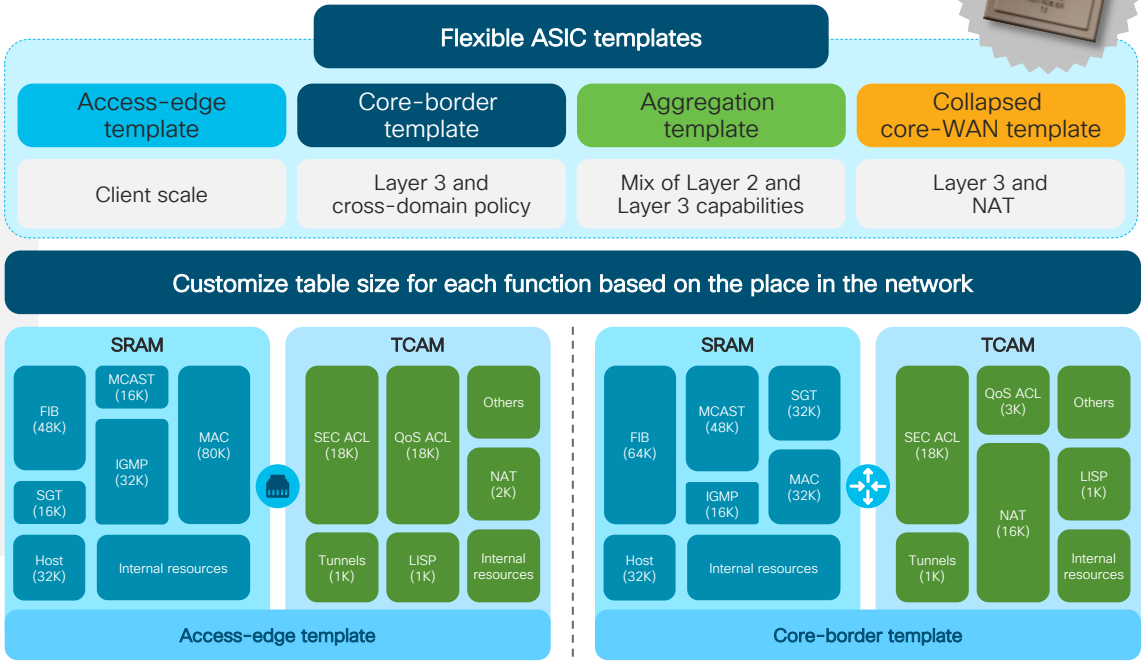
UADP – Flexible Tables

Custom ASIC templates for universal deployment flexibility



- MAC
- IPv4/IPv6
- VACL
- PACL
- RACL
- SGACL
- QoS
- NAT
- SPAN
- CoPP



Tables sizes can be tailored to support multiple templates

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High Availability

You make networking **possible**

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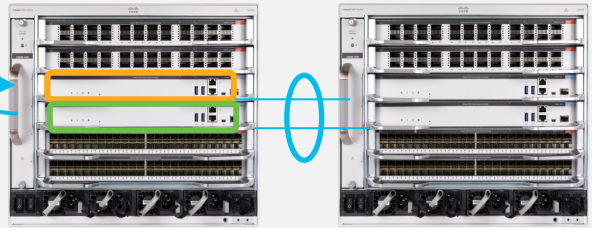
Mission-critical Resiliency with Cisco Catalyst 9000

Your Business Stops if the Core is Down

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



Cisco Catalyst 9600 Series

Cisco Catalyst 9400 Series

Cisco Catalyst 9500 Series

Architecture

- ISSU: Upgrade software with minimal to no traffic loss
- StackWise® Virtual: Redundant system for high availability, simplified configuration

Operating system

- Hot Patching: No downtime for bug fixes (no reboot)
- GIR: No downtime when device removed for maintenance

Platform

- Redundant Supervisor for Modular Switches with NSF/SSO
- Redundant Fan and Power Supply in case of any hardware failure

Eliminate Downtime with High Availability Designed at Every Level

*** Based on industry reports from Gartner and ITIC

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High Availability Architecture in Campus – SSO

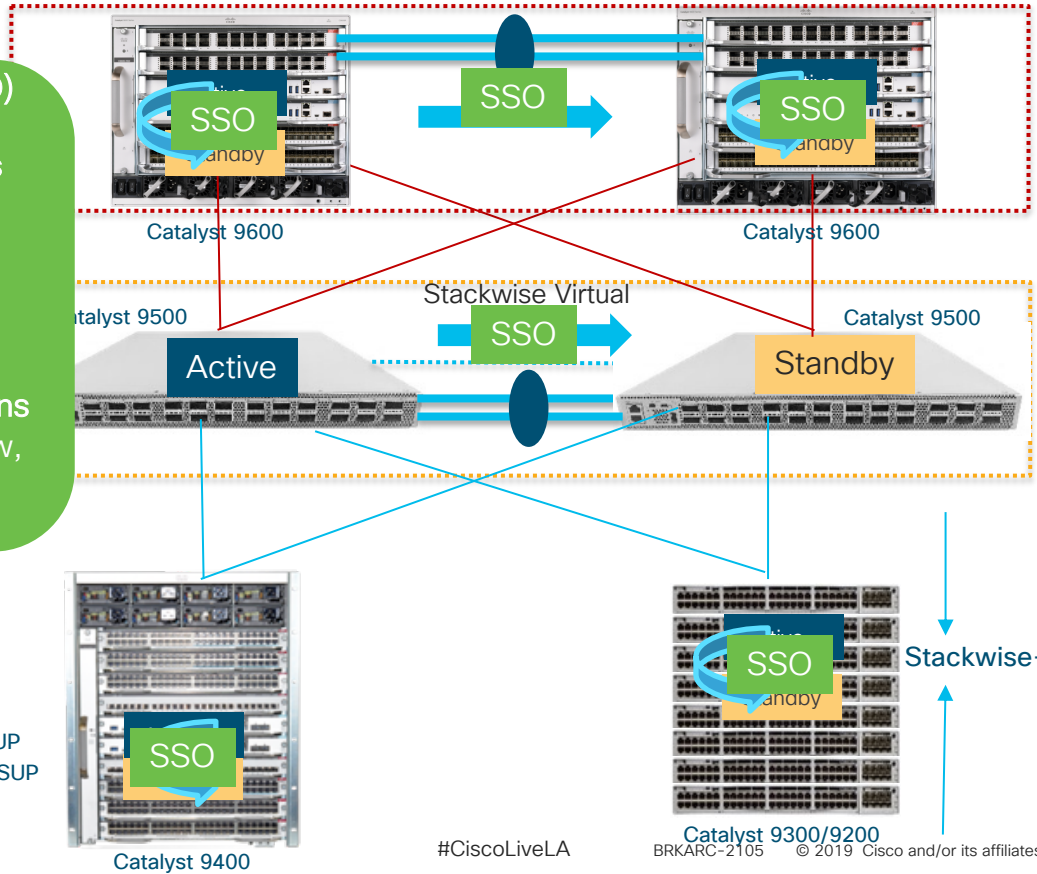
Stateful Switchover (SSO)

SSO Aware Applications

Forwarding Information Base IEEE 802.1x
PAgP / LACP
...and more

SSO Compliant Applications

Routing Protocols, Netflow, etc



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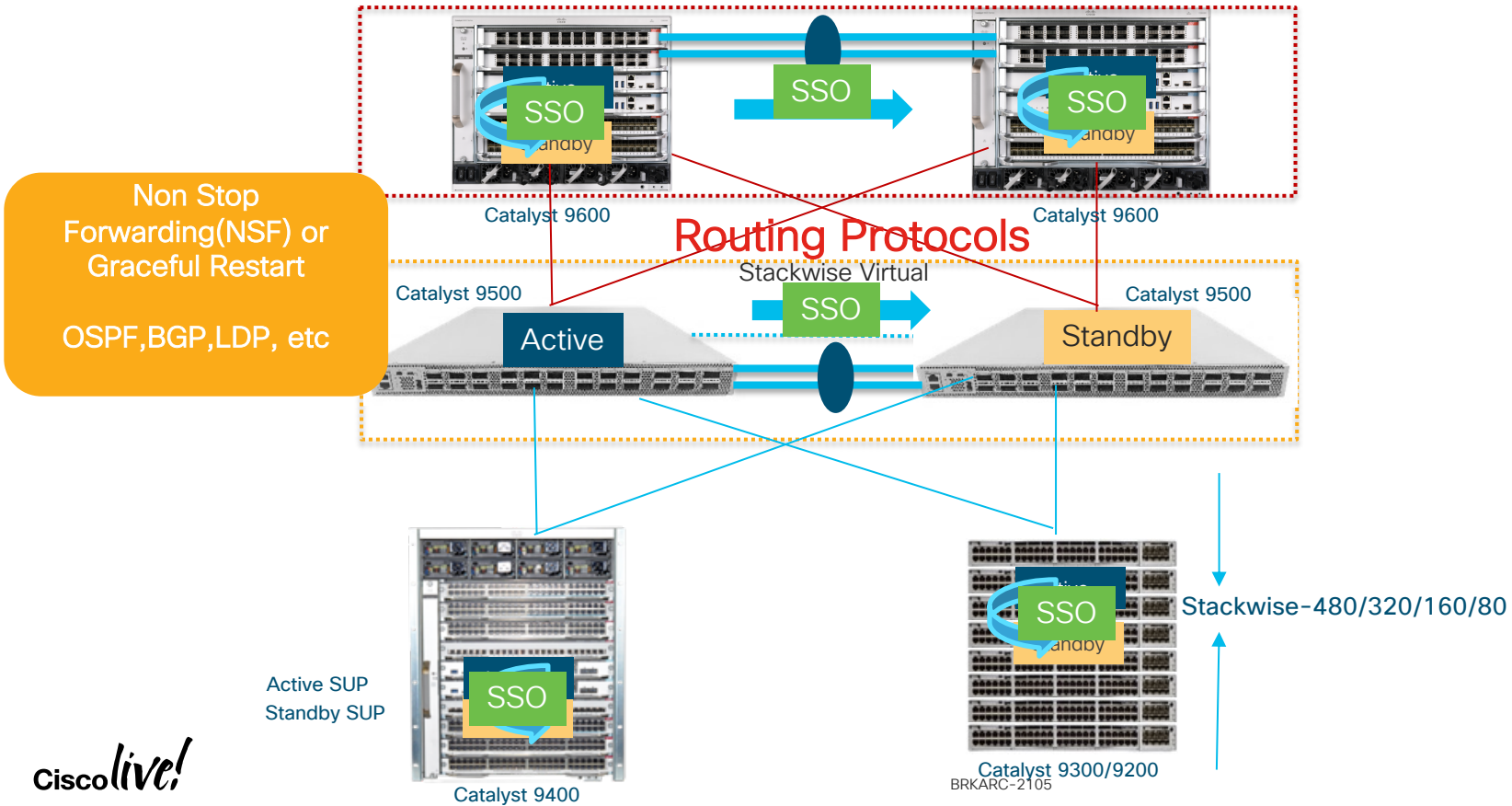
High Availability Architecture in Campus – SSO/NSF

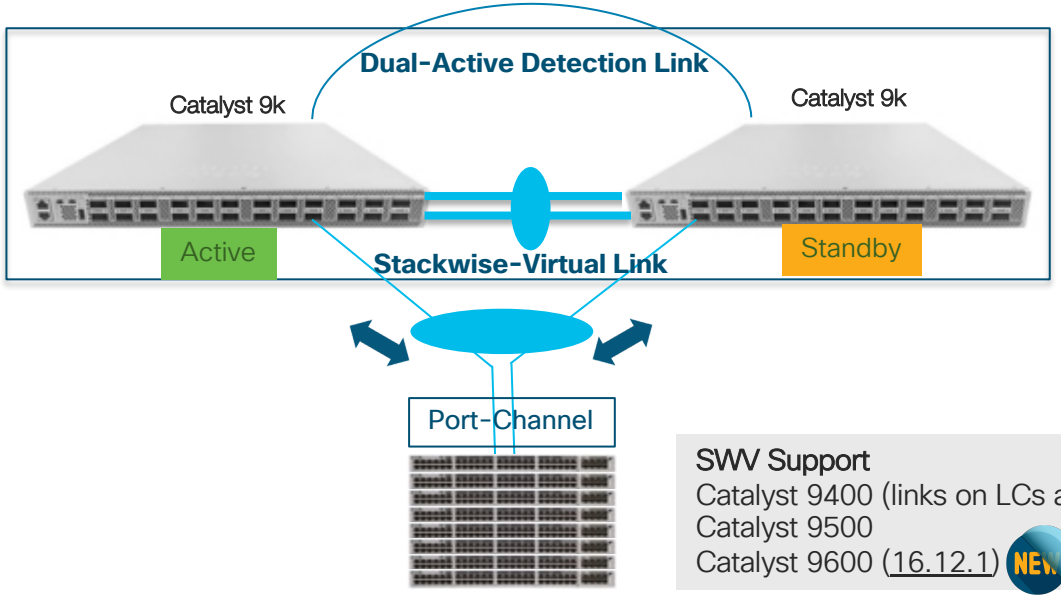


StackWise Virtual – Unified Control Plane

Manage, Configure and Troubleshoot two switches as one

Unified Control Plane & Active-Active Data Plane

- **StackWise Virtual Link**
  Dedicated Stacking Link facilitating communication between the switches
- **Dual Active Detection Link**
  Dedicated Connection to check and avoid dual-active scenario
- **Multi-Chassis Ether-channel**
  Port-Channel Spanning across StackWise virtual switches (L2 and L3 Port-channels)



SWV Support
Catalyst 9400 (links on LCs also)
Catalyst 9500
Catalyst 9600 (16.12.1) NEW

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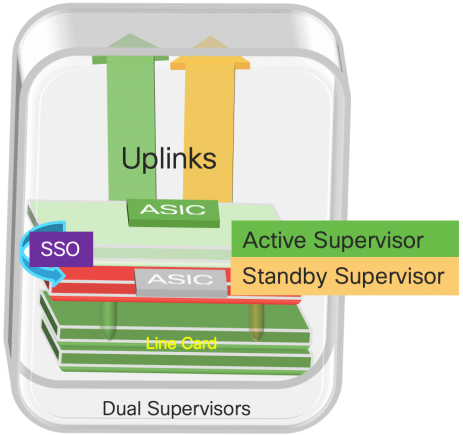
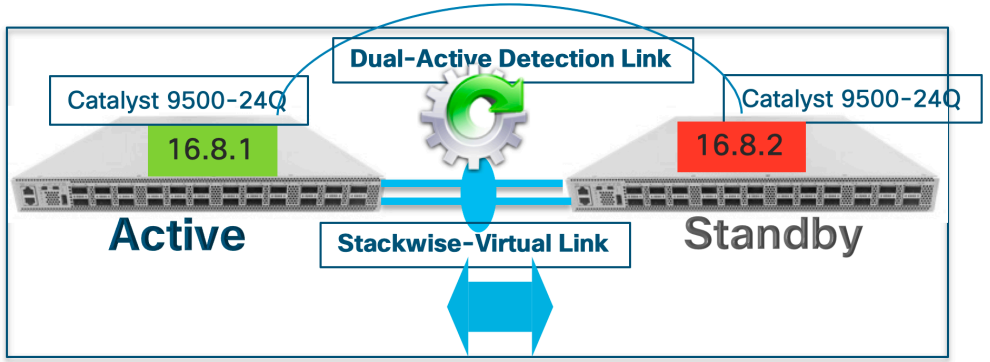
In Service Software Upgrade (ISSU)

ISSU Support
C900, C9500, C9600
EM1 (16.9.2+ rebuild) => EM1 (Any rebuild)
EM1(Any Recommended) => EM2(Current Recommended)

Perform software upgrades without taking the switch out of service



Dual Supervisors



StackWise Virtual

- With Dual Supervisors & StackWise Virtual
- ISSU Process leverages SSO/NSF Architecture
- Dual SUP: Uplinks on both active and standby SUP are forwarding traffic, convergence is less than 200 msec
- SWV: Sub-second convergence

3 Step Process

- Install add file <tftp/ftp/flash/disk:*.bin>
- Install activate ISSU
- Install commit

1 Step Process (Single Command)

Install add file <tftp/ftp/flash/disk:*.bin>activate ISSU commit

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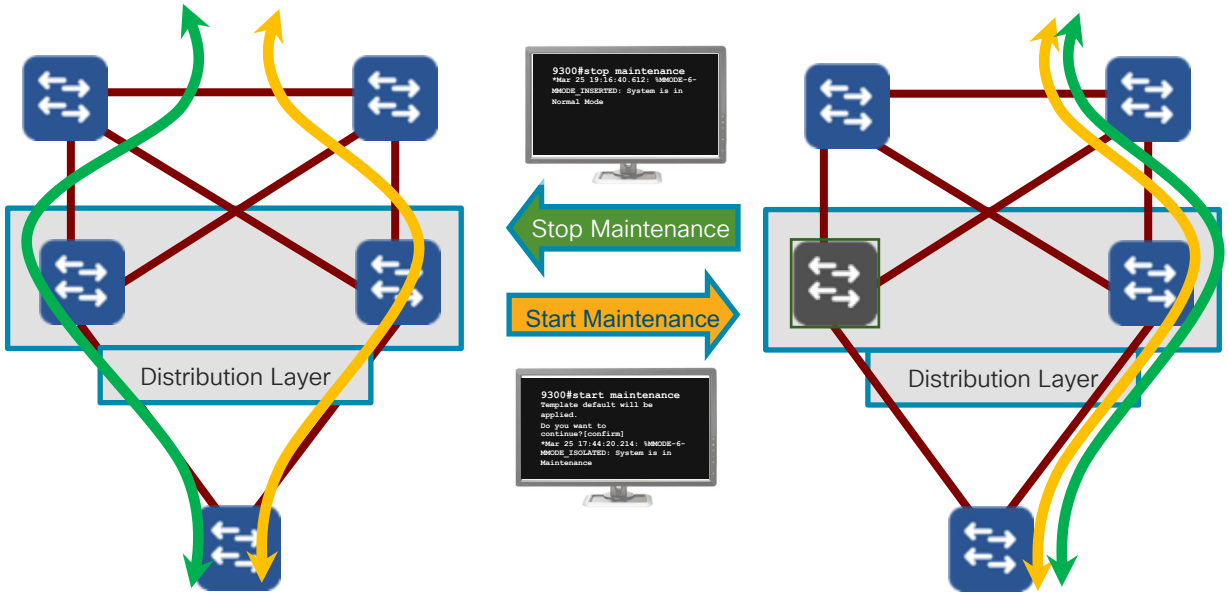
Graceful Insertion and Removal on Catalyst 9000

Isolation of Switch from Network Gracefully

Hardware replacement

Software upgrades

Configuration changes



Protocols: ISIS, OSPF, BGP, HSRP, VRRP, Interfaces (via shutdown CLI)

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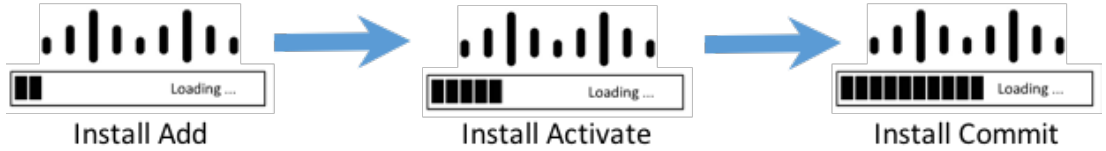
IOS-XE Software Patchability



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.

Cost
- Expensive Upgrades – Business Loss
- Each device upgrade causes Network outage

Time
- Reduced IT staff slows software roll out
- Physical presence required

Scope
- New Code requires bug analysis, certification

SMU
Point Fixes
Reduces Validation – Scope & Time

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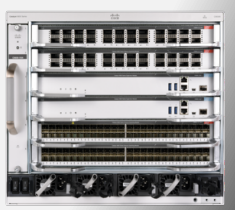
Security

You make networking **possible**

Cisco live!

End-to-end Security



256 BIT
ENCRYPTION

Trustworthy Systems

Encrypted Traffic Analytics

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Closing & Wrap up...

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Cisco Catalyst 9000 Switching – Small Branch to Mission Critical Campus

- Converged ASIC
- Single image
- Common licensing

Open Cisco IOS XE

UADP ASIC

First in enterprise

- x86 CPU with application hosting
- Cisco UADP programmable application-specific integrated circuit (ASIC)
- Software patching

Unmatched in industry

- High availability
- Multigigabit density
- Cisco UPOE® scale (90W)
- 100G Ethernet
- 25G Ethernet

Future ready

- Wi-Fi 6 (IEEE 802.11ax) ready

Security | IoT Convergence | Mobility | Multicloud

Foundation of intent-based networking

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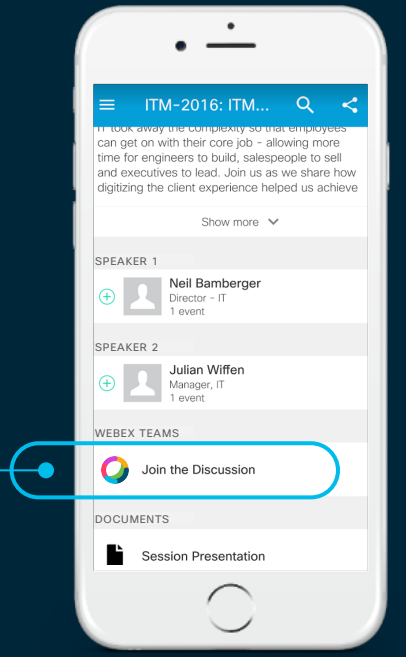

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