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You make possible

Catalyst 9000 Series Access Switching Architecture

Minhaj Uddin, Technical Marketing Engineer

BRKARC-3863

cisco Live!

Barcelona | January 27-31, 2020

A New Era of Networking

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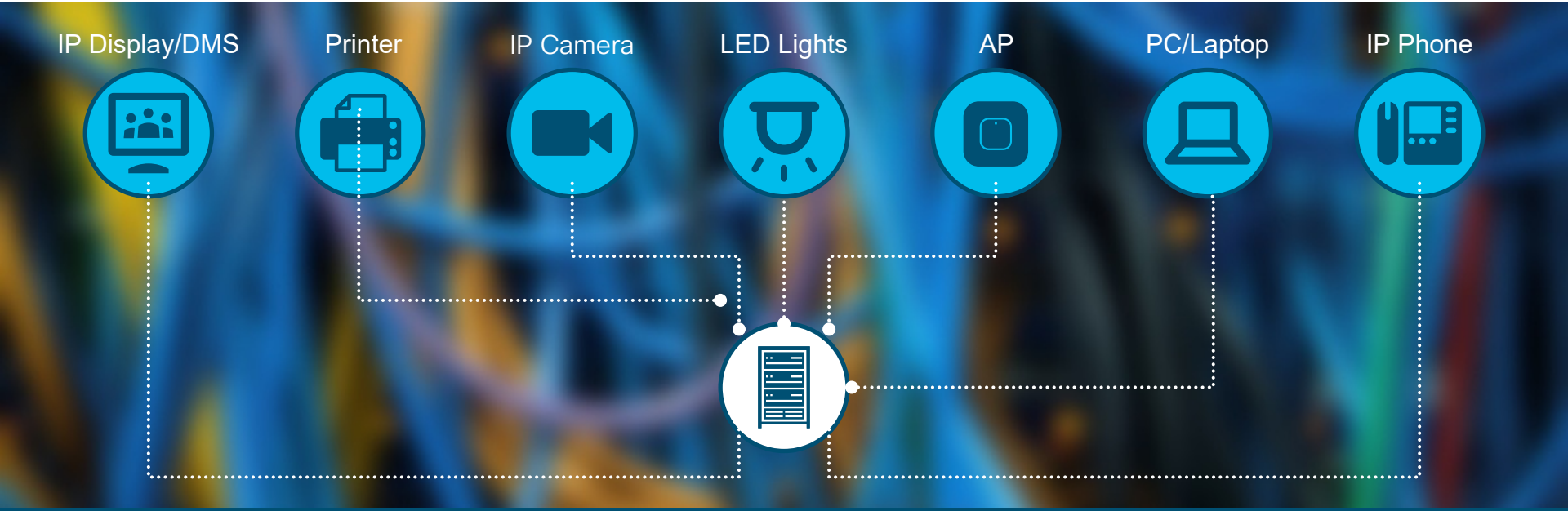
Is Your Network Ready for the New Era?



Does the platform support new PoE devices efficiently?

Does the platform make it easy to provision and scale?

Does the platform support enough Programmability?

Does the platform ensure secure network access?

Does the platform let you adapt to new connectivity requirements?

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New Era of Networking – Catalyst 9300

Integrated security	Mobility ready	IoT ready	Cloud ready
Network as a Sensor Encrypted Traffic Analytics Macsec Encryption Trustworthy Systems	Fabric Enabled Wireless Unified control and policy	CoAP POE Enhancements IEEE 1588	Devops Toolkit Streaming Telemetry SDA Web UI Patchability GIR

“The goal of this session is to give you an in depth view of the Fixed Access platforms so you can understand its strength as well as its limitations ...”

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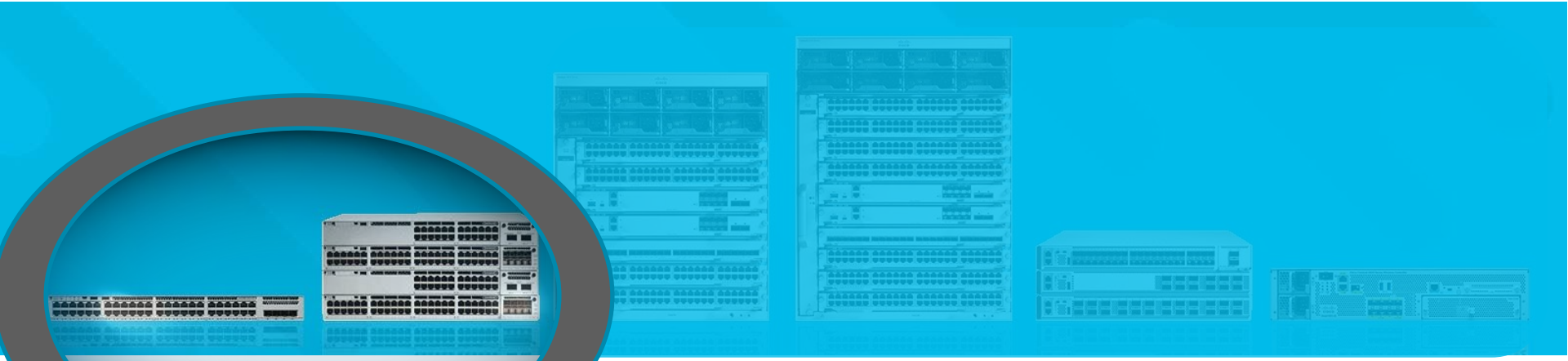
The Catalyst 9K Family



Catalyst 9200 Catalyst 9300

Fixed Access Switches

Catalyst 9400

ess & Distribution Switches

Catalyst 9500

Core & Distribution Switches

Catalyst 9800

Wireless LAN Controller

Please refer to other sessions

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

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Agenda

- Introduction & Overview
- Platform Architecture, ASIC & Packet Walks
- Stacking Architecture & High Availability
- Differentiating Features & IOS-XE
- Wrap up

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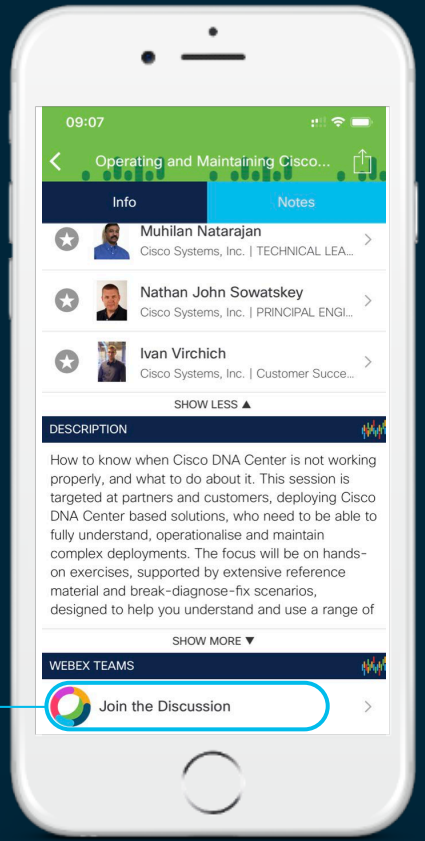
Cisco Webex Teams

Questions?

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

How

1. Find this session in the Cisco Events Mobile App
2. Click “Join the Discussion”
3. Install Webex Teams or go directly to the team space
4. Enter messages/questions in the team space



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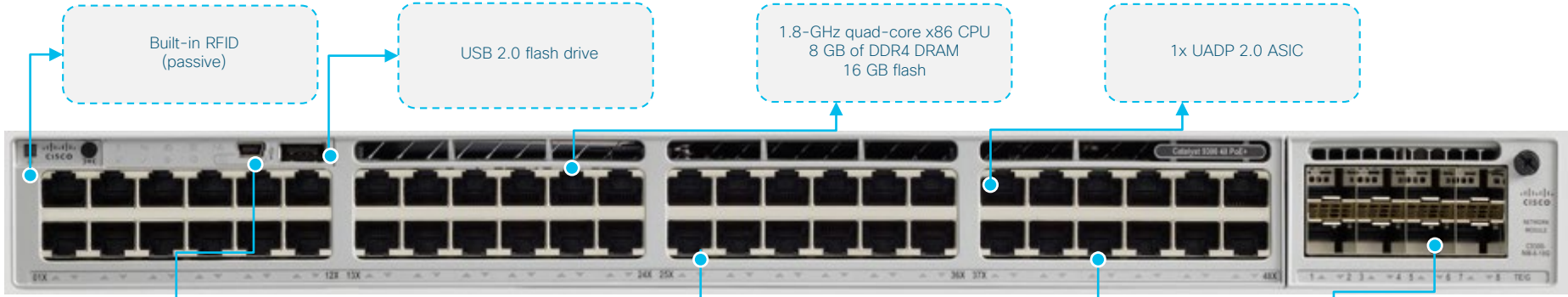
Catalyst 9300

Catalyst 9300 – Leading Fixed Access Switch



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Catalyst 9300– Back View

External Storage
USB 3.0 Removable storage
(120GB SSD)

Stack Cables

Redundant Fans

Redundant Power

Stackwise-480/320

Stackpower*

Optional Power Supplies
(AC+DC)

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

Cisco Catalyst 9300 Series Switches
New generation of fixed access

Flexible uplinks
(C9300 SKUs)

Copper – 24/48 Ports

Data-Only

POE+ – 30W

UPOE – 60W

Fiber 1G SFP – 24/48 Ports

Data-Only

Fixed uplinks
(C9300L SKUs)

Copper – 24/48 Ports

Data or POE+

C9300L Stack kit

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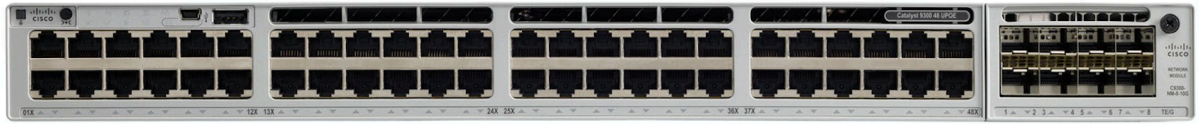
Cisco Catalyst 9300 Increased Scale Platform
C9300 AVID Models

NEW

In Progress
CERTIFIED

EXPANDED
PACKET BUFFERS



C9300-48UB

C9300-24UB

INCREASED
NETWORK SCALE

Powered by UADP 2.0 XL

Stackable Access optimized for Media Distribution and IP Storage Networks

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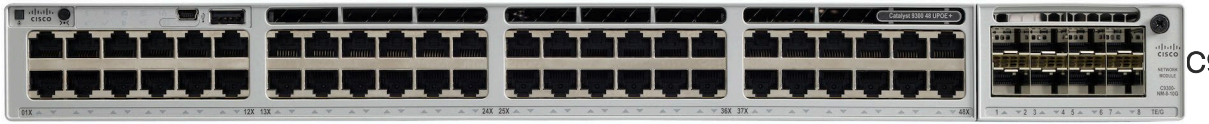
Cisco Catalyst 9300 – IEEE 802.3bt Compliance

Introducing 90W UPOE+ Models to power latest intelligent devices

NEW

~ 21 Ports of 90W in Standalone Mode



C9300-48H

168 Ports of 90W in StackWise-480

C9300-24H

Highest 90W Port Density in the industry

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Multigigabit Ethernet

What Speeds Are Supported on MultiGigabit Ports?

MultiGigabit Phys Are Different than 1Gigabit Phys

MultiGigabit Ports Are Capable of the Following Speeds

100M / 1Gig / 2.5Gig / 5Gig / 10Gig

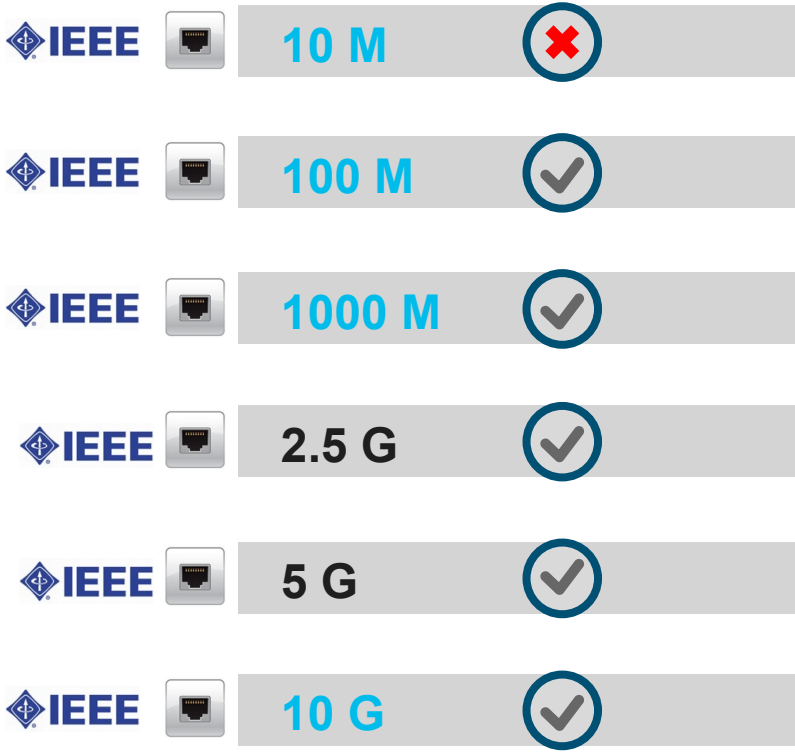
No 10M on MultiGigabit Ports

2.5Gig and 5Gig Are now standard

The Non-MultiGigabit Ports Are the Same as Previous Line Cards / Products – Support 10M/100M/1Gig Speeds

MultiGigabit Phys Are Same on Across our MultiGigabit Switch Family

Half Duplex on Multigigabit ports is **not supported**



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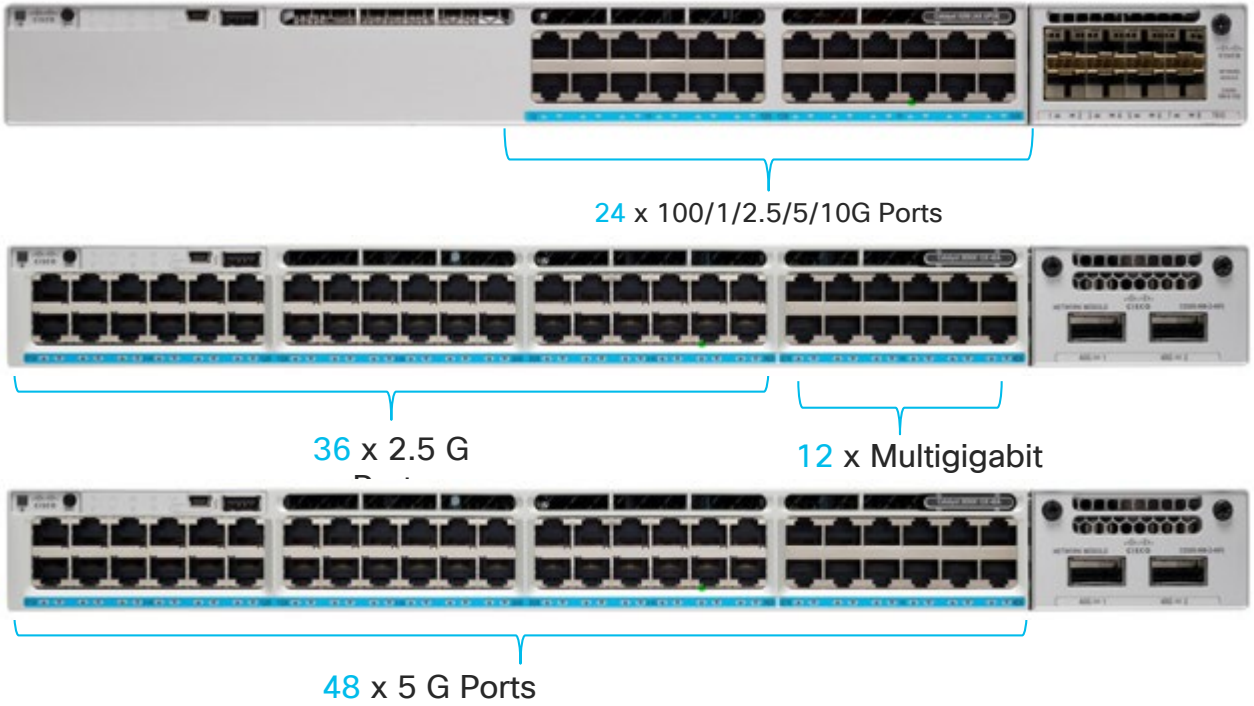
Catalyst 9300 Multigigabit Family



Highest 2.5G & mGig Density in the Industry

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Cisco Catalyst 9300 Increased Scale Platform
C9300 AVID Models

NEW

In Progress
CERTIFIED

EXPANDED
PACKET BUFFERS

INCREASED
NETWORK SCALE

24 x 100/1/2.5/5/10G Ports

Stackable Access optimized for Media Distribution and IP Storage Networks

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Introducing Multigigabit to 9300L Family

48 UPOE Ports

2x40G Uplinks

4x10G Uplinks

12x mGig Ports

24 UPOE Ports

2x40G Uplinks

4x10G Uplinks

8x mGig Ports

Stackable with 9300L Models

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Cisco Catalyst 9300 Series Switches
Multigigabit Models

Flexible uplinks
(C9300 SKUs)

Copper – 24/48 Ports

24UX

48UXM

48UN

Increased Scale/Buffer Multigigabit UPOE Model

24UXB

Fixed uplinks
(C9300L SKUs)

NEW

Multigigabit – 48 Ports (12 x Multigig)

Multigigabit – 24 Ports (8 x Multigig)

* Modular uplinks only

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Cisco Catalyst 9300 Series Switches
Uplink options

Cisco® Catalyst® 9300 Series
modular uplink models

4x Multigigabit copper

C9300-NM-4M

4x 1 Gbps SFP

C9300-NM-4G

8x 10 Gbps SFP/SFP+

C9300-NM-8X

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

C9300-NM-2Y

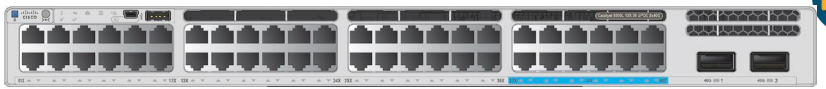
2x 40 Gbps QSFP

C9300-NM-2Q

Cisco Catalyst 9300 Series
fixed uplink models

4x 1G fixed uplinks

4x 10G fixed uplinks



NEW

2x 40G fixed uplinks

Modular Uplink options on all C9300 SKUs

Fixed uplink option on C9300L SKUs

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Catalyst 9300 – Power Supplies & Stacking

Power Supplies

350WAC 715WAC 1100WAC 750WDC

Platinum Rated

Stacking

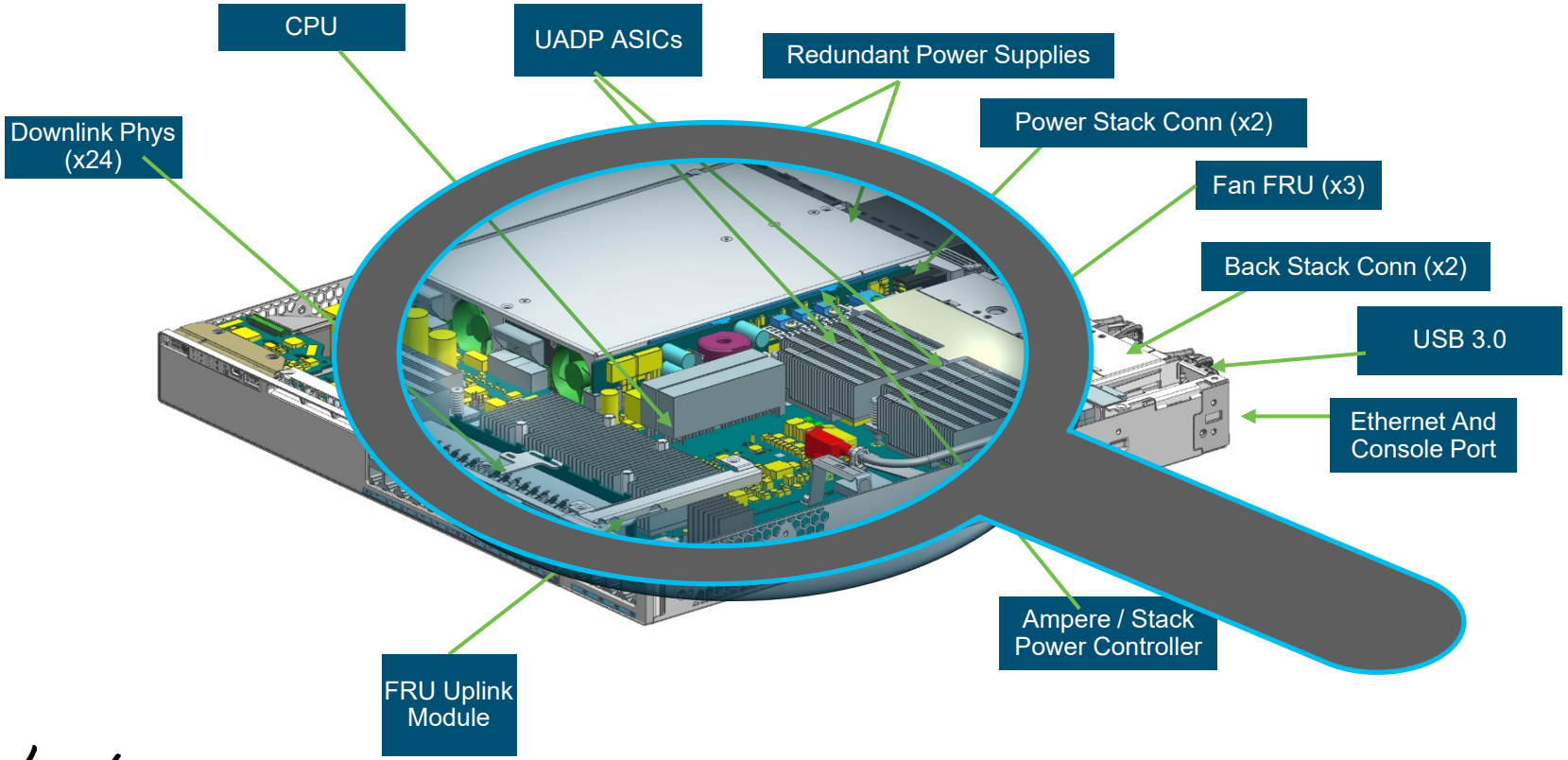
C9300

C9300L

0.5, 1 and 3 meter Options

Looking Inside the Switch

Catalyst 9300: Under the Covers...



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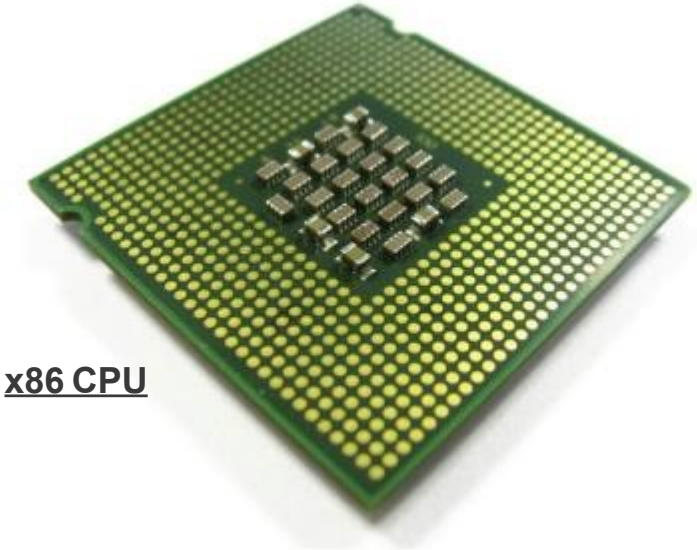
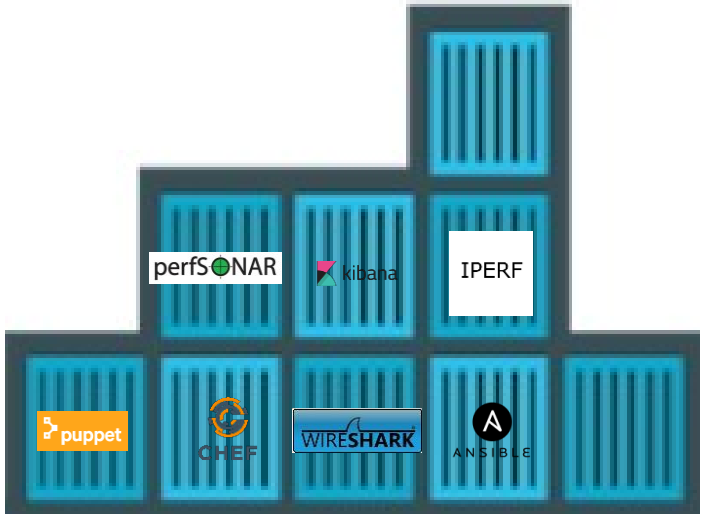
Catalyst 9K Family – x86 CPU



x86 CPU



x86 based 3rd Party Apps

x86 CPU enables hosting containers and 3rd party apps

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UADP – Next Generation of ASIC Innovation

Investment Protection
Flexible Pipeline

Universal Deployments
Adaptable Tables

Enhanced Scale/Buffering
Multicore resource share

Up to 384K Flex Counters

Shared Lookup

Up to 160G Bandwidth

Up to 2X to 4X Forwarding + TCAM

Up to 20B Transistors

16nm Technology with latest ASIC

Embedded Microprocessors

Up to 16MB Packet Buffer

Up to 64K Netflow Records

Flexible & Programmable ASIC – Adapts to the New Technologies

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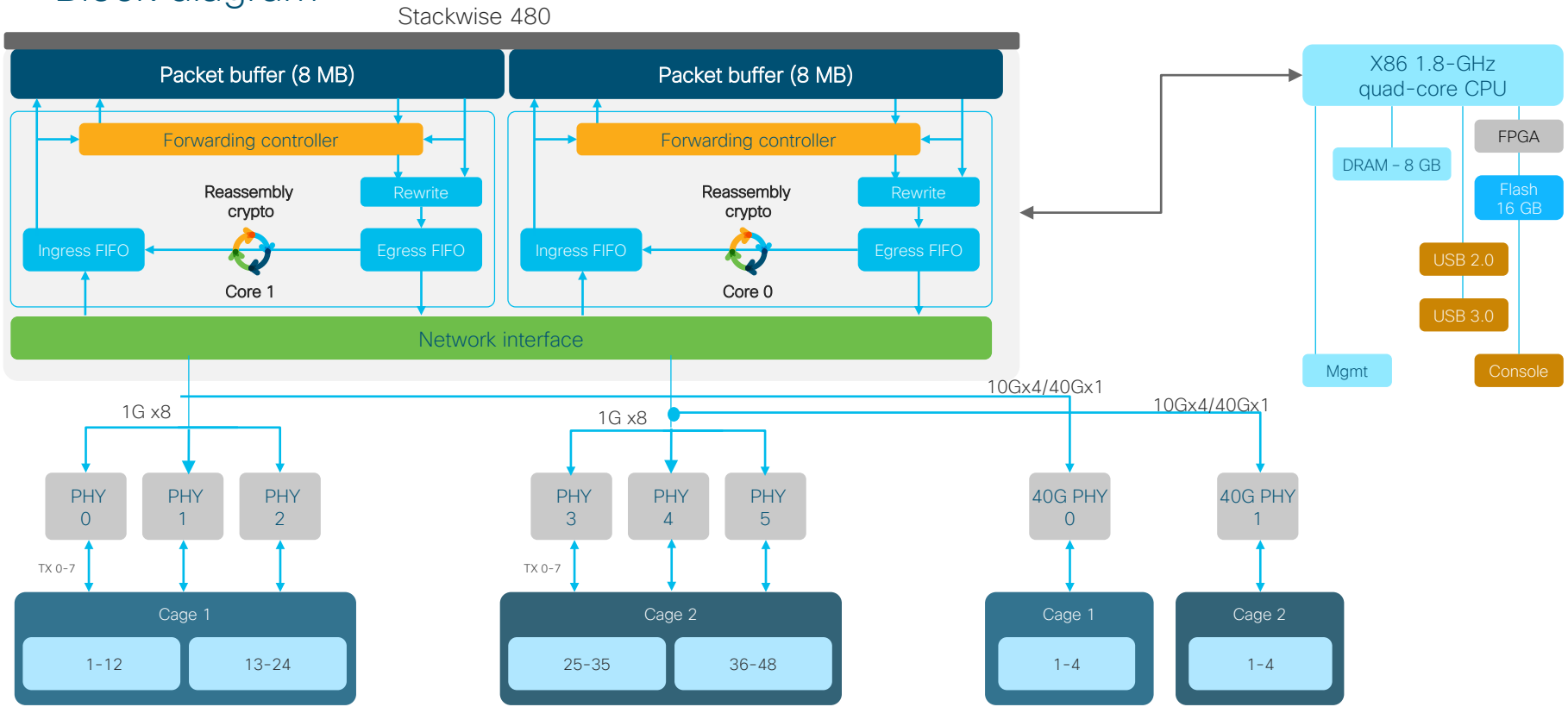
Platform Architecture & TCAM Scale

Cisco Catalyst 9300-24/48 Port

Block diagram



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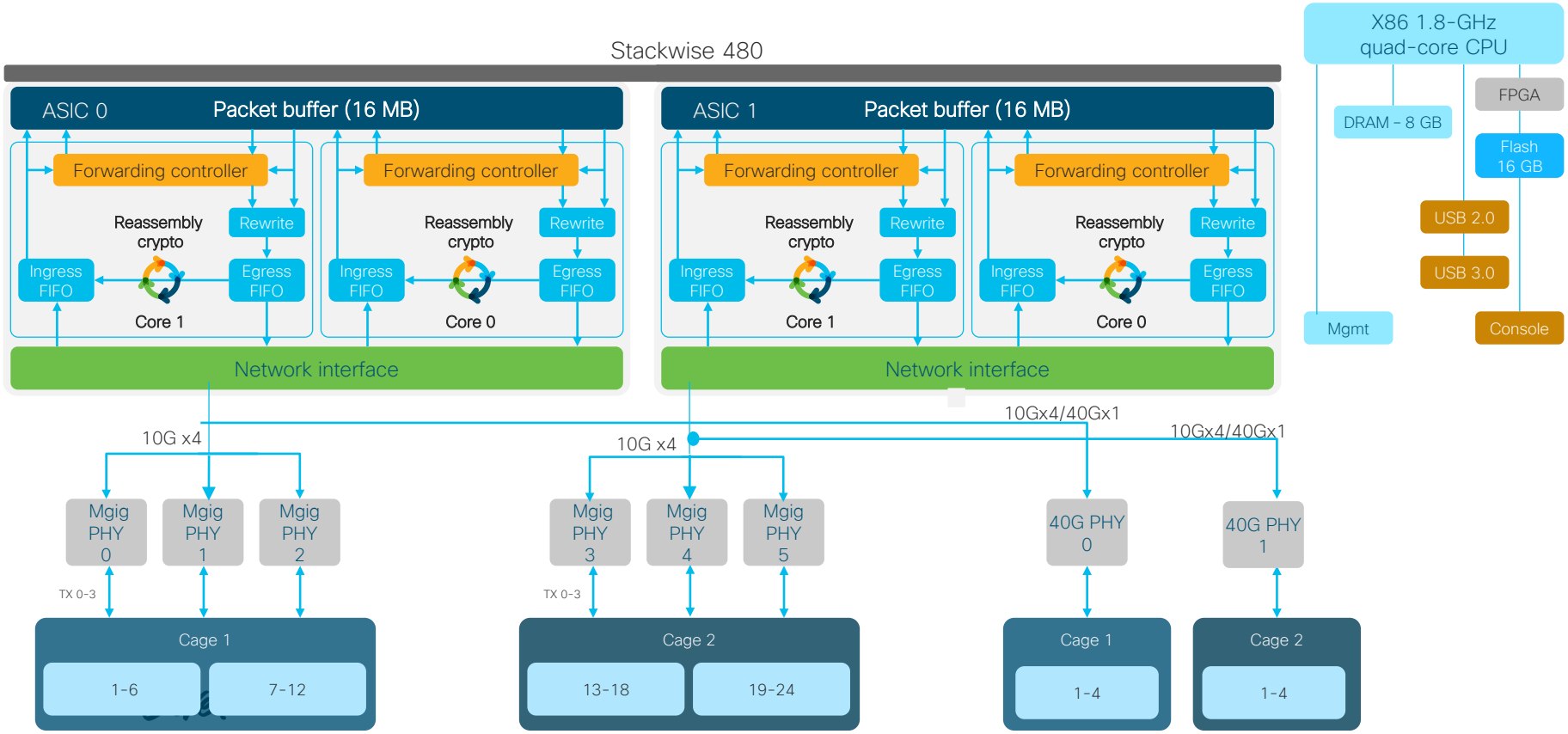
Cisco Catalyst 9300 Multigigabit-24



Catalyst 9300-B Lookup Tables

Forwarding resources

	Cisco® Catalyst® 9300-B Series Advantage	Cisco® Catalyst® 9300-B Series Essentials
MAC addresses	64,000	32,000
Host/Direct routes	48,000	24,000
IGMP groups	16,000	8000
LPM/Indirect routes	64,000	8000
Multicast routes	16,000	8000
SGTs	8000	8000

Feature resources

	Cisco® Catalyst® 9300-B Series Advantage	Cisco® Catalyst® 9300-B Series Essentials
Security ACL entries • PACL • VACL • RACL	18,000	5000
QoS ACL entries	18,000	5000

NetFlow

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

Higher Scale with Advantage License

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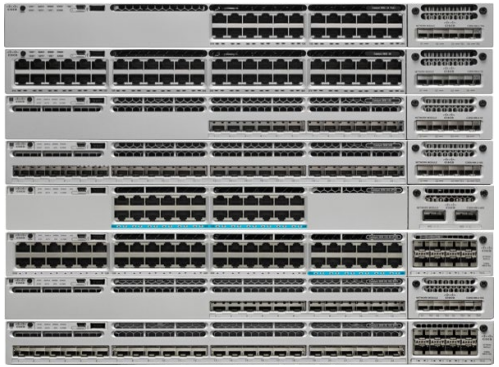
Stackwise-480

Catalyst 9300 Stacking Support

Modular Uplink
C9300 (non -B) SKUs

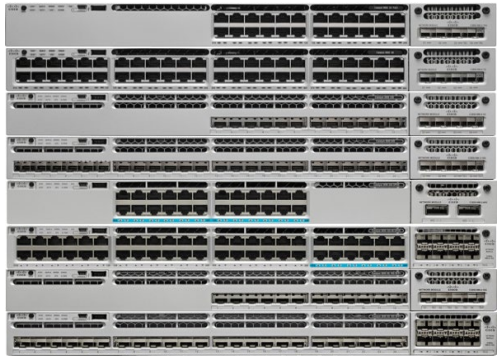


8 switches

Stacking supported among C9300 SKUs

Combination Support on Roadmap

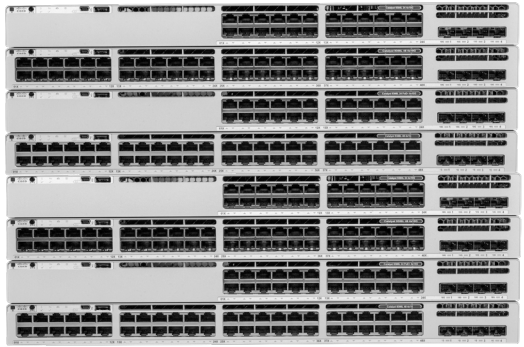
Increased Scale
C9300-B SKUs
(today)



8 switches

Stacking supported among C9300-B SKUs

Fixed Uplink
C9300L SKUs



8 switches

Stacking supported among C9300L SKUs only

Mixed stacking is not supported between C9300 and C9300L SKUs

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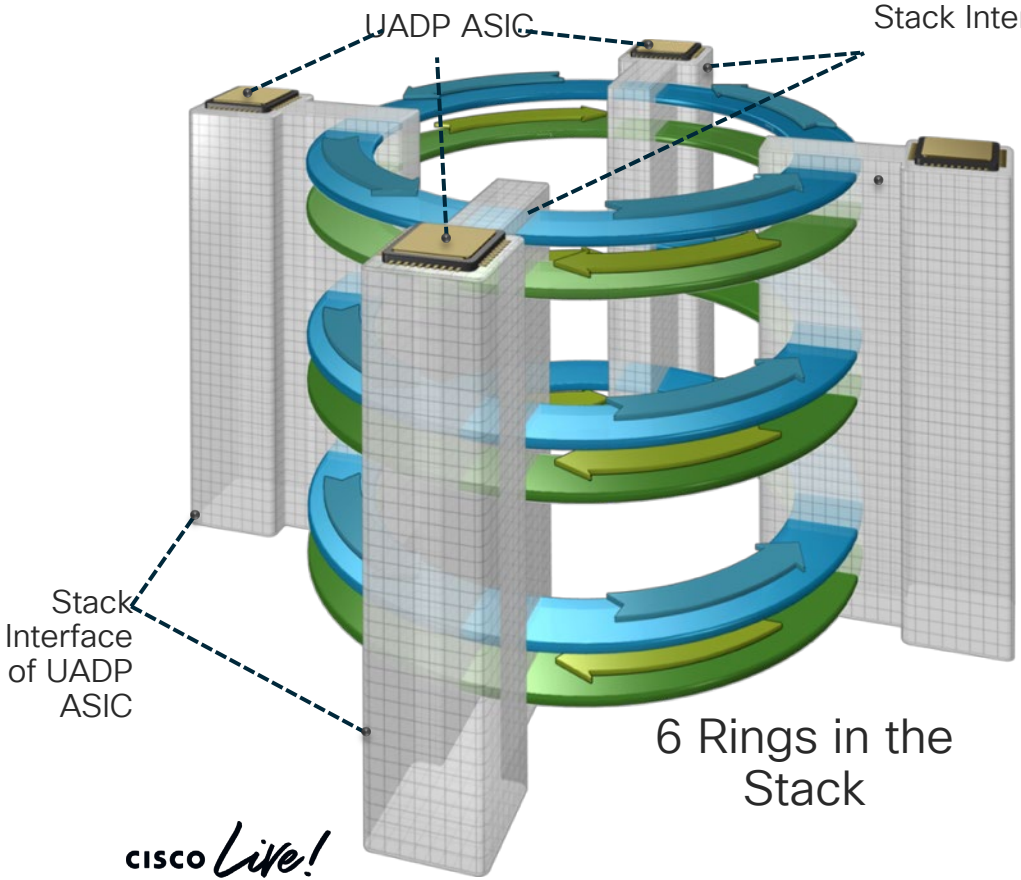
The Stack Ring

480 Gbps capacity



- 6 rings in total
- 3 rings go East
- 3 rings go West
- Each ring is 40Gbps
- 240Gbps uni-direction
- Spatial Reuse= 480Gbps

Assuming 4 x 24-port 9300 Switches

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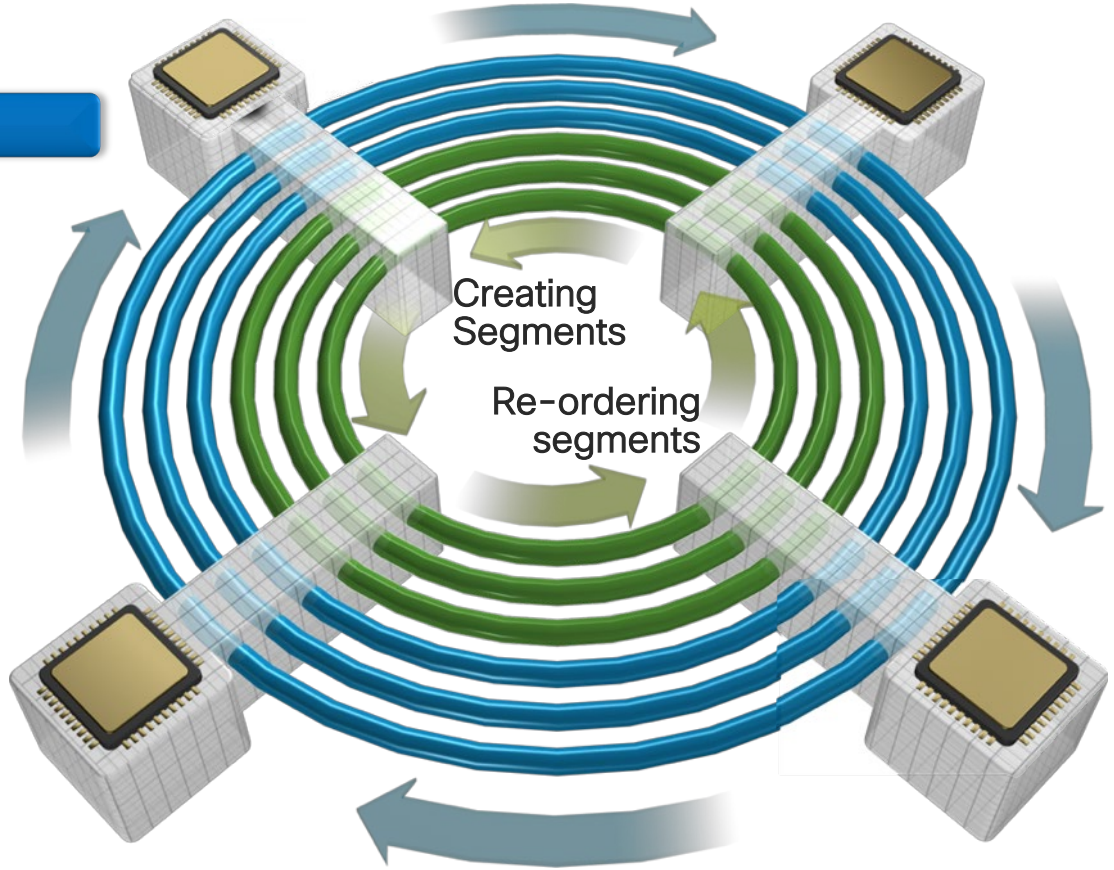
Unicast Packet Path on the Stack Ring

Assuming
4 x 24-port
9300 Switches

- Packet segmented into 256 bytes
- Packet travels half the ring for unicast traffic
- Segments reordered at destination stack port
- Destination strips the packet off the stack ring



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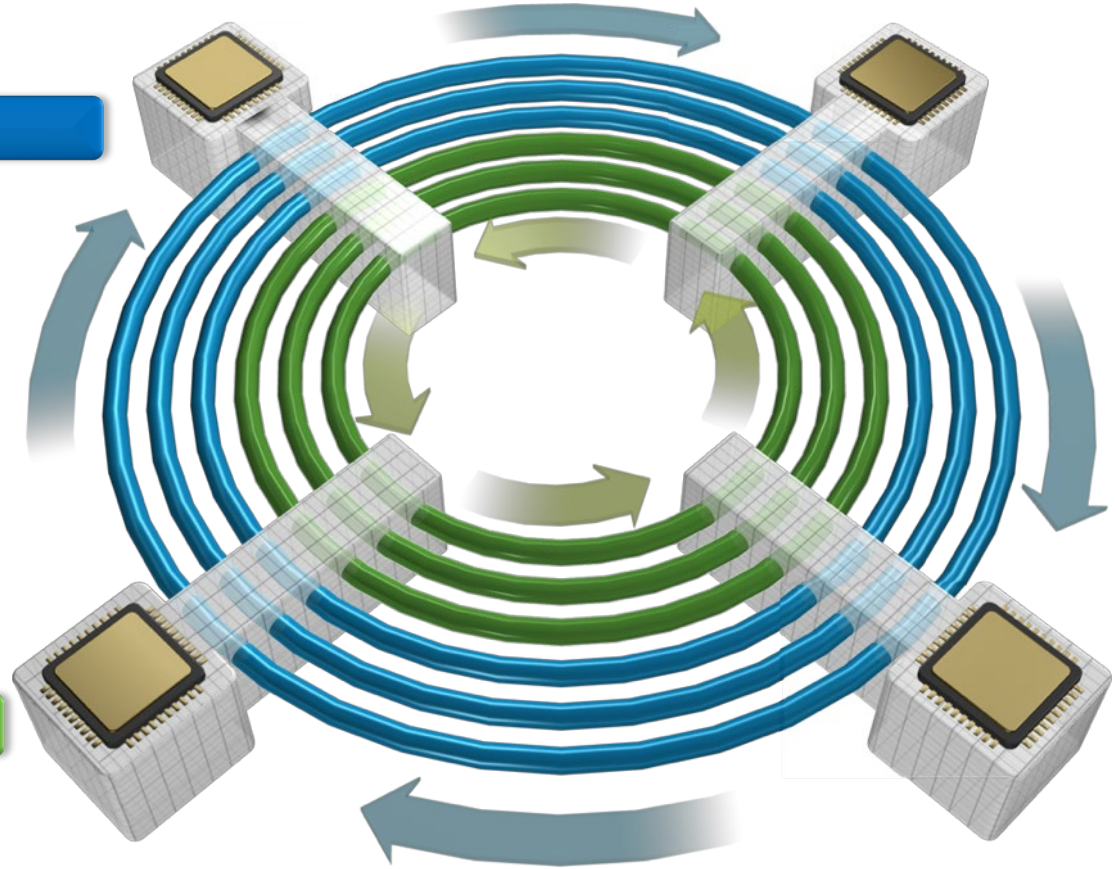
Stack Ring Spatial Reuse

Assuming
4 x 24-port
9300 Switches

- Credit based system on the Stack Ring
- Multiple stack ports grab the ring that is free and they have credits on to transmit
- Increases the stack ring bandwidth to 480Gbps



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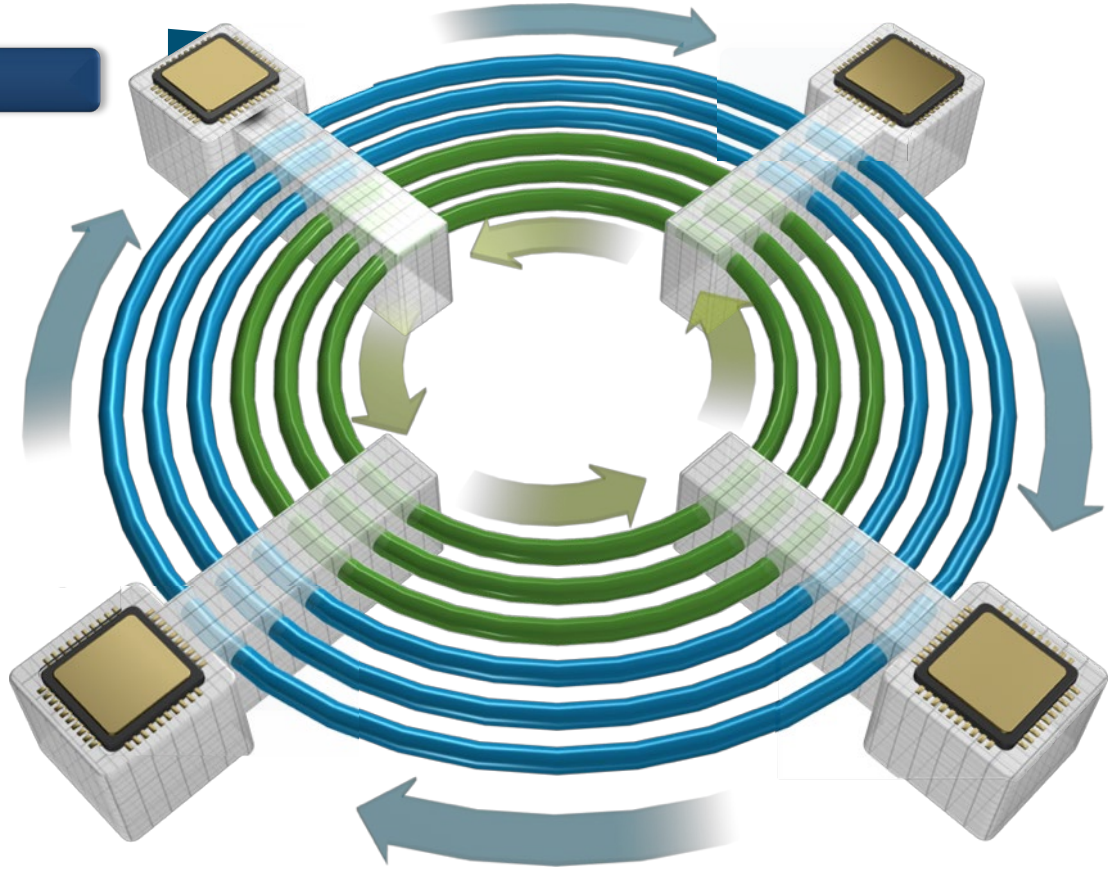
Multicast Packet Path on Stack Ring

Assuming
4 x 24-port
9300 Switches

- One copy of the source packet is placed on the rings
- Interested Stack Ports grab the segments when they see them
- Packet segments travel the whole ring back to source
- The source strips these segments off the ring (Source Stripping)
- Results in efficient replication of multicast traffic for multiple Stack Port receivers



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StackPower

Power HA – StackPower

HA with Zero RPS Footprint

1+N Redundancy

Flexible and Efficient

Power Resiliency

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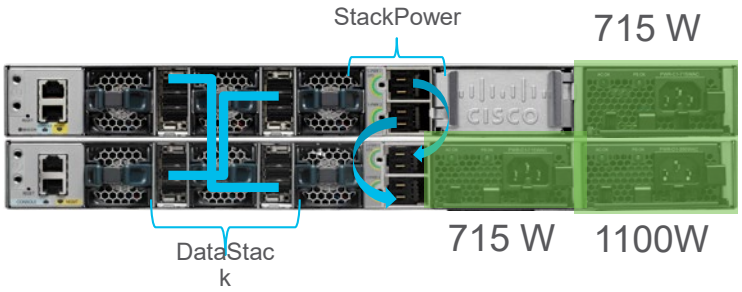
How StackPower Works?



Total Input Power 2530W

- Pools Power from All PS
- All Switches in StackPower share the available Power in Pool
- Each Switch is given their Minimum Power Budget

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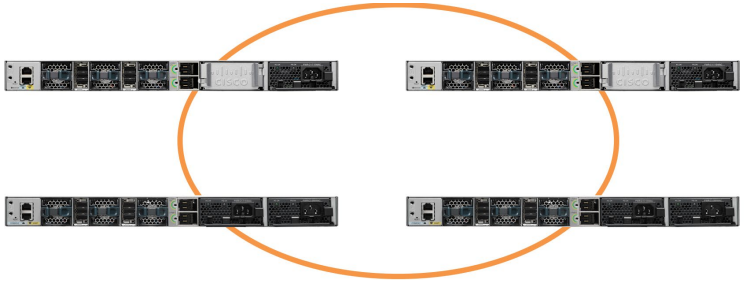
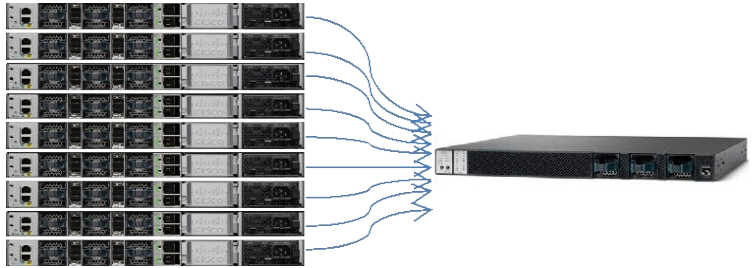
Power Redundancy Options

Zero Footprint RPS OR XPS



StackPower - Zero Footprint RPS

Stack of 4 switches



eXpandable Power System (XPS)

Stack of 8 switches

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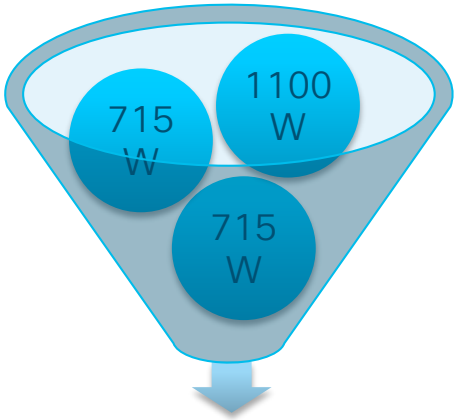
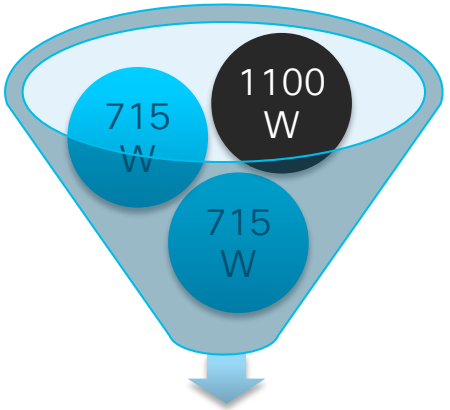
Power Budget Modes



2530W – 30W

Power Sharing Mode

- The Default Mode
- Sum of All PS – 30~60W



1430W – 30W

Redundant Mode

- User Configurable
- Sum of All PS – Largest PS - 30~60W

Global StackPower Reserve = 30W

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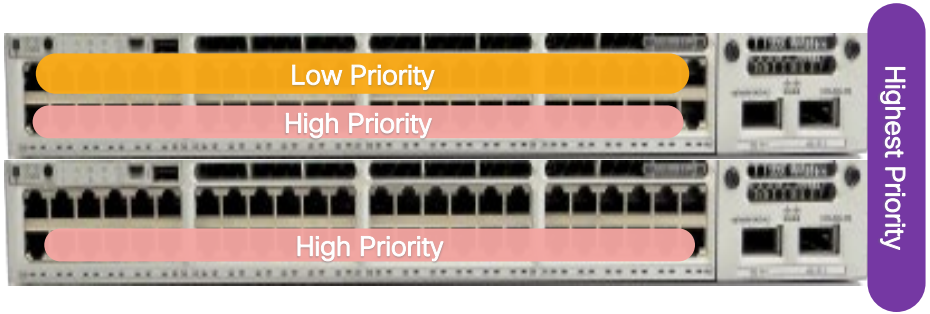
Load Shedding Power Priority

- Standalone Mode



Load Shedding Based on configured priority

1. Low Priority Ports
2. High Priority Ports
3. Switch Priority

```
9300-GIR-Access-144#show stack-power load-shedding switch 1
Power Stack           Stack   Stack    Total   Rsvd    Alloc   Unused  Num  Num
Name                  Mode    Topolgy  Pwr(W)  Pwr(W)  Pwr(W)  Pwr(W)  SW   PS
--------------------  ------  -------  ------  ------  ------  ------  ---  ---
Powerstack-1          SP-PS   Stndaln  1100    30      240     830     1    1

    Power Stack           Priority  Consumd  Consumd  Consumd  Alloc  Alloc
SW  Name                  Sw-Hi-Lo  Sw(W)    Hi(W)    Lo(W)    Hi(W)  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,
```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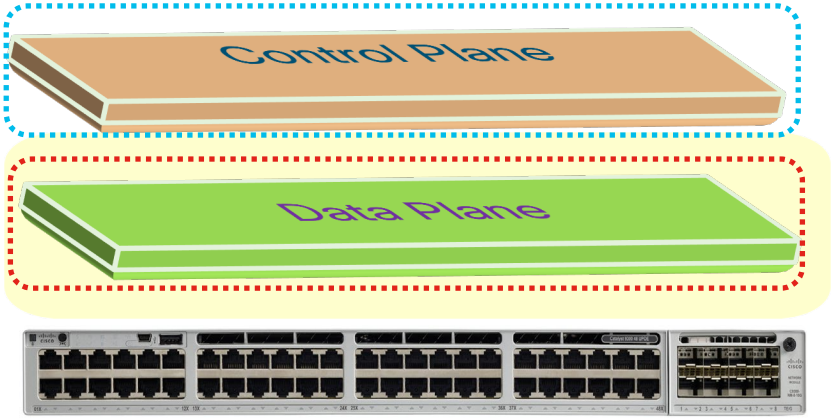
Extended Fast Software Upgrade(xFSU)

Extended Fast Software Upgrade on Catalyst 9300

- **xFSU** provides a mechanism to independently update the control plane and data plane during the upgrade process

- Control plane is upgraded by leveraging Graceful Reload Infrastructure without impacting data plane traffic

- Data plane(ASIC) is re-programmed in less than 30 seconds by leveraging special cache memory which stores active forwarding entries



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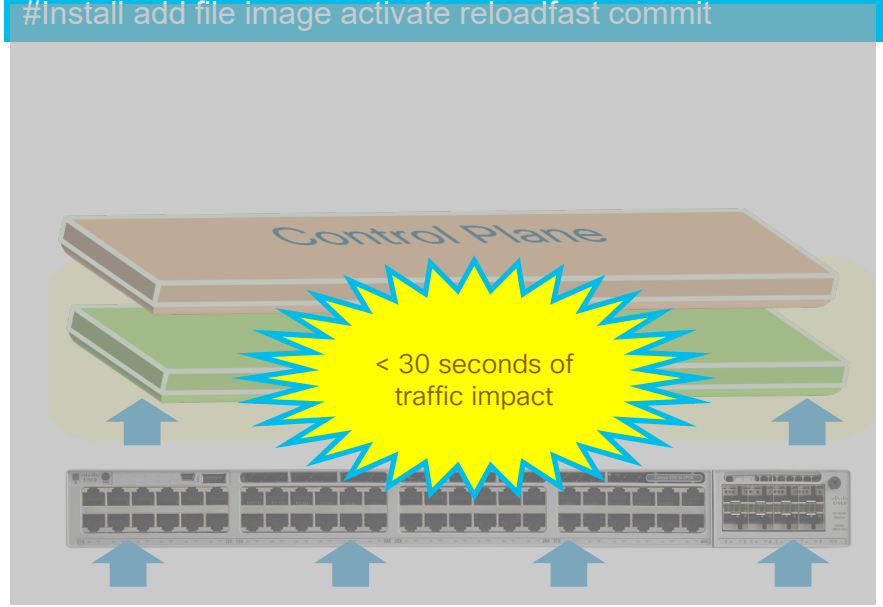
Extended Fast Software Upgrade

17.1.1

9300 Standalone

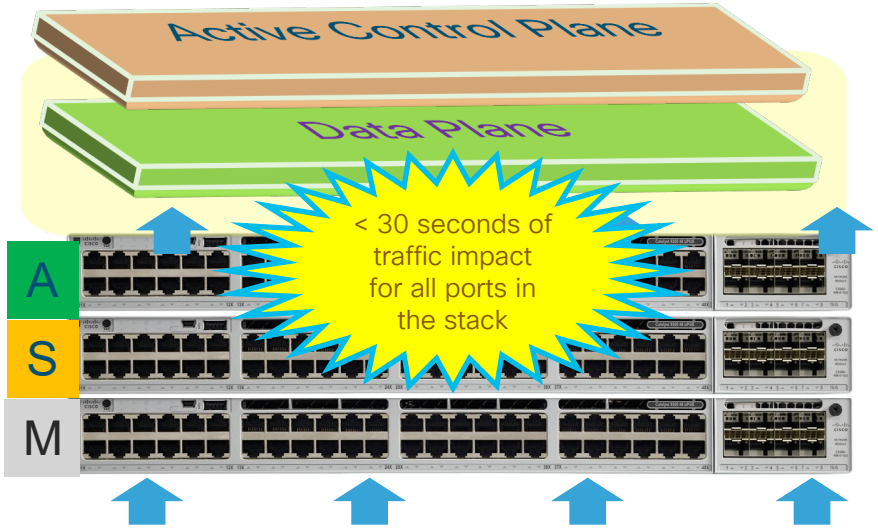
#Install add file image activate reloadfast commit



17.1.1

9300 Stack

#Install add file image activate reloadfast commit



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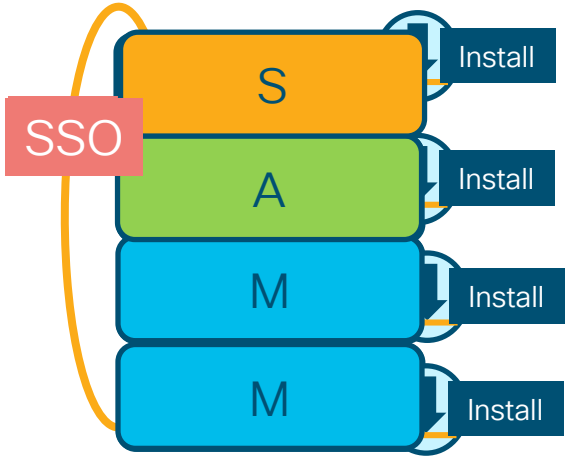
Fast Software Upgrade on Stack

#Install add file image activate reloadfast commit



1. Install the images on all switches
2. Fast reload the standby and member switches
3. Fast reload the active switch only
4. Standby becomes the new active
5. Old Active switch becomes the new standby

Traffic Impact during the complete upgrade is less than 30 seconds

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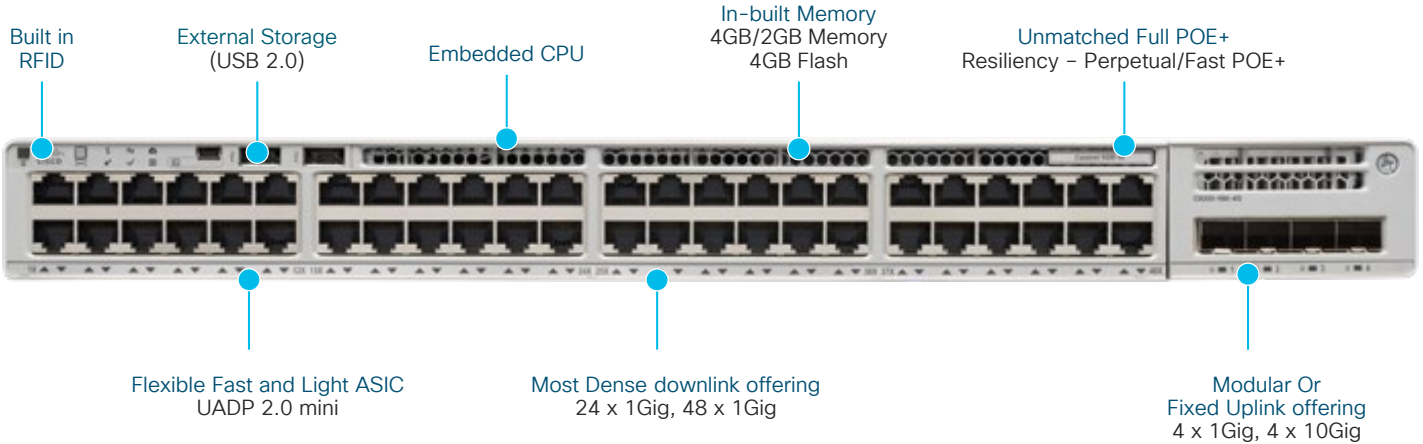
Catalyst 9200

cisco Live!

Catalyst 9200 Series



Right Sized Switching for simple Branch Deployments

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Catalyst 9200 Series switching 1G Model SKUs

Catalyst 9200 Series switching SKUs

9200 (Modular Uplinks and Fans)

Data

24X1G Ports

48X1G Ports

POE+

24X1G Ports

48X1G Ports

4 x 1G and 4 x 10G Uplinks

9200L (Fixed Uplinks and Fans)

Data

24X1G Ports

48X1G Ports

POE+

24X1G Ports

48X1G Ports

4 x 1G and 4 x 10G Uplinks

Modular Power Supplies available on all the SKUs

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Catalyst 9200 Series switching Multigigabit Model

9200 (Modular Uplinks and Fans)

NEW

POE+

8xmGig Ports

POE+

8xmGig Ports

Modular 4x10G, 2X40G, 2X25G Uplinks

9200L (Fixed Uplinks and Fans)

NEW

POE+

8xmGig Ports

POE+

12xmGig Ports

8xmGig Ports

Fixed 4X10G, 2X25G Uplinks

All models support Full PoE+

Modular Power Supplies available on all the SKUs

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Modular uplink options on Catalyst 9200 Series

- 4 x 1 Gig
- SFP Transceivers
- Supported on all modular SKUs

NEW

- 2 x 25 Gig
- SFP/SFP+ Transceivers
- 1/10/25G speed support
- Supported on all mGig SKUs only

- 4 x 10 Gig
- SFP/SFP + Transceivers
- Supported on all modular SKUs

NEW

- 2 x 40 Gig
- QSFP Transceivers
- Supported on all mGig SKUs only

All modular uplink modules are Field Replaceable Units

Modular uplinks supported on Catalyst 9200 Series modular SKUs

Resilient power supplies

Silver Rated (80% efficiency)

125WAC

Supported only on 1G Data SKUs

Platinum Rated (90% efficiency)

600WAC

Supported only on 24 Port POE+ SKUs

1000WAC

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

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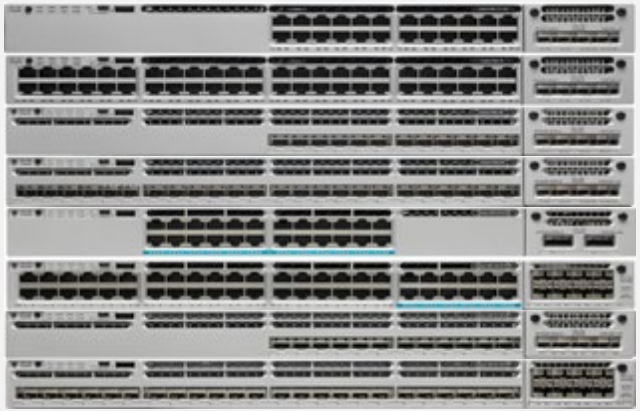
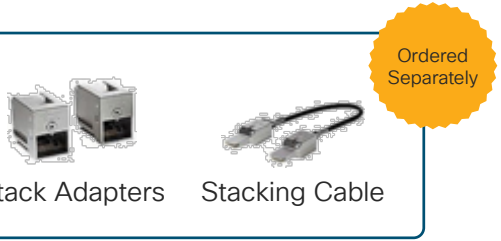
StackWise-160/80 with SSO



Up to 8
member stack

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

Stacking Kit →



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

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

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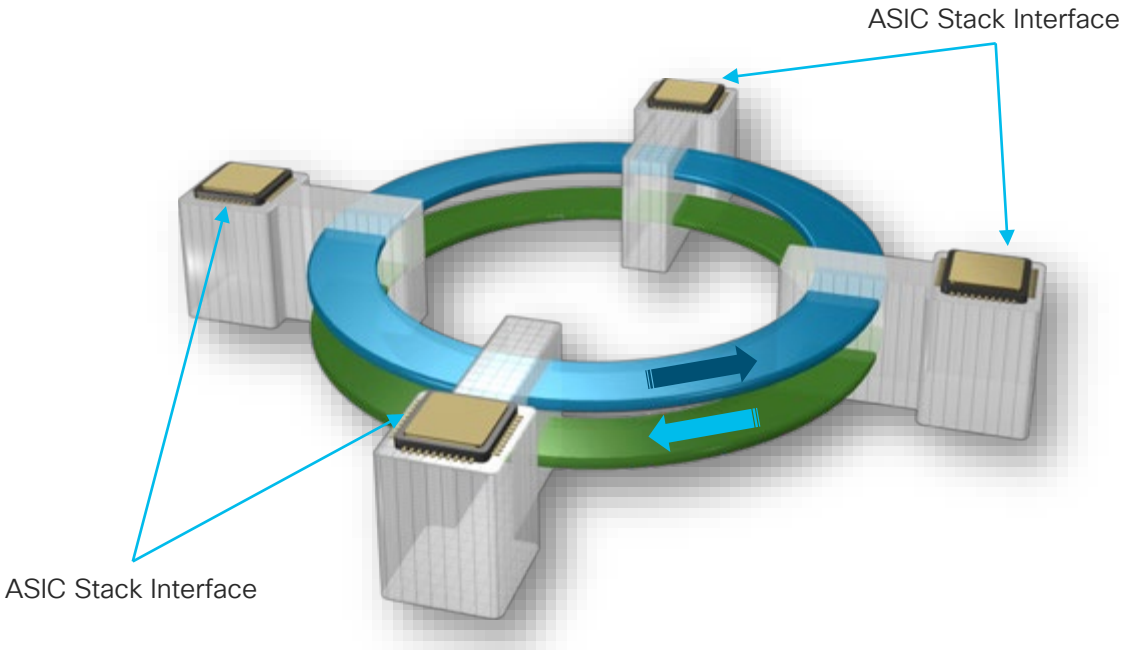
The stack ring – StackWise 160/80



- 2 rings in total
- 1 ring goes East
- 1 ring goes West
- Each ring is 40/20 Gbps
- 80/40 Gbps bi-direction
- Spatial Reuse= 160/80 Gbps

Assuming 4 x 24-port Catalyst 9200 Series modular switches

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Looking Inside the Switch

UADP 2.0 Mini

Architectural simplicity with powerful innovations

Investment Protection
Flexible Pipeline

Enhanced Scale/Buffering

100GE
Bandwidth

6MB
Packet Buffer

1/2.5/5/10/40G
Supports Different Speeds

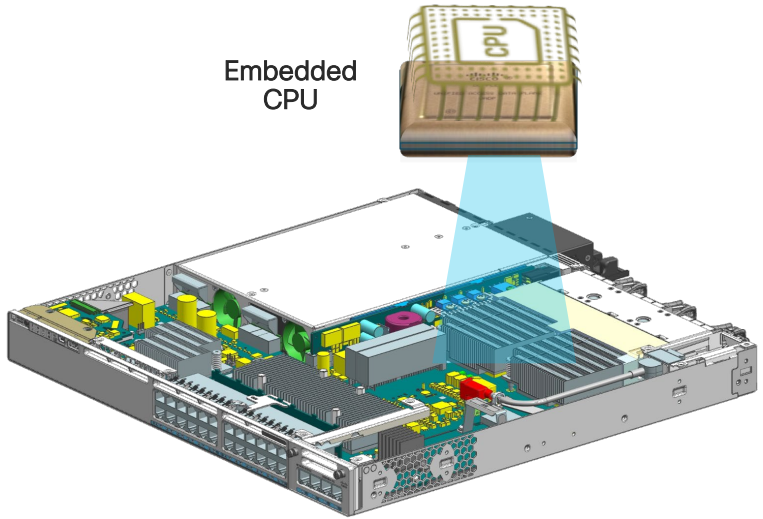
16K
Netflow Records

Flexible
Programmable Modules

SDM Templates
Flexibility

160/80G
Stacking Capacity

Up to 2X to 4X
forwarding + TCAM



Catalyst 9200

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Lookup tables

Forwarding Resources

	9200	9200L
MAC	32k	16k
Host Route	10k	8k
IGMP Groups	1k	1k
Indirect Route	4k	3k
Multicast Route	1k	1k
SGT	2k	2k

Feature Resources

	9200	9200L
Security ACL • PACL • VACL • RACL	1k	1k
QoS ACL	1k	1k
Netflow ACEs	128	128

Netflow	Netflow Entries: 16k per ASIC

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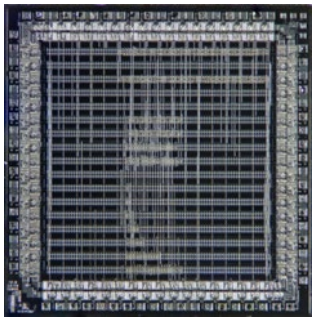
UADP ASIC Architecture

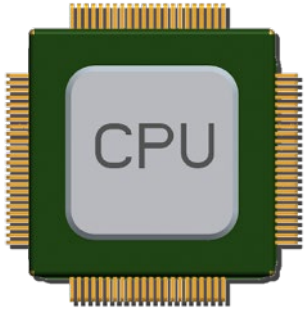
Traditional Networking ASICs vs CPUs

Performance

Flexibility



Traditional Networking ASIC



General Purpose CPU

Performance

Flexibility

Purpose Built – High Performance

General Purpose – Highly Flexible

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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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Some of the Key Capabilities of UADP ASIC

Flex Parser & Programmable Pipelines

Recirculation Capability

Micro Engines

Adaptable Tables

No Compromise on Performance

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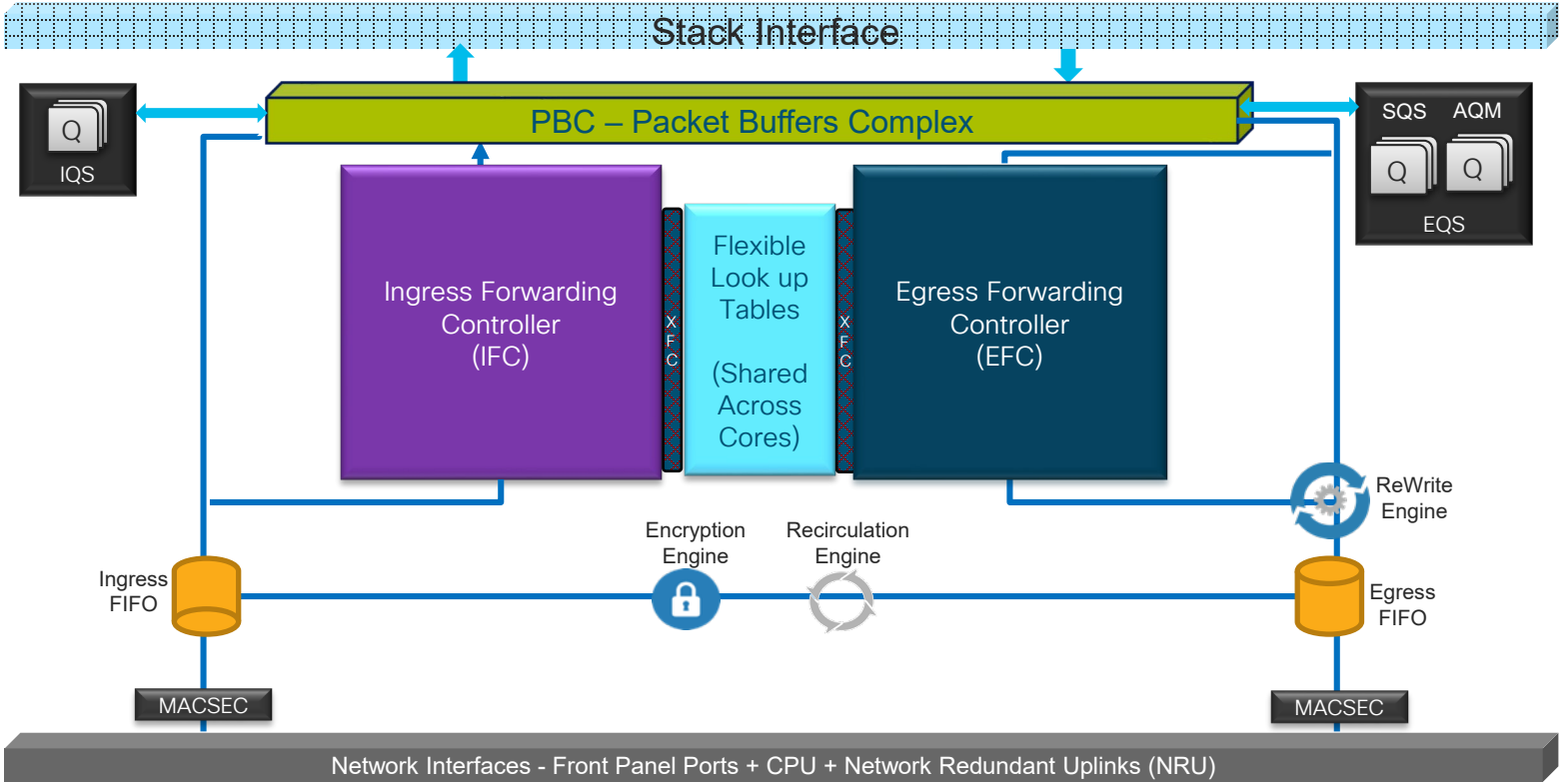
UADP 2.0 – Core Architecture



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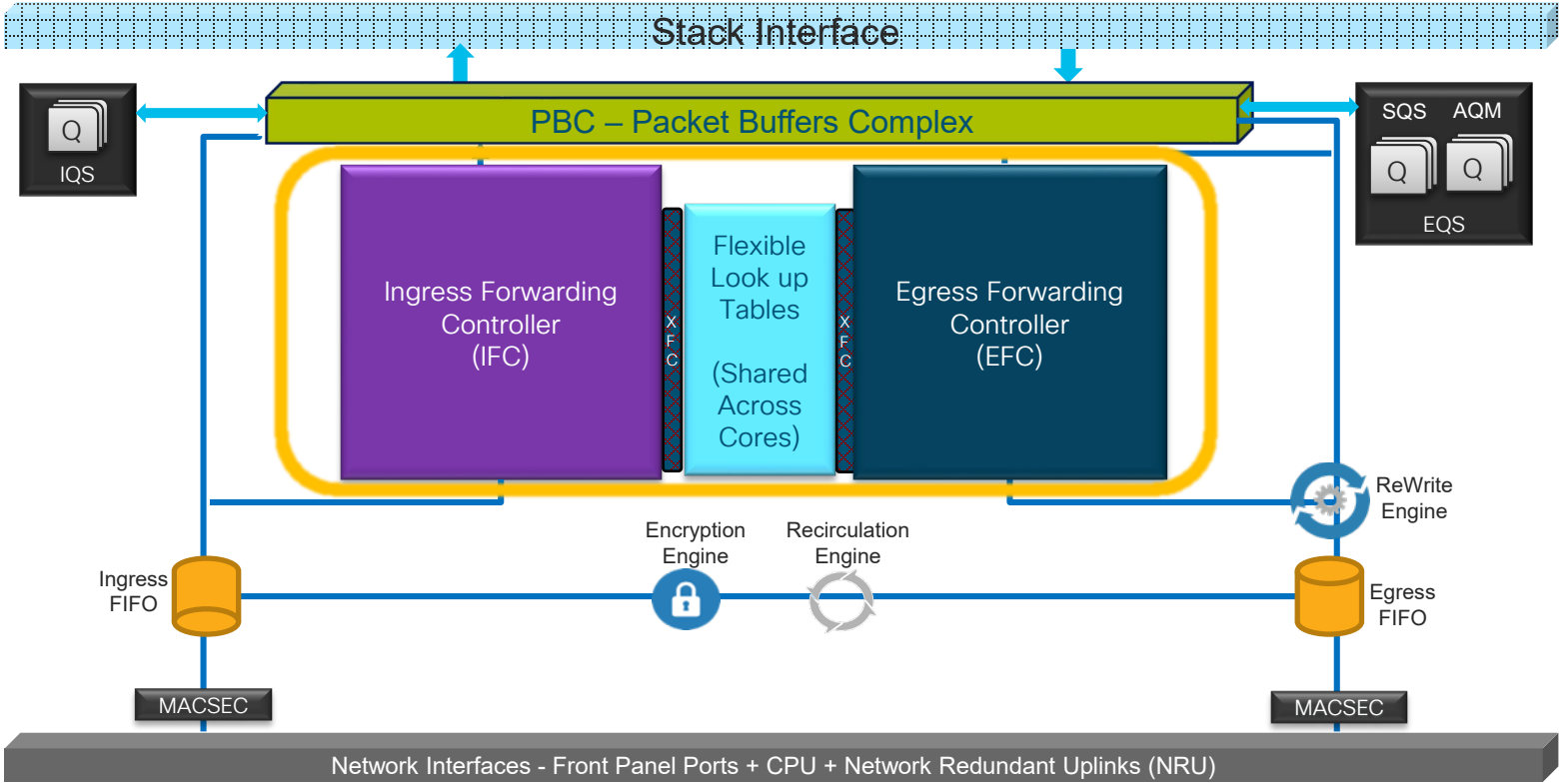
UADP 2.0 – Programmable Pipelines



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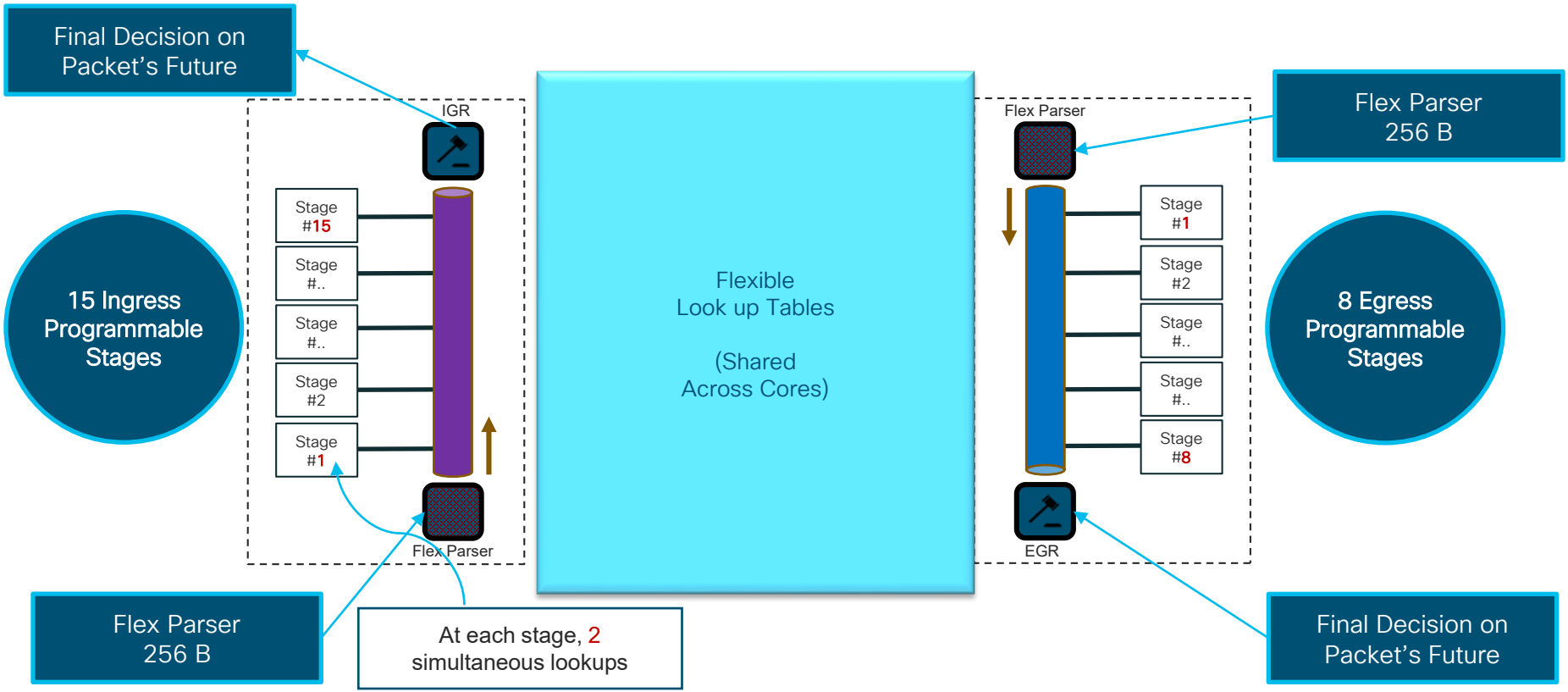
Programmable Pipelines – Closer Look…



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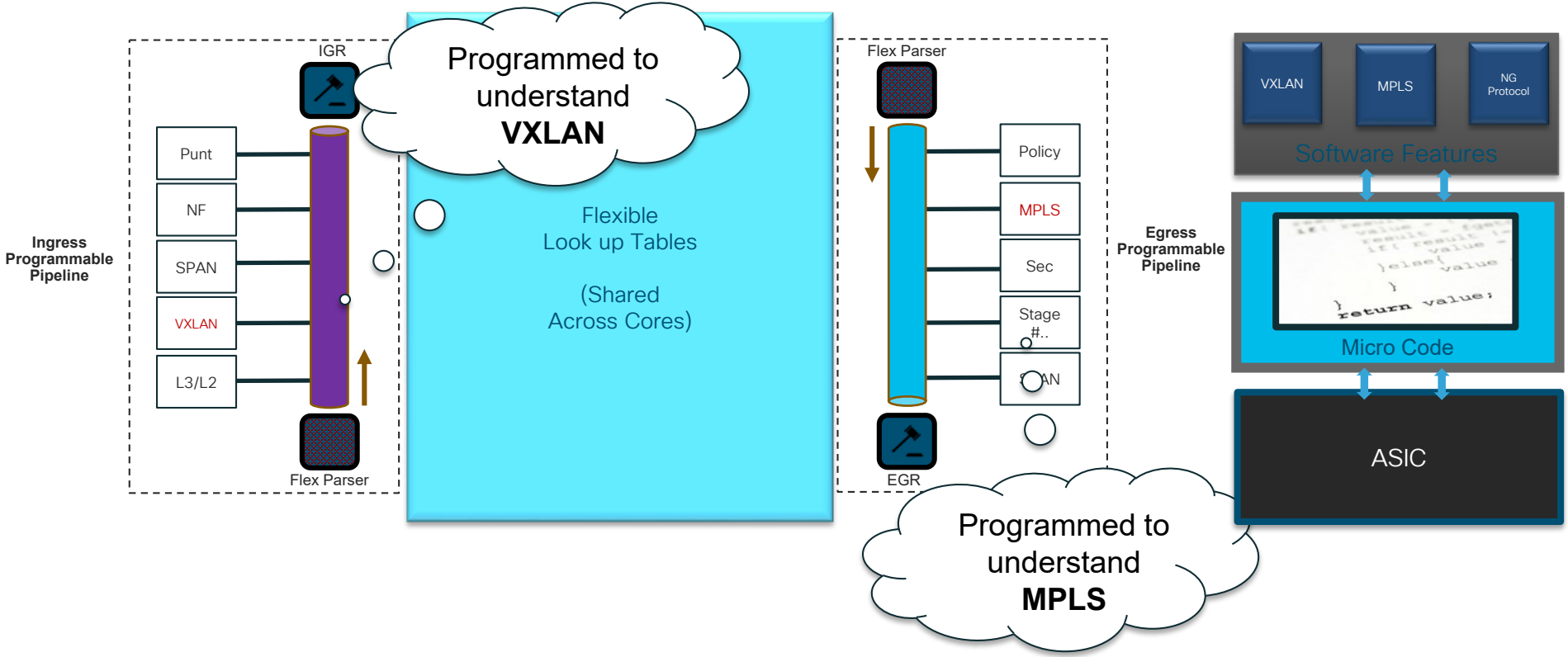
Microcode programs the Pipelines



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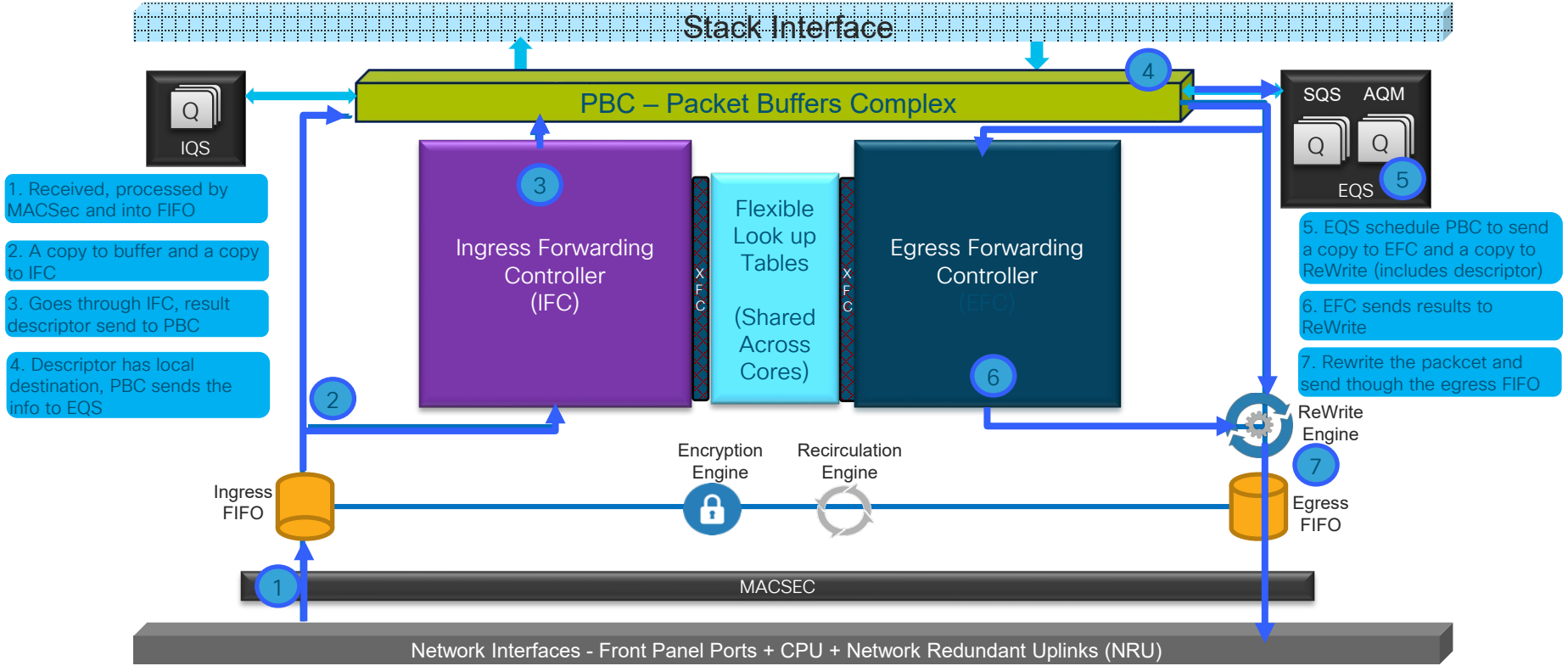
Unicast – within ASIC



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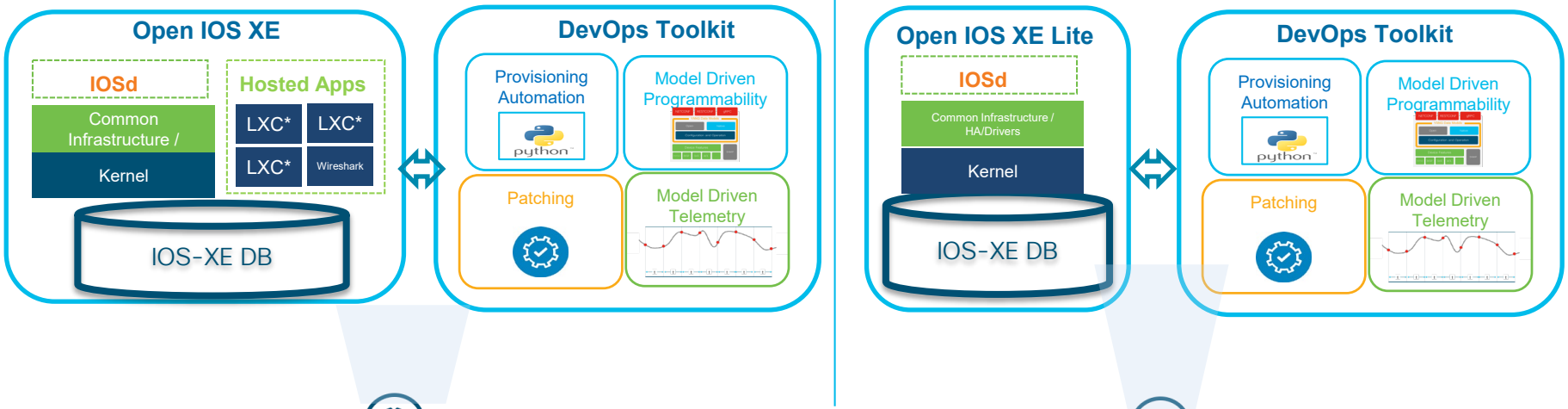
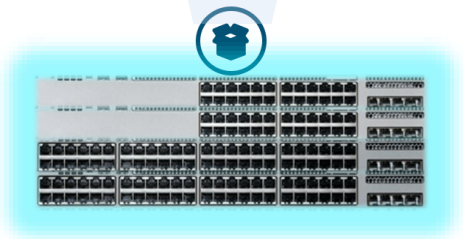
IOS-XE Software

Open IOS-XE



Catalyst 9k Family – 9300/9400/9500



Catalyst 9200

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IOS-XE 16

One Release Train

Operational Efficiency, Consistency in Control Plane Behavior,

RAFA
(Run Any Feature Anywhere)

Feature Velocity across Platforms

Patch Updates

WCM/SANET/etc sub package upgrade, Peace of mind for Customers

Comprehensive Programmability

Object based model, Netconf/REST Interfaces

Secure Platform

64 Bit ASLR, Mandatory Access Control for Processes

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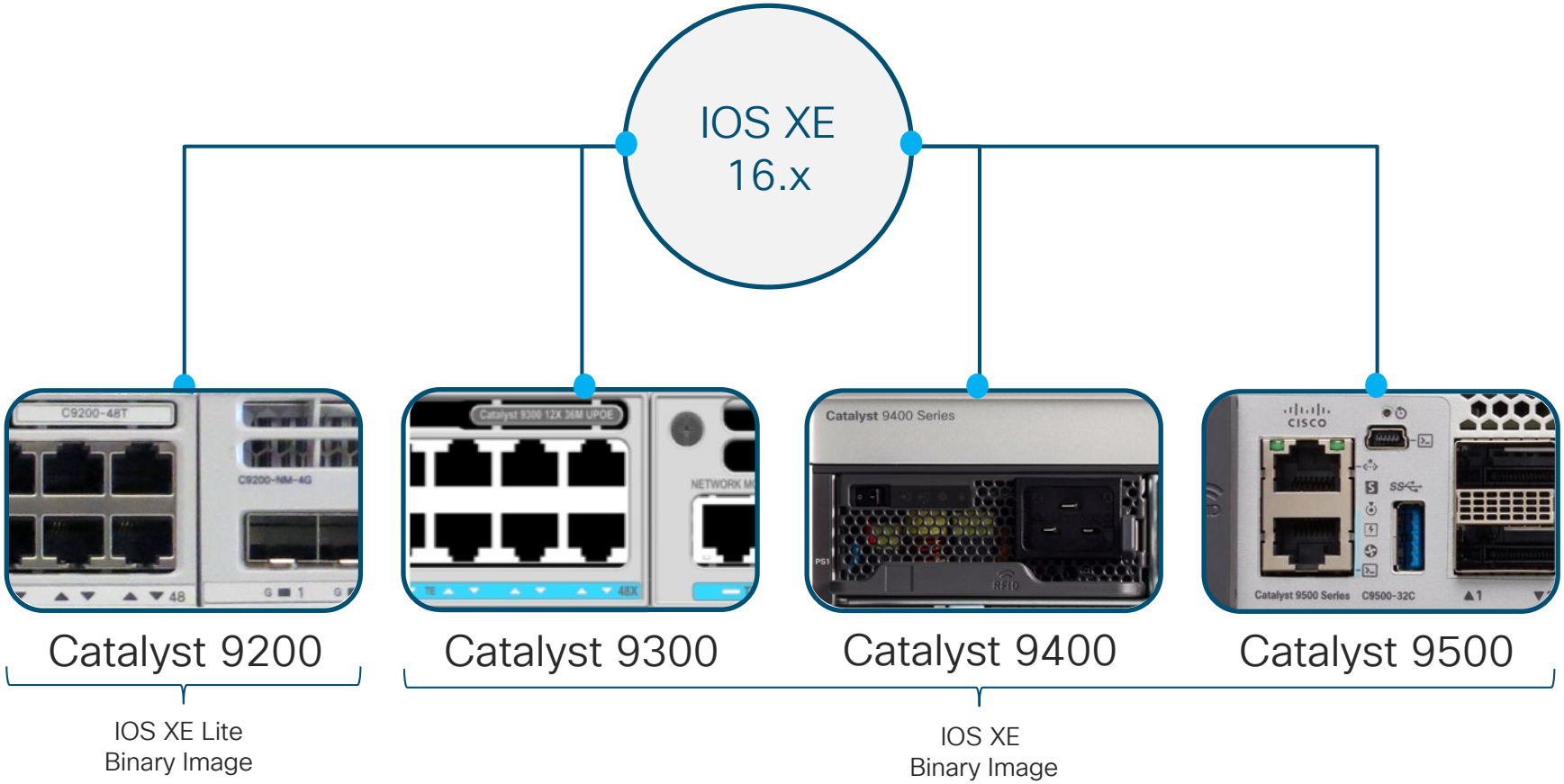

Catalyst 9200 runs the same Operating System with **Lighter Image**

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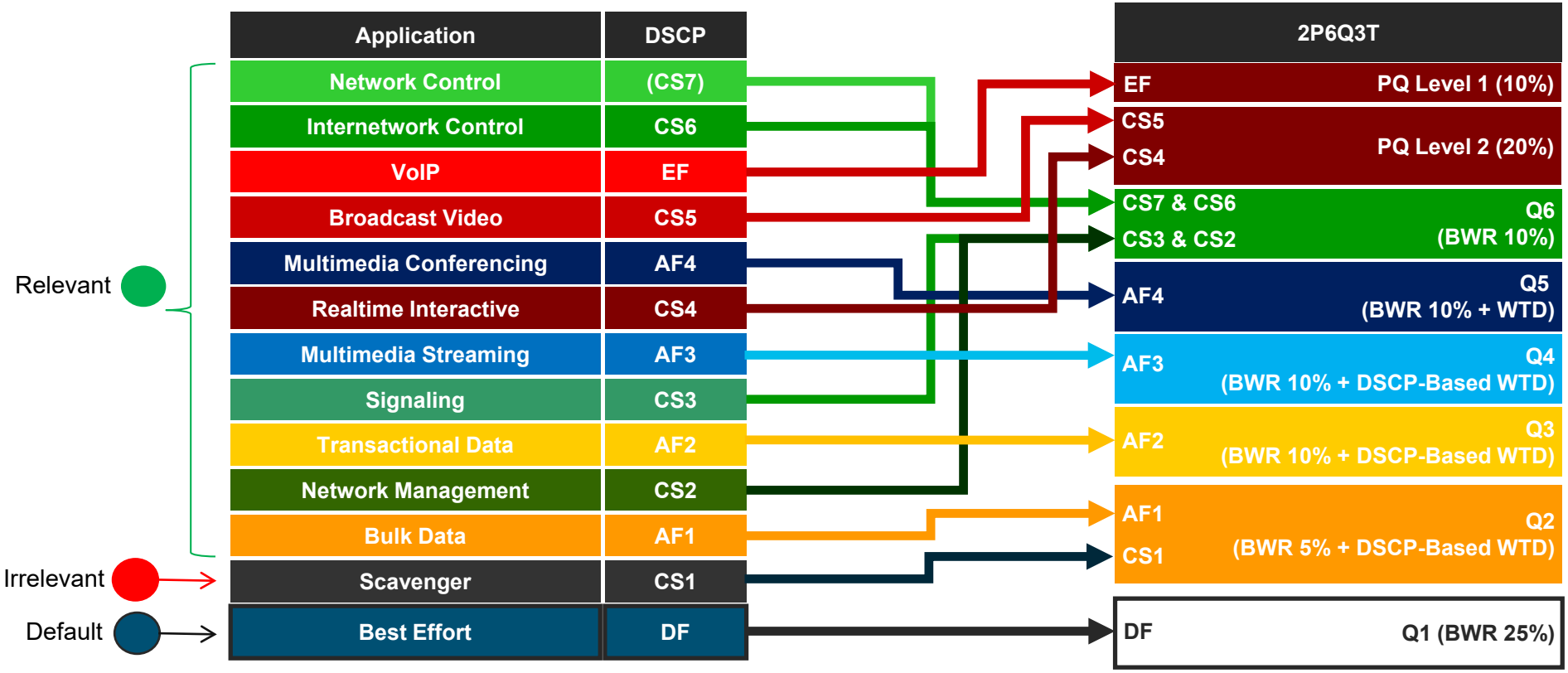
Quality of Service (QoS)

Catalyst 9000 Campus QoS Design



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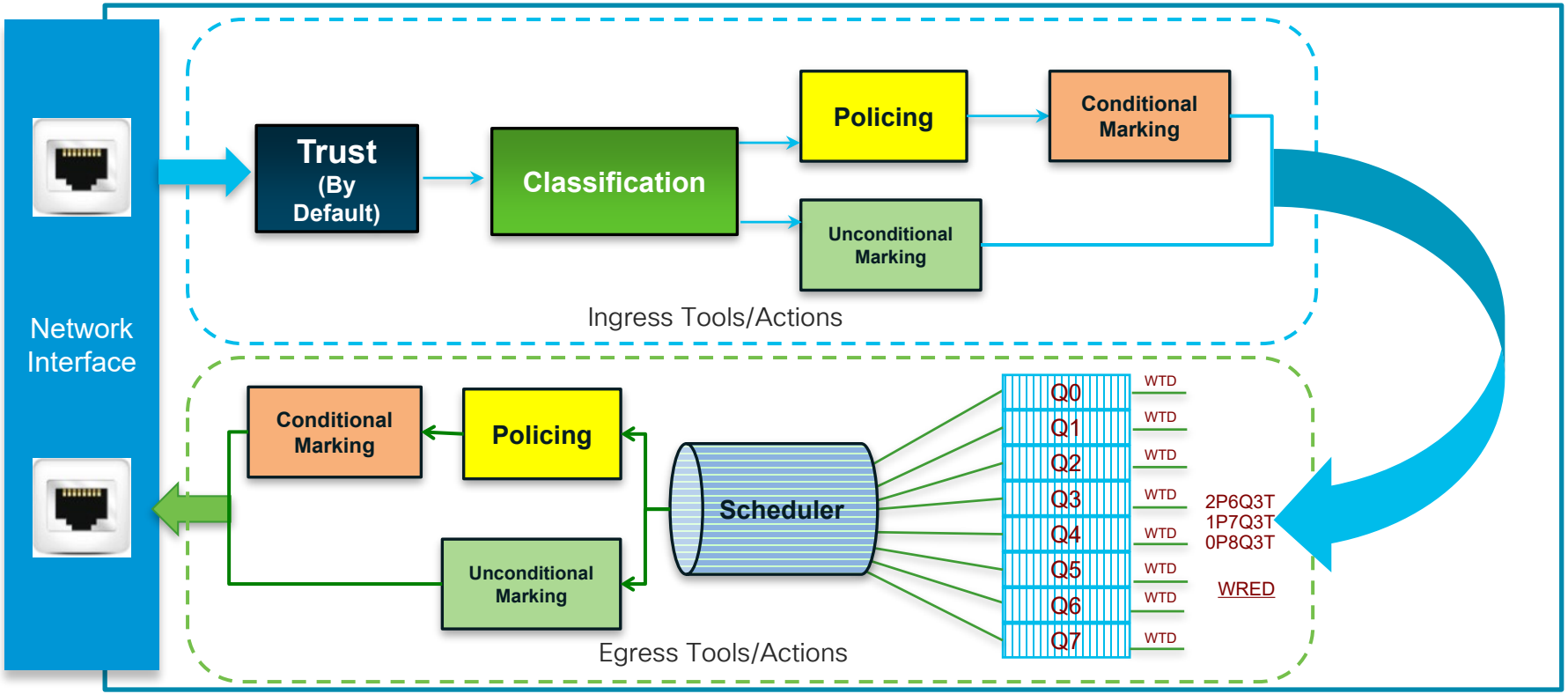
Catalyst 9000 – QoS Tools



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Catalyst 9000 Family – Consistent QoS

- Highlights

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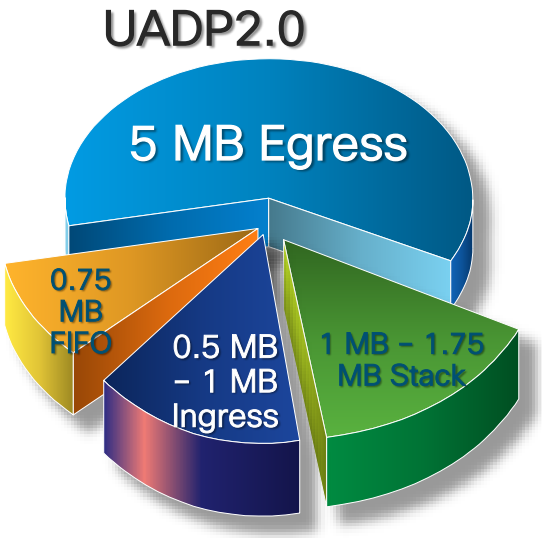
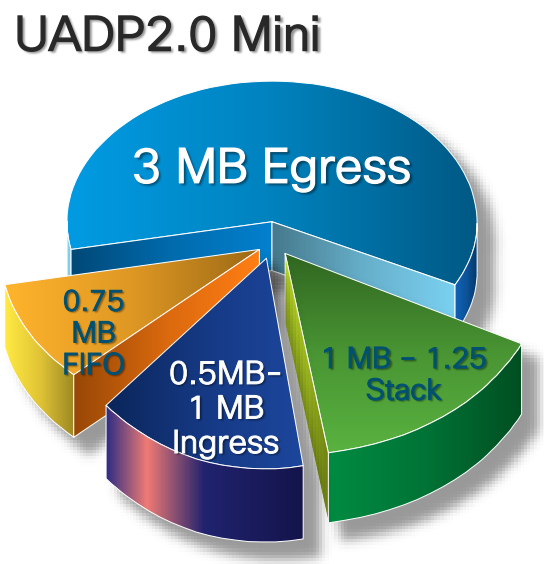
Buffer Size Comparison per Platform



per Core 8 MB
per ASIC 8+8 MB



per ASIC 6 MB

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Software Innovations

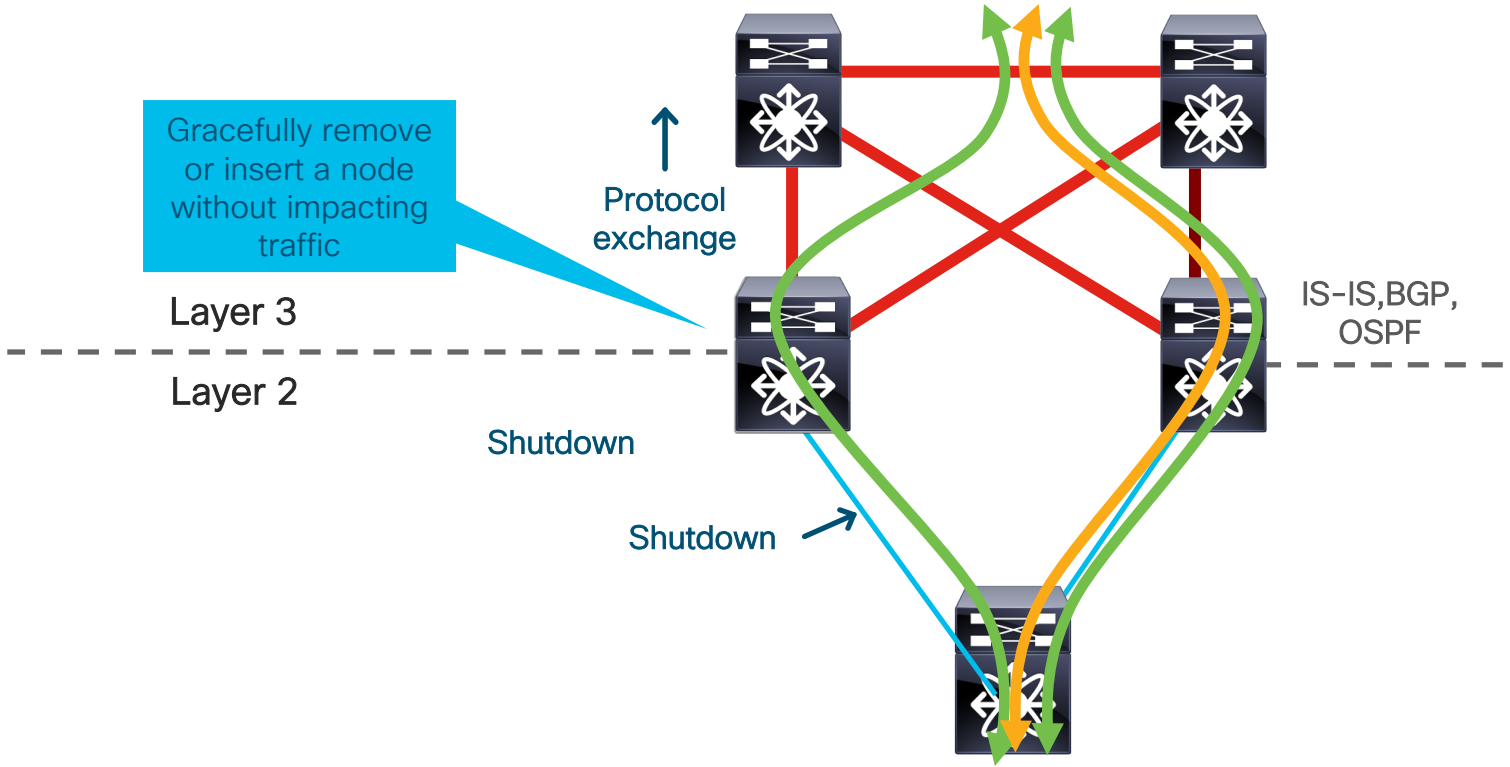
Graceful Insertion and Removal (GIR)

9300 Only

Hardware replacement

Software upgrades

Configuration changes



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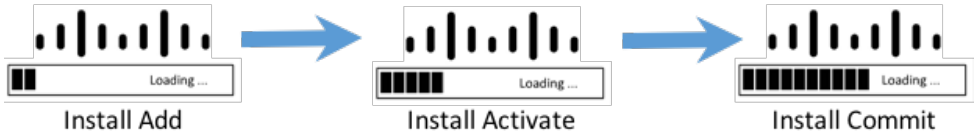
Ready for Software Patching

9300/9200

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.



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Day 0 Security– Trustworthy Systems

9300/9200

Trustworthy Systems

- **Image Signing** – Authentic OS
- **PnP** – SUDI Support, Two Way Trust
- **Hardware Authenticity** – Genuine Hardware
- **Runtime Defenses** – 64 Bit ASLR
- **Integrity Verifications** – Malware Protection
- **Secure Boot** – Boot Sequence Check

Catalyst 9K Family is Built with Security

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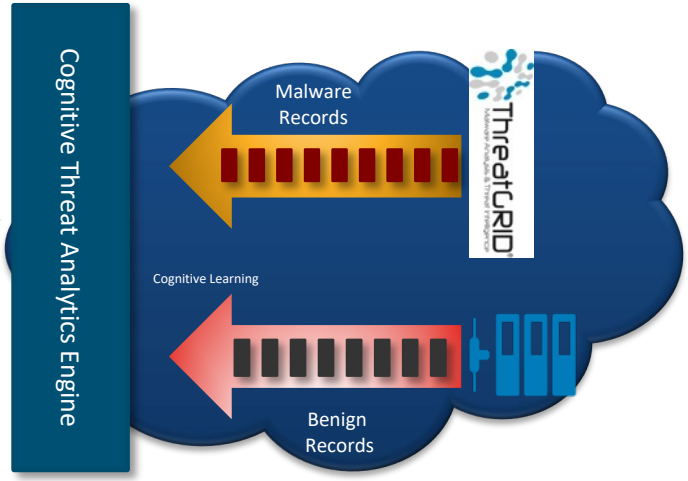
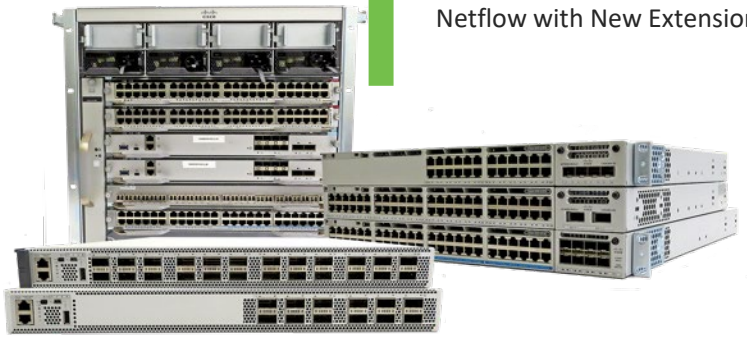
Day 1 – Security

9300 Only

StealthWatch



Netflow with New Extensions



Catalyst 9K Family

Encrypted Threat Analytics

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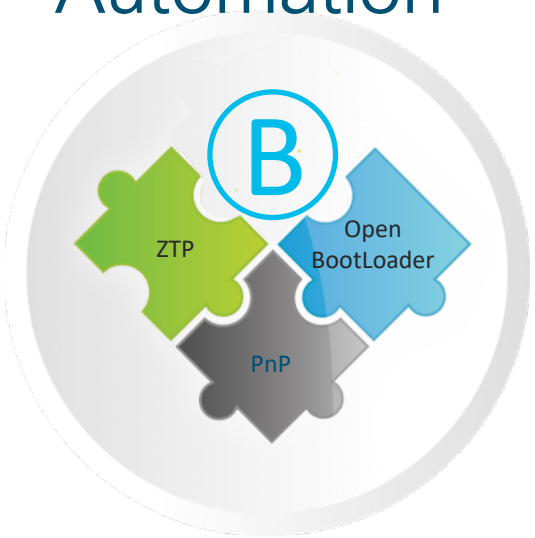
Catalyst 9K Family – Programmability & Automation

9300/9200



Device Bootstrap and Onboarding

Configuration Automation through Open Interfaces

Server Management Tools on x86 Infrastructure

Catalyst 9K Offers Complete DevOps Toolkit

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IOT Ready – Leadership in PoE Features

9300/9200

2-event classification

- Fast power negotiation without LLDP
- Physical layer negotiation < 1 sec

Perpetual UPOE

- Uninterrupted PoE power during control plane reboot

Fast UPOE

- Bypasses Cisco IOS® control plane boot
- Restores power to PD within 30 sec of power resumption

* 9200 Supports POE+ Only

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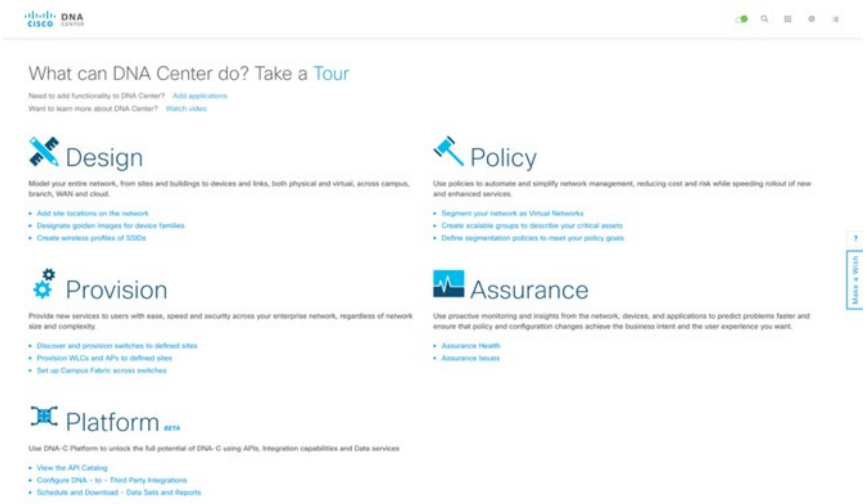

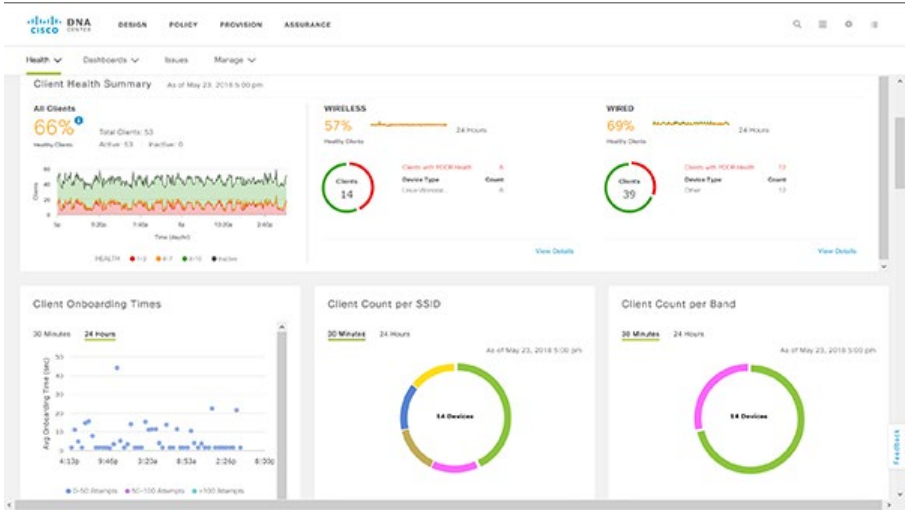

Software Defined Access

Cisco DNA Assurance

Today **Our Networks** are **Software Defined**

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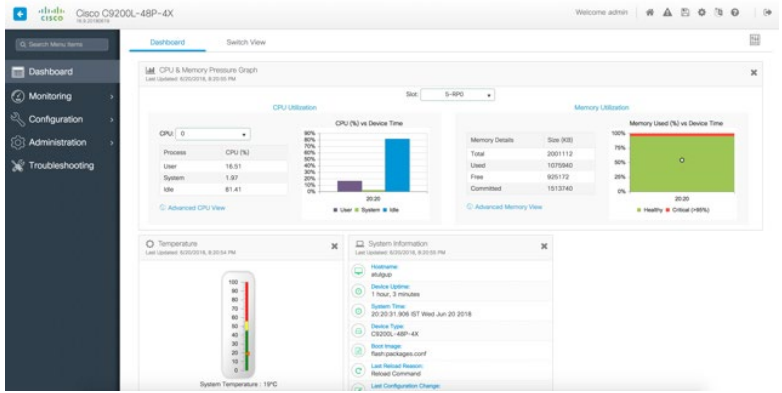
Embedded WebUI

Ease of Access	Build configurations	Intuitive Interface	Switch View	Troubleshooting made fun



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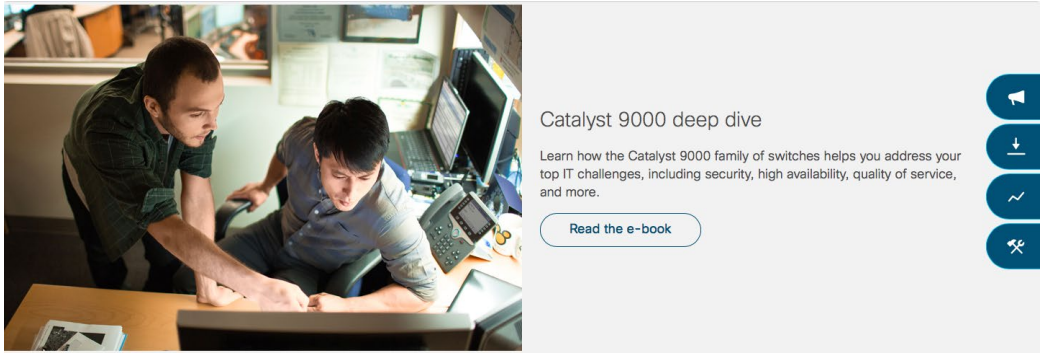
Closing & Wrap up...

Catalyst 9K Book

Cisco Catalyst 9000
A New Era of Networking

eBook Available on Cisco.com



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Questions?

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How

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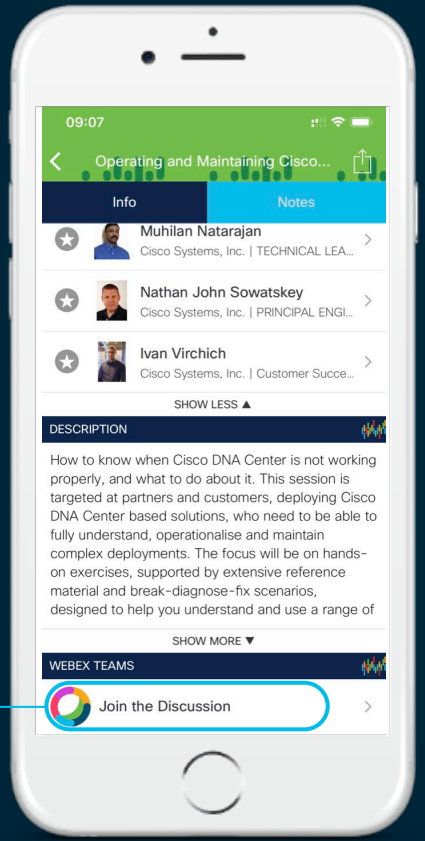
3. Install Webex Teams or go directly to the team space
4. Enter messages/questions in the team space



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Walk-In Labs

Meet the Engineer 1:1 meetings

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