



Catalyst 2960-S, 3560-X & 3750-X

Catalyst 3750-X & 3560-X Series

Catalyst 3750-X



Catalyst 3560-X



- Next Generation Gigabit Ethernet 24 and 48 port, Data and PoE+ switches
- Innovative features:
 - StackPower
 - Full PoE+
 - MACsec
 - Hot swappable network modules, dual redundant power supplies & fan modules
- Three IOS feature sets: LAN Base, IP Base, IP Services
- New Enhanced Limited Lifetime Warranty:
 - Next business day (NBD) advance hardware replacement & 90 Day access to Cisco Technical Assistance Center (TAC) support
- Full Energy-Wise support

StackPower



Innovative power interconnect system

- Share power supplies among all switches
- Power no longer confined to a particular switch, power goes where it is needed

Flexible

- From no-power supply to up to 2.2KW per switch
- Can mix different sizes or different types (AC & DC) power supply

Highly resilient

- Enable “zero-footprint” RPS
- Unused power from one power supply can back up an other one

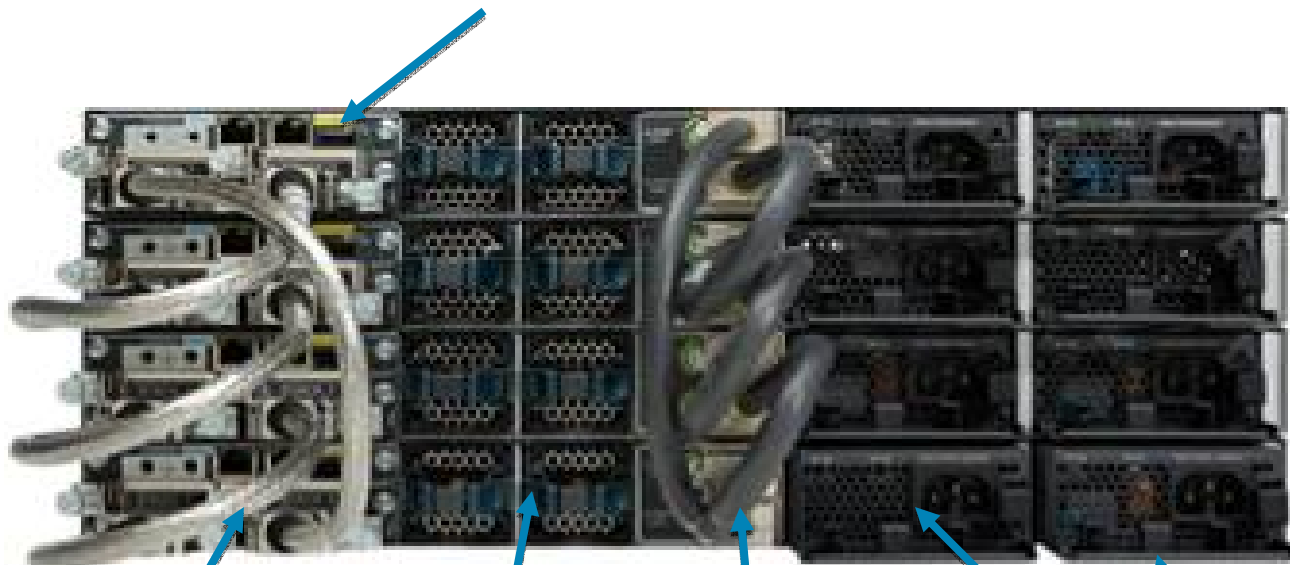
Intelligent power shedding

- Preserve the most critical part of your network in case failure

StackPower

Close up

Console, 10/100 management port, and USB type A (for flash drive)



Stackwise Plus

Redundant Fans

StackPower

Support for 2 power supplies

StackPower

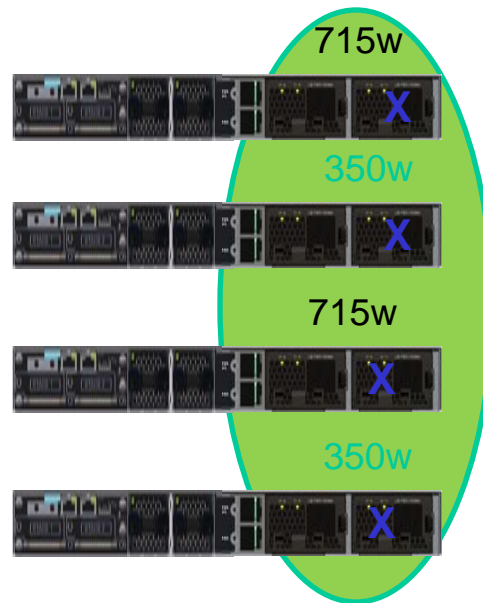
Capabilities Overview

Switch A
Full POE on 48-ports 740w PoE
Need = 986w

Switch B
48-ports, Data Only,
Needs 246w

Switch C
Full POE+ on 48-ports 1,440w PoE
Needs 1,686w

Switch D
48-ports, Data Only,
Needs 246w



Power requirements:
 $246w * 4 + 740 + 1440 = 3,172w$
Available Power = 2,130w
Deficit = 1,042w

Options:

1) Add one 1,100w PS slot B of any switch to cover the deficit.

2) Add two 1,100w PS to any two switches in slot B to cover 1,042w deficit plus 1,100w for redundancy. Extra capacity for zero-footprint RPS functionality.

Note capability to boot up a switch that doesn't have a PS and even provide PoE+ on that switch.

Stackpower can provide complementary power as well as Redundant power depending on requirements and configuration.

StackPower

Summary

Scalable infrastructure for PoE+

Complements PoE+ on switches with smaller power supplies

Better utilization of available power capacity by sharing

Flexible installations when AC outlet availability is constrained

3x 350W PS Vs. **one x 1.1KW PS**

Unprecedented reliability and efficiency

Idle power can be used as backup

“zero footprint” RPS

1+n redundancy is better than 1:n redundancy

Intelligent load-shedding

Sustainability

Highly efficient power supplies: 80% efficiency at 10% load

Energywise can off-line supplies when extra capacity is not required

Network Module

Optional

- Can be configured when ordering
- Can be added later on
- Hot swappable, does not require a restart.

Provides flexibility with two options:

- Four 1G ports (SFP)
- Two 10Gig port (SFP+) or four 1G ports (SFP)

Adopt new SFP+ 10G optics

- No need for TwinGig adaptor



Network Modules Catalyst 3750-X & 3560-X Series	
C3KX-NM-1G=	1G network module
C3KX-NM-10G=	10G network module
C3KX-NM-BLANK=	Default

Configuration Transition

Cat3750 to 3750-X

Network module Interface numbering

GigEther 1/0/1 changed to GigEther 1/1/1

TenG 1/0/1 changed to TenG 1/1/1

Automated and Configuration files tools must be updated accordingly

Mixed stack:

IOS upgrade required...!

PoE+ Support

Main features



Support for new standard PoE+ (802.3at)

- 30W per port Vs. 15.4W per port
- Backward compatible with legacy PoE (802.3af)
- Can provide 30W per port on all 48-ports simultaneously (Full PoE+)

Future proof network for next generation devices

MACsec

Supported in Hardware

- Link-layer cryptography with 128-bit Advanced Encryption Standard (AES) cryptography
- Line rate, no impacts to CPU or switching fabric

Standards based

- IEEE 802.1AE encryption
- IEEE 802.1X-Rev Key exchange protocol (MKA)

Developped in conjunction with Intel

- AnyConnect – PC Client
- Tested with current Intel PC cards
- Some newer Intel LOM chipsets support MACSEC



Dual Redundant Power supplies & fans

- **Four Power Supplies options**

 - 1100W AC

 - 715W AC

 - 350W AC

 - 440W DC (future availability)

- Switches come by default with one power supply, a second one can be configured

- High efficiency

- Support any combination Size/AC/DC

- Hot Swappable

- Redundant fan modules



Models	Default Power Supply
24 Port Data Switch	C3KX-PWR-350WAC
48 Port Data Switch	
24 Port PoE Switch	C3KX-PWR-715WAC
48 Port PoE Switch	
48 Port Full PoE Switch	C3KX-PWR-1100WAC

Models comparison

	3750-X	3750-E	3750G
StackPower	Yes	No	No
FRU Network Module	Yes	No	No
FRU Power Supplies	Yes, (dual)	Yes (single)	No
MACsec	Yes (Downlink)	No	No
PoE+ 30W/port	Yes	No	No
IOS LAN Base Option	Yes	No	No
Management Options	Console RJ45, USB console , and Out of band Ethernet	Console RJ45 and Out of Band Ethernet	Console RJ45
RPS / XPS	XPS	RPS	RPS
EnergyWise	Report Actual Power use PoE & System	Report Actual Power use PoE	Report Budgeted Power

Catalyst 3750-X & 3560-X

Model comparison

IOS	Model	Stackable	StackPower	Full PoE	PoE+	Description
LAN Base	WS-C3750X-24T-L	Yes	Available with upgrade to IP Base	-	-	24-port 10/100/1000, 350W AC, LAN Base
	WS-C3750X-48T-L	Yes		-	-	48-port 10/100/1000, 350W AC, LAN Base
	WS-C3750X-24P-L	Yes		Yes	Yes	24-port PoE+ 10/100/1000, 715W AC, LAN Base
	WS-C3750X-48P-L	Yes		-	Yes	48-port PoE+ 10/100/1000, 715W AC, LAN Base
	WS-C3750X-48PF-L	Yes		Yes	Yes	48-port PoE+ 10/100/1000, 1100W AC, LAN Base
IP Base	WS-C3750X-24T-S	Yes	Yes	-	-	24-port 10/100/1000, 350W AC, IP Base
	WS-C3750X-48T-S	Yes	Yes	-	-	48-port 10/100/1000, 350W AC, IP Base
	WS-C3750X-24P-S	Yes	Yes	Yes	Yes	24-port PoE+ 10/100/1000, 715W AC, IP Base
	WS-C3750X-48P-S	Yes	Yes	-	Yes	48-port PoE+ 10/100/1000, 715W AC, IP Base
	WS-C3750X-48PF-S	Yes	Yes	Yes	Yes	48-port PoE+ 10/100/1000, 1100W AC, IP Base
LAN Base	WS-C3560X-24T-L	-	-	-	-	24-port 10/100/1000, 350W AC, LAN Base
	WS-C3560X-48T-L	-	-	-	-	48-port 10/100/1000, 350W AC, LAN Base
	WS-C3560X-24P-L	-	-	Yes	Yes	24-port PoE+ 10/100/1000, 715W AC, LAN Base
	WS-C3560X-48P-L	-	-	-	Yes	48-port PoE+ 10/100/1000, 715W AC, LAN Base
	WS-C3560X-48PF-L	-	-	Yes	Yes	48-port PoE+ 10/100/1000, 1100W AC, LAN Base
IP Base	WS-C3560X-24T-S	-	-	-	-	24-port 10/100/1000, 350W AC, IP Base
	WS-C3560X-48T-S	-	-	-	-	48-port 10/100/1000, 350W AC, IP Base
	WS-C3560X-24P-S	-	-	Yes	Yes	24-port PoE+ 10/100/1000, 715W AC, IP Base
	WS-C3560X-48P-S	-	-	-	Yes	48-port PoE+ 10/100/1000, 715W AC, IP Base
	WS-C3560X-48PF-S	-	-	Yes	Yes	48-port PoE+ 10/100/1000, 1100W AC, IP Base
IP Base Models can be upgraded to IP services feature set at the time of order						

Optional 10G / 1G Network Modules

Price difference between 3750G and 3750-X

3750G	List Price	3750-X + 1G Network Module	LAN Base ("L")	Price difference	IP Base ("-S")	Saving
3750G-24T-S	\$5,995	3750X-24T with no Network Module	\$5,200	\$795	\$6,500	-\$505
3750G-24TS-S1U	\$6,995	3750X-24T & C3KX-NM-1G	\$5,700	\$1,295	\$7,000	
3750G-48TS-S	\$13,995	3750X-48T & C3KX-NM-1G	\$9,400	\$4,595	\$12,000	\$1,995
3750G-24PS-S	\$7,795	3750X-24P & C3KX-NM-1G	\$6,500	\$1,295	\$7,800	
3750G-48PS-S	\$15,495	3750X-48P & C3KX-NM-1G	\$10,900	\$4,595	\$13,500	\$1,995



•Catalyst 3750G

- Non-blocking wire rate switching fabric
- StackWise Plus (64G)/ Full IPv6
- Dual Redundant Power Sup and Fans
- Full PoE and **Full PoE+** capable
- MACsec/ 802.1x-REV**, 3750E feature set
- Hot upgradable to 10G
- NBD RMA and 90 days access to TAC
- StackPower**, DC PoE



•Catalyst 3750-X

•Much much more for less!

Price difference between 3750-E and 3750-X

3750-E	List Price	3750-X + 10G Network Module	LAN Base ("L")	Price difference	IP Base ("-S")	Saving
3750E-24TD-S	\$9,495	3750X-24T & C3KX-NM-10G	\$7,700	\$1,795	\$9,000	\$495
3750E-48TD-S	\$18,995	3750X-48T & C3KX-NM-10G	\$11,400	\$7,595	\$14,000	\$4,995
3750E-24PD-S	\$10,295	3750X-24P & C3KX-NM-10G	\$8,500	\$1,795	\$9,800	\$495
3750E-48PD-S	\$20,495	3750X-48P & C3KX-NM-10G	\$12,900	\$7,595	\$15,500	\$4,995
3750E-48PD-SF	\$21,995	3750X-48PF & C3KX-NM-10G	\$13,900	\$8,095	\$16,500	\$5,495



•Catalyst 3750E

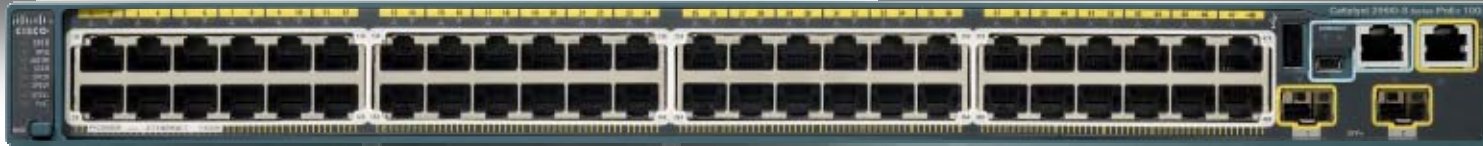
- Field replaceable, dual redundant power Sup and fans
- Full PoE+ capable
- MACsec/ 802.1x-REV
- Available with no uplinks or 1G uplinks
- NBD RMA and 90 days access to TAC
- StackPower, DC PoE



•Catalyst 3750-X

•Much more for a LOT less!

Introducing Catalyst 2960-S



- 24/48 10/100/1000 ports with fixed uplinks
- Fixed Uplink Options: 4x1G or 2x10G SFP+
- FlexStack Technology
 - Brings stackable ease-of-use features to the 2960 family, features 20G stacking links
- PoE+
 - Full standards-based PoE on every port
 - PoE+ support for next-generation high-power devices
- Sustainability - GREEN
 - Very low power for Gigabit Ethernet Switch
 - New EnergyWise functionality to control PHY power
 - Half the power of Catalyst 2960G
- E-LLW, NBD and 90 day TAC support
- LAN Lite and LAN Base Software Options
- LAN Lite option provides entry-level Gig-E platform

Catalyst 2960-S FlexStack



- FlexStack available with optional Module
Hot Swappable with two wire-speed 10G ports
- Up to 4 switches in a stack
- Unified management, control, and data plane (similar look and feel as StackWise)
- 3 FlexStack Cable lengths supported
0.5 meters, 1.0 meter, 3.0 meter

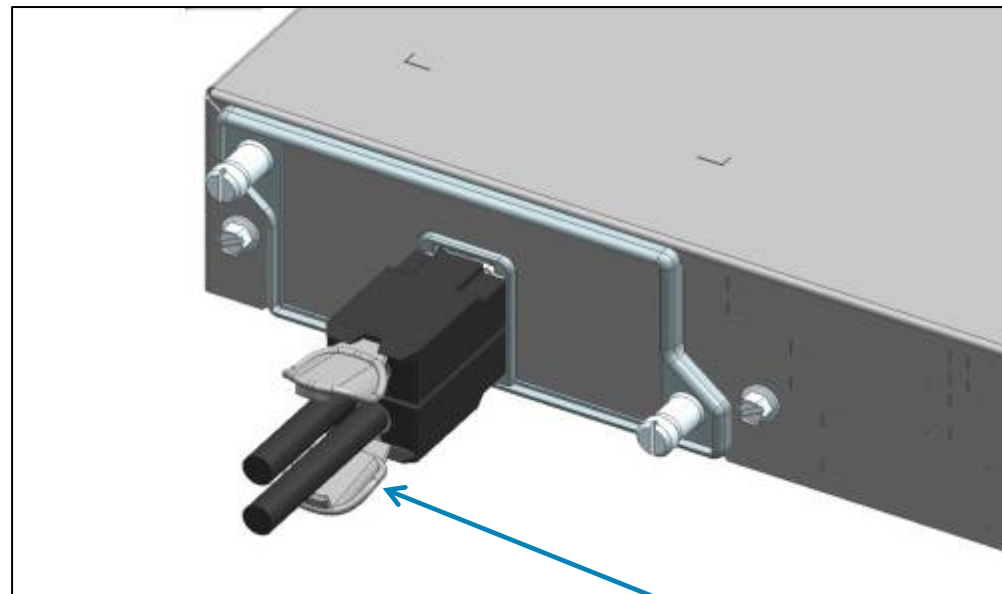
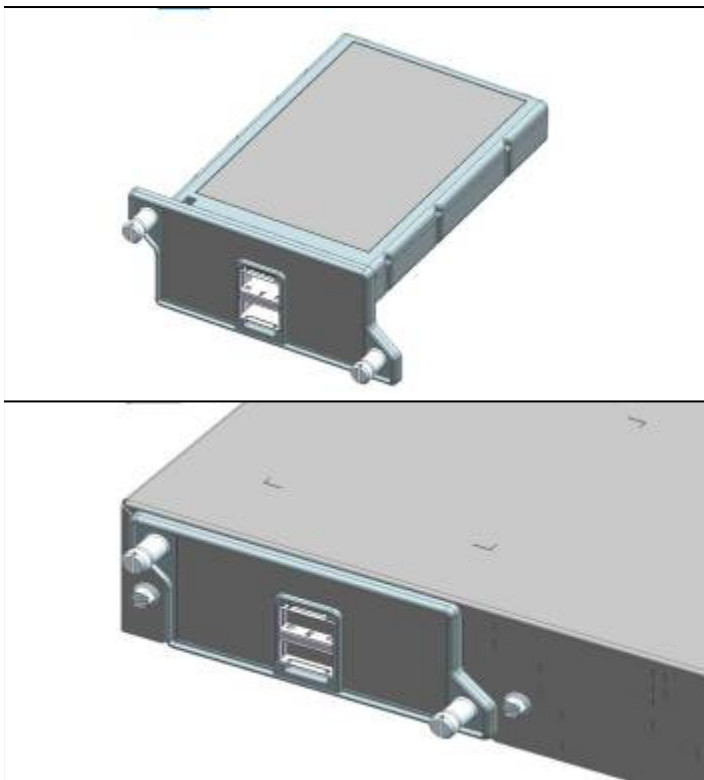
C2960-S FlexStack Stacking



- Cross-stack EtherChannel, SPAN, and FlexLink supported
EtherChannel physical links across stack members
- Pre-Provisioning of stack members supported
- Easy member addition and replacement
- Configurable Stack Master
Following same Master election rules as StackWise Plus
- Support same CISCO-STACKWISE-MIB
- Single Spanning tree node: No spanning-tree across stack
- Stack link topology change is handled in SW, not HW
Data flow recovery needs SW involvement

C2960-S FlexStack Module

- FlexStack Module inserted in the left rear of the switch.
- FlexStack module is optional for C2960-S switch operation
- Yes – Hot Swappable
- Blank plate required when FlexStack Module not inserted
- 3 Cable lengths supported, 0.5m, 1m, 3m



Note: Tabs on FlexStack cables are opposite each other

C2960-S Sustainability Green

Cisco Technology Innovation

- **Lowest Power Consumption in Industry**
 - improving Gigabit Ethernet switching power efficiency
 - Cisco ASICs: Low power consumption ASICs
 - Uses 50% power of equivalent Ethernet switches in the market
- **Additional Power savings**
 - Interfaces power down when interface not in connected to reduce power
- **EnergyWise Capable**

C2960-S Model comparison

Model	Cisco FlexStack Stacking	10G SFP+ Ports	1G SFP Ports	10/100/1000 Ports	Full PoE (15.4W) ports	PoE Budget
10G Uplink Ports						
<u>WS-C2960S-48FPD-L</u>	√	2		48	48	740W (PoE+)
<u>WS-C2960S-48LPD-L</u>	√	2		48	24	370W (PoE+)
<u>WS-C2960S-48TD-L</u>	√	2		48		
<u>WS-C2960S-24PD-L</u>	√	2		24	24	370W (PoE+)
<u>WS-C2960S-24TD-L</u>	√	2		24		
1G Uplink Ports						
<u>WS-C2960S-48FPS-L</u>	√		4	48	48	740W (PoE+)
<u>WS-C2960S-48LPS-L</u>	√		4	48	24	370W (PoE+)
<u>WS-C2960S-48TS-L</u>	√		4	48		
<u>WS-C2960S-24PS-L</u>	√		4	24	24	370W (PoE+)
<u>WS-C2960S-24TS-L</u>	√		4	24		
LAN Lite 1G Uplink Ports						
<u>WS-2960S-48TS-S</u>			2	48		
<u>WS-2960S-24TS-S</u>			2	24		



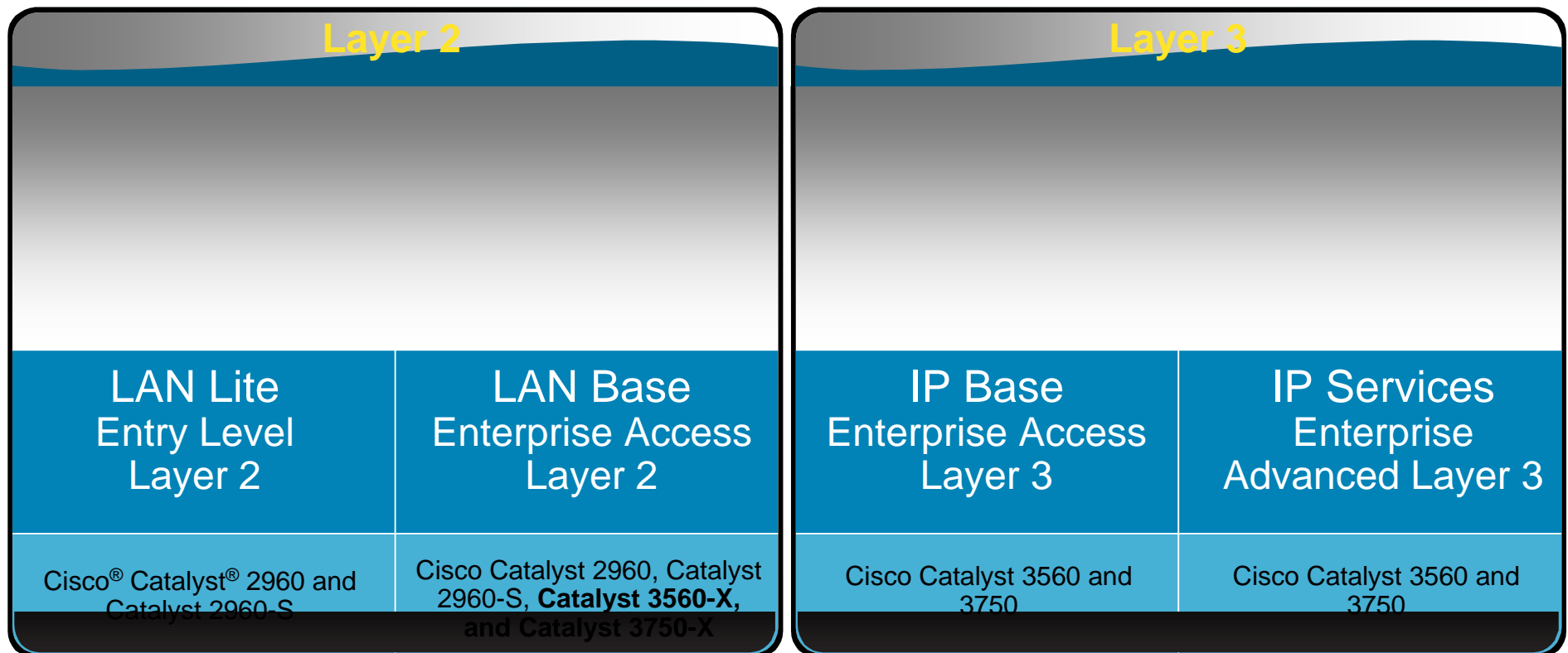
IOS 12.2(55)SE Feature additions Catalyst 2960, 3560, 3750 Enterprise

August 2010

Cisco IOS Software Feature Set Capabilities

Cisco Catalyst 2960 and Catalyst 3560 , 3750

LAN Lite: Enterprise Entry-Level Layer 2 Switching
LAN Base: Enterprise Access Layer 2 Switching
IP Base: Enterprise Access Layer 3 Switching
IP Services: Advanced Layer 3 Switching (IPv4 and IPv6)



Agenda – new Features

IOS Release 12.2(55)SE

- Smart Operations Feature Enhancements
 - Auto Smart Ports, Smart Install
- Routing Functionality
 - Static Routes in LAN Base feature set
 - OSPF for Routed Access
- Security improvements
 - MAC Replace, Multi-Auth with Vlan Assignment, SXP
- Auto QOS updates for new Media
 - Campus QOS Design
- Other Features of Importance in release

IOS 12.2(55)SE Release and Products

- Update on Enhancements in IOS release 12.2(55)SE
- Official release date: August 12, 2010
- Included Products:
 - Catalyst 2960 family – includes 2975
 - Catalyst 3560 family
 - Catalyst 3750 family

Smart Operations

- Auto Smart Ports Phase 3 Enhancements

 - Phase 2 was 12.2(52)SE

 - More devices auto Detected

 - Additional Deployment options

- Smart Install Phase 2 Enhancements

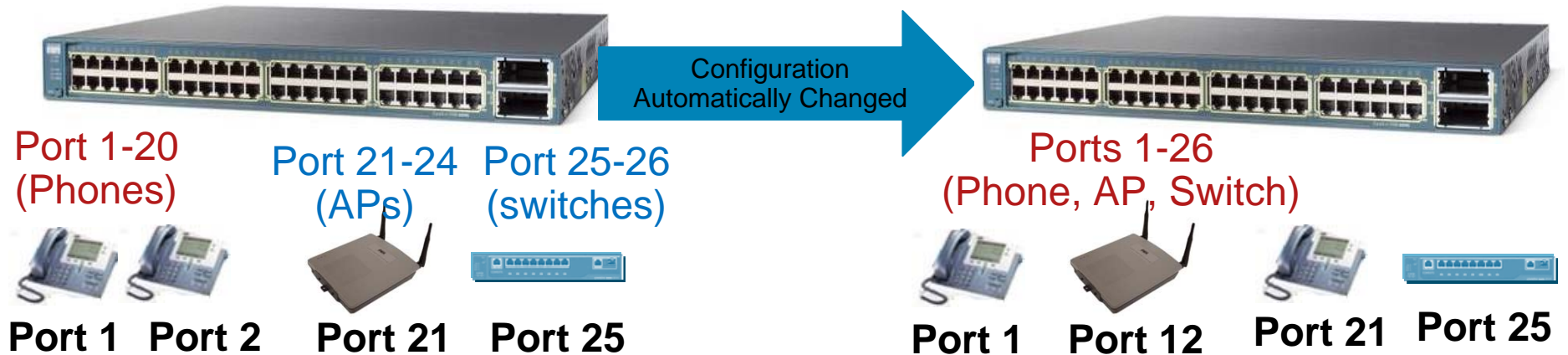
 - Director Database

 - Client Configuration backup

 - Smart Install MIB now available

Auto Smart Ports

- **Automatic Configuration Based on Device Type**
 - **Macro generates configuration automatically**
 - Customer macro capability
 - Macro storage on server or switch
 - **Radius Authentication based macro support**
 - MAB, 802.1x or Web Auth login can execute macro
 - **Supported on 2960/3560/3750**



Auto Smart Ports Phase 3

- Last Resort Macro – Applied when no device match found
 - Devices that don't support CDP or LLDP (eg: Laptops)
- Anti-Macro – Applied when device removed
 - Customizable configuration to leave the port in a known state
- Per port and Per Macro Control
 - Disallow certain Macros from being applied
 - Enable/disable detection methods (CDP, LLDP, OUI)
- VlanID Name as parameter
 - Previous release supported VlanID number only
- Will use new Auto QOS parameters for “media”
 - Covered later in presentation

Auto Smart Ports Phase 3 cont

- Enhancements for Access Points

Support new Auto-QOS CDP TLV

- WCS version 6.0.188.0 or greater

- Prevent AP buffer overruns with egress rate limit

Improved Cisco AP device detection

- New Device types detected:

TNP phones (Third Generation IP phones)

Roundtable phones (models 99xx)

ASP – list of IP Phones in phase 3

- Cisco Unified IP Phone 7900 series:
7906, 7911, 7941, 7942, 7945,
7961, 7962, 7965,
7970, 7971, 7975
- Cisco Unified IP Phone 9900 series
9971, 9951

Smart Install

Smart Install Feature Benefits

- Zero Touch Switch Plug and Play

Configure the director and attach switch to director for auto image and configuration download

- Zero Touch Switch Replacement

Switch replacement is possible if like model is replaced with new MAC address

- Single Point of Configuration

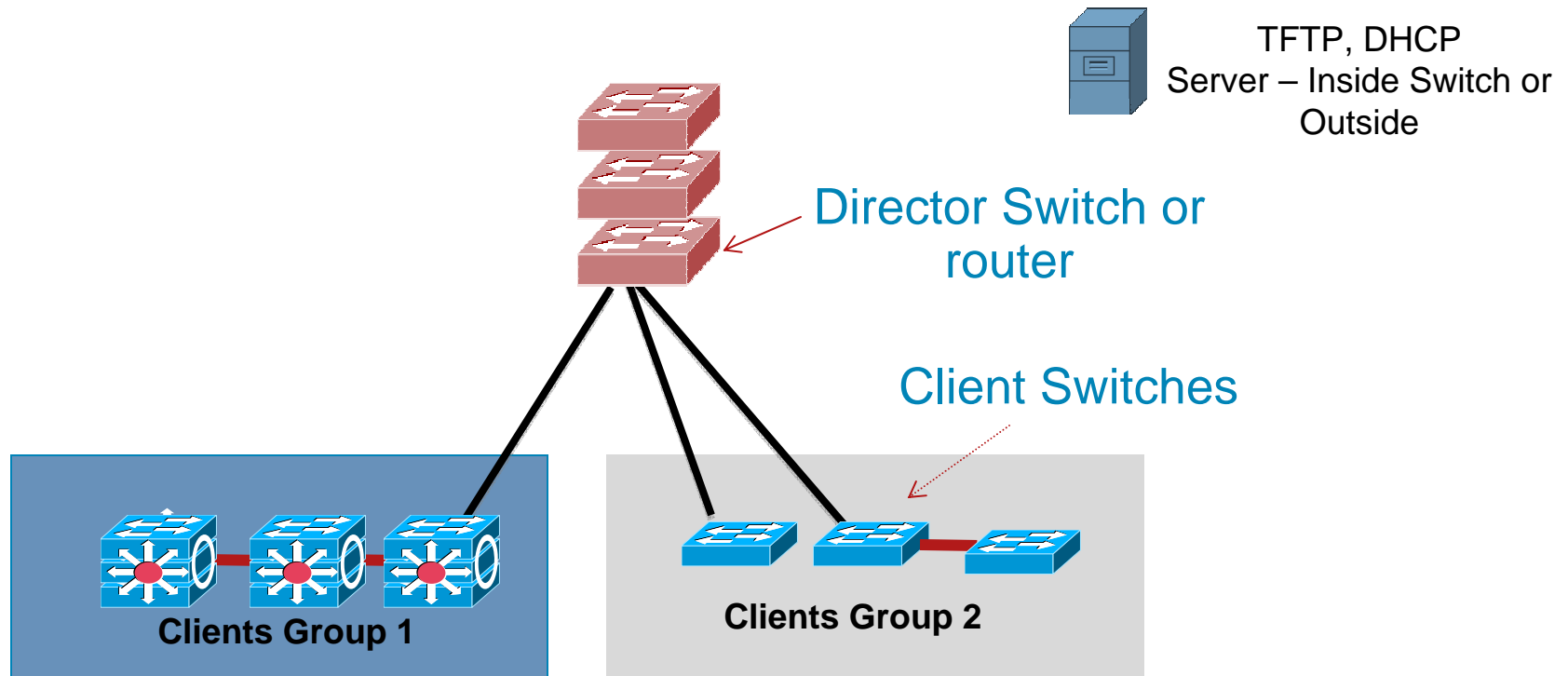
Management of all client switches from the director (telnet access)

Group based changes based on model ID or MAC address

Simplified Switch Upgrade Process with the ability to push an image and configuration across groups of switches, synchronizing and storing the latest configuration files on the director

Smart Install In the Network

- **Director** configures client switch plug and play
- Switches are groups common image and configuration
- On-demand configuration and image update possible



Smart Install Enhancements

- Archive Client configuration files
 - Each client can have unique configuration file.
- Smart Install MIB
 - CISCO-SMART-INSTALL-MIB
- Updated CLI “show vstack status” output

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Device Status      ACT - Active      INA - Inactive    PND - Pending Update
                  HLD - On-hold    DNY - Denied      NSI - Non Smart Install
Image Upgrade:    i - in progress  I - done          X - failed
Config Upgrade:  c - in progress  C - done          x - failed
Director Database:
DevNo  MAC Address      Product-ID        IP_addr           Hostname           Status
=====
0      001b.d5a9.4700   WS-C3750E-48TD   10.30.0.3         3750e-Dire        Director
1      0006.52b9.e100   WS-C2950T-24     10.30.0.2         Rack3_10_n        NSI
3      0018.ba61.5180   WS-C3750E-48PD   10.30.0.52        3750-vlann        INA I C
4      0018.ba61.6e80   WS-C3560E-48TD   10.30.0.53        3560e-vlan        ACT I C
5      0021.1caf.3680   WS-C2960-48TT-S  10.30.0.51        Switch             INA I C
6      0026.527d.5100   WS-C2960S-48FPD-L 0.0.0.0

```

Changes to Routing Features

- Adding static routes to LAN Base feature set
 - Allows Inter-Vlan Routing on traditional Layer 2 only devices
 - 16 Static Routes MAX per switch,
 - RACLs on the Vlan Interfaces
 - Models: C2960S, C2960G, C2960, C2975
 - No: RIP, OSPF, EIGRP,
 - No: IP addresses on physical interfaces
 - Vlan interfaces only!
 - New SDM Template for “lanbase-routing” must be configured.
- Use C3560/3750 for L3 most requirements
 - Fall back to C2960 if cost or demand requires it.

Changes to Routing Features cont

- Routed Access in IP Base

 - OSPF for Routed Access

 - functional equivalent to 4K feature

 - Extend the Layer3 routing to the wiring closet.

 - Full OSPF protocol in IP Base feature set

 - Limited to 200 indirect routes!!!

 - Single instance for OSPF

- Models:

 - All C3560, and C3750 models

New Security/ Identify Features

TrustSec Features

- **MAC Replace**
 - Allows new hosts behind hub or IP Phone to authenticate
 - Combined with MAC Move, complete solution for wired mobility
- **Multi-Auth with Vlan Assignment**
 - RADIUS server assigns vlan to first authenticated host
 - Subsequent hosts use same vlan.
- **Support for the Security Group Tag (SGT) Exchange Protocol (SXP)**
 - Control protocol exchange with upstream device.
 - C3560 and C3750 only.

Mobility **compromised** in an IP Telephony & Identity Enabled Network

- 1 PC connects (assume 802.1X/MAB process occurs)
- 2 Authentication Succeeds
- 3 CAM Table updated (MAC/Port)
- 4 PC Moved to new location
- 5 Authentication will fail - MAC still associate with other port

PC MAC: 00-1C-25-BA-6D-3B



Office

Intermediary Device



Conference Room

CAM TABLE

MAC Addr	Switchport
00-1C-25-BA-6D-3B	Gigabit Ethernet 1/0/1



Wiring Closet



Mobility enhanced in an IP Telephony & Identity 4.1 Enabled Network

Introduced 12.2(52)SE

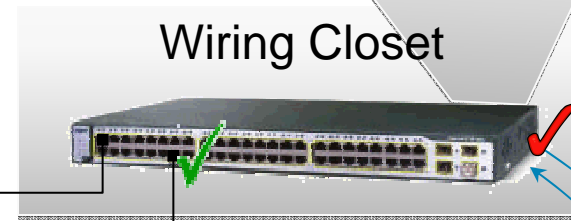
PC MAC: 00-1C-25-BA-6D-3B



- 1 PC connects (assume 802.1X/MAB process occurs)
- 2 Authentication Succeeds
- 3 CAM Table updated (MAC/Port)
- 4 PC Moved to new location
- 5 PC Authenticates (802.1X/MAB)
- 6 CAM Table updated with new entry

~~CAM TABLE~~

MAC Addr	Switchport
00-1C-25-BA-6D-3B	Gigabit Ethernet 1/0/1
00-1C-25-BA-6D-3B	Gigabit Ethernet 1/0/14



ACS - AAA RADIUS

Identity 4.1 "MAC MOVE"

Accessibility **compromised** in an IP Telephony & Identity Enabled Network

- 1 PC A connects (assume 802.1X/MAB process occurs)
- 2 Authentication Succeeds
- 3 CAM Table updated (MAC/Port)
- 4 PC A disconnects
- 5 PC B connects
- 6 Switch detects invalid MAC resulting in - Security Violation

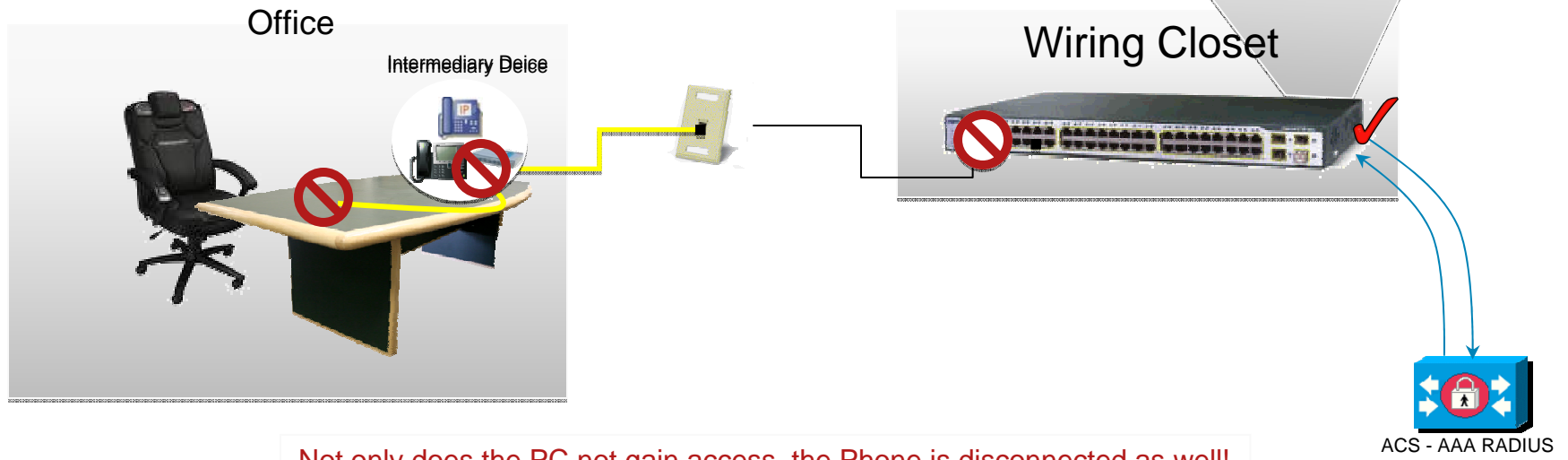


PC(A) MAC: 00-1C-25-BA-6D-3B

PC(B) MAC: 00-1C-25-BA-6E-4C

~~CAM TABLE~~

MAC Addr	Switchport
00-1C-25-BA-6D-3B	Gigabit Ethernet 1/0/1



Not only does the PC not gain access, the Phone is disconnected as well!

Accessibility enhanced in an IP Telephony & Identity 4.1 Enabled Network

- 1 PC A connects (assume 802.1X/MAB process occurs)
- 2 Authentication Succeeds
- 3 CAM Table updated (MAC/Port)
- 4 PC A disconnects
- 5 PC B connects
- 6 Authentication succeeds
- 7 CAM updated with new MAC Address

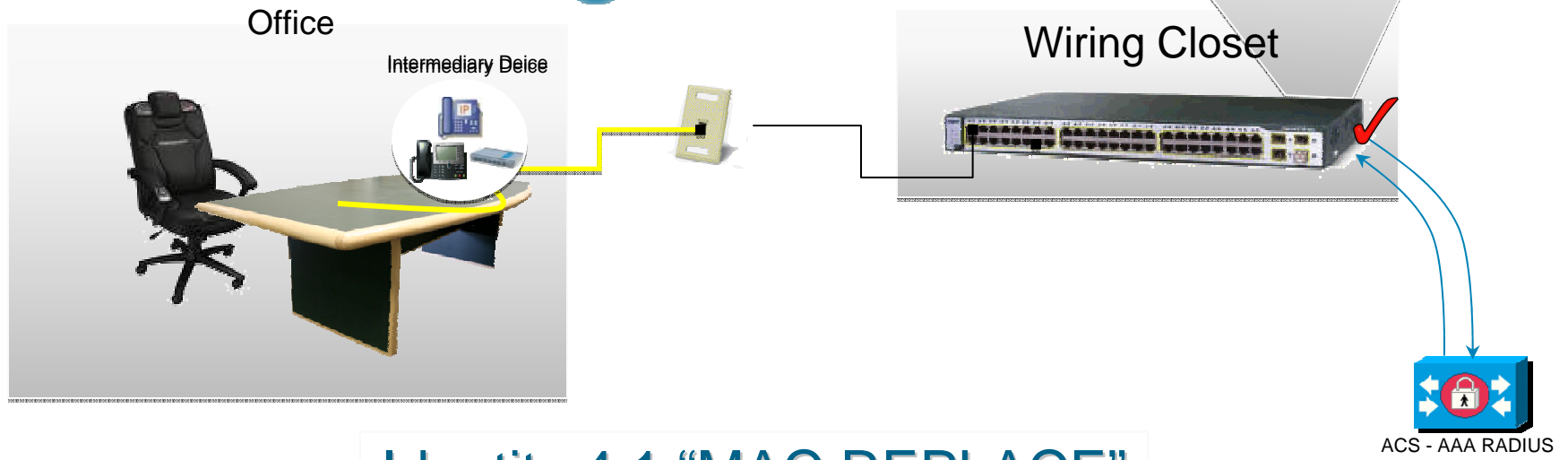


PC(A) MAC: 00-1C-25-BA-6D-3B

PC(B) MAC: 00-1C-25-BA-6E-4C

~~CAM TABLE~~

MAC Addr	Switchport
00-1C-25-BA-6E-4B	Gigabit Ethernet 1/0/1



Platform Consistency Changes

- “Class Default” Classifier for Policy-map now supported officially
- Policer Granularity for C2960 is now 8K bps
 - Consistency with 3560 and 3750.
 - C2960S: min granularity 16K bps
- Allows for consistent Service Policy configurations across 2K and 3K Switches

IOS Feature Packaging Changes

- EEM added to IP Base
Formerly in IP Services only
- LLDP_MED added to LanLite
- DHCP Snooping (with option 82 support) in LanLite

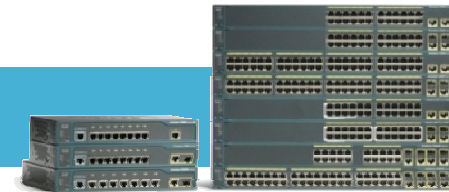
Everything Else ...





- TCAM Memory Consistency Checks
- CDP updates to support Location
 - Hierarchical location – push down to end devices
- EnergyWise MIB enhancements - CISCO-ENERGYWISE-MIB
 - 17 new attributes in cewNeighborTable

Key LAN Lite vs. LAN Base Highlights

12.2(55)SE Release Aug 2010

Cisco® Catalyst® 2960 and Catalyst 2960-S



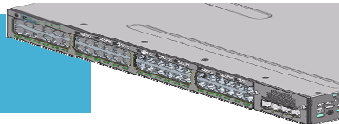
Functions	LAN Lite	LAN Base
Layer 2	<ul style="list-style-type: none"> • Entry-level access Layer 2 Basic Layer 2 access features, including 802.1Q trunking, (M)STP, STP extensions, Cisco Discovery Protocol, DTP, UDLD, VTPv2, PAGP/LACP, LLDP, storm control and LLDP-MED  	<ul style="list-style-type: none"> • Enterprise Access Layer 2 Wide range of Layer 2 access features for enterprise deployments, including FlexLinks and VTPv3
Layer 3	<ul style="list-style-type: none"> • No routing support Support for Layer 3 management interface 	<ul style="list-style-type: none"> • Static routing support  Support for SVIs with up to 16 IPv4 routes
Manageability	<ul style="list-style-type: none"> • Entry-level manageability Express setup, Cisco Device Manager, SNMPv3 (with cryptography), RMON, SPAN, TDR, Auto Smart Ports, and Smart Install client 	<ul style="list-style-type: none"> • Basic manageability Support for a wider range of MIBs, IPSLA Responder, and RSPAN
Security	<ul style="list-style-type: none"> • Entry-level access security  SSH v2 server, SSL, HTTPS, SCP, TACACS+, RADIUS, port security, 802.1x (with guest VLAN), MAB, private VLAN edge, NAC, and DHCP snooping 	<ul style="list-style-type: none"> • Enterprise access security  IPSG, DAI, RACL, PACLs, Cisco Identity 4.0, and 802.1x features
QoS	<ul style="list-style-type: none"> • Entry-level access QoS Ingress and egress queuing, scheduling, Priority Queuing, and SRR 	<ul style="list-style-type: none"> • Enterprise access QoS Ingress policing, Trust Boundary, AutoQoS, and DSCP mapping

Note: LAN Base feature set includes all LAN Lite features.

Key LAN Base vs. IP Base and IP Services Highlights



12.2(55)SE Release Aug 2010

Cisco® Catalyst® 3560-X
and Catalyst 3750-X



Cisco Catalyst 3560 and Catalyst
3750, Including E and X Series



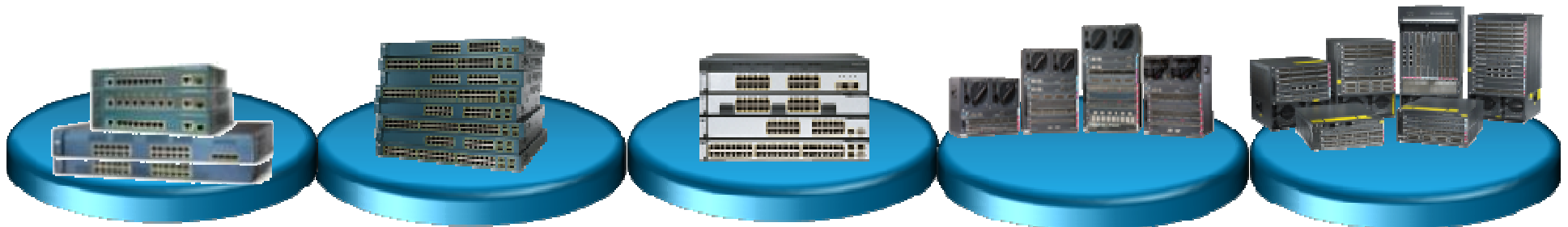
Functions	LAN Base	IP Base	IP Services
Layer 2+	<ul style="list-style-type: none"> • Enterprise access Layer 2 Wide range of Layer 2 access features for enterprise deployments 	<ul style="list-style-type: none"> • Complete Access Layer 2 Supports all Cisco Catalyst 2000 and Catalyst 3000 Layer 2 features, including hot standby protocols; supports Cisco StackPower™ technology (Cisco Catalyst 3750-X) 	
Layer 3	<ul style="list-style-type: none"> • No routing support Support for SVI with no IP routing support 	<ul style="list-style-type: none"> • Enterprise access Layer 3 Static routing, RIP, stub PIM, stub EIGRP, OSPF for Routed Access  	<ul style="list-style-type: none"> • Complete access Layer 3 OSPF, EIGRP, BGP, IS-IS, PIM, VRF-lite, WCCP, PBR
Manageability	<ul style="list-style-type: none"> • Basic manageability Support for a wide range of MIBs, IPSLA Responder, and RSPAN 	<ul style="list-style-type: none"> • Enterprise access Layer 3 Gold-Lite, Smart Install Director and EEM  	<ul style="list-style-type: none"> • Complete access Layer 3 IPSLA Initiator
Security	<ul style="list-style-type: none"> • Enterprise access security DHCP Snooping, IPSG, DAI, PACLS, Cisco Identity 4.0, NAC and 802.1x features 	<ul style="list-style-type: none"> • Complete access security Router and VLAN ACLs, private VLANs, complete security, TrustSec SXP, and IEEE 802.1AE (Cisco Catalyst 3560-X and Catalyst 3750-X) 	
QoS	<ul style="list-style-type: none"> • Enterprise access QoS Ingress policing, Trust Boundary, AutoQoS, and DSCP mapping 	<ul style="list-style-type: none"> • Complete access QoS Support for all Cisco Catalyst 2000 and Catalyst 3000 QoS features, including per-VLAN policies 	

Note: IP Services feature set includes all IP Base features. IP Base feature set includes all LAN Base features.



EnergyWise update

EnergyWise Platform and IOS Support



Catalyst 2900 including Compact Switches
12.2(50)SE
LAN Lite feature set or higher

Catalyst 3560-E & 3560 including Compact Switches
12.2(50)SE
LAN Base feature set or higher

Catalyst 3750-E & 3750
12.2(50)SE
LAN Base feature set or higher

Catalyst 4500 & 4900
12.2(52)SG (Sup7e in IOS-XE 3.1.0SG)
LAN Base feature set or higher

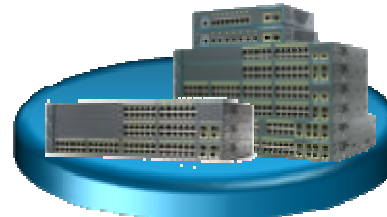
Catalyst 6500
12.2(33)SX14 or higher
LAN Base feature set or higher



EtherSwitch Modules for ISR
12.2(50)SE or higher



Integrated Services Routers (ISR i.e. 1900/2900/3900) G2
15.0(1)M3
Universal IP Base feature set or higher



Catalyst 2960-S
12.2(53)SE2
LAN Lite feature set or higher



Catalyst 3750-X & 3560-X
12.2(53)SE2
LAN Base feature set or higher

Smart PDUs using EnergyWise Enhanced SDK

- Smart PDUs (aka “Intelligent PDUs”) with EnergyWise Enhanced SDK gives EnergyWise monitoring and control down to plug outlet level



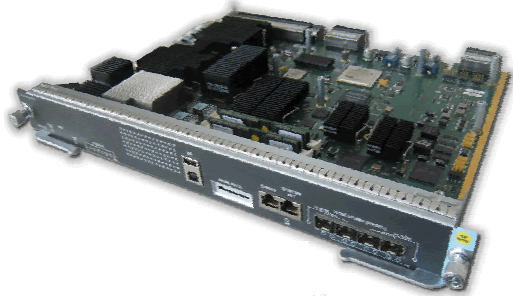


Catalyst 4500E Supervisor 7-E and Cisco IOS-XE Update



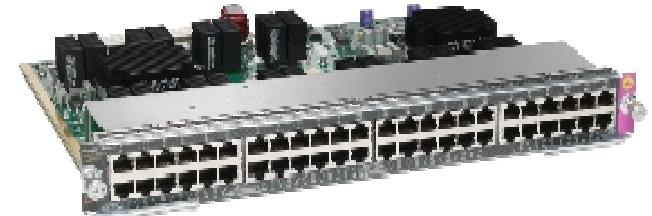
Supervisor 7-E System

Supervisor 7-E



848Gbps Switching Capacity
48G/slot
Rich hardware features

WS-X4748-RJ45V+E



48p 10/100/1000 non-blocking
48Gbps/Slot
30W/port (PoE+) on all 48 ports
Cisco TrustSec in Hardware
Jumbo frame support

WS-X4712-SFP+E

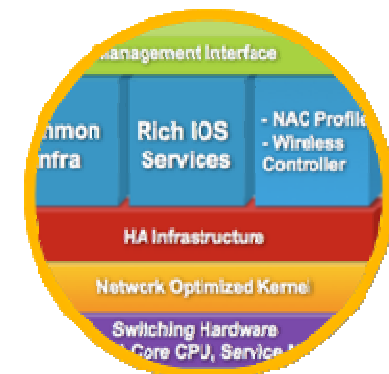


12 PORT 10GE 2.5:1 Line Card
Cisco Trustsec in Hardware
Jumbo Frame support



Catalyst 4500E and 4500E+ Chassis

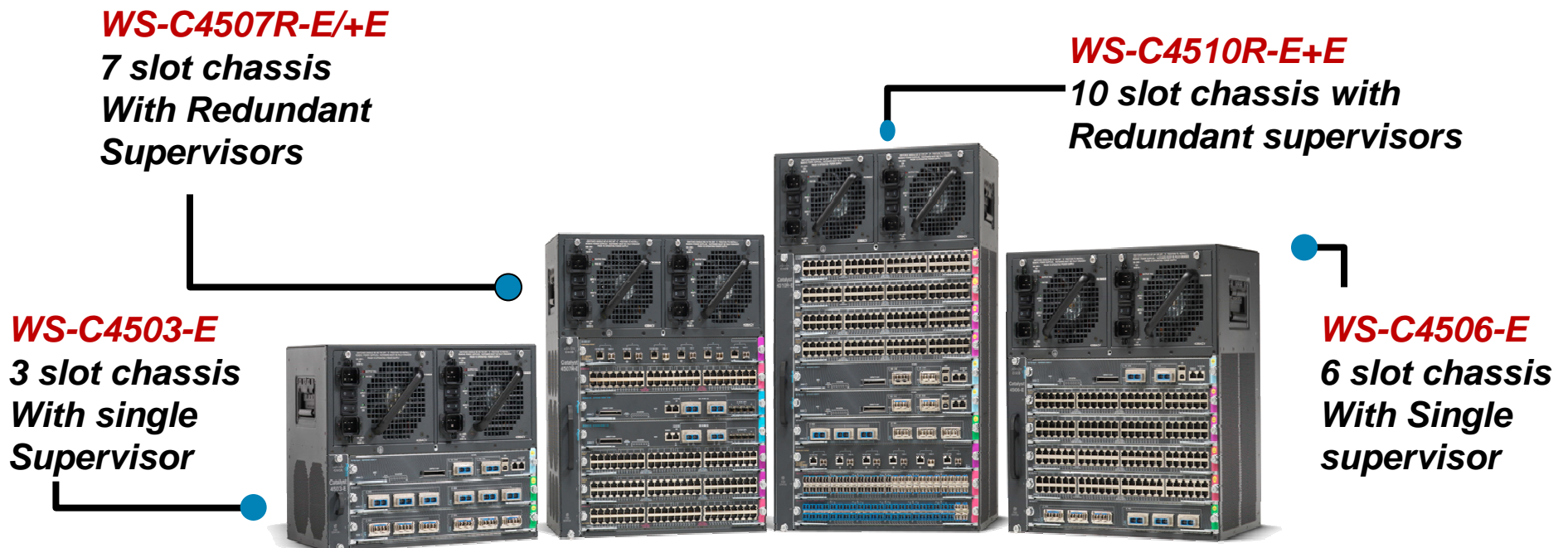
Cisco IOS-XE



Modern OS to leverage next-gen
switching HW
Enabling Open Service Platform

Catalyst 4500E and 4500E+ Chassis

E Series chassis designed to support higher bandwidth per slot line cards . The chassis provides 24G to 48G of bandwidth per slot with next generation supervisor providing **Investment Protection**



- WS-C4507R+E and WS-C4510R+E chassis add support for 48G/slot
- Existing supervisors also support the E+ chassis

Per Slot Bandwidth in 10 and 7 Slot Chassis

24G
24G
24G
24G
Supervisor 6-E
Supervisor 6-E
24G
6G
6G
6G

WS-C4510R-E

24G
24G
24G
24G
Supervisor 7-E
Supervisor 7-E
24G
24G
24G
24G

WS-C4510R-E

48G
48G
48G
48G
Supervisor 7-E
Supervisor 7-E
48G
48G
48G
48G

WS-C4510R+E

24G
24G
Supervisor 6/6L-E
Supervisor 6/6L-E
24G
24G
24G

WS-C4507R-E

24G
24G
Supervisor 7-E
Supervisor 7-E
24G
24G
24G

WS-C4507R-E

48G
48G
Supervisor 7-E
Supervisor 7-E
48G
48G
48G

WS-C4507R+E

Catalyst 4500 Supervisor 7-E

Hardware Elements

DRAM

Dual Core CPU

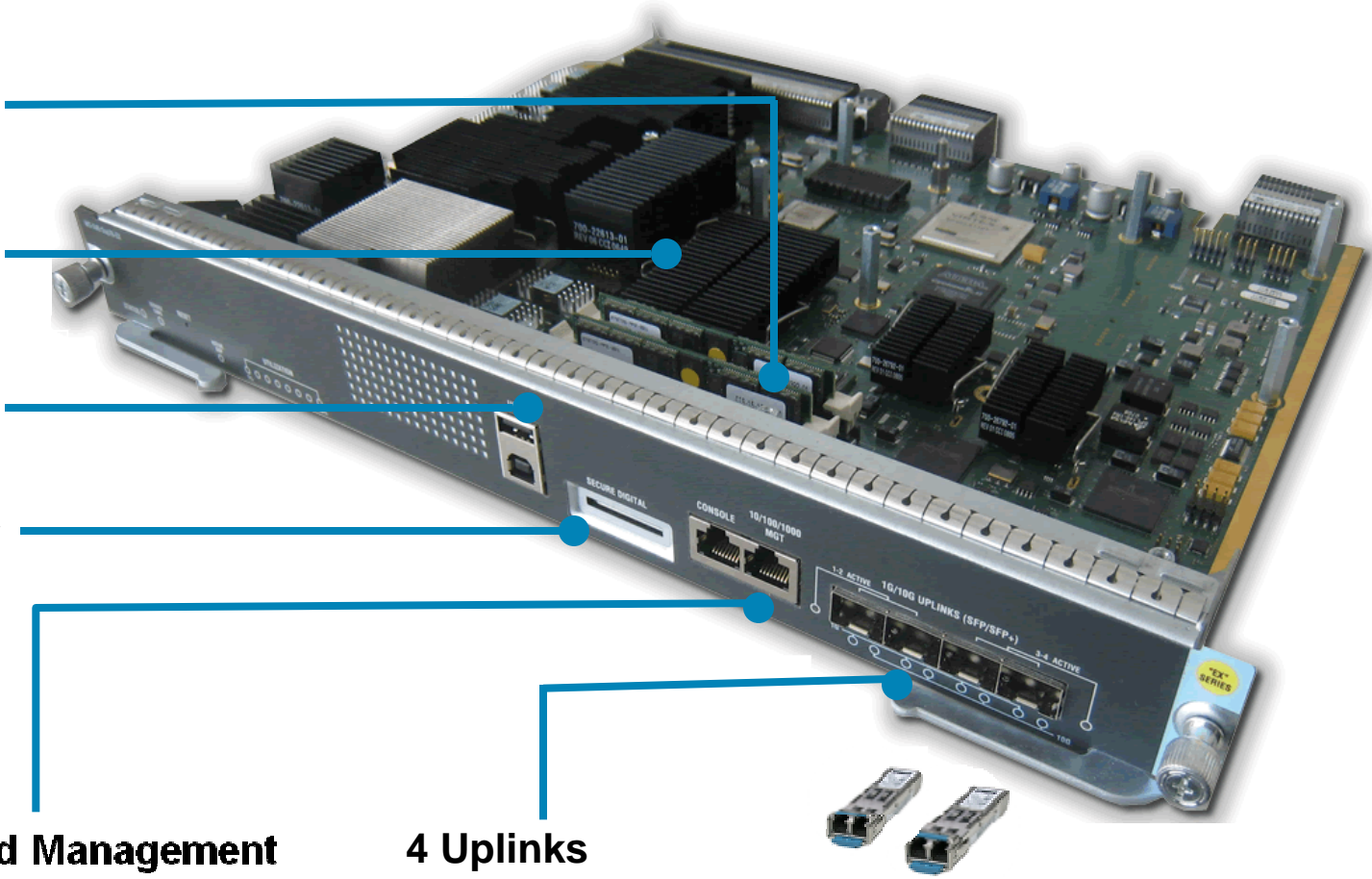
USB ports*
Type A
Type B

SD Memory Card

Console and Management Port

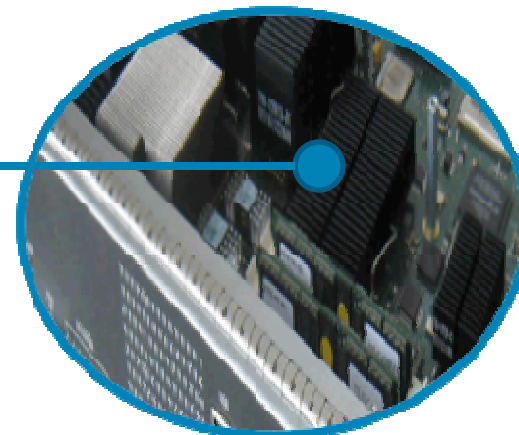
4 Uplinks
10GE with SFP+
1GE with SFP

**USB Type A is supported
USB Type B is not supported*



Catalyst 4500E Sup7-E Dual Core CPU

- Sup 7-E has a dual-core (1.5GHz) CPU
- Increased control plane scalability
 - Better routing , L2 convergence
 - 2GB DRAM by default , upgradable to 4GB



```
SUP7-E#show process cpu
```

```
Core 0: CPU utilization for five seconds: 24%; one minute: 23%; five minutes: 23%
```

```
Core 1: CPU utilization for five seconds: 24%; one minute: 19%; five minutes: 19%
```

PID	Runtime(ms)	Invoked	uSecs	5Sec	1Min	5Min	TTY	Process
1	915	918	997366	0.00	0.00	0.00	0	init
2	0	79	10810	0.00	0.00	0.00	0	kthreadd
3	247	43563	5672	0.00	0.00	0.00	0	migration/0
4	57	5786	9923	0.00	0.00	0.00	0	ksoftirqd/0
5	236	41567	5700	0.00	0.00	0.00	0	migration/1

```
<SNIP>
```

Catalyst 4500E Sup7-E Secure Digital Card

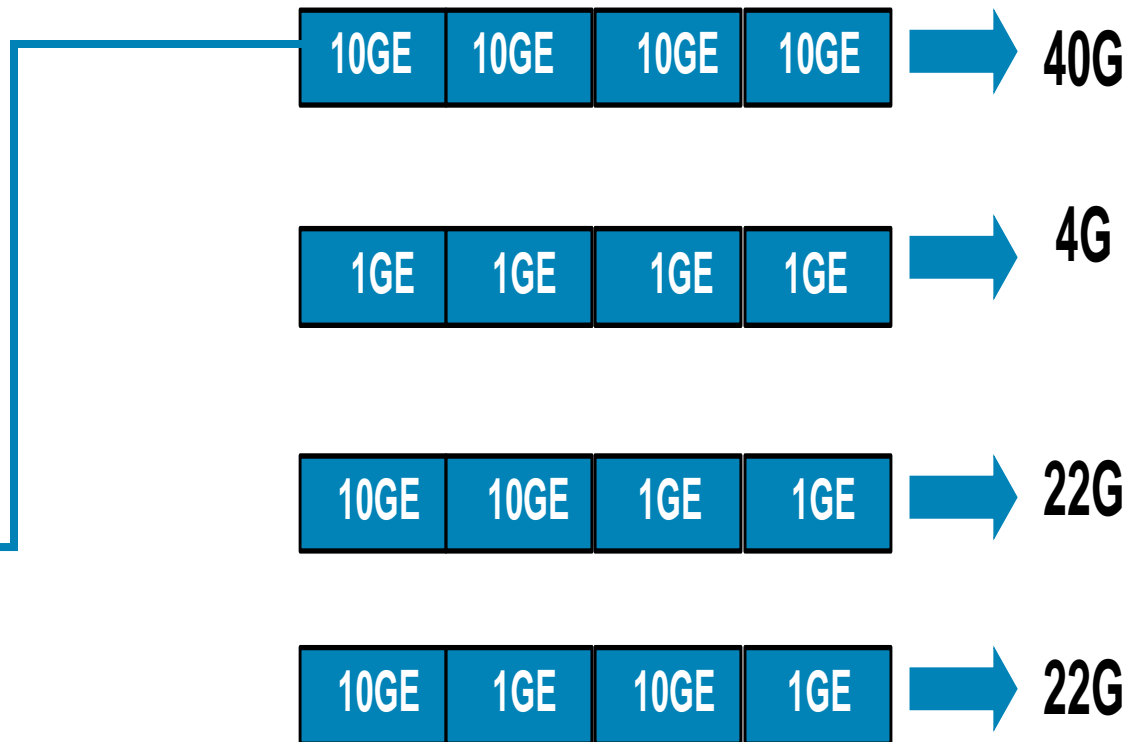
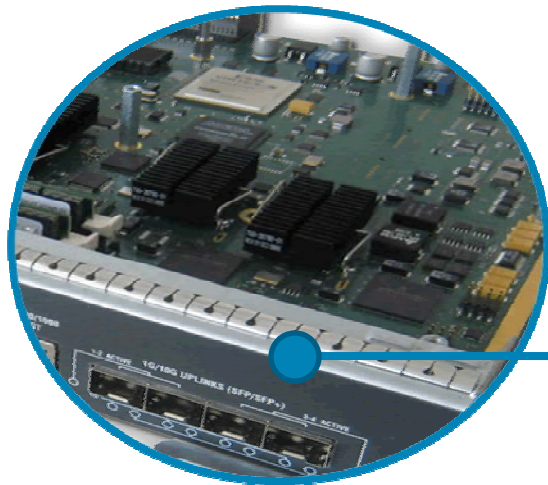


- External storage by SD card on Supervisor 7-E
- Average speed of data transfer between 10 MB/s – 20 MB/s
- Supported size 2G . PID MEM-X45-2GB-E
- Accessed by “dir disk0” command

Supervisor 7-E Uplink Configurations

Single Supervisor

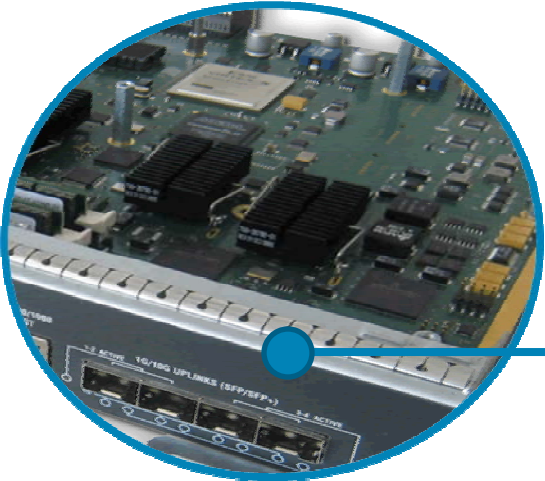
- Supervisor 7-E uplinks can either operate in 10GE or 1GE mode
- All modes are non-blocking
- Any port can be used as 1GE or 10GE without any limitation
- Speed selection is dynamic based on Optic type SFP / SFP+
- Operationally simple



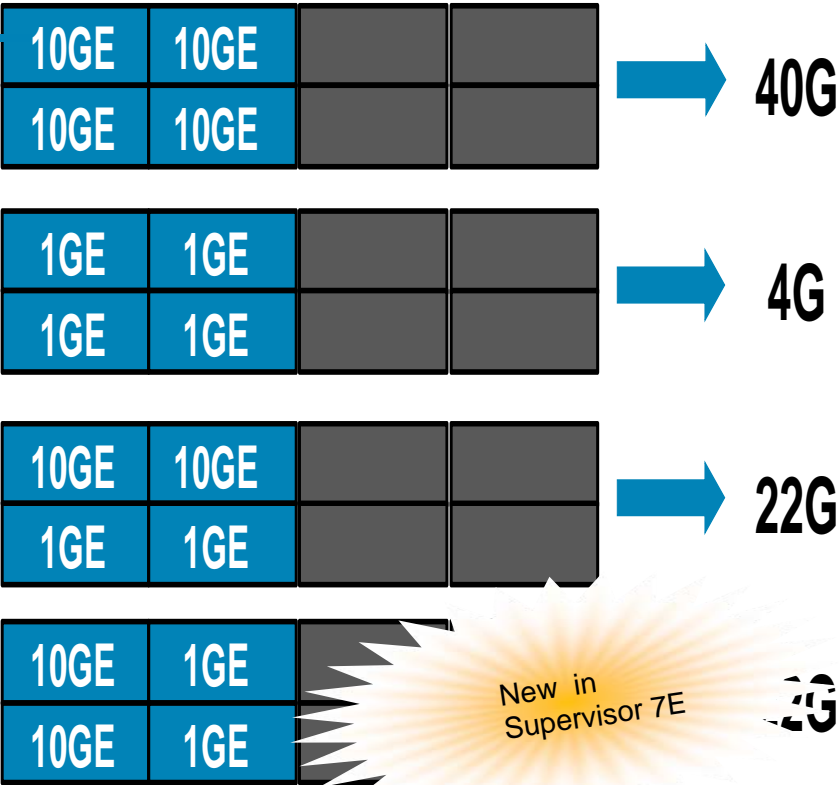
Supervisor 7-E Uplink Configurations

Redundant Supervisor

- Supervisor 7-E uplinks can either operate in 10GE or 1GE mode
- All modes are non-blocking
- Different port speeds can be used on the same or across supervisors
- Speed selection is dynamic based on optic type SFP/SFP+
- Operationally simple



 Inactive



New in Supervisor 7E

Show interface status for Supervisors

- The concept of port groups is no longer applicable
- Any ports can be used as 1GE / 10GE
- The CLI refers to ports as being 10GE (TenG mod/port) with either type of optics

```
SUP7-E#show int status module 5
```

Port	Name	Status	Vlan	Duplex	Speed	Type
Te5/1		connected	routed	full	10G	10GBase-SR
Te5/2		connected	400	full	auto	1000BaseSX
Te5/3		inactive	1	full	auto	No XCVR
Te5/4		inactive	1	full	auto	No XCVR

```
SUP7-E#show int status module 6
```

Port	Name	Status	Vlan	Duplex	Speed	Type
Te6/1		notconnect	1	full	auto	10GBase-SR
Te6/2		notconnect	1	full	auto	No XCVR
Te6/3		inactive	1	full	auto	No XCVR
Te6/4		inactive	1	full	auto	No XCVR

Supervisor 7-E Performance & Scalability

System

Feature	Supervisor 7-E	Supervisor 6-E	Supervisor 6L-E
Switching Capacity	848Gbps	320 Gbps	280 Gbps
Throughput	250 Mpps (125 Mpps for IPv6)	250 Mpps (125 Mpps for IPv6)	225 Mpps (125 Mpps for IPv6)
Bandwidth / Slot	Upto 48G	Upto 24G	Upto 24G
CPU	Dual Core 1.5 GHz	Single Core 1.3 GHz	Single Core 1 GHz
SSO failover time	0-50 msec	0-50 msec	0-50 msec
Number of Packet buffers	128000	64000	64000
DRAM	2G (Upgradable to 4G)	512 MB (Upgradable to 1G)	512 MB
Bootflash	1G	128 MB	128 MB
Number of 10/100/1000 ports	Upto 384 access Upto 4 GE uplinks	Upto 384 access Upto 4 GE uplinks	Upto 240 access Upto 4 GE uplinks
Number of 10GE ports	Upto 96 on Line cards Upto 4 on Supervisors	Upto 30 on Line cards Upto 4 on Supervisors	Upto 30 on Line cards Upto 2 on Supervisors

Supervisor 7-E Performance & Scalability (Cont'd)

Layer 2

Feature	Supervisor 7-E	Supervisor 6-E	Supervisor 6L-E
Unicast MAC entries	55000	55000	55000
Multicast MAC entries	32000	32000	16000
Number of VLANs	4094	4094	4094
Virtual Port Instances	10000	10000	10000
Number of Etherchannels	64	64	64
Mac Learning rate	20000 /second	13000/second	8000/second

Layer 3

Feature	Supervisor 7-E	Supervisor 6-E	Supervisor 6L-E
Routing Entries	256000	256000	57000
Number of VRFs	64	64	64
Netflow Entries	128000	0	0

Supervisor 7-E Performance & Scalability (Cont'd)

Qos and ACLS

Feature	Supervisor 7-E	Supervisor 6-E	Supervisor 6L-E
ACLs	64K / direction	64K / direction	32K / direction
Number of Policers	16K	16K	16K
QoS Classification Entries	64K/ direction	64K/ direction	32K/ direction
Queues per port	8 queues – 1p7q1t	8 queues – 1p7q1t	8 queues – 1p7q1t

Multicast and SPAN

Feature	Supervisor 7-E	Supervisor 6-E	Supervisor 6L-E
Number of SPAN sessions	8 bidirectional	8 bidirectional	8 bidirectional
Number of L2 Multicast Entries	32000	32000	8000
Multicast Replication Performance	250 Mpps	250 Mpps	225 Mpps

WS-X4748-RJ45V+E 10/100/1000 POE+ LC



- 48 port non blocking 10/100/1000 POE + Line card
- 30W POE+ (IEEE 802.3at) on all 48 ports
- Compatible with Supervisor 7-E , all E and all E+ chassis
- IEEE 802.1ae Macsec Link encryption on all ports. Key exchange using IEEE 802.1X REV / Macsec Key Agreement **
- Per port power consumption and reporting

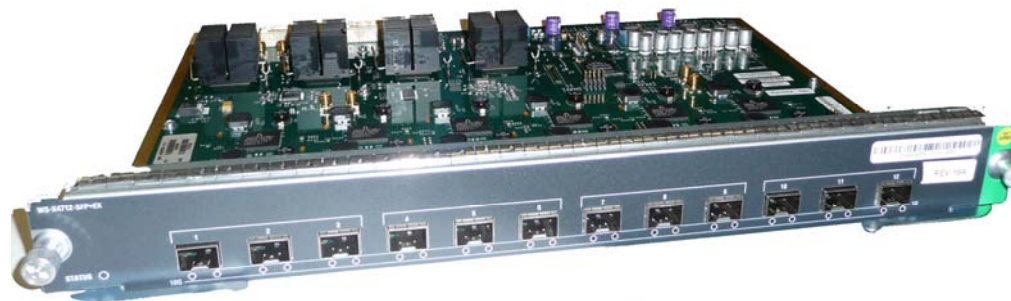
** Hardware ready , software post FCS

Differences between 4648 and 4748 LC



	WS-X4748-RJ45V+E	WS-X4648-RJ45V+E
Front Panel ports	48 10/100/1000	48 10/100/1000
POE+	Upto 48 ports	Upto 24 ports
Port Encryption (IEEE 802.1ae)	Yes	No
Backplane capacity	48Gbps	24Gbps
Oversubscription	None	2:1

WS-X4712-SFP+E 12 port 10GE Fiber LC



- 12 port 10GE line card 2.5:1 oversubscribed
 - Increases the 10GE port density on 4500E to 96 10GE ports
 - SFP+ optics for 10GE . SFP optics for 1GE
 - All ports can be used as 1GE ports with SFP optics
 - IEEE 802.1ae Macsec link encryption on all ports. Key exchange using IEEE 802.1X REV / Macsec Key Agreement (MKA)*
 - Dynamic speed selection based on SFP type
 - Works with Supervisor 7-E and 4503E , 4506E , 4507R+E , 4510R+E chassis
- * Hardware ready , software post FCS

Differences between 4712 and 4606 LC



	WS-X4712-SFP+E	WS-X4606-X2-E
Front Panel ports	12 10GE	6 10GE
1GE capable	Any port with SFP	Any port within a port group with CVR-X2-SFP (TwinGig Converter) Port group 1 : 1-3 Port group 2 : 4 -6
Port Encryption (IEEE 802.1ae)	Yes	No
Backplane capacity	48Gbps	24Gbps
Oversubscription	2.5:1	2.5:1

Differences between 4712 and 4606 LC (Continued)



	WS-X4712-SFP+E	WS-X4606-X2-E
Selection of port speed	Dynamic (based on SFP)	CLI Driven
Optic Form Factor	SFP+ for 10GE SFP for 1GE	X2 for 10GE SFP+ for 10GE with OneX converter (CVR-X2-SFP10G) SFP for 1GE with TwinGig Converter

Twin Gig Converter (Converts single 10GE ports to 2 1GE ports) CVR-X2-SFP



OneX Converter converts an X2 form factor 10GE port to an SFP+ form factor 10GE port CVR-X2-SFP10G



Optics for Supervisor 7-E and 4712 Line Card

- Wide range of 10GE and 1GE optics are available on Supervisor 7-E and 4712 LC
- Ports on Supervisor 7-E / 4712 are SFP form factor for 1GE option
- Ports on Supervisor 7-E / 4712 are of SFP+ form factor for 10GE option
- Port speed is detected dynamically based on the optic

10GE optics

SFP-10G-SR (26m – 300m)

SFP-10G-LR (10km)

SFP-10G-LRM (100m – 220m)

SFP-10G-LRM-SM (220m – 300m)

1GE optics

GLC-SX-MM (220m – 1000m)

GLC-LH-SM (550m – 10km)

GLC-ZX-SM (70-100 km)

GLC-BX-D (10km)

GLC-BX-U (10km)

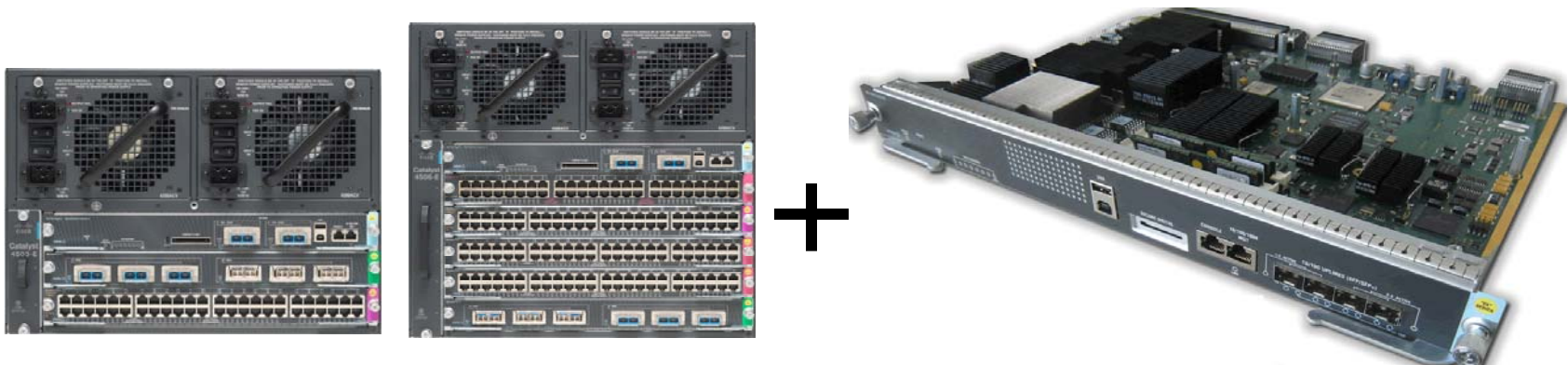
GLC-T (1 GE only) (100m)

CWDM

DWDM


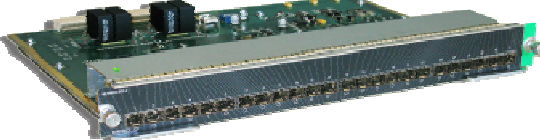

Supervisor 7-E Line Card Compatibility

3 & 6 Slot Chassis



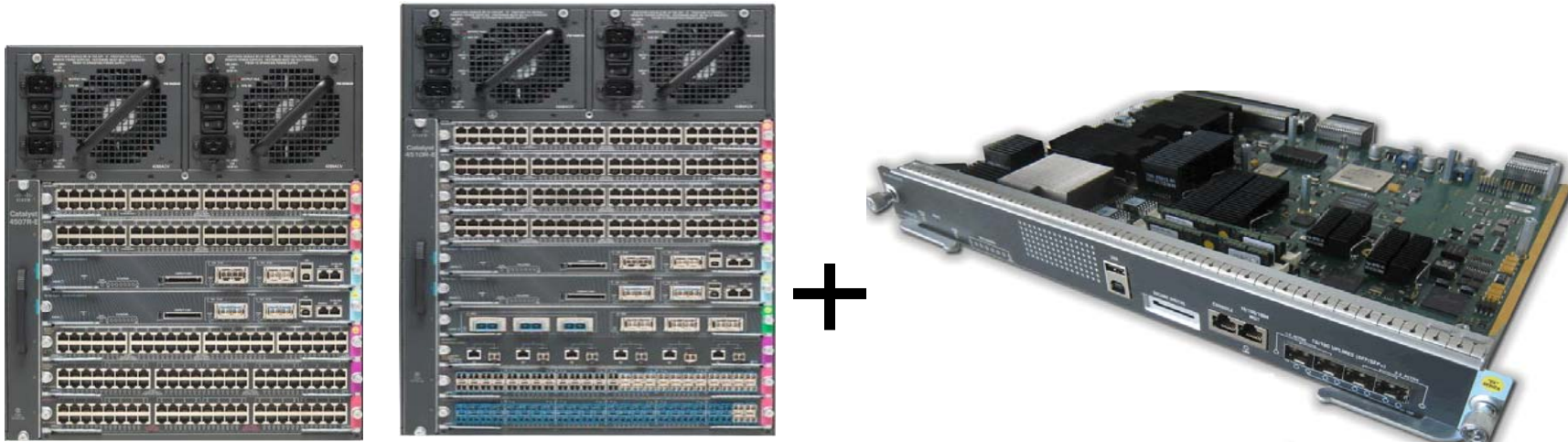
WS-C4503-E or WS-C4506-E chassis

Supervisor 7-E

6G/slot	24G/slot	48G/slot
 <p>WS-X41xx - WS-X45xx Line Cards</p>	 <p>WS-X46xx Line Cards</p>	 <p>WS-X47xx Line Cards</p>


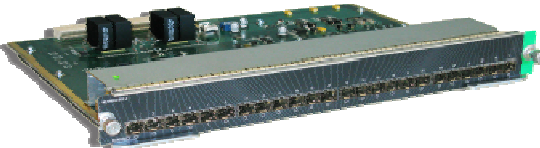

Supervisor 7-E Line Card Compatibility

7R & 10R Slot Chassis



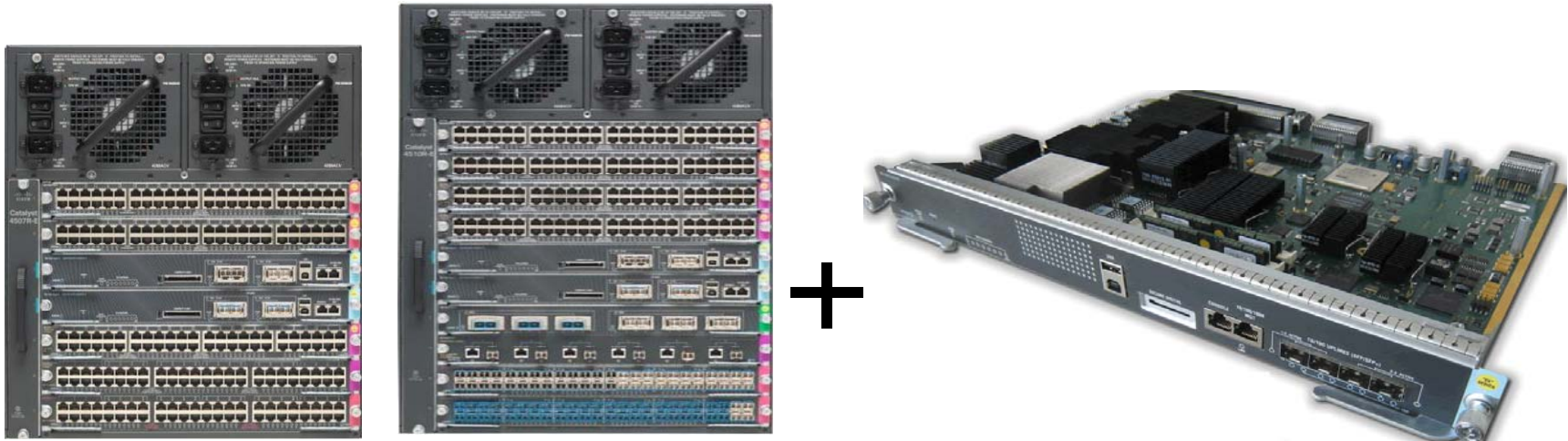
WS-C4507R-E or WS-C4510R-E chassis

Supervisor 7-E

6G/slot	24G/slot	24G/slot
 <p>WS-X41xx - WS-X45xx Line Cards</p>	 <p>WS-X46xx Line Cards</p>	 <p>WS-X4748-RJ45V+E only</p>


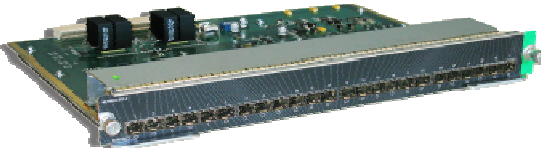

Supervisor 7-E Line Card Compatibility

7R & 10R Slot Chassis



WS-C4507R+E or WS-C4510R+E chassis

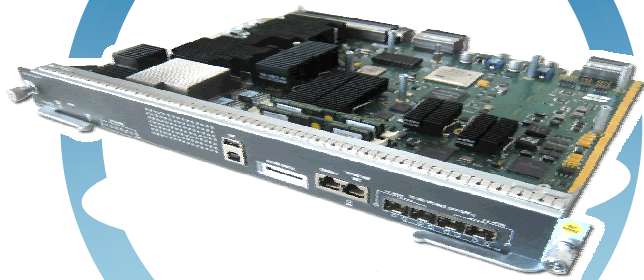
Supervisor 7-E

6G/slot	24G/slot	48G/Slot
 <p>WS-X41xx - WS-X45xx Line Cards</p>	 <p>WS-X46xx Line Cards</p>	 <p>WS-X47xx Line Cards (All 47XX LC supported)</p>

Flexible NetFlow on Catalyst 4500 Supervisor 7-E

Next Generation Application, Performance, Security, and Visibility

New



- High performance
Next-gen ASIC enables scalable and high-performance NetFlow monitoring, supports up to **128K** cached flows
- Flexibility
User-defined flow records reusable in different flow monitors for different applications with per-port, per-VLAN, or per-port-per-VLAN granularity
- Extensibility
In-depth traffic visibility allows monitoring extensive key and non-key fields, including Layer 2, Layer 3 (IPv4 or IPv6), Layer 4 header fields.
- Broad Partner Ecosystem
Version 9 (the most flexible) format exported to a wide range of industry netflow collectors



Bridged Traffic Monitoring Using Layer 2 Keys

Why Layer 2 Monitoring?

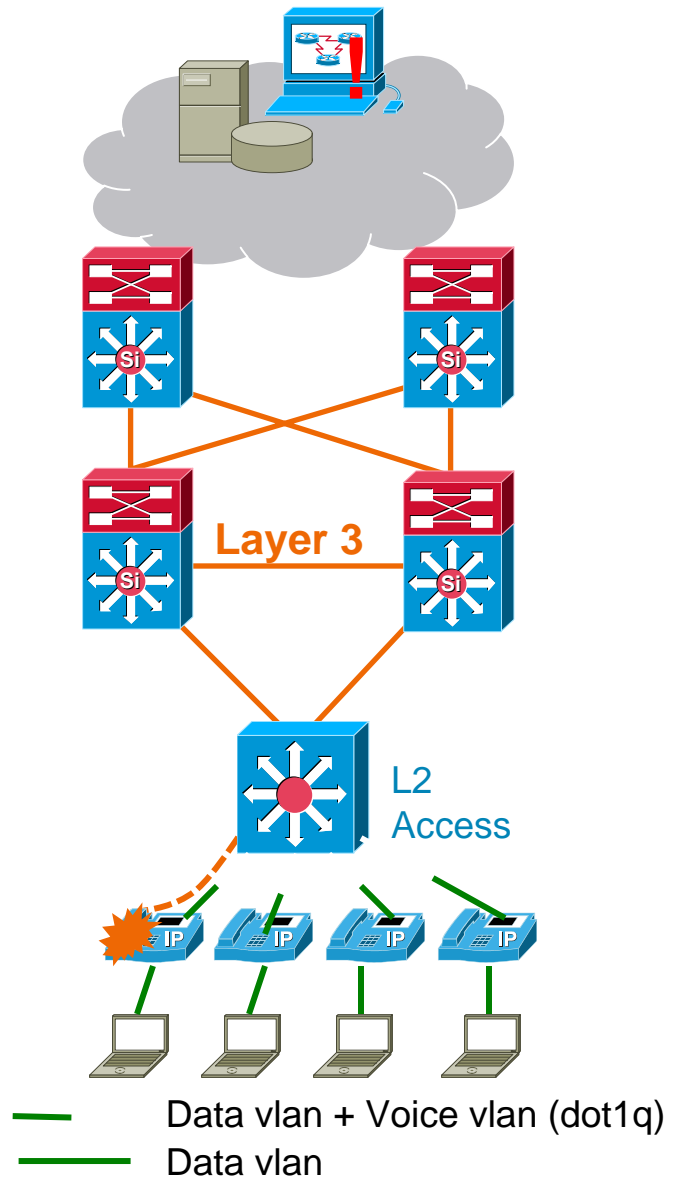
- Monitoring at campus layer 2 access for scalability
- User behavior and security monitoring based on MAC address, dot1q priority, and VLAN ID
- Competitive with sFlow

Example: Application Traffic Anomaly Detection

1 Typically, ~64kbps of traffic is expected from a single source on the voice VLAN

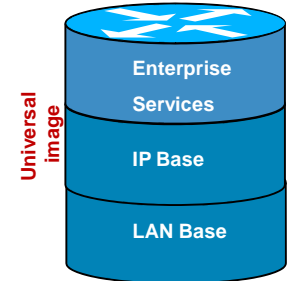
2 Compromised source injects higher than usual traffic rate

3 Anomaly detected and reported



Catalyst 4500 IOS Packaging

Key Features



Enterprise Services

IP BASE

LAN BASE

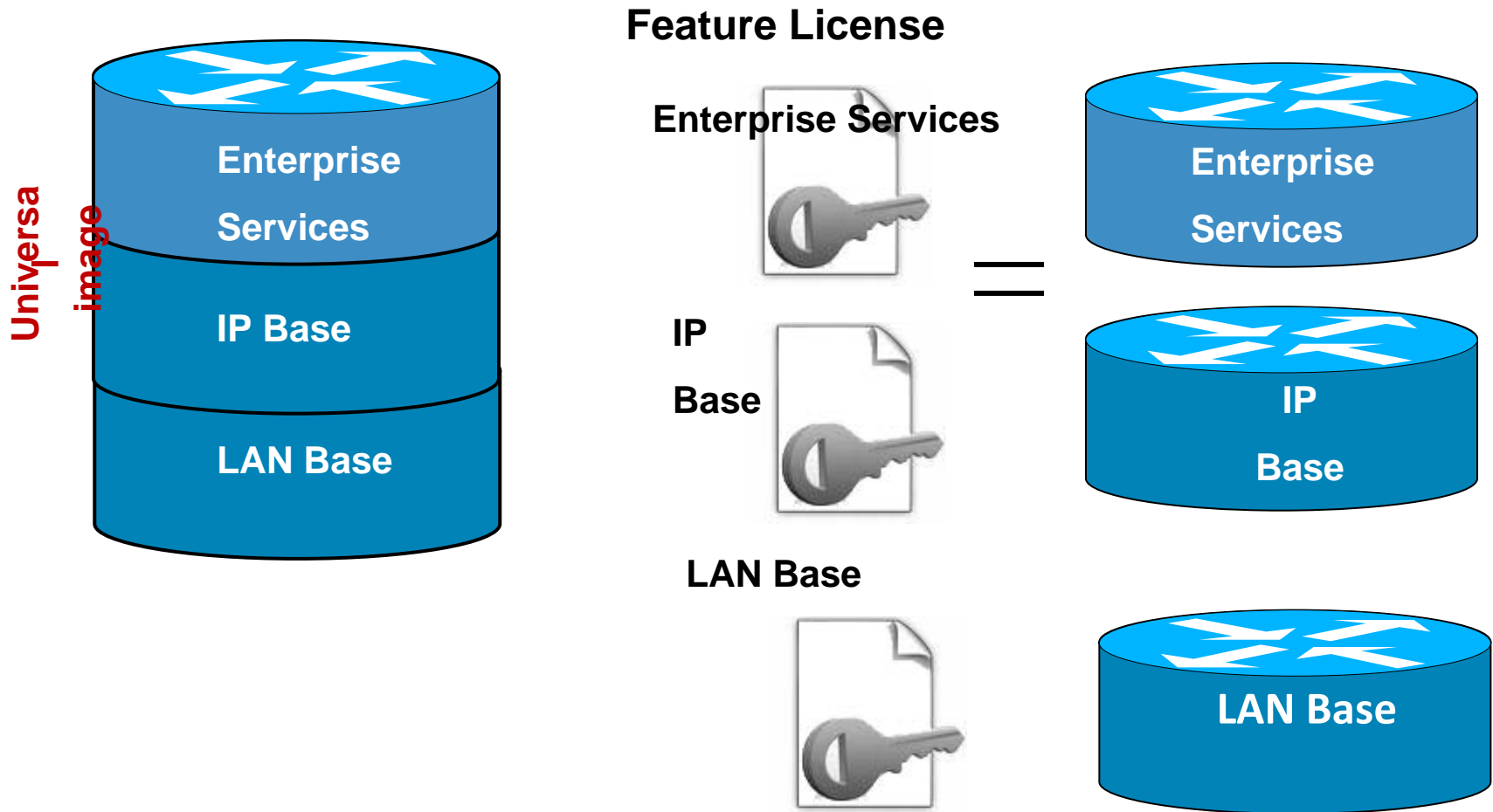
Auto QoS
Energywise
POE + IEEE 802.3at
Flexlink+
IGMP/MLD Snooping
Rapid-PVST+
IEEE 802.1x
Smartports
PACL/VACL

In Service Software Upgrade
Stateful Switchover
EIGRP Stub
OSPF for Routed Access
QinQ
IP SLA Responder
Network Mobility Services
L2PT
Multicast Routing
Embedded Event Manager
HSRP/GLBP/VRRP

BGPv4
IS-IS
EIGRP
OSPF v2/v3
PBR
VRF-Lite
IP-SLA
NSF
Multicast VRF-Lite

Please visit [Feature Navigator Tool](#) for complete listing of features and comparison between IOS Packages

Software Licensing and Activation on Supervisor 7-E Systems



Cisco IOS Licensing Config

http://www.cisco.com/en/US/prod/collateral/switches/ps5718/ps6406/white_paper_c11-579326_ps7078_Products_White_Paper.html

Catalyst 4500 IOS-XE Operations: CLI Differences

- As IOSd is a key part of an IOS-XE package, feature-level CLI will remain the same
- Changes do exist in the system management due to the underlying Linux system

KEY CLI Differences

IOS Command	IOS-XE Command	Comments on New CLI
Show proc	Show proc cpu detailed process iosd	Identical to classic “show proc”. W/o detailed shows only Linux processes
	Show proc cpu detailed	Shows detailed description of all iosd and non-iosd processes across all CPU cores
Show proc cpu history	Show proc cpu history summary	Shows overall CPU Utilization of the platform similar to single core classic IOS
	Show proc cpu history	Shows CPU utilization by core
Show proc memory	Show proc memory	Shows memory util of entire system
	Show proc memory detailed process iosd	Shows memory usage by iosd process

