cBR-8 Deep Dive

The Terminator of CCAP & D3.1 CMTS

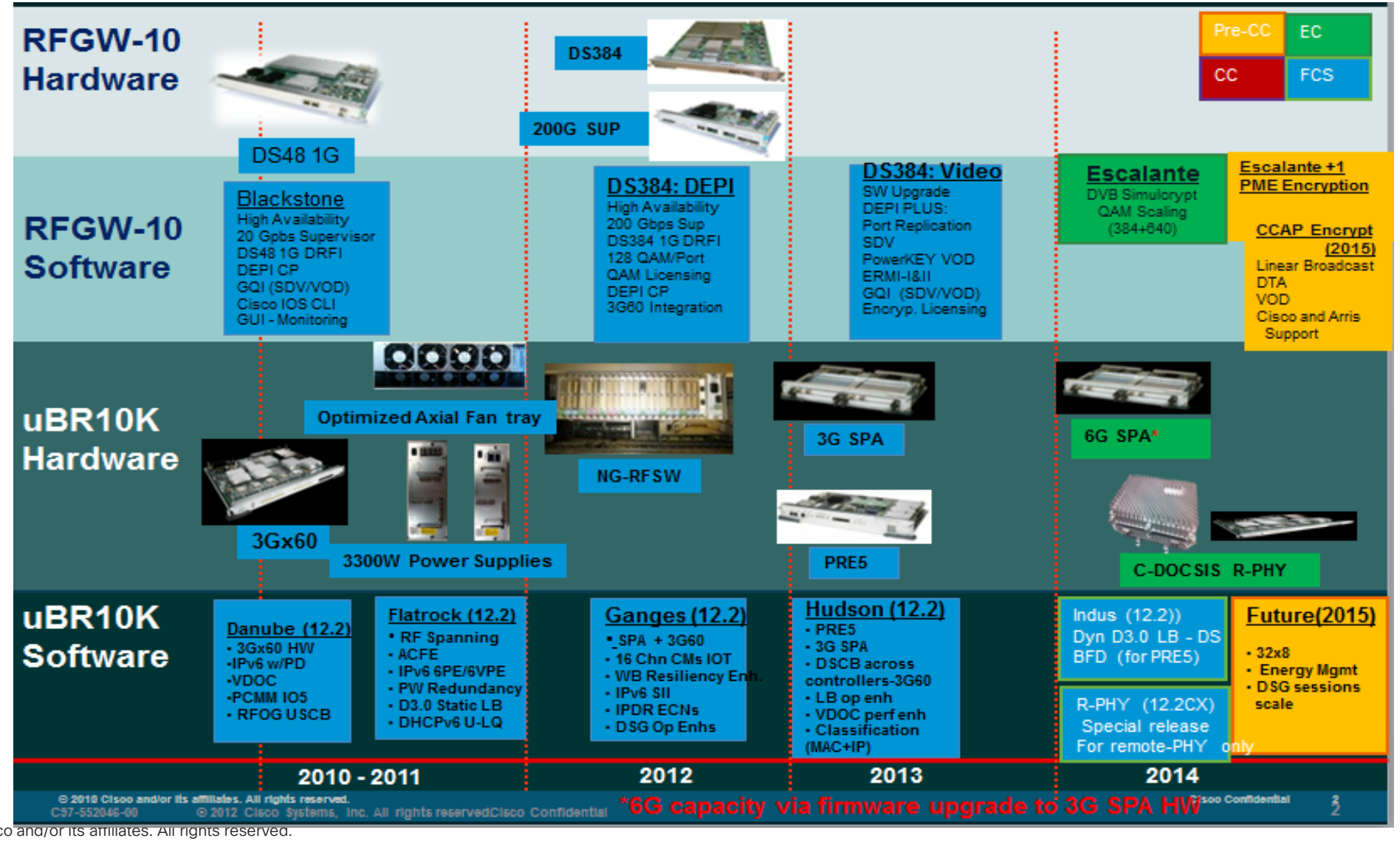
SEJOON LEE

System Engineer / Global Service Provider

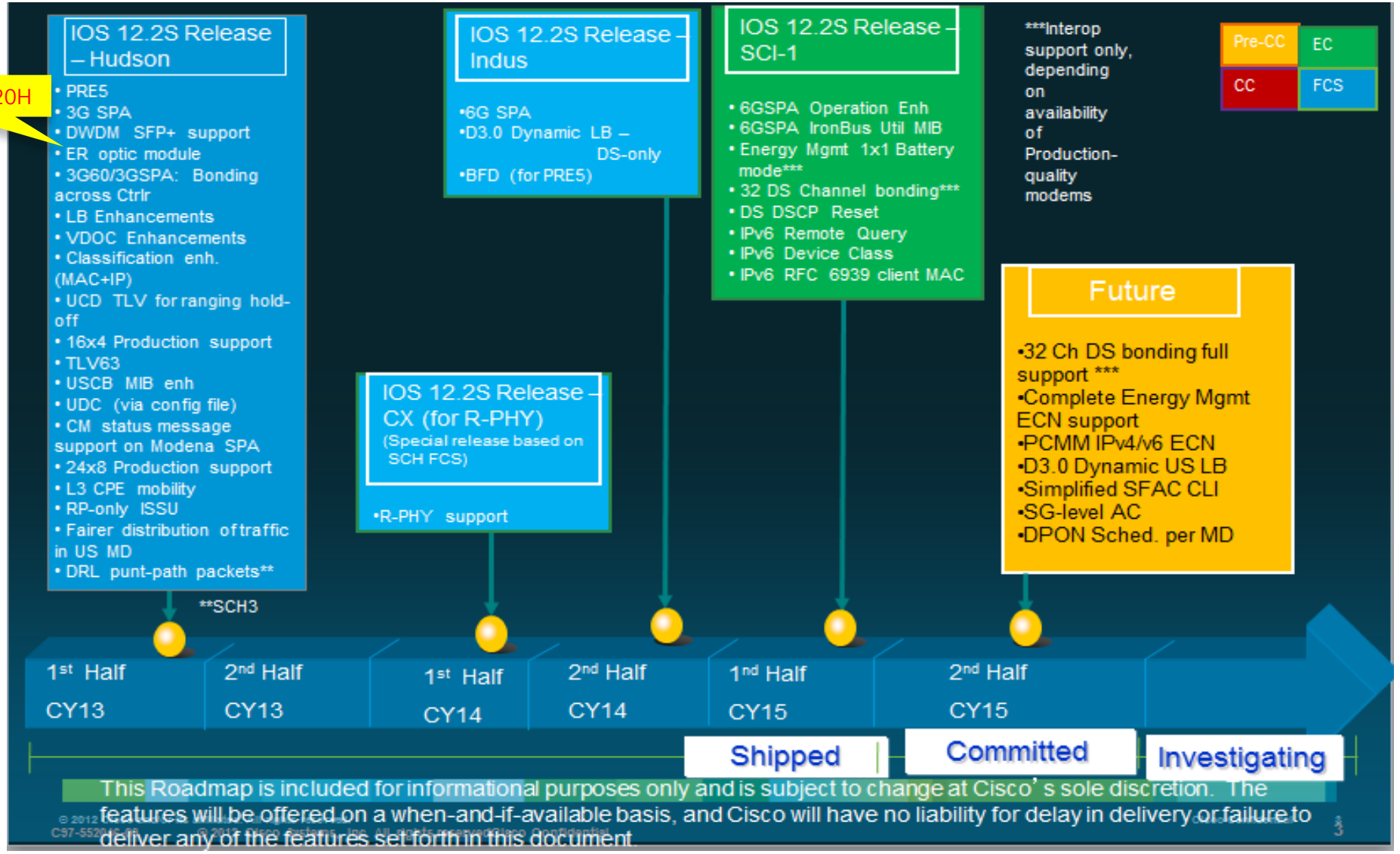
29 May 2015

Cisco Access Portfolio

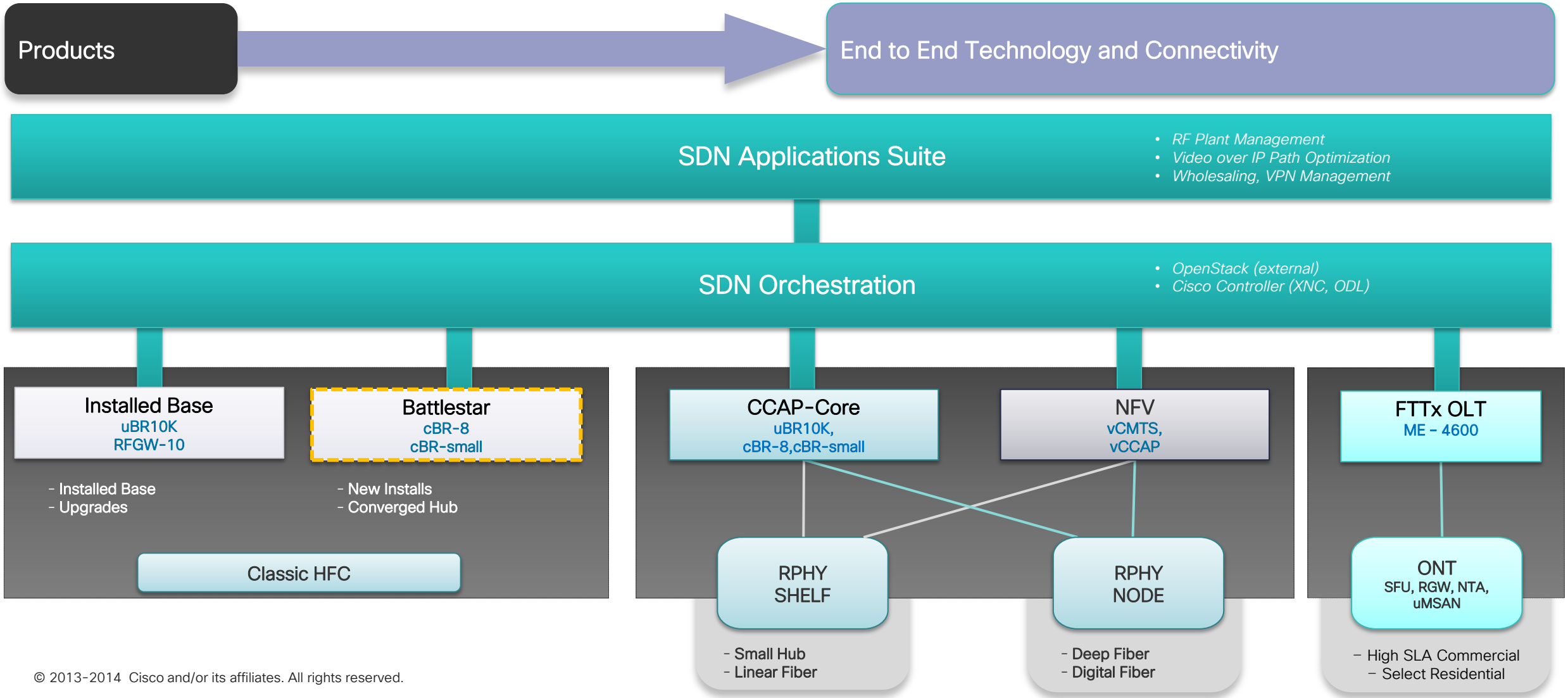
uBR10K/RFGW-10 Roadmap



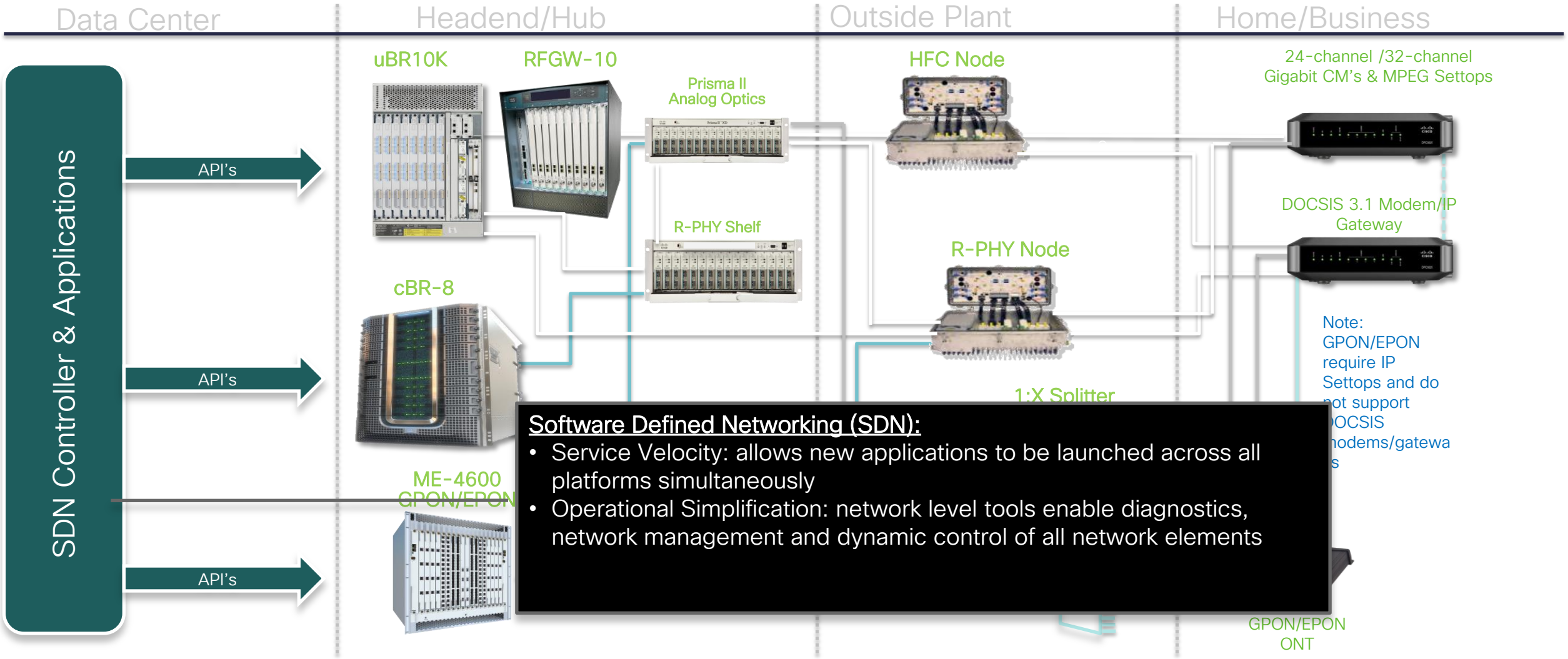
CMTS Software Release Roadmap



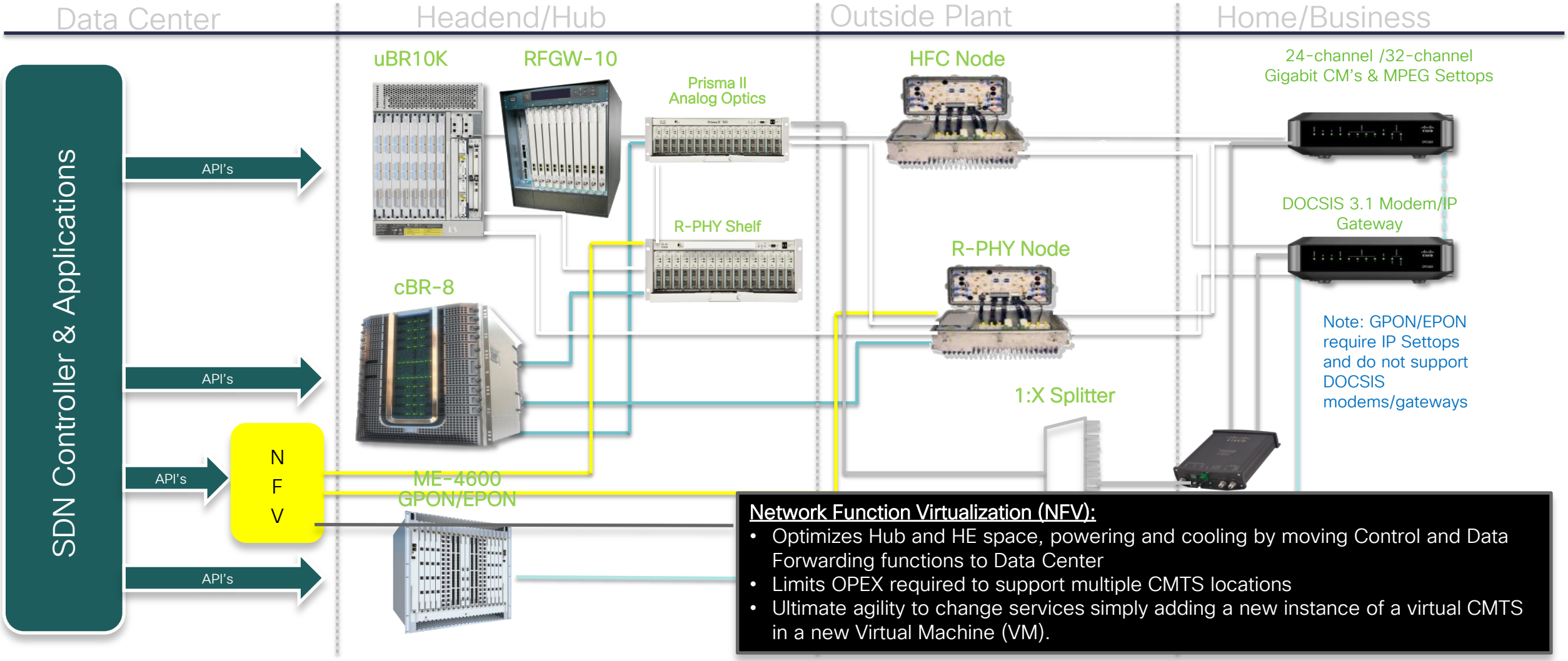
Cisco Portfolio Strategy



SDN For Service Velocity & Network Mgmt



SDN For Service Velocity & Network Mgmt



cBR-8 Overview

cBR-8 overview (front)

Chassis
- 13RU, 10-slot mid-plane design
- 8 Universal Subscriber Side slots (HFC, DPOE, etc)
- Backplane scalable to over 1 Tbps

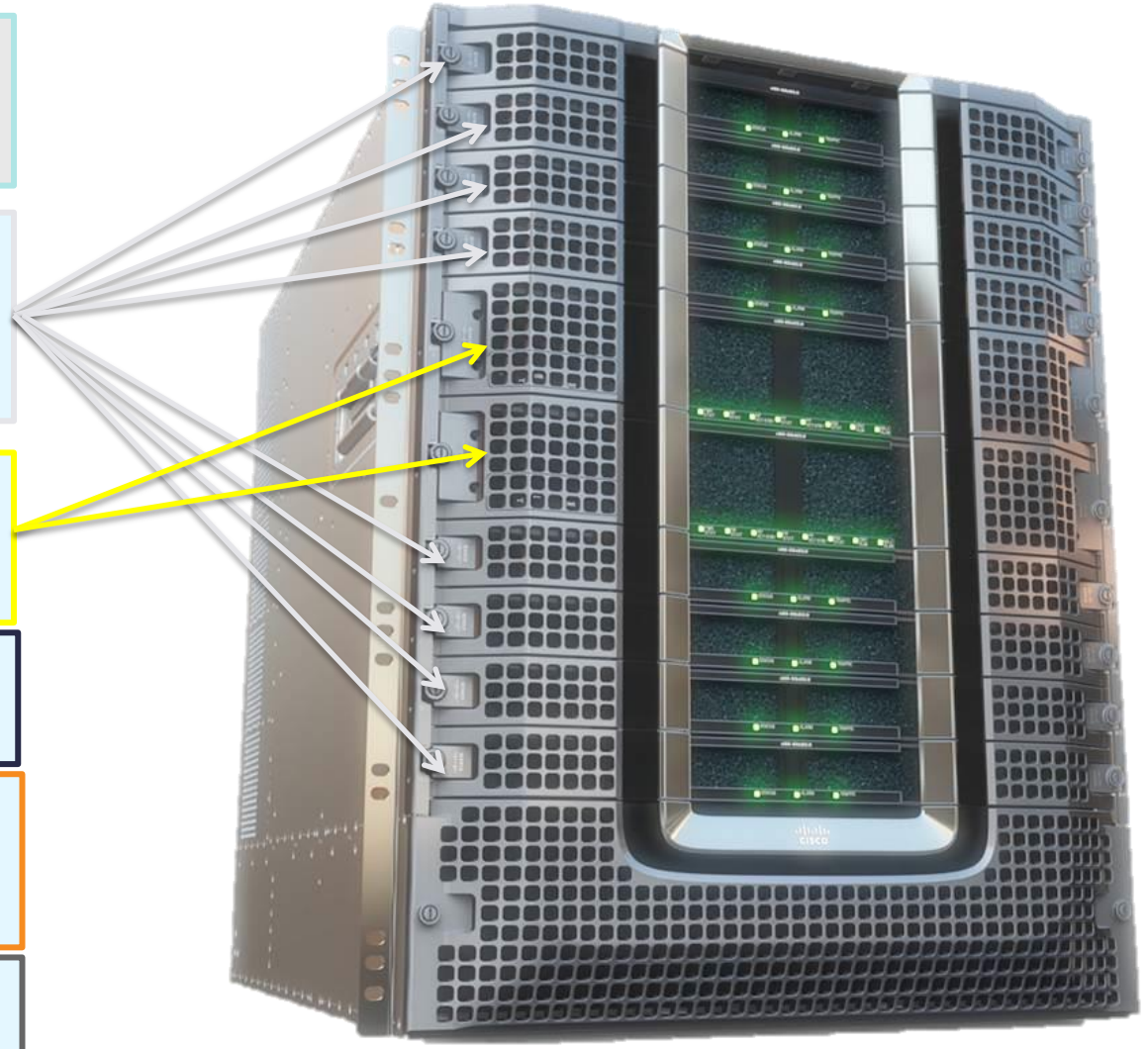
RF Line Cards
- 8 DS ports + 16 US ports per card (8x16)
- Channel capacity: 576 DS x 64 US (96 post FCS)
- Slots capable of 120+ Gbps bidirectional
- N+1 redundancy with integrated RF Switch

Supervisor Cards
- Integrated QFP, RP
- Integrated backhaul capacity: 8x10 Gbps
- 1+1 redundancy

Backhaul Cards (Optional - Future)
- Dedicated cards for WAN backhaul if required
- 1+1 redundancy

Power Supplies
- ~9KW (Facilities Requirement)
- 4+1 DC modules with 1+1 power rails
- 3+1 or 3+3 AC modules

Cooling
- Front-to-back
- Air intake on card faceplate



cBR-8 overview (rear)

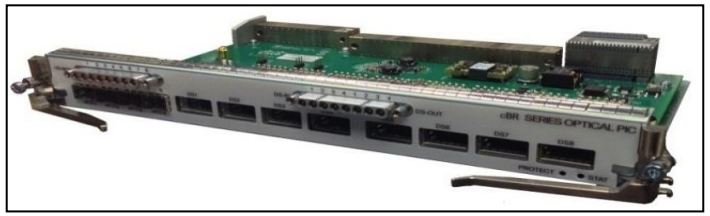
RF Line Card PICs
- MCX connectors
- N+1 with integrated RF Switch
- Integrated analog optics (future)
- Remote PHY (future)

Supervisor PICs
- 8x10 GE ports

Backhaul Card PICs (Optional – Future)
- 10/100 GE ports if required

Power Connections
- 4+1 DC or 3+1/3+3 AC

Cooling
- Exhaust fans
- 5 Field Replaceable modules



Analog Optics PIC Card

cBR-8 capacity (annex B)

	Downstream	Upstream
Average narrowcast channels / port	96	6
Peak narrowcast channels / port	128	12
Peak narrowcast + broadcast (assuming 128 channel spectrum)	90NC + 38BC	
Ports per card	8	16
Channels/card	768	96
Channels/chassis (5+1 – 8+0)	3,840 - 6,144	480 - 768
Access-side capacity per card	30 Gbps	2.8 Gbps
Access-side capacity per chassis *	150 - 240 Gbps	14.0 – 22.4 Gbps
FCS WAN Backhaul +	80 Gbps bi-directional	
FCS Aggregate forwarding	160+ Gbps aggregate	

- * Mix of unicast and multicast traffic considerably reduces WAN ingress
- + WAN backhaul: 8x10GE at FCS; 100GE options offered subsequently

cBR-8 capacity (annex A)

	Downstream	Upstream
Average narrowcast channels / port	72	6
Peak narrowcast channels / port	Full Spectrum	12
Peak narrowcast + broadcast (assuming 118 channel spectrum)	56NC + 62BC	
Ports per card	8	16
Channels/card	576	64-96
Channels/chassis (5+1 – 8+0)	2,880 – 4608	240 - 384
Access-side capacity per card	30 Gbps	1.4 Gbps
Access-side capacity per chassis *	150 - 240 Gbps	7.0 - 11.2 Gbps
FCS WAN Backhaul +	80 Gbps bi-directional	
FCS Aggregate forwarding	160+ Gbps aggregate	

- * Mix of unicast and multicast traffic considerably reduces WAN ingress
- + WAN backhaul: 8x10GE at FCS; 100GE options offered subsequently

cBR-8 Key Feature and Benefit

cBR-8: Key Features & Benefits

Minimizing Total Cost of Ownership

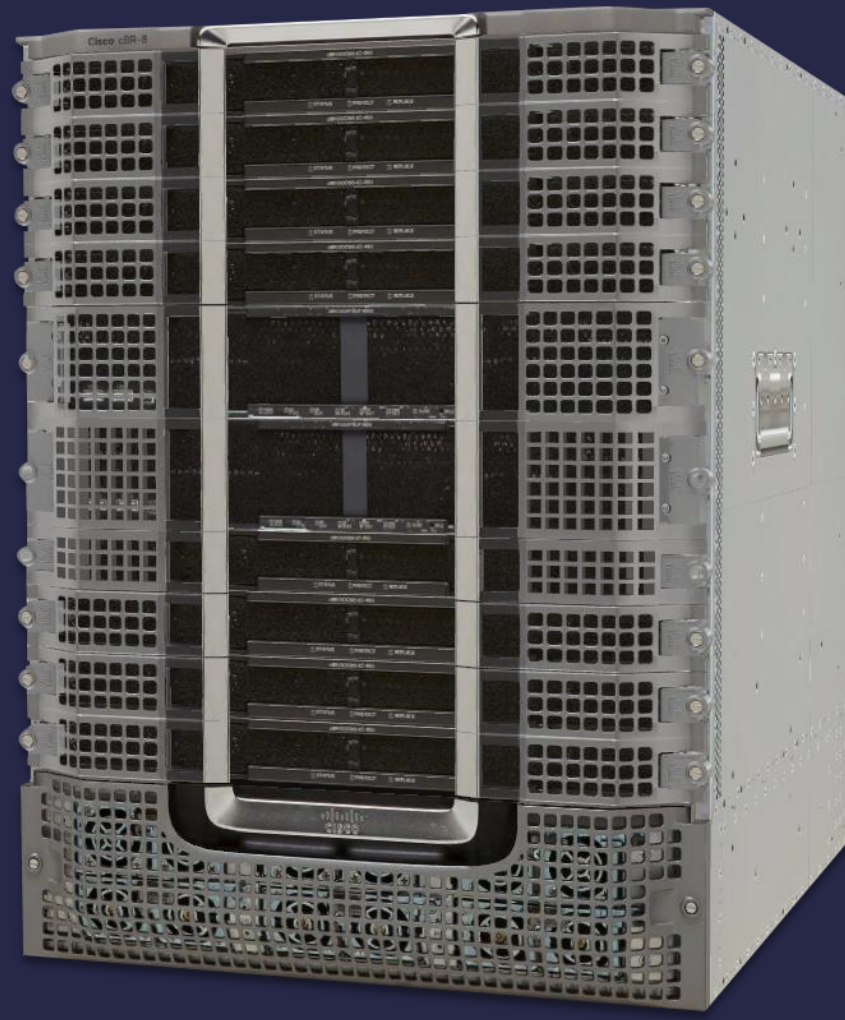
Capacity & Scalability,
Video Convergence, DOCSIS 3.1

Maximizing Subscriber Value

Unmatched Reliability, Intelligence,
Software Defined Networking

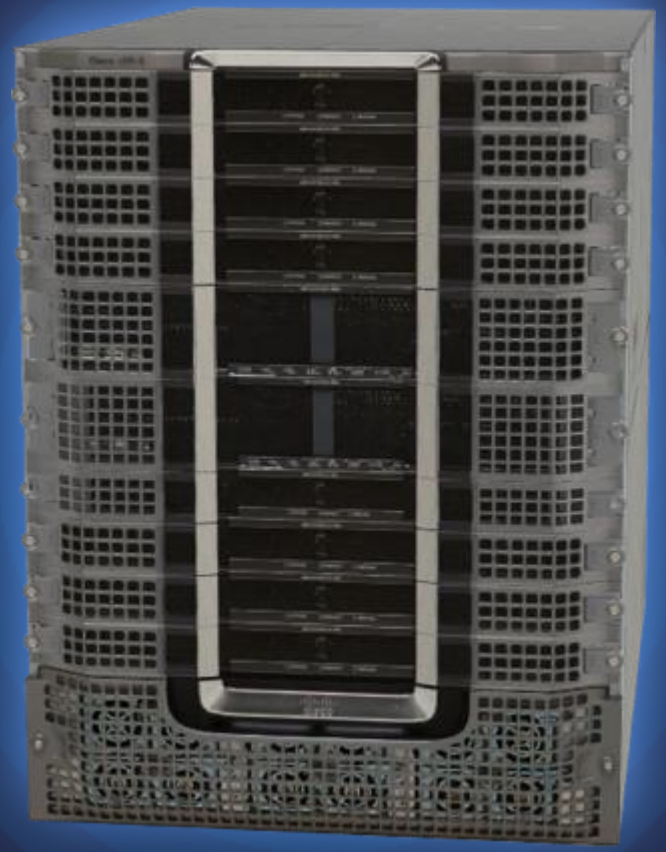
Network and Business Transformation

Pathway to
Virtualization via Cloud



Cisco cBR-8 Chassis: Better Today, Better Tomorrow

CCAP Capacity and Scalability (Annex B)



- Compact, high-density 13 RU chassis
- Delivers over 6000 downstream channels of DOCSIS 3.0, plus capability to scale to full DOCSIS 3.1 and Video
- Backplane scalable to 1.6 Tbps
- 8 Line Card Slots capable of 200 Gbps each (1.6 Tbps total)
- 2 Supervisor Slots capable of 1.6 Tbps each
- Service Group density of 4.9 SG/RU (40% higher than competition for typical configurations)

cBR-8 chassis was custom-built for ultimate scalability

Cisco cBR-8 Line Card: Delivers True CCAP, D3.1 and more…

Downstream PHY module
- 8 DS ports per line card (4 DS port per module x 2 modules per line card)
- Field replaceable and field upgradeable to DOCSIS 3.1 DS PHY modules with simple drop-in upgrade (only 3 screws required)

Upnstream PHY modules
- 16 US ports per line card
- Field replaceable and field upgradeable to DOCSIS 3.1 US PHY modules with simple drop-in upgrade (only 4 screws required)

- 30 Gbps at FCS (3x competitive solutions)
  - 8 downstream ports supporting 768 QAMs (96 unique QAMs per port; 128 QAMs per port with unique plus broadcast)
  - 16 upstream ports supporting 96 QAMs to support 2:1 upstream combining
- Designed for D3.1 migration with simple PHY changes
  - D3.1 Downstream PHY module available July 2015
  - D3.1 Upstream PHY module available March 2016
- True CCAP+ converge all services to “Hub in a Box”
- Supports Integrated and Distributed (Remote PHY) architectures
  - Integrated = 8 SGs per Line Card (64 per Chassis)
  - Distributed = up to 32 SGs per Line Card (256 per Chassis)
- N+1 High Availability

Cisco cBR-8 Supervisor Card:
Leveraging Cisco Technology for Ultimate Scalability

Custom Connector

- Scales WAN-to-Processor connectivity up to 1.6 Tbps
- Processor-to-Line Card speed scalable to 200 Gbps

- Integrated Control & Data Plane and WAN
- Data Plane: Quantum Flow Processor (QFP)
  - 200Gbps Forwarding Capacity
  - Massive Parallel Processing (248 CPU cores)
  - Sophisticated QoS
  - 75 Million PPS with Cable features enabled
- Massive control plane
  - 10-core 64 bit CPU
  - 48-96 GB of memory
- WAN
  - 8 + 8 10GE Ports and 80 + 80 Gbps Backhaul
- Fully redundant with 1+1 hitless failover

cBR-8 Physical Interface Cards (PIC)
Ultimate Flexibility & Scalability

Pluggable Interface Cards allow flexibility to change network-side and customer-side interfaces as market transitions dictate

Line Card PICs

- Standard RF MCX (Shown in Chassis): 8DS x 16US for traditional Integrated CMTS applications
- Future: Analog Optics PIC: Pluggable XFP analog optics for fully converged applications
- Future: Remote PHY PIC: Multiple 10Gbps pluggable Ethernet optics for Remote PHY applications

cBR-8 Power Supplies
Ultimate Flexibility & Scalability

Pluggable Power Supplies allow flexibility to change network and customer side interfaces as market transitions dictate.

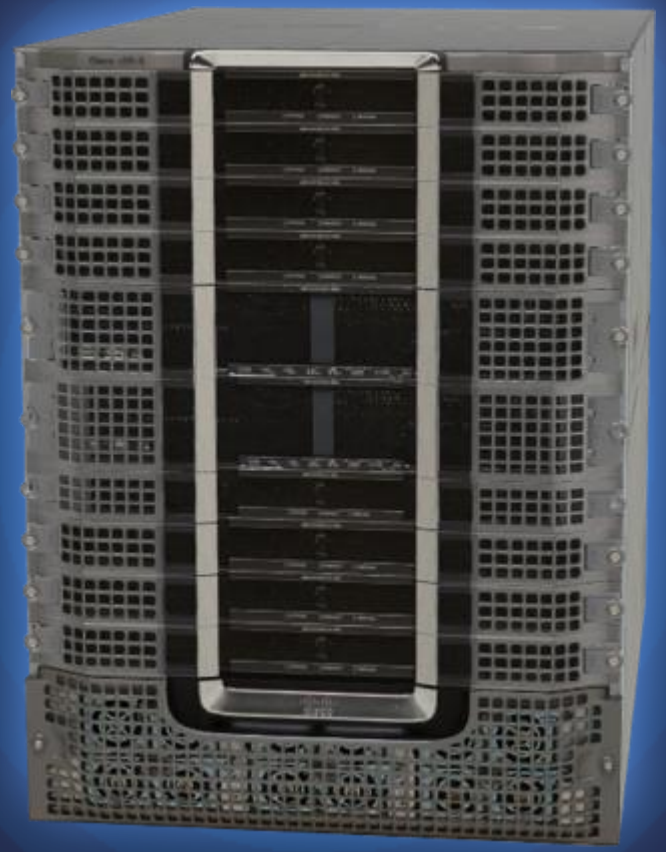
Power Supplies

- Ability to scale up 9000W powering with individual power supply plug-ins modules for future service needs
- Cisco's power calculator can assist in defining optimal power supply requirements for your architecture

Scenario	Total Power	Power per SG	Power /channel (full FCS capacity)
Max power for ch assis	9,000 W	141 W	1.46 W
Max power for FC S HW	7,912 W with D3 .1 PHYs (7,265 W D3.0 PHYs)	124 W with D3. 1 PHYs (114 W D3.0 PHYs)	1.29 W with D3 .1 PHYs (1.18 W D3.0 PHYs)
Lab at 25 C	5,000 W	78 W	0.81 W

DOCSIS 3.1 Market Readiness

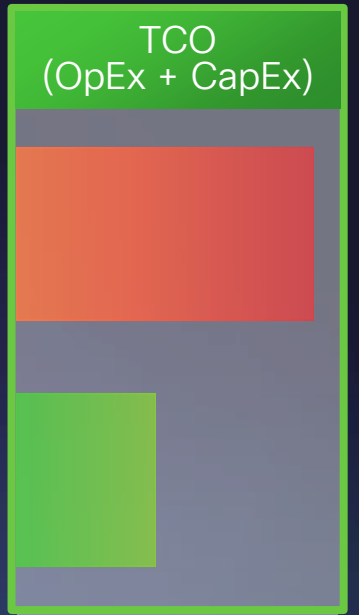
cBR-8 is the 1st and only platform designed for DOCSIS 3.1



- DOCSIS 3.1 is all about unlocking 5 to 7 times more bandwidth to support new service capabilities and assure competitiveness in a landscape including FTTH operators
- cBR-8 is the 1st and only platform on the market designed ground up for DOCSIS 3.1
  - Custom-built chassis
  - Enables full scale 3.0 and 3.1 capacity on every SG
- Competitor solutions, even if introduced more recently:
  - Represent earlier generation product
  - Were designed around the requirements of DOCSIS 3.0 (likely requires chassis, line card and processor swap)
  - Are constrained by fundamental limitations of the ATCA chassis architecture (10Gb per slot)

Cisco cBR-8: Innovative Chassis Design Optimizes TCO

	D3.0	D3.0	D3.0	D3.0 + Video	D3.0 + D3.1 + Video
	16 DS x 8 US	24 DS x 8 US	32 DS x 8 US		
ATCA Chassis					
cBR-8 Chassis					



40%
Savings over 5 Years

Wire once!

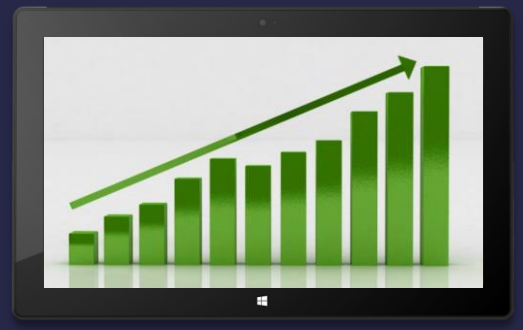
cBR-8 is the only platform on the market that can handle large-scale D3.0,plus Converged Video, plus D3.1, without a forklift upgrade

- All configurations supported with July 2015 hardware, except 3.1 US
- 3.1 US requires LC Module field upgrade, availability estimated March 2016

cBR-8: Key Features & Benefits

Minimizing Total Cost of Ownership

Capacity & Scalability,
Video Convergence, DOCSIS 3.1

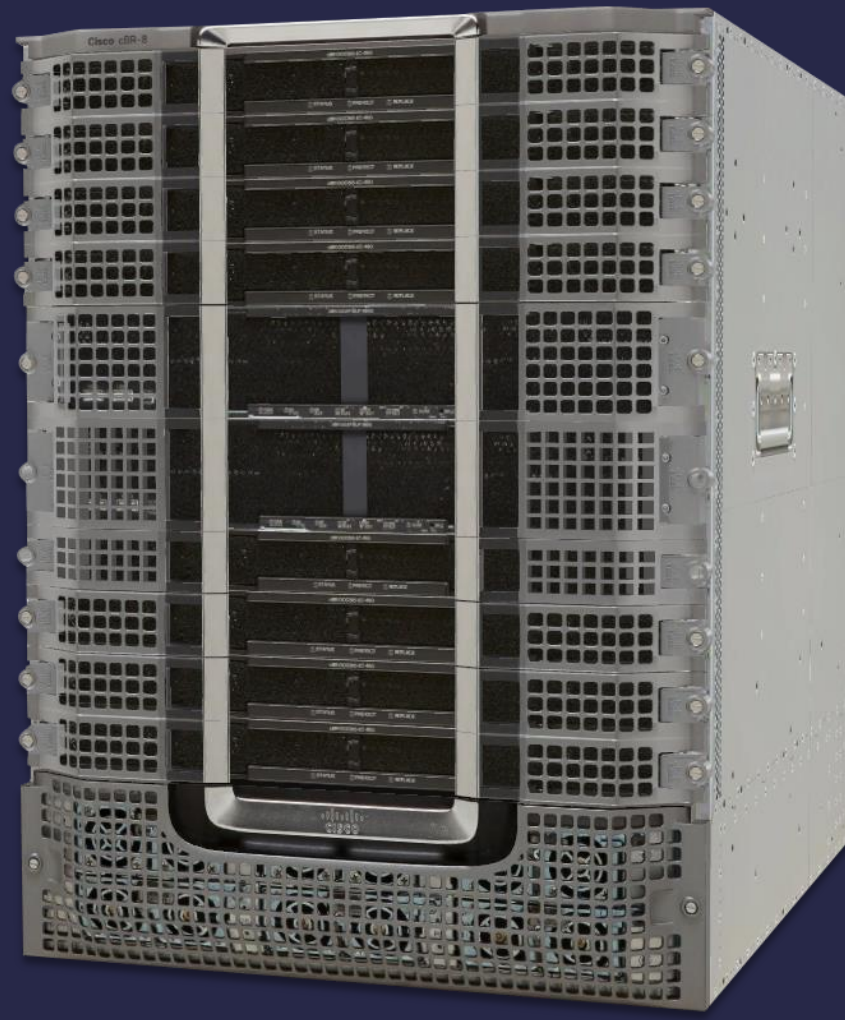


Maximizing Subscriber Value

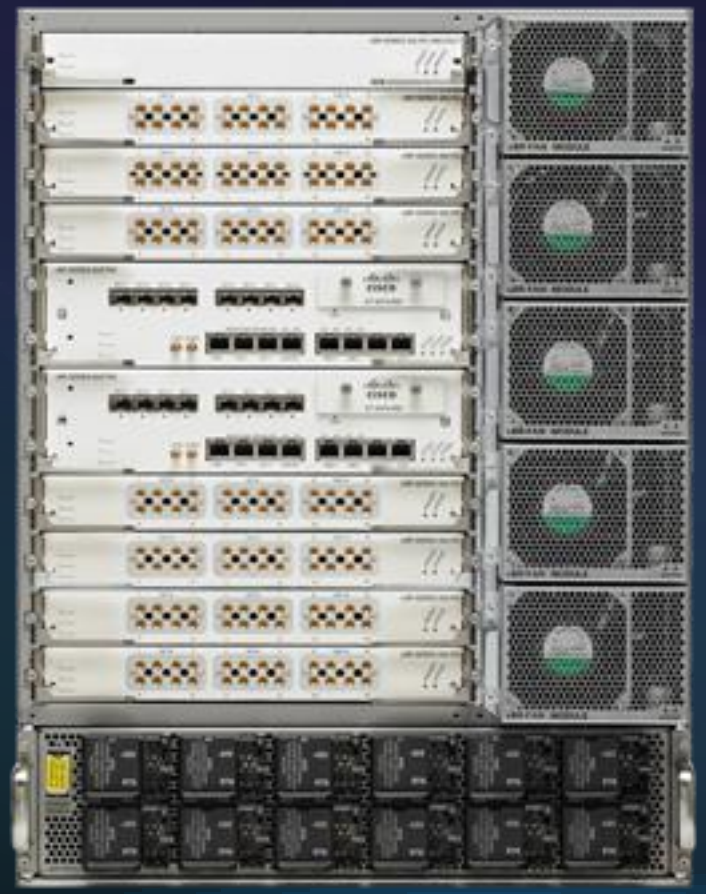
Unmatched Reliability, Intelligence,
Software Defined Networking

Network and Business Transformation

Pathway to
Virtualization via Cloud



cBR-8: Designed for High Availability
Supports 99.999% Availability

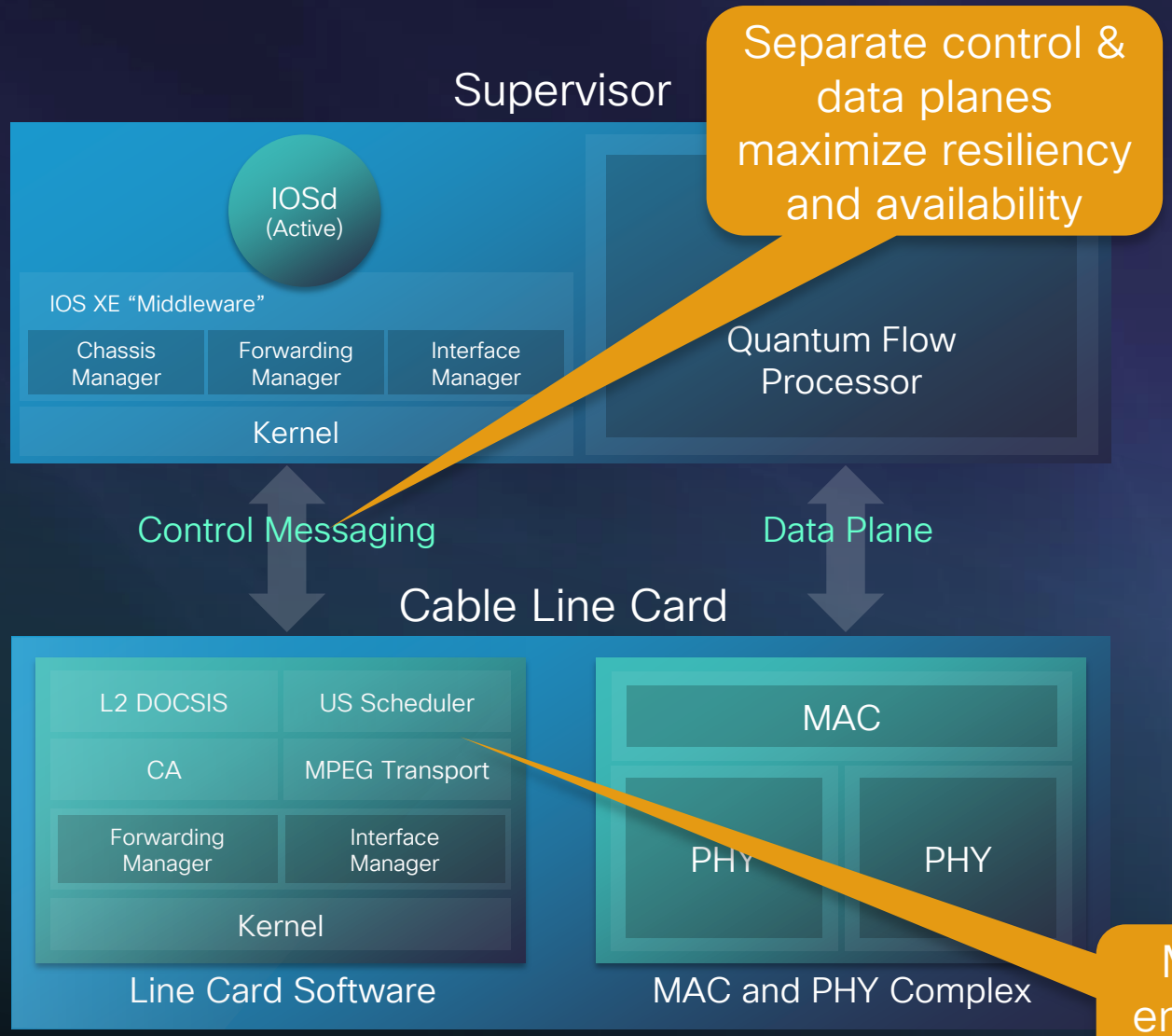


Full Redundancy Design to support “5-nines” availability

Hitless failover of all active cards and modules

RF Line Card	N+1 Redundancy with integrated RF switch
Supervisor Card	1+1 Redundancy
Power Supplies	DC Modules: 4+1 Redundancy with 1+1 Power Rails AC Modules: 3+1 or 3+3 Redundancy
Fan Modules	Fully redundant with hot-swappable and independent fan modules. Reduces time for replacements. Maintains airflow at all times, even during fan replace ment

cBR-8 Software Architecture
Intelligence, Elastic and Resilient

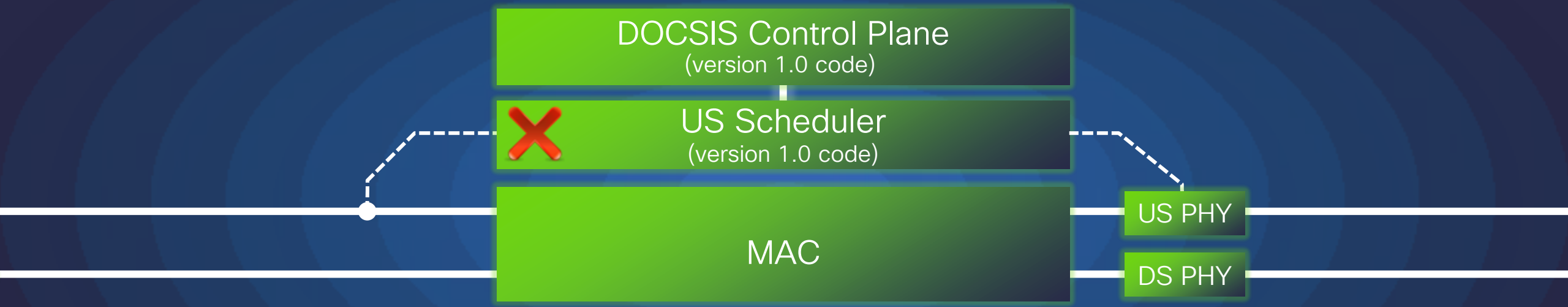


- Next generation, retains advantages of IOS and adds modularity, resiliency, restartability and patchability:
- **Highly intelligent** with full IOS-XE routing and DOCSIS features
- **Operational Consistency** – same look and feel as IOS Router
- **Restartability** ensures failure recovery with zero packet loss
- **Patchability** enables true hitless upgrades
- SDN functionality provides **Service Velocity**

Restartability with fault containment (DOCSIS control)
ZERO packet loss

1. DOCSIS Control Plane fails
2. Fault contained within the control plane, not affecting data plane
   Result: Zero Packet Loss
3. DOCSIS Control Plane restarts

Restartability with fault containment (US scheduler)
- Hitless recovery



1 US Scheduler fails

Restartability with fault containment (US scheduler)
- Hitless recovery

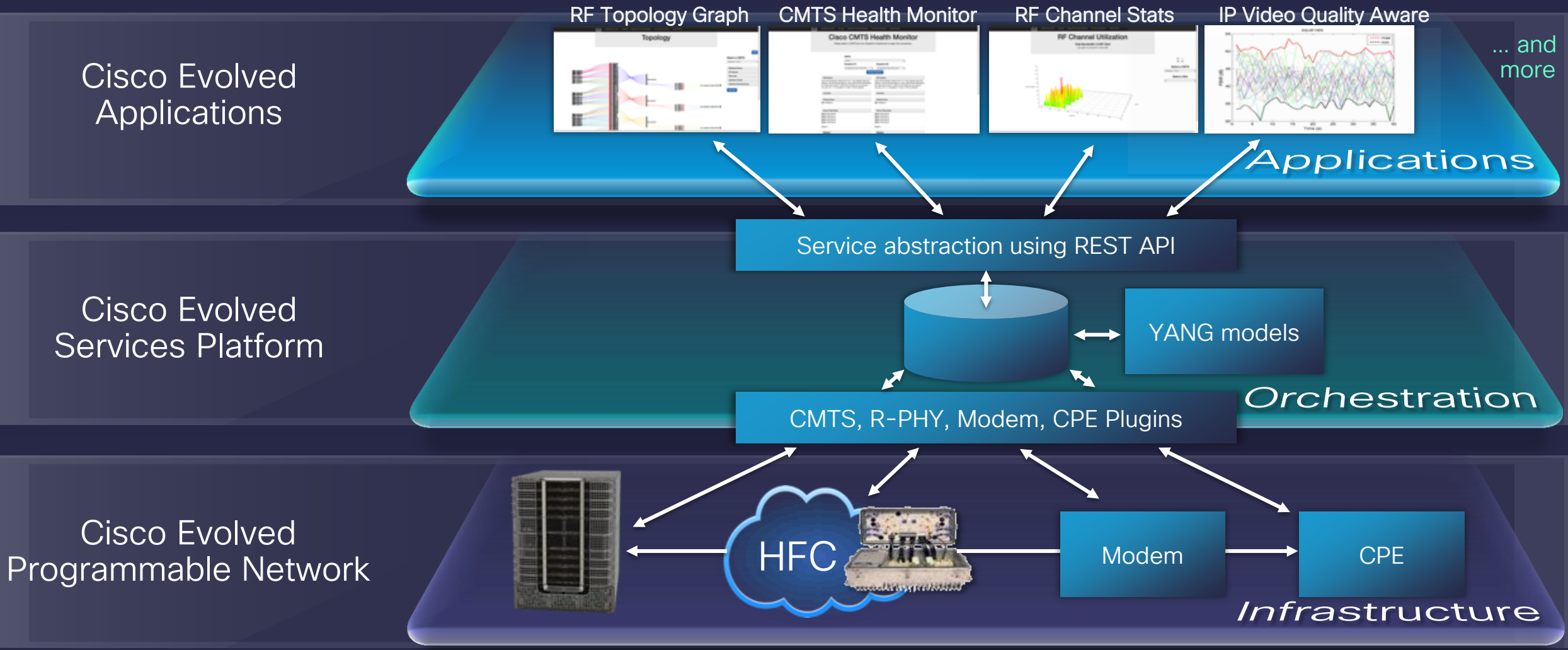
1. US Scheduler fails
2. Fault contained within US scheduler
   Result: Few 100ms loss of Upstream Packets. No Downstream packet loss.
3. US Scheduler restarts

Patchability (DOCSIS control)

1. DOCSIS Control Plane v 1.0 has new software patch release v 1.1 code available. V1.1 code has been downloaded and is ready to replace the v1.0 code
2. Separation between control plane and data plane

   Result: Bug fixes contained within DOCSIS Control Plane can be patched with ZERO packet loss.
3. Control plane is now running with new v 1.1 code

SDN Platform for Cable Applications



Major Cable SDN Applications

Category	SDN Applications
cBR-8 Operations, Manageability	Automated software upgrades, health check monitor, Topology graph with utilization, Modems & CPE mgmt, RF channels monitoring, EQAM mgmt
DOCSIS 3.1	D3.1 OFDM/OFDMA Profiles mgmt, 1588 timing, other operational applications for DOCSIS 3.1
Proactive Network Maintenance	PNM is a must for D3.1. DOCSIS 3.0 PNM has become important as well.
Dynamic Service Provisioning and Monitoring	Video quality aware bandwidth adjustment, Dynamic L2VPN service provisioning and monitoring

cBR-8: Key Features & Benefits

Minimizing Total Cost of Ownership

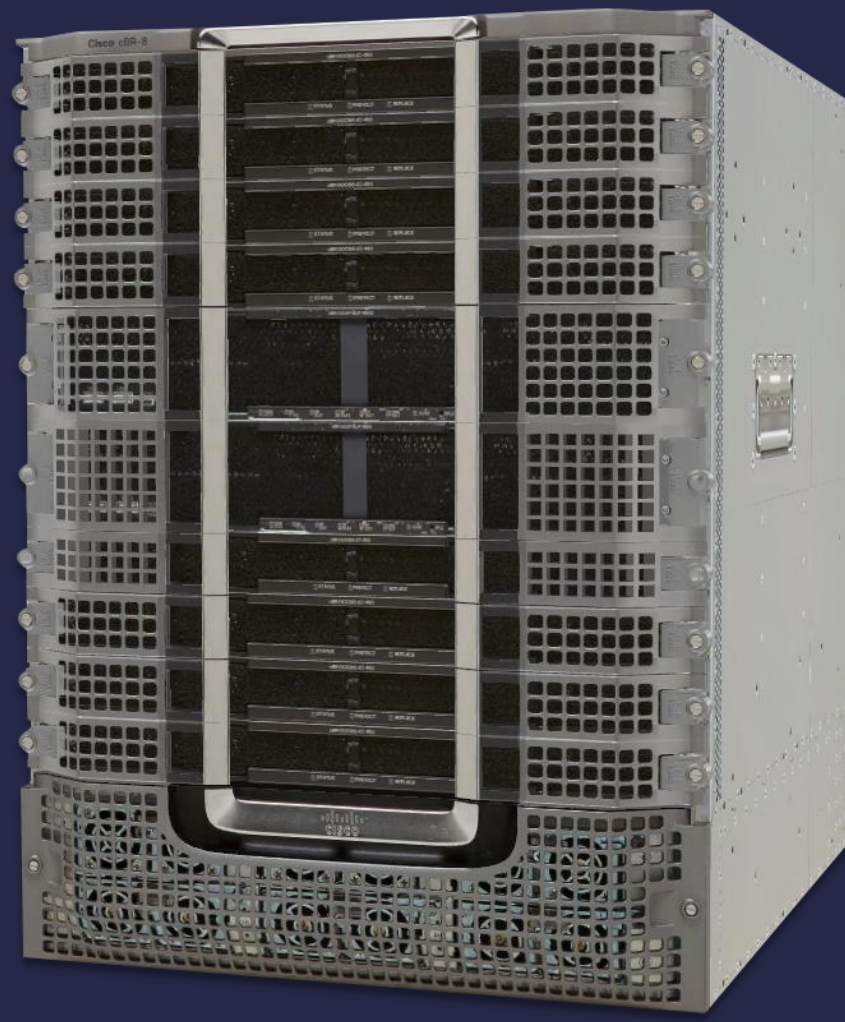
Capacity & Scalability,
Video Convergence, DOCSIS 3.1

Maximizing Subscriber Value

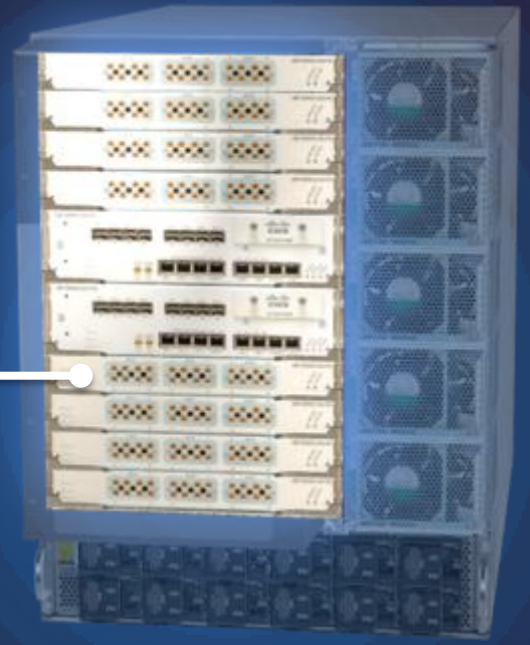
Unmatched Reliability, Intelligence,
Software Defined Networking

Network and Business Transformation

Pathway to
Virtualization via Cloud



cBR-8 Core and Remote PHY Module
Evolving Cable SP Network Architectures



New PIC Card

Remove PHY Modules from Line Card

Benefits

- Scaling service groups beyond the port capacity of the traditional CMTS
- Decoupling the scaling from dependency on the integrated PHY ports
- Allowing Digital Fiber / Ethernet to be driven deeper into the network
- Enabling migration to a Cloud-centric ecosystem focused on service velocity and value creation

cBR-8: Pathway to Virtualization

cBR-8 Roadmap

cBR-8 Worldwide Market

cBR-8 Worldwide Early Customer Engagement

- Comcast
- Charter
- BrightHouse
- Mediacom
- Cablevision
- Videotron
- Cogeco
- Rogers
- Shaw
- Cogeco
- RCN
- Eastlink

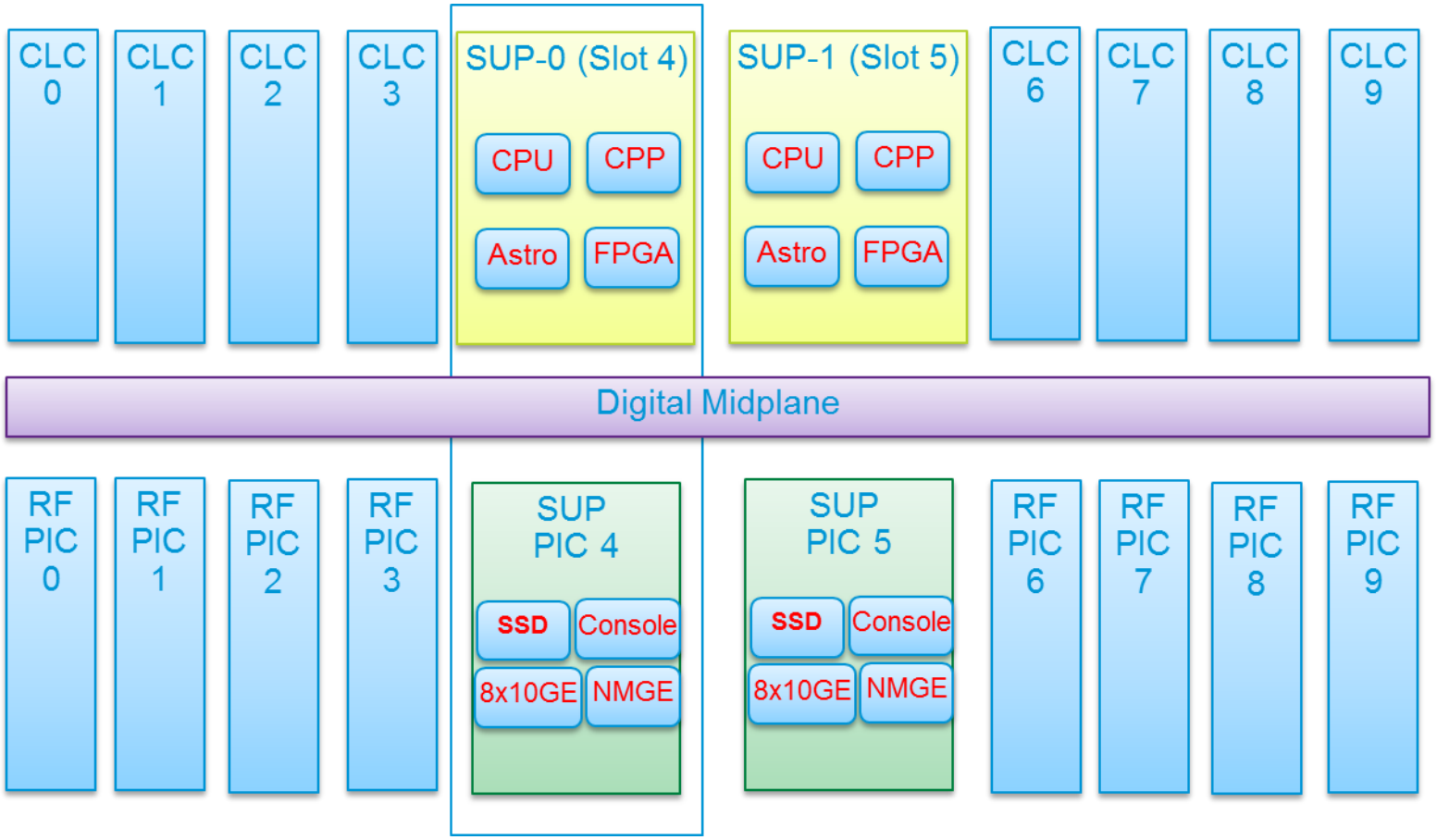
- Altice
- KDG
- LGI
- Comhem
- Canal Digital
- Quickline
- GET
- ONO
- Finnet
- Starman
- Voo
- Akado

- JCOM
- SKB
- True
- KBRO
- Linknet
- Gehua Cable
- Guangdong Cable

- Magacable
- NET Brazil
- Televisa

cBR-8 Hardware

cBR-8 Platform Overview



cBR-8 13RU Chassis Major Components

Product	P/N	Description	Comment
Chassis	CBR-8-CCAP-CHASS	cBR-8 CCAP Chassis	
Supervisor	CBR-CCAP-SUP-160G	Integrated Route Processor, Forwarding Processor, and Timing/Backhaul complexes.	2 units / chassis
SUP PIC	CBR-SUP-8X10G-PIC	SUP Physical Interface Card provides console, GE, Timing ports, and 10G backhaul interface ports.	2 units / chassis
CCAP Linecard	CBR-LC-8D30-16U30	Provide US and DS interfaces to DOCSIS cable modems.	8 units / chassis
RF PIC	CBR-RF-PIC	Provide US and DS RF cable interfaces.	8 units / chassis
RF Protect PIC	CBR-RF-PROT-PIC	CCAP Protect PIC (for N+1 redundancy)	
FAN	CBR-FAN-ASSEMBLY	5 fan modules provide variable speed fan for cooling	5 units / chassis
Power Module	CBR-AC-PS CBR-DC-PS	AC/DC Power Supply Module	6 units (AC) 5 units (DC)
FPIM	CBR-PEM-AC-6M CBR-PEM-DC-6M	AC/DC physical connectivity	1 unit / chassis
Power Tray	CBR-AC-PWR-TRAY CBR-DC-PWR-TRAY	Mechanical assembly - Power Supplies installed here	1 unit / chassis

CCAP Line Card

- **Standard DOCSIS RF Card**
  - **8x16 with modular US RF and DS modules**
- **MPEG EQAM Card**
  - **Support for native MPEG video channels on all DS ports.**
- **40Gbps Backplane BW**
  - **Two ESI 4 links to both SUPs running at 7.5Gbps SERDES rate**

CCAP Line Card

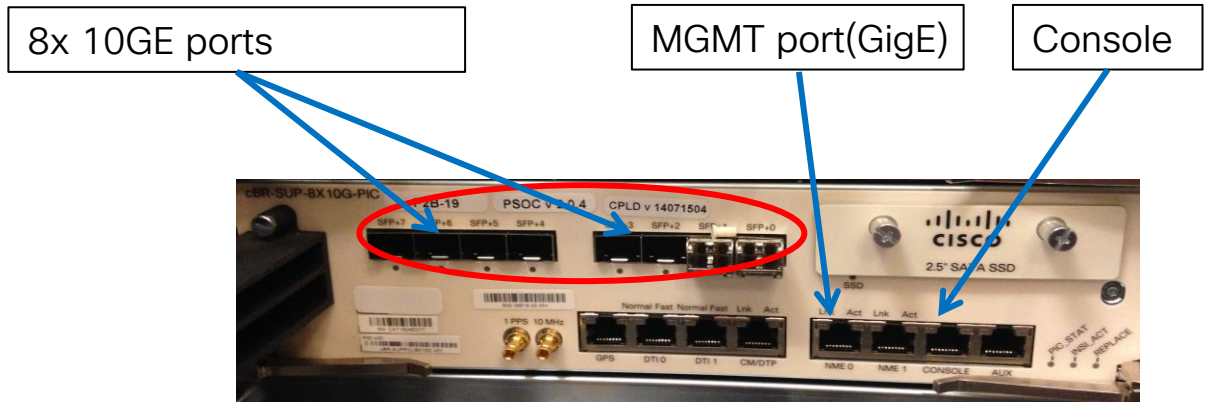
- **Downstream**
  - **8 DS Ports made up of two 4-Port Gemini UPXs**
  - **4-PORT Gemini UPXs**
    - **The module can support total of 384 QAMs, but is limited to only 256 because of the 66 watts module power budget.**
    - **96 channels can be broadcasted across any number of ports**
  - **DS JIB Supports**
    - **Supports up to 768 channels(qams) at annex-B qam-256 rate or up to 576 channels (qams) at annex-A qam-256 rate. This equals the capacity of two 4-port DS PHY modules. (future proof to 1200 channels in DS JIB)**
- **Upstream**
  - **16 US Ports**
  - **US JIB supports 96 channels (future proof to 192)**
  - **FCS US module (Leoben) supports 8 Broadcom 3142R PHYs for a total of 96 US channels**

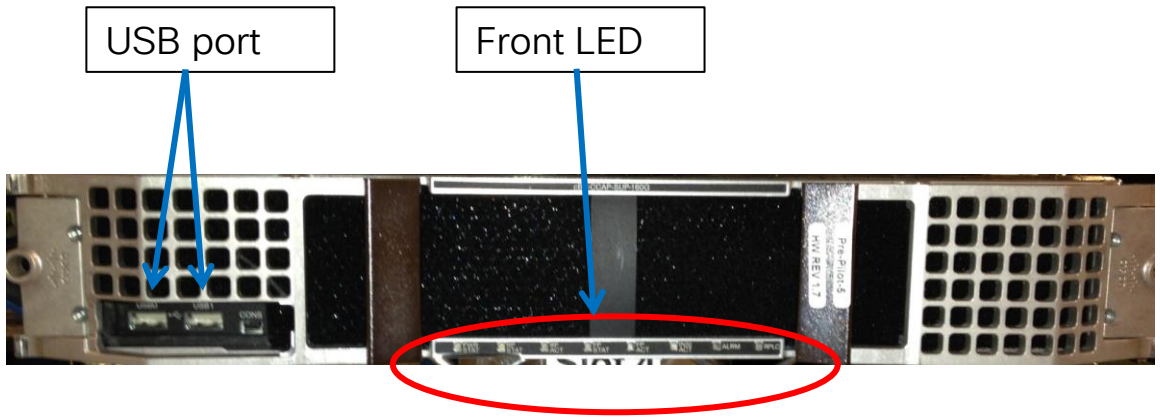
CCAP Line Card

- **MPEG Video Functionality**
- **MPEG Processing**
  - **PCR restamping, PID remapping, Stream muxing, Switched digital video**
- **Video decryption**
  - **Decryption of video packets is performed after packet has been processed by LCPU.**
  - **Video decryption is supported on 100% of video traffic.**
- **Video encryption**
  - **Encryption is performed after decryption.**
  - **Video encryption is supported on 100% of video traffic.**

Supervisor Card

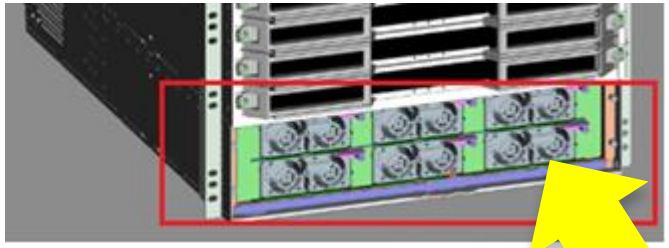
- **Routing processor to manage routing control and chassis management**
- **Forwarding processor to forward packets between backhaul ports and linecards**
- **Backhaul Interface ports**
- **Networking timing**





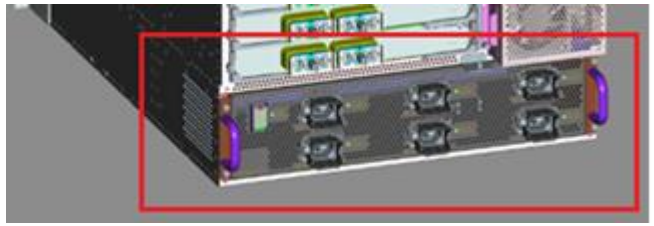
Power

- Power Shelf



Power Tray

Power Module



FPIM

- Power Module

Input mode	Input voltage(V)	Input current(A)	Frequency (Hz)	Max output (W)	Hot swappable	Redundancy
AC	200 ~ 240	14 ~ 16	50/60	3000	yes	N+N / N+1
DC	-48 ~ -60	60	-	2100	yes	N+1

Power

- Power consumption

Slot	Slot Power Budget (W)	Quantity	Power/Item (W)
Supervisor	930	2	1860
Supervisor PIC	120	2	240
Linecard	530	8	4240
Linecard PIC	60	8	480
Fan Module	170	5	850
Chassis	150	1	150

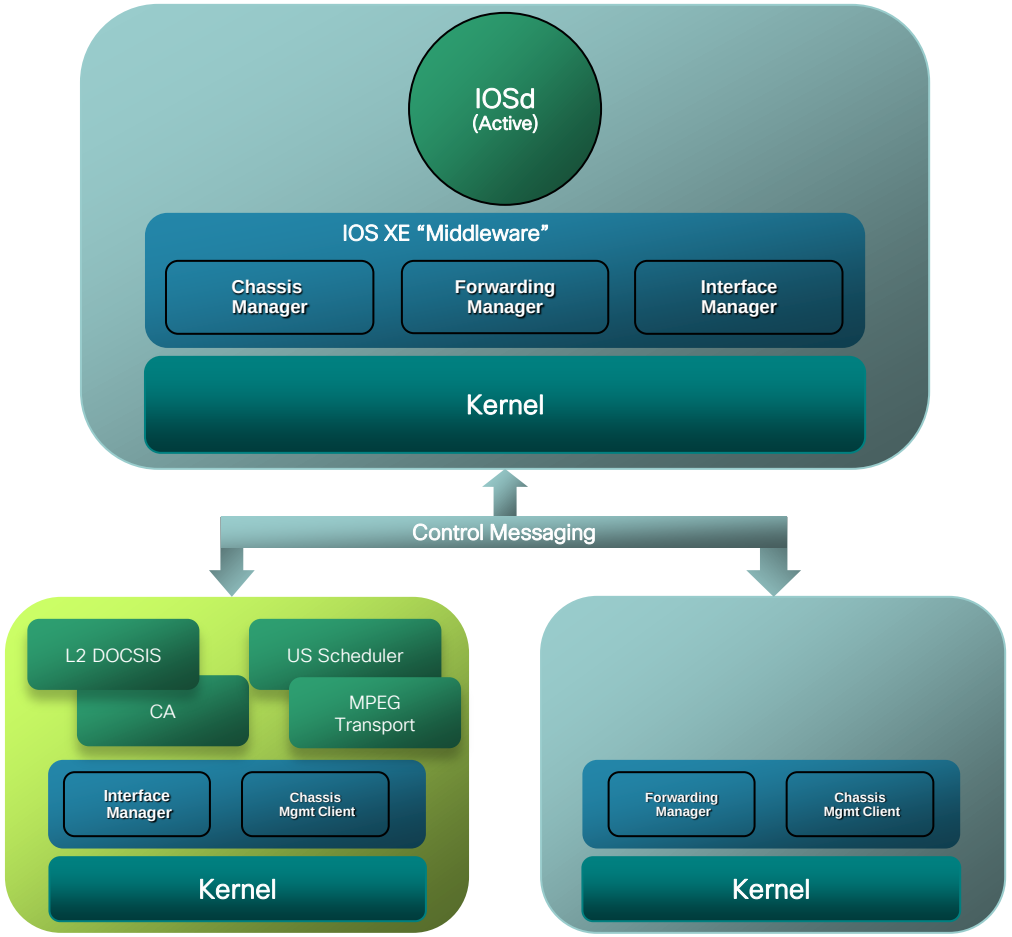
(Example)
cBR-8#sh environment power

Slot	Controller	Value
3	FRU Power	320 W
2	FRU Power	330 W
1	FRU Power	330 W
0	FRU Power	310 W
6	FRU Power	330 W
P0	PEM Power	540 W
P1	PEM Power	540 W
P2	PEM Power	540 W
P3	PEM Power	540 W
P4	PEM Power	540 W
R0	FRU Power	705 W
R1	FRU Power	715 W

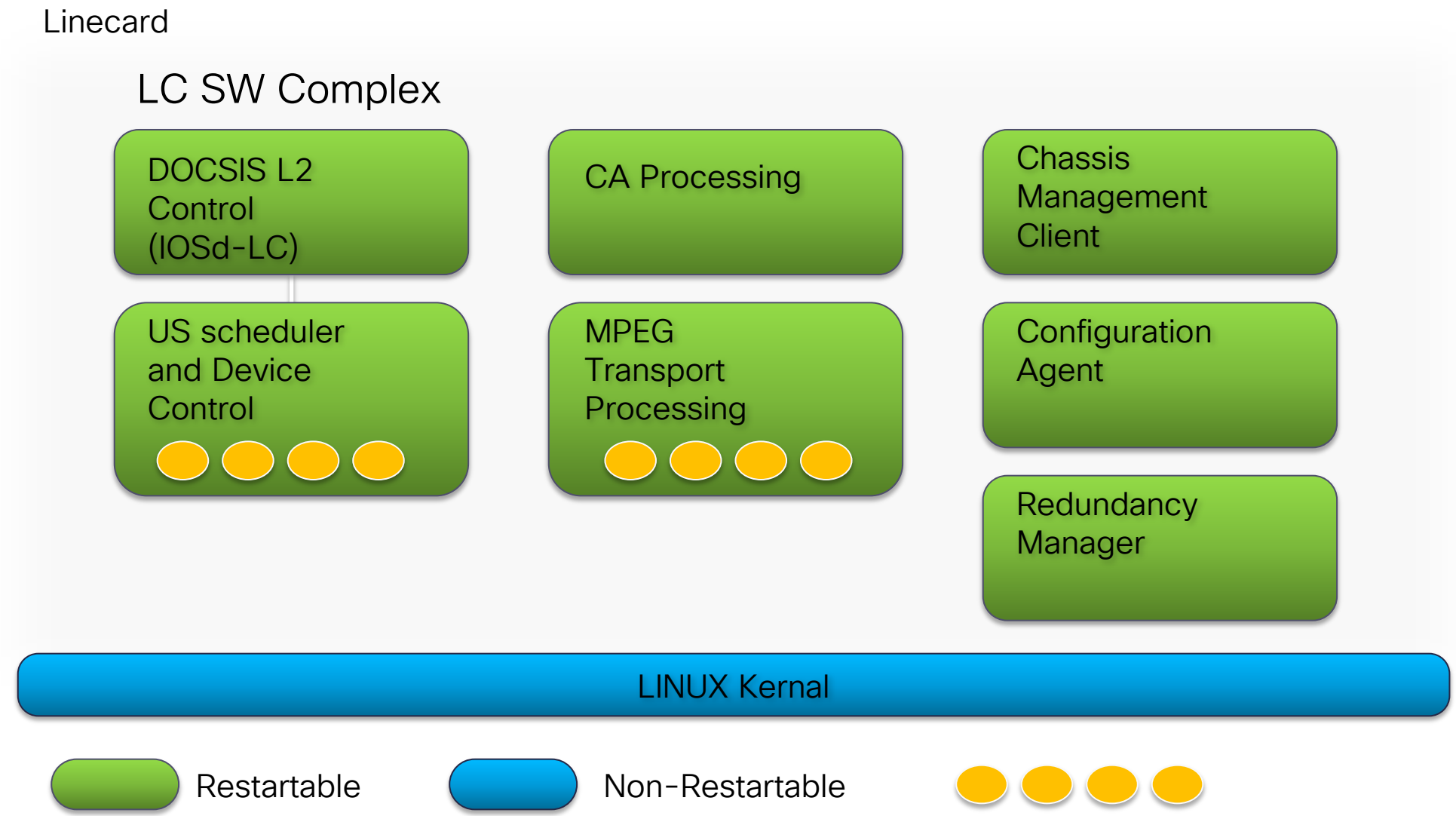
cBR-8 Software Design

Benefits of IoS-XE on cBR-8

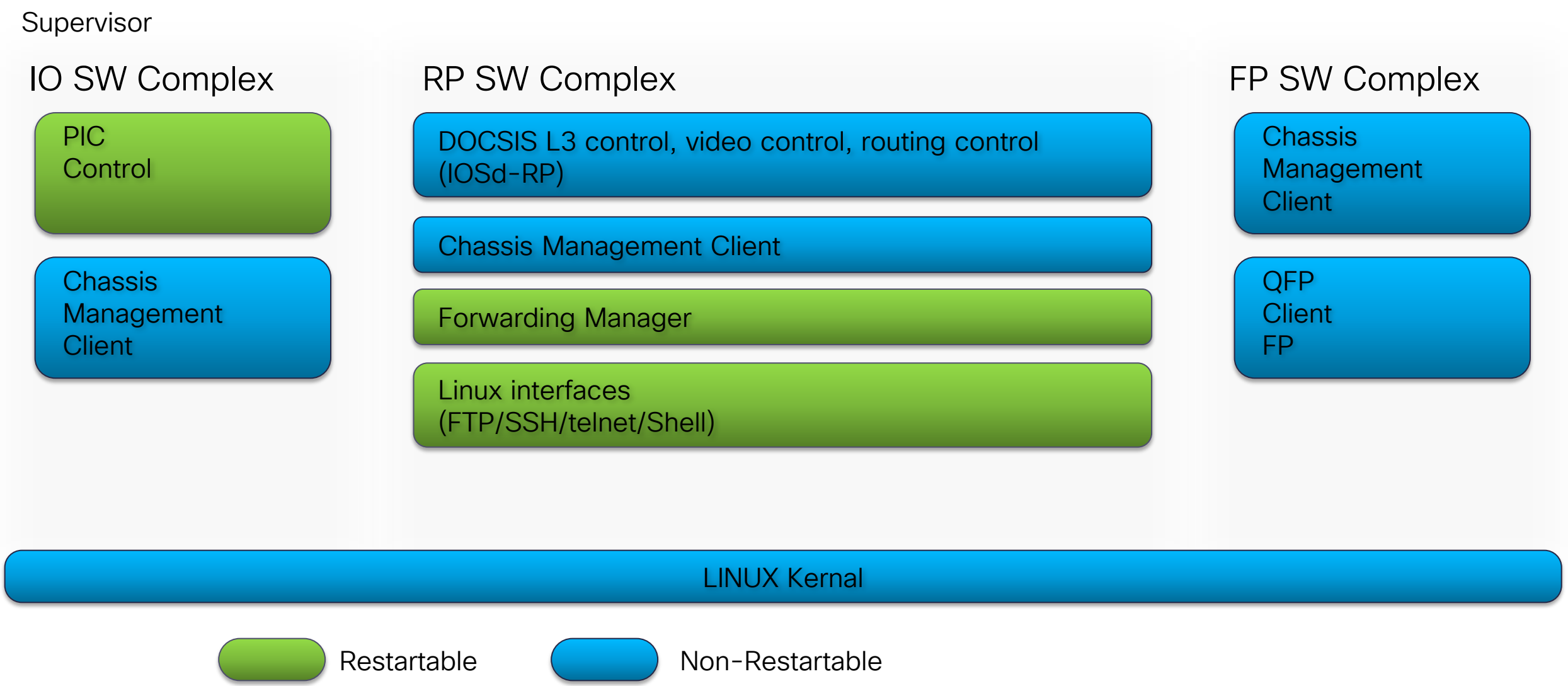
- **IOS XE = IOS + IOS XE Middleware + Platform Software**
- **Software feature richness and velocity**
  - **Full IOS-XE feature parity (MPLS, VPN, L3)**
  - **Full DOCSIS feature set (VDOC, BSOD, etc.)**
- **Service Velocity through SDN functionality**
- **Operational Consistency - same look and feel as IOS Router**



cBR-8 Line Card IoS-XE Design



cBR-8 FCS Supervisor IoS-XE Design



cBR-8 Configuration

Configuration Flowchart – uBR10K vs cBR-8

- uBR10K

  controller Integrated-Cable 5/0/0

  controller Modular-Cable 6/0/0

  => ch-id, Freq, output level, Annex, Modulation, rf-shut, etc…

  interface Cable5/0/0

  => primary DS, us max-port, US BG, US RF para, US ch sh ut

  interface Integrated-Cable 5/0/0:0

  interface Modular-Cable7/0/0:0

  => narrow DS

  Interface Wideband-Cable7/0/0:0

  => DS BG

  cable fiber-node 70

  => DS/US chs in FN

- cBR-8

  controller Upstream-Cable 1/0/0

  => US RF para, US ch shut

  controller Integrated-Cable 1/0/0

  => ch-id, Freq, output level, Annex, Modulation, rf-shut, etc…

  interface Cable1/0/0

  => primary DS, US BG

  interface Integrated-Cable 1/0/0:0

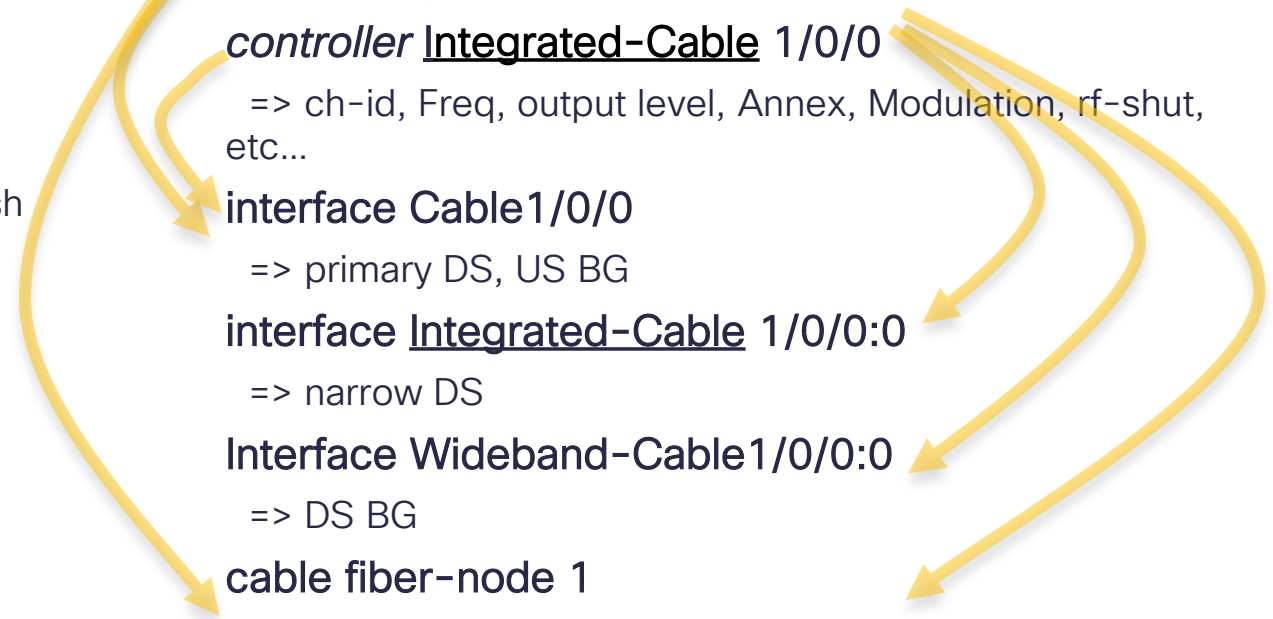
  => narrow DS

  Interface Wideband-Cable1/0/0:0

  => DS BG

  cable fiber-node 1

  => DS/US controllers in FN



Recommended Configuration Process

- Core Interfaces, Loopback interfaces
- General global commands (leave TACACS to end)
  - ✓ Routing protocols, snmp, access-lists, logging, VTYs, etc.
- Global cable commands
  - ✓ Packetcable, mod profiles, lPDR, QAM profiles, etc.
- RF and QAM profiles
- Integrated and Upstream controllers
- Bundle interfaces
- Cable interfaces (16 max per linecard)
- Wideband interfaces (RF-ch range now instead of multiple lines on 10K)
  - ✓ Resilient bonding groups (RBGs)
  - ✓ **Note**: Max of 64 Wideband Interfaces per controller
- Integrated-Cable interfaces (rf-bandwidth-percent)
- Fibers nodes (slightly different from 10K now)
- TACACS

Cable Interface & Fiber Nodes

- Since each LC has 8 DS controllers & 16 US controllers, customer can adjust mac-domain based on fiber-node design
- Current cBR-8 supports max 16 mac-domains per LC
  - ✓ 16x8 without HA = 128 mac-domains per chassis
- This will need to be re-visited when remote phy added
- Fiber Node example of 1:2 SG

```
cable fiber-node 1
 downstream Integrated-Cable 3/0/0
 upstream Upstream-Cable 3/0/0 (US connector now)
!
cable fiber-node 2
 downstream Integrated-Cable 3/0/0
 upstream Upstream-Cable 3/0/1 (US connector now)
```

Change from uBR10k

- "TFTP-enforce" not exist => DMIC covers this functionality
- "NTP update-calendar" not configurable, but not needed anymore
- "Max-cpe" and "max-ipv6-cpe" moved under "cable submgmt"
- "Cable ds-max-burst peak-rate" => Powerboost(ERBA) still there, but peak rate moved to service class
- "us-channel 0 equalization-coefficient" moved under US controller. With this configuration, "no cable upstream 0 equalization-error-recovery" option comes up along under interface cable.
- Cisco legacy Loadbalancing not exist => "DOCSIS Loadbalancing" (D2.0 & 3.0) replaced it. (same as SCH)
  - ✓Primary DS distribution
  - ✓D3.0 modem count-based distribution
  - ✓Option "downstream-only" for d3.0 is missing
- Mgmt interface(GigabitEthernet0) changed to VRF port on cBR-8(1Gbps port). This cannot be used for data traffic.
- "logging event link-status global" should be configured for link up/down event.
- There are several CLI for 'shutdown' channel. e.g) "shutdown" , "mute" under controller level
- "logging linecard debugging" should be configured for detail LC level debuging. e.g) debug cable range, registration

cBR-8 Troubleshooting

Monitoring commands

- show platform

```
router#show platform
Chassis type: CBR-8-CCAP-CHASS

Slot      Type                State                 Insert time (ago)
--------- ------------------- --------------------- -----------------
0         CBR-CCAP-LC-40G     ok                    6w3d
0/1       CBR-RF-PROT-PIC     ok                    6w3d
1         CBR-CCAP-LC-40G     ok                    6w3d
1/1       CBR-RF-PIC          ok                    6w3d
SUP0      CBR-CCAP-SUP-160G   inserted              6w3d
 R0                           ok, active
 F0                           ok, active
 4                            ok, active
 4/1      CBR-SUP-8X10G-PIC   ok                    6w3d
SUP1      CBR-CCAP-SUP-160G   inserted              6w3d
 R1                           ok, standby
 F1                           ok, standby
 5                            ok, standby
 5/1      CBR-SUP-8X10G-PIC   ok                    6w3d
P0        CBR-DC-PS           ok                    6w3d
P1        CBR-DC-PS           ok                    6w3d
P2        CBR-DC-PS           ok                    6w3d
P3        CBR-DC-PS           ok                    6w3d
P4        CBR-DC-PS           ok                    6w3d
P5        Unknown             ps, fail              never
P10       CBR-FAN-ASSEMBLY    ok                    6w3d
P11       CBR-FAN-ASSEMBLY    ok                    6w3d
P12       CBR-FAN-ASSEMBLY    ok                    6w3d
P13       CBR-FAN-ASSEMBLY    ok                    6w3d
P14       CBR-FAN-ASSEMBLY    ok                    6w3d

Slot      CPLD Version        Rommon Version
--------- ------------------- ------------------------------------
0         0000001C            2011.03.12
1         0000001C            2011.03.12
SUP0      14121111            15.5(2r)S
SUP1      14121111            15.5(2r)S
```

Column name	Description
slot	• Indicate the slot number: • SUP: SUP0, SUP1(R0,F0,4&R1,F1,5 are onboard device) • Linecard:0,1,2,3,4,5,6,7,8,9 • Pic card:0/1,1/1,2/1,3/1,4/1,5/1,6/1,7/1,8/1,9/1(4/1&5/1 are sup-pic, the reset are rf-pic) • Power module :P0,P1,P2,P3,P4,P5 • Fan tray:P10,P11,P12,P13,P14
type	Indicate the card type. “UNKNOWN” will be printed when a power/fan module not programed or inserted.
state	Include : “ok”, “disable”, “booting”, “disconnecting”, “unknown”, “fail”, “ok, active”, “ok, standby”, “inserted”, “out of service”
Insert time (ago)	Indicate the insert time

Monitoring commands

- show platform (cont'd)

```
router#show platform
Chassis type: CBR-8-CCAP-CHASS

Slot      Type                State                 Insert time (ago)
--------- ------------------- --------------------- -----------------
0         CBR-CCAP-LC-40G     ok                    6w3d
0/1       CBR-RF-PROT-PIC     ok                    6w3d
1         CBR-CCAP-LC-40G     ok                    6w3d
1/1       CBR-RF-PIC          ok                    6w3d
SUP0      CBR-CCAP-SUP-160G   inserted              6w3d
 R0                           ok, active
 F0                           ok, active
 4                            ok, active
 4/1      CBR-SUP-8X10G-PIC   ok                    6w3d
SUP1      CBR-CCAP-SUP-160G   inserted              6w3d
 R1                           ok, standby
 F1                           ok, standby
 5                            ok, standby
 5/1      CBR-SUP-8X10G-PIC   ok                    6w3d
P0        CBR-DC-PS           ok                    6w3d
P1        CBR-DC-PS           ok                    6w3d
P2        CBR-DC-PS           ok                    6w3d
P3        CBR-DC-PS           ok                    6w3d
P4        CBR-DC-PS           ok                    6w3d
P5        Unknown             ps, fail              never
P10       CBR-FAN-ASSEMBLY    ok                    6w3d
P11       CBR-FAN-ASSEMBLY    ok                    6w3d
P12       CBR-FAN-ASSEMBLY    ok                    6w3d
P13       CBR-FAN-ASSEMBLY    ok                    6w3d
P14       CBR-FAN-ASSEMBLY    ok                    6w3d

Slot      CPLD Version        Rommon Version
--------- ------------------- ------------------------------------
0         0000001C            2011.03.12
1         0000001C            2011.03.12
SUP0      14121111            15.5(2r)S
SUP1      14121111            15.5(2r)S
```

state	Description
ok	1. All the cards , power modules and fan-trays should enter the ok state if they boot up successfully. It indicate the module are in online state and ready to work. 2. SUP0, SUP1 will display inserted instead.
disable	1. Sup or line card was disabled by software and power off due to some protect mechanism. 2. card was sopped by "hw-module slot * stop" command
Booting	1. Once a card is powered, it will enter "booting" when it is booting up.
Disconnecting	1. The card begin to become offline, this is the first state after it was powered up.
Unknown	1. When a card was reloaded, it will enter unknown state first, then enter "booting". 2. if the card can not power up due to power limitation, it will enter "unknown" state. 3. Some abnormal issue happened on the card.
fail	1. If the power module not inserted, it will display "fail". 2. 2 if the eeprom on fan-tray not programed, It will display "fail"
Ok, active, ok standby	1. Indicate the active/standby state of the sup
inserted	1. It is ok for Sup0&sup1 to enter inserted state after boot up, 2. it is false for pic card to enter "insert" state.
Out of service	1. false state for the pic card. 2. after reload the pic , it will enter "out of service" first.

Monitoring commands

- show environment power

cBR-8r#**show environment power**

Slot	Controller	Value	
6	FRU Power	320 W	<===== 6번 카드 소모 전력
0	FRU Power	320 W	<===== 0번 카드 소모 전력(protect)
3	FRU Power	320 W	<===== 3번 카드 소모 전력
2	FRU Power	320 W	<===== 2번 카드 소모 전력
1	FRU Power	340 W	<===== 1번 카드 소모 전력
P0	PEM Power	540 W	<===== PS 0번 모듈 전력
P1	PEM Power	550 W	<===== PS 1번 모듈 전력
P2	PEM Power	540 W	<===== PS 2번 모듈 전력
P3	PEM Power	540 W	<===== PS 3번 모듈 전력
P4	PEM Power	540 W	<===== PS 4번 모듈 전력
R0	FRU Power	692 W	<===== sup0번 카드 소모 전력(slot4)
R1	FRU Power	696 W	<===== sup1번 카드 소모 전력(slot5)

- show environment location P0

cBR-8#**show environment location P0**

Sensors by Location: Environmental Monitoring

Location: P0

Sensor	Location	State	Reading
PEM Iout	P0	Normal	10 A
PEM Vout	P0	Normal	54 V DC
PEM Vin	P0	Normal	53 V DC
Temp: INLET	P0	Normal	22 Celsius
Temp: OUTLET	P0	Normal	31 Celsius

- show environment location P10 (Fan module)

cBR-8#**show environment location P10**

Sensors by Location: Environmental Monitoring

Location: P10

Sensor	Location	State	Reading
Temp: U17	P10	Normal	35 Celsius
Temp: U18	P10	Normal	35 Celsius
Temp: FC	P10	Fan Speed 44%	22 Celsius
MPL115A	P10	Normal	100 Kpa

Expected fan speed

- show platform hardware slot P10 fan mcu status

cBR-81#**show platform hardware slot P10 fan status**

Fan 0: Normal

Fan 1: Normal

Anyang_cBR_1#show platform hardware slot P10 mcu status

Model ID: 0

12V I: 0

12V V: 0

Temp: 0

Input V: 0

Fan speed: 43%

Real fan speed

Monitoring commands

- show redundancy

```
cBR-8#show redundancy
Redundant System Information :
------------------------------
       Available system uptime = 10 minutes
Switchovers system experienced = 0
              Standby failures = 0
        Last switchover reason = none

                 Hardware Mode = Duplex
    Configured Redundancy Mode = sso
     Operating Redundancy Mode = sso
              Maintenance Mode = Disabled
                Communications = Up

Current Processor Information :
-------------------------------
              Active Location = slot 4
        Current Software state = ACTIVE
       Uptime in current state = 10 minutes
                 Image Version = Cisco IOS Software, cBR  Software (X86_64_LINUX_IOSD-
UNIVERSALK9-M), Version 15.5(2)S, RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2015 by Cisco Systems, Inc.
Compiled Sun 22-Mar-15 03:32 by mcpre
                       BOOT = bootflash:cbrsup-universalk9.03.15.00.S.155-2.S-
std.SPA.bin,12;
        Configuration register = 0x2102
```

- show redundancy (cont'd)

```
Peer Processor Information :
----------------------------
              Standby Location = slot 5
        Current Software state = STANDBY HOT
       Uptime in current state = 5 minutes
                 Image Version = Cisco IOS Software, cBR  Software (X86_64_LINUX_IOSD-
UNIVERSALK9-M), Version 15.5(2)S, RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2015 by Cisco Systems, Inc.
Compiled Sun 22-Mar-15 03:32 by mcpre
                       BOOT = bootflash:cbrsup-universalk9.03.15.00.S.155-2.S-std.SPA.bin,12;
                  CONFIG_FILE =
        Configuration register = 0x2102
```

Access to the linecard

- Access to the CLC

cBR-8#**request platform software console attach 3/0**
#
Connecting to the CLC console on 3/0.
Enter Control-C to exit the console connection.
#
Slot-3-0>
Slot-3-0>ena
Slot-3-0#
Slot-3-0# <==== *exit to shell via Ctrl+'c' key.*
cBR-8#

Useful troubleshooting commands

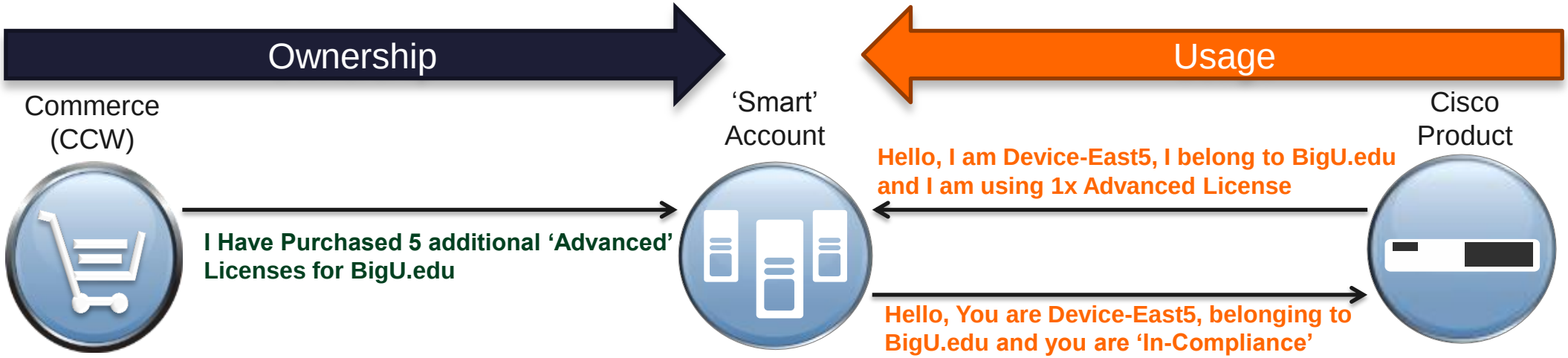
- term exec prompt timestamp
- term length 0
- show platform hardware slot f0 serdes status
- show platform hardware qfp active system state
- show platform hardware qfp active datapath utiliz
- show platform hardware qfp active statistics drop
- show platform hardware qfp active infrastructure bqs queue output default interface <Int_Cable-if>
- show cable dp queue <wb_if>
- show plat so obj fp act stat
- show controllers integrated-Cable $Cable_int counter rf-channel | exc 0\.0
- show plat ha qfp act infra bqs status
- show plat hard qfp act bqs 0 fif
- show plat hard qfp act bqs 0 cif
- show plat hard qfp act bqs 0 gif detail
- show plat hard qfp act bqs 0 opf config
- show plat hard qfp act bqs 0 opf status all
- show cable card <slot> ds-mac all
- show cable card <slot> ds-phy display
- show cable modem summary total
- show cable modem docsis device-class summ
- show cab hop; threshold
- show cable modem phy
- show cable flap-list
- show cable resiliency
- show cable modem resiliency
- show cable modem wideband channel
- show cable modem wide registered-traditional
- show cable mac-domain cx/y/z rcc
- show processes cpu sorted 5min
- show version
- show running
- show processes cpu platform sorted
- show proc memory
- show proc memory platform

Smart License

What is Smart Licensing?

Smart Licensing is a new way of thinking about Licensing at Cisco that is being applied to all products.

Instead of DRM, Smart Licensing provides a Software Inventory Management System that Provides **Customers**, **Cisco**, and **Selected Partners** with information about Software Ownership and Software Utilization.



BigU.edu	
I Own: 10	+5
I am Using: 10	+1

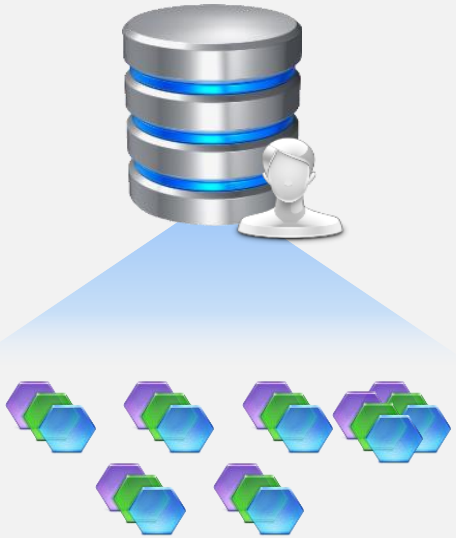
What is a Cisco Smart Account?

single place to keep and manage all your Cisco assets

Smart Account

Assets

Pool all assets, User roles, and agreements



Users

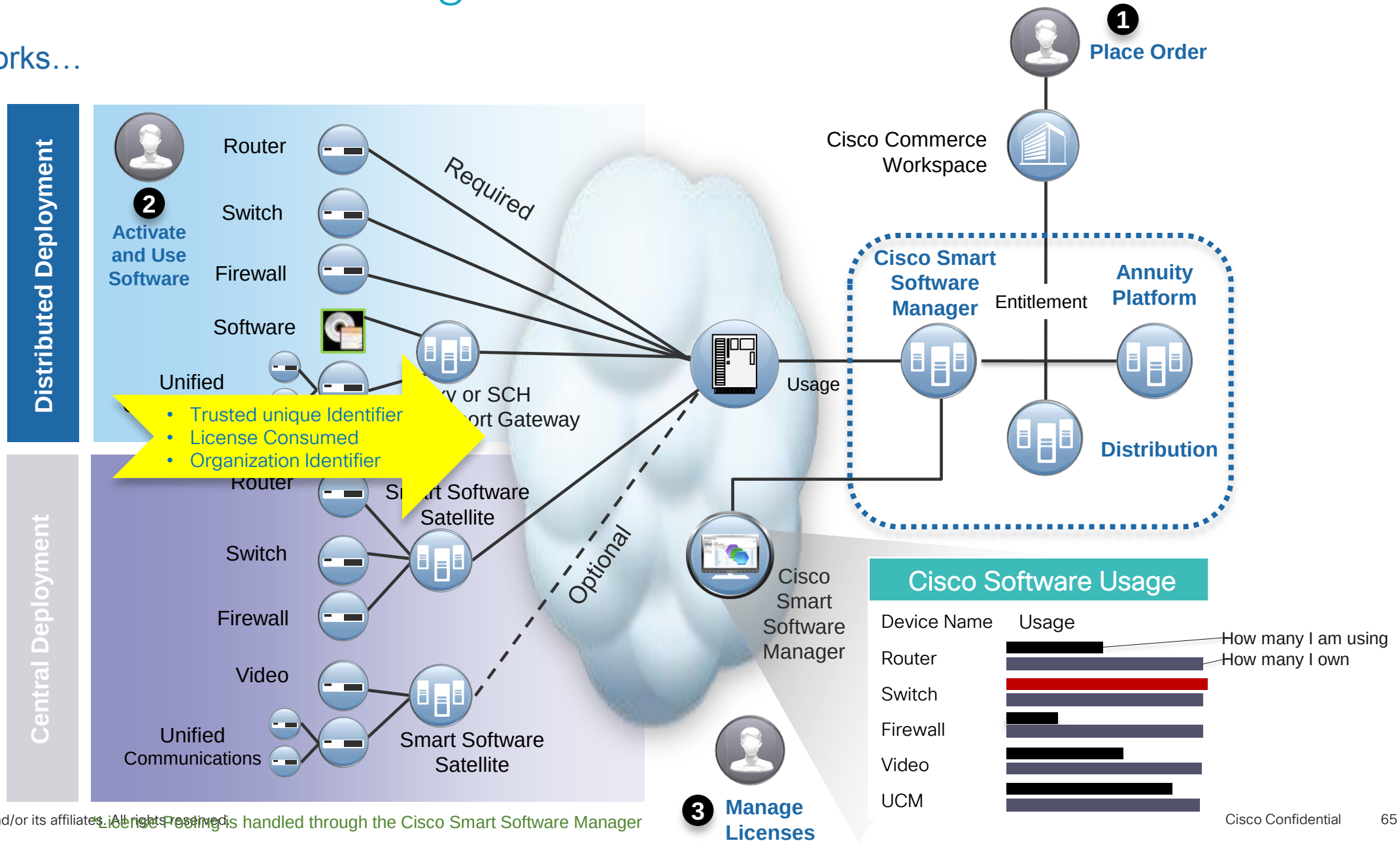
Customer, designated VAR, Integrator, or other authorized party

Additional Benefits of Smart Accounts include:

- ✓ Downloading new software
- ✓ Find out what new licenses you have
- ✓ Review Service contracts
- ✓ Review logs and specific cases you've opened
- ✓ Track Purchases

Smart Software Licensing

How it works…



License Pooling is handled through the Cisco Smart Software Manager

Balancing Simplicity with Security

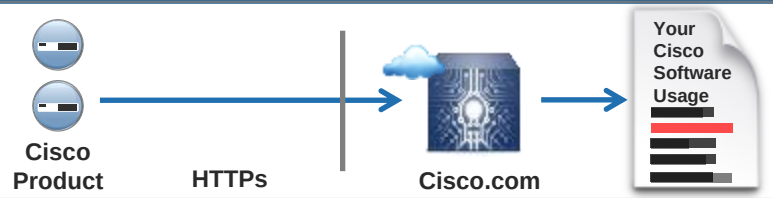
Ease of use

Security Policy

Options

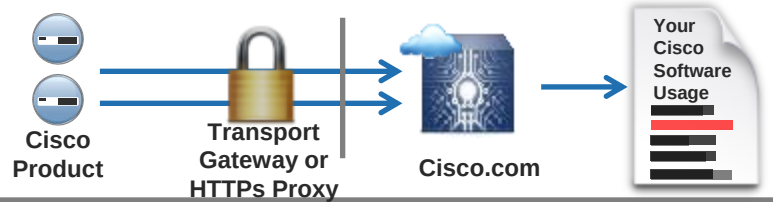
1 Direct cloud access

Cisco product sends usage information directly over the internet. No additional components are needed.



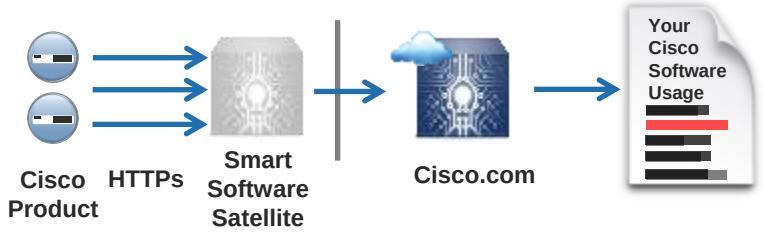
2 Direct cloud access through an HTTPs proxy

Cisco Products send usage information over the internet via a Proxy Server – Smart Call Home Transport Gateway (Free VM Download) or off-the-shelf Proxy (such as Apache).



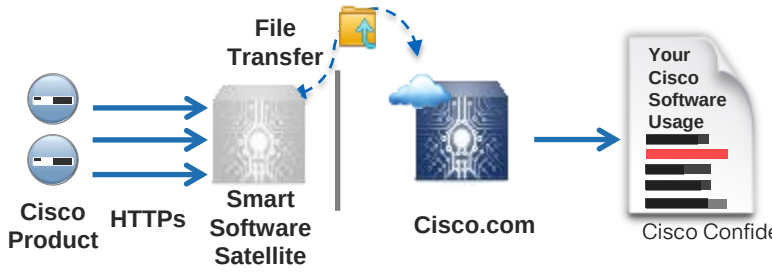
3 Mediated access through Smart Software Satellite, an on-premises collector – connected

Cisco Products send usage information to a local connected collector, which acts as a local license authority. Periodically, an exchange of information will be performed to keep the databases in sync.



4 Mediated access through Smart Software Satellite, an on-premises collector – disconnected

Cisco Products send usage information to a local disconnected collector, which acts as a local license authority. Once a month, an exchange of human readable information will be performed to keep the databases in sync.



Smart License Rule

The cBR-8 Operates In Two States:

- Communicating Regularly with Cisco
- Not Communicating Regularly with Cisco

A cBR-8 That Communicates Regularly with Cisco Will NEVER Encounter License Enforcement!!!

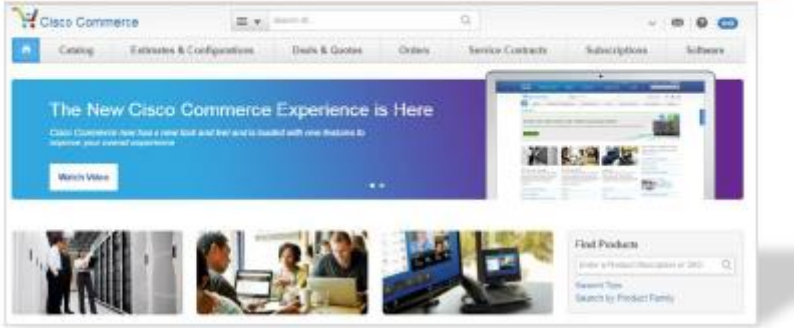
- License Enforcement Does NOT Impact Existing Services
- If a cBR-8 Doesn't Communicate in 90 – 180 days No Changes to the DOCSIS Config are Allowed – All Existing Ser vices Continue to Operate
- If the cBR8's are Configured for More Licenses than are Available in the Pool, all Devices are Considered to be out o f Compliance until Additional Licenses are Added to the Pool or Licenses are Released by Devices in the Pool
- "License Pool Out-of-Compliance" Syslog Error Messages are generated
- Expect a Visit from you Friendly Cisco Account Manager Looking for a PO or to Have the Licensed Functionality Red uced

A cBR-8 That is Operating in "License Pool Out-of-Compliance" Is Fully Functional and No Invoices are Generated

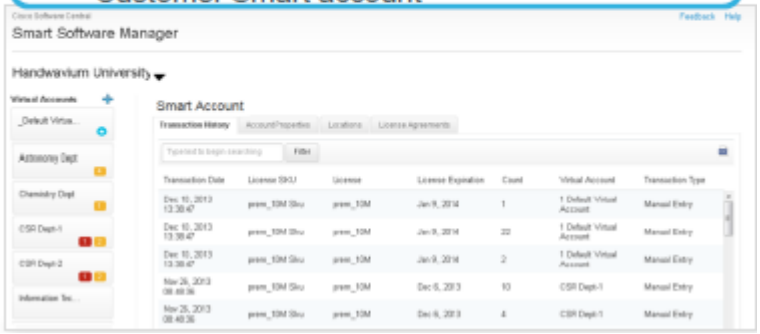
Smart Licensing Tools

1 Cisco Software Workspace (CSW)
Create and Manage Smart Accounts

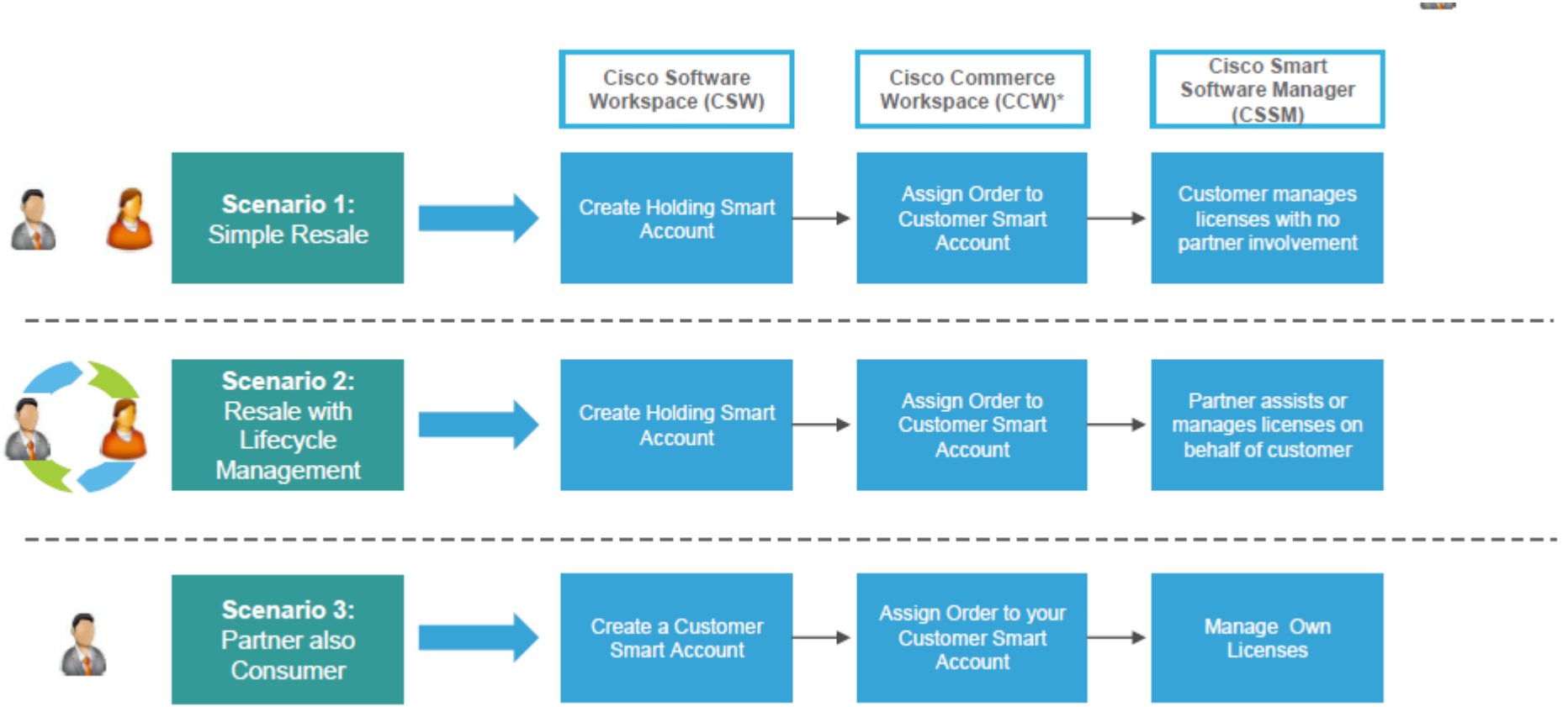
2 Cisco Commerce Workspace (CCW)
Order & Assign Smart Products to Smart Accounts



3 Cisco Smart Software Manager (CSSM)
Mange Licenses and Virtual Accounts for a Customer Smart account



Smart Licensing – CCW Ordering Scenarios

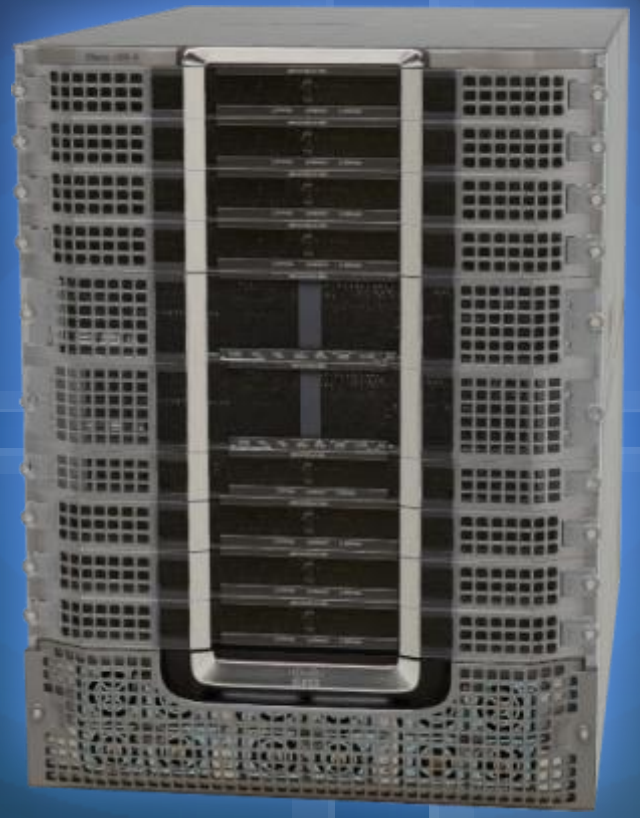


Summary

cBR-8: Reimagining the CMTS

Future-Proof Scalability

- 1.6 Tbps throughput
- 56 to 64 SGs with all services
- No forklift required – only chassis designed ground up for D3.1



Unmatched Software Resiliency

- Software process restart
- Zero packet loss failure recovery
- True hitless upgrades

Maximum Performance & Reliability

- 200 Gbps forwarding
- Robust control plane
- Full redundancy with seamless switchover and hot swap

Pathway to Virtualization & Cloud

- SDN orchestration & service velocity
- Streamlined operations, SMART licensing
- Support for distributed architectures & virtualization

cBR-8 is ….

- cBR-8 is later than the competitor's. But this means it is really up-to-date CCAP & D3.1 platform which is designed by the strongest CMTS vendor.
- cBR-8 is simpler h/w & s/w than the legacy platform.
- cBR-8 is not fixed & limited but extendable & scalable solution.
- Convince the customer to choose the future-proof platform. The CMTS runs over 10 years.
- Need Giga-tier service? Need cBR-8!

Thank you.