LET'S
BUILD
TOMORROW
TODAY

cBR-8 Technical Overview & Deployment Considerations

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BRKSPG-2506

Agenda

- Introduction
- Hardware Overview
- Basic Configuration & Troubleshooting
- Software Overview
- Migration & Deployment
- Demonstrations Showcasing Capabilities
- Conclusion

Introduction

cBR-8 Introduction

- **CCAP scaling**
  200 Gbps of switching capacity in 13 RU I-CCAP chassis with built-in HA; scalable to 1.6 Tbps
  With HA 56 SGs, 5,376 DS QAMs & 672 US QAMs[1]
- **Path to CCAP video convergence**
  “Hub in a Box”; CapEx/OpEx savings
- **Path to DOCSIS 3.1**
  Designed from the ground up with D3.1 in mind
- **Path to Remote PHY**
  SG scaling & hub consolidation; full advantages of DOCSIS 3.1
- **Service & feature velocity with SDN**
  Faster feature implementation; customization

Cisco live!

Hardware Overview

Cisco cBR-8 Chassis - Front

13RU,10-Slot Mid-Plane Design

Integrated N+1 RF Switch

2 Supervisor Slots
200 Gbps forwarding

8 Cable Line card Slots
Initial cards support up to 40 Gbps
768 DS QAMs & 96 US QAMs each[1]

Up to 6 AC or DC
Power Entry Modules

13 RU

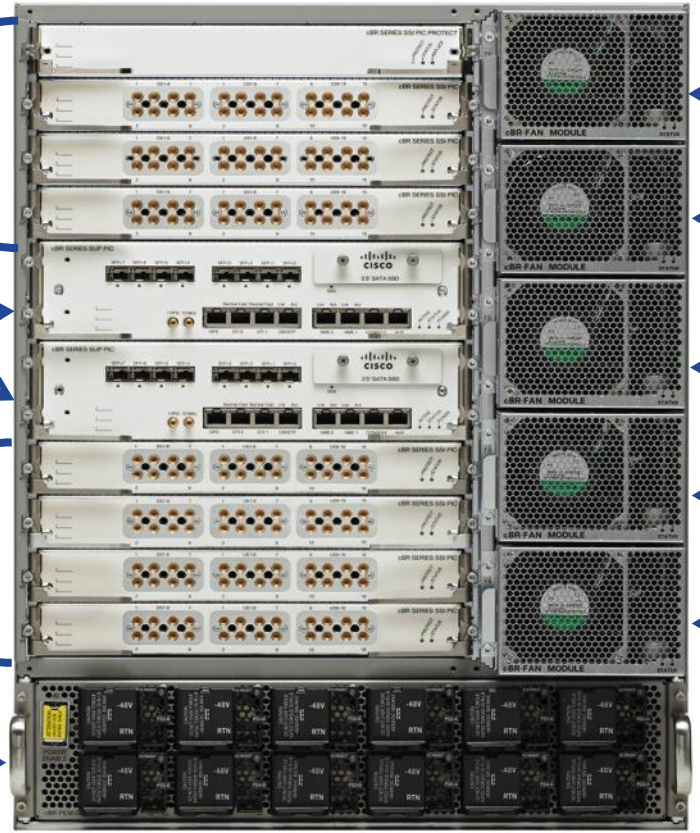
Cisco cBR-8 Chassis - Back

Connectivity on back via Physical Interface Cards (PICs) enabling "wire-once" operation

2 Supervisor PICs
each has 8x10GE SFP+ ports

8DSx16US RF PICs
3 UCH.8 connector blocks
1 Downstream / 2 Upstream

AC or DC Facility Power Interface Module (FPIM) for power connections

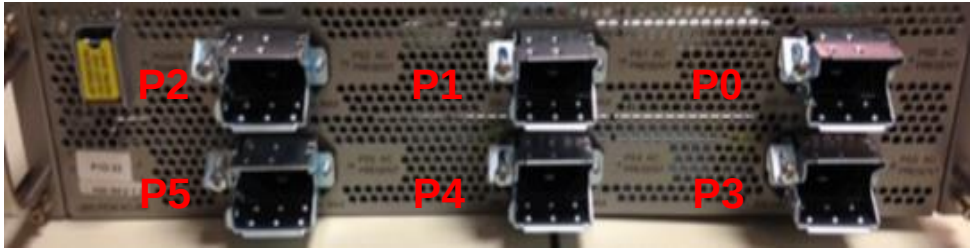


5 Fan modules (Each module has 2 overlapped fans)
Front to Back airflow

Cisco cBR-8 Power

DC FPIM

AC FPIM

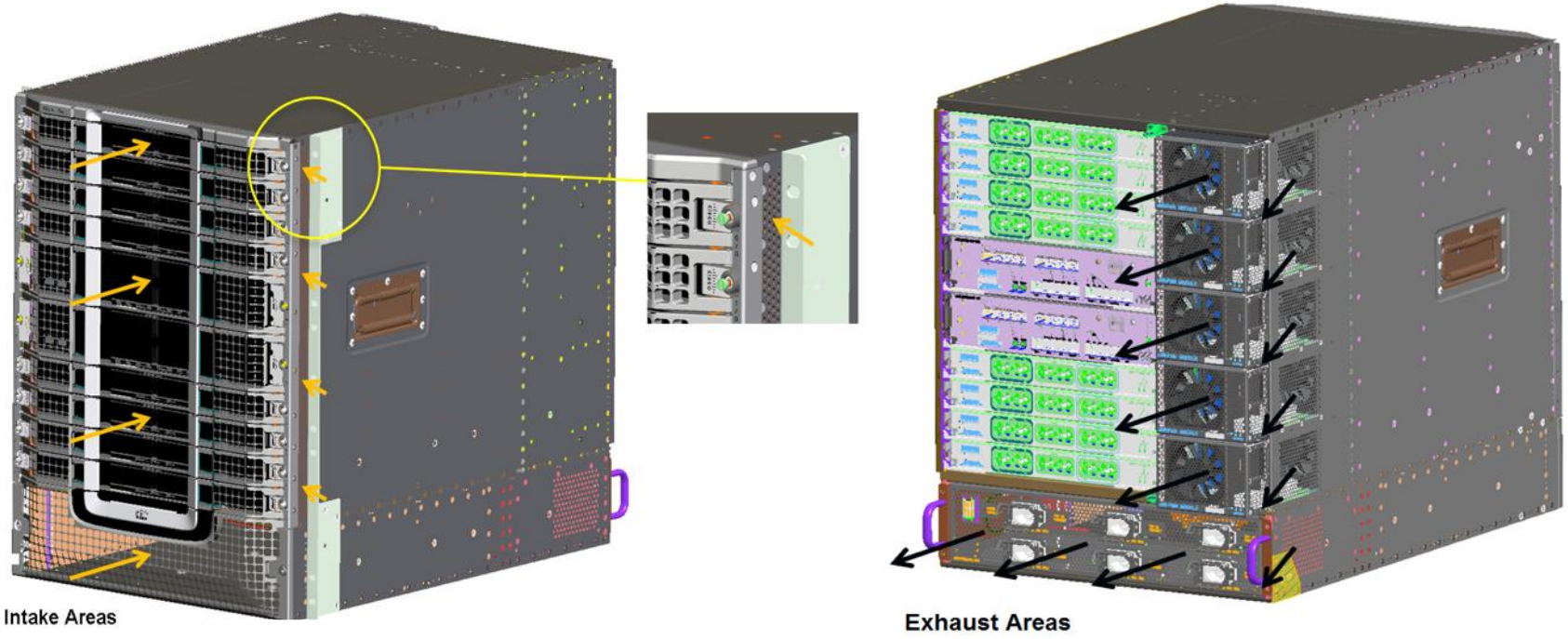


- AC or DC Power Options; up to **6 Power Modules** housed in a **Power Cassette Module**
- Chassis cooling capacity (9 kW) – 4+1 DC or 3+1 or 3+3 AC (load shared across modules)
- Typical D3.0 power load of full chassis @ 25 C - ~5 - 6 kW
- Power connections made in the back via the **Facility Power Interface Module (FPIM)** which also has AC/DC variants

FAN Module

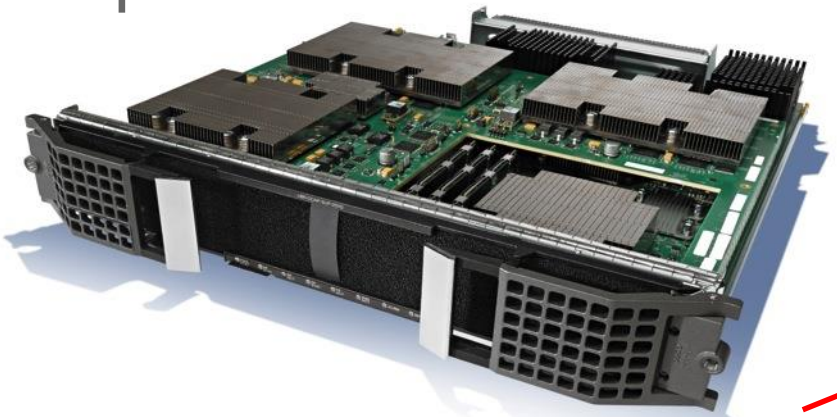
- Rear fan draws air from front of the chassis to cool it
- Front fan expels circulated air from the sides and back of the chassis
- Only one fan module should be removed at a time for servicing or replacement
- Do not operate the chassis with an empty fan bay

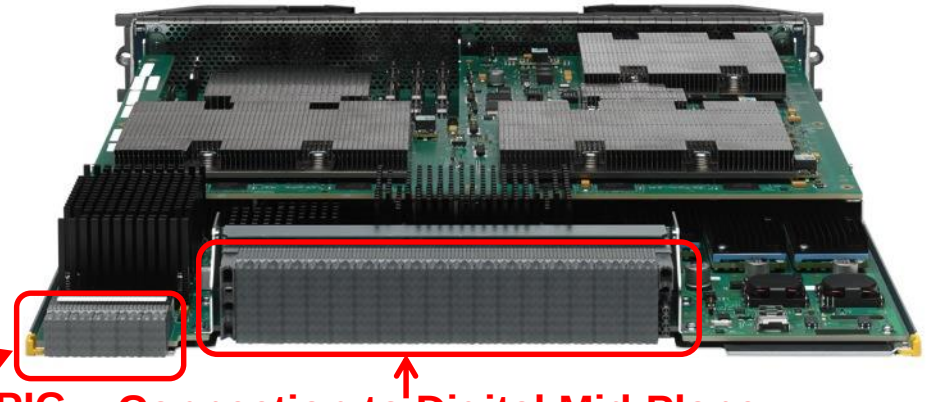
Air Flow Paths



- Fan Module slots numbered from P10 (top) to P14 (bottom)

Supervisor



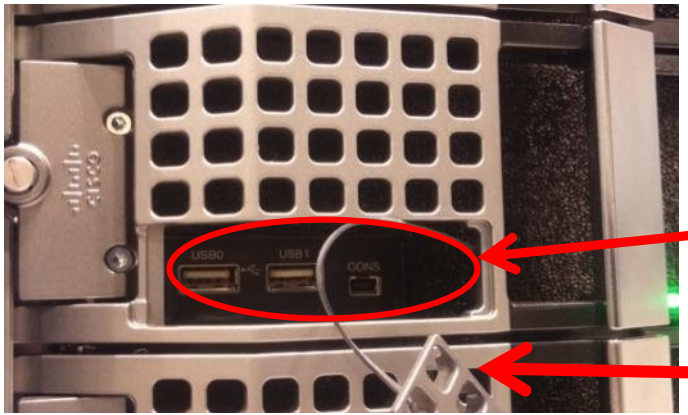


- Consists of forwarding processor (FP) complex and route processor (RP) complex
- FP performs packet forwarding and operations such as:
  MAC classification, QoS classification, security ACLs, policing, shaping, etc.
- RP performs route processing & chassis management
  (distribution of timing, controlling fans, collecting health information, etc.)

Supervisor/Supervisor PIC Functionality

- Provides data plane and control plane connectivity to/from all interface cards
- Two Supervisor versions available – 200 Gbps & 60 Gbps
- **Active FP handles 200 Gbps aggregate forwarding across BOTH Supervisor PICs with 160 Gbps of connectivity**
- **Failed SUP's associated PIC remains fully functional as long as it remains inserted**
- **SUP removal from chassis will power down associated SUP-PIC and its interfaces will go down**

Supervisor Front and USB Access



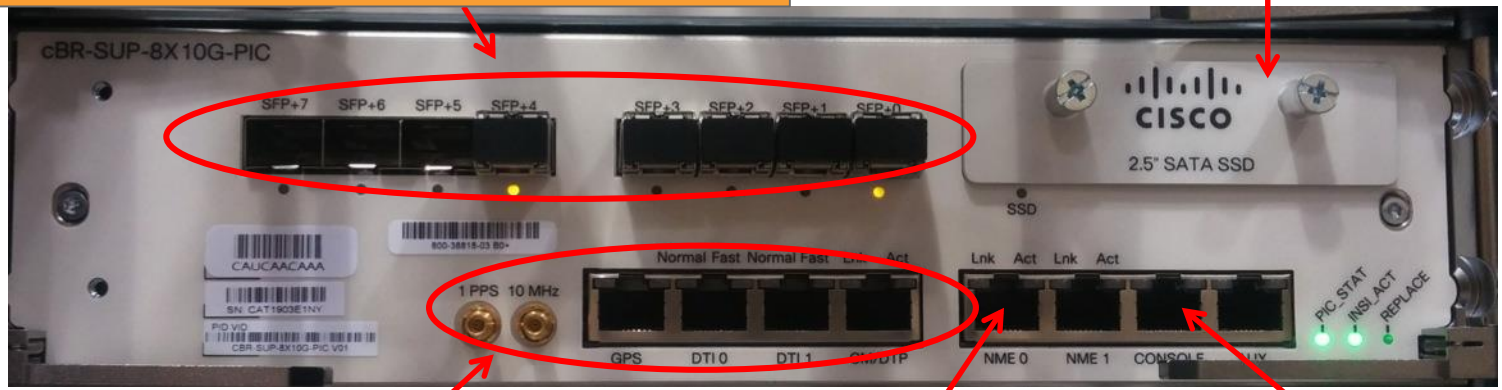
Two USB ports and one mini-USB console port

Remove darker cover from the left handle

Cisco cBR-8 Supervisor PIC

8 10G SFP+ ports per Sup PIC
Supported optics:
SFP-10G-SR, SFP-10G-LR, SFP-10G-ER
SFP-10G-ZR, SFP-10G-LRM

100 GB Solid State Drive



Timing Connectivity (future use)

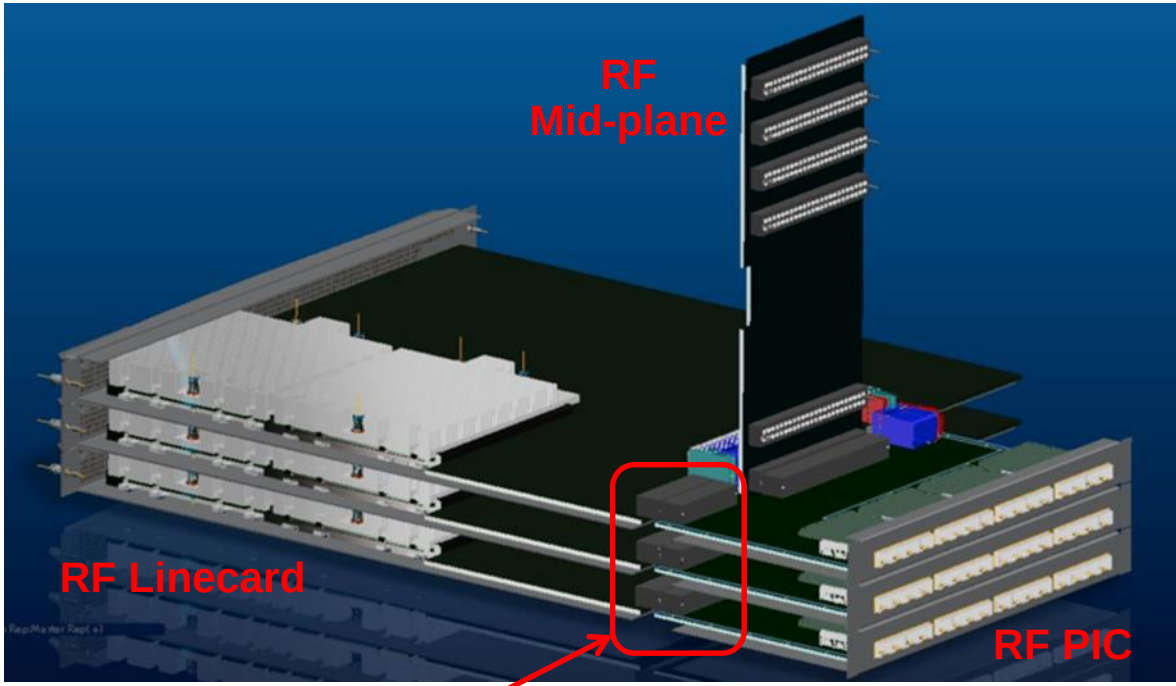
Management => GigbitEthernet0

Console => 9600bps

cBR-8 RF Architecture

Three components with RF connectivity:

- RF Linecard
- RF PIC
- RF Mid-plane

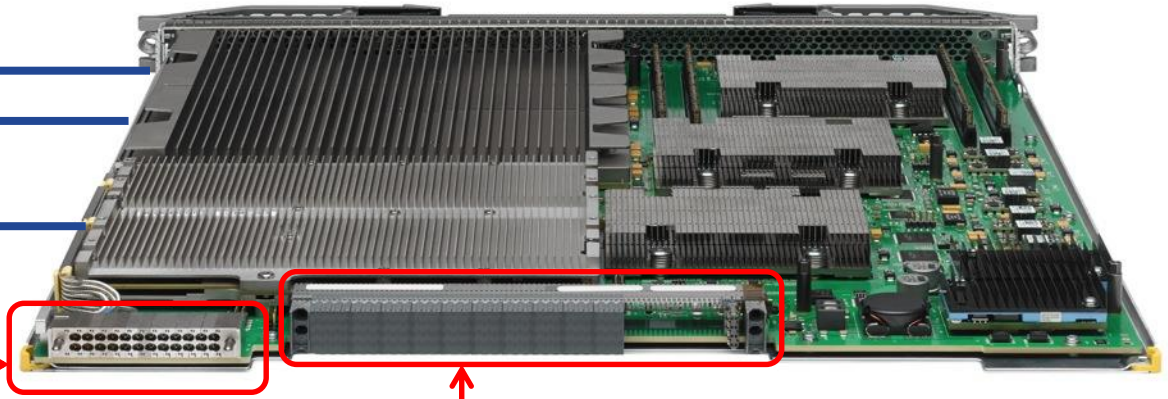


Downstream & Upstream RF directly connected between RF Linecard & PIC

Cisco cBR-8 RF Line Card

Downstream PHY
CBR-D30-DS-MOD

Upstream PHY
CBR-D30-US-MOD



RF connection directly to RF PIC

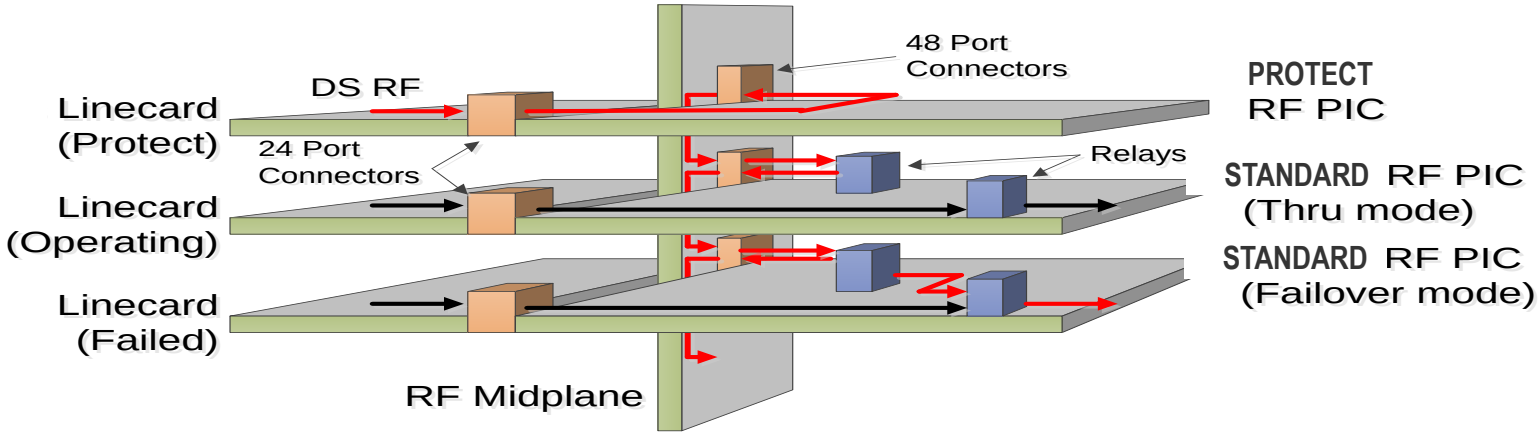
Connection to Digital Mid-Plane

- Field Replaceable PHY modules enabling transition to DOCSIS 3.1
- 2 DS PHY modules each supporting 4 ports and 384 Annex B QAMs
  768 DS QAMs per LC; **6,144 per chassis (5,376 w/ HA)**
- 1 US PHY module supporting 16 ports and 96 QAMs (64 QAMs @ R0)
  96 US QAMs per LC; **768 per chassis (672 w/ HA)**

Cisco cBR-8 RF PIC

RF PIC (8DSX16US)
8 DS ports + 16 US ports per Card (24 total ports)
UCH8 (2 x 4 layout)

Cable Line Card N+1 Redundancy

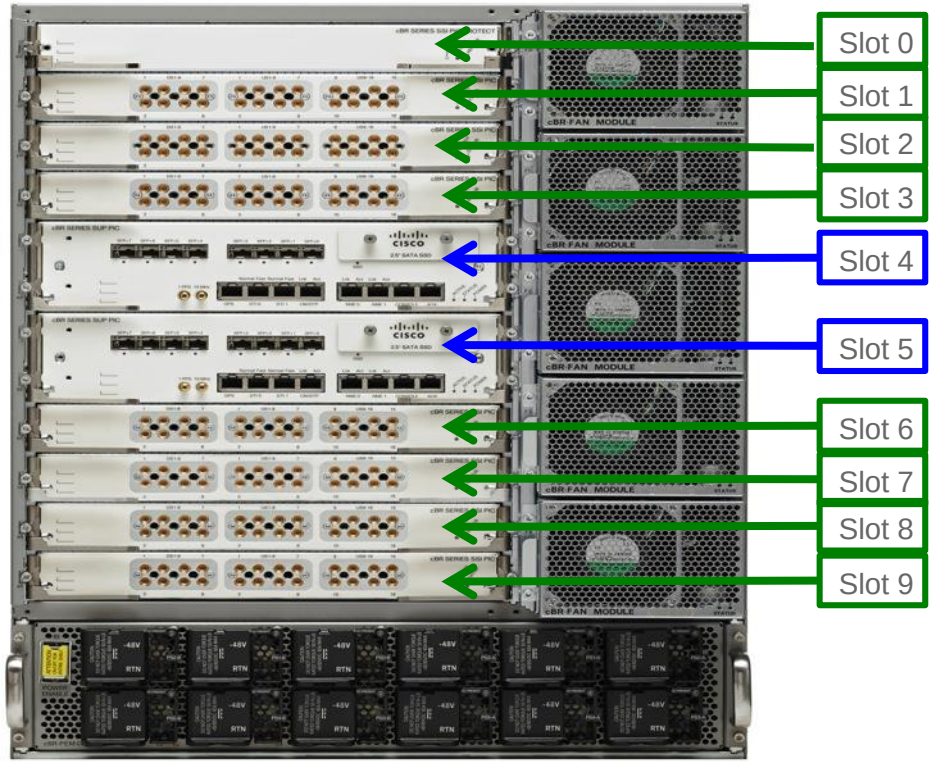


- Protect RF PIC installed in uppermost slot
- cBR-8 uses a ‘daisy-chain’ switching topology for RF Linecard HA
- Each RF PIC connects to the ‘next-adjacent’ RF PIC above and below via an RF Mid-plane (RFMP).

Cisco cBR-8 Chassis Numbering

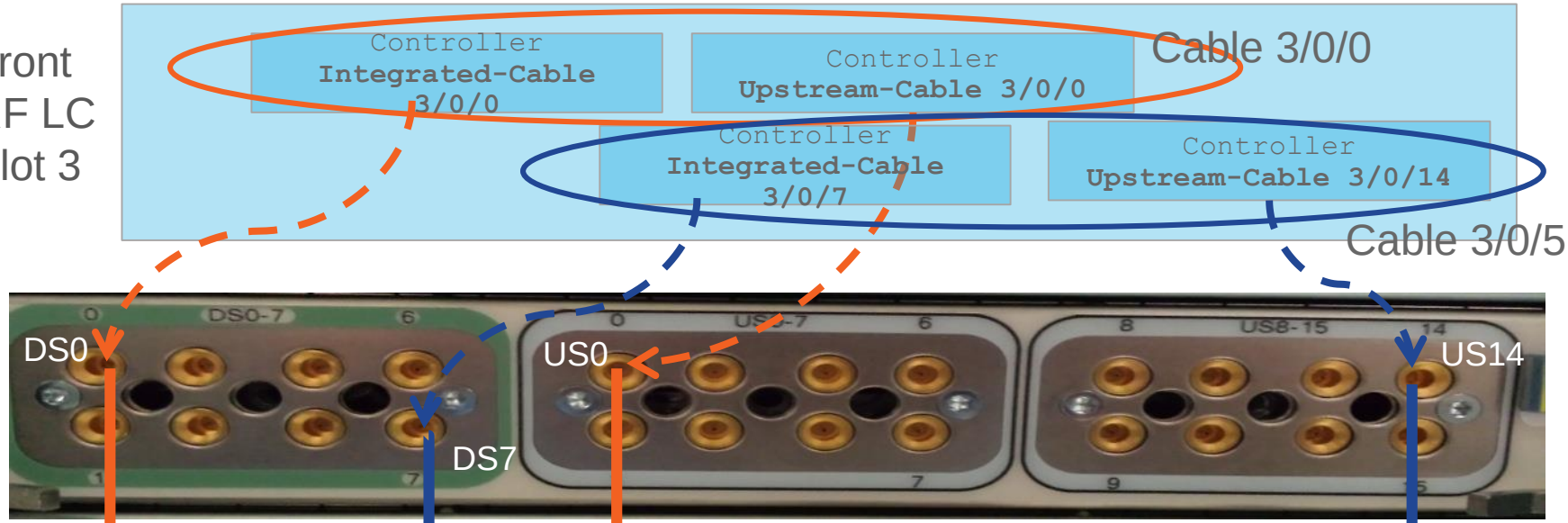
Cable resources numbered
<slot #>/0/<port #>
Example Cable LC #3 has
8 downstream ports:
controller Integrated-Cable 3/0/0-7
and16 upstream ports:
controller Upstream-Cable 3/0/0-15

10GE interfaces numbered
<slot #>/1/<port #>
Example Supervisor PIC #4 has
8 10GE interfaces:
interface TenGigabitEthernet4/1/0-7



Cable Interfaces/MAC Domains/PIC Ports

Front
RF LC
Slot 3

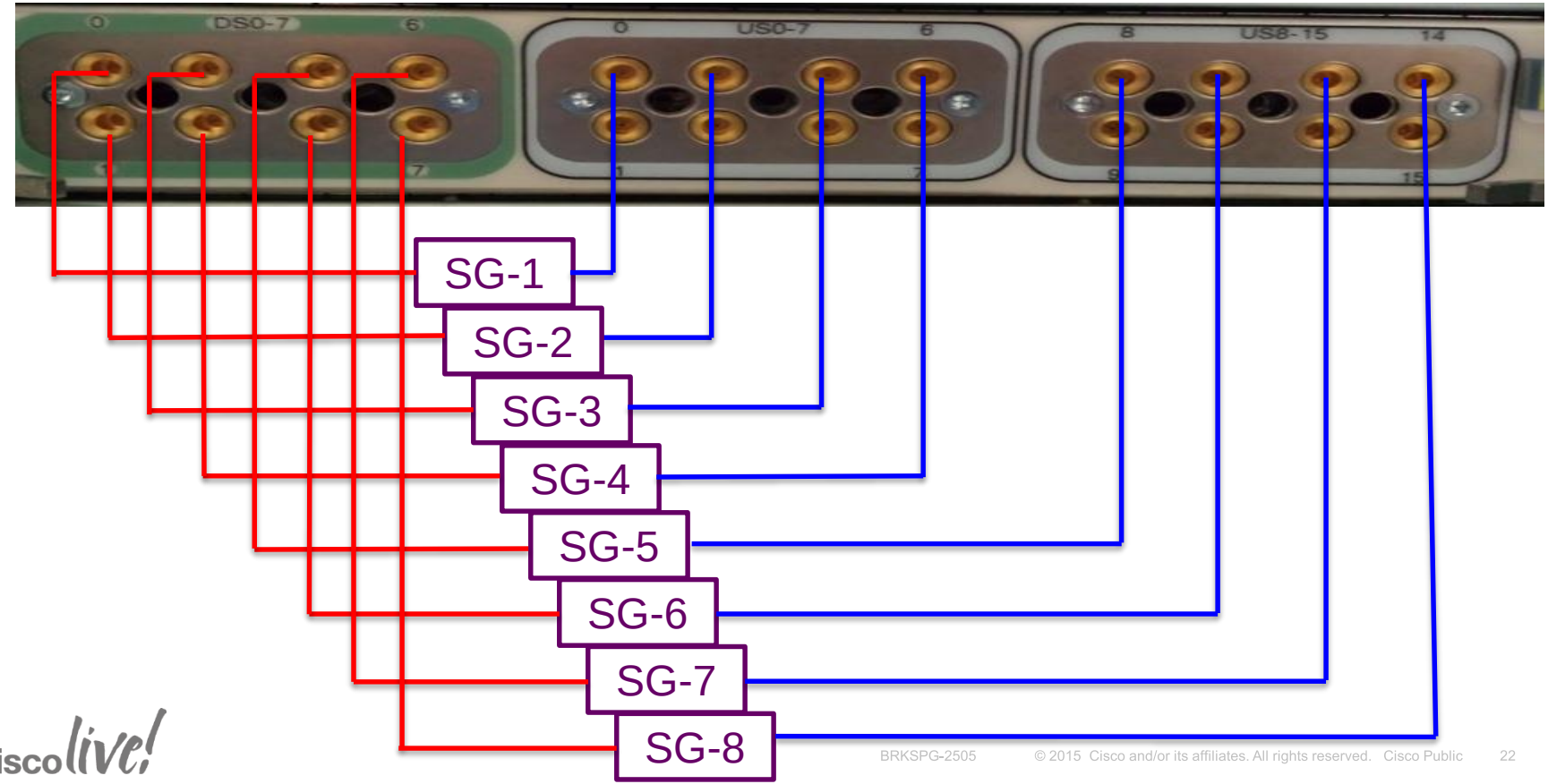


Rear
RF LC PIC
Slot 3

SG#1

SG#8

cBR-8 Line Card Wiring Example 1:1



Whole Chassis – 1:2 Combining

SG 1-8

SG 9-16

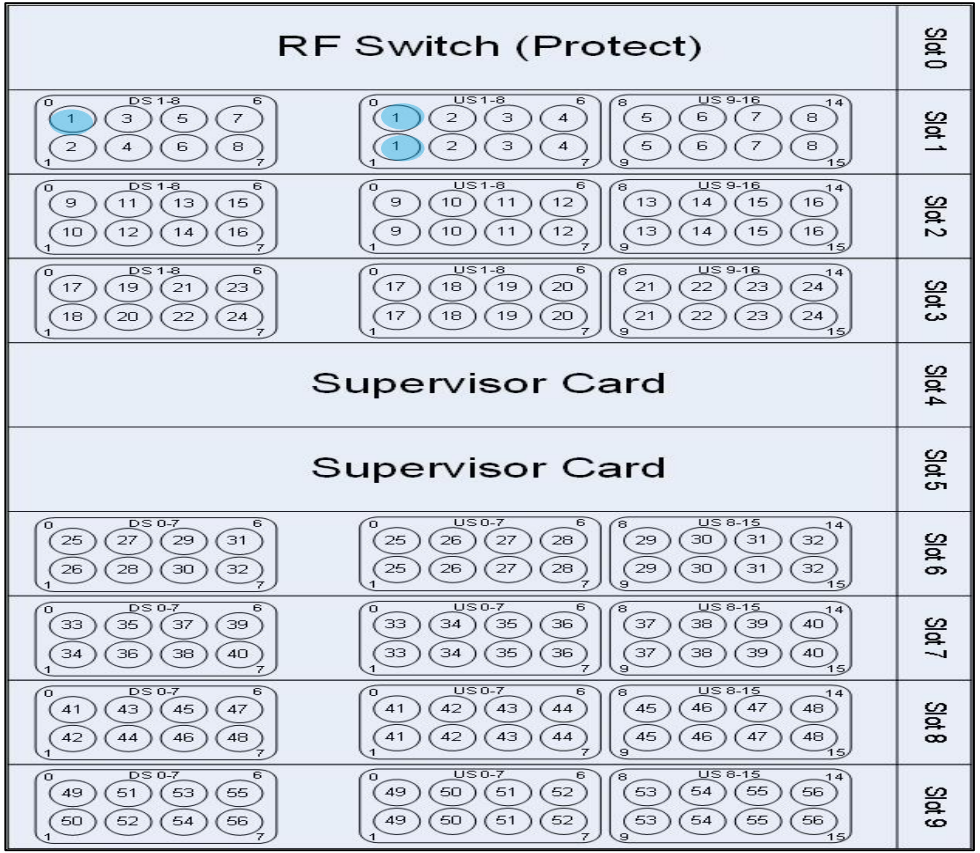
SG 17-24

SG 25-32

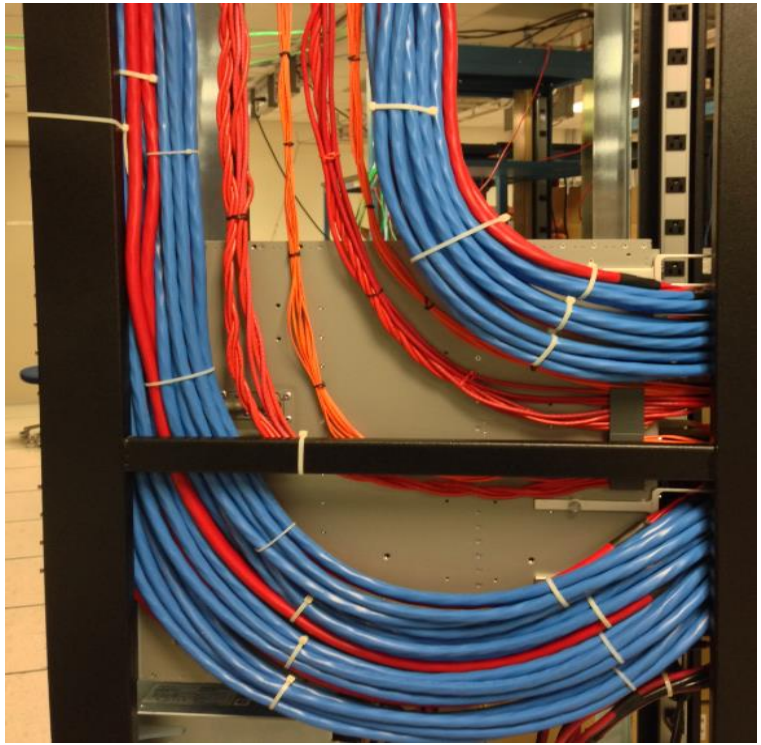
SG 33-40

SG 41-48

SG 49-56



Wiring Illustrations



Side View

Rear View

Compare/Contrast to uBR10012

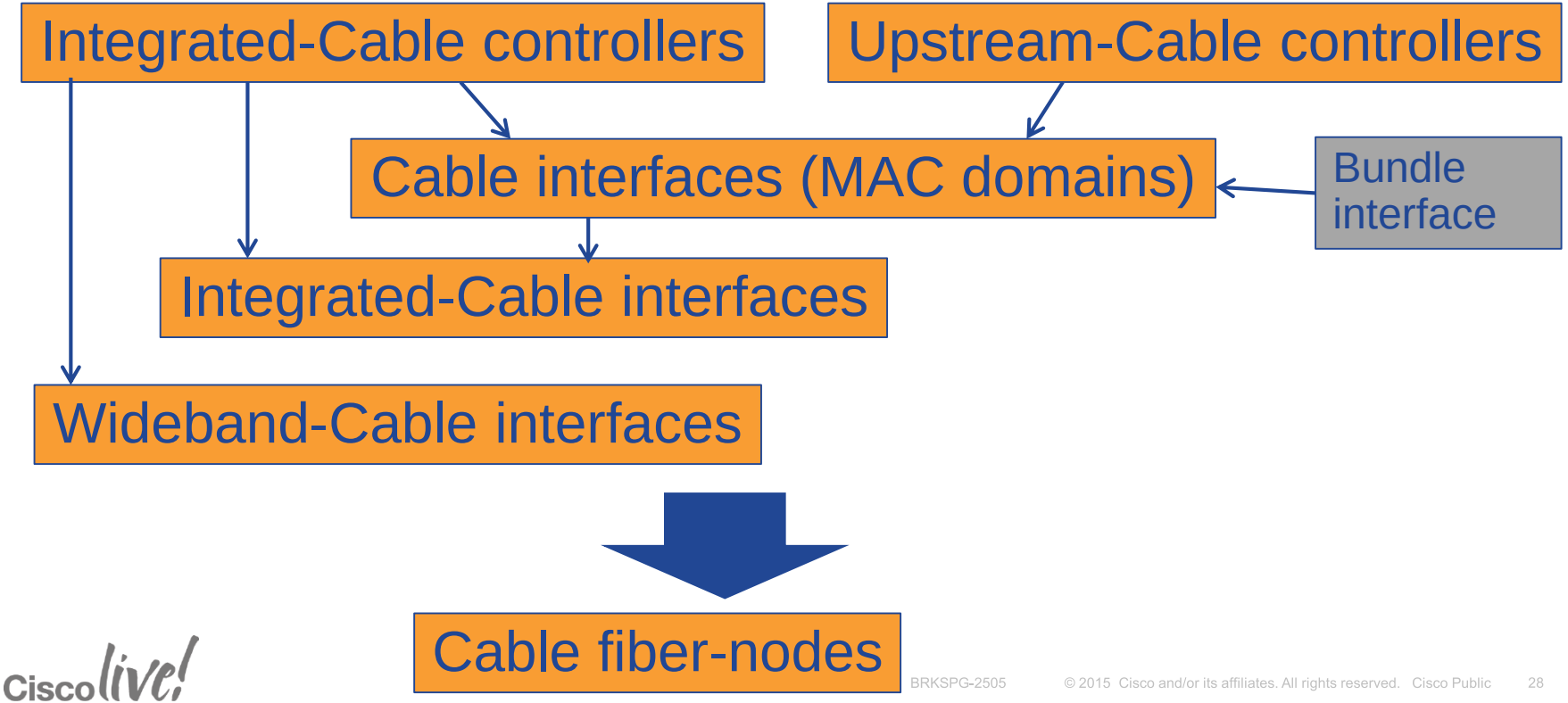
	uBR10012 (w/ 3G60)	cBR-8
Chassis size	18 RU	13 RU
Total DOCSIS Solution RUs	**~35 RU (M-CMTS)**	**13 RU (I-CCAP)**
# of Cable LCs	8	8
Total # DS Channels	**1,728 (w/ 6G SPA)**	**6,144 (5,376 w/ HA)**
Average # DS Chs/port	48 (RFGW-10 w/ DS-384)	96
Total # US Channels	480	768 (512 @ R0)
Average # US Chs/port	3	6 (4 @ R0)
Total # SGs	varies (28-54 typical)	64 (56 w/ HA)
Line card HA	**Requires external RF switch**	**Integrated (mid-plane design)**
Backhaul Capacity	4 10GEs per PRE-5	8 10GEs per Sup PIC
Card Connectivity	**Directly on LCs**	**Separate PICs used**
Power Connectivity	**Directly to PEMs**	**To FPIM, not to modules**
Image size	~95 MB (SCI1)	~700 MB (R0)

Basic Configuration & Troubleshooting

Software Notes

- Linux kernel based operating system
- Runs IOS-XE which leverages IOS
- Traditional IOS runs as a daemon (IOSd)
- **Same look and feel as IOS enabling easy migration**
  - **Majority of configuration and show CLIs are the same**
- HW interfaces implemented as Linux level drivers
- Functionality split across processes – IOSd, US scheduler, Chassis Management, Video, Video Encryption
- **Process modularity allows for hitless recover, restartability and patchability**

Cable Configuration Flowchart



Integrated-Cable Controller

```
controller Integrated-Cable 3/0/0
 max-carrier 32
 base-channel-power 42
 freq-profile 0
 rf-chan 0 23
  type DOCSIS
  frequency 591000000
  rf-output NORMAL
  power-adjust 0
  docsis-channel-id 1
  qam-profile 1
```

- 4 Frequency Profiles created by default[1]
  0 (Annex B/Low), 1 (Annex B/High),
  2 (Annex A/Low), 3 (Annex A/High)

- 4 QAM Profiles created by default
  0 (Annex B/64 QAM), 1 (Annex B/256 QAM)
  2 (Annex A/64 QAM), 3 (Annex A/256 QAM)

- max-carrier can be set up to 128; base-channel-power will adjust accordingly

- Changes to freq-profile or max-carrier requires RF channels to be in shutdown state

[1] Frequency Profiles only required for initial release of DS PHY.

Channel Power and Max-Carrier

Max-Carrier	Default Power (dBmV)	Power Range (dBmV)
8	49	41-49
16	45	37-45
24	43	35-43
32	42	34-42
48	39	31-39
64	38	30-38

- "`no base-channel-power`" will change the power level to the "Default Power"
- If max-carrier is changed but current power level is within the the new "power range" the base-channel-power will not be modified.

Upstream-Cable Controller

```
controller Upstream-Cable 3/0/0
 us-channel 0 frequency 17600000
 us-channel 0 channel-width 6400000 6400000
 us-channel 0 docsis-mode atdma
 us-channel 0 minislot-size 1
 us-channel 0 modulation-profile 224
 us-channel 0 equalization-coefficient
 no us-channel 0 shutdown
```

```
 …
 us-channel 3 frequency 37500000
 us-channel 3 channel-width 6400000 6400000
 us-channel 3 docsis-mode atdma
 us-channel 3 minislot-size 1
 us-channel 3 modulation-profile 224
 us-channel 3 equalization-coefficient
 no us-channel 3 shutdown
!
```

- Starting in R1 release maximum of 12 channels per pair with a default of 6 per connector.
- In R0 only up to 8 channels per pair of connectors can be configured.

Cable Interface

```
interface Cable3/0/0
 downstream Integrated-Cable 3/0/0 rf-channel 0
 downstream Integrated-Cable 3/0/0 rf-channel 4
 upstream 0 Upstream-Cable 3/0/0 rf-channel 0
 …
 upstream 3 Upstream-Cable 3/0/0 rf-channel 3
 cable upstream bonding-group 1
  upstream 0
  upstream 1
  …
 cable bundle 1
 cable dynamic-secret reject nocrypt
 cable privacy bpi-plus-policy total-enforcement
```

- Up to 16 MAC domains/cable interfaces per card
- By default a MAC domain contains ZERO channels
- Maximum of 32 primary channels per MAC domain
- MAC domain and DS/US channels must be of the same slot

Integrated-Cable and Wideband-Cable Interfaces

```
interface Integrated-Cable3/0/0:0
 cable bundle 1
 cable rf-bandwidth-percent 10
!
interface Wideband-Cable3/0/0:0
 cable bundle 1
 cable rf-channel channel-list 0-7 bandwidth-percent 1
!
```

IC numbering is a static mapping to IC controller and RF channel

Bundle inherited from MAC domain

Up to 64 WB interfaces per controller (512 WB interfaces max per card)

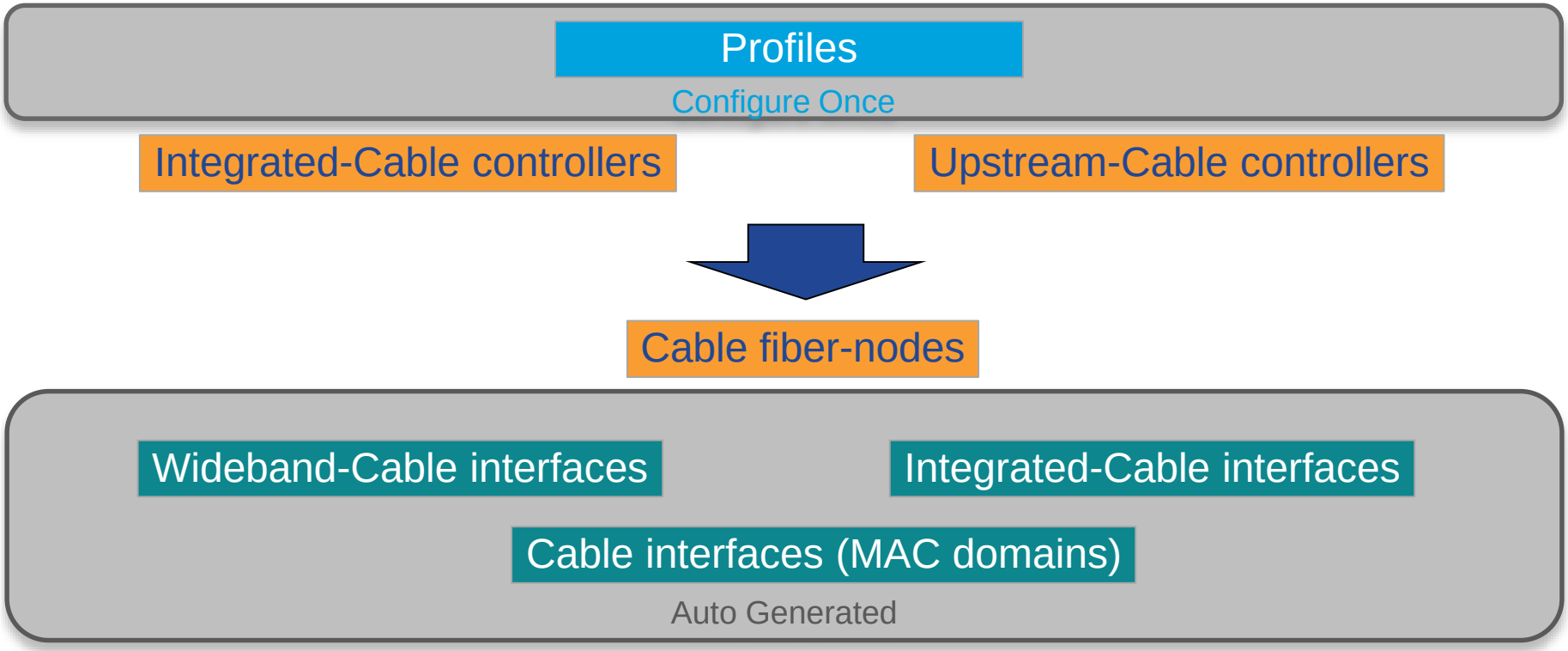
Multiple channels can now be defined with a single line of configuration

Fiber-node

```
cable fiber-node 1
 downstream Integrated-Cable 3/0/0
 upstream Upstream-Cable 3/0/0
!
```

- Up to 512 fiber nodes per chassis
- No longer need rf-channel set with downstream controller configuration (all DS channels associated)
- Upstream configuration changes to refer to controller (all US channels associated)

Configuration Flowchart - Simplified



Platform Related Show Commands

- **show inventory** - Displays info for each card, PIC, power supply, and fan module. For the cable LCs also shows individual PHY modules
- **show platform {[diag] [hardware] [packet-trace] [software]}** – Many valuable options with this CLI to get various info such as HW and SW component status & uptimes, sub-component firmware versions, internal connection status, hardware & software feature information, packet tracing, and much more.
- **show hw-module …** - To verify FPD images on PICs
- **show process cpu [platform], show process memory [platform]** – Without the platform option only information related to the IOS daemon is displayed

Power & Fan CLI Overview

- **show diag chassis eeprom detail** - shows detailed factory information
- **show environment location P** - shows temperature/voltage/current info
- **show environment power** - shows the current power usage
- **show platform hardware slot P<slot> mcu status** - shows power controller status or the current fan speed
- **show platform hardware slot P<slot> psoc <0-1> {version | status}** - shows fan controller version / internal status

Show Controllers (Downstream)

```
#show controllers integrated-Cable 3/0/0 ?
  acfe                Show contrller acfe
  all                 Show all M-CMTS information
  association         Show interface association info
  bandwidth           Show bandwidth of WB/RF channels
  counter             Show channel counters
  mapping             Show mapping of WB/RF channels
  rf-channel          Show rf channels
  rf-port             Show rf port
  wideband-channel    Show wideband channels
```

New option, not on the uBR10K

Show Controllers (Downstream)

```
#show controllers integrated-Cable 3/0/0 rf-channel 0-23

Chan State Admin Frequency  Type   Annex Mod  srate Interleaver  dcid  power  output
 0    UP    UP   591000000 DOCSIS  B    256   5361  I32-J4       1    42     NORMAL
 1    UP    UP   597000000 DOCSIS  B    256   5361  I32-J4       2    42     NORMAL
 2    UP    UP   603000000 DOCSIS  B    256   5361  I32-J4       3    42     NORMAL
 3    UP    UP   609000000 DOCSIS  B    256   5361  I32-J4       4    42     NORMAL
 4    UP    UP   615000000 DOCSIS  B    256   5361  I32-J4       5    42     NORMAL
 5    UP    UP   621000000 DOCSIS  B    256   5361  I32-J4       6    42     NORMAL
 6    UP    UP   627000000 DOCSIS  B    256   5361  I32-J4       7    42     NORMAL
 7    UP    UP   633000000 DOCSIS  B    256   5361  I32-J4       8    42     NORMAL
 8    UP    UP   639000000 DOCSIS  B    256   5361  I32-J4       9    42     NORMAL
```

Show Cable Mac-domain

```
#show cable mac-domain cable 3/0/0 ?
  cgd-associations           CGD Downstream Association
  downstream-service-group   MAC Domain service groups
  dsbg-associations          MAC domain's DSBG associations
  forwarding                 Forwarding Statistics
  mdd                        MDD of all Primary Channels in MAC domain
  rcc                        Associated RCCs
  upstream-service-group     MAC Domain service groups
```

New option, not on the uBR10K

Collecting Troubleshooting Information

- Supervisor crash files are saved in the /bootflash/ directory
- Cable line card crash files are saved in the /harddisk/ directory
- Core files for the Active SUP and all line cards are saved in the /harddisk/core/ directory of the Active SUP
- Core files for the Standby SUP are saved in it's /harddisk/core/ directory
- Tracelogs are saved in the /harddisk/tracelogs/ directory
- On Board Fault Logging (OBFL) information is saved in the /harddisk/bay<x>-obfl/ directory where "x" is the card slot number
- Linecard console access: **request platform software console attach <slot #>**

Software Overview

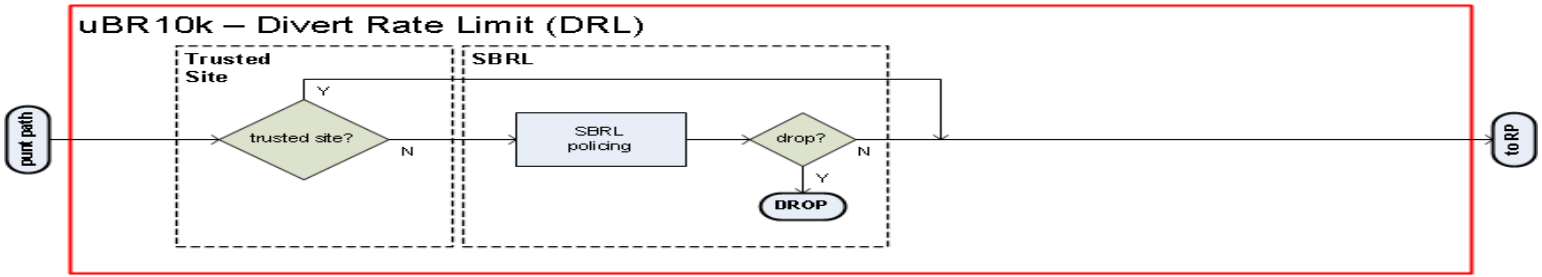
Comparing to the uBR10K

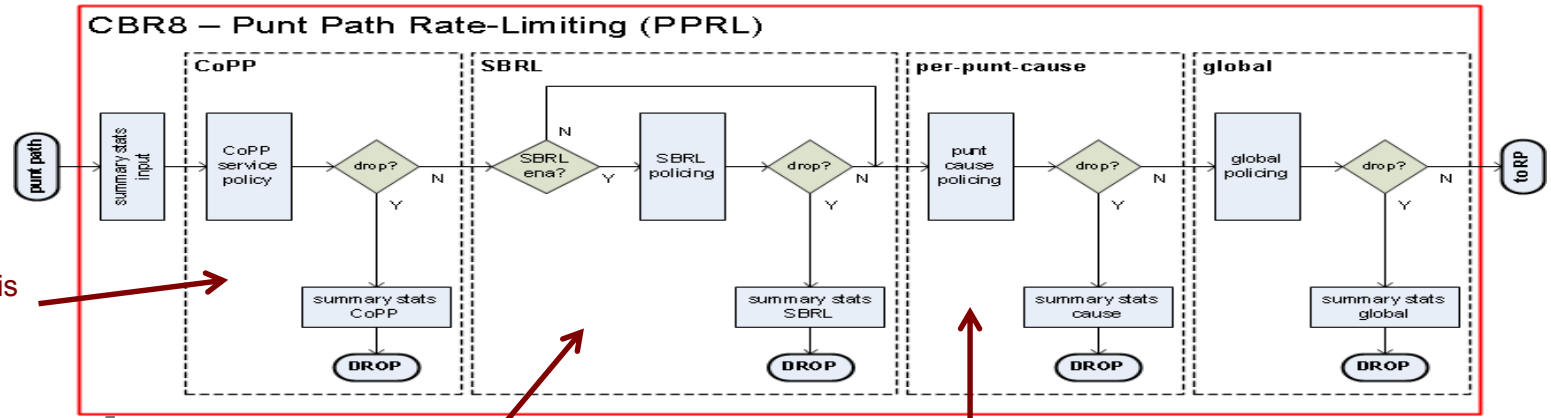
- **Initial release has overall feature parity with SCH (with exceptions)**
- cBR-8 supports 20,000 multicast sessions compared to 5,000 on the uBR10K
- Generally SAMIS template can reach 500+ records/sec compared to 50 records/sec on the uBR10k
- Legacy Cisco load balancing no longer supported; only DOCSIS standards based load balancing
- Traditional Netflow commands supported by uBR10k are not supported on cBR-8; supports new Flexible Netflow commands (as with ASR1K)
- **cable mtc-mode** & **cable def-phy-burst 0** now default
- Bulltet Failure Detection: Verification of DS and US signals between RF Lincecard and RF PIC. Not available on UBR10K

Improved DDOS Protection

- The uBR10K Divert Rate Limiting (DRL) feature used to protect against high CPU from DOS attacks is greatly enhanced on the cBR-8; now referred to as Punt Path Rate Limiting (PPRL)
- Includes four levels of protection via Control Plane Policing (CoPP), Source Based Rate Limiting (SBRL), per-punt cause policing, AND global policing (not user configurable)
- uBR10K DRL only has SBRL and limited per-punt cause policing
- PPRL's use of CoPP and ACLs enables the configuration of any number of trusted (and non-trusted) sites
- SBRL uses an enhanced statistics algorithm and has the ability to dynamically identify an attack and place the attacker in a quarantine state

UBR10K vs. cBR-8



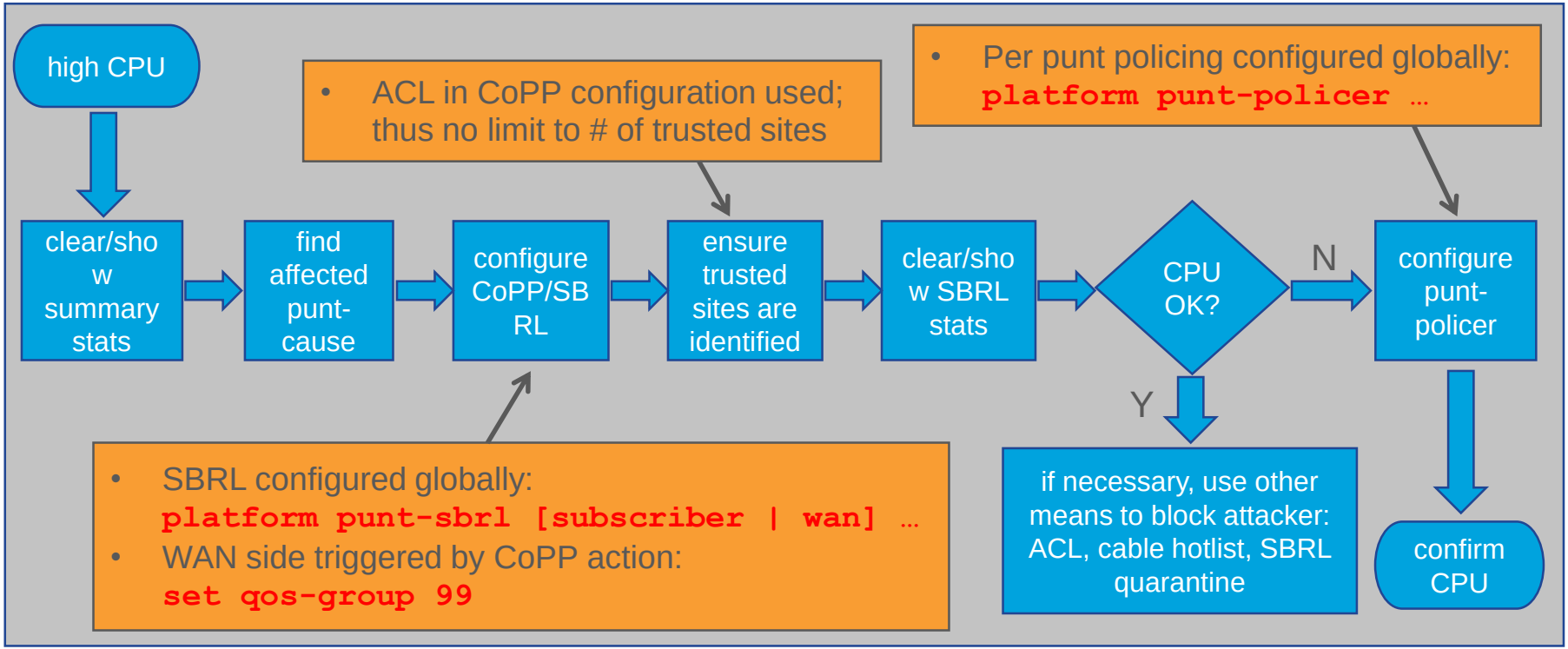


Define via ACL's who is trusted and who not

Drop packets based on the rate of the source IP's

Drop packets in an aggregated fashion based in the "reason" (punt cause) the packet was sent to the RP.

(D)DoS Attack Mitigation Plan



Summary Statistics

```
CBR# show platform hardware qfp active infrastructure punt summary [clear] [threshold <T>]

CBR# show platform hardware qfp active infrastructure punt summary threshold 10
Punt Path Rate-Limiting summary statistics
Subscriber-side
ID   punt cause                CPP punt    CoPP drop    SBRL drop    per-cause       global
-------------------------------------------------------------------------------------------
017  IPv6 Bad hop limit              22            0            0            0            0
050  IPv6 packet                     13            0            0            0            0
080  CM not online                  335            0            0            0            0

WAN-side
ID   punt cause                CPP punt    CoPP drop    SBRL drop    per-cause       global
-------------------------------------------------------------------------------------------
017 IPv6 Bad hop limit              471            0            0            0            0
018 IPV6 Hop-by-hop Options       29901            0            0         1430            0
024 Glean adjacency              450911            0       308912            0            0
025 Mcast PIM signaling              19            0            0            0            0
050 IPv6 packet                      11            0            0            0            0
```

Total number of pkts punted from the FP to the RP due "L2 Adjacency table is incomplete"

High number of Gleans indicative of subnet scanning

- Clear & show the summary-stats to determine how to configure SBRL or punt-policer.

Feature Comparison

Feature	UBR10012	cBR-8	Comments
DMIC	Yes	Yes	On cBR-8 only one feature can be activated at the time
Shared Secret	Yes	Yes	
TFTP Enforce	Yes	No	Functionality included in DMIC already
D3.0	Yes	Yes	UBR10K 32 channels since SCJ.
D3.1	No	Yes	To be supported in Jul 2016
DOCSIS LB	Yes	Yes	UBR10K: Since SCI supports Dynamic LB utilization. cBR-8: LB based only CM count
IPDR	Yes	Yes	UBR10K: IPDR ACL added in SCI2 cBR-8: IPDR ACL since R0.
PCMM Multicast	Yes	Yes	cBR-8: Supported since R2
PCMM (Unicast)	Yes	Yes	
BPI+	Yes	Yes	
DDOS Protection	Yes	Yes	UBR10K: SBRL+ Per Punt Cause cBR-8: CoPP+: SBRL+ Per Punt Cause
Dynamic Modulation Profile	Yes	Yes	

Feature Comparison (Cont'd)

Feature	UBR10012	cBR-8	Comments
ACFE	Yes	Yes	cBR-8: Full parity functionality in R2
mVPM + PCMM Multicast concurrency	Yes	No	cBR-8: to be supported in R3
RFOG	Yes	Yes	cBR-8: in R2 release including suport per MAC domain.
Packet –Trace	No	Yes	
Bullet Failure Detection	No	Yes	
LACP	Yes	Yes	UBR10K: Supported since SCJ
Smart Licensing	No	Yes	
ISSU	Yes	Yes	cBR-8: Full ISSU since R2
SW Patching	No	Yes	

Cisco Smart Licensing

Smart Licensing is a new licensing model based on a trust but verify model

Limited View
Customers do not know what they own.

PAK Registration
Manually register each device. Unlock with license key.

Device Specific
Licenses specific to only one device.

Locked
You cannot use more than you paid for.

Complete View
Software, services, devices in one easy to use portal.

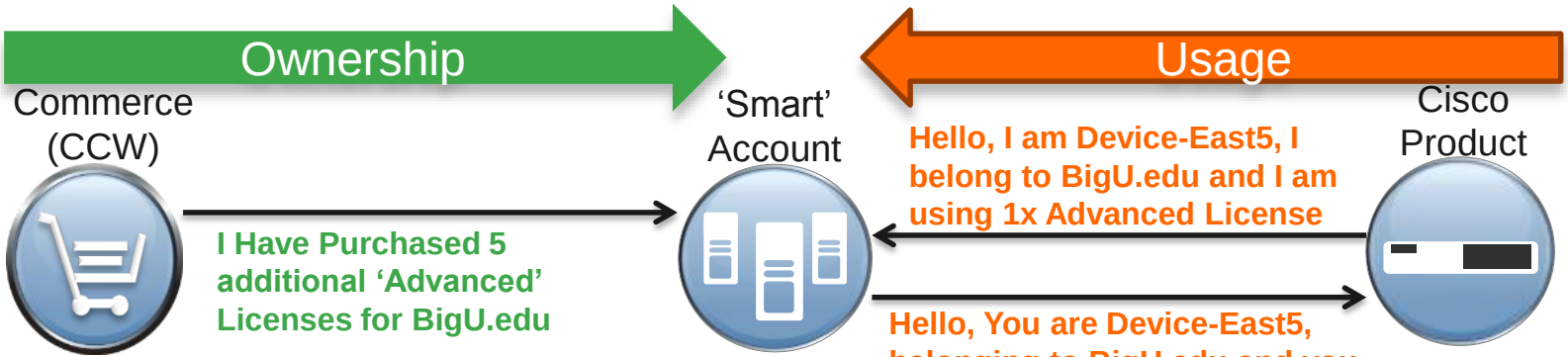
Easy Registration
No PAKs. Easy activation. Device is ready to use.

Company Specific
Flexible licensing, use across devices.

Unlocked
Add users and licenses as needed.

What is Smart Licensing

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.



Customer.MSO	
I Own:	10 + 5
I am Using:	10 + 1

Balancing Simplicity with Security

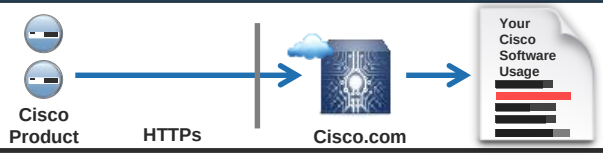
Ease of use

Security Policy

Options

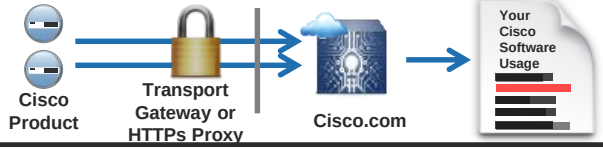
1 Direct cloud access

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



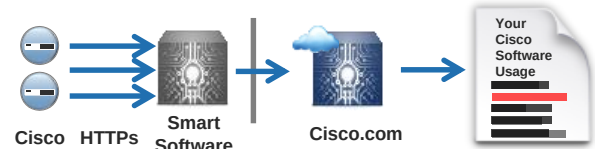
2 Direct cloud access through an HTTPs proxy

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).



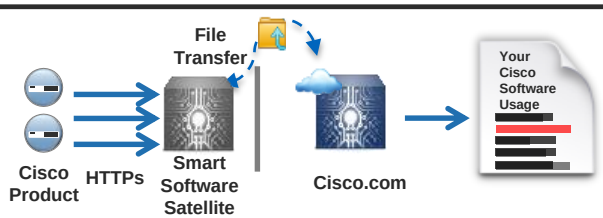
3 Mediated access through Smart Software Satellite, an on-premises collector – connected

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 Licensing on the cBR-8

- Smart Licensing is enabled by default on the cBR-8
- Legacy node locking licensing NOT supported
- Initial licensed parameters include DOCSIS DS & US channels and Supervisor 10GE ports
- Licensed functionality enabled by “no shutting” an interface or RF channel
- Chassis based licenses; no licenses for protect card RF channels
- Future licensed functionality includes LCHA, video channels, QAM replication, video encryption, and D3.1 DS & US channels
- Entitlements maintained on the Cisco License Portal

Licensing States

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

cBR-8 Licensing Procedure

- Setup a Cisco Smart Account (requires CCO ID) on Cisco Software Workspace
- Optionally create virtual accounts to organize licenses
- All licenses assigned to a customer and Smart Account when purchased
- Registration tokens generated on license portal that must be configured on the product (i.e. cBR-8)
- Transfer between license pools supported

cBR-8 IOS-XE Boot Overview

- Two boot mode options available
  - Single/consolidated image binary boot
  - Sub-package mode boot
- Single binary images are published on CCO
- Single image consists of 15 sub-packages which are extracted during the boot process
- Package mode boot require the CCO published image to be extracted into sub-packages and stored on a file system on the cBR8

Pros & Cons of Sub-Package Mode

- In sub-package mode individual sub-packages can be upgraded (i.e. patched) independently
- Router boots faster when operating in sub-package mode.
- Network boot not possible in sub-package mode
- Operationally easier to manage in single consolidated package mode

Sub-Package Extraction

- Load the image to be extracted in a directory on a cBR-8 file system (**`mkdir bootflash:<dir name>`**)
- Extract using **`request platform software package expand`**
- Along with sub-package extraction a **package.conf** file is created in the directory
- Boot commands point to the **package.conf** file instead of the .bin file

```
cBR-8#request platform software package expand file bootflash:/CCO_R0/cbrsup-
universalk9.03.15.00.S.155-2.S-std.SPA.bin

Verifying parameters

Validating package type

Copying package files

SUCCESS: Finished expanding all-in-one software package.

cBR-8#
```

Sub-Package List

- cbrsup-cciomdsup
- cbrsup-clc-firmware
- cbrsup-clccontrol
- cbrsup-clcdocsis
- cbrsup-clcios
- cbrsup-clciosdb
- cbrsup-clcmipsbase
- cbrsup-clcvideo

- cbrsup-espx86base
- cbrsup-rp-firmware
- cbrsup-rpaccess
- cbrsup-rpbase
- cbrsup-rpcontrol
- cbrsup-rpios-universalk9
- cbrsup-rpvideo


- For Supervisor PIC
- For Cable LC


- For Supervisor FP
- For Supervisor RP

Software Patch

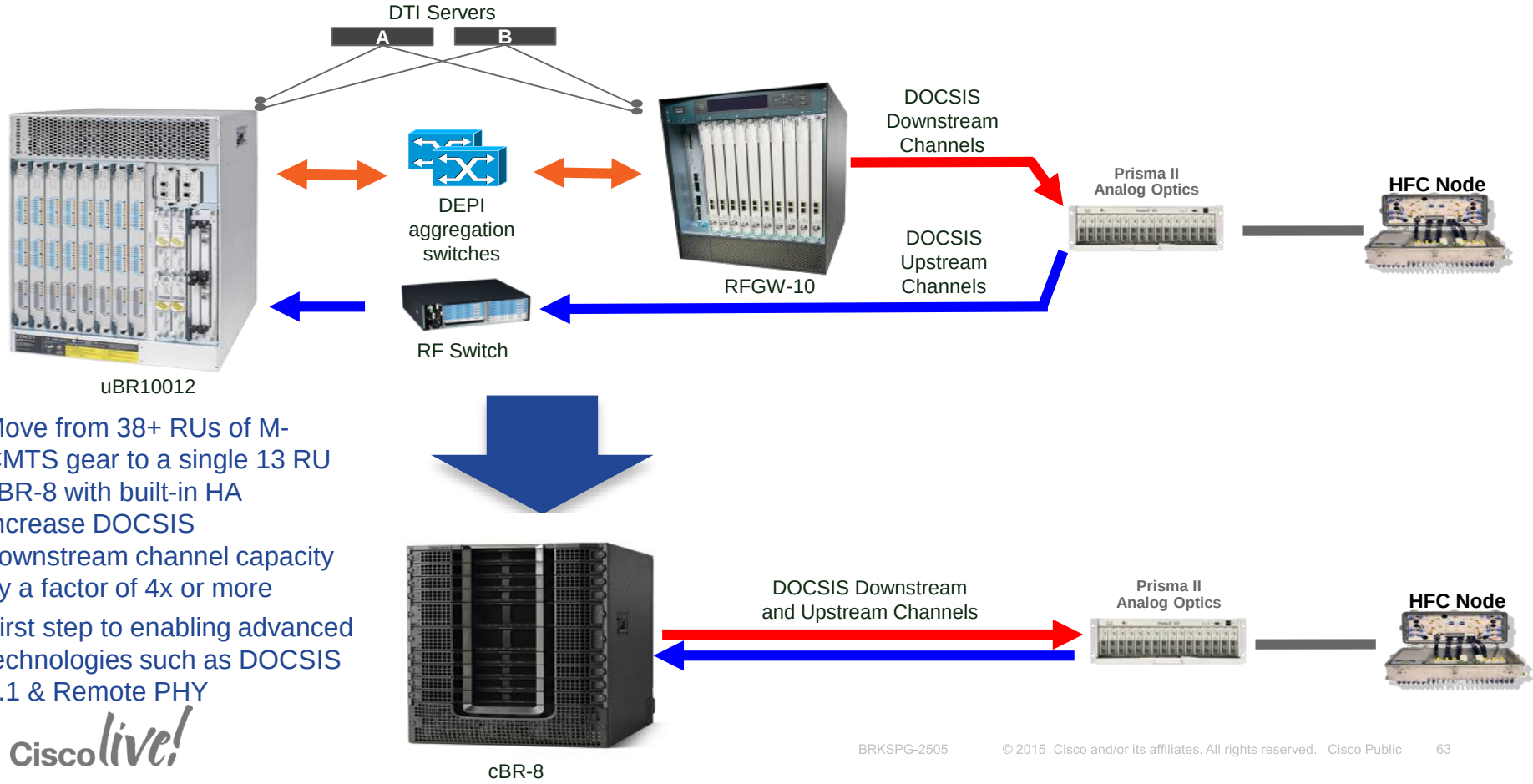
- SW patch will consist of one or more sub-packages and a .info file
- .info file will include
  - Version
  - List of sub-packages
  - Software version compatible with the patch
- Cumulative and non-cumulative patches will be available
  - Cumulative patch will include all the fixes
  - Non-cumulative patch will only include the latest fix(es) that are being released
  - (Availability will be on a case-by-case basis due to the potential dependencies)

Software Upgrade in Sub-Package Mode

- System MUST be booted in Sub-Package Mode
- Extracted sub-package stored in the file-system
- The **`request platform software package install`** command will update the system package.conf file to point to new version of the package
- Cable LC based package upgrades require reboot of all LCs (Process Restartability will eliminate this step)
- Supervisor based package requires a system reboot (Repeat for redundant SUP)

Migration & Deployment

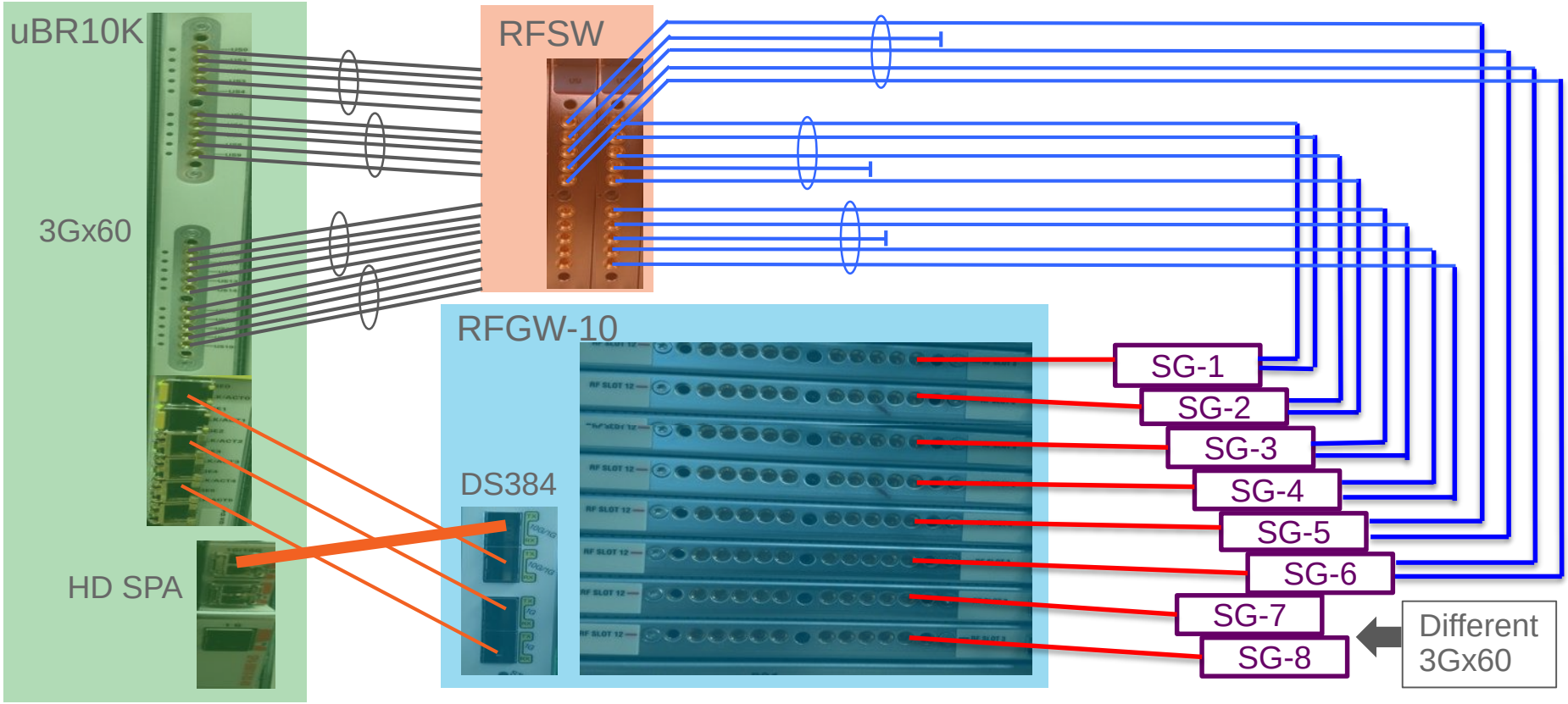
M-CMTS -> cBR-8 Migration



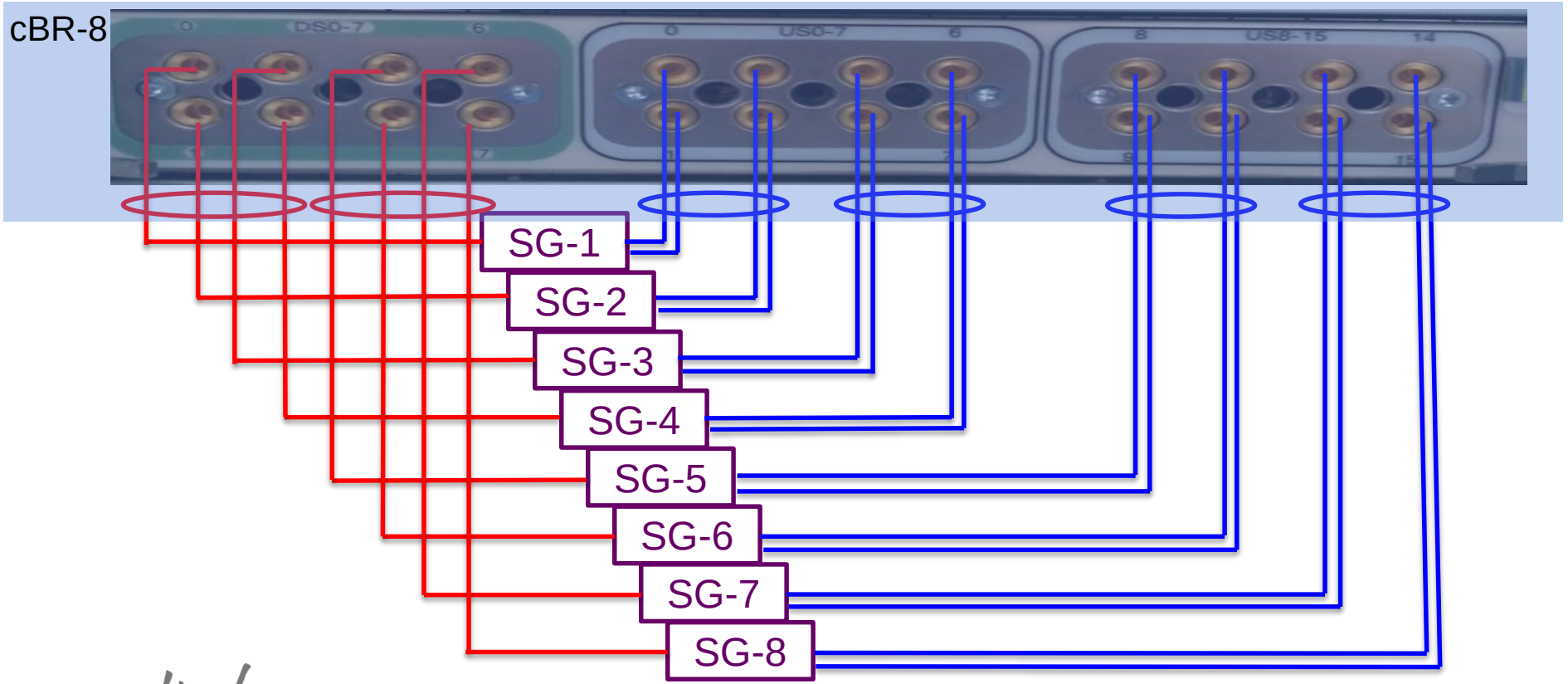
- Move from 38+ RUs of M-CMTS gear to a single 13 RU cBR-8 with built-in HA
- Increase DOCSIS downstream channel capacity by a factor of 4x or more
- First step to enabling advanced technologies such as DOCSIS 3.1 & Remote PHY

Cisco live!

Migration at the Line Card Level – 1:2 Combining



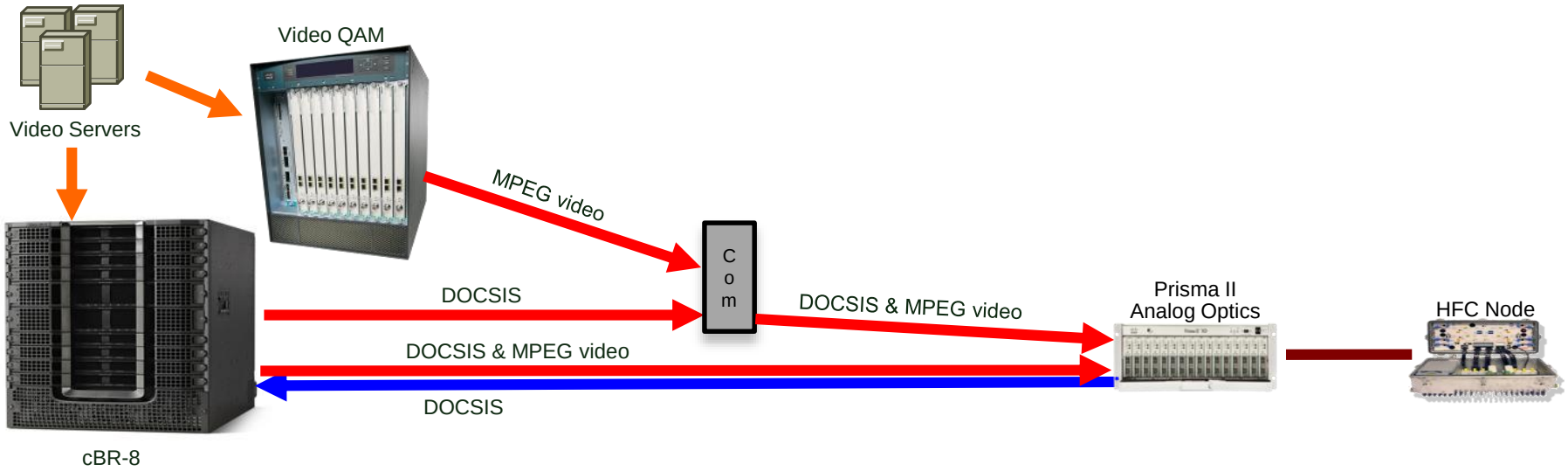
cBR-8 Line Card Wiring 1:2



Migration Points to Consider

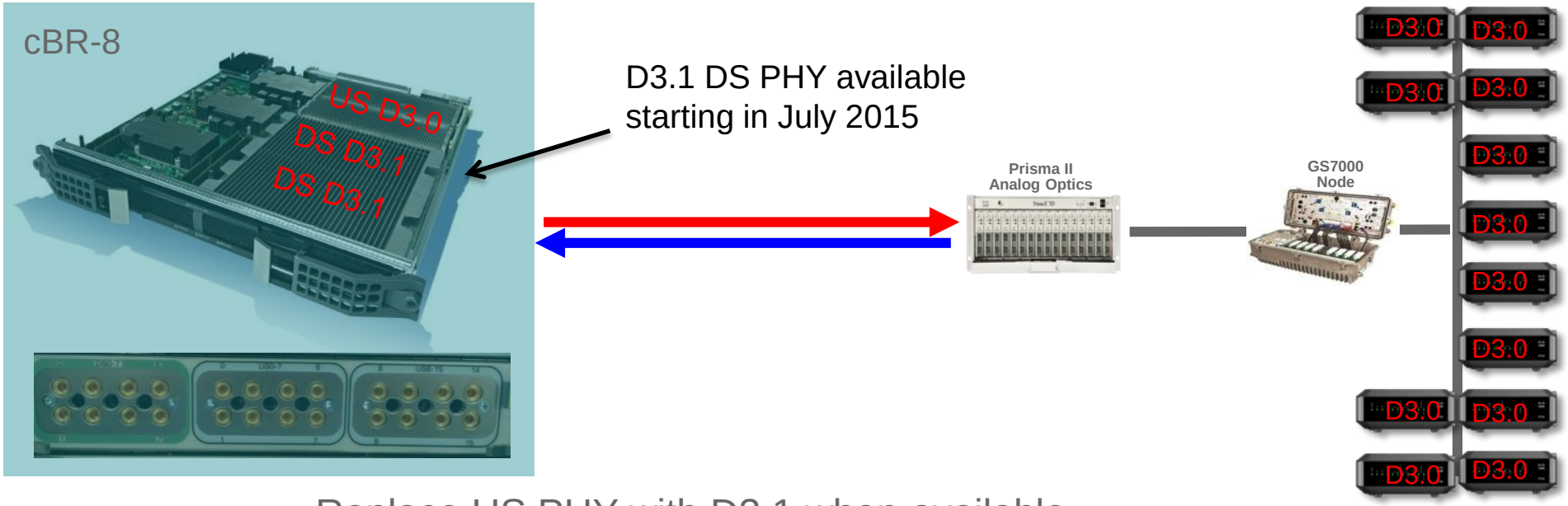
- Assume 56 Service Groups with the cBR-8; how many SGs per chassis on the old platform? Does it make sense to consolidate multiple boxes on a single cBR-8?
- As N+1 LCHA is integrated on the cBR-8 highly recommended to utilize; so could be migrating from non-LCHA system to LCHA system
- Likely will not be able to simply map on a card by card basis (i.e. one 3Gx60 to one cBR-8 CLC) due to differences in number of SGs and/or nodes supported per card. Better to take holistic approach.
- As the cBR-8 is an Integrated CCAP platform, no longer need DTI servers and DEPI aggregation switches/routers
- For the initial release (R0) the cBR-8 does NOT support video integration

Video Convergence Migration



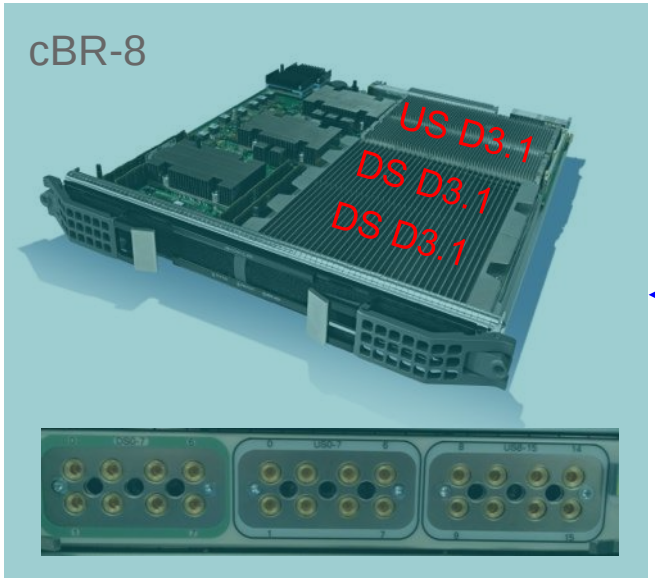
- By converging MPEG video onto the cBR-8 realize true CCAP savings
- No longer need separate video QAM; savings in combining

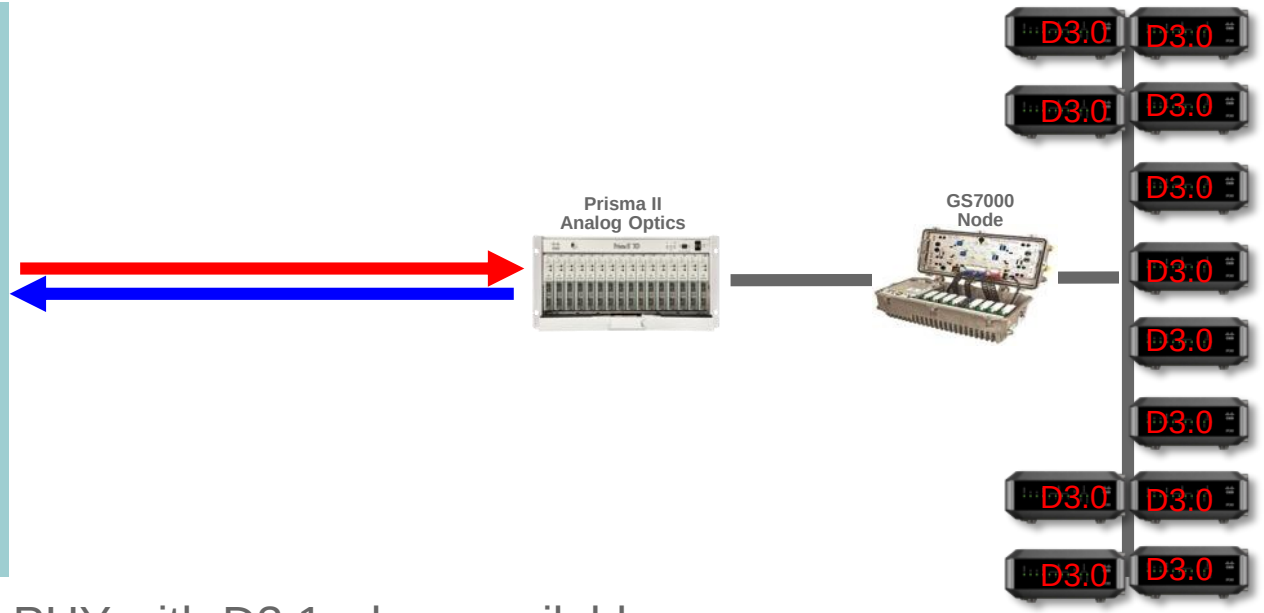
DOCSIS 3.1 Migration



- Replace US PHY with D3.1 when available

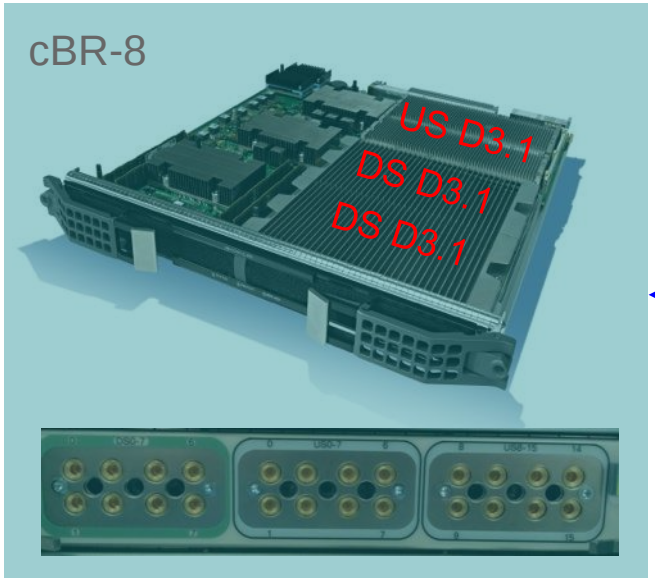
DOCSIS 3.1 Migration

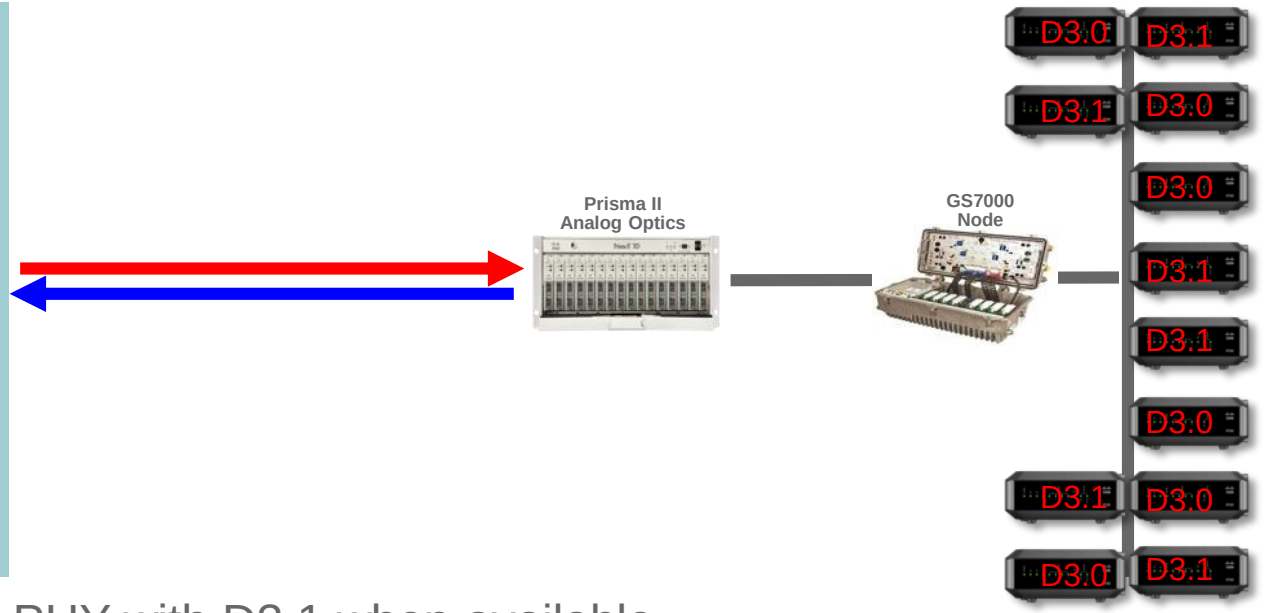




- Replace US PHY with D3.1 when available
- Upgrade inside & outside plant gear to support D3.1
- Get an install base of D3.1 modems

DOCSIS 3.1 Migration





- Replace US PHY with D3.1 when available
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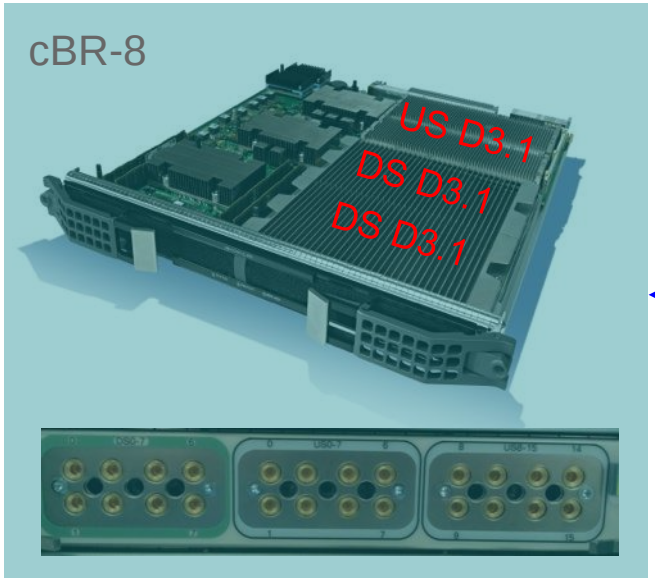
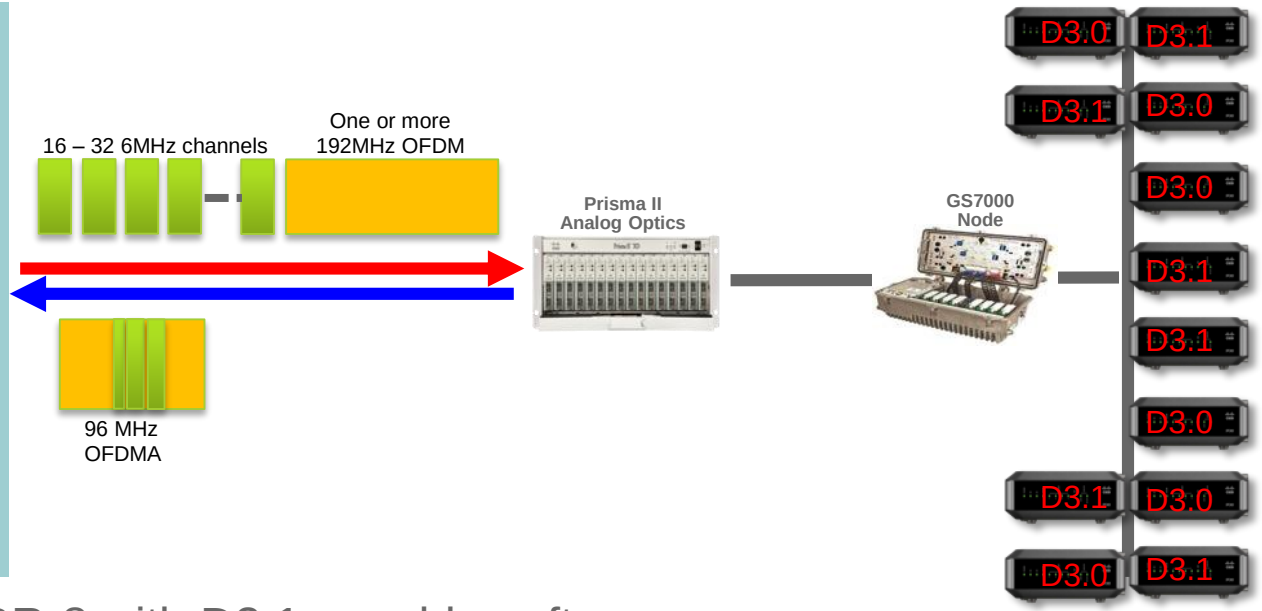
- Get an install base of D3.1 modems

DOCSIS 3.1 Migration





- Upgrade cBR-8 with D3.1 capable software
- Add OFDM channel(s) for D3.1 downstream
- Upstream OFDMA channel(s) can overlay ATDMA channels

Conclusion

Conclusion

- Over 6,000 downstream channels and 200 Gbps of switching capacity (scalable to 1.6 Tbps) in a compact 13 RU chassis
- Mid-plane design with built-in HA enabling “wire once” capability
- Same look and feel as IOS enabling easy migration for those familiar with 10k
- Simplified licensing model and resilient SW architecture with process modularity allowing for hitless recovery, patching & restartability
- Built with the future in mind with easy transitions to DOCSIS 3.1, video convergence, R-PHY architectures, & SDN

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Suggestions….

- WoS Service Provider:

  DOCSIS 3.1 Demo

- BreakOut Session

  Managing DOCSIS Capacity over HFC Networks.
  Jueves 3:15pm – Coba5

Thank you

TOMORROW starts here.

Useful Links

- cBR-8 Documentation
  - http://www.cisco.com/c/en/us/support/video/cbr-8-converged-broadband-router/model.html
- Smart Licensing Introduction
  - www.cisco.com/go/smartlicensing
- Smart Call Home Details
  - https://supportforums.cisco.com/community/4816/smart-call-home
- Transport Gateway Documentation
  - http://www.cisco.com/c/dam/en/us/td/docs/switches/lan/smart_call_home/user_guides/SCH_Ch4.pdf

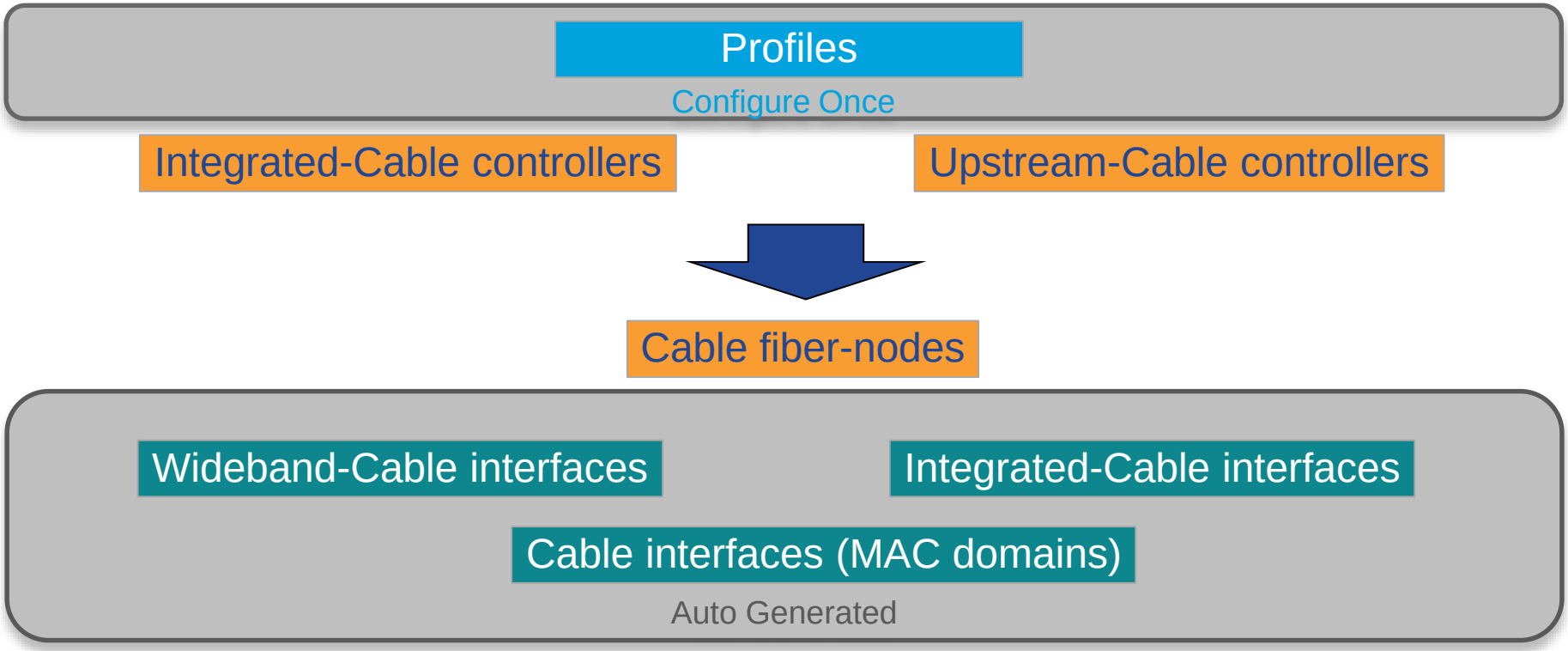
Demo #1 – Scale & HA

Scale System Details

- Fully loaded system with 56 Service Groups in 1:2 Topology
- 96 D3.0 DS channels per port
- 7 Active cBR-CCAP Cards
  - ~21.5 Gbps Downstream unicast traffic per card (96 QAMs per port * 8 Ports)
  - ~6 Gbps Downstream multicast traffic per card
  - ~2.8 Gbps Upstream traffic per card
  - ~2100 D3.0 CMs
- 16 TenGigiabit Backhaul connectivity
  - Dual SUP-PIC with Active-Active
  - 150.5 Gbps (ucast) + 6 Gbps (mcast) ingress
  - 19.6 Gbps egress

Demo #2 – Operation Simplification

Configuration Flowchart - Simplified



Demo #3 - Patching

Linecard Patch with Process Restart

- Single LC with 21.25 Gig of active upstream and downstream traffic
- ~200 Active CMs
- Patch – CLI output fix that only impacts the LC; cbrsup-clciosdb sub-package
- Applying and activating the patch on LC with process restart without LCHA event and/or an LC reset
- Multiple LCs can be upgraded in parallel without N+1 requirement
- No traffic loss nor service impact

On Board Tunner & Bullet Failure Detection

Using the Gemini On-board Tuner

- Each Gemini (DS PHY) has a built-in tuner/analyzer
- Its use is non-destructive.
- RF signal can be coupled back to the tuner. Enable it on a linecard console:
  `test cable dcm qam-res rftuner <module>  <port> <freq>`
- To check result:
  `test cable dcm qam-resource rftuner <module> <port> 1`

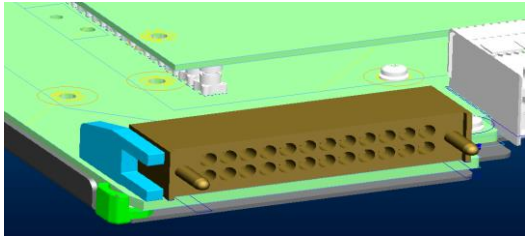
  Locked, and power should match configured
- Need to reset the analyzer after each use:
  `test cable dcm qam-resource rftuner <module> <port> 0`

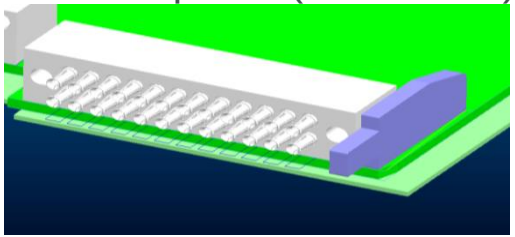
Example

```
Slot-3-0#test cable dcm qam-resource rftuner 0 0 591000000

-------------------------------------------------------

Module  0 RF tuner set to monitor port  0 freq 591000000 HZ:

-------------------------------------------------------

Slot-3-0#test cable dcm qam-resource rftuner 0 0 1

-------------------------------------------------------

Module of the read  0: addr   4724c0 words    9

       0        0     92fe      18c 60400000

      1e   200004        0        0

QAM is Locked, Power dBMv 39

RFMHex: BERPST=0,BERPRE=0,SNRMER=92fe,Power=18c

,OST=60400000, Locks=1e

LOCK Status, Nonzero means lock. Freq  2, SYM 4, MPEG 8, FEC 10

Power in One 10th dBMv 396, SNR 37, INTL 200004, I 32 J 4. Addr of RFMS Base 4724c0

RFM CFG: Base Addr=472400 Value c0000050 4e0095 168b7c00
```

Bullet Failure Detection (BFD) Motivation

- Need to troubleshoot US and DS RF connection issues on CBR8
  - DS & US PHY modules are working fine, but CM does not come online
  - Working CLC stop working after OIR of LC or PIC
- Possible cause: RF bullets break or are poorly connected
  - Between CLC and RF PIC, Between RF PIC and RF-Midplane (for failover)

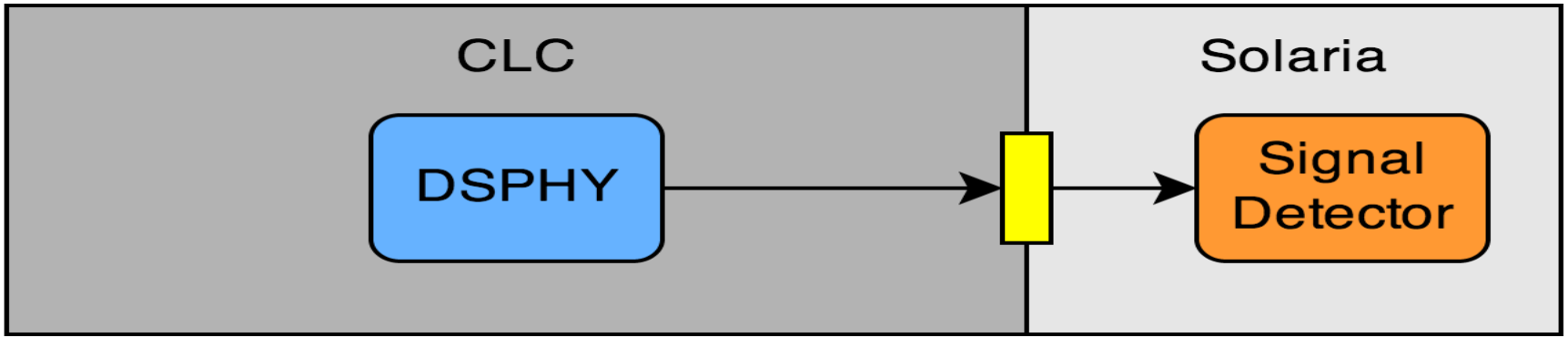




Solution: a new facility to check US/DS RF path (through/protect) using modulator/demodulator on RF PIC

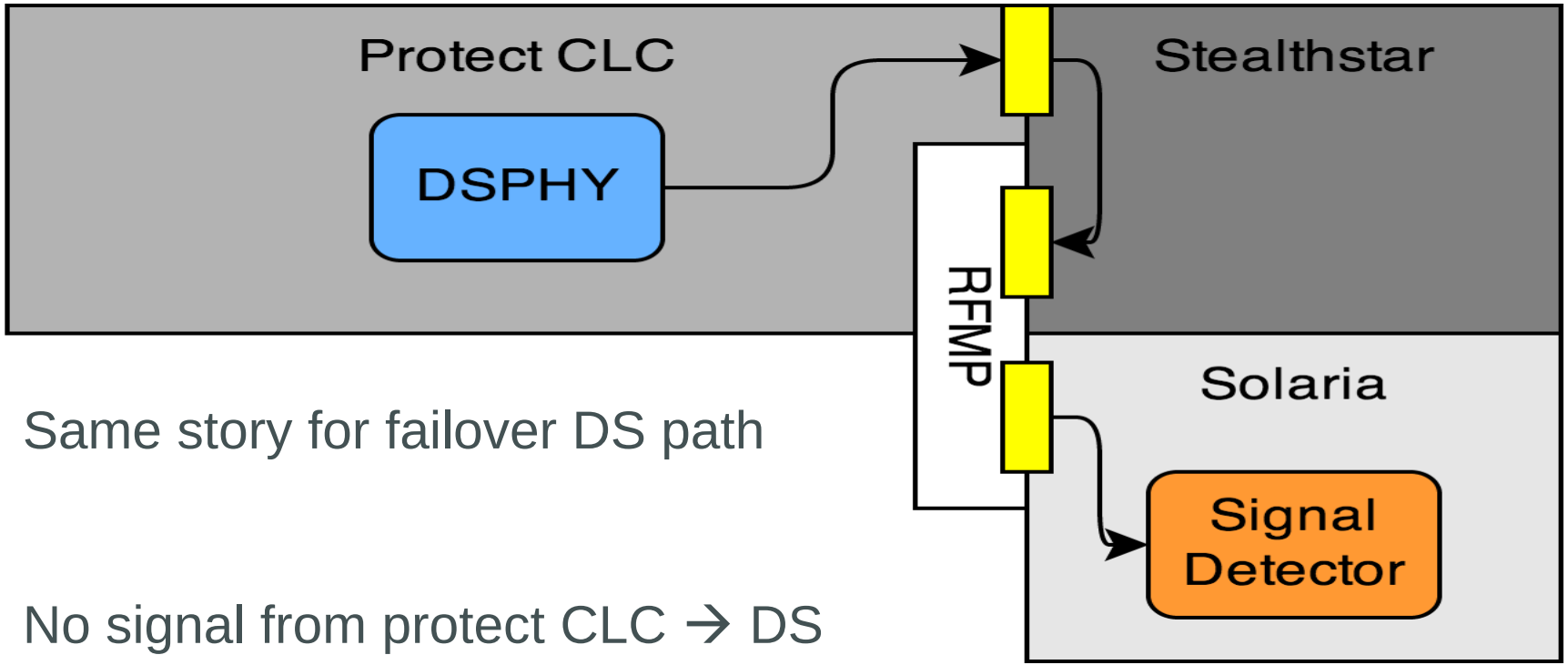
Note: this facility IS service impacting

How it works: DS Thru Path



- Solaria/RF PIC has a demodulator (one per port)
- Demodulator configured to receive a current DS QAM on a port
- If QAM is not seen by Solaria → DS path is broken somewhere

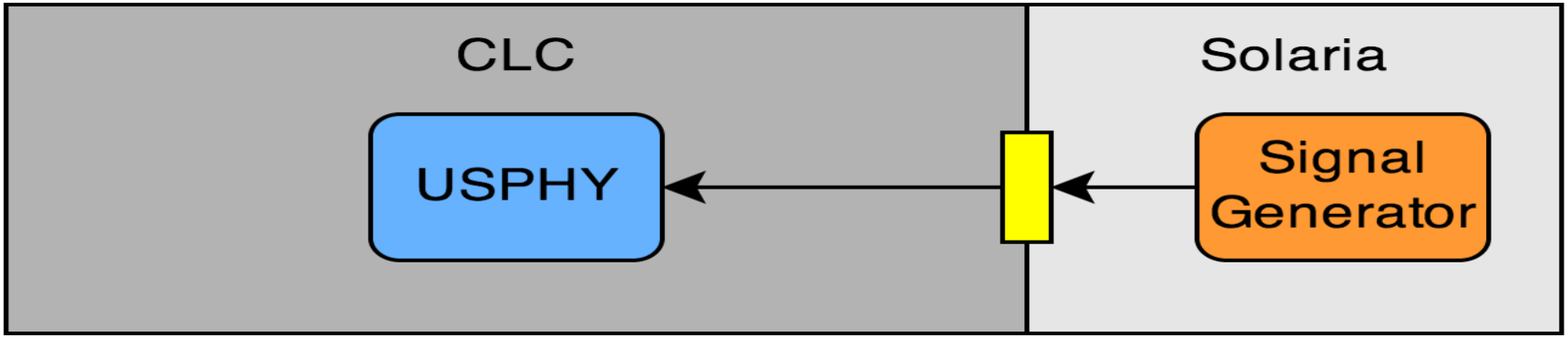
How it works: DS Protect Path



- Same story for failover DS path

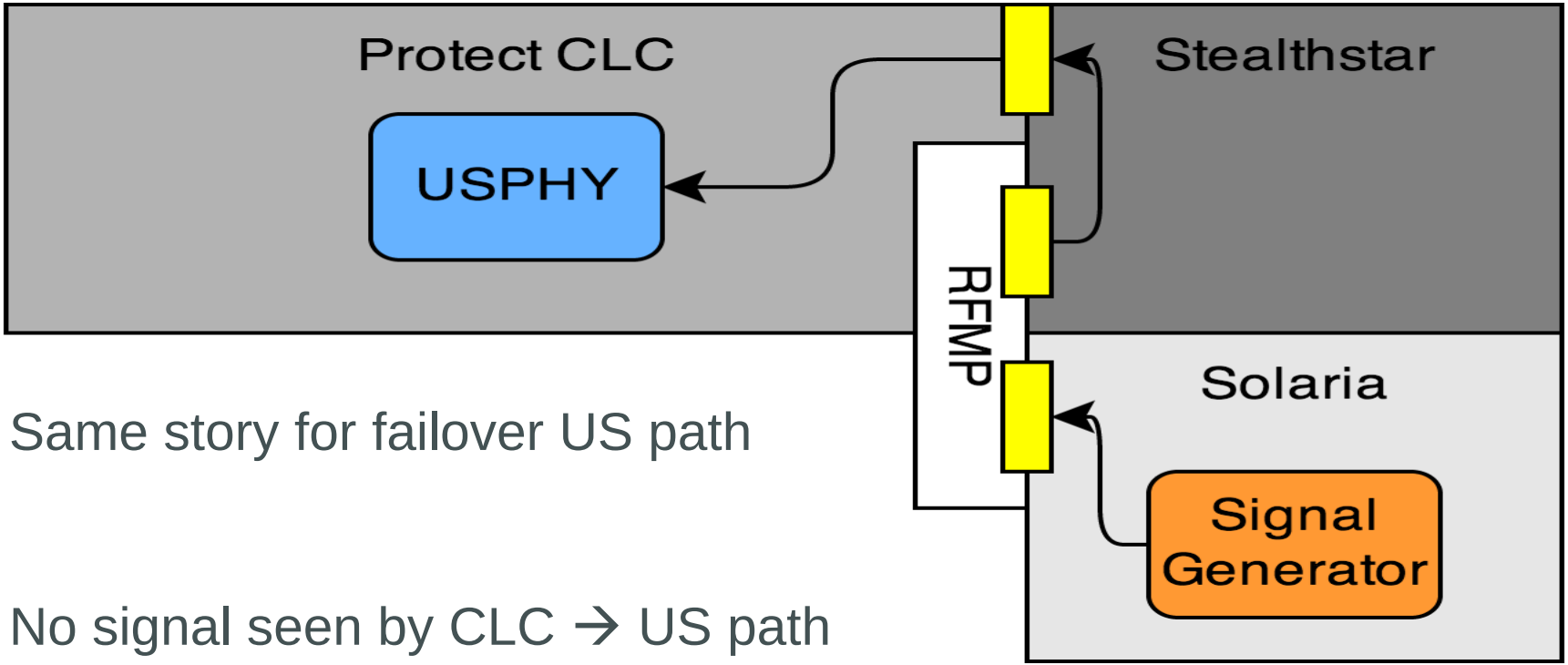
- No signal from protect CLC → DS path broken somewhere

How it works: US Thru Path



- Solaria/RF PIC can generate a signal (a sine wave) similar to US signal
- USPHY Checks power of signal at US receiver(BCM3142)
- If no power → US bullets broken/not connected

How it works: US Protect Path



- Same story for failover US path

- No signal seen by CLC → US path is broken somewhere

BFD CLIs for DS path verification

- **MUST** be on console port to see the output and CLI **IS service impacting**
- DS through path: **`test bfd thru ds <slot> <port> <rf-chan>`**
- DS protect path:
  - **`test bfd protect ds <protect-slot> <active-slot> <port> <rf-chan>`**

```
F241-37-00-cBR8-01#test bfd thru ds 3 all 0
F241-37-00-cBR8-01#
  ***** port 0 PASS
  ***** port 1 PASS
  ***** port 2 PASS
  ***** port 3 PASS
  ***** port 4 PASS
  ***** port 5 PASS
  ***** port 6 PASS
  ***** port 7 PASS
```

BFD CLIs for US path verification

- **MUST** be on console port to see the output and CLI **IS service impacting**
- US through path: **`test bfd thru us <slot> <port>`**
- US protect path:
  - **`test bfd protect us <protect-slot> <active-slot> <port>`**

```
F241-37-00-cBR8-01#test bfd thru us 3 all
F241-37-00-cBR8-01#
   ***** port 0  PASS
   ***** port 1  PASS
   ***** port 2  PASS
   ***** port 3  PASS
   ***** port 4  PASS
   ***** port 5  PASS
   ***** port 6  PASS
   ***** port 7  PASS
   ***** port 8  PASS
   ***** port 9  PASS
   ***** port 10 PASS
   ***** port 11 PASS
   ***** port 12 PASS
   ***** port 13 PASS
   ***** port 14 PASS
   ***** port 15 PASS
```